MEKONG-LANCANG COOPERATION SPECIAL FUND

FINAL REPORT



THE STATE OF PREPAREDNESS OF THE LANCANG-MEKONG REGION'S MARKET ADOPTION FOR NEW ENERGY VEHICLES (NEVS) AND SMART MOBILITY

Content

Chapter 1 Introduction 1
1.1 Introduction 1
1.2 Objective 1
1.3 Methodology 1
1.4 Schedules 2
1.5 Project's Output 3
Chapter 2 Market Preparedness Assessment Methodology 4
2.1 Definition 4
2.1.1. New Energy Vehicle (NEV) 4
2.1.2. Smart Mobility 4
2.2 NEV Market Readiness Assessment Index 4
2.2.1. Literature review on NEV readiness indices 4
2.2.2. Proposed indices for NEV and Smart Mobility Readiness Assessment 7
Chapter 3 State of Preparedness of China 22
3.1 Market and Adoption Status 22
3.1.1. NEV Market Trend 22
3.1.2. Smart Mobility Trend 35
3.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption 41
3.2.1. NEV Promotion Policy 42
3.2.2. Financial Incentives 44
3.2.3. Non-Financial Measures 45
3.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility 47
3.3.1. New Energy Vehicles (NEVs) 47
3.3.2. Vehicle Emission Standards 49
3.3.3. Intelligent Connected Vehicles (ICVs) 50
3.4 Energy Policy 56
3.4.1. Policy and Regulation 57
3.4.2. Supporting measures 63
3.5 Infrastructure Related to New Energy Vehicle and Smart Mobility 67
3.5.1. Energy Infrastructure 67
3.5.2. Road Infrastructure 70

3.5.3. Digital Infrastructure 74
3.6 Consumer Preferences and Trends in Vehicle Ownership 75
3.6.1. Vehicle Ownership 75
3.6.2. Consumer Preferences 79
3.7 Assessment of NEV & Smart Mobility Market Preparedness 92
3.7.1. Country Assessment 92
3.7.2. Key Success Factors and Gap Analysis 100
3.8 Policy Recommendations 103
Chapter 4 State of Preparedness of Thailand 106
Market and Adoption Status 106
4.1.1. NEV Market Trend 106
4.1.2. Smart Mobility Trend 114
4.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption 116
4.2.1. NEV Promotion Policy 116
4.2.2. Financial Incentives 116
4.2.3. Non-Financial Measures 118
4.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility 118
4.3.1. New Energy Vehicles (NEVs) 118
4.3.2. Vehicle Emission Standards 121
4.3.3. Smart Mobility 122
4.4 Energy Policy 123
4.4.1. Policy and Regulation 123
4.4.2. Supporting Measures 125
4.5 Infrastructure Related to New Energy Vehicle and Smart Mobility 128
4.5.1. Energy Infrastructure 128
4.5.2. Road Infrastructure 133
4.5.3. Digital Infrastructure 142
4.6 Consumer Preferences and Trends 147
4.6.1. Vehicle Ownership 147
4.6.2. Consumer Preferences 148
4.7 Assessment of NEV & Smart Mobility Market Preparedness (TU) 161
4.7.1. Country Assessment 161
4.7.2. Key Success Factors and Gap Analysis 167

4.8 Policy Recommendations 169
Chapter 5 State of Preparedness of Lao PDR 172
5.1 Market and Adoption Status 172
5.1.1. NEV Market Trend 172
5.1.2. Smart Mobility Trend 179
5.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption 180
5.2.1. NEV Promotion Policy 180
5.2.2. Financial Incentives 180
5.2.3. Non-Financial Measures 180
5.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility 181
5.3.1. New Energy Vehicles (NEVs) 181
5.3.2. Vehicle Emission Standards 182
5.4 Energy Policy 183
5.4.1. Policy and Regulation 185
5.4.2. Supporting measures 186
5.5 Infrastructure Related to New Energy Vehicle and Smart Mobility 188
5.5.1. Energy Infrastructure 188
5.5.2. Road Infrastructure 189
5.5.3. Digital Infrastructure 192
5.6 Consumer Preferences and Trends in Vehicle Ownership 195
5.6.1. Vehicle Ownership 195
5.6.2. Consumer Preferences 196
5.7 Assessment of NEV & Smart Mobility Market Preparedness 202
5.7.1. Country Assessment 202
5.7.2. Key Success Factors and Gap Analysis 209
5.8 Policy Recommendations 211
Chapter 6 State of Preparedness of Vietnam 214
6.1 Market and Adoption Status 214
6.1.1. NEV Market Trend 214
6.1.2. Smart Mobility Trend 221
6.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption 223
6.2.1. NEV Promotion Policy 223
6.2.2. Financial Incentives 223

6.2.3. Non-Financial Measures 224
6.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility 225
6.3.1. New Energy Vehicles (NEVs) 225
6.3.2. Vehicle Emission Standards 226
6.4 Energy Policy 227
6.4.1. Policy and Regulation 229
6.4.2. Supporting measures 231
6.5 Infrastructure Related to New Energy Vehicle and Smart Mobility 233
6.5.1. Energy Infrastructure 233
6.5.2. Road Infrastructure 236
6.5.3. Digital Infrastructure 239
6.6 Consumer Preferences and Trends 243
6.6.1. Vehicle Ownership 243
6.6.2. Consumer Preferences 244
6.7 Assessment of NEV & Smart Mobility Market Preparedness 254
6.7.1. Country Assessment 254
6.7.2. Key Success Factors and Gap Analysis 261
6.8 Policy Recommendations 263
Chapter 7 State of Preparedness of Cambodia 266
7.1 Market and Adoption Status 266
7.1.1. NEV Market Trend 266
7.1.2. Smart Mobility Trend 273
7.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption 275
7.2.1. NEV Promotion Policy 275
7.2.2. Financial Incentives 275
7.2.3. Non-Financial Measures 276
7.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility 276
7.3.1. New Energy Vehicle (NEV) Safety Standards 276
7.3.2. Electric Vehicle (EV) Charging Standards 276
7.3.3. Vehicle Identification Standards 277
7.3.4. Vehicle Emission Standards 277
7.4 Energy Policy 278
7.4.1. Policy and Regulation 278

7.4.2. Supporting measures 281
7.5 Infrastructure Related to New Energy Vehicle and Smart Mobility 284
7.5.1. Energy Infrastructure 284
7.5.2. Road Infrastructure 287
7.5.3. Digital Infrastructure 290
7.6 Consumer Preferences and Trends 292
7.6.1. Vehicle Ownership 292
7.6.2. Consumer Preferences 293
7.7 Assessment of NEV & Smart Mobility Market Preparedness 299
7.7.1. Country Assessment 299
7.7.2. Key Success Factors and Gap Analysis 306
7.8 Policy Recommendations 308
Chapter 8 Summary 310
8.1 Country Benchmarking and Key Finding 310
8.1.1. Market Readiness: Comparative Country Assessment 310
8.1.2. Gaps and Challenges 312
8.2 Policy Recommendations 313
8.2.1. China: Market-Driven Maturity with Strategic System Alignment 314
8.2.2. Thailand: From Incentive-Led Growth to Ecosystem Consolidation 314
8.2.3. Vietnam: From Rapid Expansion to Competitive and Interoperable Systems 315
8.2.4. Cambodia: Laying the Foundations for System Readiness 315
8.2.5. Lao PDR: Aligning Energy Strengths with Mobility Readiness 315
8.2.6. Sub-Regional Cooperation 316
Chapter 9 Qualitative Data Collection and Field Study Visit 317
9.1 China 317
9.1.1. List of Visited Companies and Organization 317
9.1.2. Lists of Participants (Thailand) 317
9.1.3. Summary of Key Points from the Trip 318
9.1.4. Fieldwork Observations in China 344
9.2 Thailand 345
9.2.1. List of visited companies and organization 345
9.2.2. Lists of Participants (Thailand) 345
9.2.3. Summary of Key Points from the Trip 345

9.2.4. Fieldwork Observations in Thailand 354
9.3 Vietnam (Activity 1) 356
9.3.1. List of visited companies and organization 356
9.3.2. Lists of Participants (Thailand) 356
9.3.3. Summary of Key Points from the Trip 357
9.3.4. Fieldwork Observations in Vietnam (Activity 1) 378
9.4 Vietnam (Activity 2) 380
9.4.1. List of visited companies and organization 380
9.4.2. Lists of Participants (Thailand) 380
9.4.3. Summary of Key Points from the Trip 381
9.4.4. Fieldwork Observations in Vietnam (Activity 2) 404
9.5 Lao PDR (Activity 1) 405
9.5.1. List of visited companies and organization 405
9.5.2. Lists of Participants (Thailand) 405
9.5.3. Summary of Key Points from the Trip 406
9.5.4. Fieldwork Observations in Lao PDR (Activity 1) 422
9.6 Lao PDR (Activity 2) 423
9.6.1. List of visited companies and organization 423
9.6.2. Lists of Participants (Thailand) 423
9.6.3. Summary of Key Points from the Trip 424
9.6.4. Fieldwork Observations in Lao PDR (Activity 2) 435
Chapter 10 Workshop Training 437
10.1 Workshop Training in Thailand 437
10.1.1. Lists of Participants 437
10.1.2. Training Course Topics 437
10.1.3. Summary of the Training in Thailand 438
10.1.4. Results of the Workshop Training in Thailand 442
10.2 Workshop Training in China 446
10.2.1. List of visited companies and organization 446
10.2.2. Lists of Participants 446
10.2.3. Summary of Key Points from the Trip 447
10.2.4. Results of the Workshop Training in China 470
Chapter 11 Public Relations Activities 474

Reference 477

List of tables

Table 2-1: Indicators used for assessing NEV readiness 5
Table 2-2: Indices used for assessing NEV readiness in..... 6
Table 2-3: Market Readiness Assessment Indices 7
Table 2-4: Definitions and Assessment Criteria for Market Status Readiness Indices..... 9
Table 2-5: Definitions and Assessment Criteria for Policy Readiness Indices..... 10
Table 2-6: Definitions and Assessment Criteria for Energy Infrastructure Readiness Indices..... 15
Table 2-7: Definitions and Assessment Criteria for Road and Digital Infrastructure Readiness Indices 16
Table 2-8: Definitions and Assessment Criteria for Vehicle Technology Readiness Indices..... 17
Table 3-1: NEV Models for Top 10 Brands in China as the end of 2024..... 28
Table 3-2: Total cost of ownership (TCO) in China 31
Table 3-3: ICVs Penetration rate in China..... 35
Table 3-4: Penetration Rate of ADAS in 2022 36
Table 3-5: Penetration Rate of Cockpit specification in 2022 37
Table 3-6: Number of Users in Shared and Multimodal Services (million) 40
Table 3-7: Penetration rate in Shared and Multimodal Services..... 40
Table 3-8: Estimated Number of Cities in China Offering Shared and Multimodal Mobility Services41
Table 3-9: Pilot MaaS Projects in Major Chinese Cities 41
Table 3-10: Key national ICV policies and regulations in China (2017-2023) 51
Table 3-11: Key National Plans Supporting NEV and Smart Mobility Development in China (Targets by 2025)..... 62
Table 3-12: The Total Length of Highways in China 73
Table 4-1: NEV Models for Top 10 Brands in Thailand as the end of June 2025..... 110
Table 4-2: Total cost of ownership (TCO) in Thailand (Baht) 112
Table 4-3: Key DLT Regulation for Essential Content Related to NEV 120
Table 4-4: TISI has already announced four general standards to support the upcoming Euro 5 and Euro 6 levels..... 121
Table 4-5: Thailand's National Targets for ZEV Passenger Cars and DC Fast Charging Infrastructure (2025–2035) 129
Table 4-6: NEV Charging Station Licensing Requirements (ERC) 132
Table 4-7: National Highway Classification Standards 134
Table 4-8: Local Highway Classification Standards. In urban and community areas 135
Table 4-9: Local highway standards, outside the city/outside the community 136

Table 4-10: Smart City and Road Design 138
Table 4-11: ITS system development operations 143
Table 5-1: EV Registration 2020 – 2024 in Lao PDR 172
Table 5-2: NEV Models in Lao PDR in 2025 175
Table 5-3: Total cost of ownership (TCO) in Lao PDR (Kip) 177
Table 5-4: Road Network Statistics by Surface Type 190
Table 6-1: NEV Models for TOP 5 Brands in Vietnam in 2025 218
Table 6-2: Total cost of ownership (TCO) in Vietnam 220
Table 7-1: NEV Models in Cambodia in 2025 270
Table 7-2: Total cost of ownership (TCO) in Cambodia 272
Table 7-3: Euro Emission Standard Implementation in Cambodia 277
Table 7-4: Yearly capital investment in charging infrastructure 285
Table 7-5: National Roads 288
Table 7-6: Provincial Roads 289
Table 7-7: Expressway 290

List of Figures

Figure 2-1: EV readiness indices used by Lease Plan in 2023 6
Figure 3-1: Passenger vehicle registration (stock volume) 23
Figure 3-2: NEV registration number in China 23
Figure 3-3: Automotive domestic sale in China by engine types 24
Figure 3-4: Consumer preference on BEV models 26
Figure 3-5: Top 10 NEV Brands in China, 2024 27
Figure 3-6: Average prices of passenger vehicles in China 30
Figure 3-7: The total cost of ownership comparison in China 33
Figure 3-8: Development history of NEV in China 34
Figure 3-9: Frequency of driving personal vehicle in China in 2024 38
Figure 3-10: Mobility needs currently addressed by private vehicle vs. MaaS in China in 2024 39
Figure 3-11: Percentage of consumer preference for mobility needs by type in five years 39
Figure 3-12: Provincial and municipal targets under China's 14th Five-Year Plan for the NEV industry 43
Figure 3-13: Transport Energy Demand by Carrier (EJ/year, 1990–2050) 56
Figure 3-14: Energy Demand in China under the Stated Policies Scenario (2023–2050) 59
Figure 3-15: Ratio of electric light-duty vehicles to public charging points and charging capacity per vehicle, 2024 67
Figure 3-16: Number of privately owned passenger vehicles in China 2023, by region 76
Figure 3-17: Interest in replacing ownership with vehicle subscription in China 77
Figure 3-18: Top Important characteristics of vehicle subscription 78
Figure 3-19: Main concerns regarding vehicle subscription services 78
Figure 3-20: Importance of a vehicle brand committing to sustainable practices 79
Figure 3-21: Consumer preference for EV battery recycling responsibility 80
Figure 3-22: Consumer expectations on BEV driving range in China 81
Figure 3-23: Frequency of trips exceeding 100 km from home in China 81
Figure 3-24: Expected wait time for public charging station 82
Figure 3-25: Most important factors in BEV charging experience in China 82
Figure 3-26: Preference for type of engine in next vehicle in China in 2024 83
Figure 3-27: Consumer using same brand as previous car in China in 2024 83
Figure 3-28: Intention to switch vehicle brand in China in 2024 84
Figure 3-29: Most important factors driving the choice of brand for next vehicle 84
Figure 3-30: BEV charging expectation in China 85

Figure 3-31: Home BEV charger plan in China 86
Figure 3-32: Preference for public BEV charging location in China 86
Figure 3-33: Level of consumer interest in connected vehicle features in China 87
Figure 3-34: Percentage of most trusted entity for managing vehicle data 89
Figure 3-35: The concern on BEV usages 89
Figure 3-36: Level of agreement on purchase experience aspects 90
Figure 3-37: Perceived benefit of AI in vehicle systems in China 91
Figure 3-38: Perceived benefit of AI in vehicle systems in China 91
Figure 3-39: The concerns on local robotaxi and autonomous commercial vehicles on highways 91
Figure 3-40: China's Market Readiness Index 92
Figure 3-41: Market Status Index in China 94
Figure 3-42: China's Policy Readiness Index 94
Figure 3-43: China's Energy Infrastructure Readiness 97
Figure 3-44: China's Road and Digital Infrastructure Readiness Index 98
Figure 3-45: Vehicle Technology in China 100
Figure 4-1: Passenger vehicle registration (stock volume) in Thailand 107
Figure 4-2: NEV registration number in Thailand 107
Figure 4-3: Share of Top 10 NEV Brands in Thailand, 2024 109
Figure 4-4: Total cost of ownership (TCO) in Thailand 113
Figure 4-5: Thailand's NEV Integration Development Direction 130
Figure 4-6: Testing Center for Connected and Automated Vehicles (T-CAVs 142
Figure 4-7: Importance of a vehicle brand committing to sustainable practices in Thailand 2024 149
Figure 4-8: Consumer preference for EV battery recycling responsibility in Thailand 2024 150
Figure 4-9: Consumer expectations on BEV driving range in Thailand 2024 151
Figure 4-10: Frequency of trips exceeding 100 km from home in the past month in Thailand 2024 151
Figure 4-11: Expected wait time to charge an EV at public charging stations from empty to 80% in Thailand 2024 152
Figure 4-12: Most important factors of BEV charging experience in Thailand 2024 152
Figure 4-13: Preference for type of engine in next vehicle in Thailand 2024 153
Figure 4-14: Consumers using same brand as previous cars in Thailand 2024 153
Figure 4-15: Most important factors driving the choice of brand for next vehicle in Thailand 2024 154
Figure 4-16: BEV charging expectation in Thailand 2024 155
Figure 4-17: Home BEV charger plan in Thailand 2024 155

Figure 4-18: Preference for public BEV charging location in Thailand 2024 156
Figure 4-19: Level of consumer interest in connected vehicle features in Southeast Asia 2023 157
Figure 4-20: Percentage of most trusted entity for managing vehicle data in Thailand 2024 158
Figure 4-21: The concern on BEVs usages in Thailand 2024 158
Figure 4-22: Level of agreement on purchase experience aspects in Thailand 2024 159
Figure 4-23: Perceived benefit of AI in vehicle systems in Thailand 2024 160
Figure 4-24: Willingness to pay extra for connected vehicle services in Thailand 2024 160
Figure 4-25: Concerned about local robotaxi services and autonomous commercial vehicles on highways in Thailand 2024 161
Figure 4-26: Market Readiness Index in Thailand 162
Figure 4-27: Market Status Index in Thailand 163
Figure 4-28: Policy Index in Thailand 164
Figure 4-29: Energy Infrastructure Index in Thailand 165
Figure 4-30: Road and Digital Infrastructure Index in Thailand 166
Figure 4-31: Vehicle Technology Index in Thailand 167
Figure 5-1: EV Registrations (Cumulative volume) in the Lao PDR, 2024–July 2025 173
Figure 5-2: Number of Imported Vehicles in the Lao PDR 174
Figure 5-3: The total cost of ownership comparison in Lao PDR 178
Figure 5-4: Energy mix in Lao PDR 184
Figure 5-5: Informational Requisites by Non-EV Consumers in Lao PDR in 2024 197
Figure 5-6: Informational Requisites by EV customers in Lao PDR 2024 197
Figure 5-7: Informational Requisites EV dealers' analysis in Lao PDR 2024 198
Figure 5-8: Communication channel preferences non-EV customer analysis in Lao PDR 2024 200
Figure 5-9: Communication channel preferences EV customer analysis in Lao PDR 2024 201
Figure 5-10: Communication channel preferences EV dealer analysis in Lao PDR 2024 201
Figure 5-11: Market Readiness Index of Lao PDR 203
Figure 5-12: Market Status Index of Lao PDR 203
Figure 5-13: Policy Readiness Index of Lao PDR 205
Figure 5-14: Energy Infrastructure Index in Lao PDR 207
Figure 5-15: Road and Digital Infrastructure Readiness Index in Lao PDR 208
Figure 5-16: Vehicle Technology Readiness in Lao PDR 208
Figure 6-1: Annual NEV Registrations in the Vietnam, 2015–2024 215
Figure 6-2: Share of Automotive Brands in Vietnam, 2024 216

Figure 6-3: The total cost of ownership comparison in Vietnam (million VND) 220
Figure 6-4: The NDC target of Vietnam by 2030 and 2050 227
Figure 6-5: Conversion Roadmap: Road motor vehicles 227
Figure 6-6: Vietnam projected energy mix in 2030 228
Figure 6-7: General Objectives of Vietnam's Smart Grid Roadmap 234
Figure 6-8: Factors impacting the decision to buy a particular vehicle in Vietnam 2024 244
Figure 6-9: Key factors impacting electric vehicle purchase in Vietnam 2024 245
Figure 6-10: Factors Influencing the Decision to Purchase a Four-Wheel Vehicle in Vietnam 2024 245
Figure 6-11: Key factors influencing the decision not to purchase in Vietnam 2024 246
Figure 6-12: Perceptions of statements among those who do not buy EVs in Vietnam 2024 246
Figure 6-13: Consumers' Intended Vehicle Type for Future Purchase in Vietnam 2024 247
Figure 6-14: Share of vehicle engine preference by age groups 247
Figure 6-15: Main intended uses of vehicle by age group in Vietnam 2024 248
Figure 6-16: Share of engine types by income and by age for 4-wheel vehicles in Vietnam 2024 248
Figure 6-17: Desired EV features for 4-wheel vehicle by age group in Vietnam 2024 249
Figure 6-18: Factors scored 4 and above by age group and engine type in Vietnam 2024 249
Figure 6-19: Main charging locations in Vietnam 2024 250
Figure 6-20: Reasons for charging outside in Vietnam 2024 250
Figure 6-21: Preferred charging locations in Vietnam 2024 251
Figure 6-22: Expected wait time for charging in Vietnam 2024 251
Figure 6-23: Expected wait time for charging for 4-wheel vehicles in Vietnam 2024 252
Figure 6-24: Success factors of charging station system in Vietnam 2024 252
Figure 6-25: Expected Waiting duration for 4-wheel vehicles in Vietnam 2024 253
Figure 6-26: Preferred information channels in Vietnam 2024 253
Figure 6-27: Market Readiness Index of Vietnam 254
Figure 6-28: Market Status Index of Vietnam 255
Figure 6-29: Policy Readiness Index of Vietnam 257
Figure 6-30: Policy Readiness Index of Vietnam 258
Figure 6-31: Policy Readiness Index of Vietnam 259
Figure 6-32: Vehicle Technology Readiness in Vietnam 260
Figure 7-1: ICE Vehicles Registration (Cumulative Volume) in Cambodia 266
Figure 7-2: Annual Vehicles Registration (Stock volume) in Cambodia 267
Figure 7-3: Vehicles Registration (Cumulative Volume) in Cambodia 268

Figure 7-4: EV market share June 2024 270
Figure 7-5: The total cost of ownership comparison in Cambodia (Million KHR) 273
Figure 7-6: Factor Category Prioritization (4-wheel vehicles) 294
Figure 7-7: Factors' Priority Weight within the Technology Category (4-wheel Vehicles) 295
Figure 7-8: Factors' Priority Weight within the Economic Category (4-wheel Vehicles) 296
Figure 7-9: Factors' Priority Weight within Infrastructure Category (4-wheel Vehicles) 296
Figure 7-10: Factors' Priority Weight within Government Support Category (4-wheel Vehicles) 297
Figure 7-11: Factors' Priority Weight within Consumer Category (4-wheel Vehicles) 298
Figure 7-12: Market Readiness Index in Cambodia 299
Figure 7-13: Market Status Index in Cambodia 301
Figure 7-14: Policy Index in Cambodia 302
Figure 7-15: Energy Infrastructure Index in Cambodia 303
Figure 7-16: Road and Digital Infrastructure Index in Combodia 304
Figure 7-17: Vehicle Technology Index in Cambodia 306
Figure 8-1: Comparative Country Assessment of Market Readiness 310
Figure 8-2: Comparative Country Assessment of Key Indices 312

Chapter 1 Introduction

1.1 Introduction

The Lancang-Mekong region has a strong bond over the shared river system, economic interdependence, and cross-border connectivity, which makes it a strategic area for collaborative initiatives like the adoption of New Energy Vehicles (NEVs) and Smart Mobility. Only three countries in the Lancang-Mekong region—Thailand, Vietnam, and China—currently have well established automotive industries, China being the world's largest NEV production hub. The regional market holds significant potential for integration and collective development. This is supported by the region's strong economic, social, and infrastructural connectivity.

However, the adoption of NEVs and smart mobility solutions presents notable differences from conventional vehicle usage, particularly in terms of consumer behavior, infrastructure requirements, and policy frameworks. These differences necessitate substantial adaptation and development across the region. In response, this project aims to assess the level of market readiness within each Lancang-Mekong country, and to support the transition.

1.2 Objective

1. Conduct a comprehensive research study on NEV, smart mobility, and ICE technology adoption.
2. Providing targeted training on road infrastructure and vehicle safety standards.
3. Strengthening regional collaboration through networking among government agencies.
4. Establishing a cooperative framework to support long-term integration and policy alignment.

1.3 Methodology

1. Interacting and collaborating with various stakeholders, including government agencies, automobile manufacturers, industry experts, research institutions, and consumers, for data gathering
2. Research and data collection (Desk research, survey and interview, site visits and field studies)
   2.1 Desk research

   2.2 Collect data in China

   2.3 Collect data and monitoring in Cambodia, Lao PDR, Vietnam, and Thailand
3. Workshop training 4 days in Thailand for participating countries in topics of standards for road infrastructure and safety for vehicles
4. Workshop training 5 days in China to learn the best practices and attend the dialogue meeting among the participating countries for brainstorming and further collaboration.
5. Dialogue meeting among the participating countries for further collaboration
6. Publishing the Final report

1.4 Schedules

Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Interacting and collaborating with various stakeholders, including government agencies, automobile manufacturers, industry experts, research institutions, and consumers, for data gathering	X	X	X	X	X	X	X											
2. Research and data collection (Desk research, survey and interview, site visits and field studies)																		
2.1 Desk research	X	X	X															
2.2 Collect data in China (5 days)				X														
2.3 Collect data and monitoring in Cambodia, Lao PDR, Vietnam, and Thailand					X	X	X								X	X	X	
3. Data analysis and reporting								X	X	X	X	X	X	X	X	X	X	
4. Workshop training 4 days in Thailand for participating countries in topics of standards for road infrastructure and safety for vehicles										X								
5. Workshop training 5 days in China to learn the best practices and attend the dialogue meeting among the participating countries for brainstorming and further collaboration.													X					
6. Dialogue meeting among the participating countries for further collaboration													X					
7. Final report																		X

1.5 Project's Output

1. Research report on market readiness and adoption of NEV, smart mobility, and ICE technology in the Lancang-Mekong region
2. Training in the knowledge of standards for road infrastructure and safety for vehicles
3. Networking and collaboration among government agencies in the Lancang-Mekong region

Chapter 2 Market Preparedness Assessment Methodology

2.1 Definition

2.1.1. New Energy Vehicle (NEV)

A New Energy Vehicle (NEV) in this study refers to a class of vehicles that are powered wholly or primarily by non-fossil energy sources and advanced electric propulsion technologies. NEVs include battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEVs). Conventional internal combustion engine vehicles and non-plug-in hybrid vehicles are generally excluded from this category. Moreover, the definition of NEV differs from that of Electric Vehicles (EVs), which generally include Hybrid Electric Vehicles (HEVs).

2.1.2. Smart Mobility

Smart mobility refers to an integrated, technology-enabled approach to transportation that emphasizes efficiency, sustainability, accessibility, and user-centric mobility services rather than private vehicle ownership alone. It combines digital technologies, real-time data, intelligent transport systems, electrified vehicles, shared mobility services (such as ride-hailing, car-sharing, and micromobility), public transport integration, and increasingly, automated driving systems. The objective of smart mobility is to optimize how people and goods move through cities and regions by reducing congestion, lowering emissions, improving safety, and enabling seamless multimodal travel through digital platforms and coordinated infrastructure. In this study, smart mobility is examined through two main dimensions: the vehicle dimension, represented by intelligent connected vehicles (ICVs), and the service dimension, represented by shared and multimodal mobility services. This dual focus reflects both the technological evolution of vehicles and the transformation of mobility from an ownership-based model to a service-oriented and digitally integrated system.

2.2 NEV Market Readiness Assessment Index

Assessing market readiness is essential to identify strengths, gaps, and opportunities for effective deployment of NEVs. A structured NEV Market Readiness Assessment Index offers a comprehensive and comparative framework to evaluate a region's preparedness across various dimensions, such as national infrastructure, energy policies, and regulations related to energy and NEV deployment. This section presents a detailed overview of existing readiness indices, followed by a proposal for an indicator set for NEV market assessment.

2.2.1. Literature review on NEV readiness indices

To assess the market readiness for NEVs in the Lancang-Mekong region- which includes Thailand, Vietnam, China, Lao PDR, and Cambodia- it is essential to examine a set of key indices that reflect the progress and enabling conditions for NEV development. Consideration of these indices can help assess the market readiness of these countries and evaluate which ones are better prepared to support NEV adoption. A literature review was conducted to identify the relevant indices that can help assess the market readiness of these countries. Several representative studies were selected, each offering different perspectives and frameworks for assessing NEV readiness:

2.2.1.1. City Readiness System Assessment of New Energy Vehicle in China

According to the study "City Readiness System Assessment of New Energy Vehicle in China[1]," the city readiness assessment indices for NEV adoption is summarised into five major factors, which are

- Government policies and investment,
- Charging infrastructure construction and operation,
- Business models and maintenance service system,
- Consumer awareness education, and
- Operation scope and environmental benefits.

These five major factors are separated into 16 observation indicators as shown in Table 2-1

Table 2-1: Indicators used for assessing NEV readiness

Major indicators	Observation indicators
Government policies and investment	Central government investment (Million yuan)
	Local government investment (Million yuan)
	Charging infrastructure subsidies percentage (%)
	Purchasing subsidies (10,000 yuan per vehicle)
Charging infrastructure construction and operation	Quantity of charging piles per vehicle
	Total infrastructure investment per resident (10,000 yuan)
	Quantity of cumulative electricity per vehicle (kWh)
	Quantity of cumulative charging times per vehicle (10,000 times)
Business models and maintenance service system	Quantity of monitoring centres
	Quantity of operators
	Operation mileage per vehicle (1,000 kilometres)
	Quantity of service guarantee measure
Consumer awareness education	Quantity of consumers publicity
	Quantity of policies for consumers
Operation scope and environmental benefits.	Quantity of fuel savings per vehicle (ton)
	Quantity of CO_2 emission reductions (10,000 ton)
	Quantity of electric vehicles per resident

2.2.1.2. NEV Readiness Index 2023 by LeasePlan

The "NEV Readiness Index 2023" report by Lease Plan evaluates the level of NEV readiness across several European countries, such as Norway, the Netherlands, the United Kingdom, and Austria. The index comprises three main categories of indicators, each assigned a different weight in the calculation of the overall index, which are illustrated in Figure 2-1:.

[1] Wang, N. & Liu, Y. (2015, July). City Readiness System Assessment of Electric Vehicle Adoption in China. SAE International Journal of Materials and Manufacturing, 8(3), 678-684. http://dx.doi.org/10.4271/2015-01-0469

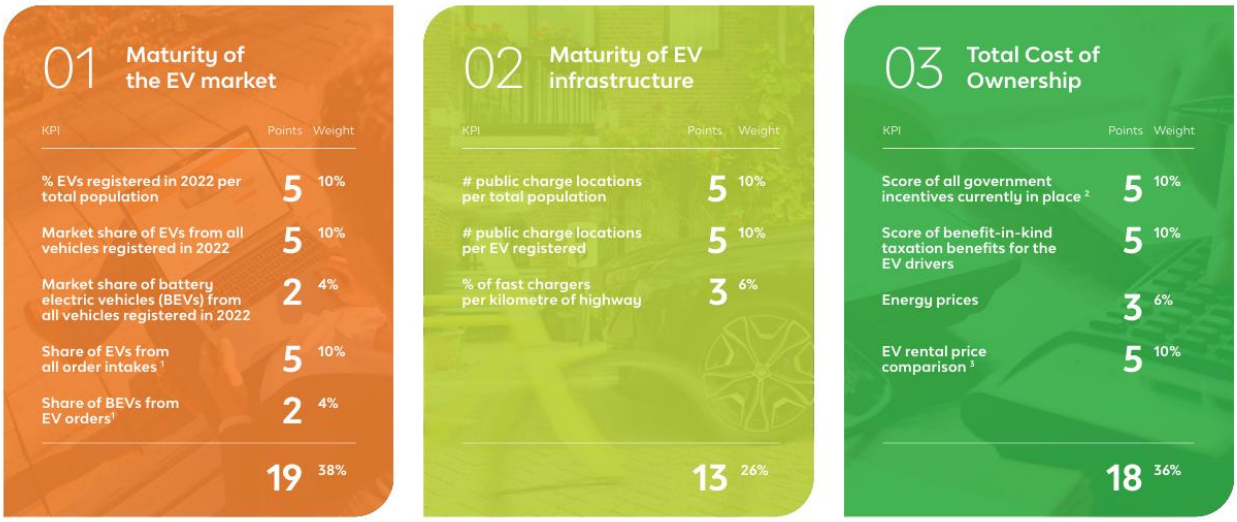


Figure 2-1: EV readiness indices used by Lease Plan in 2023[2]

2.2.1.3. Plug-in Electric Vehicle Readiness: Rating cities in the United States

The study titled "Plug-in Electric Vehicle Readiness: Rating cities in the United States" introduces a set of indices aimed at identifying and ranking the readiness of major U.S. cities for electric vehicle deployment. The indicators focus on policy instruments, infrastructure development, municipal investment in plug-in NEV technology, and participation in stakeholder coalitions. The specific indicators used in this study are summarized in Table 2-2.

Table 2-2: Indices used for assessing NEV readiness in[3]

Indices	Description
Consumer purchase incentives	PEV purchase and EVSE incentives are defined as any specific dollar amount offered by the state, local government, or utility as an incentive for the purchase of a PEV or the purchase and installation of EVSE
Public/private purchase incentives	
Consumer EVSE incentives	
Public/private EVSE incentives	
Time of use / special PEV electricity pricing	Whether the utility offers TOU pricing (unrelated to PEV ownership) or a specific PEV charging rate to PEV owners
Reduced fees	Whether a PEV is afforded special consideration regarding registration fees, vehicle tax, or sales and use tax
Charging station count	The number of L1, L2, and DC Fast charging stations per capita
EVSE permitting	Whether the city has streamlined the permitting process for installing EVSE

[2] Lease Plan. (2023). EV Readiness Index 2023. https://www.leaseplan.com/-/media/20a0b5d1acb04f1f8a367dfeedfa4df5.pdf?rev=06c88fd399c2463fb5bef230bf37b507

3 Kyle Clark-Sutton, K., Siddiki, S., Carley, S., Wanner, C, Rupp, J. & Graham, J. D. (2016). Plug-in electric vehicle readiness: Rating cities in the United States. The Electricity Journal, 29(1), 30-40. https://doi.org/10.1016/j.tej.2015.12.006

Indices	Description
HOV access	Whether a PEV is allowed unrestricted access to HOV lanes within the city of interest
Parking privileges	Whether free parking or reserved parking is offered for PEV owners
Gas price	Average gas price on 4/14/15
Electricity price	Average electricity price for 2013 (cents/kWh)
Municipal fleet	Whether the local government has made efforts to integrate PEVs into municipal fleets ("Lead by example")
EV car sharing	Whether a car sharing service featuring PEVs exclusively is present in the city
Clean cities coalition	Whether a Clean Cities Coalition exists in the city of interest
Tesla direct sale	Whether Tesla is allowed to sell directly to consumers in the state rather than through a dealer

2.2.2. Proposed indices for NEV and Smart Mobility Readiness Assessment

The readiness assessment, as evidenced by the review, uses an index score designed to cover various factors, specifically supportive policies, market/consumer readiness, and infrastructure for NEV and smart mobility adoption. In this study, the assessment of Market Readiness for each country in the region will provide a broad overview of the development landscape for NEV and Smart Mobility Adoption. The selection of the indices is underpinned by a broad evaluation of the factors critical to NEV and smart mobility market expansion. Specifically, this evaluation does not solely focus on market or product factors. Instead, it comprehensively assesses the ecosystem, infrastructure, and supporting policies of each respective country.

The components of the Market Readiness assessment are categorized into five distinct indices, as illustrated in the table below.

Table 2-3: Market Readiness Assessment Indices

Indices	Component Indices
1. Market Status	1.BEV Penetration 2.PHEV, REEV Penetration 3.ICV Penetration (L2 Autonomous) 4.Motorization rate 5.DC Fast Charging Share Index 6.BEV Price 7.PHEV, REEV Price
2.Policy Readiness	1.NEV Target 2.NEV Financial Incentive

Indices	Component Indices
	3.NEV non-financial Measures 4.Smart Mobility Policy Focus 5.Autonomous Driving Pilot License 6.Cybersecurity & Data Privacy in EVSE and CAV 7.Charging Financial Incentive - Personal use 8.Charging Financial Incentive - Public station 9.Charging Financial Incentive - ToU (Personal Use) 10.Charging Financial Incentive - ToU (Public station) 11.Charging non-Financial Incentive - Public station (Energy Abritage) 12.Charging non-Financial Incentive - Public station (V2G)
3. Energy Infrastructure Readiness	1.Smart Grid Readiness 2.Charging communication protocol standard - Single platform 3.NEVs per charging pile – cumulative AC/DC
4. Road and Digital Infrastructure Readiness	1.5G Coverage 2.Traffic Management Systems 3.Road Quality 4.Road Environment 5.Traffic Separation
5.Vehicle technology Readiness	1.BEV Product Offering (range distance) 2.PHEV, REEV Product Offering (range distance) 3.NEV experience (years) 4.BEV Model variety 5.PHEV, REEV Model variety

Source: Author

2.2.2.1. Definitions and Assessment Criteria

The evaluation and scoring of each index are determined by unique definitions and criteria. Many of these indices employ quantitative metrics, whereas others require qualitative evaluation.

The Market Readiness Score is calculated from the bottom up, commencing with the Component Indices derived according to the criteria below. The results are used to calculate the Index score for each dimension, and these are then aggregated into a simple average, referred to as the Market Readiness Score. As supporting data on the impact of each component index on the overall Market Readiness Score is not yet available, this study employs a simple averaging method, implying that each index contributes equally to the Market Readiness Score.

1) Market Status

Table 2-4: Definitions and Assessment Criteria for Market Status Readiness Indices

Component Indices	**Definition**	**Assessment Criteria**	**Score**
1.BEV Penetration	The ratio of Battery Electric Vehicle (BEV) sales to total vehicle sales in 2024, representing the degree of BEV technology adoption.	< 2.5%	1
		2.6 – 16%	2
		17 – 50%	3
		51 – 84%	4
		85 – 100%	5
2.PHEV, REEV Penetration	The ratio of PHEV and REEV sales to total vehicle sales in 2024, representing the degree of BEV technology adoption.	< 2.5%	1
		2.6 – 16%	2
		17 – 50%	3
		51 – 84%	4
		85 – 100%	5
3.ICV Penetration (L2 Autonomous)	The ratio of ICV sales to total vehicle sales in 2024, representing the degree of BEV technology adoption.	< 2.5%	1
		2.6 – 16%	2
		17 – 50%	3
		51 – 84%	4
		85 – 100%	5
4.Motorization rate	Car ownership per 1,000 people	0-100	1
		101-200	2
		201-250	3
		251-400	4
		>400	5
5.DC Fast Charging Share Index	The proportion of public EV charging connectors that are DC fast chargers. A higher share indicates better readiness to support fast charging and reduce waiting time, which is critical for scaling NEV adoption.	0-10%	1
		11-20%	2
		21-30%	3
		31-40%	4
		>40%	5
6.BEV Price	The ratio of average price of BEV to ICE by model segment.	Higher than by 21-50%	1
		Higher than by 1-20%	2

Component Indices	Definition	Assessment Criteria	Score
		Equal price	3
		Lower than by 1-20%	4
		Lower than by 21-50%	5
7.PHEV, REEV Price	The ratio of average price of PHEV and REEV to ICE by model segment.	Higher than by 21-50%	1
		Higher than by 1-20%	2
		Equal price	3
		Lower than by 1-20%	4
		Lower than by 21-50%	5

2.Policy Readiness

Table 2-5: Definitions and Assessment Criteria for Policy Readiness Indices

Component Indices	Definition	Assessment Criteria	Score
1.NEV Target	This index evaluates the country's publicly declared policy goals for future NEV numbers and the existence of tangible measures to realize those targets. The underlying query is: "Has the country set any production or sales targets for NEVs?" A firm target suggests that NEV growth is a policy priority for its policymakers.	None	1
		Annouced but no enforcable measures to achieve targets	3
		Announced with enforceable measures	5
2.NEV Financial Incentive	The total financial support, including subsidies and consumption tax benefits currently available at the highest level, compared to the average price of NEVs.	None	1
		>0%-10%	2
		>10%-20%	3
		>20%-30%	4
		>30%	5

Component Indices	Definition	Assessment Criteria	Score
3.NEV non-Financial measures	Policies granting NEV users special privileges over ICE vehicles, such as priority license plate access, exemption from driving restrictions, free parking, and access to restricted zones.	None	1
		Annouced but no enforcable measures to achieve targets	3
		Announced with enforceable measures	5
4.Smart Mobility Policy Focus	This index assesses whether the country has clear goals for smart mobility development and possesses concrete, enforceable measures to achieve them. The defining question is: "Has the country ever officially announced a policy or strategy for promoting smart mobility?" Smart mobility, in this context, includes: 1) Intelligent Connected Vehicles (ICVs): ADAS-enabled promotion, Autonomous Driving Pilots. 2) Digital Transport Infrastructure: [e.g., Vehicle-to-Infrastructure (V2I), number of cities with real-time traffic management].	None	1
		Announcement Only, No Implementation	3

Component Indices	Definition	Assessment Criteria	Score
	3) Shared & Multimodal Services: Promotion of ride-hailing and integrated services.	Annoucement + Implemetation (Pilot or full operation)	5
5.Autonomous Driving Pilot License	This index evaluates the tangible outcomes of autonomous driving and smart mobility development by seeking to confirm whether the country has issued licenses permitting autonomous driving trials, either in controlled test areas or on public roads under real traffic conditions.	None	1
		Announcement only, No Implementation	2
		Sandbox or Closed-area Trials Authorized	3
		Limited Public Road Pilots Licensed	4
		Full Public Road License Issued	5
6.Cybersecurity & Data Privacy in EVSE and CAV	This index assesses the institutional infrastructure crucial for future smart mobility development. The core question asked is: Does the country have regulatory guidelines for cybersecurity and data privacy to protect driver and vehicle data related to smart mobility and EV charging?	None	1
		Planned, no legislation	3
		Enforcement	5

Component Indices	Definition	Assessment Criteria	Score
7.Charging Financial Incentive - Personal use	Measures the financial incentives provided to individual NEV owners for installing home chargers	No financial or tax-related incentives.	1
		Only indirect financial support, such as tax exemptions or reductions (e.g., VAT, import duty, excise tax), without direct subsidies.	2
		Direct subsidies are implemented (<15%)	3
		Direct subsidies are implemented (<30%)	4
		Nationwide support or ≥ 30% cost subsidy	5
8.Charging Financial Incentive - Public station	Measures the level of government financial support for public NEV charging stations	No financial or tax-related incentives.	1
		Only indirect financial support, such as tax exemptions or reductions (e.g., VAT, import duty, excise tax), without direct subsidies.	2
		Direct subsidies are implemented (<15%)	3
		Direct subsidies are implemented (<30%)	4
		Nationwide support or ≥30% cost subsidy	5
9.Charging Financial Incentive - ToU (Personal Use)	Compares peak and off-peak residential electricity rates (energy charge only). A larger gap provides stronger incentives for NEV users to shift charging to	0-10%	1
		10-20%	2
		20-30%	3

Component Indices	Definition	Assessment Criteria	Score
	off-peak times, easing grid stress and improving load balancing.	30-40%	4
		>=40%	5
10.Charging Financial Incentive - ToU (Public station)	Compares the peak–off-peak energy charges for NEV charging stations. A larger price gap incentivizes stations to shift charging to off-peak periods, helping reduce grid stress and support load balancing.	0-10%	1
		10-20%	2
		20-30%	3
		30-40%	4
		>=40%	5
11. Charging non-Financial Incentive – Energy Arbitrage	Legal framework that enables arbitrage or resale of electricity (e.g. dynamic pricing)	No mention	1
		Mentioned in plan	2
		Pilot in cities	3
		Commercial pilot in multiple regions	4
		Fully commercialized with dynamic pricing or incentives	5
12. Charging non-Financial Incentive – Public Station (V2G)	Level of implementation of Vehicle-to-Grid (V2G) technology in NEV infrastructure	No policy	1
		Mentioned in plan	2
		Pilot projects under testing in selected cities	3
		Commercial-scale pilots in multiple cities	4
		Full commercial deployment with regulatory and technical framework in place	5

3) Energy Infrastructure Readiness

Table 2-6: Definitions and Assessment Criteria for Energy Infrastructure Readiness Indices

Component Indices	**Definition**	**Assessment Criteria**	**Score**
1.Smart Grid Readiness	An index measuring the capability and reliability of the smart grid to support NEVs.	<20	1
		20 - 40	2
		40 - 60	3
		60 - 80	4
		> 80%	5
2.Charging communication protocol standard - Single platform	Measures the readiness and openness of EVSE communication standards (e.g., GB/T, OCPP) and the ability of systems to interoperate with different platforms and service providers.	No willingness to connect; operators maintain closed and isolated networks.	1
		Acknowledges the idea but no concrete action or ngagement.	2
		Participating in early discussions or pilots with limited scope.	3
		Officially agrees to connect or open API/data to others but only with selected partners.	4
		Willing to fully open platform/data to all qualified partners	5
3.NEVs per charging pile – cumulative AC/DC	The ratio of cumulative registered NEVs to the total accumulated number of AC/DC charging piles, indicating the adequacy of charging infrastructure to meet growing NEV demand.	> 12	1
		8.1 – 12	2
		5.1 – 8	3
		3.1 – 5	4
		≤ 3	5

4) Road and Digital Infrastructure Readiness

Table 2-7: Definitions and Assessment Criteria for Road and Digital Infrastructure Readiness Indices

Component Indices	**Definition**	**Assessment Criteria**	**Score**
1.5G Coverage	This index assesses the high-speed internet network infrastructure, which is essential for the development of ICVs (Intelligent Connected Vehicles) and smart mobility.	No 5G Coverage	1
		Minimal 5G Pilot Zones	2
		Partial Urban Coverage	3
		Extensive Urban Coverage	4
		Near Nationwide Coverage	5
2.Traffic Management Systems	Vehicel to Infrastructure (V2I) for complimenting ADAS (L2-L3) operation: two-way data exchange between vehicles and roadside infrastructure, such as traffic signals, road signs, and sensors.	No V2I Deployment	1
		Planning Stage	2
		Limited Pilot Deployments	3
		Partial Urban Deployment	4
		Widespread Urban Coverage	5
3.Road Quality	This index assesses the overall condition of roads, including surface smoothness and maintenance, using secondary data from the World Population Review (2019), which scores on a scale of 1–7.	Score 1-1.5 (out of 7)	1
		Score 1.6-3 (out of 7)	2
		Score 3.1-4.5 (out of 7)	3
		Score 4.6-6 (out of 7)	4
		Score 6.1-7 (out of 7)	5
4.Road Environment	This index evaluates the operational quality and standardization of physical road elements (including marked lanes, signage, and traffic signals) to ensure consistency, clarity, and safety necessary for supporting advanced mobility systems	No standard	1
		Standard Exist but not homogeneity	2
		Standard Exist but some homogeneity	3
		Local Standardized	4
		Global Standardized	5
		None	1

Component Indices	Definition	Assessment Criteria	Score
5.Traffic serparation	This index assesses the enforcement of measures to organize and separate lanes for motorcycle traffic. The core question asked is: Is there any law or enforcement to separate MC from normal traffic?	Law or regulation announced but no enforcement	3
		Law or regulation announced with enforcement	5

5) Vehicle Technology Readiness

Table 2-8: Definitions and Assessment Criteria for Vehicle Technology Readiness Indices

Component Indices	Definition	Assessment Criteria	Score
1.BEV Product Offering (range distance)	The BEV average range distance in the market (weighted by number of models)	< 200 km	1
		200-299 km	2
		300-399 km	3
		400-499 km	4
		>499 km	5
2.PHEV, REEV Product Offering (range distance)	The PHEV/REEV average range distance for only BEV mode in the market (weighted by number of models)	< 30 km	1
		31-59 km	2
		60-100 km	3
		101-160 km	4
		>160 km	5
3.NEV experience (years)	NEV launching years (based on the national action plan and policy)	1-3 years	1
		4-9 years	3
		>9 years	5
4.BEV Model variety	Ratio of BEV models to ICE models	0-10%	1
		11-20%	2
		21-30%	3
		31-50%	4
		>50%	5
5.PHEV, REEV Model variety	Ratio of PHEV/REEV models to ICE models	0-10%	1
		11-20%	2
		21-30%	3

Component Indices	Definition	Assessment Criteria	Score
		31-50%	4
		>50%	5

2.2.2.2. Data Sources

The calculation of the indices relies on data compiled by the research team from both secondary and primary sources through field study conducted in various countries. However, it is undeniable that access to market data in certain countries remains a significant limitation of this study.

Indices	Data Source
1. Market Status Readiness	China: • MIIT Database • CEIC • Chinamobil • Evboosters Thailand: • PwC Automotive ASEAN • The office of Industrial Economics • Statista Market Insights Lao PDR: • Ministry of Public Works and Transport of Lao • Lao Automotive Industry Association (LAIA) Vietnam: • PwC Automotive ASEAN • IEA • Hanoi University of Science and Technology • Vietnam Register • MarkLine Report • Ai Han (2025), Số lượng ô tô điện tại Việt Nam tăng gần 20 lần trong 3 năm, VinFast dẫn đầu thị trường khi bán hơn 87.000 xe trong năm 2024 Cambodia: • Ministry of Public Works and Transport of Cambodia

Indices	Data Source
2.Policy Readiness	China: • Ministry of Industry and Information Technology (MIIT) • China Automobile Enterprise International Development Innovation Alliance • China Briefting (2025). China's Industrial Power Rates 2025: A Guide for Investors Thailand: • National Electric Vehicle Policy Committee (EV Board / NEV Committee) • Electric Vehicle Association of Thailand (EVAT) • Energy Regulatory Commission (ERC) • Metropolitan Electricity Authority (MEA) Lao PDR: • Department of Transport, Ministry of Public Works and Transport (MPWT) • Electricité du Laos (EDL) Vietnam: • Hanoi University of Science and Technology (HUST) • World Banl (2024) Recommendations to the National Roadmap and Action Plan for the Electric Mobility Transition • RETAIL ELECTRICITY TARIFF (Decision No. 1279/QD-BCT dated 9 May 2025 of Ministry of Industry and Trade) • Vietnam's 2025 Retail Electricity Rates Cambodia: • National Energy Efficiency Policy (2022-2030) • ESCAP (2025) Policy Framework on Electric Vehicles in Cambodia • Electricity Authority of Cambodia (EAC) • KiriPost (2024). Cambodia has lowered its electric vehicle charging price to support EV adoption. • UNDP (2024) Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia
3. Energy Infrastructure Readiness	China: • SP Group (2024). Smart Grid Index Annual Report. Singapore Power (SP Group). • Ministry of Industry and Information Technology (MIIT)

Indices	Data Source
	Thailand: • SP Group (2024). Smart Grid Index Annual Report. Singapore Power (SP Group). • Electric Vehicle Association of Thailand (EVAT) • Energy Regulatory Commission (ERC) Lao PDR: • SP Group (2024). Smart Grid Index Annual Report. Singapore Power (SP Group). • LOCA Co., Ltd. Vietnam: • Vietnamplus (2025). Vietnam's EV market booms amid challenges • Vietnamplus (2025). Vietnam boosts charge to match EV growth Cambodia: • Cambodia's Electric Vehicle Landscape in 2025
4. Road and Digital Infrastructure Readiness	China: • https://worldpopulationreview.com/country-rankings/road-quality-by-country • https://www.opensignal.com/global-network-excellence-index Thailand: • https://worldpopulationreview.com/country-rankings/road-quality-by-country • https://www.opensignal.com/global-network-excellence-index LAO PDR: • https://worldpopulationreview.com/country-rankings/road-quality-by-country • https://www.opensignal.com/global-network-excellence-index Vietnam: • https://worldpopulationreview.com/country-rankings/road-quality-by-country • https://www.opensignal.com/global-network-excellence-index Cambodia: • https://worldpopulationreview.com/country-rankings/road-quality-by-country • https://www.opensignal.com/global-network-excellence-index

Indices	**Data Source**
5.Vehicle technology Readiness	China: • Autostation • CATARC (2025) Thailand: • Electric Vehicle Association of Thailand (EVAT) • Department of Land Transport • Schröder, M. (2021). Electric vehicle and electric vehicle component production in Thailand. Lao PDR: • Worldbank • Kimura, S., Purwanto, A. J., Ueda, K., & Hiruma, T. (Eds.). (2022) Vietnam: • EBOOST • Vietnam Automobile Manufacturers' Association (VAMA) • Le, H., & Posada, F. (2022) Cambodia: • Ministry of Public Works and Transport of Cambodia

Chapter 3 State of Preparedness of China

3.1 Market and Adoption Status

3.1.1. NEV Market Trend

China has remained the world's largest automotive manufacturer since 2009. In 2023, the country produced 31.2 million vehicles, accounting for 33% of global output. The United States and Japan followed, with shares of approximately 11% and 9%, respectively[4]. In 2024, China's vehicle production increased by 4%. Moreover, in the first four months of 2025, China's automotive industry reached a new milestone, with vehicle production for the first time. This reflects steady growth in this sector[5]. Most of the vehicles produced were passenger cars, while commercial vehicles made up a smaller portion.

3.1.1.1. NEV Registration

In China, the number of registered vehicles has steadily increased over the years, as illustrated in Figure 3-1. In 2011, the total number of registered passenger vehicles was 105 million. Within just seven years, this figure had more than doubled, reaching 217 million in 2017. Currently, the number has risen further to 353 million vehicles.

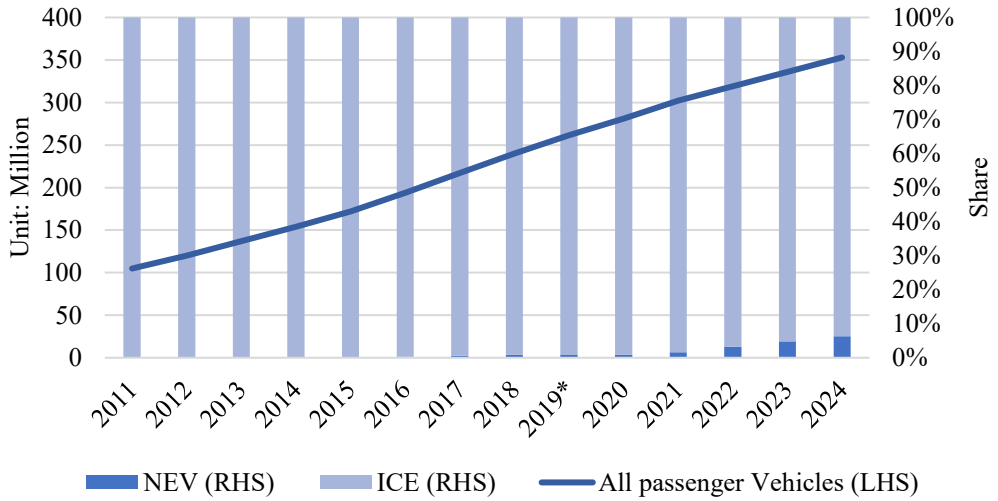
The vast majority of registered private vehicles are still ICE vehicles, accounting for nearly 90% of the total. In contrast, NEV vehicles represent only about 10% of the registered fleet (Figure 3-1).

However, NEV market has gradually developed since 2016 after the NEV small-scale pilot programs (2009-2012) and the NEV large scale promotion (2013-2015). These early efforts laid the groundwork for building domestic production capacity and encouraging consumer acceptance. As a result, the number of registered NEVs reached approximately 0.5 million. This figure increased to 1.27 million by 2017 and further rose to 5.05 million by 2020. In 2024, the total number of registered NEVs surged to 37.73 million units.

In 2024, BEV vehicles account for the largest share of cumulative NEV registrations, totaling 26.6 million units. This is followed by Plug-in Hybrid Electric Vehicles (PHEVs), with 11.0 million units. In contrast, Range-Extended Electric Vehicles (REEVs) remain in the early stages of market adoption, with only 23,530 registered units. This figure is significantly lower compared to the other two NEV types.

[4] International Organization of Motor Vehicle Manufacturers. (2025, June). OICA database.

[5] Ren, P. (2025, May 14). Examining China's economic outlook through automobile output and sales, and foreign trade. Global Times. https://www.globaltimes.cn/page/202505/1334066.shtml



Note: This figure represents only the passenger vehicle registration number due to the limitation of Pick-up truck data.

Figure 3-1: Passenger vehicle registration (stock volume)

Source: Author's compilation from China Association of Automobile Manufacturers, Statista (2024)[6], and IEA (2023)[7]

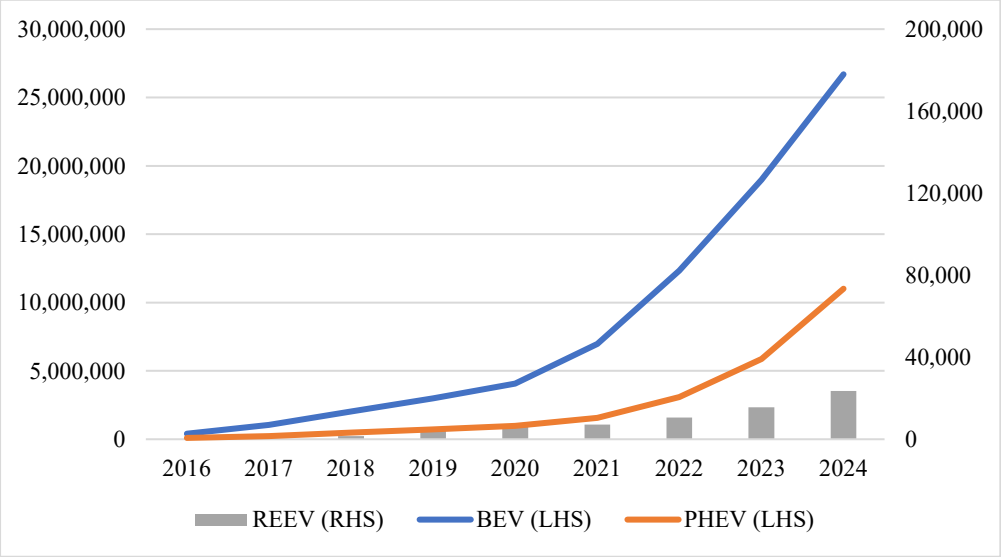


Figure 3-2: NEV registration number in China

Source: Author's compilation from China Association of Automobile Manufacturers, and IEA (2023)[8]

[6] Statista. (2024). Number of car owners in China [Statistic]. Retrieved from https://www.statista.com/statistics/285306/number-of-car-owners-in-china/

[7] IEA. (2023, April). Global EV Outlook 2023: Trends in electric light-duty vehicles [Chart/report]. Retrieved from https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-light-duty-vehicles

[8] IEA. (2023, April). Global EV Outlook 2023: Trends in electric light-duty vehicles [Chart/report]. Retrieved from https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-light-duty-vehicles

3.1.1.2. NEV Sales

China is also the world's largest automotive market, with 31.4 million vehicles sold in 2024. The rapid growth of the domestic market has played a key role in driving the country's automotive industry. It is noteworthy that Chinese domestic brands could expand their market share. This success can be attributed to China's earlier strategy of attracting foreign car manufacturers to produce vehicles for the domestic market. Initially, foreign automakers were only allowed to operate in China through joint ventures with local firms. Over time, these restrictions were gradually relaxed. This approach allowed domestic manufacturers to acquire production knowledge and technology from their foreign partners, and some local companies eventually developed their own automotive brands such as SAIC, Geely, and GWM.

In 2023, nearly 60% of all registered New Energy Vehicles (NEV) were in China, followed by Europe (25%) and the United States (10%) (International Energy Agency, 2024). This indicates a growing divergence in the global adoption of vehicle electrification. China has been able to lead this trend, with NEV accounting for around 40% of its total new car sales in 2024.

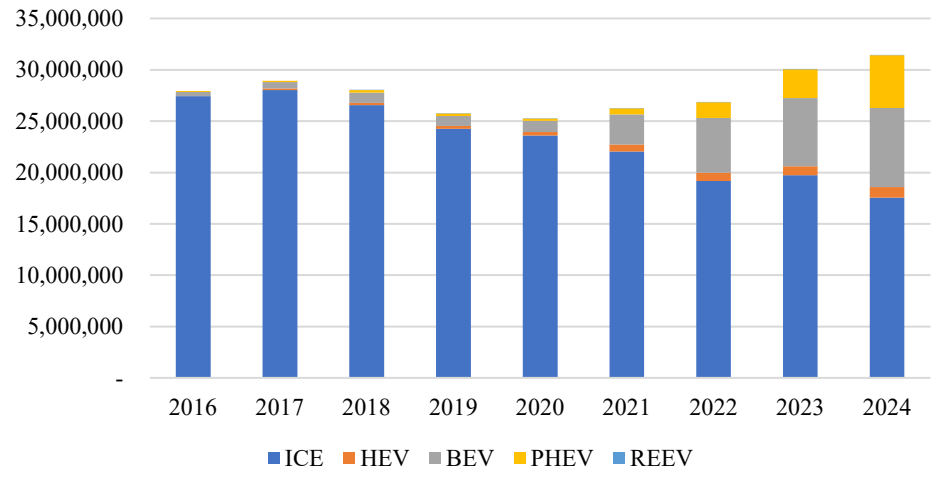


Figure 3-3: Automotive domestic sale in China by engine types

Source: China Association of Automobile Manufacturers[9].

[9] China Association of Automobile Manufacturers. (2024). Sales and production report. http://en.caam.org.cn/Index/lists/catid/76.html

Figure 3-3 shows automotive domestic sales in China. The COVID-19 crisis led to a decline in domestic vehicle sales in China between 2019 and 2020, dropping from 28.0 million units in 2018 to just 25.2 million units in 2020. However, sales gradually recovered, reaching 31.4 million units in 2024. Since 2021, there has been a noticeable trend. Sales of ICE vehicles have declined, while sales of NEV have risen significantly. For example, in 2021, sales of PHEV and BEV stood at 0.6 million and 2.9 million units, respectively. By 2024, these figures had surged to 5.1 million and 7.7 million units.

According to the China Association of Automobile Manufacturers, China's NEV market has shown a notable shift in recent years. While BEV have continued to dominate in terms of sales, there has been a significant surge in Plug-in Hybrid Electric Vehicles (PHEV) and Range-Extended Electric Vehicles (REEV)[10].

For example, BEV sales increased from 1.07 million units in 2020 to 7.71 million units in 2024. Meanwhile, PHEV sales grew dramatically from only 0.24 million units in 2020 to 5.13 million units in 2024. Similarly, REEV sales, which stood at just 1,458 units in 2020, rose to 8,000 units by 2024. Therefore, BEV currently account for approximately 60% of total NEV sales, while PHEV represent around 39%. In contrast, REEV make up only 1% of the market share.

This sale trend in NEV is consistent with findings from field interviews conducted in China during June 2025. A key reason behind the growing popularity of PHEV and REEV is the need among consumers in certain regions to drive long distances without concerns about access to charging infrastructure. In addition, cold weather in some parts of the country can significantly reduce the driving range of BEV, making them less suitable for year-round use. So, automakers have increasingly developed alternative NEV powertrains, such as PHEV and REEV, to better meet the specific demands of the domestic market.

Moreover, the BEV market has shown a clear shift in consumer preferences from 2018 to 2023 (Figure 3-4). While medium-sized cars have consistently held the largest share of BEV sales, the proportion of small cars has declined significantly. At the same time, SUV (Sport-Utility Vehicles category including smaller SUVs (crossovers), and the larger ones) have gained increasing popularity, reflecting a growing demand for larger and more versatile vehicle types. Our field survey conducted in June 2025 also revealed that SUV models are gaining popularity among Chinese consumers, who increasingly prefer larger vehicles over smaller ones. SUVs are perceived to better meet their practical and lifestyle needs, contributing to their growing share in the BEV market.

However, BEV pick-up trucks entered the market for the first time in 2023, albeit with a very small share, indicating the initial stage of electrification in the utility vehicle segment. So, Chinese consumers have no interest in BEV pick-up compared to the U.S. market.

[10] GlobalData. (2024, December). NEV development in China: a review of 2024 and expectations for 2025. Just Auto. Retrieved from https://www.just-auto.com/analyst-comment/nev-development-in-china-a-review-of-2024-and-expectations-for-2025/

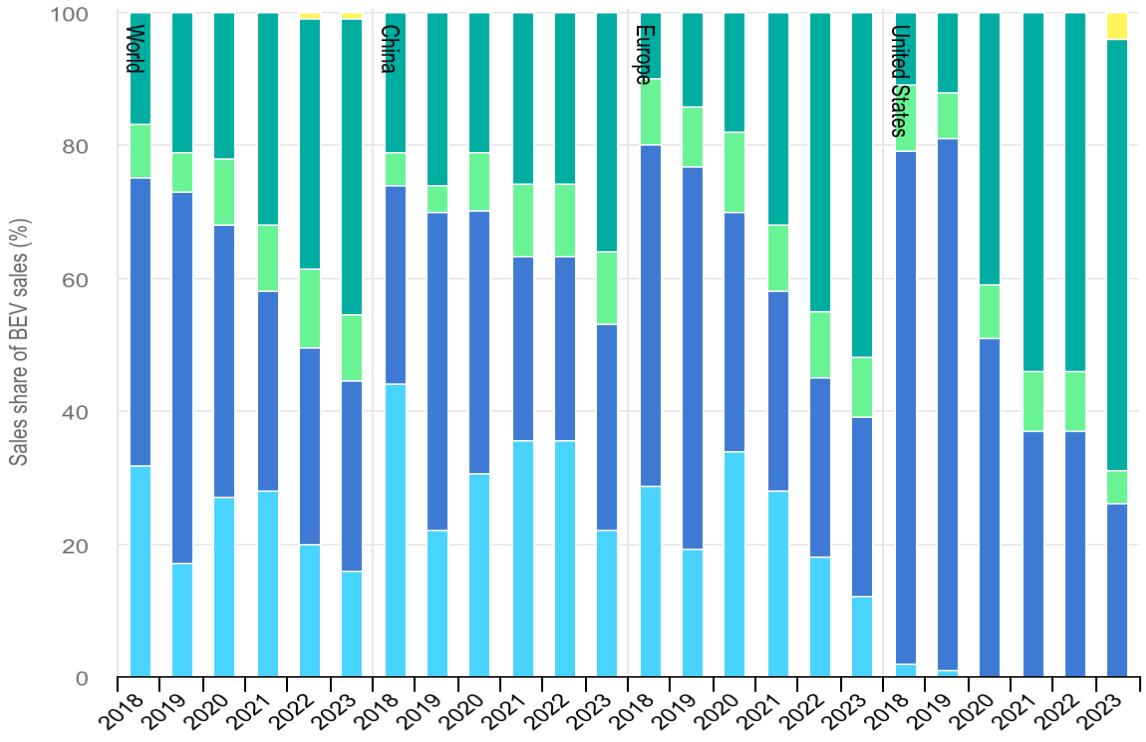


Figure 3-4: Consumer preference on BEV models

Source: IEA (2024)[11]

The success of vehicle electrification in China can be largely attributed to the government's ambitious New Energy Vehicle (NEV) targets. In 2020, authorities announced a long-term goal for NEVs to account for 50% of new vehicle sales by 2035, with interim targets of 20% by 2025 and 40% by 2030. These clear policy signals have accelerated industry transformation. Moreover, its NEV sale accounts for 40.9% of total sales in 2024[12].

As a result, Chinese automakers such as BYD and Geely have grown rapidly, both entering the top 10 global car manufacturers. Just five years ago, BYD was relatively small, however by 2024 it had delivered nearly as many electric vehicles as Tesla—1.76 million units—and is on track to potentially become the world's largest battery electric vehicle (BEV) producer by the end of 2025.

However, the future growth of China's NEV market could be affected by new trade policies if Donald Trump returns to the U.S. presidency. His administration is expected to introduce higher tariffs and stricter regulations targeting Chinese automotive companies. These trade barriers may create difficulties for China's NEV exports to the U.S. market[13].

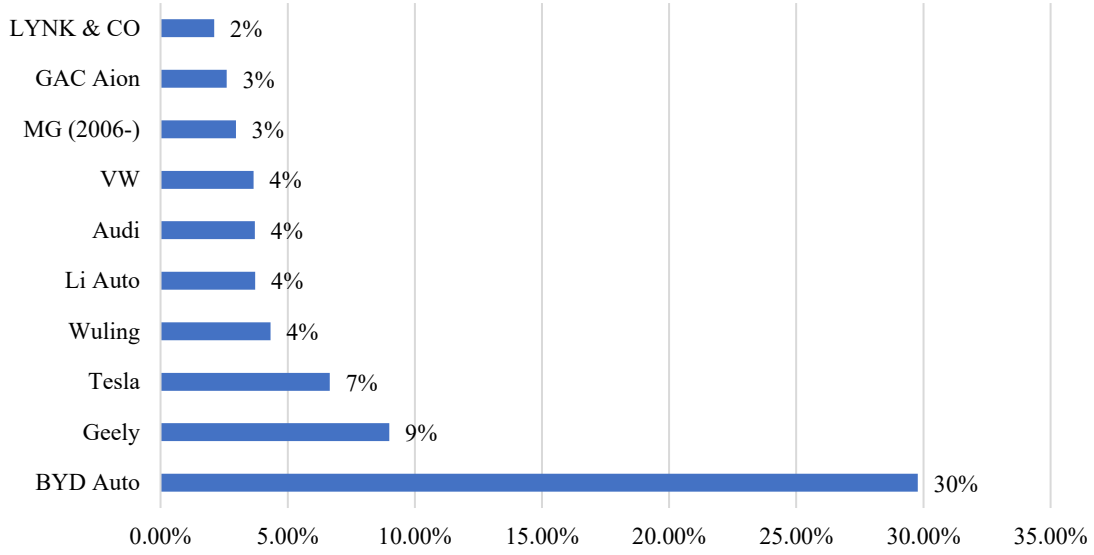
[11] IEA. (2024). Breakdown of battery electric car sales in selected countries and regions by segment, 2018–2023. Retrieved from https://www.iea.org/data-and-statistics/charts/breakdown-of-battery-electric-car-sales-in-selected-countries-and-regions-by-segment-2018-2023

[12] Zhang, Y. (2025). China's NEV production, sales surpass 12m each, leading globally in 2024 for 10th year. Global Times. Retrieved from https://www.globaltimes.cn/page/202501/1326817.shtml

[13] Greeven, M. J. (2025, February). Trump 2.0: A catalyst for China's next transformation? IMD. Retrieved from https://www.imd.org/ibyimd/geopolitics/trump-2-0-a-catalyst-for-chinas-next-transformation/

3.1.1.3. Model Availability

The NEV market in China is highly concentrated, with BYD emerging as the dominant player, holding a 30% market share. This is significantly higher than other brands, with Geely and Tesla following at 9% and 7%, respectively. Several other brands, including Li Auto, Wuling, Audi, and VW, each account for 4% of the market, while MG and GAC Aion hold 3%, and LYNK & CO has the smallest share at 2% (Figure 3-5). Moreover, the top 10 NEV brands accounted for approximately 70% of the total NEV market share, while the remaining 30% was divided among more than 70 OEMs.



Note: The market share is derived from production volume conducted by Marklines. Most NEV productions are sold in domestic markets.

Figure 3-5: Top 10 NEV Brands in China, 2024

Source: Author's calculations.

Despite the high sales concentration in the domestic NEV market, the large number of OEMs in China contributes to highly market competition. This is evident in the ongoing price wars and the wide variety of NEV models available. OEMs compete not only on price but also by offering diverse options in terms of driving range, powertrain types, and vehicle segments, reflecting a dynamic and highly competitive market environment.

According toFigure 3-5, the data highlights BYD's strong market leadership in China's NEV sector. A key factor contributing to this dominance is BYD's wide range of NEV models tailored for the domestic market. The company produces both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), offering greater flexibility to consumers. Notably, BYD has launched 24 NEV models —the largest number among all brands. In comparison, Geely offers 8 models across both BEV and PHEV segments, while Tesla provides only two BEV models in the Chinese market.

Li, Q., Yan, Z., & Goh, B. (2025). China's car sales rise 14.4% year on year in March. Reuters. Retrieved from https://www.reuters.com/business/autos-transportation/chinas-car-sales-rise-144-year-march-2025-04-09/

Moreover, the NEV market in China already offers a sufficient driving range to meet consumer needs, with the majority of models falling within the 401–700 km range. This extended range is available across all major vehicle types, including sedan, hatchback, SUV, and van. Thus, the Chinese market provides a broad and adequate selection of NEV models, ensuring that diverse consumer preferences are well accommodated.

Table 3-1: NEV Models for Top 10 Brands in China as the end of 2024

Brand	**Engine type**	**Model**	**Distance range (km.)**			
			0-200	201-400	401-700	>700
BYD	BEV	Sedan/Hatchback		1	8	
		MPV			2	
		SUV		1	6	
	PHEV	Sedan/Hatchback				3
		SUV				3
Geely	BEV	Sedan/Hatchback	1		1	
		SUV		2	1	
	PHEV	Sedan/Hatchback			1	2
Tesla	BEV	Sedan/Hatchback			1	
		SUV			1	
Wuling	BEV	Sedan/Hatchback		2	3	
		SUV			1	
	PHEV	SUV	1			
Li Auto	REEV	MPV				1
		SUV				4
Audi	BEV	SUV			2	
	PHEV	Sedan/Hatchback	3			
		SUV	1			
VW	BEV	Sedan/Hatchback		1		

Brand	Engine type	Model	Distance range (km.)			
		SUV			4	
	PHEV	Sedan/Hatchback	3			
MG	BEV	Sedan/Hatchback		2	1	
		SUV		1	2	
	PHEV	Sedan/Hatchback	1		1	
		SUV			1	
GAC Aion	BEV	Sedan/Hatchback			4	
		SUV			4	
LYNK & CO	BEV	SUV				1
	PHEV	SUV			1	3
Total models			10	10	45	17

Source: Author's compilation from the NEV models in China in 2024.

Importantly, major OEMs in China have established a wide network of dealerships, especially in large cities, to better serve and support consumers. For example, BYD operates around 3,400 dealers, Geely has approximately 900, and Tesla has about 400. This broad distribution network plays a key role in making NEVs more accessible to the public.

3.1.1.4. Affordability

In recent years, the prices of NEV, particularly BEV and PHEV, have undergone significant changes. Over the past five years, the price gap between NEV and ICE vehicles has narrowed considerably. Since 2018, the average transaction prices of both BEV and PHEV have steadily declined, while ICE vehicle prices have exhibited a modest upward trend. In 2018, BEV were substantially more expensive than ICE vehicles, with PHEV showing the widest price disparity. However, by 2023, the average price of BEVs had fallen below that of ICE vehicles, while PHEV reached price parity (Figure 3-6). In 2024, NEV prices declined further, in some cases undercutting ICE vehicle prices. For instance, the Wuling Starlight sedan—an affordable model in China—offers both PHEV (USD 12,400–14,800) and BEV (USD 13,800–15,100) versions, both of which are priced below the average ICE vehicle.

Several factors have contributed to this declining price gap. Chief among them is sustained policy support from the Chinese government. These include direct subsidies (nationally phased out by the end of 2022 but still offered in some regions), purchase tax exemptions, and non-financial incentives such as preferential license plate access in urban areas. Furthermore, a policy extension announced in 2023 guarantees NEV purchase tax exemptions through 2027, further strengthening consumer confidence.

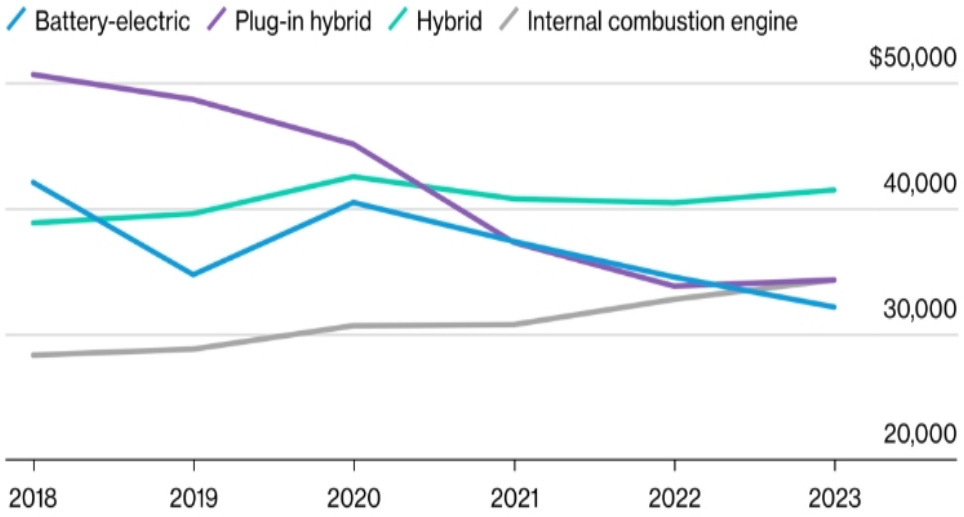


Figure 3-6: Average prices of passenger vehicles in China

Source: EVBoosters (2024)[14]

As a result, many NEV models in China, particularly smaller and more affordable electric cars, are now priced similarly to ICE vehicles. This price competitiveness has helped reduce a key barrier to adoption for many consumers. For instance, the average price of BEVs declined from approximately USD 40,000 in 2020 to around USD 30,000 in 2023. This reduction in purchase price has significantly lowered the total cost of ownership for Chinese consumers compared to ICE vehicles.

Despite these gains, the future of NEV price competitiveness remains uncertain. When tax incentives are scheduled to expire in 2027, the price gap between NEVs and ICE vehicles may widen once again. The long-term affordability of NEVs will depend on key factors such as the continuation of supportive policies, battery material costs, and advances in technology.

Moreover, the total cost of ownership (TCO) analysis provides valuable insights into consumer affordability when comparing NEVs and ICE vehicles. To ensure a fair comparison, the analysis focuses on best-selling NEV models in both sedan and SUV categories, matched with ICE vehicles of similar specifications such as vehicle weight, dimensions, and wheel size.

The total cost of ownership (TCO) in this analysis is calculated based on the following assumptions: (1) a vehicle lifespan of seven years; (2) an average annual driving distance of 20,000 kilometers; (3) one tire replacement during the ownership period; (4) vehicle weight ranging between approximately 1,000 and 2,400 kilograms; (5) constant fuel and electricity prices; (6) differences in annual registration and license plate fees between NEVs and ICE vehicles; (7) a resale value of 45% of the original purchase price for BEV (Sedan), 49% for ICE (sedan), 52% for PHEV (Sedan), 48% for BEV (SUV), 50% for ICE (SUV), and 53% for PHEV (SUV)[15] ; and (8) identical insurance depends on vehicle types and prices.

[14] EVBoosters. (2024). Electric vehicles now cheaper than combustion models in China. https://evboosters.com/ev-charging-news/electric-vehicles-now-cheaper-than-combustion-models-in-china/

[15] Das Green, A. (2025, May). Depreciation Dynamics of Electric vs. Internal Combustion Engine Vehicles in the US Car Market (Master's thesis, University of Michigan). Deep Blue.
Retrieved from

Under these assumptions, the Total Cost of Ownership (TCO) comparison encompasses BEV, PHEV, and ICE vehicles across both sedan/hatchback and SUV segments. The results consistently indicate that BEVs generally present the most compelling TCO across all analyzed segments. These vehicles demonstrate significantly lower overall expenditures compared to their ICE and PHEV counterparts. For instance, the BYD Dolphin (BEV) exhibits the lowest TCO in the Sedan/Hatchback Segment B, and similarly, the BYD Qin L (BEV) leads in the Sedan/Hatchback Segment D, primarily attributable to lower electricity costs compared to fuel and potentially reduced maintenance expenses. Conversely, ICE vehicles consistently incur the highest TCO across all categories (Figure 3-7:), notably exemplified by the Toyota Camry in the Sedan/Hatchback Segment D and the Toyota RAV4 in the SUV Segment D, reflecting higher fuel and maintenance costs.

The generally lower TCO for BEVs and PHEVs compared to ICE vehicles is also attributed to lower vehicle purchase prices and significantly reduced energy costs, as ICE vehicles consume substantially more fuel than their electric or hybrid counterparts. Furthermore, BEVs and PHEVs benefit from governmental incentives, such as exemptions on annual vehicle taxes and license plate fees, contributing additional savings to their overall TCO. However, it is important to note that these considerable cost efficiencies are partially mitigated by the initial investment required for the installation of electric vehicle (EV) chargers (Table 3-2).

PHEVs typically occupy an intermediate TCO position, offering a lower TCO than ICE vehicles but generally higher than BEVs. However, specific models like the BYD Song PLUS (PHEV) in the SUV Segment D can be an exception, demonstrating the lowest TCO within its group, suggesting that PHEV technology can be cost-competitive when initial vehicle pricing and overall technological costs are optimized. When comparing total costs across vehicle types, the analysis finds that sedan/hatchbacks are generally the most cost-effective option, followed by BEV sedans/hatchbacks, BEV SUVs, and PHEV SUVs, respectively. In conclusion, for consumers in the Chinese market prioritizing long-term vehicle ownership costs based on this data, BEVs emerge as the most economically advantageous option due to their demonstrably lower TCO.

Table 3-2: Total cost of ownership (TCO) in China

Costs (RMB)	**Sedan/Hatchback comparison (Segment B)**			**Sedan/Hatchback comparison (Segment D)**			**SUV (Segment SUV-D)**		
	BEV (BYD Dolphin)	**ICE (Toyota Yaris)**	**PHEV (Geely Xingyuan)**	**BEV (BYD Qin L)**	**ICE (Toyota Camry)**	**PHEV (BYD Haibao/ Seal 06)**	**BEV (BYD Song L)**	**ICE (Toyota RAV4)**	**PHEV (BYD Song PLUS)**
Car Prices	99,800	103,800	98,800	129,800	196,800	139,800	189,800	229,800	175,800
Fuel/ Electricity Costs	19,752	58,240	29,904	14,712	68,320	32,480	20,161	94,080	21,056

https://deepblue.lib.umich.edu/bitstream/handle/2027.42/196898/Das_Green_Antara_Thesis.pdf?sequence=1&isAllowed=y

Costs (RMB)	Sedan/Hatchback comparison (Segment B)			Sedan/Hatchback comparison (Segment D)			SUV (Segment SUV-D)		
	BEV (BYD Dolphin)	ICE (Toyota Yaris)	PHEV (Geely Xingyuan)	BEV (BYD Qin L)	ICE (Toyota Camry)	PHEV (BYD Haibao/ Seal 06)	BEV (BYD Song L)	ICE (Toyota RAV4)	PHEV (BYD Song PLUS)
Maintenance cost	25,898	20,831	23,335	25,898	23,123	23,335	25,898	22,180	23,335
Insurance	28,000	35,000	31,500	36,400	49,000	38,500	38,500	52,500	45,500
Motor-vehicle tax	-	3,360	-	-	3,360	-	-	3,360	-
License Plate Fee	-	2,000	-	-	2,000	-	-	2,000	-
Install EV Charger cost	5,243	-	5,243	5,243	-	5,243	5,243	-	5,243
Depreciation	44,910	50,862	51,376	58,410	96,432	72,696	91,104	114,900	93,174
TCO (RMB)	133,782	172,369	137,405	153,642	246,171	166,661	188,497	289,020	177,759

Source: Author's calculation

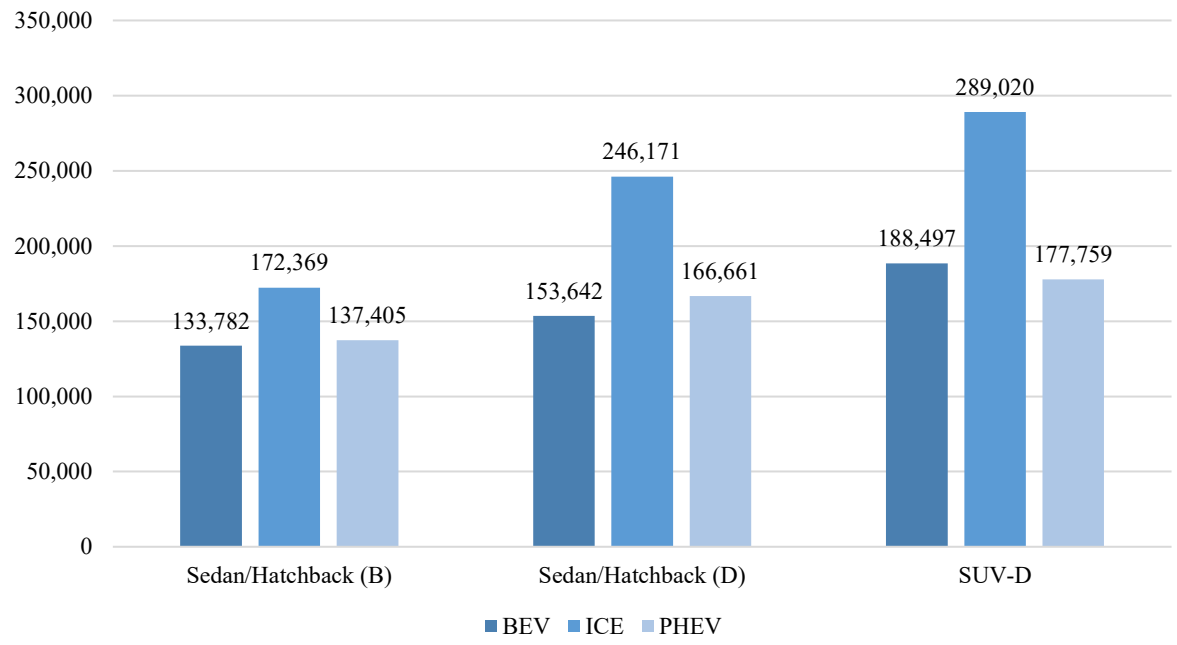


Figure 3-7: The total cost of ownership comparison in China

Source: Author's calculation

In addition, our TCO analysis reveals new insights that differ from findings in earlier studies, such as Ouyang et al. (2021)[16]. According to that study, small BEV in China were expected to achieve total cost parity with internal combustion engine (ICE) vehicles before 2025, while medium and large BEV were projected to reach parity around 2030. The study also found that PHEV, particularly in medium and large segments, tended to perform better in terms of TCO. In contrast, our updated analysis suggests that recent market dynamics such as rapid price reductions, tax incentives, and energy cost advantages may allow certain NEV models to achieve cost competitiveness earlier than previously expected.

3.1.1.5. Years of NEV Experience

Chinese consumers have been exposed to NEV adoption for more than a decade. However, the level of consumer experience and familiarity with NEVs has varied over time and across regions. This is because the government adopted a phased and regionally targeted strategy for promoting NEV production and use. In the early years, policy efforts focused primarily on urban pilot areas, gradually expanding to cover the entire country as the market matured. Figure 3-8 illustrates the development history of NEV in China.

[16] Ouyang, D., Zhou, S., & Ou, X. (2021). The total cost of electric vehicle ownership: a consumer-oriented study of China's post-subsidy era. Energy Policy, 149, 112023. https://www.sciencedirect.com/science/article/abs/pii/S0301421520307345

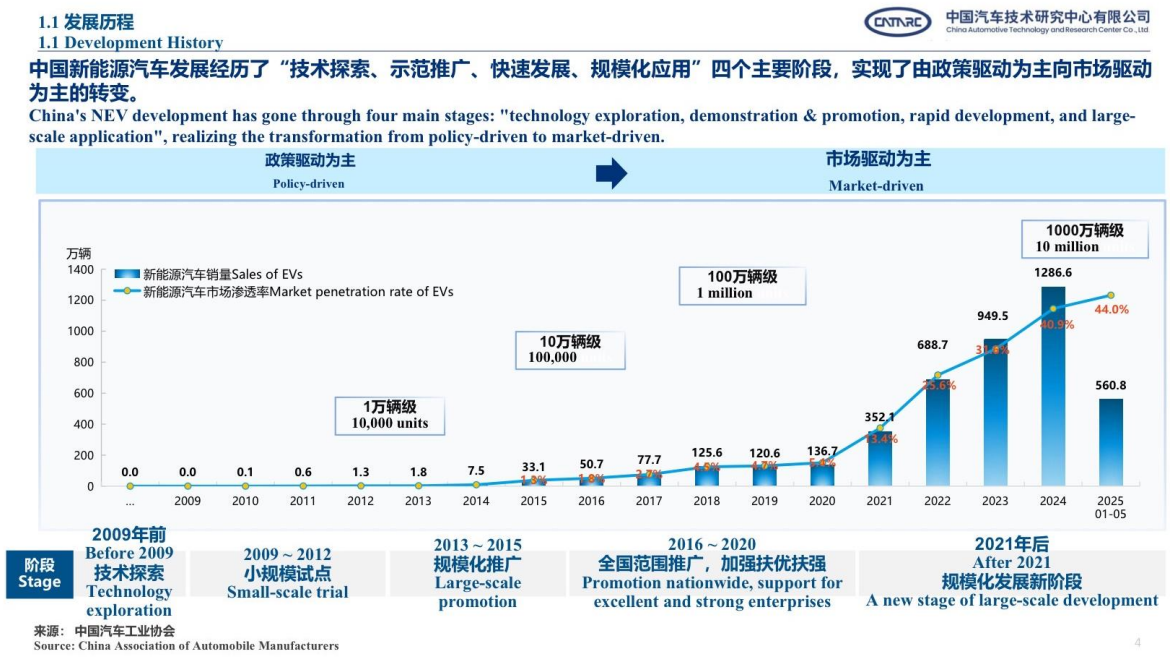


Figure 3-8: Development history of NEV in China

Source: CATARC (2025)[17]

From Figure 3-8, China's New Energy Vehicle (NEV) development has progressed through four distinct policy-driven and market-driven stages. Prior to 2009, the focus was on technology exploration, laying the groundwork for future innovation. Between 2009 and 2012, the government launched small-scale trials, testing NEVs in limited urban areas with strong state guidance. From 2013 to 2015, the policy shifted to large-scale promotion, encouraging broader adoption through subsidies and pilot city programs.

In the period 2016 to 2020, China pursued nationwide promotion and increased support for leading enterprises, resulting in substantial growth. The annual NEV sales exceeded 1 million units by 2018. After 2021, the industry entered a new stage of large-scale development, driven increasingly by market forces. By 2024, NEV sales reached 12.86 million units, with a market penetration rate of 40.9%, signaling China's transition from a policy-led to a market-led NEV ecosystem.

Moreover, China's NEV development can be understood through the lens of technology diffusion theory, particularly the adopter categories outlined by Rogers (1995). The market penetration rate of NEVs in China increased rapidly from 13.4% in 2021 to 44.0% in 2025 (Jan-May), signaling a shift into the early majority and late majority stages of diffusion.

The early majority, who constitute the first part of the mainstream, bring new technology into common use; while the late majority are typically more cautious and skeptical about the technology's benefits. The current market status in China indicates that NEVs are no longer limited to Chinese consumers, but have gained widespread acceptance among mainstream consumers in China.

[17] CATARC. (2025). Development of China's ICV Industry Policies.

3.1.2. Smart Mobility Trend

3.1.2.1. Intelligent Connected Vehicles (ICVs)

Over the past decade, the development of China's automotive industry has extended beyond the shift from traditional ICE vehicles to environmentally friendly New Energy Vehicles. A parallel and significant advancement has occurred in the field of intelligent vehicle technologies, most notably the rise of Intelligent Connected Vehicles (ICVs). These vehicles combine advanced driver assistance systems with internet connectivity to improve driving safety, traffic efficiency, and user experience.

According to data from IHS Markit and YiOu Thinktank, China's ICV market has shown consistent growth. In 2018, the ICV penetration rate was 24.9%, representing approximately 6.98 million vehicles out of 28 million total vehicle sales. By 2023, this rate had increased to 66.0%, or about 19.83 million units, and is projected to reach 75.9% by 2025. This upward trend underscores the pivotal role of government policy support and sustained technological investment in advancing China's position as a global leader in smart mobility and automotive innovation.

Table 3-3: ICVs Penetration rate in China

Year	ICVs Penetration rate in Chinese Market	Total Automobile sales in China	ICVs sale
2018	24.9%	28,038,947.00	6,981,697.80
2019	38.4%	25,754,482.00	9,889,721.09
2020	48.8%	25,267,553.00	12,330,565.86
2021	53.3%	26,248,287.00	13,990,336.97
2022	59.8%	26,849,438.00	16,055,963.92
2023	66.0%	30,045,440.00	19,829,990.40
2024	72.1%	31,426,370.00	22,658,412.77
2025	75.9% (expected)	N/a	N/a

Source: IHS Markit, YiOu Thinktank.

A key component of Intelligent Connected Vehicles (ICVs) is the Advanced Driver-Assistance System (ADAS). The internationally recognized classification developed by SAE International categorizes ADAS capabilities into six levels, from Level 0 (no automation) to Level 5 (full automation). In contrast, the U.S. National Highway Traffic Safety Administration (NHTSA) uses a classification system ranging from Level 0 to Level 4 and does not officially define Level 5 in its legal framework.

In China, Gaogong Auto, a widely cited industry source, simplifies the classification into Levels 0 to 3, focusing on levels that are commercially applicable. Additionally, the term "L2+" is often used in the Chinese context to describe systems that offer more advanced autonomous functions than L2, yet still require human intervention under specific conditions.

Across all frameworks, Levels 0 to 1 indicate driver-assist features where the human driver retains full control. These include commonly used systems such as Lane Departure Warning (LDW), Autonomous Emergency Braking (AEB), and Adaptive Cruise Control (ACC), which are prevalent in current ICVs. Level 2 systems offer partial automation, enabling the vehicle to control steering and speed in certain

situations, as seen in features like Automated Parking Assist (APA) and Highway Driving Assist (HWA).

At Level 3 (SAE/NHTSA) or L2+ (Gaogong Auto), vehicles can interpret road conditions and make driving decisions autonomously, although a driver must remain available to take control when necessary. Level 4 (or L3 in the Gaogong Auto system) allows for high automation within a defined Operational Design Domain (ODD). Meanwhile, Level 5, which represents full automation under any conditions, remains experimental and is not yet commercially available.

According to Gaogong Auto (2022), the most widely implemented ADAS features in China were AEB (48.7%) and LDW (38.8%). Although more advanced functions like Navigation on Autopilot (NOA) and Remote Parking Assist (RPA) currently have lower penetration rates, they reflect an emerging trend toward higher levels of automation in the Chinese automotive market.

Table 3-4: Penetration Rate of ADAS in 2022

SAE	**NHTSA**	**Gaogong Auto**	**Feature**		**Penetration rate**
L0	L0	L0	LDW	Lane Departure Waring	38.80%
			RCTA	Rear Cross Traffic Alert	16.90%
			AVM	Around View Monitor	30.90%
L1	L1	L1	ACC	Adeptive Cruise Control	4.00%
			LKA	Lane Keeping Assist	34.90%
			AEB	Autonomous Emergency Braking	48.70%
L2	L2	L2	APA	Automated Parking Assist	14.40%
L3	L3	L2+	HWA	Highway Driving Assist	21.30%
			NOA	Navigation on Autopilot	1.10%
			RPA	Remote Parking Assist	8.10%
L4	L4	L3	HPP	Home Zone Parking Pilot	0.70%
L5			-	Full Automation	N/a

Source: Gaogong Auto.

In addition, Intelligent Connected Vehicles (ICVs) are increasingly equipped with "Smart Cockpit" systems—advanced in-cabin technologies that enable real-time connectivity, control, and user interaction. One example is T-BOX technology, which links vehicle data to a central management system and reached a usage rate of 60.1% in 2022. Similarly, Over-the-Air (OTA) update systems—allowing remote software updates without requiring a visit to a service center—were installed in 49.7% of vehicles.

Moreover, in-vehicle infotainment (IVI) displays larger than 10 inches were adopted in 55.3% of ICVs, reflecting growing consumer demand for enhanced digital interfaces. Additional smart cockpit features include Heads-Up Displays (HUDs), Digital Keys, and Occupant Monitoring Systems (OMS), all of which contribute to a more connected and intelligent driving experience.

The development of Intelligent Connected Vehicles (ICVs) in China signifies not only a technological shift but also a broader structural transformation within the automotive industry. By integrating intelligent driving features, real-time connectivity, and advanced safety systems, China is positioning itself as a global leader in the future of mobility. This progress aligns closely with the country's national strategy for industrial innovation, reflecting a strong synergy between government policy support and private-sector investment. The coordinated efforts across public and private domains underscore China's ambition to shape the next generation of smart transportation.

Table 3-5: Penetration Rate of Cockpit specification in 2022

Cockpit specification		**Penetration rate**
Connection	T-BOX	60.1%
	5G	2.0%
	OTA (Over-the-Air update)	49.7%
SW	Digital Key	23.1%
	DMS (Driver Monitoring System)	5.8%
	OMS (Occupant Monitoring System)	3.4%
HW	Above 10" IVI Display	55.3%
	Above 10" Cluster	37.0%
	W/AR HUD	7.3%
EE	Connectivity Domain Controller	8.1%

Source: Gaogong Auto[18].

3.1.2.2. Shared & Multimodal Services

Over the past decade, China has actively promoted the development of a new form of public transportation known as Shared and Multimodal Services, designed to ease traffic congestion and reduce urban pollution. This system includes a variety of mobility options such as bike-sharing, e-scooter sharing, car-sharing, ride-hailing, and Mobility-as-a-Service (MaaS) platforms. MaaS aims to integrate these services into a single digital application, enhancing user convenience and enabling more seamless, sustainable urban mobility.

According to Statista Market Insight, bike-sharing and ride-hailing services have achieved the highest user adoption rates in China, particularly in large metropolitan areas such as Beijing, Shanghai, and Shenzhen. In contrast, car-sharing and e-scooter sharing remain in the early stages of development, with

[18] Data-in-China. (n.d.). The intelligent connected vehicle in the Chinese market. Retrieved from https://www.data-in-china.com/post/icv-industry-status-in-china

limited infrastructure and user base. Although MaaS platforms are not yet widely implemented—largely due to service fragmentation and weak cross-sector coordination—they are considered a key element of China's future urban mobility strategy. As such, MaaS has attracted growing government policy support and strategic interest, signaling its potential for long-term transformation in urban transportation systems.

The changing of urban transportation in China reveals a coexistence of strong reliance on private vehicles and a growing openness to shared mobility solutions such as Mobility-as-a-Service (MaaS). Deloitte's 2024 survey (Deloitte, 2025)[19] reveals insightful trends regarding driving habits, acceptance of Mobility-as-a-Service (MaaS) and changing mobility preferences across China. A large segment of the population frequently uses personal vehicles, with 40% driving daily and 36% driving three to four times weekly (Figure 3-9). Despite this widespread personal vehicle use, a notable 54% of participants showed a willingness to give up owning a car in favor of MaaS options.

This openness is further clarified through the examination of current and future mobility demands. Presently, private vehicles fulfill a substantial share of transportation needs: 10% of respondents rely entirely on private cars, and another 14% depend on them for 90% of their travel. Meanwhile, a small but existing group (1%) already depends exclusively on MaaS (Figure 3-10). Looking ahead five years, consumer preferences are expected to shift more clearly toward MaaS. Although 9% still foresee exclusive private vehicle use, and 10% expect to use private cars for 90% of their trips, the proportion anticipating a balanced split, 50% private vehicle and 50% MaaS, rises markedly to 18%. Additionally, the group relying entirely on MaaS is still 1% (Figure 3-11). Collectively, these patterns indicate growing acceptance and a gradual movement toward shared and multimodal transportation solutions in China over the next five years, despite the current dominance of private car use.

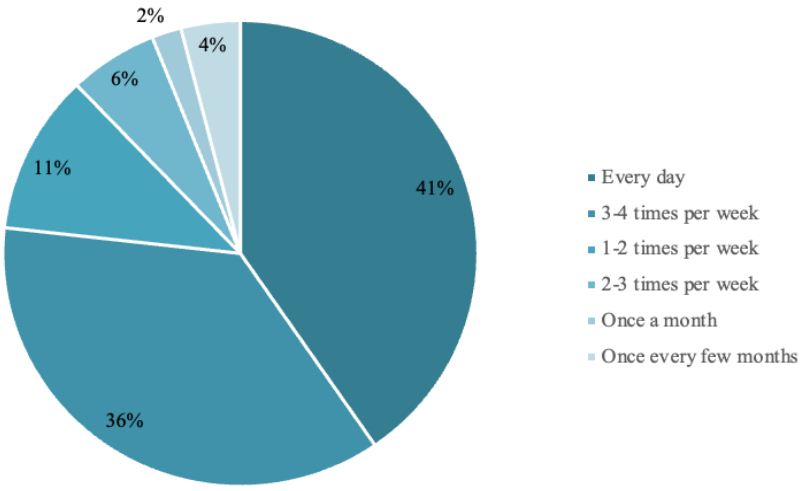
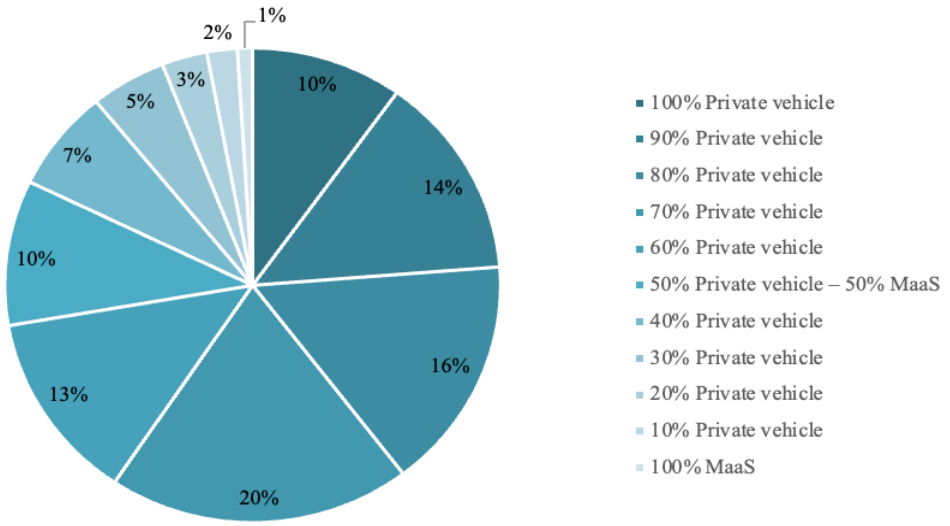


Figure 3-9: Frequency of driving personal vehicle in China in 2024

Source: Deloitte (2025)

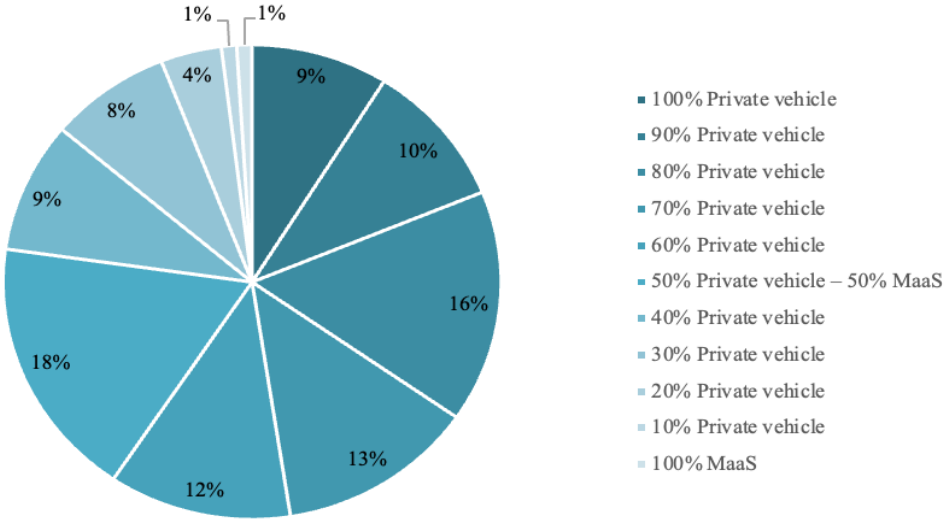
[19] Deloitte. (2025, January). 2025 Global Automotive Consumer Study: Key findings and insights. Retrieved from https://www.deloitte.com/global/en/Industries/automotive/perspectives/global-automotive-consumer-study.html



Note: Percentages may not add to 100 due to rounding.

Figure 3-10: Mobility needs currently addressed by private vehicle vs. MaaS in China in 2024

Source: Deloitte (2025)



Note: Percentages may not add to 100 due to rounding.

Figure 3-11: Percentage of consumer preference for mobility needs by type in five years

Source: Deloitte (2025)

Table 3-6: Number of Users in Shared and Multimodal Services (million)

Service Type	2018	2019	2020	2021	2022	2023	2024	2025
Bike-sharing	341.9	374.9	406.9	437.1	460.3	489.7	513.8	528.4
E-Scooter-sharing	0.00	0.03	0.03	0.03	0.05	0.06	0.06	0.06
Car-sharing	10.1	11.2	12.3	13.5	14.5	15.6	16.5	16.9
Ride-hailing	408.4	426.5	444.5	462.6	480.6	498.7	523.2	538.1

Source: Statista Market Insights[20].

Table 3-7: Penetration rate in Shared and Multimodal Services

Service Type	2018	2019	2020	2021	2022	2023	2024	2025
Bike-sharing	24.0	26.2	28.4	30.5	32.1	34.2	36.0	37.1
E-Scooter-sharing	-	-	-	-	-	-	-	-
Car-sharing	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.2
Ride-hailing	28.6	29.8	31.0	32.3	33.5	34.9	36.7	37.8

Source: Statista Market Insights.

At the urban service provision level, a report by the Volvo Research and Educational Foundations (2022) indicates that over 300 cities in China currently offer bike-sharing services, reflecting their widespread adoption. In comparison, ride-hailing services have expanded to nearly all major cities across the country, demonstrating broad national coverage. In contrast, car-sharing and e-scooter sharing services remain relatively limited and are primarily available in medium to large-sized cities where adequate infrastructure and regulatory support are in place.

In the case of Mobility-as-a-Service (MaaS), China has initiated pilot implementations in selected cities, where multiple transportation services are integrated into a unified digital platform that supports trip planning, booking, and payment. These efforts aim to improve convenience and efficiency for urban travelers. The pilot programs are primarily concentrated in cities with strong technological infrastructure and supportive policy environments, such as Beijing, Shanghai, Shenzhen, and Hangzhou. These cities serve as testing grounds for scalable MaaS solutions and offer valuable insights for future national deployment.

[20] Statista. (n.d.). Shared mobility in China [Statista market forecast]. Retrieved from https://www.statista.com/outlook/mmo/shared-mobility/china?currency=USD

Table 3-8: Estimated Number of Cities in China Offering Shared and Multimodal Mobility Services

Service Type	**Approximate Number of Cities with Service**
Bike-sharing	>300 cities
Ride-hailing	>350 cities
Car-sharing	~50 cities
E-Scooter-sharing	~20–30 cities
MaaS (Pilot/Trial)	2 major cities *(Beijing, Guangzhou)*

Source: Volvo Research and Educational Foundations (2022).

Table 3-9: Pilot MaaS Projects in Major Chinese Cities

City	**Project Description**	**Main Providers**
Beijing	Pilot MaaS platform jointly launched by Gaode (Amap) and the Beijing Transport Institute (BTI)	Gaode (mapping app), BTI (transport research institute)
Guangzhou	MaaS pilot integrating bus, metro, and ride-hailing services into a single application	Guangzhou Bus Group, Didi Chuxing

Source: Volvo Research and Educational Foundations (2022).

Although these MaaS initiatives are still in the early stages of development, they represent a significant step toward the integration of urban mobility through digital platforms. However, several key challenges remain. These include the absence of standardized data-sharing protocols, limited public-private collaboration, and the lack of a comprehensive legal and regulatory framework to oversee the diverse range of service providers involved.

In summary, China's Shared and Multimodal Mobility Services are experiencing steady progress, reflected in growing user adoption, expanded urban coverage, and the gradual implementation of MaaS pilot programs. Despite this momentum, critical regulatory challenges persist—particularly in areas such as safety standards, data privacy, and equitable access. Addressing these issues will be crucial to ensuring the long-term sustainability, scalability, and inclusivity of China's shared mobility ecosystem.

3.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption

The expansion of China's New Energy Vehicle (NEV) industry and market is fundamentally driven by influential policy and support measures implemented across both central and local government tiers. The development of NEVs is not coincidental; rather, it represents a deliberately planned and goal-oriented national strategy that explicitly addresses both industrial advancement and environmental stewardship.

China's aggressive promotion of NEVs stems from crucial strategic imperatives. Primarily, the nation contends with significant challenges concerning severe air pollution and energy security. This reality has necessitated the implementation of policies specifically designed to reduce dependence on imported fossil fuels and to mitigate greenhouse gas emissions. Secondly, the Chinese government has recognized the NEV sector as a prime strategic opportunity to achieve technological superiority in global automotive innovation and to establish itself as a world leader in the future mobility sector.

Consequently, these concerted governmental efforts have positioned China as the world's preeminent market for NEVs and an indispensable, central actor in the global transition toward vehicle electrification.

3.2.1. NEV Promotion Policy

Landmark policies that have shaped and accelerated the sector's growth include the following:

3.2.1.1. Made in China 2025

The overarching policy supporting and directing NEV development is China's Made in China 2025 strategy. Launched in 2015, this strategic initiative aims to transform China into a global leader in high-tech manufacturing, with NEVs as one of the ten prioritized sectors. The plan emphasizes innovation, local supply chain development, and competitiveness in key technologies like batteries, electric motors, and power electronics. It has catalyzed significant investment in R&D and infrastructure for electric mobility.

3.2.1.2. New Energy Vehicle Industry Development Plan (2021-2035)

The New Energy Vehicle Industry Development Plan (2021–2035), issued by China's State Council in 2020, serves as the country's flagship roadmap for advancing the NEV sector over the long term. Aligned with the strategic direction set by the 14th Five-Year Plan for National Economic and Social Development, this policy translates national goals into concrete technological and market milestones for the automotive industry. It aims to accelerate the transition toward a low-carbon, intelligent, and globally competitive automotive industry. The plan outlines ambitious targets. In 2020, authorities announced a long-term goal for NEVs to account for 50% of new vehicle sales by 2035, with interim targets of 20% by 2025 and 40% by 2030. Moreover, NEVs are expected by 2025 to reach a fuel consumption benchmark of 12 kWh/100 km for BEVs and account for 20% of new vehicle sales, a target already achieved ahead of schedule. By 2035, the government aims for full electrification of public transport, for NEVs to dominate new vehicle sales, and for fuel cell and autonomous vehicles to achieve commercial-scale deployment. The policy envisions China becoming a global innovation hub for NEV technologies. The plan emphasizes key areas such as enhancing energy efficiency, scaling up battery swapping infrastructure, and achieving full lifecycle traceability of power batteries. It also promotes R&D in core technologies, including batteries, electric drive systems, fuel cells, and autonomous driving. Importantly, the policy aligns NEV deployment with broader national goals of carbon peaking by 2030 and carbon neutrality by 2060, contributing to reduced oil dependency and cleaner urban mobility. The plan is supported by a range of complementary measures, including fiscal incentives, industrial upgrading, and digital infrastructure development.

The plan is supported by complementary measures such as fiscal incentives, supply chain localization, and digital infrastructure upgrades. In 2023, the Ministry of Finance and related agencies announced an extension of the vehicle purchase tax exemption policy, under which NEVs purchased between 2024 and 2025 will be fully exempt from the vehicle purchase tax up to RMB 30,000, and those purchased between 2026 and 2027 will receive a 50% tax reduction up to RMB 15,000[i]. The success of the national plan is also reflected in the regional policy landscape, where provinces and cities have introduced their own targets and industrial development plans to align with national goals.

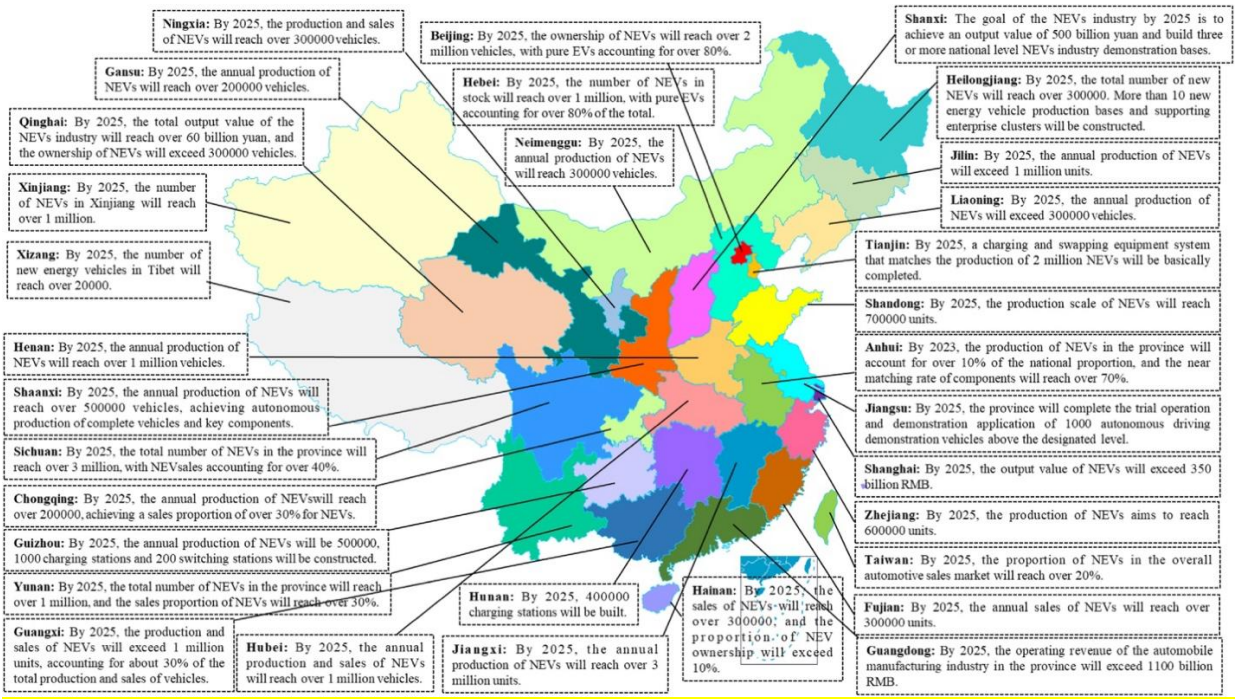


Figure 3-12: Provincial and municipal targets under China's 14th Five-Year Plan for the NEV industry

Source: Tian et al. (2024)

As shown in Figure 3-12, most provinces have set specific objectives for NEV production volumes, ownership targets, charging infrastructure rollout, and industry output value by 2025. For instance, Jiangsu aims to exceed 3 million NEVs, Shandong targets 700,000 units in sales, and Guangdong expects its operating revenue from the NEV industry to surpass 110 billion RMB. These regional targets illustrate the vertical coordination between national strategy and subnational implementation and are crucial for achieving the broader vision laid out in the 2021-2035 plan.

Looking ahead to 2035, the plan envisions China becoming a global leader in NEV technologies. Domestically, this includes achieving full electrification of public transportation, ensuring NEVs dominate new vehicle sales, and enabling the commercial rollout of fuel cell and autonomous vehicles. To support this, the plan calls for substantial improvements to the battery swapping system, the advancement of core R&D in NEV technologies, the strengthening of the battery supply chain, and the implementation of a comprehensive battery recycling and reuse strategy. These measures are intended to enhance system efficiency, reduce environmental impact, and bolster China's international competitiveness in the clean mobility sector[ii].

3.2.1.3. Dual Credit Policy (CAFC & NEV Credits)

China's Dual-Credit Policy, formally known as the Corporate Average Fuel Consumption (CAFC) and New Energy Vehicle (NEV) credit regulation, was finalized in 2017 and officially implemented in April 2018, with major technical revisions taking effect in 2021. The policy remains fully enforced today and continues to serve as one of China's most powerful structural instruments for driving vehicle electrification and fuel-efficiency improvement. It is centrally administered by the Ministry of Industry and Information Technology (MIIT) and applies nationwide to passenger vehicle manufacturers and importers that exceed the annual production or import thresholds. The system integrates two mandatory compliance requirements: CAFC, which regulates the fleet-average fuel consumption of conventional

internal combustion vehicles, and NEV credits, which mandate a minimum share of NEV production based on each firm's conventional vehicle output.

Covered vehicles include gasoline and diesel passenger cars under CAFC, and qualifying BEVs, PHEVs, and FCEVs under the NEV credit system, while heavy trucks and buses are regulated separately. Under the NEV scheme, different vehicle types generate different credit values depending on technical performance such as driving range and energy efficiency: for example, a short-range BEV may generate around 2–3 credits per vehicle, a long-range efficient BEV around 4–6 credits, PHEVs fewer than BEVs, and FCEVs the highest credits due to their zero-emission status.

Each manufacturer must meet a required NEV credit quota defined as a percentage of its conventional passenger-car production; for instance, a company producing 1 million conventional cars with an 18% NEV credit requirement must generate 180,000 NEV credits. If it only generates 150,000 credits, it must purchase the remaining 30,000 credits from the market. Meanwhile, CAFC sets maximum fleet-average fuel consumption limits; if a manufacturer exceeds these limits, it generates CAFC deficits. Surplus NEV credits can be used, within regulatory limits, to offset CAFC shortfalls, thereby tightly linking the two systems. Manufacturers with persistent deficits and no available credits face regulatory penalties such as restrictions on new model approvals, production controls, and heightened supervision. Through this integrated "carrot-and-stick" mechanism—combining mandatory quotas, credit trading, and production restraints—the Dual-Credit Policy simultaneously forces automakers to improve fuel efficiency of ICE vehicles while rapidly expanding NEV production, making it a central driver behind China's large-scale electrification of the passenger vehicle market.

3.2.2. Financial Incentives

Previously, one of China's most significant NEV drivers was the use of direct subsidies. From 2009 to 2017, the Chinese government had provided direct subsidies to NEV manufacturers and buyers, covering battery electric vehicles (BEVs), plug-in hybrids (PHEVs), and fuel cell vehicles (FCVs). The subsidy was scheduled to decline roughly 20% every two years from 2017 onward and already phased out in 2022.

3.2.2.1. Vehicle Purchase Tax Exemption

China has strategically leveraged tax policy to reduce the cost of NEVs and accelerate market adoption. A cornerstone incentive has been the Vehicle Purchase Tax exemption, which normally amounts to 10 % of a vehicle's price. Since 2014, NEVs have been periodically exempted from this tax, effectively lowering upfront purchase costs. Originally scheduled to expire at the end of 2017, the exemption was extended through 2020, and again through 2022. In mid-2022, the State Council announced a further one-year extension through December 2023. In June 2023, the government introduced its most comprehensive NEV tax relief package to date, extending support through 2027 as part of the post-subsidy transition strategy. Valued at an estimated ¥520 billion (approximately USD 72 billion) in forgone tax revenue, the policy includes two phases:

- 100% Tax Exemption in 2024–2025: NEVs bought in 2024 and 2025 pay no purchase tax, up to a cap of ¥30,000 per vehicle (i.e. the tax is fully waived for the portion up to ¥300k of the car's price). This covers the vast majority of mainstream NEVs.
- 50% Tax Reduction in 2026–2027: NEVs purchased in 2026–27 will pay only half the normal purchase tax (5% instead of 10%), with the tax break capped at ¥15,000 per vehicle. In other words, a buyer can still save up to ¥15k in those years.

By phasing the incentive out gradually (full exemption then half), authorities intend to avoid a steep "cliff" in 2024 or 2026 when the policy changes. As a result of these extensions, NEV purchase tax relief will have been in place for well over a decade (2014–2027)**,** helping bridge the gap as direct subsidies are removed. It's worth noting that as of 2023, cumulative NEV purchase tax exemptions have already exceeded ¥200 billion in value. The continued tax breaks through 2030 underscore China's commitment to sustaining NEV adoption.

3.2.2.2. Value-Added Tax (VAT)

In China, NEVs are subject to the standard 13% Value-Added Tax (VAT), the same as conventional internal combustion engine vehicles. This VAT is included in the final invoice price shown to consumers and is not exempted under current NEV promotion policies[iii]. While there are no VAT-specific reductions for NEVs, manufacturers may benefit from broader tax incentives-such as qualification for high-tech enterprise status, which allows for a reduced corporate income tax rate. Overall, China's fiscal policy to support NEVs has prioritized purchase tax exemptions rather than VAT adjustments.

3.2.2.3. Trade-in Subsidies

China's Strengthened Vehicle Trade-In Program Relaunched and substantially strengthened since 2024, China's nationwide trade-in program offers significant financial incentives to accelerate NEV adoption and stimulate auto market demand. The joint policy, covering both "scrap-and-replace" and "trade-in" pathways, targets older gasoline and diesel vehicles, as well as specific older NEVs. Consumers scrapping an eligible old car and purchasing a New Energy Vehicle (NEV) receive a central government subsidy of 20,000 yuan; purchasing a small-displacement fuel vehicle yields 15,000 yuan. For the trade-in pathway, the maximum national subsidy is 15,000 yuan for NEVs. Local governments frequently supplement these funds, potentially raising the total incentive for certain NEVs to 30,000 yuan. Eligibility requires the old vehicle to have been registered under the consumer's name by specific cutoff dates. Since the 2024 rollout, the program has seen extremely high uptake, with cumulative applications exceeding 10 million and NEVs accounting for over 50% of new purchases under the scheme, successfully linking market growth with the green transition.

3.2.2.4. Other Fiscal Incentives

Beyond those fiscal incentives, NEVs have benefited from other tax incentives. Since 2012, NEVs have been exempt from annual vehicle ownership taxes (vehicle and vessel tax) and certain road taxes, reducing operating costs slightly. Additionally, electric buses received purchase tax exemptions in early 2012. There have also been moves to support the NEV used-car market- for example, China simplified the VAT on used car sales (down to 0.5% in 2020) and encouraged removing inter-city transfer restrictions on used NEVs, making it easier and cheaper to resell electric cars, thus improving their resale value.

3.2.3. Non-Financial Measures

3.2.3.1. License Plate Access

In China's largest cities, license plate restrictions have become a powerful non-financial tool to encourage the adoption of NEVs. To relieve traffic congestion and reduce pollution, cities such as Beijing, Shanghai, Tianjin, Hangzhou, Guangzhou, and Shenzhen have implemented vehicle purchase restrictions- typically via lottery or auction systems for internal combustion engine vehicles (ICEVs)[iv].

NEVs, by contrast, are largely exempt from these constraints. For example, *Beijing and other cities exempt NEVs from license-plate lottery and auction requirements.* Beijing has a quota system that only

issues a limited number of car plates each year (100,000 in 2023), with traditional gasoline cars subject to a low probability lottery. NEVs, however, are in a special category with far higher odds of getting a plate. In fact, Beijing has steadily increased the quota share allocated to NEVs- by 2023, *80% of new license plates were reserved for NEVs* (80k out of 100k)[v]. In mid-2024, Beijing even released an extra 20,000 *NEV-only license quotas* (on top of the regular allotment) for families without a car, marking the first relaxation of its car cap in a decade and exclusively benefiting NEV buyers.

This effectively means a Beijing resident has a much better chance of getting a car plate if they choose an NEV. Similarly, *Shanghai waives its pricey license plate auction fee for NEVs*- a consumer buying a gasoline car in Shanghai must bid for a plate (often costing ¥80,000-¥100,000), but electric car buyers receive a *free "green" license plate*, saving that huge expense[vi]. Other megacities like Guangzhou, Shenzhen, Hangzhou, and Tianjin have also carved out special plate quotas or free plate policies for NEVs, vastly lowering the barrier to owning a car. This policy incentive has been crucial in cities where plate restrictions are a bigger deterrent than the vehicle's price.

3.2.3.2. Driving and Usage Privileges

To control urban air pollution, many Chinese cities enforce driving restrictions based on license plate numbers or vehicle emissions, such as banning cars one day per week or limiting the entry of high-emission vehicles into central zones. However, NEVs are often exempt from these rules. In Beijing, for example, electric vehicles are not subject to the one-day-per-week road space restriction that applies to conventional vehicles, allowing NEV owners to drive every day. Similarly, cities like Shanghai and Hangzhou frequently exclude NEVs from temporary traffic control measures, such as odd-even license plate bans during high-smog days. Additional incentives offered by some local governments include free or discounted public parking, access to bus or high-occupancy vehicle lanes, and toll exemptions or reductions for electric delivery trucks. These privileges significantly improve the convenience and reduce the operational costs of NEVs, making them especially appealing to urban commuters and commercial fleet operators.

3.2.3.3. Fleet and Quota Mandates

Regulators in China have adopted a combination of production and fleet-based mandates to accelerate the adoption of NEVs. At the national level, the dual-credit policy, first introduced in 2017, effectively sets minimum NEV production quotas for automakers. Under this system, manufacturers are required to earn NEV credits based on the type and volume of NEVs they produce or, alternatively purchase credits from compliant firms. The credit targets have steadily increased from 10% in 2019 to 38% in 2025 and will further rise to 48% in 2026 and 58% in 2027. Recent revisions have also reduced the credit value per vehicle to reflect technological maturity, with BEVs capped at 1.2 credits, plug-in hybrids at 0.5, and fuel-cell vehicles at 4.0. To stabilize the oversupplied credit market, authorities have introduced a centralized NEV credit reserve system. Manufacturers falling short must now buy credits directly from the reserve, rather than from the open market[vii].

In parallel, fleet mandates have been introduced to stimulate demand. As of 2025, public agencies and institutions are required to ensure that at least 30% of new vehicle purchases are NEVs, with expectations for increased targets in future policy cycles[viii]. City-level mandates have gone further, such as Shenzhen achieved 100% electrification of its bus fleet by 2020[ix], and other cities have mandated full electrification of buses and taxis by specific deadlines. In the commercial sector, cities such as Shanghai and Shenzhen have designated low-emission zones requiring a growing proportion of urban freight vehicles to be NEVs. Local implementation frameworks and infrastructure planning strongly support these non-financial mandates.

3.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility

3.3.1. New Energy Vehicles (NEVs)

China has established the GuoBiao (GB) standards as a regulatory framework covering a wide range of products, from food safety to battery electric vehicles. Any company wishing to introduce its products to the Chinese market must comply with these GB standards. It can be said that China's ability to set standards and regulations for electric vehicles positions the country as a leader in regulatory frameworks and ecosystems for electric mobility, ranging from infrastructure and vehicles to regulations.

For instance, GB standard code GB29743.2, which pertains to coolants for electric vehicles, aims to establish safety requirements (such as electrical conductivity, stability, pH levels, and corrosion), as well as performance, service life of the battery, and other components of electric vehicles. Furthermore, China's GB standards also address thermal stability, electrical conductivity, and environmental safety.

The Standardization Administration of China (SAC) has also introduced safety requirements for conductive charging systems for electric vehicles. These include warning labels, communication protocols, charging interface specifications, and protections for both AC and DC charging. One of the notable standards is GB/T 39752-2021 - Safety Requirements and Test Specifications for Electric Vehicle Conductive Supply Equipment, which outlines safety and testing specifications for EV conductive power supply equipment.

Other important standards include:

- GB 38031-2020 - Electric Vehicles Traction Battery Safety Requirements, which covers safety requirements for battery cells, battery packs, and battery systems used in electric vehicles.
- GB 18384-2020 - Electric Vehicles Safety Requirements, which defines general safety requirements for electric vehicles.
- GB 38032-2020 - Electric Bus Safety Requirements, which specifies technical requirements and test procedures for electric buses, including battery charging and control system operations.

The Ministry of Industry and Information Technology (MIIT) of China has announced a strategic plan for establishing automotive industry standards, with a particular focus on new energy vehicles (NEVs) and intelligent vehicles. The plan positions China as a leader in promoting approximately 20 international standards, including those related to electromagnetic compatibility and automotive radar. It also includes the development of performance testing standards for electric vehicles, safety-related terminology, and technical regulations for autonomous driving systems, as well as protocols for measuring the energy consumption of electric vehicles.

Moreover, the Ministry is actively supporting the integration of national and international standardization initiatives to ensure consistency and to address the research needs of emerging technologies such as solid-state batteries, battery swapping, and automotive-related artificial intelligence. As a result, China's electric vehicle industry is working to establish credibility and gain broader international recognition through the development and implementation of robust safety standards.[21]

[21] Naphakhawat Wanchai. (2025). Electric Vehicle Industry: Strategic Competition between Superpowers and Implications for Thailand.

3.3.1.1. Regulations for the Registration of New Energy Vehicles (NEVs)

The procedures and regulations that manufacturers must follow in order to register New Energy Vehicles (NEVs) in China constitute a rigorous and essential process. This is because the Chinese government places great emphasis on safety, quality control, and the promotion of innovation in the NEV industry. The registration process, which is required before NEVs can be legally sold in the Chinese market, can be summarized in the following key five steps:

1. Manufacturer Registration with the Ministry of Industry and Information Technology (MIIT):

Before manufacturing or importing NEVs for sale in China, companies must obtain certification as an "Approved Vehicle Manufacturer" from the Ministry of Industry and Information Technology (MIIT). The core requirements include: (1) establishing a physical manufacturing base in China (or being officially registered as an importer), (2) implementing a quality control system in the production process, and (3) operating an in-house testing facility or having access to a certified testing laboratory.

2. Product Type Approval:

After registering as a manufacturer or importer, the company must apply for approval of each vehicle model intended for sale. This is referred to as "Product Type Approval" or inclusion in the New Energy Vehicle Catalogue issued by MIIT. Required documentation includes vehicle specifications (covering the electrical system, battery, and motor), certified safety test results from accredited testing agencies (e.g., CATARC, CAERI), photographs, design schematics, production plans, and evidence of compliance with GuoBiao (GB) standards.

3. Inclusion in the NEV Catalogue:

If the vehicle model passes inspection and receives approval from MIIT, it will be officially listed in the NEV Catalogue, which is updated and published monthly. Only vehicles included in this catalogue are legally permitted for sale in China, eligible for government subsidies (if applicable), and allowed to apply for local license plate registration.

4. China Compulsory Certification (CCC):

The CCC mark is a mandatory safety certification for products manufactured domestically or imported into China. Vehicles and related components must receive this certification before entering the market. The certification process includes product testing, factory inspections, and documentation reviews. In some cases, individual components such as battery packs, electric motors, or safety devices that are on the compulsory certification list must also be separately certified under the CCC scheme.

5. Local Traffic Bureau Registration (for customers):

Once a vehicle model has been approved and listed in the NEV Catalogue, customers or dealers can proceed to register the vehicle with local traffic bureaus in various cities. The registration system cross-references vehicle information with the MIIT's NEV Catalogue to validate eligibility for license plate issuance.

In major Chinese cities such as Beijing and Shanghai, vehicle license plate quotas are strictly controlled to manage road congestion. Internal combustion engine (ICE) vehicles are subject to license plate allocation through lotteries or auctions, making license plates difficult to obtain and often extremely expensive—sometimes reaching up to 100,000 yuan[22]. These are typically issued as blue plates.

[22] Jane Li. (2021). China is trying to put the brakes on Tesla's biggest rival.

In contrast, the Chinese government actively promotes the adoption of New Energy Vehicles (NEVs), which are issued green license plates. Only battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEVs) are eligible for green plates. Conventional hybrids (HEVs) and traditional ICE vehicles are not qualified. Importantly, green license plates are exempt from the lottery and auction process, thus significantly lowering the barrier for registration. This policy is part of the government's broader effort to encourage the use of environmentally friendly vehicles.

3.3.2. Vehicle Emission Standards

China's national light-duty vehicle emission regulation, known as the China 6 Emission Standard, was issued in December 2016 and implemented in two phases. The first phase, China 6A, took effect on July 1, 2020. The second and more stringent phase, referred to as China 6B, was officially enforced nationwide from July 1, 2023, following the announcement by the Ministry of Ecology and Environment (MEE). From this date onward, vehicles that do not comply with the China 6B standard are prohibited from being produced, imported, or sold in the Chinese market. To facilitate a smooth market transition, the ministry granted a six-month grace period, allowing the sale of light-duty vehicles that had already passed regulatory pollution monitoring tests, which expired on December 31, 2023[23].

The Chinese government has prioritized improving the energy efficiency of conventional internal combustion engine (ICE) vehicles while simultaneously accelerating the development of new energy vehicles (NEVs) as part of its broader strategy to reduce transport-related carbon emissions. The transportation sector is estimated to account for approximately 10% of China's total carbon emissions, making vehicle electrification and fuel efficiency critical policy priorities. According to the China Association of Automobile Manufacturers (CAAM), more than 95% of passenger vehicles sold in China were already compliant with the China National Emission Standard VI during its early stage of implementation. Major metropolitan areas such as Beijing, Shanghai, Guangzhou, and Shenzhen have taken the lead in early adoption and strict enforcement of the standard.

In the commercial vehicle segment, heavy-duty trucks have generally been better prepared for compliance with the upgraded China VI B emission standard than light-duty trucks. Manufacturers of heavy-duty trucks (typically over 31,000 lbs), many of which are state-owned or have significant state ownership, began investing aggressively in clean diesel technologies and emissions-control solutions following the issuance of the China VI emission standard for diesel-fueled heavy-duty vehicles (GB17691–2018) in 2018. In contrast, light-duty truck manufacturers were relatively less proactive in upgrading their technologies during the earlier stages of policy implementation.

As a result, industry concerns have emerged regarding the large inventory of non-compliant light-duty trucks (generally below 13,000 lbs) that struggle to meet the stricter China VI B emission requirements. Compared with heavy-duty trucks, light-duty trucks typically operate with lower profit margins and have been more strongly affected by the relatively weak macroeconomic environment. Manufacturers are therefore facing increasing pressure to identify clean, cost-effective technical solutions to upgrade or phase out existing light-duty truck inventories.

[23] U.S. Department of Commerce, International Trade Administration. (2023, July 30). China auto industry National VI B emission standard. https://www.trade.gov/market-intelligence/china-auto-industry-national-vi-b-emission-standard

Market data further reflect the structural transformation underway in China's automotive sector. According to the China Passenger Car Association (CPCA), sales of internal combustion engine vehicles declined to 15.2 million units in 2022, representing a year-on-year decrease of 16% and a market share of 74.4%. In contrast, China sold approximately 6.9 million new energy vehicles in 2022, corresponding to a year-on-year increase of 93.4% and a market share of 25.6%. With this performance, China maintained its position as the world's largest new energy vehicle producer and market for the eighth consecutive year, underscoring the strong momentum of its transition toward electrified transport.

3.3.3. Intelligent Connected Vehicles (ICVs)

The ongoing digital transformation of the transport sector has played a central role in making transportation systems more environmentally sustainable, efficient, and user-centric. Intelligent Connected Vehicles (ICVs) are a core driver of this transformation, as they offer significant potential to reduce traffic congestion, enhance road safety, and improve overall transport efficiency. The ICV industry encompasses not only vehicle technologies, but also new operational models and integrated services across mobility platforms, traffic management, and infrastructure systems. Its development requires the complex coordination of multiple elements, including users, vehicles, road infrastructure, communications networks, and cloud-based computing systems.

A critical foundation for ICV deployment is the establishment of industry-specific regulations, technical standards, and safety governance frameworks. Because ICV technologies are still evolving rapidly, the sector faces persistent challenges—particularly in the areas of cybersecurity, data protection, system reliability, and operational safety. To manage these risks while accelerating innovation, governments must support real-world testing, pilot demonstrations, and controlled commercial trials. In recent years, the Chinese government has placed growing strategic emphasis on the development of the ICV industry and has introduced a series of national-level policies and regulatory frameworks covering technical standards, automated-driving safety requirements, road testing permissions, data governance, and vehicle–road–cloud integration. These policies reflect China's ambition to become a global leader in next-generation vehicle technologies and intelligent mobility systems.

According to a study by Ruet, Wang, and Wei (2024), published in The Emerging Intelligent and Connected Vehicle Industry in China, a total of nine major national policies related to ICVs were issued between 2017 and 2023. These policies focus on establishing technical standards, promoting cross-sectoral collaboration, enhancing data and cybersecurity frameworks, and launching pilot programs for on-road testing and deployment in specific scenarios. A summary of these key policies is provided in the following Table 3-10.

Table 3-10: Key national ICV policies and regulations in China (2017-2023)

Year	Title	Released by	Main contents
2017	Guidelines for the Construction of the National Intelligent Connected Vehicle Industry Standard System	Ministry of Industry and Information Technology, National Standardization Administration Committee	It established China's objective to develop intelligent vehicles with network connectivity. The proposed standard system includes 95 standards, covering basics, general specifications, product and technology applications, and related standards. In the next 2 to 3 years, priority will be given to the formulation of the following standards: 1) basic and general standards that support the entire standard system, such as system terms and definitions, level classification standards; 2) relatively mature and widely applied technology product and functional standards, such as automatic emergency system standards and commercial vehicle electronic stability control system standards; 3) technology and product standards related to national strategic planning, such as general technical specifications for automotive information security.
2018	Intelligent Connected Vehicles Industry Development Plan	Ministry of Industry and Information Technology	By 2020, breakthroughs will be made in cross-industry integration of the intelligent and connected vehicle industry. Vehicles with high-level autonomous driving functions will be applied in specific scenarios on a large scale; a comprehensive application system will be basically established; and user penetration will be greatly increased. The level of smart road infrastructure will be significantly improved. Policies, regulations, standards and safety guarantee systems that adapt to industrial development will be initially established.

Year	Title	Released by	Main contents
2020	Intelligent Vehicle Innovation and Development Stategy	National Development and Reform Commission and other 10 minitries	It consists of four parts: development situation, overall requirements, main tasks, and safeguard measures. Strategic Vision: By 2025, the technological innovation, industrial ecology, infrastructure, regulations and standards, product supervision and network security systems of China's intelligence vehicles will be basically formed.
2020	New Energy Vehicle Industry Development Plan (2021-2035)	State Council	By 2025, highly autonomous vehicles will be commercially available in limited areas and specific scenarios; large-scale application will be achieved in 15 years. Use NEVs as the first carrier for the application of intelligent connected technology, support cross-industry collaboration among enterprises, and develop key technologies and products include high-precision mapping and positioning, V2X communication, and wire-controlled execution systems. Promote the integrated development of NEVs and information communications and carry out demonstration applications in specific scenarios, regions and roads. Support urban driverless logistics and distribution, municipal sanitation, bus rapid transit systems (BRT), automatic valet parking and specific scene demonstration applications using intelligent connected vehicles as the carrier. Accelerate the improvement of policies and regulations on road traffic, accident liability, data use, etc. that adapt to the development requirements of intelligent connected vehicles.

Year	Title	Released by	Main contents
2021	Intelligent Connected Vehicle Road Testing and Demosstration Application Management Specifications	Ministry of Industry and Information Technology, Ministry of Public Security and Ministry of Transport	It is a revision of the old version of the 'Specification' in April 2018. The first aspect is to add demonstration application scenarios and extend test demonstration roads to highways and urban roads. Second, special utility vehicles have been added to the range of test vehicles, and requirements for the test demonstration subjects have been increased in terms of network security and data security, etc. Third, improve the general testing projects for the autonomous driving functions of intelligent connected vehicles and promote the unification of testing projects and standards. Fourth, cancel the issuance requirement of road test/demonstration application notice and simplify the application procedures.
2021	Opinions on Strengthening the Access Management of Intelligent Connected Vehicle Manufacturers and Products	Ministry of Industry and Information Technology	Intelligent connected car manufacturing enterprises should assume the main responsibilities on the management of data security, network security, software upgrades, functional safety, and ensure product quality and production consistency. Make clear regulations on the data of intelligent connected cars from the aspects of data security and network security. Enterprises that produce automotive products with online upgrade functions should establish compatible management capabilities. Enterprises producing automotive products with driving assistance and automatic driving functions should clearly inform the vehicle functions and performance limitations, driver responsibilities, human-computer interaction equipment instructions, function activation and exit methods and conditions, etc.

Year	Title	Released by	Main contents
			Improve safeguard measures. Enterprises should establish a self-examination mechanism.
2022	Guidelines for the Construction of Internet of Vehicles Network Security and Data Security Standard Systems	Ministry of Industry and Information Technology	It is proposed that by the end of 2023, a network security and data security standard system for the IoV will be initially established. Focus on research on basic commonalities, terminal and facility network security, network communication security, data security, application service security, security assurance and support, and other standards. The development of more than 50 urgently needed standards.
2023	Guidelines for the Construction of the National Intelligent Connected Vehicle Industry Standard System	Ministry of Industry and Information Technology, National Standardization Administration Committee	Construct an intelligent connected vehicle standard system, including intelligent connected vehicle foundation, technology, products, test standards, etc., and guide the formulation and revision of relevant standards. In the first phase, by 2025, an intelligent connected car standard system will be formed that can support common functions of assisted driving and autonomous driving. In the second phase, by 2030, an intelligent connected vehicle standard system will be fully formed that can support the coordinated development of single-vehicle intelligence and network empowerment.
2023	Carry out pilot projects for access and on-road access of intelligent connected vehicles	Ministry of Industry and Information Technology, Ministry of Public Security, Ministry of Housing and Urban-Rural Development, Ministry of Transport	For intelligent and connected vehicle products that have obtained access, pilot projects will be carried out on the road in limited areas. The pilot projects concern L3 and L4 autonomous driving according to the national standard "Automotive Driving Automation Classification" (GB/T 40429-2021).

Year	Title	Released by	Main contents
			Companies must provide full description of their self-driving system (a total of 59 technical parameters in 9 categories), as well as satisfy multiple product testing and safety assessment requirements. Five phases of implementation: pilot application, product access pilot, on-road pilot, pilot suspension and withdrawal, evaluation and adjustment.
2023	Guide to autonomous vehicle transportation safety services	The Ministry of Transport	Specific requirements in terms of scope of application, basic principles, application scenarios, autonomous driving transportation operators, transportation vehicles, staffing, safety assurance, supervision and management, etc. Roboshuttles or robotrucks need to have in-car safety operators, while robotaxis can use remote operators. The ratio of robotaxis to remote operators cannot exceed 3:1, and operators need to pass certain skill tests.

Source: Ruet, J., Wang, X., & Wei, Z. (2024, June). The emerging intelligent and connected vehicle industry in China. In Gerpisa-Convergence or Divergence of trajectory of change.

3.4 Energy Policy

This chapter presents an overview of China's energy policy and the current state of infrastructure readiness to support the adoption of NEVs. The information compiled in this chapter is based on a comprehensive literature review and data collection from relevant national agencies and institutions.

China, as the world's current largest emitter, has formalized its commitments through its Nationally Determined Contribution (NDC), pledging to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060[x]. This pledge, announced in 2020, has become the cornerstone of China's climate strategy. As part of this commitment, China aims to reduce carbon dioxide emissions per unit of GDP by over 65% from 2005 levels and increase the share of non-fossil fuels in its primary energy consumption to around 25% by 2030. Additionally, the country has set a target to expand its installed capacity of wind and solar power to over 1,200 GW by the same year.

In the transportation sector, China has implemented a range of initiatives to support its climate goals. The country has actively promoted the deployment of New Energy Vehicles (NEVs), including electric buses, taxis, and delivery trucks, particularly in urban public transport systems. China has become one of the leaders in the global NEV market, which has taken multiple measures in response to the global promotion of NEVs. Efforts are also being made to shift both passenger and freight transport to low-carbon modes such as high-speed rail.

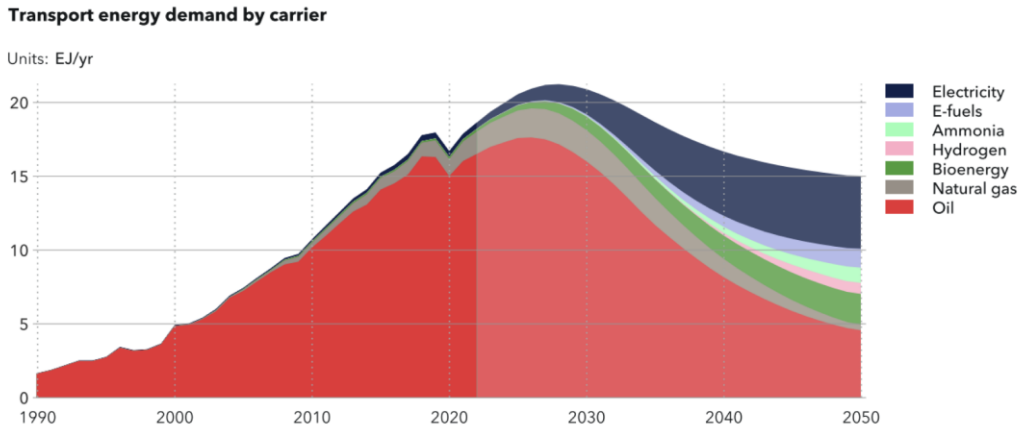


Figure 3-13: Transport Energy Demand by Carrier (EJ/year, 1990–2050)

Source: DNV (2024)

These transformations are reflected in projected shifts in transport energy demand Figure 3-13 While oil has historically dominated the sector, its share is expected to decline sharply after 2030. Electricity is projected to become the dominant energy source for transport by 2050, accompanied by increasing contributions from bioenergy, hydrogen, and synthetic e-fuels. This aligns with China's policy direction-phasing out fossil-fuel dependence and electrifying key segments of the economy, especially transport.

Through participation in the NDC Transport Initiative for Asia (NDC-TIA), China collaborates with international partners to enhance the ambition and implementation of transport-related climate actions. Notably, some provinces have adopted a "double peaking" strategy, aiming to reduce both greenhouse gas emissions and air pollutants from the transport sector. Shenzhen stands out as a leader in this space, having piloted NEV programs since 2009 and becoming the world's first city to fully electrify its public transportation system since 2017.

3.4.1. Policy and Regulation

China has positioned NEVs at the intersection of its energy, environmental, and industrial policy agendas. The government views NEVs not only to improve urban air quality and reduce fossil fuel dependence, but also as a key pillar in transforming its industrial and energy systems. NEV development is closely tied to national efforts to expand renewable energy, accelerate circular economy practices, and digitalise transport infrastructure. The following section outlines major policies and development plans that together form China's integrated policy approach to scaling NEVs and advancing smart, low-carbon mobility.

3.4.1.1. Dual carbon strategy

On September 22, 2020, China formally announced its Dual-Carbon targets, committing to peak carbon emissions by 2030 and achieving carbon neutrality by 2060. This declaration marks a pivotal moment in global environmental governance, signalling China's intent to take a leading role in addressing climate change. Domestically, the Dual-Carbon strategy carries profound significance not only as a climate commitment but also as a national development agenda. It reflects the need to transform China's economic structure toward sustainability and serves as a strategic pathway to achieving high-quality economic growth[xi]. Achieving these goals presents a major challenge: how to effectively reduce carbon emissions while ensuring energy security and continued economic development. The key lies in optimising the energy consumption structure, particularly by reducing dependence on fossil fuels and increasing the share of clean energy[xii]. To that end, China has set clear targets: by 2030, non-fossil energy should account for 25% or more of total energy consumption, rising to 80% by 2060. In the near term, the 14th Five-Year Plan for a Modern Energy System establishes a 2025 target of 20% non-fossil energy consumption. These goals imply a dramatic transformation in China's energy mix over the next two decades. Rapid progress is required to phase down coal, scale up renewables and nuclear power, and promote electrification across end-use sectors. NEVs play a central role in this transformation. By replacing internal combustion engine vehicles, NEVs help reduce direct fossil fuel use in the transport sector while creating new electricity demand that can be increasingly met by clean power. As such, the dual-carbon strategy justifies large-scale NEV deployment and incentivizes investments in supporting infrastructure, battery innovation, and smart mobility platforms. It serves as the high-level policy anchor from which China's integrated approach to scaling NEVs, advancing digital transport infrastructure, and aligning transport with clean energy goals has emerged.

3.4.1.2. The 14th Five-Year Plan for National Economic and Social Development

The 14th Five-Year Plan (2021–2025) sets the strategic direction for China's national development, placing strong emphasis on economic modernization, environmental sustainability, and the energy transition. Within this framework, NEVs, including BEVs, plug-in hybrid electric vehicles (PHEVs), and fuel cell vehicles (FCEVs), are identified as a strategic emerging industry essential to achieving climate objectives, enhancing energy security, and advancing industrial upgrading. This progress builds on more than two decades of policy support. China has promoted NEVs through a combination of industrial policy, subsidies introduced in 2009, and infrastructure investment. These efforts were later reinforced by pandemic recovery packages and long-term strategic planning. While these measures initially helped scale the industry, the government has recently shifted away from direct financial support. Producer-side subsidies ended in 2022, and consumer-side tax exemptions are scheduled to phase out by 2027[xiii]. Despite this transition, the NEV market has continued to expand, reflecting growing market maturity. Factors such as competitive pricing, localized supply chains, and widespread charging infrastructure have strengthened consumer confidence. The gradual removal of subsidies has not slowed adoption, which highlights the effectiveness of coordinated industrial policy in promoting sustainable growth.

The rapid expansion of NEVs is also reshaping China's energy landscape. As of 2024, electric vehicles account for about half of all new car sales, significantly undercutting 3.5% of new fuel demand[xiv]. This trend signals a structural shift in China's transport-energy nexus, where the electrification of mobility is directly reducing reliance on petroleum. It also aligns with broader national goals around air quality improvement, energy security, and climate mitigation. The continued promotion of NEVs reinforces their role not only as a decarbonization tool but also as a strategic component of China's industrial and energy transformation agenda. This growth occurred despite the phase-out of producer-side subsidies, reflecting increasing consumer confidence, cost competitiveness, and a maturing domestic supply chain. While consumer-side financial incentives remained in place through the end of 2022, the market's resilience suggests a shift toward a more self-sustaining, demand-driven NEV sector. The government's continued promotion of NEVs is motivated not only by decarbonization goals but also by urgent concerns over local air pollution, energy security, and dependence on imported oil, positioning NEVs as a key pillar of both environmental and strategic policy. Looking ahead, China is expected to remain the global leader in NEV sales through 2030, with electric vehicles projected to comprise around 80% of all new car sales by the end of the decade[xv]. This trajectory reflects a market that is no longer dependent on short-term incentives but is driven by strong demand, technological innovation, and policy continuity.

At the subnational level, the 14th Five-Year Plan for Green Transportation, a key component of the national strategy, sets a target for NEVs to make up 72% of the public bus fleet by 2025[xvi]. Nineteen provinces have adopted NEV-specific targets for public transit. For example, Hainan, Liaoning, Shandong, and Hunan aim to fully electrify all new buses, while 16 other provinces have pledged to increase NEV shares in their fleets. Beijing and Hainan have announced ambitions to transition toward fully NEV-based public transport systems. In the private sector, the central government maintains a 20% NEV sales target, while frontrunner provinces such as Hainan (80%), and Beijing and Shanghai (50%) have set more aggressive goals.

3.4.1.3. Renewable energy policy and sectoral integration

China's 14th Five-Year Plan (2021–2025) set a national target for renewables to supply 33% of electricity by 2025. Building on this, solar capacity is projected to overtake coal as the country's dominant energy source by 2026, reaching 1.38 terawatts (TW), approximately 150 GW more than coal. This marks a pivotal structural shift from fossil fuels toward clean power. China is the global leader in clean energy deployment, accounting for more than 40% of global installed capacity in wind and solar PV, and over half of the world's electric vehicles. In 2023 alone, China added a record 260 GW of solar PV and over 75 GW of wind capacity, while also commissioning nearly 50 GW of new coal-fired power plants. This highlights the complexity of balancing rapid demand growth with decarbonisation[xvii].

As illustrated in , coal currently dominates China's energy mix but is expected to decline steadily through 2050, replaced by solar PV, wind, and other low-carbon sources. Solar PV and wind are projected to become the largest single source of energy. Meanwhile, oil and natural gas are set to decline, supporting China's dual-carbon strategy and aligning with global decarbonization trends. The expansion of nuclear and hydropower further contributes to building a resilient and diversified energy system.

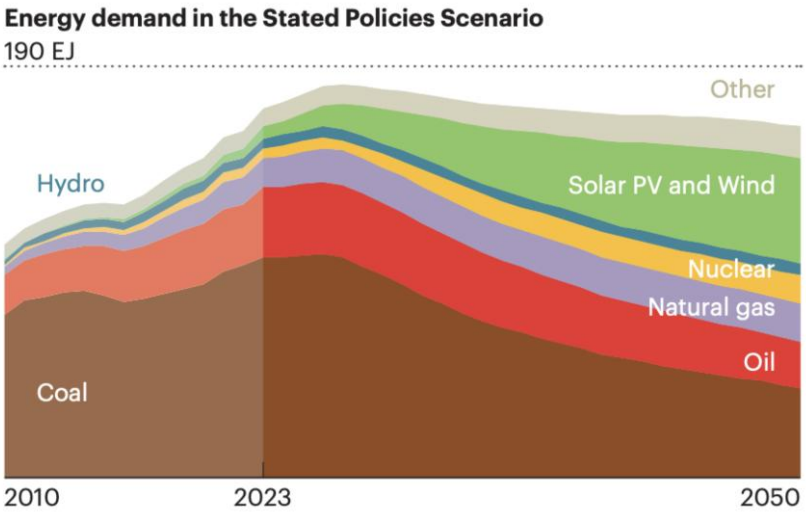


Figure 3-14: Energy Demand in China under the Stated Policies Scenario (2023–2050)

Source: IEA (2024)[liii]

To reinforce this transition, the government introduced the New Renewable Energy Plan, jointly issued by the National Development and Reform Commission (NDRC) and five other agencies. The plan sets an ambitious goal of raising renewable energy consumption to over 1 billion tonnes of standard coal equivalent (tce) by 2025, approximately 20% of total energy use. Unlike previous plans that focused mainly on capacity growth, this strategy emphasizes sectoral integration, embedding renewable energy into industry, transportation, buildings, and urban development[xviii]. A core focus is aligning the rapid deployment of NEVs with renewable electricity sources such as solar and wind to ensure that transport electrification meaningfully reduces emissions. This includes promoting co-located renewable energy generation near charging infrastructure and advancing smart charging and vehicle-to-grid (V2G) systems. In parallel, the government is actively promoting green mobility, including efforts to reduce the number of fuel-based private vehicles and support the expansion of shared mobility modes such as car-sharing and ridesharing. These models not only reduce vehicle ownership and usage frequency but also help alleviate traffic congestion and minimize urban air pollution[xix].

China's transport technologies are already reshaping demand for oil. In 2024, electric vehicles accounted for nearly 50% of new car sales, resulting in an estimated 3.5% reduction in new fuel demand. In the freight sector, the growing adoption of compressed and liquefied natural gas (CNG/LNG) has further displaced an additional 2% of oil consumption. Since 2009, the Chinese government has offered financial incentives to encourage the purchase of NEVs with a strategy aimed at advancing domestic automotive capabilities and improving urban air quality. The launch of a vehicle trade-in program in April 2024[xx], with further expansion in 2025, continues to stimulate NEV sales. At the same time, China's cost-competitive NEV manufacturers are increasingly securing a foothold in international markets, reinforcing the country's role as a global leader in transport electrification. These trends are driven by unprecedented clean energy investment. In 2023, China accounted for one-third of global clean energy investment, with clean tech emerging as a major engine of GDP growth. That same year, China installed more solar PV capacity than the rest of the world combined in 2022, and increased wind capacity by 66% year-on-year. The rise of the so-called "new three" industries- solar cells, lithium batteries, and NEVs- which saw a 30% increase in exports, underscores China's leadership in global clean technology supply chains[xxi].

Looking ahead, China's GDP is expected to grow by just under 4% annually through 2030 and then slow to around 2.4% per year from 2030 to 2050. This economic trajectory will shape energy demand patterns and underscores the importance of clean energy integration in ensuring both energy security and long-term emissions reduction.

3.4.1.4. Circular Economy

China's Circular Economy Development Plan plays a key role in supporting both resource efficiency and the long-term sustainability of the NEV sector[xxii]. The plan aims to improve overall resource utilization and reduce lifecycle emissions, particularly by advancing the recycling of critical materials such as power batteries. Firstly, the plan targets a 20% increase in national resource productivity by 2025, using 2020 levels as the baseline. This reflects a strong policy push to decouple economic growth from resource consumption. Secondly, it aims to scale up recycling efforts, including the production of 20 million tonnes of recycled non-ferrous metals, which are vital components in NEV manufacturing. This not only reduces dependence on primary raw materials but also mitigates the environmental impacts of mining and extraction. Lastly, the plan seeks to expand the resource recycling industry to reach a total output value of RMB 5 trillion (approximately USD 773 billion), signalling the government's intention to position circularity as a major pillar of industrial growth. These goals are reinforced by NEV-specific measures to reduce material waste and recover valuable components. The plan targets a 30% battery recovery rate by 2025, the establishment of over 100 circular economy pilot zones, and the promotion of green product design to reduce embedded energy and improve recyclability in NEVs. Together, these measures are intended to create a closed-loop system for battery production and disposal- reducing reliance on raw material imports while supporting China's dual-carbon strategy.

The government places great emphasis on the significance of complete vehicle recycling, specifically highlighting the recycling of NEVs and the safe disposal and resource reuse of waste batteries. The utilisation of retired batteries in alternative scenarios allows for the maximization of their remaining value while minimizing environmental pollution risks[xxiii]. Moreover, scrap batteries can be recycled for valuable metal materials to produce new batteries[xxiv] . The government and industry can work together to establish a comprehensive waste battery recycling[xxv] system. It involves providing guidance to businesses and individuals on the safe disposal of waste batteries or entrusting them to professional institutions for proper treatment.

Although the Circular Economy Development Plan is framed as an industrial and environmental initiative, it plays a crucial supporting role in China's energy policy by enhancing the material efficiency and lifecycle sustainability of NEVs, reducing embodied emissions, and supporting the dual-carbon strategy.

3.4.1.5. Action plan to accelerate the Construction of a New Power System (2024-2027)

In 2024, China launched the Action Plan to *Accelerate the Construction of a New Power System (2024-2027),* jointly issued by the National Development and Reform Commission (NDRC)**,** the National Energy Administration (NEA)**,** and the National Data Administration**.** The plan outlines a strategic framework to modernize China's power system in support of high-renewable integration, electrification, and digital transformation. The Action Plan outlines nine strategic focus areas to support China's energy transition. First, it emphasizes the need to guarantee power system stability and ensure secure, reliable operations amid the growing share of variable renewable energy. It also seeks to increase the transmission of wind and solar energy through long-distance power lines, while promoting the high-quality development of the distribution grid to enable better integration of distributed energy resources (DERs). The plan calls for the construction of a smart power dispatching system with advanced automation, enhanced data sharing, and real-time grid optimization. In parallel, it supports the development of renewable energy–friendly power stations and the rollout of smart microgrid

demonstration projects. Existing coal-fired power plants are to be upgraded for enhanced flexibility to facilitate a cleaner power mix. Furthermore, the Action Plan aims to improve regulation and balancing capabilities across the power system—enhancing load-following, frequency regulation, and resource coordination. It also focuses on enhancing demand-side management, enabling responsive load behaviors, smart home technologies, and price-based demand coordination. Lastly, the plan includes expanding the national NEV charging infrastructure to support large-scale NEV deployment and ensure grid readiness for rising electricity demand.

Together, these measures form the foundation of a "new power system" that is more resilient, flexible, low-carbon, and digitally integrated—a critical enabler of China's long-term energy transition. NEVs remain a key focus in the 2024–2027 energy plan, with infrastructure and grid upgrades designed to ensure stable, renewable-based electricity can support large-scale NEV adoption.

3.4.1.6. Guideline for Action Plan to Accelerate the Construction of a New Power System (2024–2027)

In 2024, the National Development and Reform Commission (NDRC), together with the National Energy Administration (NEA) and other agencies, released *the Implementation Guidelines on Strengthening the Integration and Interaction between New Energy Vehicles (NEVs) and the Power Grid*[xxvi]. This policy aims to enhance the synergy between NEV deployment and power system modernization, supporting China's transition toward a renewable-based, digitally enabled "new power system." The guidelines set targets for developing a technical standards system for vehicle-grid integration by 2025, implementing time-of-use (ToU) electricity pricing, and launching pilot demonstrations in selected cities. By 2025, more than 60% of charging in pilot areas is expected to occur during off-peak hours. Looking further to 2030, NEVs are expected to function as distributed energy storage resources and play a significant role in grid flexibility.

The guidelines outline six key areas of action: technological innovation, standardization, market mechanism reform, infrastructure upgrades, pilot demonstrations, and grid enterprise capability building. Notably, it calls for upgrading bi-directional charging infrastructure, integrating renewable energy into charging systems, and scaling demand response services. It also proposes interagency coordination, clear role allocation across NEV manufacturers, grid operators, and local governments, and the establishment of at least five demonstration cities and 50 vehicle-to-grid (V2G) projects by 2025. These efforts underscore China's ambition to transform NEVs into active grid participants, contributing to both transportation decarbonization and grid stability.

3.4.1.7. Action Plan for High-Quality Distribution Grid Development (2024-2027)

As China accelerates the electrification of its transport sector, smart and resilient power infrastructure has become a foundational enabler of long-term NEV deployment. In October 2024, the National Energy Administration (NEA) released the Action Plan for High-Quality Distribution Grid Development (2024-2027), which directly supports the country's broader goals under the Action Plan for Accelerating the New Power System and the dual-carbon strategy. This initiative recognizes that China's existing distribution grid must evolve rapidly to accommodate new types of energy demand-particularly the proliferation of distributed renewable energy systems and NEV charging infrastructure. The plan aims to create a flexible, intelligent, and low-carbon distribution system capable of meeting the needs of new market participants while enhancing grid stability and supply security[xxvii]. The action plan outlines several strategic priorities aimed at enhancing the resilience, inclusiveness, and adaptability of the power grid. First, it prioritizes targeted upgrades in regions with weak or ageing infrastructure to improve reliability and address regional disparities in electricity access. Second, the plan emphasizes disaster resilience by reinforcing grid components and operational protocols to better withstand extreme weather events, such as typhoons and floods—an increasingly urgent need in the

face of climate change. Third, the grid must be technically and digitally prepared to accommodate emerging energy users, including distributed solar systems, battery storage, and NEVs, all of which introduce bi-directional and intermittent loads. Finally, the plan promotes the deployment of distributed smart grids, particularly in urban and industrial clusters, where real-time data exchange, dynamic load balancing, and efficient coordination with renewable energy resources are essential for future power system flexibility.

The plan also emphasizes alignment with the forthcoming 15th Five-Year Plan, proposing updated technical standards, investment frameworks, and implementation mechanisms. To track progress, the NEA will conduct regular performance assessments between 2025 and 2027, ensuring accountability and regional coordination. By upgrading the distribution network in parallel with national power system reforms, this action plan helps establish a robust local infrastructure foundation to support NEV charging, distributed energy integration, and the broader electrification of demand.

Table 3-11: Key National Plans Supporting NEV and Smart Mobility Development in China (Targets by 2025)

Plan Name	**Focus Area**	**NEV/Smart Mobility Relevance**	**Key Targets by 2025**
New Energy Vehicle Industry Development Plan (2021–2035)[xxviii]	NEV industry development, innovation, and decarbonization	Sets national NEV adoption targets, promotes core technologies (battery, FCEV, autonomous), aligns with carbon goals	● NEVs = 20% of new vehicle sales ● BEV efficiency ≤ 12 kWh/100km ● full electrification of public transport ● battery traceability
Renewable Energy Policy and Sectoral Integration[xxix]	Energy transition and integration across sectors	Aligns NEV charging with renewable sources; promotes co-located solar/wind + NEV infra; enables V2G and smart charging	● 33% of electricity from renewables ● 1B tce renewable energy use ● solar to overtake coal as top power source
Circular Economy Development Plan[xxx]	Resource efficiency and lifecycle sustainability	Supports battery recycling, vehicle reuse, material recovery, and green product design for NEVs	● 30% battery recovery rate ● 20M tons recycled metals ● 100+ circular pilot zones ● 20% increase in resource productivity
High-Quality Distribution Grid Development Plan (2024–2027)[xxxi]	Local grid resilience and DER accommodation	Strengthens low-voltage networks to support NEV charging, DERs,	● Grid upgrades in underserved provinces

Plan Name	Focus Area	NEV/Smart Mobility Relevance	Key Targets by 2025
		and disaster-resilient electricity access	● Embedded smart charging and control tech ● Pilot smart grid zones in cities and industrial parks

3.4.2. Supporting measures

Various supporting measures have been implemented across strategic national plans to support the NEV development in China, aligning with the country's energy policy and going beyond fiscal incentives. These measures focus on enabling infrastructure, renewable energy integration, and industrial transformation, ensuring the readiness of the broader energy ecosystem for large-scale NEV adoption.

3.4.2.1. Financial Supporting Measures

China uses a mix of financial tools such as ToU pricing, subsidies, tax exemptions, and green financing to lower NEV costs and boost charging infrastructure investment. These measures make NEV ownership more affordable, support grid flexibility, and accelerate clean transport adoption, as follows.

1) Time-of-Use (ToU) pricing incentive – Personal (residential) charging

For private NEV owners who charge at home, Time-of-Use (ToU) pricing has become an increasingly common tool to promote energy-efficient behavior. Under residential ToU schemes, electricity rates are significantly lower during off-peak hours, typically late at night and early morning, to encourage cost-conscious, off-peak charging. Smart home charging systems often support these schemes by automatically scheduling charging to align with lower-priced periods.

China's 2024 NEV grid integration guidelines set a clear goal: by 2025, over 80% of private NEV charging should occur during off-peak hours, integrating consumer behavior into broader grid modernization and electrification efforts. According to the IEA's Global EV Outlook 2024, China is already piloting managed charging programs in selected cities that promote sustainable charging patterns across both public and residential contexts.

These initiatives aim to shift at least 60% of total NEV charging to off-peak periods by 2025, reflecting a coordinated national strategy for improving demand-side efficiency. In provinces such as Guangdong and Shanghai, utilities have adopted multi-level peak-valley time-of-use pricing that further strengthens financial incentives. A typical four-tier system, comprising peak, off-peak, valley, and deep-valley periods, offers steep discounts for nighttime charging. For example, electricity prices can drop from RMB 1.134/kWh during peak hours to RMB 0.599/kWh during valley periods, a difference of approximately 47%. This substantial price spread significantly improves the economics of home charging, enabling households to save on energy costs while contributing to load balancing, making home charging significantly more affordable[xxxii]. Together, these dynamic pricing mechanisms and behavioural incentives help reduce grid congestion, lower consumer electricity bills, and accelerate the deployment of smart, grid-friendly residential charging infrastructure.

2) Time-of-Use (ToU) pricing incentive – Public charging stations

China has introduced ToU pricing mechanisms to shift NEV charging away from peak demand periods and enhance grid flexibility. For public charging stations, the government encourages operators to adopt dynamic electricity pricing models that offer substantial cost reductions during off-peak hours. These measures are part of a broader strategy outlined in the 2024 Guidelines on the Integration of NEVs and the Power Grid, which sets a target for over 60% of NEV charging in pilot cities to occur during off-peak hours by 2025.

In addition to national policies, regional electricity pricing reforms have played a key role in supporting this transition. Initially applied to the industrial sector, these reforms have now expanded to include public NEV charging. Many provinces have adopted tiered and ToU pricing structures, allowing charging station operators to access lower electricity prices during valley periods. This pricing flexibility helps reduce operating costs while improving load balancing across the grid. For example, under China's ToU pricing scheme, electricity costs can vary widely, ranging from RMB 1.08/kWh during peak hours to RMB 0.486/kWh during valley periods, representing a price spread of approximately 55% that enables significant cost optimization and arbitrage potential across different regions. This regional diversity in electricity pricing allows operators to optimize charging infrastructure deployment based on local cost advantages, thereby enhancing the economic viability of public charging[xxxiii].

3) Charging financial incentive - Personal use

While most of China's charging infrastructure (CI) subsidies target public and commercial deployment, some local governments have introduced direct financial incentives for personal or residential users to encourage at-home NEV charging. Hangzhou, for example, provides a one-time flat-rate subsidy of 600 RMB per charging interface specifically for individual consumers. This measure directly reduces upfront installation costs for home charging equipment. In cities like Shanghai, additional support is available through a combination of investment and operational subsidies: dedicated chargers may receive a 30% equipment cost subsidy during installation and operating subsidies of up to 0.2 RMB/kWh depending on usage patterns.

Although not all cities offer targeted incentives for residential charging, these examples demonstrate how city-level programs can support the expansion of private NEV infrastructure. As electricity pricing reforms and managed charging initiatives continue to roll out, financial incentives for personal-use charging are likely to play a more prominent role in driving smart, grid-responsive home charging behavior.

4) Charging financial incentive – Public station

To accelerate the expansion of NEV charging infrastructure, local governments in China offer a variety of targeted financial incentives that complement national NEV policies through region-specific implementation strategies. These measures include both construction subsidies, which are calculated based on installed capacity in RMB per kW, and operational subsidies, which are based on the amount of electricity dispensed in RMB per kilowatt-hour (kWh). Local governments administer these programs, often providing RMB 40–400/kW depending on charger type and location. For instance, Hangzhou offers different subsidies depending on whether you install chargers in public parking lots, residential compounds, or along highways. Similarly, Chongqing offers RMB 150–300/kW for fast-charging stations, with higher rates for installations in rural or less-developed areas. Operational support, like Hangzhou's RMB 0.1 per kWh dispensed, complements these construction subsidies and enhances financial sustainability[xxxiv].

Beyond Hangzhou and Chongqing, similar subsidy programs have been implemented in numerous major cities, including Beijing, Shanghai, Shenzhen, Guangzhou, Suzhou, and Tianjin. These urban centers provide a blend of financial incentives based on installation and usage, demonstrating a wider subnational dedication to expanding NEV charging infrastructure throughout China. These measures are particularly important in the context of industrial electricity pricing reforms, which have revealed significant regional disparities in power costs. To maintain station viability and attract private investment, provinces with higher base electricity tariffs often provide more generous subsidies to offset operational challenges and ensure equitable infrastructure development.

China introduced a "dual credit" policy in 2017 to incentivize NEV production, modelled after California's Zero Emission Vehicle (ZEV) mandate. Under this system, automakers are required to earn NEV credits based on their annual production of conventional vehicles. Credits are awarded for producing or importing BEVs, PHEVs, or FCEVs, with higher credits granted to models offering greater energy efficiency or longer range.

Manufacturers that fail to meet their credit targets must either purchase credits from compliant firms or face penalties, creating a strong financial incentive to scale up NEV output. The credit requirement started at 10% in 2019, rising incrementally to 18% by 2023. New targets have been set at 28% for 2024 and 38% for 2025, which correspond to NEVs making up roughly 18–20% of vehicle sales, depending on credit weightings[xxxv].

The policy not only subsidizes NEV producers indirectly but also supports flexibility by allowing credit trading and rewarding advanced models. In 2023, China expanded the system with a national credit trading platform and revised credit calculations to further encourage high-performance NEVs. This market-based compliance mechanism has significantly boosted NEV production and benefited leading automakers such as BYD and Tesla.

5) R&D and Manufacturing support

China has provided extensive financial support for R&D and manufacturing in the NEV sector, recognising its strategic value for industrial upgrading and energy transition. At the national level, ministries such as the Ministry of Industry and Information Technology (MIIT) and the National Development and Reform Commission (NDRC) have offered direct grants, project-based funding, and preferential tax treatment to encourage innovation in core technologies, including power batteries, electric drive systems, lightweight materials, and hydrogen fuel cells.

Notably, the Made in China 2025 strategy identifies NEVs as one of ten priority sectors for national technological self-reliance and industrial modernization, serving as a catalyst for large-scale R&D investment[xxxvi]. Local governments also play a crucial role; for example, Shenzhen's NEV industry guidelines include targeted subsidies for key technology breakthroughs, interest subsidies on R&D loans, and equity investment via industrial guidance funds.

In addition, manufacturers can raise capital through green bonds, as NEV production qualifies under China's green finance framework, further lowering financing costs. Collectively, these measures reflect a coordinated strategy to strengthen domestic NEV supply chains and accelerate the commercialisation of next-generation vehicle technologies.

6) Green Financing Initiatives

China has promoted green finance as a key tool to support NEV development, including issuing green bonds with lower interest rates to finance NEV initiatives. The People's Bank of China and other financial regulators have encouraged NEV projects by classifying them as green. The local governments often set up dedicated industrial investment funds to invest in NEV startups, battery makers, and supply

chain companies. For example, Shenzhen's 2023 guidelines for NEV industry development include measures to enhance financial services to support NEV enterprises, such as facilitating cross-border financing and insurance for NEV companies[xxxvii].

3.4.2.2. Non-Financial Supporting Measures

In addition to financial incentives, China has implemented a range of non-financial supporting measures that reduce administrative and behavioural barriers to NEV adoption. These regulatory and institutional tools have been especially effective in dense urban markets where cost is not the only obstacle- access, convenience, and usage rights also play a crucial role in influencing consumer choice.

1) Regulatory Support for Electricity Arbitrage

China has established a regulatory environment that actively enables electricity arbitrage through non-financial mechanisms such as ToU pricing, bi-directional grid interaction rules, and supportive energy market regulations. Charging infrastructure operators and energy service providers are permitted to store electricity during off-peak hours, when prices can drop to RMB 0.4/kWh, and sell or discharge it during peak periods at higher tariffs, thereby generating revenue through price differentials.

This arbitrage model is further reinforced by national standards that allow bi-directional electricity flows and the integration of distributed energy resources like BESS. Integrated PV-storage-charging stations are increasingly being deployed across urban areas, enabling site-level optimization of electricity use and grid support. In cities such as Beijing and Shenzhen, pilot projects and regulatory sandboxes allow participation in frequency regulation and demand response markets, laying a legal and operational foundation for energy arbitrage. These mechanisms not only enhance the financial viability of charging infrastructure but also contribute to broader grid flexibility and decarbonization objectives, without relying on direct subsidies.

2) V2G and Smart Charging Pilot Programs

To accelerate smart grid integration, China is actively piloting V2G and smart-charging technologies that enable NEVs to function as distributed energy resources. According to guidelines issued by the National Development and Reform Commission (NDRC), the country aims to establish at least five V2G demonstration cities and 50 pilot projects by 2025, with initial focus in the Yangtze River Delta, Pearl River Delta, Beijing–Tianjin–Hebei region, and Shandong Province. These pilots deploy bi-directional chargers, energy management platforms, and ToU pricing mechanisms, enabling NEVs to either feed power back to the grid or shift charging to off-peak periods.[xxxviii] Cities such as Shanghai, Suzhou, Qingdao, Beijing, and Shenzhen are already moving forward with deployment, often in collaboration with automakers, local governments, and grid operators.

While financial incentives such as installation subsidies and dynamic pricing schemes help encourage user participation, the effectiveness of these pilots' rests largely on a comprehensive set of non-financial enablers. The central government has established a clear legal framework that authorizes bidirectional electricity flows, ensuring that energy can legally move from vehicles back into the grid.

At the same time, regulatory coordination between national and local authorities, grid firms, and automakers has created the institutional capacity to design, test, and scale V2G systems. Technical progress has been driven by the development of GB/T communication protocols, which enable interoperability between vehicles, chargers, and grid platforms. Under NDRC guidelines, pilot areas must ensure that over 60% of NEV charging occurs during off-peak hours and that bidirectional charging accounts for more than 80% of energy exchanged. These mechanisms improve both user economics and grid efficiency. For example, in Beijing's China Reinsurance pilot, participants earn up to RMB 1,300 annually through V2G-enabled revenue streams. China also plans to scale V2G

nationally through the development of GB/T-compliant communication protocols, aggregator business models, and integration with carbon markets and demand response platforms.

A Reuters report confirms plans for 30 grid-connected NEV projects in nine cities to test these models at scale[xxxix]. In Beijing's China Reinsurance V2G pilot, users are earning up to RMB 1,300 annually in net revenue after offsetting home charging costs, demonstrating one of China's first commercialized V2G business models. Looking ahead, China estimates that by 2040, over 300 million NEVs could provide more than 20 billion kilowatt-hours of onboard storage capacity, equivalent to a full day of national electricity demand, positioning NEVs as a strategic asset in achieving grid decarbonization. These non-financial policy measures are foundational to building a flexible, low-carbon energy system while creating new value streams for households, fleets, and charging operators.

3.5 Infrastructure Related to New Energy Vehicle and Smart Mobility

3.5.1. Energy Infrastructure

China is rapidly scaling up its energy infrastructure to support the accelerating adoption of NEVs. As of May 2025, the country had installed approximately 14.4 million charging points, a 49.1% increase year-on-year. In 2025, an additional 3.62 million chargers are expected to be added, primarily for private use[lxxix]. To incentivize infrastructure buildout, the central government offers performance-based subsidies of up to RMB 90 million (around USD 14 million) to localities that meet NEV adoption and charger utilization targets.

In parallel, battery swapping is also scaling, particularly for taxis and commercial fleets, with regulatory support and land and funding assistance from local governments. These developments reflect a coordinated push to ensure charging and battery replacement infrastructure keep pace with rising NEV demand.

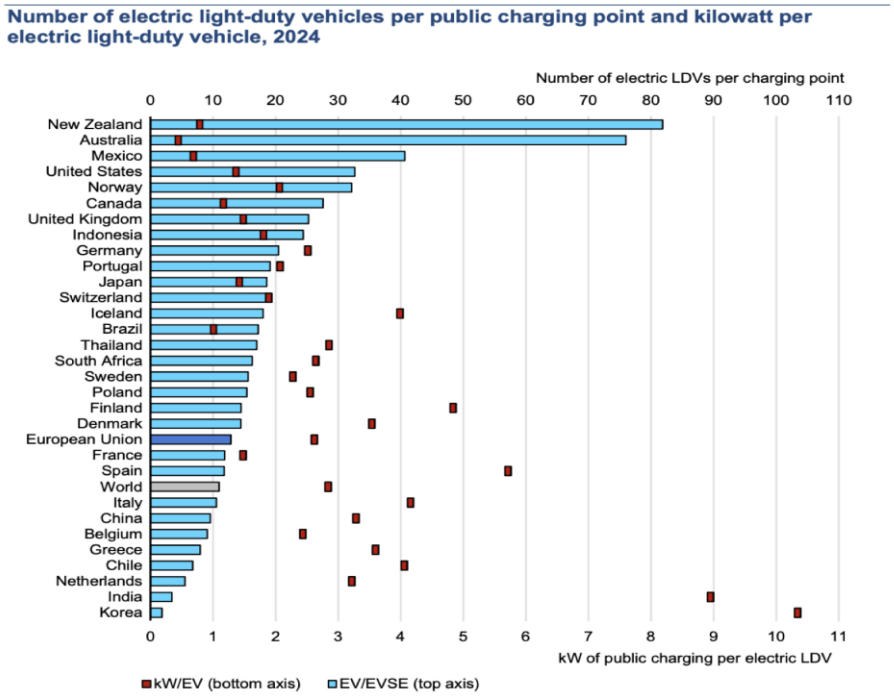


Figure 3-15: Ratio of electric light-duty vehicles to public charging points and charging capacity per vehicle, 2024

Source: IEA (2025)[lxxx]

As shown in Figure 3-15, China has one of the lowest ratios of electric vehicles per public charging point globally. This reflects the government's proactive and large-scale infrastructure deployment strategy, which has resulted in relatively high charger accessibility compared to many peer countries. However, the average public charging power per NEV remains comparatively low, indicating a continued reliance on AC slow chargers within the national mix. As battery capacities and user expectations rise, scaling up fast and ultra-fast charging capabilities will become increasingly important to optimize infrastructure efficiency and user experience.

China has developed a centralized NEV charging infrastructure tailored to dense urban environments, where most residents live in high-rise apartments without private parking. To ensure accessibility and high utilization, public charging stations, often medium- to large-scale, are strategically located in residential areas, commercial zones, and highways. To enhance grid resilience and efficiency, China has promoted hybrid charging models that integrate solar PV and battery energy storage systems (BESS). These systems store off-peak or solar-generated power for use during peak hours, reducing grid stress. One example is TechOne's integrated solution, combining solar PV, BESS, and ultra-fast chargers (30–640 kW) to offer flexible, high-speed services. This model supports economic viability through grid independence, energy arbitrage, and diversified revenue streams—achieving typical payback within three years.

To support this rapid growth, China has strengthened digital and system-level enablers to ensure that the electricity network and charging ecosystem can accommodate the surging NEV demand as follows:

3.5.1.1. NEVs to Charging Piles (AC/DC) ratio

The NEV-to-pile ratio is a key indicator of charging infrastructure adequacy, measuring how many NEVs are supported by each charging pile in the system. A lower ratio means higher infrastructure availability and better user convenience, while a higher ratio indicates growing pressure on existing chargers.

As of May 2025, China has accumulated approximately 30 million NEVs nationwide. Over the same period, the total number of charging facilities reached 14.4 million units, including both public and private charging infrastructure. Of this total, more than 3 million units are public charging piles, consisting of approximately 1.7 million AC chargers and 1.35 million DC fast chargers, with DC accounting for about 44.2% of all public charging piles.

Based on these figures, the overall ratio of NEVs to total charging piles in China is approximately 2:1, meaning two NEVs share one charging pile on average. This indicates a well-balanced level of infrastructure coverage, made possible through the large-scale deployment of both public and private charging facilities. A 2:1 ratio is widely recognized as a planning benchmark in advanced NEV markets, as it promotes efficient use of charging assets while ensuring convenient access for users. Maintaining this ratio reflects China's effective coordination between vehicle deployment and infrastructure expansion, supporting continued growth of the NEV market and ensuring charging availability keeps pace with rising demand.

3.5.1.2. Smart Grid Readiness

Smart grid readiness is important for the adoption of NEVs, making sure the electricity system can handle the increasing power needs from charging while staying reliable and flexible. The Smart Grid Index (SGI), developed by SP Group, evaluates grid maturity across seven core dimensions: monitoring and control, data analytics, supply reliability, DER integration, green energy, cybersecurity, and customer empowerment. First, monitoring and control refer to the ability of utilities to observe real-time grid conditions and respond to changes, which is essential for managing localized surges in NEV charging. Data analytics supports forecasting and load optimization, helping utilities plan for peak usage

times. Supply reliability ensures consistent power delivery, which is critical for NEV user trust. DER integration enables NEVs to interact with other distributed technologies like rooftop solar, while green energy reflects the system's ability to align with renewable targets. Cybersecurity ensures the safety of increasingly digitalized infrastructure, and customer empowerment includes demand response programs and tools that let users manage their charging behavior.

In the Smart Grid Index 2024, China scored 65.0 out of 100 in this category, reflecting moderate national progress in areas such as demand response and grid flexibility[lxxxi]. However, regional utilities in leading cities show much higher performance. State Grid Shanghai scored 94.6, Shenzhen Power Supply Bureau scored 91.0, and Guangzhou Power Supply Bureau scored 91.0. These scores indicate advanced capabilities in grid digitalization, automation, and real-time load management, which are essential for managing the growing number of NEVs in urban centers. Smart grid infrastructure allows for off-peak charging coordination, frequency regulation, and future deployment of V2G services, making it a foundation for energy-efficient NEV growth.

3.5.1.3. Charging communication protocol standard - Single platform

China's NEV charging infrastructure is underpinned by the national GB/T standards, which define technical specifications for AC and DC charging interfaces, communication protocols, and data exchange between NEVs and chargers. These standards ensure interoperability across diverse charger manufacturers and vehicle types, forming the technical backbone of China's widespread NEV deployment.

GB/T also provides the basis for integration with smart grid services and has been regularly updated to align with evolving needs, including support for high-power charging and two-way communication. To enhance efficiency and reduce fragmentation, many cities, such as Beijing, Shanghai, Shenzhen, Hangzhou, and Guangzhou, are developing centralized digital platforms that connect chargers, grid operators, and service providers using open communication protocols. These platforms allow for real-time data exchange, remote monitoring, dynamic power allocation, and integration with solar PV and BESS. For instance, some commercial solutions now support unified interfaces that comply with GB/T, offer liquid-cooled fast charging, and are built to meet the upcoming 3C certification requirements, which will be mandatory nationwide by 2026. These advances support broader goals of enabling V2G readiness, load shifting, and managed charging. Unified communication platforms also help streamline demand-side response, predictive maintenance, and time-of-use pricing, ultimately supporting more intelligent, resilient grid operations. As reflected in international assessments like the Smart Grid Index, platform integration and standardized communication protocols are fundamental for scaling NEV infrastructure and aligning transport electrification with broader energy system goals.

3.5.1.4. Battery Swap Stations

Battery swapping has emerged as a pivotal component of China's energy infrastructure strategy, complementing traditional charging methods to support the rapid growth of NEVs. This approach is particularly advantageous for high-utilization scenarios such as taxis, logistics fleets, and long-haul trucks, where minimizing downtime is critical. In late 2024, China's Ministry of Industry and Information Technology (MIIT) announced plans to draft guidelines promoting the battery swapping model. These guidelines aim to accelerate pilot projects for the full electrification of public sector vehicles and deepen NEV application in key areas. This policy initiative underscores the government's commitment to diversifying energy replenishment methods and enhancing the convenience of NEV usage[lxxxii].

As of the end of 2024, China had built 4,443 battery swapping stations, reflecting strong growth in alternative NEV energy replenishment infrastructure. Most of these stations—over 2,700—were developed by NIO, whose aggressive deployment strategy includes nearly 1,000 highway locations and partnerships with state-owned enterprises to expand into provinces such as Liaoning, Jilin, Heilongjiang, and Inner Mongolia. Other key players include Aulton (738 stations) and E-Energee (378 stations), alongside smaller operators like GCLET and Botan. This diverse landscape indicates growing interest in both urban fleet electrification and regional network expansion. Nio's strategic partnerships with state-owned enterprises have facilitated the deployment of additional stations in regions such as Liaoning, Jilin, Heilongjiang, and Inner Mongolia[lxxxiii,lxxxiv]. Other major industry actors are also scaling investment. Contemporary Amperex Technology Co. Limited (CATL), one of the world's largest battery manufacturers, has partnered with Sinopec to build at least 500 new swap stations in 2025, with a long-term goal of reaching 10,000 stations nationwide. These facilities are being designed as integrated energy hubs- combining battery swapping, charging, and storage- and are expected to contribute to grid stability through V2G services[lxxxv,lxxxvi].

The integration of battery swapping into China's energy infrastructure not only offers a rapid and convenient energy replenishment solution but also aligns with the country's broader goals of reducing carbon emissions and promoting sustainable transportation. The integration of battery swapping into China's energy infrastructure provides a fast and convenient recharging solution that complements the country's broader goals for low-carbon transport. However, its scalability—particularly in the private passenger car segment—may remain limited. This limitation is due to interoperability challenges across different vehicle manufacturers and a market trend that favors rapid-charging battery technologies. As a result, battery swapping is likely to grow within closed ecosystems, such as urban fleets, taxis, airport shuttles, or logistics vehicles, where standardized vehicle platforms and centralized operations enable efficient deployment. By leveraging policy support and industry collaboration, China is positioning battery swapping as a viable and scalable component of its NEV ecosystem.

3.5.1.5. National charging coverage and load-shifting targets

China remains the global leader in electric vehicle supply equipment (EVSE) deployment, accounting for more than 85 % of the world's fast chargers and approximately 60 % of slow chargers. With NEV sales now surpassing 35% of new vehicle registrations, China has exceeded its 2025 targets ahead of schedule. The focus is now shifting toward infrastructure optimization. The national goal is to achieve full coverage of NEV charging infrastructure across all urban areas and highway corridors by 2030, with continued expansion in rural areas[lxxxvii].

At the same time, to improve power system efficiency and reduce stress on the grid, the government aims to encourage more sustainable charging behavior. By 2025, 60 % of NEV charging is targeted to occur during off-peak hours in pilot cities. These goals reinforce China's broader strategy to align transport electrification with energy efficiency, grid stability, and decarbonization[lxxxviii].

3.5.2. Road Infrastructure

The World Economic Forum (WEF) Global Competitiveness Report rates the Quality of Roads based on an Executive Opinion Survey on a scale from 1 (poor/underdeveloped) to 7 (extensive/efficient). China achieved a road quality score of 5.0 points in the 2019 report. This score placed China significantly above the global average of 4.07 points and ahead of most developing economies. It reflected the massive investment and rapid expansion of its national highway and expressway network over the preceding decades. The 5.0 rating indicates that surveyed business leaders consider China's road infrastructure to be good and generally efficient by international standards. The score is largely driven by the extensive, high-quality, and well-maintained expressway network (G-series roads)

connecting major economic hubs, though the quality of local roads in remote or underdeveloped areas can still vary.

1) Road Environment

Marked Lanes and Standard Traffic Signals, China's road environment is highly standardized, particularly on high-speed roads, and is governed by the Road Traffic Safety Law of the People's Republic of China.

- Traffic Signals and Signage: China utilizes the universal red, yellow, and green signal system. Traffic signals and regulatory signs are standardized, widespread, and clearly visible, especially in urban areas and on national highways. Signage often includes Pinyin (Romanized Chinese) and/or English on major routes.
- Marked Lanes: Lane markings are consistently present and well-maintained on all major routes, adhering strictly to international standards (e.g., solid lines prohibit crossing, dashed lines permit it). Urban roads frequently employ specific markings for bus, high-occupancy vehicles (HOV), and non-motorized vehicle lanes.
- Adherence and Enforcement: Enforcement of traffic rules is generally strict and technologically supported, utilizing vast networks of CCTV cameras and traffic management systems, particularly in major cities. While congestion is severe in urban centers, the adherence to lane markings and signals is higher than in many developing nations.

2) Traffic Separation: Motorcycles vs. Normal Traffic

Traffic separation for motorcycles (MC) in China is implemented through a complex and highly variable system of prohibition (bans) rather than uniform segregation, primarily driven by urban density and air quality concerns.

- Expressway Prohibition: Motorcycles are strictly prohibited from using the vast national expressway (G-series) system across the entire country. This is the most consistent and enforced form of separation by vehicle class.
- City-Specific Bans (The "Ban-Mo" Policy): The key mechanism for separation is the widespread local prohibition or restriction of motorcycle traffic within the core areas of many major cities (e.g., Beijing, Shanghai, Guangzhou, Shenzhen). These "Ban-Mo" (*jinzhi motuoche*) policies are mandatory and heavily enforced, effectively separating MCs from car traffic by removing them entirely from central city zones.
- Designated Lanes in Permitted Areas: In areas or cities where motorcycles are still permitted (e.g., rural areas or secondary cities), the law requires slow-moving vehicles, including motorcycles, to use the rightmost lane or dedicated non-motorized lanes. Many urban roads are designed with a central motorized vehicle lane (for cars) separated by a barrier or curb from a side non-motorized/slow vehicle lane (used by bicycles, scooters, and allowed motorcycles).
- Enforcement: Enforcement is extremely strict for city-wide bans and expressway use, often involving fines and vehicle confiscation. The local nature of these bans means the rules vary significantly from one city to the next, but the legal basis and rigorous enforcement are clear and effective where the restrictions are implemented.

3) Highway System

China's national highway system represents one of the most ambitious and extensive infrastructure achievements of the modern era. The sheer scale of development, driven by decades of rapid economic growth and urbanization, has resulted in a road network that is unparalleled globally, particularly in its expressway component. Understanding the composition of this network, categorized by both total length and technical class, provides crucial insight into the country's logistical capabilities and regional connectivity.

The Total Length of Highways in China reached an astounding 5,436,845 kilometers by the end of 2023, according to data reported by the Ministry of Transport. This figure marks a significant increase from the length of 2022 of 5,354,837 kilometers, continuing a trend of consistent annual expansion. The historic trajectory of this development is remarkable, with the network growing from a mere 80,700 km in 1949 to its current massive extent. This sustained growth underlines the central government's unwavering commitment to infrastructure investment as a pillar of national development. The network's expansion is not only about volume but also about quality, with a substantial portion now consisting of paved surfaces, reported at 4,805,882 km in 2023.

Expressway and High-Grade Highway Categories, the road network is stratified into several technical classes, with Expressways and Class I to Class IV Highways representing the higher-quality, higher-capacity segments. These categories are defined by strict technical standards concerning design speed, lane width, and traffic volume capacity.

3.1) Expressway Network

China's Expressway system stands out as the world's largest, a testament to its strategic importance in connecting major economic hubs and provincial capitals. The length of the Expressway network was recorded at 183,645kilometers in 2023, up from 177,252 kilometers in the preceding year. Independent projections suggest this growth trajectory will continue, with the total length expected to have surpassed 190,700 kilometers by the end of 2024. These controlled-access, high-speed routes are the backbone of modern freight and passenger transport, linking over 99% of cities with populations exceeding 200,000 and approximately 88% of all counties. Class I, II, III, and IV Highways, the other categorized road lengths provide a detailed picture of the overall network quality:

3.2) Length of First-Class Highways (Class I)

These are high-standard roads designed for high traffic volumes, often serving as major arterial routes complementing the expressway network. In 2023, the total length of Class I highways was 139,833 kilometers. This segment is critical for regional economic integration and the movement of goods between cities and industrial zones.

3.3) Length of Second-Class Highways (Class II)

Designed for moderate traffic volumes and slightly lower technical standards than Class I roads, this class forms an essential layer of connectivity. In 2023, the length of Class II highways stood at 438,746 kilometers. These roads often serve as important inter-county connectors.

3.4) Length of Third-Class Highways (Class III)

These roads are designed for lower traffic volumes and serve as crucial links for local and regional transport. Their total length was reported to be 494,800 kilometers in 2023.

3.5) Length of Fourth-Class Highways (Class IV)

This classification generally encompasses roads with the lowest technical standards among the classified grades, primarily serving local communities and rural areas. The total length of Class IV roads was exceptionally large, measured at 4,013,030 kilometers in 2023. The total length of Expressways and Class I to IV Highways combined reached 5,270,055 kilometers in 2023.

3.6) Highways Below Class IV

The final category, Highways Below Class IV, represents the most basic roads in the network, often unpaved or with minimal infrastructure, primarily serving remote villages and rural communities. While the government's focus is on upgrading these routes, they still constitute a measurable portion of the total mileage. The length of Highways Below Class IV was 166,790.000 kilometers in 2023. The significant and ongoing reduction in this category's length over time, exemplified by provincial data, is a strong indicator of the sustained efforts to modernize the rural road network, converting these lower-grade roads into Class IV or higher categories to improve accessibility and living standards in less developed regions.

Table 3-12: The Total Length of Highways in China

Indicators (10000 km)	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Length of Highways	457.73	469.63	477.35	484.65	501.25	519.81	528.07	535.48	543.68
Length of Expressway and Class I to IV Highways	404.63	422.65	433.86	446.59	469.87	494.45	506.19	516.25	527.01
Length of First-Class Highways	9.1	9.92	10.52	11.17	11.71	12.31	12.82	13.48	13.98
Length of Second-Class Highways	36.04	37.11	38.05	39.35	40.53	41.83	42.64	43.16	43.87
Length of Highways Below Class IV	53.1	46.97	43.49	38.07	31.38	25.36	21.88	19.24	16.68
Total	960.6	986.28	1,003.27	1,019.83	1,054.74	1,093.76	1,111.6	1,127.61	1,145.22

Source: National Bureau of Statistics of China (2025)[25]

[25] National Bureau of Statistics of China. (2025). Advanced search [Data portal]. https://data.stats.gov.cn/english/adv.htm?cn=C01

3.5.3. Digital Infrastructure

Autonomous Vehicles (AVs) rely heavily on vast amounts of data for their development. In this regard, China possesses a significant advantage due to its large population, extensive surveillance network, and relatively less stringent data privacy regulations compared with Western countries. Chinese AV companies have access to a diverse range of data for algorithm training — from traffic patterns and pedestrian behaviors to accident scenarios. Moreover, the rapid urban infrastructure development in China has facilitated the integration and operation of AV technologies. New cities and road networks have been designed with smart technologies in mind, incorporating widespread installations of 5G networks, sensors, and intelligent traffic management systems, thereby creating an ecosystem conducive to the efficient operation of autonomous vehicles.[27]

China is a global leader in the scale and speed of its digital infrastructure build-out, particularly in advanced mobility technologies. The country's strategy is characterized by massive government backing, rapid 5G deployment, and the aggressive development of Autonomous Vehicles (AVs), often within state-supported "Smart City" and "Intelligent Connected Vehicle (ICV)" initiatives.

- 5G Coverage & Speed: China possesses the world's largest 5G network, with near-ubiquitous coverage in major cities and rapidly expanding rural deployment. Mobile connection speeds are exceptionally high, providing the ultra-low latency and massive capacity required for sophisticated V2X communications.
- Driverless (L4-L5) Vehicles: China is aggressively pursuing Level 4 (L4) autonomy and has numerous active public road testing permits across dozens of cities for large fleets (e.g., Baidu's Apollo, Pony.ai). These L4 services, including robotaxis and robobuses, are beginning commercial operation in geo-fenced zones. L5 remains the long-term goal.
- Traffic Management Systems (TMS): Large cities utilize highly advanced Intelligent Transportation Systems (ITS) incorporating AI and big data to manage congestion. This includes widespread deployment of Adaptive Traffic Signal Control (ATSC), which optimizes flow based on real-time vehicle and network data.
- V2I for ADAS (L2-L3) and L4/L5: China is heavily investing in Cellular V2X (C-V2X) infrastructure, installing roadside units (RSUs) across dedicated testing zones and public roads. This robust two-way data exchange directly enhances L2-L3 ADAS (e.g., providing non-line-of-sight hazard warnings) and is critical for the safe operation and expansion of L4/L5 autonomous fleets.
- Vehicular Communication Technology: A key technology driving the realization of fully autonomous driving is Vehicular Communication, particularly Vehicle-to-Vehicle (V2V) Communication, which allows vehicles to exchange driving and traffic information directly with one another through 5G networks, ensuring fast and accurate data transmission. The technology has since evolved into Vehicle-to-Everything (V2X) Communication, expanding communication to include road infrastructure such as streetlights, sidewalks, and buildings equipped with network devices capable of interacting directly with vehicles. Many countries around the world are preparing their infrastructure for the era of intelligent vehicles. A prominent example is Nanning City, China, which has launched the province's first Smart

[27] From: Intertraffic Global. (2025). China, the Global Leader in Autonomous Vehicles – how did that happen?. https://www.intertraffic.com/news/autonomous-driving/china-the-global-leader-in-autonomous-vehicles

Highway pilot project, spanning 25.8 kilometers. The project integrates V2X technology as the core of its communication system, featuring 5G base stations installed every 125 meters to support real-time communication between vehicles and roadside infrastructure efficiently and reliably.

China's centralized governance structure also enables the country to develop infrastructure and introduce legal frameworks at a much faster pace. In contrast, countries such as the United States face administrative complexities involving federal, state, and municipal authorities, which often delay AV testing and deployment.

3.6 Consumer Preferences and Trends in Vehicle Ownership

3.6.1. Vehicle Ownership

According to aggregated passenger vehicle registration data, China has experienced a steady increase in vehicle ownership. In 2018, the total number of registered passenger vehicles stood at 23.25 million, declining to 17.27 million in 2023, and rapidly increasing to 23.56 million by 2024. This fluctuating trend reflects a significant growth in private vehicle ownership across the country. When adjusted for population, the number of passenger vehicles per 1,000 people increased from 145 units in 2018 to 170 units in 2020, and further to 218 units in 2024, indicating a notable rise in motorization rates in line with China's economic development and urbanization.

Economic growth and rising income levels are key drivers of increasing vehicle ownership in China. Over the past seven years, China has experienced notable socio-economic transformations marked by economic growth, increasing urbanization, and shifting demographic structures. Between 2018 and 2024, the country's Gross Domestic Product (GDP) expanded from 13.89 trillion USD to an estimated 18.8 trillion USD, reflecting the resilience and continued momentum of its economy despite external shocks such as the COVID-19 pandemic. Concurrently, GDP per capita rose from 9,910 USD in 2018 to a peak of 12,610 USD in 2023.

Although the Chinese economy has slowed to an annual growth rate of 4–5%—a decline compared to the rapid expansion of the past two decades. Vehicle ownership is expected to continue growing, albeit at a more moderate pace. Moreover, as many Chinese cities remain in the initial or take-off stages of motorization, vehicle ownership rates in these areas are projected to rise further, contributing to continued growth in the national vehicle stock (Duan et al., 2024)[28].

These economic gains coincided with a progressive urban expansion, with the proportion of the population residing in urban areas growing from 61.5% in 2018 to 67% in 2024. The number of privately owned passenger vehicles in China by region in 2023 (Figure 3-16) shows that Guangdong recorded the highest number at 25.59 million vehicles, followed by Shandong (24.80 million) and Jiangsu (19.97 million), all of which are economically advanced and densely populated provinces. In contrast, regions with the lowest numbers of private vehicles include Tibet (0.49 million), Qinghai (1.13 million), and Ningxia (1.57 million), which are generally more remote or less populated. This regional disparity highlights the uneven distribution of vehicle ownership across the country. Eastern and central provinces tend to have higher vehicle ownership compared to western and less developed regions, reflecting differences in economic development, urbanization, and population density.

[28] Duan, L., Song, L., Wang, W., Jian, X., Heijungs, R., & Chen, W. Q. (2024). Urbanization inequality: evidence from vehicle ownership in Chinese cities. Humanities and social sciences communications, 11(1), 1-12.

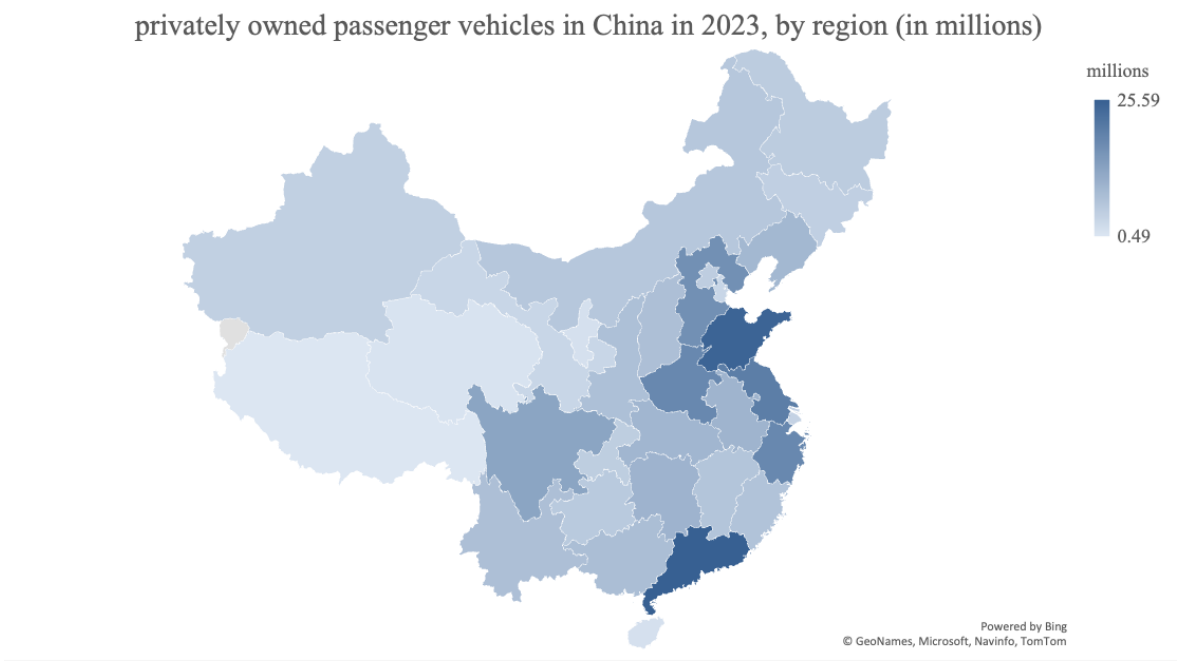


Figure 3-16: Number of privately owned passenger vehicles in China 2023, by region

Source: Ministry of Transport of China; National Bureau of Statistics of China (2023)[29]

However, demographic dynamics signal emerging challenges. While the total population peaked at approximately 1.426 billion in 2021, it has since experienced a gradual decline. The working-age population (15–64 years) decreased from 71.2% to 68.3% between 2018 and 2023, whereas the proportion of the elderly (65 years and older) rose markedly from 11.9% to 15.4%, indicating accelerated population aging. Simultaneously, the share of the population aged 0–14 years continued to decline, dropping from 16.9% to 16.3% in the same period.

On the education front, China demonstrated steady improvements, particularly in higher education. Gross tertiary enrollment increased from 38% in 2018 to 43% in 2023, while secondary education enrollment remained relatively stable around 76–78%, underscoring the government's continued investment in human capital development. Collectively, these trends depict a nation in economic ascent, yet increasingly shaped by demographic shifts.

Looking ahead to 2030, Chinese consumers are expected to maintain strong demand for private vehicles, supported by rising incomes, ongoing urbanization, and favorable policy frameworks. However, the nature of car ownership is evolving. The transition toward electrification will significantly reshape the vehicle fleet, with NEV playing an increasingly dominant role. Additionally, demographic trends indicate that consumers aged 30 to 50 years with higher education levels will form a growing segment of the vehicle-owning population. This group is expected to drive future demand, as they are more likely to purchase and own vehicles, particularly those that align with new technological and environmental standards.

[29] Cited in Statista : Wenyi Zhang. (2025). Number of privately owned passenger vehicles in China 2023, by region. Statista. https://www.statista.com/statistics/278434/privately-owned-passenger-cars-in-china-by-region/

The Deloitte survey shows that Chinese consumers expressing interest in replacing private vehicle ownership with subscription-based services increased from 48% in 2023 to 56% in 2024. Because shared mobility in China remains at an early stage, we expect private car ownership to remain the dominant mode of commuting through 2030.

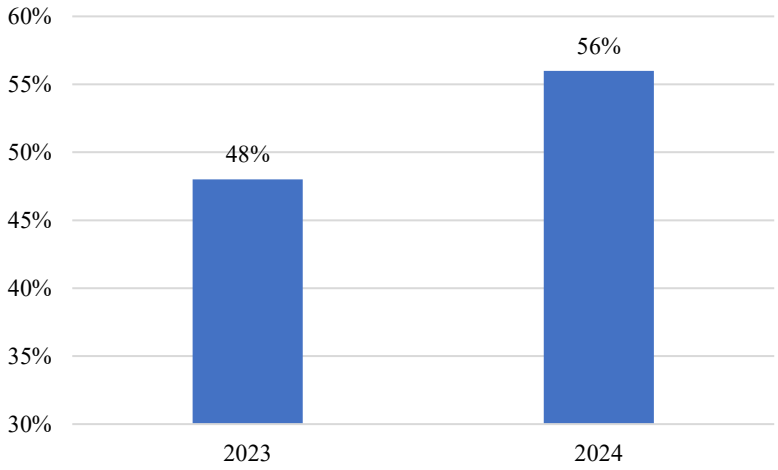
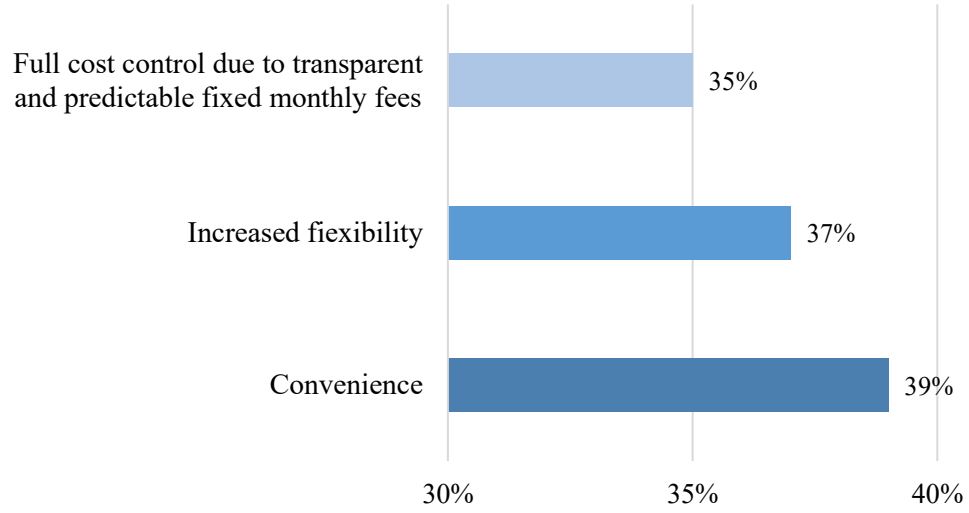


Figure 3-17: Interest in replacing ownership with vehicle subscription in China

Source: Deloitte (2025).

However, the vehicle subscription-based services trend will shape Chinese private ownership in the future. The shared mobility will provide convenience and flexibility and transparent, predictable monthly fees for Chinese consumers as shown in the key attributes in Figure 3-18. Moreover, Chinese consumers have still perceived the gaps between the conceptual appeal of vehicle subscription services and their current practical limitations, particularly regarding personalization. In Figure 3-19, Chinese consumers also identified several primary concerns regarding vehicle subscription services. These include vehicle availability and waiting time (45%), total cost of ownership (38%), and limited configuration options (36%).

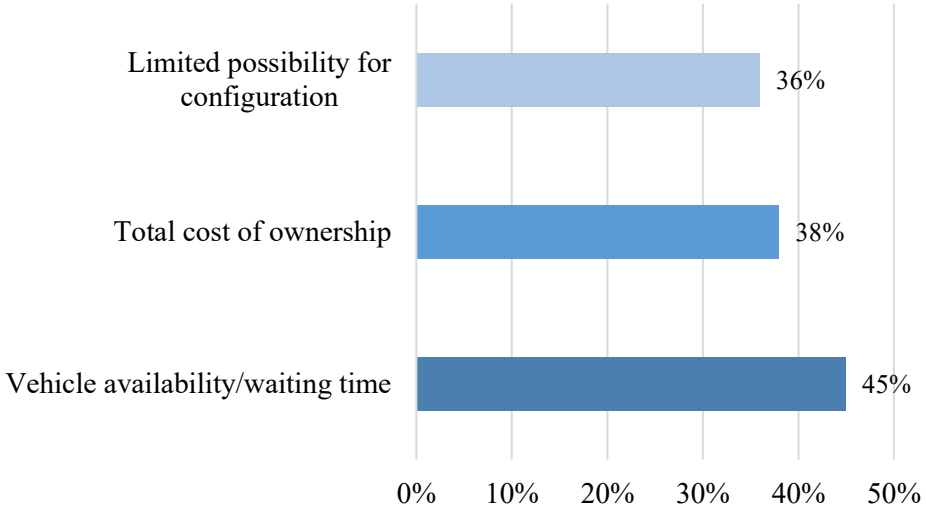
Therefore, while vehicle subscription models are gaining increasing consumer interest in China, their broader adoption remains conditional upon resolving key service concerns. These include operational efficiency, cost competitiveness, and product customization. As traditional vehicle ownership continues to expand, particularly among the middle-income and educated demographic, subscription services may evolve as a complementary form of mobility aligned with the demand for flexibility and technology-enabled convenience.



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 3-18: Top Important characteristics of vehicle subscription

Source: Deloitte (2024)



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 3-19: Main concerns regarding vehicle subscription services

Source: Deloitte (2024)[30]

[30] Deloitte. (2024). 2024 Global Automotive Consumer Study. https://www.deloitte.com/nl/en/Industries/automotive/perspectives/global-automotive-consumer-study.html

3.6.2. Consumer Preferences

As mentioned earlier, NEVs have gained broad acceptance among Chinese consumers, with the domestic market now reaching the early majority stage in the technology diffusion process. This section presents a detailed examination of consumer preferences in NEV purchasing decisions, with a primary focus on BEV, as the survey data used in this analysis is centered on BEV users rather than the broader NEV category. The key determinants influencing consumer choices will be summarized and discussed in the subsections below.

3.6.2.1. Environmental Awareness

One of the most prominent drivers of acceptance is the environmental awareness of consumers. As urban air pollution and carbon emissions have become serious public health and climate concerns in China, individuals with strong environmental consciousness tend to favor NEV as an environmentally responsible choice. This environmentally driven motivation is further reinforced by China's status as the largest carbon emitter globally, which heightens the perceived importance of personal contributions to pollution reduction.

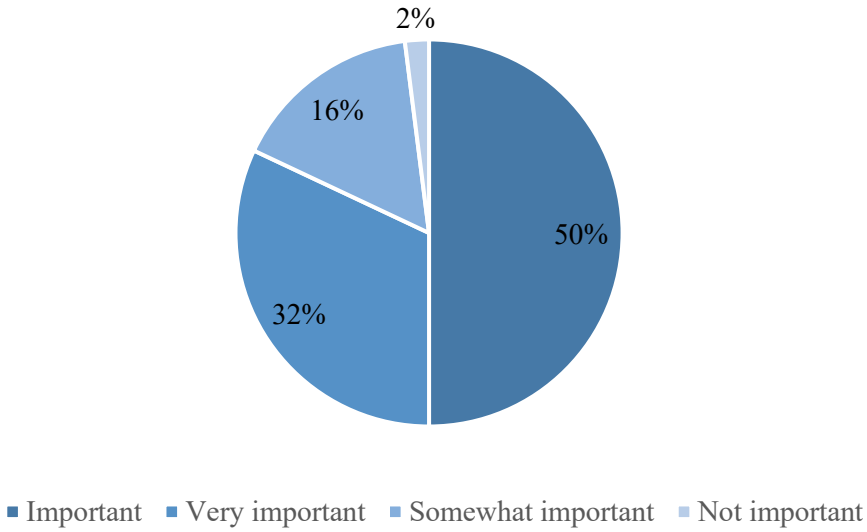


Figure 3-20: Importance of a vehicle brand committing to sustainable practices

Source: Deloitte (2024)

According to a Deloitte survey, Figure 3-21 shows that Chinese consumers place considerable importance on the sustainability practices of automotive brands. Over 80% of respondents indicated that a brand's "commitment to sustainable business practices"—such as low carbon manufacturing footprint, use of environmentally friendly materials, and electrification strategy— had either a "Very Important" or "Important" influence on their vehicle purchasing decisions. This finding reflects a heightened level of environmental awareness among consumers and a growing trend toward environmentally conscious purchasing behavior—particularly among younger consumer segments who increasingly view corporate social and environmental responsibility as integral to brand identity.

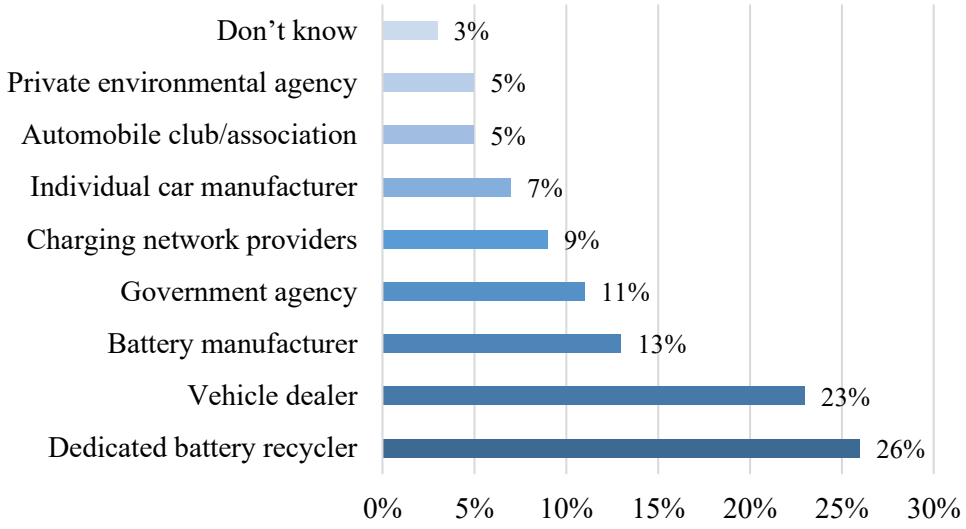


Figure 3-21: Consumer preference for EV battery recycling responsibility

Source: Deloitte (2025)

Moreover, findings from Deloitte survey, shown in Figure 3-21, suggest that Chinese consumers are becoming more deeply engaged with environmental issues, particularly concerning the responsibility for the recycling and disposal of electric vehicle batteries. The survey revealed that 26% of consumers preferred a dedicated battery recycling agency to be responsible for this task, while 23% believed that vehicle dealers should assume this role. Additionally, 13% pointed to battery manufacturers, and 11% indicated that the government should take the lead.

These results indicate that, from the perspective of consumers, sustainability in the EV industry extends beyond the use phase of the vehicle and encompasses the end-of-life management of its components—especially batteries. Consumers expect a recycling system that is standardized, transparent, and managed by clearly accountable entities. Addressing these expectations is therefore crucial for enhancing brand credibility and fostering long-term acceptance of EVs in the Chinese market.

3.6.2.2. Perceived Product Attributes

The specific product attributes play a significant role in shaping consumer acceptance. Among these, battery warranty length has emerged as a particularly critical determinant, with the Deloittle (2025) study showing that consumers are significantly more willing to purchase BEV when longer battery warranties are offered. This preference is tied to the perception of reduced long-term financial and performance risks.

Driving range remains a primary driver of NEV adoption. In a Deloitte survey, 32% of respondents expected BEV range between 400–499 km and 23% expected 500–599 km, indicating a preference for mid- to long-range models. This finding is consistent with China's landscape with long-range road among cities.

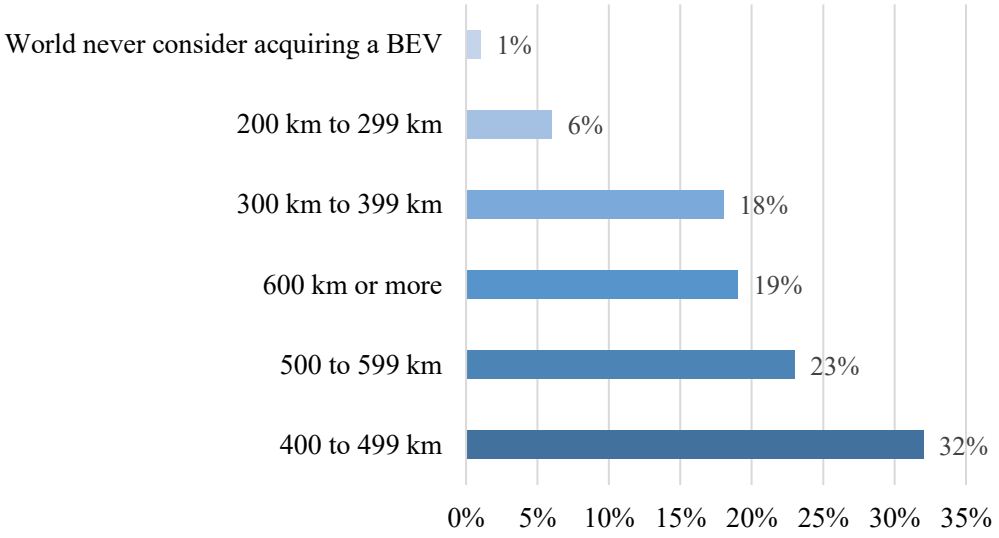


Figure 3-22: Consumer expectations on BEV driving range in China

Source: Deloitte (2025)

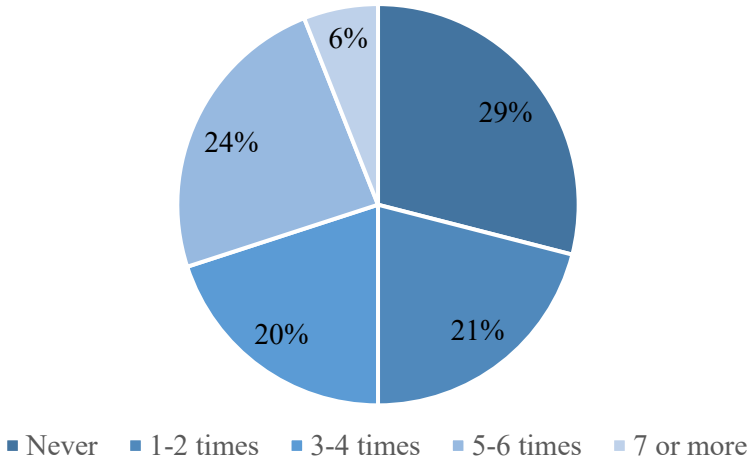


Figure 3-23: Frequency of trips exceeding 100 km from home in China

Source: Deloitte (2025)

The Deloitte survey indicates that long-distance travel beyond 100 km from home is relatively infrequent among Chinese BEV users. Approximately half of the respondents reported taking such trips fewer than two times per month. Although the mid-distance travel (100km per trip) is relatively infrequent, Chinese consumers continue to hold high expectations for extended driving ranges in BEVs.

Charging time is another influential factor; while it is not the most decisive, long charging times can be a source of hesitation, especially when compared to the rapid refueling of conventional vehicles.

Figure 3-24 shows that 46% of Chinese respondents expect the charging time from 0% to 80% to be within 20–40 minutes. Moreover, fast charging speed and convenient access to charging locations are considered the most important aspects of the BEV charging experience.

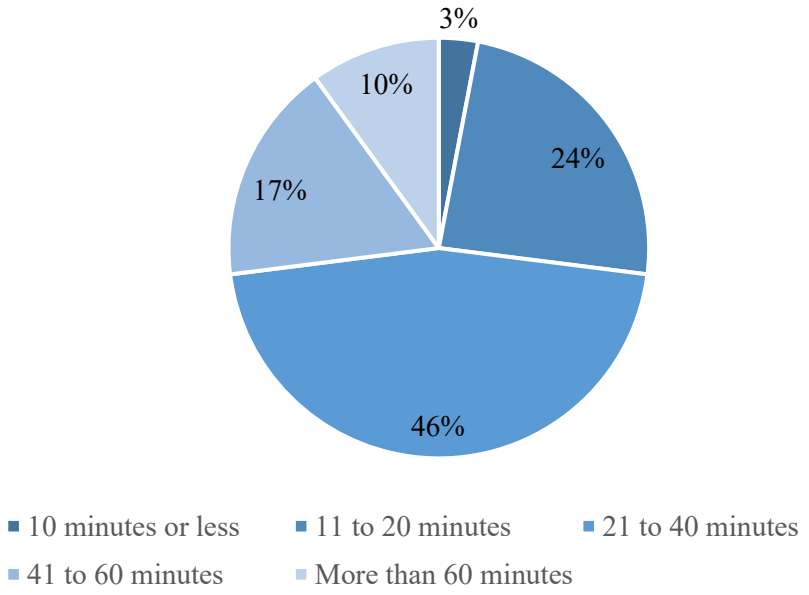
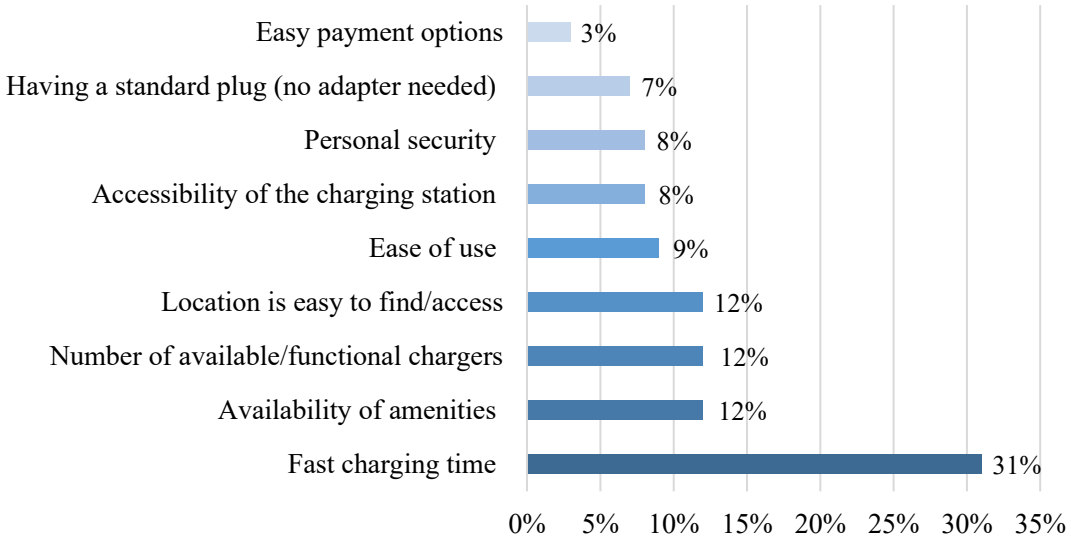


Figure 3-24: Expected wait time for public charging station

Source: Deloitte (2025)



Note: Percentages may not add up to 100 due to rounding.

Figure 3-25: Most important factors in BEV charging experience in China

Source: Deloitte (2025)

According to Deloitte survey, consumer preferences in China regarding vehicle type and brand reveal important insights into product attributes influencing purchasing behavior. Figure 3-26: shows that 38% of consumers prefer internal combustion engine (ICE) vehicles for their next purchase, followed by 35% opting for hybrid or plug-in hybrid electric vehicles (PHEV & HEV), and 27% choosing battery electric vehicles (BEV), indicating that although BEVs are growing in popularity, traditional engines still hold a significant share.

Moreover, 55% of respondents plan to purchase the same vehicle brand as their current one, whereas 31% are first-time owners and 15% intend to switch brands, suggesting strong brand loyalty but also openness to change (Figure 3-27). Figure 3-28: shows that 73% of consumers in 2024 express an intention to switch vehicle brands, slightly declining from 76% in 2025, which may reflect growing satisfaction or entrenchment with current brands. Importantly, the top factors influencing brand selection are as follows: product quality (50%), vehicle performance (47%), and brand image (38%). These findings reinforce the importance of perceived reliability and technical excellence in shaping EV adoption and brand loyalty in China.

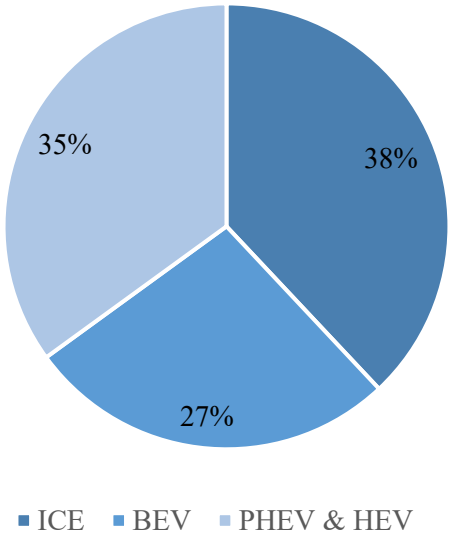


Figure 3-26: Preference for type of engine in next vehicle in China in 2024

Source: Deloitte (2025)

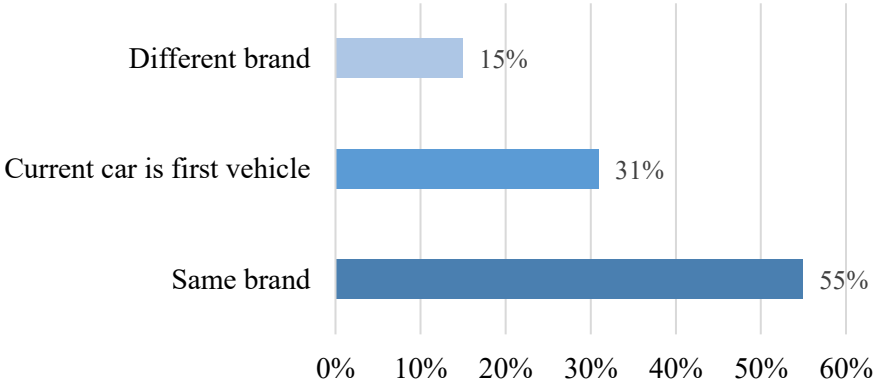


Figure 3-27: Consumer using same brand as previous car in China in 2024

Source: Deloitte (2025)

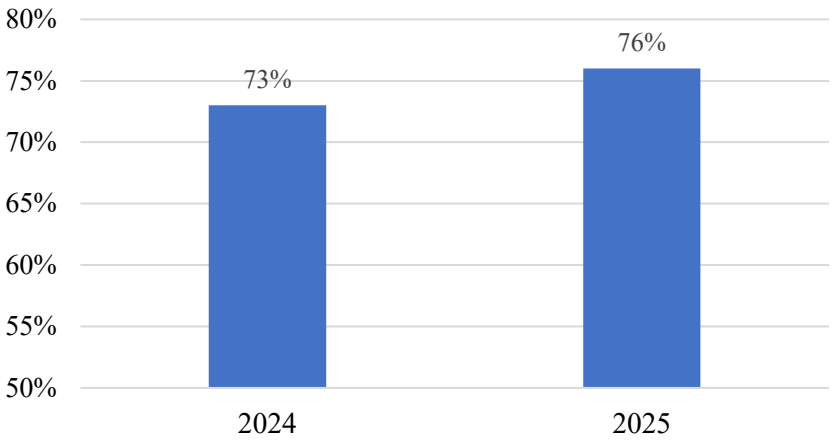
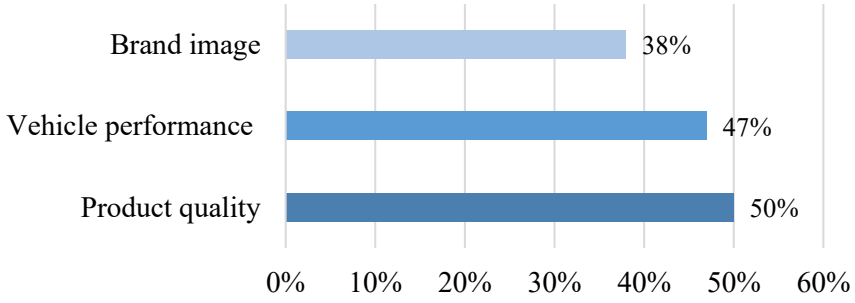


Figure 3-28: Intention to switch vehicle brand in China in 2024

Source: Deloitte (2025)



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 3-29: Most important factors driving the choice of brand for next vehicle

Source: Deloitte (2025)

Moreover, brand perception and distribution channel preferences significantly influence consumer choices in China. According to Deloitte survey over half of Chinese consumers (52%) do not prioritize the origin of the manufacturer as long as the vehicle meets their needs, while 34% express a preference for domestic brands, and only 14% prefer foreign brands. These insights suggest that Chinese consumers are becoming increasingly open to alternative sales and service models that offer direct engagement with manufacturers, especially when such channels can enhance value, trust, and efficiency.

Therefore, Chinese consumers' preferences in the EV market are influenced by product quality, performance, brand trust, and practical usability. Domestic brands, especially BYD, dominate due to strong local trust, while international brands remain competitive in specific segments. Declining EV prices, openness to direct sales and insurance models, and preference for locally manufactured vehicles reflect a maturing market. Crucially, extended driving range and fast charging are key determinants of adoption, highlighting the need for brands to balance technological advancement with user convenience.

3.6.2.3. Infrastructure Availability

Infrastructure-related readiness primarily hinges on the availability of reliable and accessible charging stations. In metropolitan areas of China, such as Beijing, Shanghai, and Shenzhen, significant investments have been made in public charging networks, which have substantially improved the readiness of urban consumers. Conversely, rural and inland regions continue to suffer from a lack of charging infrastructure, which undermines consumer confidence and limits the geographic spread of BEV adoption.

Moreover, home charging capability, often dependent on private parking availability, is a critical factor. Consumers with dedicated parking spaces are more likely to be ready to own BEV due to the convenience and cost-effectiveness of home charging.

In Figure 3-30: the majority of Chinese consumers (63%) expect to charge their electric vehicles primarily at home. However, a significant portion also anticipates relying on-street or public charging stations (22%) and workplace facilities (15%) as regular charging locations. This finding underscores that, while home charging remains the most preferred option, the availability and accessibility of public charging infrastructure are equally important in supporting widespread BEV adoption.

Among those who plan to install a home EV charger, 77% have access to a dedicated home charging unit, while 15% report no access, and 7% rely on shared charging with neighbors. These results reinforce the importance of residential charging capability as a key enabler for EV adoption, particularly in urban areas where dedicated parking and charger installation are feasible.

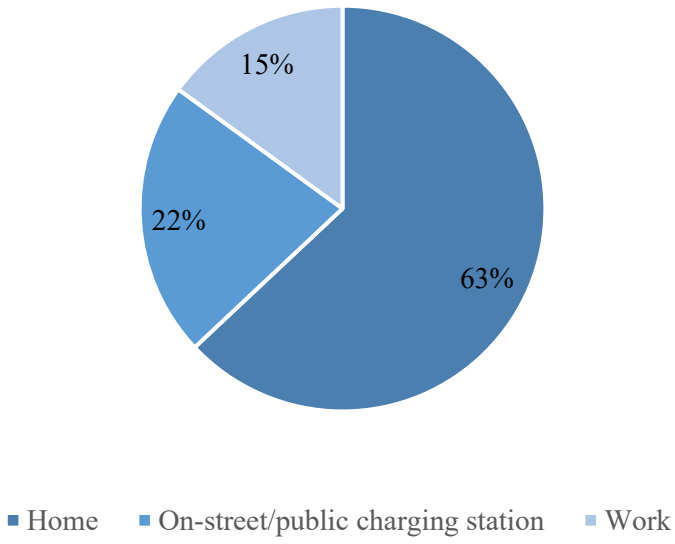


Figure 3-30: BEV charging expectation in China

Source: Deloitte (2025)

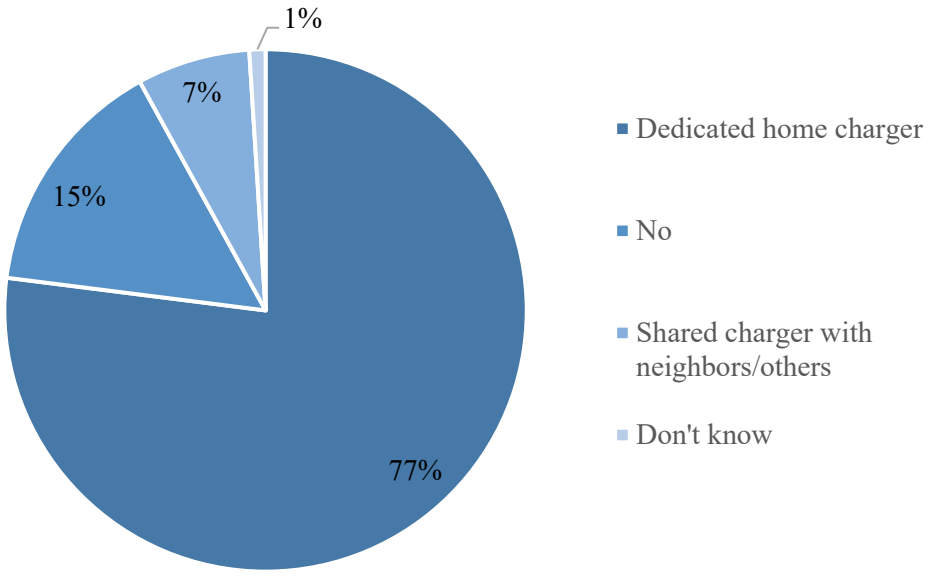


Figure 3-31: Home BEV charger plan in China

Source: Deloitte (2025)

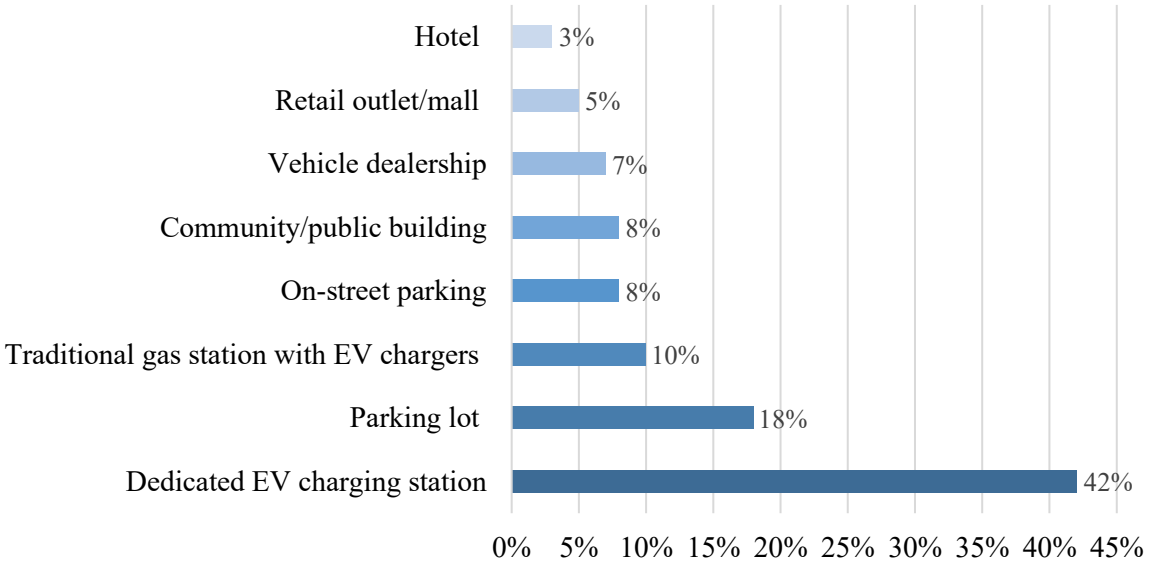


Figure 3-32: Preference for public BEV charging location in China

Source: Deloitte (2025)

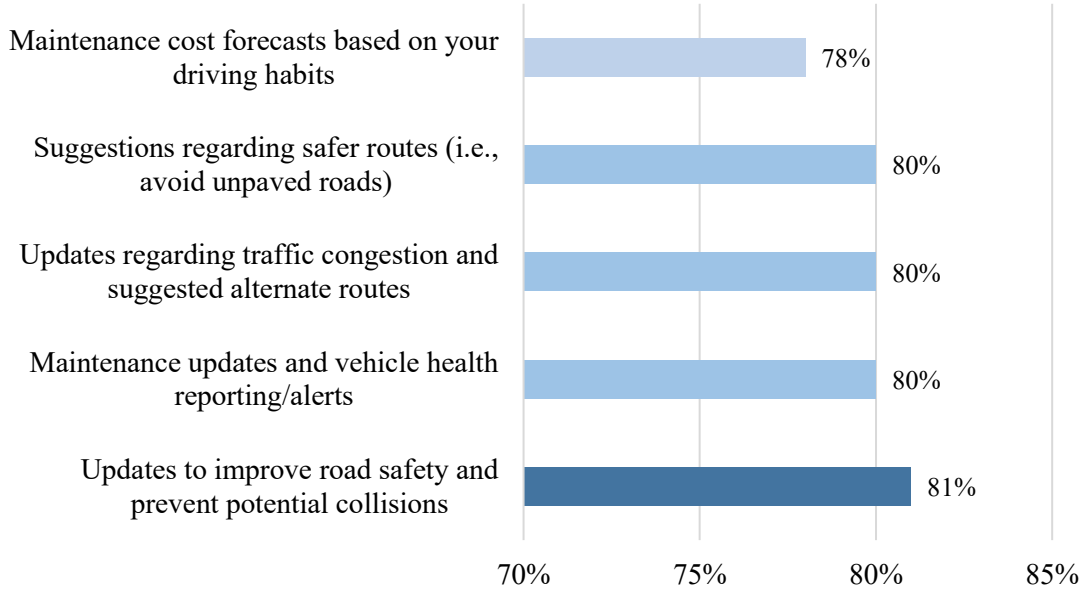
Moreover, Figure 3-32 indicates consumer preferences regarding specific types of public charging locations. A substantial share of respondents (42%) indicated a preference for dedicated BEV charging stations, in contrast to lower preferences for large parking facilities (18%) and traditional fuel stations equipped with EV chargers (10%). These results suggest a strong consumer inclination toward purpose-built BEV infrastructure that better meets expectations for functionality, safety, and charging speed, rather than retrofitted conventional infrastructure.

Therefore, infrastructure readiness plays a vital role in supporting EV adoption in China. Although most consumers prefer home charging and many have access to dedicated chargers, public infrastructure remains essential for broader coverage. China's steady expansion of charging stations shows strong commitment, but users still seek more convenient and faster charging options. Preferences for dedicated EV stations and shorter wait times highlight the need for improvements in charging experience. Ensuring both accessibility and efficiency of charging networks will be key to driving sustainable and widespread NEV adoption.

3.6.2.4. Experience with NEV

Experiential readiness, such as prior use of electric public transportation or exposure to BEV through peer networks, plays a crucial role in reducing psychological barriers and enhancing consumer preparedness for NEV adoption. The prior experience with BEV, as well as perceived tangible benefits, are critical in shaping consumer readiness and purchase intention. According to Deloitte survey, the top reasons for choosing an BEV in China as the next vehicle have remained relatively stable over the two years. In 2024, the most commonly cited motivation was the driving experience, followed by government incentives or subsidies , and lower fuel costs.

In the Chinese context, the adoption of NEVs is closely linked with the broader development of Intelligent Connected Vehicles (ICV). Notably, China has achieved one of the highest ICV penetration rates globally, indicating a strong foundation for the integration of smart mobility technologies.



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 3-33: Level of consumer interest in connected vehicle features in China

Source: Deloitte (2024)

Chinese consumers show a strong preference for connected and intelligent vehicle features that enhance safety and functionality. The Deloitte survey indicates that high interest in systems such as collision and accident-avoidance alerts (81%), vehicle health monitoring (80%), and real-time traffic updates and route optimization (80%). Other highly valued features include safer route recommendations (80%) and predictive maintenance based on driving behavior (78%). These findings reflect a shift in consumer focus toward advanced in-vehicle technologies, suggesting that the overall driving experience and system intelligence are becoming key decision-making factors.

3.6.2.5. Information Access & Awareness

Peer influence is a significant factor in consumers' decisions to adopt EVs. Information sharing and social validation within peer groups have been shown to strongly impact purchasing behavior, especially among first-time buyers[31]. Studies suggest that the peer effect is particularly influential in encouraging EV adoption among both existing vehicle owners and potential new buyers, reinforcing the importance of social networks in the diffusion of clean technologies.

The level of information and awareness that consumers have about EV technology, policy incentives, and total cost of ownership also contributes to readiness. Consumers who are well-informed about battery performance, long-term maintenance costs, and government policy changes tend to feel more confident in their decision-making process.

In China, the younger age groups dominate China's prospective car buyers in 2020, with individuals aged 25–30 years (26.2%) and 24 years or younger (23.5%) making up nearly half of all potential buyers, suggesting that digital-native consumers will drive future BEV demand (QuestMobile survey). The young consumers could access information on BEV decisions and BEV experiences.

Moreover, Deloitte survey reveals that nearly half of respondents (48%) prefer to pay for public BEV charging using a dedicated app, followed by third-party platforms (30%), indicating high smartphone penetration and comfort with digital transactions. This payment pattern requires information access on available data for public charging stations and the trust of digital transactions.

In addition, Chinese consumers need to share private information while using their private vehicles because NEV models are connected vehicles. The Deloitte survey shows that car manufacturers are the most trusted entities for managing vehicle data (25%), ahead of government agencies (20%) and vehicle dealers (17%). This implies that trust and control over digital ecosystems will be essential in shaping future mobility services and EV user experiences.

Although the BEV market in China has experienced rapid growth, the Deloitte survey reveals that consumers still harbor several concerns that may hinder their purchase or actual usage decisions. The most frequently cited concern was driving range and charging time (38%), followed closely by battery safety and performance in cold weather conditions (37%), and long-term battery replacement costs (35%). Additional issues such as charging and operating costs (30%) and lack of public charging infrastructure and overall sustainability (24%) were also mentioned by a considerable proportion of respondents. However, some concerns are not significant problems due to development in BEV technology. For example, many BEV models provide more long distance range.

While many consumers are receptive to New Energy Vehicles, gaps in information, understanding, and confidence in technology continue to influence purchasing behavior. This is particularly evident in Figure 3-34, which shows that Chinese consumers still place a high value on in-person interactions prior to making a purchase decision. Specifically, 88% emphasized the need for physical interaction with the vehicle before finalizing a purchase, 86% indicated a preference for test-driving the vehicle, 85% preferred in-person price negotiations, and 85% expressed trust in long-term relationships with dealerships.

[31] Zhao, X., Ma, Y., Shao, S., & Ma, T. (2022). What determines consumers' acceptance of electric vehicles: A survey in Shanghai, China. Energy Economics, 108, 105805.

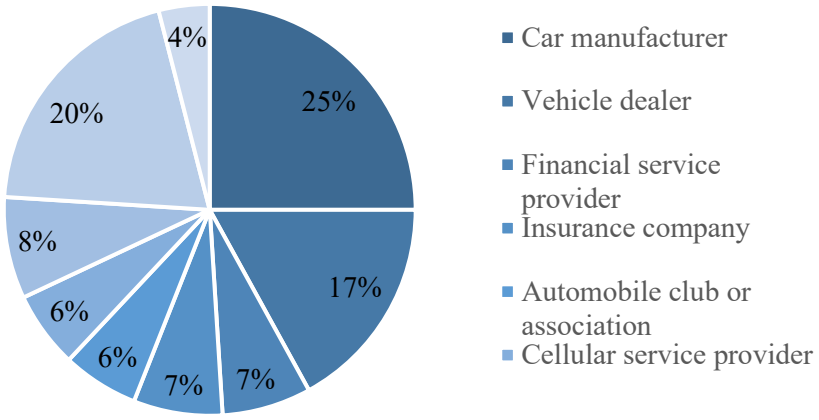
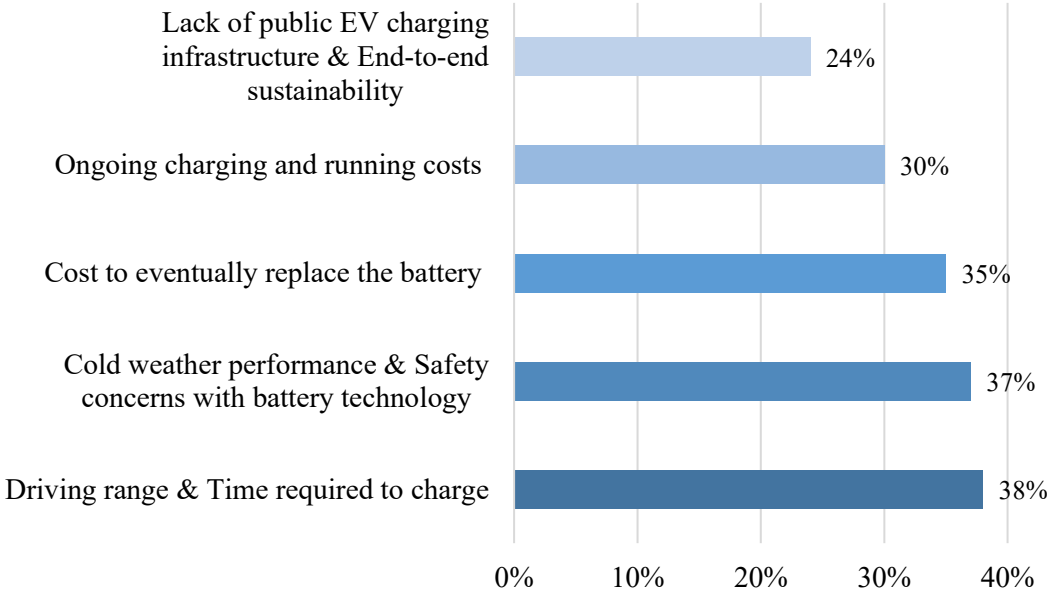


Figure 3-34: Percentage of most trusted entity for managing vehicle data

Source: Deloitte (2025)



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 3-35: The concern on BEV usages

Source: Deloitte (2025)

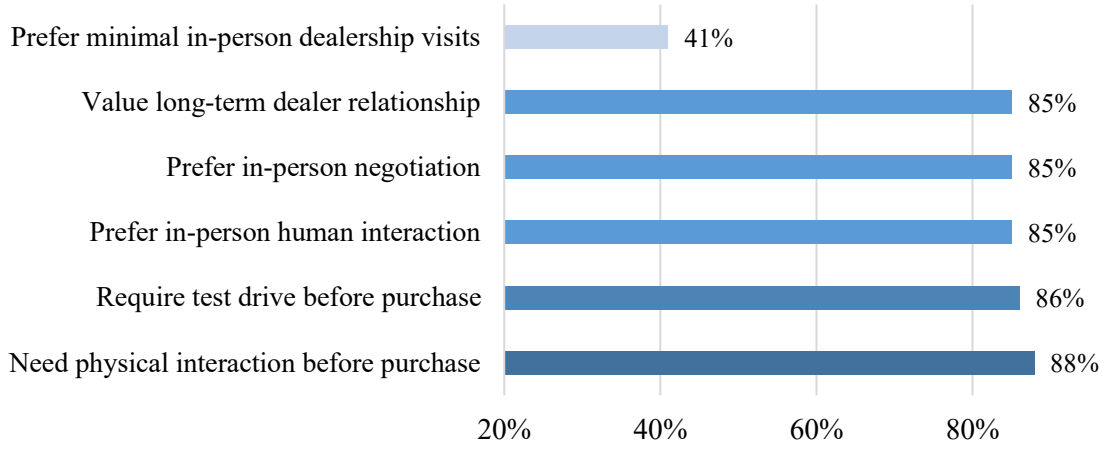


Figure 3-36: Level of agreement on purchase experience aspects

Source: Deloitte (2025).

Therefore, NEV adoption in China is driven by young, digitally literate consumers, but key concerns such as private information, battery performance, battery replacement costs, and NEV purchase experience remain. Bridging these gaps through clear communication is essential to build trust and awareness for NEV adoption.

3.6.2.6. Intelligent Connected Vehicle Services

As China advances its transition toward smart mobility, Intelligent Connected Vehicle (ICV) services have become an increasingly important component of the automotive ecosystem. These services, which integrate digital technologies with vehicle functionality, play a critical role in enhancing safety, efficiency, and the overall driving experience. So, the willingness to pay for various connected vehicle services could provide insights into the market readiness for ICV adoption and the broader implications for the future of NEV deployment in China.

According to Deloitte's 2024 survey, Chinese consumers exhibit a strong willingness to adopt connected vehicle services, particularly those related to safety and emergency assistance. This trend highlights a high level of technological awareness and market readiness. Notably, 77% of respondents perceive AI integration in vehicle systems as beneficial, indicating a strong receptiveness to intelligent features (Figure 3-37:). Specifically, 78% of respondents indicated a willingness to pay extra for automatic detection of vehicles and pedestrians, while 77% and 75% expressed similar willingness for emergency assistance and anti-theft tracking features, respectively (Figure 3-38:).

However, despite the favorable view of AI applications, there remains a significant degree of public concern. As illustrated in Figure 3-39:, 47% of respondents express concern about autonomous commercial vehicles on highways, and 43% are wary of local robotaxi services. These findings underscore that while Chinese consumers are generally optimistic about intelligent technologies in vehicles, ongoing apprehensions about safety and control must still be addressed through policy, design, and user education.

In summary, China's transition toward smart mobility is underpinned by strong consumer receptiveness to Intelligent Connected Vehicle (ICV) technologies, particularly those enhancing safety and emergency support. A majority of consumers recognize the benefits of AI in vehicle systems and are willing to pay extra for advanced features, reflecting high digital readiness. Nonetheless, lingering concerns around autonomous driving—such as robotaxi services and highway automation—highlight the need for further public assurance. The combination of strong demand, technological openness, and

urban affluence signals a favorable environment for scaling NEVs embedded with intelligent capabilities, positioning digital connectivity as a cornerstone of China's future mobility ecosystem.

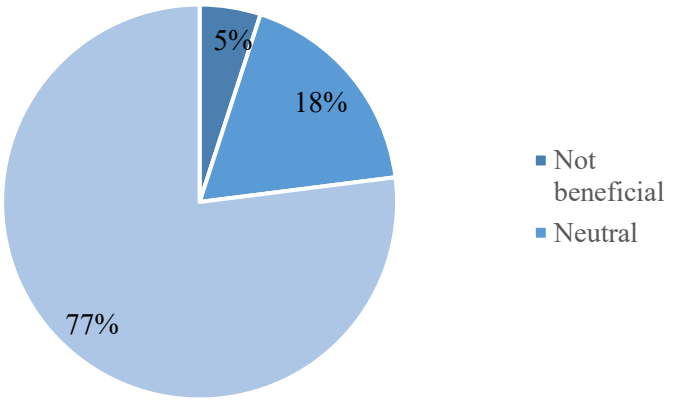


Figure 3-37: Perceived benefit of AI in vehicle systems in China

Source: Deloitte (2025)

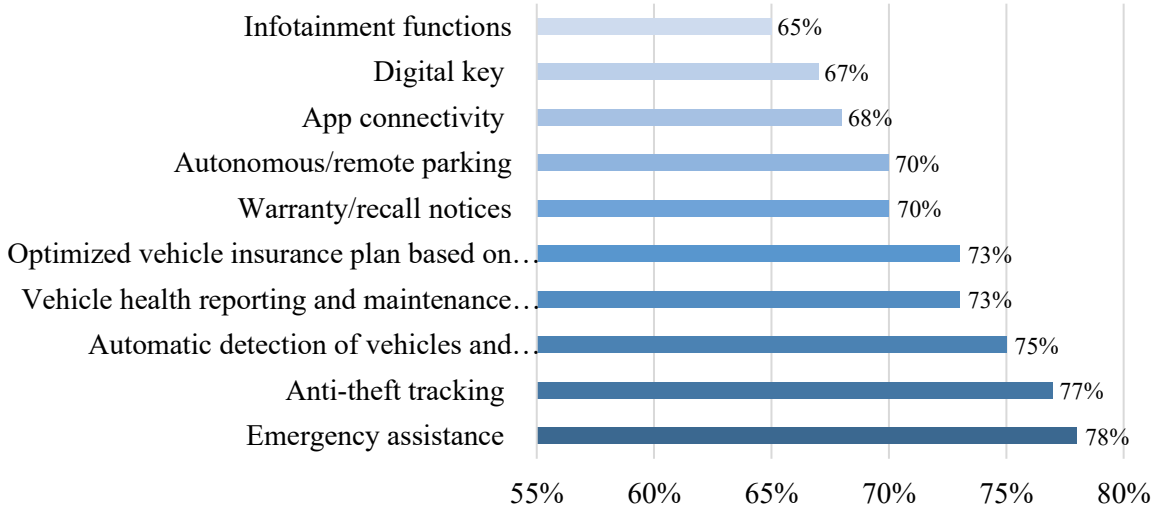


Figure 3-38: Perceived benefit of AI in vehicle systems in China

Source: Deloitte (2025)

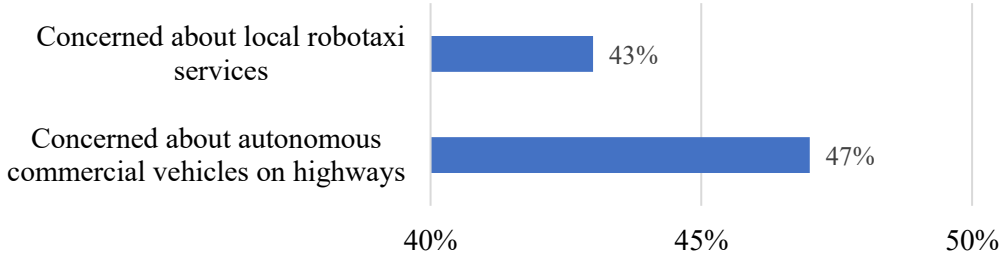


Figure 3-39: The concerns on local robotaxi and autonomous commercial vehicles on highways

Source: Deloitte (2025)

3.7 Assessment of NEV & Smart Mobility Market Preparedness

3.7.1. Country Assessment

China exhibits a high level of readiness, achieving an average Market Readiness Index of 4.2. Two primary drivers of this performance are the nation's Energy Infrastructure (4.7) and Policy Readiness (4.7). China has established a formidable New Energy Vehicle (NEV) ecosystem, underpinned by an advanced energy infrastructure characterized by high charging-pile density, standardized communication protocols, and a high level of smart grid readiness. This foundation is strengthened by a clear national strategy and seamless inter-agency coordination, utilizing a dual-track policy approach that combines fiscal incentives, such as purchase tax exemptions, with non-fiscal measures like preferential license plate issuance and dedicated traffic rights. Consequently, China's vehicle technology has achieved an exceptionally high level of readiness (4.0), offering a diverse range of models across all segments with competitive driving ranges. Continuous innovation in battery density and "flash-charging" architectures has further solidified the nation's technological leadership. This progress is augmented by the road and digital infrastructure readiness (4.0), particularly through the widespread deployment of advanced traffic management systems. However, while these pillars are strong, the overall market status remains at a moderate level (3.3), as the market penetration of PHEV and REEV models continues to be constrained by relatively high price points.

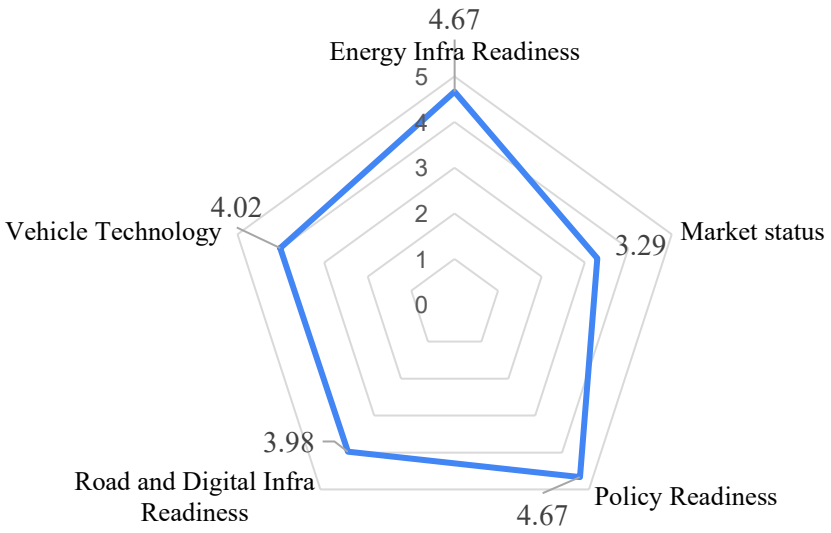


Figure 3-40: China's Market Readiness Index

Source: Author's estimation

3.7.1.1. Market Status Index

The Market Status index is constructed using annual data reported by the China Association of Automobile Manufacturers (CAAM) for the most recent year, providing a standardized basis for subsequent index score analysis. The BEV Penetration, the PHEV, REEV Penetration, and the ICV Penetration (L2 Autonomous) indices are calculated from the ratio of BEV/ PHEV, REEV/ICV sales to total sales in 2024 using annual data reported by the China Association of Automobile Manufacturers (CAAM) and Gaogong Auto.The motorization rate index is calculated from car ownership per 1,000 people. In addition, the DC Fast Charging Share Index measures the proportion of public EV charging

connectors that are DC fast chargers by using data from EVBoosters (2024). Finally, the BEV Price and PHEV, REEV Price indices are computed as the ratios of BEV/ PHEV, REEV to ICE prices by model segment using China car price (2024).

China's market status score is moderate-to-high 3.3., primarily driven by strong performance in three key indicators: the DC Fast Charging Share Index (5.0), BEV Price Index (4.0), and ICV Penetration Index (4.0). These indicators reflect the rapid and sustained development of China's New Energy Vehicle (NEV) market since 2020. Over this period, the share of NEV sales increased sharply, reaching approximately 40 percent of total vehicle sales by 2024.

This market expansion has been accompanied by a substantial build-out of charging infrastructure, with more than 3 million charging points nationwide, of which around 44 percent are DC fast chargers. The widespread availability of fast-charging facilities has significantly improved convenience and usability for NEV users, thereby reinforcing consumer confidence and adoption.

Also, the price of battery electric vehicles (BEVs) has declined to levels that are increasingly competitive with internal combustion engine vehicles. This trend is largely attributable to China's rapid and large-scale reductions in battery production costs, which have enabled certain BEV models to be priced at or even below comparable gasoline vehicles.

Moreover, China exhibits a high level of Intelligent Connected Vehicle (ICV) penetration, with NEVs extensively integrating advanced digital and connectivity technologies. These features strongly resonate with younger, technology-oriented consumers and play a critical role in shaping purchase decisions, further strengthening the overall market readiness of China's NEV ecosystem.

Nevertheless, China continues to face several market structural challenges, particularly with respect to the average price and market penetration of Plug-in Hybrid Electric Vehicles (PHEVs) and Range-Extended Electric Vehicles (REEVs). Both price index and penetration index are quite low at 2.0.

PHEVs and REEVs are currently in the early stages of market development in China. Automakers are actively accelerating product development and market expansion to better address domestic usage patterns, especially in regions characterized by long travel distances. As a result, the market share of PHEVs and REEVs remains relatively low compared with that of BEVs. Moreover, while the prices of PHEVs and REEVs are declining and approaching competitiveness with internal combustion engine vehicles, they have not yet achieved the same level of price parity observed in the BEV segment.

In addition, China's motorization rate index remains moderate at 3.0. Car ownership stands at approximately 218 vehicles per 1,000 people, suggesting that despite the rapid growth of the NEV market, overall vehicle ownership has not yet reached saturation levels. This structural characteristic simultaneously reflects untapped long-term demand potential and a short-term constraint on market expansion within the Market Status dimension.

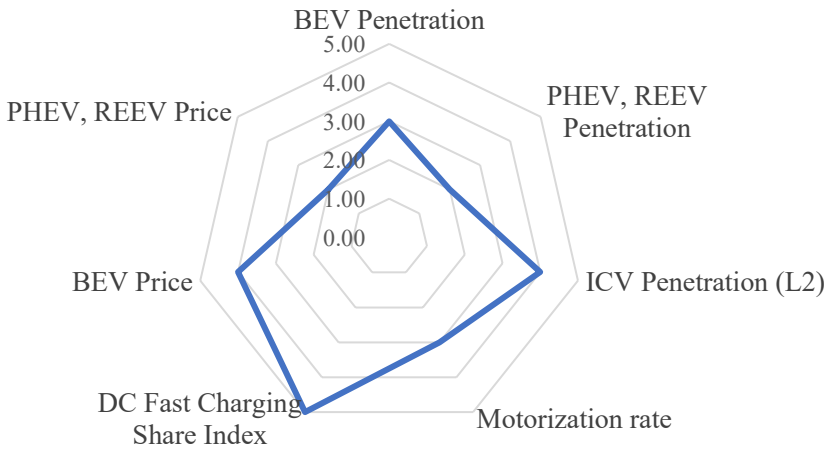
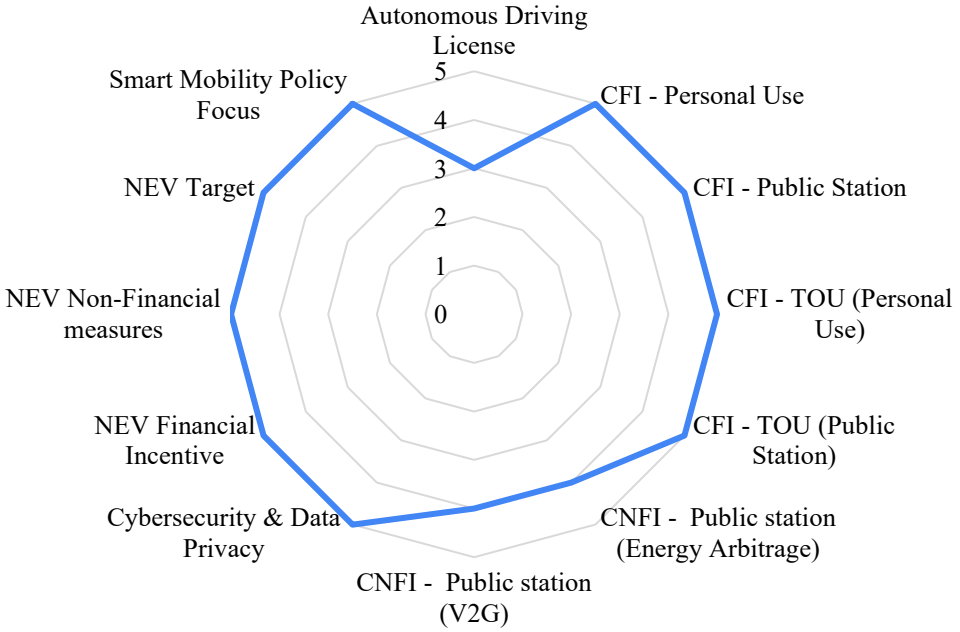


Figure 3-41: Market Status Index in China

Source: Author's estimation

3.7.1.2. Policy Readiness Index

It is undeniable that China's NEV support policies have been a critical factor driving the rapid growth of the NEV market. China's readiness in both market policy and energy infrastructure is exceptionally high, scoring approximately 4.7 out of a possible 5 points.



Note: CFI - Charging Financial Incentive; CNFI - Charging non-Financial Incentive

Figure 3-42: China's Policy Readiness Index

Source: Author's estimation

China has clearly defined its NEV adoption objectives within the New Energy Vehicle Industry Development Plan (2021-2035), reflecting a strong national focus on the sector. Authorities established ambitious long-term goals for NEVs to account for 50% of new vehicle sales by 2035, with intermediate targets of 20% by 2025 and 40% by 2030. Furthermore, the plan mandates stringent technical milestones, requiring BEVs to meet a fuel consumption benchmark of 12 kWh/100 km by 2025. Notably, the 2025 sales target has already been achieved ahead of schedule. Looking toward 2035, the government aims for the full electrification of public transport, NEVs to dominate new vehicle sales, and the commercial-scale deployment of fuel-cell and autonomous vehicles.

Considering the two primary financial incentives currently supporting NEV adoption, the Vehicle Purchase Tax Exemption, which can provide a benefit of up to 30,000 yuan, and China's Trade-in program, which offers additional subsidies from central and local governments totaling up to 30,000 yuan, China provides relatively high financial support at around 36.6% compare the weighted average market price of NEVs, which stands at 165,000 yuan. So, the country's incentive scheme earns a score of 5.0.

In addition, China enforces several concrete NEV Non-Financial measures, such as License Plate Access, Driving and Usage Privileges, and Fleet and Quota Mandates. These policies strongly incentivize users, particularly in urban areas, to adopt NEVs, resulting in a score of 5.0.

Smart Mobility Advancedment certainly has been in China's policy strategy. The strategy for intelligent-connected vehicles (ICVs) centres on a "vehicle-road-cloud" integration pilot (2024–2026) launched by five central ministries to build unified standards, 5G/C-V2X roadside infrastructure, edge computing, high-precision mapping, and cloud-controlled platforms. The goal is to accelerate automated driving, increase penetration of connected vehicle technology, and support large-scale deployment of ICVs. Meanwhile, digital transport infrastructure is promoted under the national "14th Five-Year Plan" (2021–2025) to realize an intelligent, data-driven, integrated transport network by 2035—including a fully networked transport grid ("123 travel circle") with one-stop digital mobility services. To promote shared and multimodal mobility, the government supports MaaS ("Mobility as a Service") platforms, encouraging private firms to integrate public transport, ride-hailing, shared bikes, taxis, etc., into unified digital services. Incentives come through central-level policy guidance, pilot cities, and demonstration zones, but implementation is largely decentralized: cities apply to be pilot zones for integration.

In term of autonomous driving initiative, China does not issue a single "autonomous-driving license," but instead grants test / demonstration permits for vehicles in its national ICV pilot zones. As of end-2023, there are 17 national-level autonomous driving demonstration zones, plus 7 vehicle-network pilot zones.[32] hese zones cover over 22,000 km of public roads open for testing. By mid-2024, more than 6,800 demonstration licenses had been issued and the cumulative on-road testing mileage had exceeded 88 million km.[33] Cities like Beijing, more than 900 test-vehicles were licensed across dozens of companies. In terms of spatial coverage, there is both national-level coordination (via central ministries for "vehicle-road-cloud" integrated pilot zones) and strong local-city implementation: for example, Beijing covers 600 km² (with plans to expand to ~3,000 km²) commercial trials are also allowed: in several cities, autonomous taxis and buses operate on designated routes / zones under local regulations. So, the score for this index is 3.0 as limited public road pilots have been licensed.

[32] https://www.gov.cn/lianbo/bumen/202401/content_6926704.htm?utm_source=chatgpt.com

[33] https://www.globaltimes.cn/page/202406/1313709.shtml?utm_source=chatgpt.com

Moreover, China enforces cybersecurity and data-privacy requirements for both EV charging infrastructure and connected/autonomous vehicles mainly through national rules such as the 2021 Automobile Data Security Management Provisions, which regulate vehicle-related personal data, sensitive geographic data, storage, transfer, and cross-border use. Nationwide technical standards, including the new GB 44495-2024 for vehicle information security (effective 2026), set requirements for secure OTA updates, encryption, vulnerability handling, and system protection. These measures are centrally issued and apply across all provinces, while sector inspections have highlighted risks such as over-collection of user data in charging-station apps and security weaknesses in some EVSE platforms. So, the score for this index is 5 as the country has been enforcing regulation on Cybersecurity & Data Privacy in EVSE and CAV.

China's charging infrastructure (CI) subsidies target public and commercial deployment. However, some local governments have introduced direct financial incentives for personal or residential users. In some cities, for example Shanghai, dedicated chargers may receive a 30% equipment cost subsidy during installation and operating subsidies of up to 0.2 RMB/kWh depending on usage patterns. As a result, based on the scoring rubric, China scores a 5 for the Charging Financial Incentive - Personal use index. This is because the provision of a 30% direct subsidy on equipment cost aligns with the criterion for Score 5.0.

Local governments in China also offer a variety of targeted financial incentives that complement national NEV policies through region-specific implementation strategies. These measures include both construction and operational subsidies. The investment subsidy is applied nationwide, reaching up to 600 RMB per kW, which accounts for more than 30% of the total charger cost. With this nationwide implementation and a subsidy level exceeding 30%, the Charging Financial Incentive – Public Station index for China is therefore assigned a score of 5.0.

In provinces such as Guangdong and Shanghai, utilities have adopted multi-level peak-valley time-of-use pricing. A typical four-tier system, comprising peak, off-peak, valley, and deep-valley periods, offers steep discounts for nighttime charging. Electricity prices in China can drop from RMB 1.134/kWh during peak hours to RMB 0.599/kWh during valley periods, a difference of approximately 47%. This substantial price spread significantly improves the economics of home charging, enabling households to save on energy costs while contributing to load balancing, making home charging significantly more affordable. With approximately a 47% difference between the highest and lowest electricity prices, China scores a 5.0 in the Charging Financial Incentive - ToU (Personal Use) index.

Many provinces have adopted tiered and ToU pricing structures, allowing charging station operators to access lower electricity prices during valley periods. This pricing flexibility helps reduce operating costs while improving load balancing across the grid. Under China's ToU pricing scheme, electricity costs can vary widely, ranging from RMB 1.08/kWh during peak hours to RMB 0.486/kWh during valley periods, representing a price spread of approximately 55%. With approximately 55% difference of the highest and lowest electricity prices, China scores a 5.0 in the Charging Financial Incentive - ToU (Public Station) index.

China has developed a regulatory framework that actively facilitates electricity arbitrage through time-of-use (ToU) pricing, bi-directional grid interaction policies, and supportive energy market mechanisms. Under these regulations, charging infrastructure operators and energy service providers are allowed to purchase and store electricity during off-peak hours, then discharge or sell it back to the grid during peak periods at higher tariffs, profiting from price differentials. This framework is strengthened by national standards permitting bi-directional power flows and the integration of distributed energy resources such as battery energy storage systems (BESS). In leading cities like Beijing and Shenzhen, pilot programs and regulatory sandboxes further enable participation in

frequency regulation and demand response markets, providing a legal and operational basis for large-scale energy arbitrage. Given the presence of commercial-scale pilot projects across multiple regions, China attains a Charging Non-Financial Incentive – Public Station (Energy Arbitrage) score of 4.0.

China is actively piloting vehicle-to-grid (V2G) and smart charging technologies that enable NEVs to operate as distributed energy resources. Major cities such as Shanghai, Suzhou, Qingdao, Beijing, and Shenzhen are advancing these deployments in collaboration with automakers, local governments, and grid operators. Accordingly, China attains a Charging Non-Financial Incentive – Public Station (V2G) score of 4.0.

3.7.1.3. Energy Infrastructure Readiness Index

China's readiness in energy infrastructure is another key factor driving NEV growth. The country demonstrates high preparedness score of 5.0 across smart grid technology and the number of NEV charging piles. However, unified service delivery via single platforms, leading to an average score of 4.0.

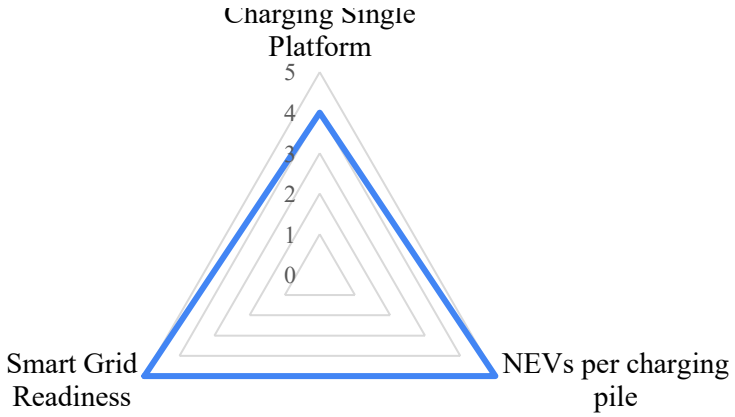


Figure 3-43: China's Energy Infrastructure Readiness

Source: Author's estimation

In the Smart Grid Index 2024, China achieved a score of 65.0 out of 100 in this category, indicating moderate national progress in areas such as demand response and grid flexibility. Nevertheless, regional utilities in major cities demonstrate significantly higher performance. State Grid Shanghai scored 94.6, while both the Shenzhen Power Supply Bureau and Guangzhou Power Supply Bureau achieved 91.0, showcasing advanced capabilities in grid digitalization, automation, and real-time load management. Reflecting these strong regional advancements and nationwide progress, China attains a Smart Grid Readiness index score of 5.0.

In charging service under single platform, China's NEV charging infrastructure is built upon the national GB/T standards, which establish unified technical specifications for AC and DC charging interfaces, communication protocols, and data exchange between NEVs and chargers. These standards ensure full interoperability among different charger manufacturers and vehicle models, providing the foundational framework that supports China's large-scale NEV deployment. However, Compatibility is maintained for both the GB/T national standard and, to a limited extent, the Open Charge Point Protocol (OCPP), China attains a Charging Communication Protocol Standard – Single Platform score of 4.0.

In addition, the country possesses a highly developed charging ecosystem. As of May 2025, the country had deployed over 14.4 million charging piles. This massive infrastructure results in a cumulative ratio of approximately 2 New Energy Vehicles (NEVs) per charging pile (combining AC and DC). This balanced ratio strongly indicates sufficient charging accessibility and network maturity across its regions. Accordingly, China achieves the maximum score of 5.0 in the NEVs per Charging Pile – Cumulative AC/DC Index.

3.7.1.4. Road and Digital Infrastructure Readiness Index

China's readiness in road and digital infrastructure is considered high, with the average score for this index standing at 4.0. The most advanced components are the Traffic Management Systems and 5G Coverage, while areas such as traffic separation and road quality score at a moderate level.

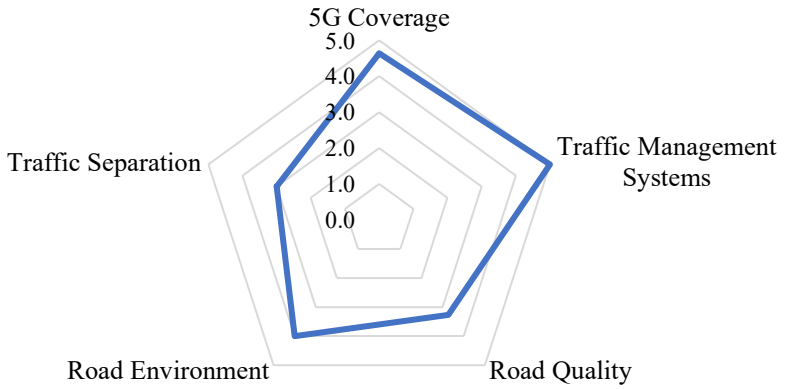


Figure 3-44: China's Road and Digital Infrastructure Readiness Index

Source: Author's estimation.

Based on data collected by the Global Network Excellence Index, China's 5G Coverage is approximately 92.7% (Q2, 2025 data), resulting in a score of 5.0 in this index.

Moreover, China has widely deployed urban traffic management systems using AI, big data, and integrated city-brain platforms that operate across large urban areas. The Ministry of Transport reports that multiple cities now use AI-driven signal-control systems to manage intersections in real time, reducing congestion across broad urban networks. Platforms such as Alibaba's City Brain—adopted in cities including Hangzhou, Beijing, Shanghai, and Zhengzhou—centralize traffic data from cameras, vehicles, and sensors to optimize signal timing, predict congestion, and support citywide traffic operations. Industry analyses also note that these systems enable refined, real-time management across entire metropolitan areas rather than isolated corridors, showing that China's urban traffic management capabilities cover extensive citywide road networks. So, the score of this index is 5.0.

Based on the 2019 Quality of Road Infrastructure (QRI) data from The World Bank and World Economic Forum, China scored 4.57 out of a possible 7 points. Consequently, the score for this index is calculated at 3.3 out of a possible 5 points.

In road environment index, China relies on its own road-engineering standards: for example, it has a well-developed "JTG" system, its highway-engineering technical standard system that has evolved over decades. Urban road design also uses domestic codes: the City Road Design Specification (CJJ 37) is

distinctly Chinese in how it handles road cross-section, urban features, and infrastructure context. There are also city-level / local standards, such as the DB11/T 1116-2024 "Urban Road Spatial Planning Design Standard", which explicitly guides road spatial planning under Chinese planning logic and local priorities. At the same time, China's Ministry of Transport has recently called for enhancing the internationalization of its road-engineering standard system, but this is part of a future goal, not full alignment so far. So, China's road environment is regard as local standard and attain score of 4.0.

In some Chinese cities, there are pilot or local-level measures for separating motorcycle traffic: for example, Xi'an opened its first motorcycle-only lane in July 2020 on Qujiang Avenue south of the Third Ring Road, with a motor-vehicle lane, a dedicated motorcycle lane, and a non-motor (bicycle) lane laid out side-by-side. In that city, the motorcycle lane was designed explicitly for safety and convenience, but local police said it was a "convenience measure", not part of a broad city-wide rollout, and "not for large-scale promotion." According to a planning commentary, Chinese cities could build a "three-level spatial system" of main-road special lanes, scenic route lines, and neighborhood connector networks using physical separation (barriers, markings) to achieve motor-vs-non-motor traffic separation, but such spatial plans are still at the proposal or pilot stage in many areas. Meanwhile, in Xi'an the traffic-safety data since some of these changes show a drop in crash/incidence rates, indicating that the approach has some practical effect. So. the score for this index is 3.0.

3.7.1.5. Vehicle Technology Readiness Index

The Vehicle Technology Readiness index assesses the technological capabilities of new energy vehicles (NEVs). The BEV Product Offering (range distance) index is calculated from the average driving range of BEV models in the market, weighted by number of models, while the PHEV, REEV Product Offering (range distance) index draws on the average BEV-mode range of PHEV and REEV models, similarly weighted. The NEV experience (years) index measures the number of years since the country initiated its national NEV action plans, capturing the policy-driven timeline of market development. In addition, the BEV Model variety and the PHEV, REEV Model variety indices are computed as the ratios of BEV and PHEV/REEV models to ICE models, respectively, reflecting the diversification of electrified product offerings.

China achieves the vehicle technology readiness index at a high score of 4.0, reflecting its position as the global leader in NEV technology. This performance is driven by strong performance in three core indicators: NEV market experience (5.0), BEV model variety (5.0), and BEV Range Distance (4.4). China has accumulated extensive experience in developing the NEV market over a period of approximately 16 years, beginning in 2009, when the government initiated comprehensive policy support encompassing domestic production capacity, purchase subsidies, and the development of electric-vehicle charging infrastructure. This long-term policy continuity has enabled the domestic automotive market to progressively adapt to technological change and has fostered widespread consumer acceptance of NEVs.

In addition, China's automotive market offers a broad and diversified range of BEV models across multiple vehicle segments, including sedans, SUVs, sports cars, and vans. Such diversity enhances consumer choice and lowers adoption barriers by allowing consumers to select vehicles that closely match their usage preferences and lifestyles.

Moreover, technological performance has advanced significantly, with the average driving range of many BEV models now exceeding 500 kilometers. This improvement reflects substantial progress in battery efficiency, energy density, and energy management systems, further reinforcing China's high vehicle technology readiness and its leadership in NEV innovation.

Nevertheless, the PHEV and REEV markets in China remain at an early stage of development, as reflected in the moderate scores for PHEV and REEV range distance index (3.7) and the relatively low scores for PHEV and REEV model variety (2.0). Despite this, there are strong signals of rapid market expansion, particularly within the PHEV segment. Sales of PHEVs increased sharply from approximately 3 million units in 2022 to around 11 million units in 2024, representing nearly a threefold increase within just two years.

This growth trajectory suggests that the PHEV and REEV markets are poised for further expansion, supported by ongoing improvements in driving technology and range performance. At present, the electric-only driving range of PHEVs and REEVs has improved significantly, reaching an average of approximately 100–160 kilometers, which enhances consumer confidence in hybrid powertrain options and reduces concerns related to range anxiety.

However, the diversity of models in the PHEV and REEV segments remains limited. Current offerings are largely concentrated in niche market segments, where manufacturers can achieve profitability more readily. Given that PHEV and REEV prices remain close to those of internal combustion engine vehicles, automakers have adopted relatively cautious marketing and product strategies to ensure commercial viability and maintain competitiveness during this early phase of market development.

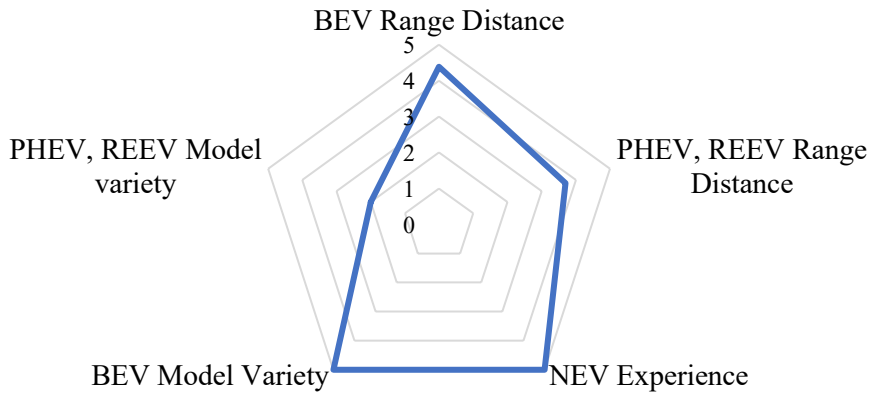


Figure 3-45: Vehicle Technology in China

Source: Author's estimation

3.7.2. Key Success Factors and Gap Analysis

3.7.2.1. Key Success Factors

China's emergence as the world's largest New Energy Vehicle (NEV) market rests on a combination of decisive government intervention, rapid industrial capability building, and the amplifying effect of a very large domestic market. While policy has been a central catalyst, industrial structure and consumer responses have been powerful multipliers. The following factors synthesize the principal drivers of China's NEV success, preserving the evidence cited in your source passages.

1) Demand-side policy levers and urban vehicle controls: a key demand-shaping strategy has been the use of tight restrictions on internal-combustion engine (ICE) vehicle ownership in major cities (e.g., auctions and lotteries for ICE license plates in Shanghai and Beijing), while exempting NEVs from those constraints. This regulatory asymmetry made NEVs relatively

easier and cheaper to acquire in dense urban markets and produced very large localized demand effects. Empirical studies indicate that license-plate restrictions increased NEV sales by roughly 65–87% in cities such as Tianjin, Hangzhou, Shenzhen, and Haikou (Yuan-Ying Chi et al., 2021). Such demand-side measures worked in concert with other financial incentives to create rapid urban uptake.

2) Growing consumer acceptance, product fit, and shifting preferences: consumer confidence and satisfaction have strengthened NEV uptake. Buyers report high satisfaction based on objective features (motor power, driving range) and subjective attributes (interior space, design, handling, comfort). Nonetheless, range anxiety and increased price sensitivity, especially after the rollback of some subsidies, remain real constraints. Across factors, affordability, performance, and design appeal are the most important determinants of purchase decisions (Chaoxi Liang et al., 2024). In short, policy nudges initiated trials and purchases, but consumer experience and product quality sustained longer-term adoption.
3) Supply-side mandates that force technological and production shifts: the Dual-Credit regime (CAFC + NEV credits) compelled automakers to improve ICE fleet fuel efficiency while simultaneously expanding NEV production; non-compliance requires buying credits or facing penalties. This embedded both "sticks" (penalties and regulatory constraints) and "carrots" (credit banking and trading) that pushed manufacturers to invest in NEV R&D, retool production lines, and prioritize electrified models. Empirical assessments indicate the policy significantly enhanced industry innovation capacity and NEV output. In short, the credit framework transformed firm incentives from short-term sales tactics into longer-term technological repositioning.
4) Product diversity and consumer segmentation: chinese automakers rapidly expanded model ranges across price bands, from ultra-compact city EVs to mainstream passenger cars and commercial NEVs, so that there were vehicles tailored to diverse consumer needs. This model breadth helped reduce barriers across income segments and use cases (commuting, ride-hailing, delivery), improving market penetration and smoothing adoption across regions and demographics.
5) Localized industrial ecosystem and scale economies: china's vertically integrated supply chains (notably in batteries, motors, and power electronics) enabled rapid scale-up and aggressive production strategies. This industrial depth reduced unit costs, shortened time-to-market, and backed massive production growth (from roughly 17,500 NEVs in 2013 to over 3.5 million in 2021 in your data). The scale advantage amplified the effect of policy signals and made Chinese firms globally competitive.
6) Policy evolution and calibration (2018–2023): from 2018 onward, policy gradually shifted from heavy direct subsidies toward market-based instruments and structural measures embedded in strategic plans (e.g., the NEV Development Plan 2021–2035 and the 14th Five-Year Plan). Central subsidies were largely phased out by 2023, but other supports—tax exemptions, local incentives, technical standards, and regulatory pressure—continued to sustain industry momentum while encouraging cost-competitiveness and innovation.
7) Secondary factors that magnified policy impact: large domestic market scale, state-led coordination among ministries and provinces, the rapid roll-out of charging and battery-related infrastructure, and a digitally native consumer base receptive to connected features all multiplied the effectiveness of policy measures. Together these create an enabling environment that foreign competitors and smaller markets find hard to replicate quickly.

3.7.2.2. Gap Analysis

Nevertheless, while China exhibits a high degree of market readiness, there remain existing gaps. The primary gaps are not in infrastructure adequacy or financial support but in the final stage of market and grid integration for advanced technologies.

As demonstrated in the Index score evaluation, China's market status readiness currently registers at a moderate level. Even though China has achieved its NEV adoption policy targets, NEVs are not yet the majority of the vehicle market, particularly the Plug-in Hybrid Electric Vehicles PHEV and Range-Extended Electric Vehicles (REEV), which still maintain a low market share. A key factor is the price competition against conventional vehicles. Although the Total Cost of Ownership (TCO) calculation for the selected car models indicates that NEVs are price-competitive with ICE vehicles, the comparative price of PHEVs and REEVs across the overall market remains higher. Furthermore, the model variety for PHEVs and REEVs is still lower compared to BEVs and ICE vehicles.

Secondly, China has achieved significant progress in enabling Energy Arbitrage and Vehicle-to-Grid (V2G) operations through advanced commercial pilots across multiple regions. The remaining gap lies in scaling these pilots to nationwide commercialization with fully established regulatory and technical frameworks. Although China maintains a favorable NEV-to-charging-pile ratio of 2:1, public charging capacity per NEV remains low, reflecting the predominance of AC slow chargers. The key challenge is to accelerate the expansion of fast and ultra-fast charging to serve a growing fleet of long-range NEVs.

China's energy policy framework—anchored in the Dual Carbon Strategy and the 14th Five-Year Plan—provides a globally leading foundation for NEV deployment. Major policies, including the New Energy Vehicle Industry Development Plan (2021–2035), the Renewable Energy Plan, the Circular Economy Development Plan, and the Action Plan to Accelerate the Construction of a New Power System (2024–2027), are reinforced by instruments such as the dual-credit system, extended tax exemptions, national R&D support, and Time-of-Use pricing reforms. Together, these measures align the electricity, industrial, and transport sectors. However, several policy gaps could constrain sustainable and equitable NEV scale-up:

1) Limited Integration of Renewable Energy in NEV Charging While renewable energy and NEV deployment are expanding rapidly, policies do not yet guarantee that NEV charging is powered by clean electricity. Existing plans encourage co-location of solar with NEV infrastructure and support smart charging, but lack binding requirements for renewable shares. Without stronger mandates or incentives, NEVs may continue drawing from a fossil-dominated grid, undermining decarbonization goals.
2) Underdeveloped V2G Regulations and Market Mechanisms V2G pilots exist, but a comprehensive national framework is absent. NEVs lack defined rights to participate in ancillary service markets or receive compensation for grid services such as peak shaving and frequency regulation. Without clear pricing structures, standards for bidirectional charging, and market rules, NEVs will remain passive loads rather than active grid resources.
3) Uneven Distribution Grid Readiness Grid preparedness varies significantly across provinces, especially in less-developed regions. Although the 2024–2027 distribution grid action plan prioritizes resilience and digital upgrades, implementation remains inconsistent. Some urban and industrial areas are adopting smart charging, while others still face infrastructure bottlenecks. Ensuring targeted investment and technical support is essential for equitable NEV adoption.
4) Fragmented Cross-Sector Coordination Despite strong high-level alignment, operational coordination between energy and transport agencies remains limited. MIIT leads NEV policy,

while NEA and NDRC oversee grid infrastructure and electricity pricing. This division hampers integrated planning for charging networks, renewable alignment, and smart grid deployment. Structured coordination platforms or joint planning mandates are needed to bridge these institutional silos.

Overall, China demonstrates high policy and institutional readiness for NEV deployment through clear national strategies, strong coordination mechanisms, and effective local implementation. Leading provinces such as Guangdong and Beijing drive innovation, while less-developed regions advance through targeted support. Yet, challenges in renewable integration, grid capacity, and inter-agency coordination persist.

3.8 Policy Recommendations

Although the market gap persists, China's policies and supportive measures related to pricing and NEV adoption should increasingly align with market mechanisms, given that NEVs are already technologically and product-wise competitive with ICE vehicles. Furthermore, after years of relying on substantial financial support as the primary incentive measure, China is currently phasing out these supports. Therefore, the critical policy focus should shift toward inclusiveness by expanding energy infrastructure and connecting it more comprehensively with clean energy sources.

1) Strengthen NEV Market Adoption and Affordability

Reduce Battery Costs Through Domestic Innovation. Continued investment in R&D and scaling production of LFP and sodium-ion batteries can reduce BEV and PHEV costs by 10–20% within five years. Expanding domestic capacity in these chemistries will help secure supply chains and enhance affordability for private consumers and commercial fleets.

2) Accelerate Smart Mobility and Autonomous Driving Deployment

China's smart mobility leadership stems from its smart city strategy, technological innovation, and robust regulatory support. To maintain its lead and expand real-world applications, the following policy directions are essential:

2.1) Maintain Strong Government Leadership and Long-Term Vision: autonomous driving should continue to be treated as a strategic emerging industry, ensuring stable policy direction, long-term investment, and space for technological experimentation.

2.2) Strengthen Regulatory Flexibility and Local Pilots: cities such as Beijing, Shanghai, Shenzhen, and Wuhan should further expand L3–L4 test zones and commercial robotaxi operations. Local regulatory sandboxes will remain crucial for validating new technologies, including driverless freight and automated delivery.

2.3) Enhance National Standards and Industrial Coordination: Updating standards such as GB/T 40429-2021 will ensure consistent definitions, safety benchmarks, cybersecurity protocols, and interoperability across AV developers, automakers, and smart traffic systems.

2.4) Support Ecosystem Collaboration and Industry Alliances: partnerships between technology firms (e.g., Baidu, Huawei, WeRide), OEMs, and research institutions should be encouraged to innovate AI-based driving stacks, simulation tools, and V2X technologies.

2.5) Expand High-Quality Digital Infrastructure: Investments in 5G, edge-computing nodes, and V2X roadside units will support real-time perception, communication, and safety. These systems are essential for autonomous buses, robotaxis, and logistics automation.

3) Link NEV Deployment with Renewable Energy Integration

To ensure that NEV growth contributes fully to decarbonization, China should shift from simply expanding charging infrastructure to strategically aligning it with the clean power transition:

3.1) Synchronize NEV Charging Demand with Renewable Energy Targets: Provincial renewable energy goals should be directly linked to NEV charging development plans. Incorporating NEV load forecasts into power sector planning will reduce reliance on fossil-based grid electricity.

3.2) Address Regional Disparities in Grid Preparedness: Coastal provinces exhibit world-class smart grid capabilities, whereas inland regions have slower deployment of automation and digital monitoring. Differentiated regulatory targets and dedicated grid-investment programs can narrow this gap.

3.3) Move Toward Market-Based Incentive Structures: Integrating the dual-credit system with the national carbon market would enable monetization of NEV-related emissions reductions. This shift can gradually replace direct subsidies with more efficient, market-driven incentives.

4) Modernize Energy Infrastructure for NEV and Smart Mobility Expansion

4.1) Expand Ultra-Fast Charging and National DC Corridors: China should strategically deploy ultra-fast charging along expressways and freight corridors to support long-distance passenger travel and electrified logistics, paired with coordinated grid reinforcement.

4.2) Scale Managed Charging and Vehicle-to-Grid (V2G) Deployment: A nationwide regulatory framework—defining technical standards, aggregator roles, and market participation rules—is needed to allow NEVs to provide peak shaving, frequency regulation, and renewable balancing services.

4.3) Upgrade Distribution Grids in Interior Provinces: Targeted investments in digital controls, advanced metering, and automated distribution equipment will ensure that inland provinces can manage rising NEV loads and integrate renewable energy production.

4.4) Strengthen Interoperability and Cybersecurity Standards: Updating GB/T charging standards to reflect higher power levels, bidirectional flows, and stronger cybersecurity will support a secure and unified charging ecosystem.

4.5) Deploy Battery Swapping Strategically: Battery swapping should be prioritized for high-utilization fleets—taxis, ride-hailing, heavy logistics—while avoiding over-expansion in private passenger segments where ultra-fast charging may be more efficient.

5) Deepen Institutional Coordination and Green Financing Mechanisms

5.1) Enable Cross-Sector Coordination Across Agencies: Improved cooperation between MIIT, NDRC, NEA, and transport bureaus will reduce fragmentation in planning for charging networks, smart mobility services, and electricity market reform.

5.2) Expand Green Finance and Private Investment Mobilization: Green bonds, concessional loans, and credit guarantees should target charging infrastructure, smart mobility systems, and underdeveloped provinces. Meanwhile, enabling NEV fleets to participate in demand-response markets can unlock new revenue streams.

6) Priority Actions for 2025–2030

6.1) Integrate NEV charging forecasts into provincial renewable energy and grid planning.
6.2) Accelerate digital grid modernization under the 15th Five-Year Plan.
6.3) Formalize V2G participation and aggregator licensing nationwide.
6.4) Mandate compliance with upgraded GB/T interoperability and cybersecurity standards.
6.5) Expand expressway ultra-fast charging corridors and inland grid reinforcement.
6.6) Strengthen autonomous driving pilots and large-scale smart mobility deployments.

Chapter 4 State of Preparedness of Thailand

4.1 Market and Adoption Status

4.1.1. NEV Market Trend

4.1.1.1. NEV Registration

Thailand's vehicle registration data[34]—specifically categorized under R.Y.1 and R.Y.2, referring to passenger cars with up to seven seats and those with more than seven seats, respectively—has shown a consistent upward trend from 2019 to September 2025, as illustrated in Figure 4-1. In 2019, the total number of registered passenger vehicles was 10.398 million units, increasing steadily each year to reach 12.888 million units by September 2025, reflecting an average annual growth rate of approximately 3–4%.

In the early phase, most registered vehicles were internal combustion engine (ICE) cars, accounting for over 99% of all registrations, while Hybrid Electric Vehicles (HEVs) represented only around 1%, and New Energy Vehicles (NEVs) were almost negligible.

However, since 2020, the number of registered NEVs has risen significantly—from 805 units in 2019 to 26,198 units in 2020, an increase of 25,393 units. Although this figure still represents a small portion of total registrations, it marked the early stage of NEV market development in Thailand.

A major acceleration occurred in 2023, when NEV registrations increased sharply from 55,908 units in 2022 to 142,796 units, largely attributed to the implementation of the EV 3.0 policy, which provided tax incentives and purchase subsidies to both manufacturers and consumers. Consequently, NEV registrations have grown at an average rate of around 50% per year, while HEV registrations have expanded by about 30% annually, and the growth of ICE vehicles has gradually slowed down. As a result, the overall market composition has shifted. By September 2025, ICE vehicles accounted for 93% of total registrations, followed by HEVs (4%) and NEVs (2%), indicating a gradual but noticeable transition in Thailand's passenger vehicle market.

According to Figure 4-2, Thailand's NEV registrations consist of Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs). In the early phase (2020), the NEV market was primarily driven by PHEVs, which increased from zero in 2019 to 24,115 units, while BEVs grew modestly to 1,278 units. However, between 2022 and 2023, BEV registrations surged dramatically by 9,557 units in 2022 and 75,330 units in 2023, reflecting the strong impact of the EV3.0 policy, which boosted both consumer confidence and automaker participation. Meanwhile, PHEVs continued to grow steadily at an average annual rate of about 20%.

[34]Department of Land Transportation (2025). https://web.dlt.go.th/statistics/

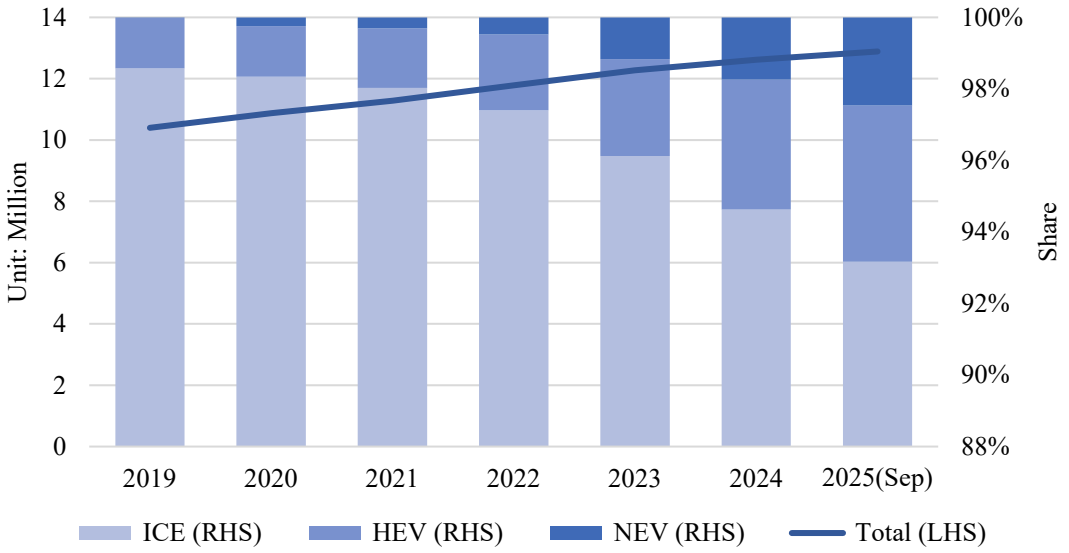


Figure 4-1: Passenger vehicle registration (stock volume) in Thailand

Source: Author's compilation from Transport Statistics Group, Department of Land Transport, Ministry of Transport (Thailand)

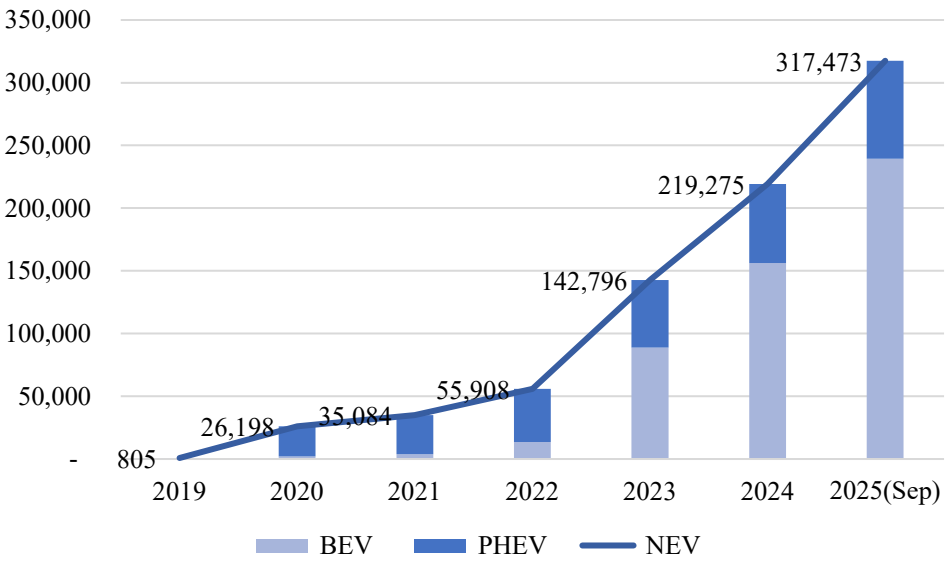


Figure 4-2: NEV registration number in Thailand

Source: Author's compilation from Transport Statistics Group, Department of Land Transport, Ministry of Transport (Thailand)

4.1.1.2. NEV Sales

The automotive market in Thailand has experienced a dual-track evolution, marked by a short-term contraction in overall vehicle production and domestic sales, contrasted by robust growth in the electric vehicle (EV) segment, particularly battery electric vehicles (BEVs) and hybrid electric vehicles (HEVs). In 2024, total vehicle production declined by approximately 19.9% year-on-year, dropping from 1.83 million units in 2023 to an estimated 1.47 million units.

This decline was largely attributed to weakening domestic demand, tightening loan conditions, and subdued purchasing power, particularly among rural households impacted by rising living costs and reduced agricultural income. Domestic vehicle sales followed a similar downward trajectory, falling by over 26% to approximately 573,000 units in the same period. Nonetheless, the market is expected to stabilize and rebound modestly between 2025 and 2026, supported by a recovering tourism sector, government economic stimulus measures, improved agricultural output, and increased investment in infrastructure.

Amid this broader market contraction, Thailand's EV sector has emerged as a growth engine, propelled by supportive government policies and evolving consumer preferences. The BEV market has shown particularly strong momentum. In 2023, BEV registrations surged by approximately 690% year-on-year, reaching over 75,700 units. This growth continued into 2024, albeit at a slower pace; by the first nine months of the year, BEV registrations rose by 5.4% to 52,702 units.

However, HEVs posted the strongest growth among all electrified vehicle types, with registrations increasing by 59.9% to 103,686 units over the same period. Plug-in hybrid electric vehicles (PHEVs) experienced a contraction, with registrations falling by 23.3% to 7,303 units, reflecting both pricing challenges and the limited number of new PHEV offerings in the Thai market.

In terms of production, xEV[35]capacity is expanding significantly. In 2024, production capacity for xEVs was estimated at between 400,000 and 500,000 units annually, with expectations to exceed 500,000 units by 2027. However, BEV production still accounts for a relatively small portion of total output; only around 9,688 BEVs were produced domestically in 2024, representing less than 1% of Thailand's total vehicle output.

This gap is set to narrow rapidly as EV 3.0 and 3.5 mandates compel automakers to offset subsidized imports with domestic BEV production at ratios of 1:1 to 1.5:1. As a result, several foreign automakers, particularly Chinese firms such as BYD and Great Wall Motors, have accelerated their investment in Thai assembly plants and supply chains.

Another important trend is the increasing model diversity and competitive pricing within the BEV segment.

As of September 2024, the Thai market offered 56 BEV models from 25 brands, spanning a wide price range from THB 330,000 to over THB 12 million, and battery ranges between 120 and 702 kilometers. This diversity has helped expand consumer access and address various market segments. Notably, more than 60% of BEVs sold in Thailand were priced under THB 2 million, making them eligible for government incentives and more attractive to middle-income consumers. Popular models like the Neta V (302 km range, announced priced in 2022 at THB 549,000) and Ora Good Cat (500 km range, announced priced in 2022 starting at THB 959,000) have contributed significantly to total sales, capturing approximately 17% and 8.9% of BEV registrations respectively.

Thus, the BEV market is expected to grow steadily, with new registrations projected to reach between 100,000 and 190,000 units annually by 2025–2026. This growth will be supported by continuous government subsidies under the EV 3.5 program, increased public awareness, expanding fast-charging infrastructure, and a broader range of models tailored to Thai consumer preferences. At the same time, Thailand's positioning as a regional manufacturing hub for xEVs, backed by rising export potential to ASEAN and global markets, will further reinforce its role in the global EV transition.

[35] xEV refers to the Thai policy term covering the entire spectrum of electric vehicles: HEV, PHEV, and BEV

4.1.1.3. Model Availability

The implementation of the EV 3.0 and EV 3.5 policies has significantly boosted the registration of New Energy Vehicles (NEVs) in Thailand. As a result, a wide range of NEV brands have entered the domestic market. Based on the new vehicle registration data in 2024, BYD emerged as the most popular NEV brand, capturing 34.8% of total registrations. This market share was nearly three times higher than that of the second-ranking brand, MG, which held 11.2%, followed closely by NETA at 10.3%, and DEEPAL at 7.3%. Other brands such as BMW, AION, TESLA, and VOLVO each accounted for approximately 5% of the market, while the remaining brands held smaller shares, as shown in Figure 4-3.

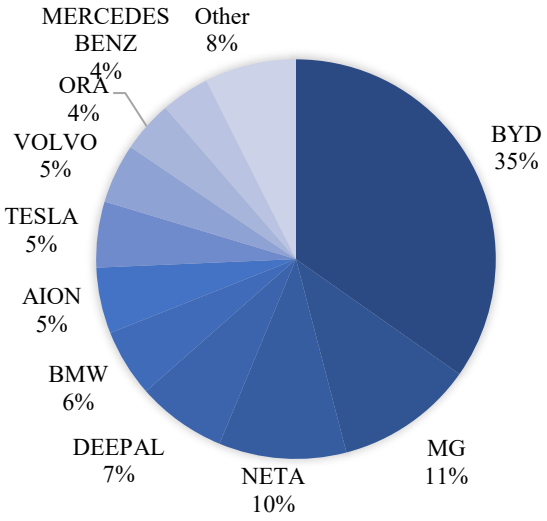


Figure 4-3: Share of Top 10 NEV Brands in Thailand, 2024

Source: Author's compilation from Transport Statistics Group, Department of Land Transport, Ministry of Transport (Thailand) (2024)

According to data from the Electric Vehicle Association of Thailand (EVAT), there were 56 electric vehicle models available in 2024, offered by 24 different brands. Among these, BYD is ranked as the most popular NEV brand in the country (Figure 4-3). In 2024, BYD offered five Battery Electric Vehicle (BEV) models—ATTO 3, Dolphin, e6, Seal, and Tang EV—with a total of 26,847 units registered throughout the year. The second-ranking brand, MG, offered six models, yet recorded only 8,638 registrations in 2024.

Driven by the growing domestic demand for NEVs between 2022 and 2024, several international and Chinese automakers have accelerated their vehicle imports into Thailand in 2025. Based on an assessment of the top 10 NEV brands, it was found that Thai consumers tend to prefer vehicles with a driving range between 401–700 kilometers per charge, most of which are Battery Electric Vehicles (BEVs). The second most preferred range is around 200 kilometers per charge, typically corresponding to Plug-in Hybrid Electric Vehicles (PHEVs).

In terms of vehicle type, SUVs remain the most popular segment among Thai consumers, reflecting a growing preference for larger and more versatile electric vehicles. This is consistent with global consumer trends observed in other NEV markets, where practicality and driving range have become key decision factors for EV adoption (Table 4-1).

Table 4-1: NEV Models for Top 10 Brands in Thailand as the end of June 2025

Brand	Engine type	Model	Distance range (km.)			
			0-200	201-400	401-700	>700
BYD	BEV	Sedan/Hatchback			4	
		MPV			3	
		SUV		1	10	
	PHEV	SUV	3			
MG	BEV	Sedan/Hatchback			2	
		MPV		1	3	
		SUV			2	
	PHEV	SUV	1			
NETA	BEV	SUV		2	1	
DEEPAL	BEV	Sedan/Hatchback			2	
		SUV			4	
BMW	BEV	Sedan/Hatchback			7	
		SUV			5	
	PHEV	Sedan/Hatchback	9			
		SUV	9			
AION	BEV	Sedan/Hatchback			2	
		SUV			3	
TESLA	BEV	Sedan/Hatchback			2	
		SUV			4	
VOLVO	BEV	SUV			5	1
	PHEV	Sedan/Hatchback	2			
		MPV				
		SUV	2			
ORA	BEV	Sedan/Hatchback			3	

Brand	Engine type	Model	Distance range (km.)			
			0-200	201-400	401-700	>700
MERCEDES BENZ	BEV	Sedan/Hatchback			4	
		SUV			5	
	PHEV	Sedan/Hatchback	7			
		SUV	5			
Total models			38	4	71	1

Source: Author's compilation from the NEV models in Thailand in 2025.

4.1.1.4. Affordability

The Total Cost of Ownership (TCO) analysis in Thailand provides critical insights into the financial feasibility and consumer affordability of Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Internal Combustion Engine Vehicles (ICEs) across multiple market segments. To ensure a consistent comparison, the analysis applies the following standardized assumptions: (1) a vehicle lifespan of seven years; (2) an average annual driving distance of 20,000 kilometers; (3) one tire replacement during the ownership period; (4) constant fuel and electricity prices; (5) differences in annual registration and license plate fees between NEVs and ICE vehicles, where the initial registration cost remains identical but NEVs are granted an 80% reduction in the first year of the annual vehicle tax. This tax reduction reflects Thailand's current policy, applicable to electric vehicles registered between 9 November 2022 and 10 November 2025[1]; (6) a depreciation rate of 20% across all vehicle types[36], as Thailand does not differentiate the depreciation rates for ICEs and NEVs; and (7) insurance costs determined by vehicle type and market price.

Under these assumptions, the TCO comparison encompasses three major vehicle categories: Sedan/Hatchback Segment B, Sedan/Hatchback Segment D, and SUV-D. The results reveal distinct variations in cost competitiveness across market tiers. Within the Segment B hatchback category, the Toyota Yaris demonstrates a comparatively lower TCO than BEV equivalents like the BYD Dolphin. (Figure 4-4). This cost advantage primarily stems from the lower purchase prices of ICE vehicles, whose upfront cost benefits outweigh long-term operational savings of BEVs (i.e., reduced energy and tax expenses) over a seven-year ownership period.

However, this pattern reverses in higher-end market segments. In both the Sedan/Hatchback Segment D and SUV-D categories, certain BEV models demonstrate a lower TCO when compared to their ICE counterparts. In the Segment D sedan category, the BYD SEAL (BEV) demonstrates a marginally lower TCO than the Toyota Camry (ICE). Similarly, the BYD SEALION 7 (BEV) achieves a more favorable TCO compared to the Toyota Fortuner (ICE) in the SUV-D segment. The superior cost performance of BEVs in these premium segments is primarily driven by substantial energy cost savings (electricity versus gasoline) and the fiscal benefit of the 80% annual vehicle tax reduction for NEVs (Table 4-2).

[36]The Revenue Department. (2020, November 14). https://www.rd.go.th/828.html

Overall, the TCO analysis for Thailand indicates that BEVs emerge as the most financially advantageous option for consumers preferring mid-to-upper vehicle classes (D-Sedan and SUV segments), driven by notable operational cost savings and reinforced by favorable tax incentives and low electricity prices. Conversely, ICE vehicles remain the most cost-efficient option only within the entry-level Segment B, where the initial purchase price exerts dominant influence on total ownership costs.

Table 4-2: Total cost of ownership (TCO) in Thailand (Baht)

Costs (THB)	**Sedan/Hatchback comparison (Segment B)**		**Sedan/Hatchback comparison (Segment D)**		**SUV (Segment SUV-D)**	
	BEV (BYD Dolphin)	ICE (Toyota Yaris)	BEV (BYD SEAL)	ICE (Toyota Camry)	BEV (BYD SEALION 7)	ICE (Honda CR-V)
Car Prices	699,999	559,000	1,325,000	1,475,000	1,249,900	1,649,000
Fuel/ Electricity Costs	61,849	249,609	69,650	279,734	110,883	621,440
Maintenance cost	47,380	31,821	47,380	42,734	47,380	38,245
Basic Insurance	185,094	123,396	241,490	160,993	204,740	136,493
Motor-vehicle tax	8,060	8,010	9,930	32,482	11,780	29,962
License Plate Fee	355	355	355	355	355	355
Install EV Charger cost	24,964	-	24,964	-	24,964	-
Depreciation	140,000	111,800	265,000	295,000	249,980	329,800
TCO (THB)	887,702	860,391	1,453,769	1,696,297	1,400,022	2,145,695

Source: Author's calculation

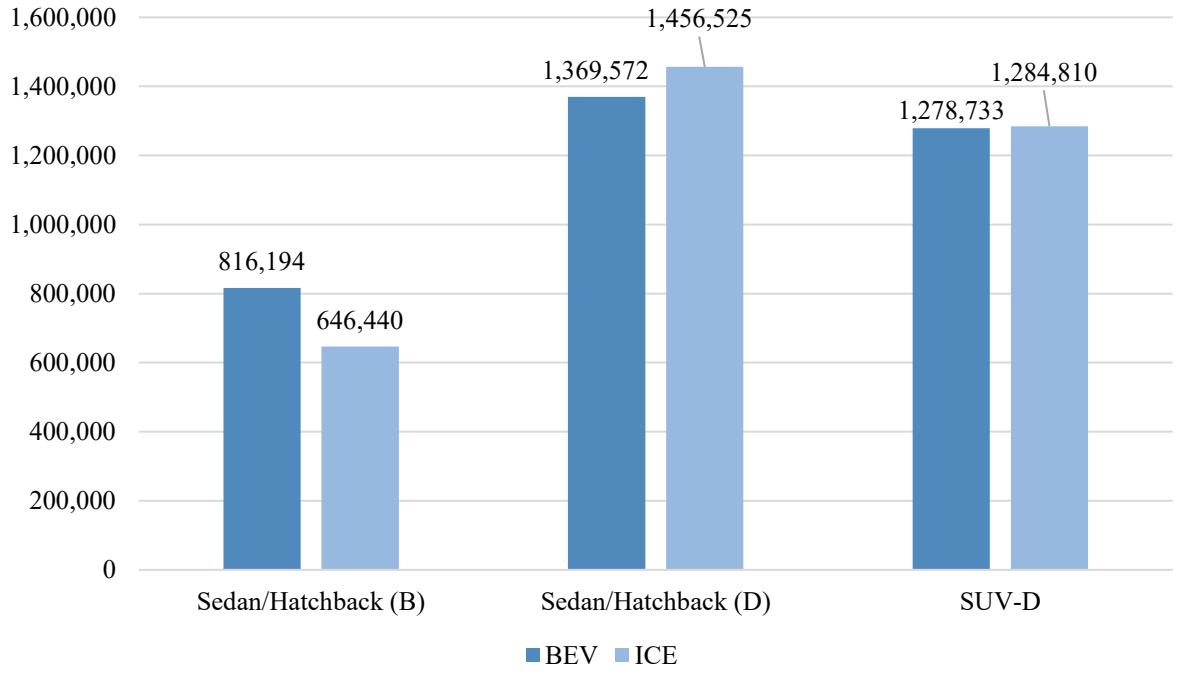


Figure 4-4: Total cost of ownership (TCO) in Thailand

Source: Author's calculation

4.1.1.5. Years of NEV Experience

Thailand's experience with New Energy Vehicles (NEVs) has evolved gradually over the past decade, characterized by a strong policy foundation but a slower pace of consumer adoption compared to China. In fact, NEVs in Thailand experienced around 10 years. In the first stage, NEVs development was in HEVs and PHEVs. Then NEVs turned to be BEVs due to newcomers of Chinese firms in Thailand market.

The country's NEV development can be divided into several key stages driven primarily by government policy and industrial strategy. Prior to 2012, Thailand focused on establishing a policy and industrial foundation, providing general investment incentives for advanced automotive technologies but without specific measures for EVs[37]. During 2016–2017, the government launched its first formal EV policy, introducing tax incentives for manufacturers of Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Hybrid Electric Vehicles (HEVs), along with key components such as batteries, motors, and inverters. Pilot programs for charging infrastructure and small-scale EV trials were also initiated in major urban areas during this period, marking the beginning of Thailand's early exposure to NEVs.

Between 2018 and 2020, Thailand entered a testing and infrastructure development phase. The government supported technology testing, standardization, and legal frameworks to facilitate the adoption of EVs. Several global automakers, such as Toyota and BMW, began producing hybrid and

[37] Schröder, M. (2021). Electric vehicle and electric vehicle component production in Thailand. https://www.eria.org/uploads/media/Research-Project-Report/2021-03-Promotion-Electromobility-ASEAN/6_ch.2-Electric-Vehicle-Component-Industry-Thailand.pdf

plug-in hybrid vehicles domestically, while component suppliers like Dräxlmaier established battery module assembly operations in Thailand. These developments helped lay the groundwork for domestic EV production capacity and signaled growing industry readiness, although consumer familiarity remained limited to early adopters due to high vehicle costs and a lack of charging facilities.

After 2021, Thailand's NEV experience entered an expansion stage as part of the national electrification strategy. The government set ambitious targets, including producing 1.2 million EVs by 2036, and expanded incentives to promote local manufacturing of batteries, motors, inverters, and energy management systems. Major policy initiatives focused on building a complete EV ecosystem, combining industrial promotion, charging infrastructure development, and fiscal incentives to stimulate consumer demand. Public awareness and acceptance of EVs have gradually increased, supported by more visible charging stations and a wider range of models on the market.

From the perspective of technology diffusion theory (Rogers, 1995), Thailand's NEV market currently lies between the early adopters and early majority stages. While a small but growing group of consumers has embraced EVs, mass-market penetration remains limited due to infrastructure and cost barriers. Nevertheless, Thailand's steady policy direction and growing industrial base indicate that the country is moving toward broader consumer experience and a gradual normalization of EV use, signaling the early formation of a sustainable NEV ecosystem.

4.1.2. Smart Mobility Trend

4.1.2.1. Intelligent Connected Vehicles (ICVs)

Thailand is currently at SAE Level 3 in autonomous vehicle (AV) development[38], with the government and academia collaborating on pilot projects most notably an autonomous electric bus service trialled along public roads in the Ayutthaya Historical Park from January to July 2024, led by KMUTT's MOVE center in partnership with TKC Company. In terms of policy, Thailand has begun to address regulatory, legal, and infrastructure challenges, though frameworks remain nascent: laws governing liability in accidents involving AVs, data privacy for vehicle-collected information, and clear guidelines for testing on public roads are cited as needing further development. Infrastructure readiness is also a critical factor, including deployment of vehicle-to-infrastructure (V2I) communications, establishment of geofenced zones, and improvements to road design to support autonomous and connected mobility. Thailand's readiness is reinforced by government interest in "smart city" agendas, electric vehicle promotion, and urban planning that supports sustainable mobility, although widespread adoption of AVs will require coordinated investment, standardization of technologies, and public acceptance.

4.1.2.2. Shared & Multimodal Services

Thailand exhibits one of the most mature and structurally diverse informal and shared mobility (ISM) ecosystems in Southeast Asia[39]. Its transport landscape has evolved through the longstanding coexistence of traditional informal modes and digitally enabled shared services. This evolution has been driven by rapid urbanisation, widespread digital penetration, and progressive policy reforms.

The ISM sector in Thailand comprises a wide range of mobility modes operating across two-, three-, and four-wheeled vehicles. Motorcycle taxis (locally known as "win motorcycles") represent the core

[38] Ratanathamwat, N. (2024, December 26). Autonomous vehicles: The future of transportation. Krungsri Research. https://www.krungsri.com/en/research/research-intelligence/ai-autonomous-car-2024

component of daily mobility, particularly in metropolitan Bangkok, where they play a critical role in facilitating first- and last-mile connectivity. Tuk-tuks, predominantly used in urban and tourist areas, remain important both as functional transport vehicles and as cultural icons. Four-wheeled informal services—such as songthaews (converted pickup trucks) and shared passenger vans—typically support medium-distance travel, connecting city centres with suburban and peri-urban locations.

In recent years, Thailand has experienced significant digital transformation within its informal transport sector. The rise of ride-hailing applications (RHAs), particularly Grab, has contributed to the partial formalisation of previously informal mobility services through the integration of algorithmic ride-matching, fare transparency, and electronic payment systems. Rather than displacing traditional modes, digitalisation has led to the emergence of a hybrid operational environment in which app-based and conventional services coexist, often overlapping in both geographic coverage and user base.

Digital adoption has also aligned with Thailand's transition toward electrified informal mobility. Pilot projects involving electric tuk-tuks and e-motorcycle taxis reflect the synergy between technological innovation and national environmental policy objectives. This shift is supported by broader national strategies that promote green mobility, digital innovation, and carbon reduction.

Thailand has made notable advancements in regulating and formalising shared mobility. The legal recognition of ride-hailing services represents a key shift away from their formerly informal status. Regulatory measures have increasingly provided clearer guidelines on vehicle standards, driver licensing, and pricing mechanisms, which in turn have enhanced transparency and accountability, contributing to a more stable business environment.

Despite this progress, institutional fragmentation persists. The division of responsibilities between national and local authorities has resulted in inconsistent policy enforcement and limited inter-agency coordination. Additionally, challenges remain in mitigating labour precarity, income instability, and inadequate social protection among ISM workers. Although platform-based drivers benefit from digital market access and more predictable demand, they often operate under unclear employment conditions with limited welfare entitlements.

Informal and shared mobility services act as vital complements to formal public transport systems. In Bangkok, ISM modes provide flexible, demand-responsive connectivity to major mass transit networks such as the BTS Skytrain, MRT, and bus services. Their adaptability helps fill spatial and temporal service gaps, particularly in suburban and peripheral areas. However, multimodal integration remains incomplete. While digital platforms enable user–operator coordination, institutional integration across agencies is limited. Fare systems, payment mechanisms, and information-sharing processes remain fragmented. The increased adoption of QR-based and mobile payment systems signals initial progress toward greater multimodal coherence.

Thailand's ISM market is highly dynamic and characterised by innovation. Digital platforms have improved service delivery efficiency and broadened mobility options, while the gradual integration of electrified vehicles indicates a growing shift toward low-carbon urban transport. Nevertheless, competition between platform-based providers and traditional motorcycle taxi associations has created tensions related to market access, fare control, and occupational rights. This duality underscores the broader national challenge of reconciling innovation-led formalisation with the protection of informal sector livelihoods.

In conclusion, Thailand's experience demonstrates that shared and informal mobility can evolve toward a digitally enabled, environmentally sustainable, and socially inclusive urban transport model within a mixed regulatory framework. Sustaining this progress will require strengthening institutional coordination, expanding infrastructure to support electrified and multimodal connectivity, and

developing comprehensive policy mechanisms to protect labour rights and ensure equitable access to mobility innovations.

4.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption

4.2.1. NEV Promotion Policy

As ,emtioned earlier. policy and support measures have been a crucial factor in the growth of electric vehicles, particularly BEVs, in Thailand. Previously, Thailand supported various electrified vehicles, or xEVs, including hybrid electric vehicles (HEVs), primarily utilizing tax measures and investment promotion incentives. The major turning point in Thailand's automotive policy, however, was the 30@30 policy. A key tool under this new policy, differentiating it from previous support, is the use of direct purchase subsidies under the EV3.0 and EV 3.5 scheme. Under the 30@30 policy, Thailand set a clear vision and goal to become the regional manufacturing hub for electric vehicles. Recent outcomes in terms of market adoption and domestic manufacturing investment reflect that Thailand is currently on the right track toward electrification.

4.2.1.1. The National Strategy 30@30 Policy

Thailand, the long-standing "Detroit of Asia," has set an ambitious target, the "30@30" policy, under the direction of the National Electric Vehicle Policy Committee (NEVP). The primary goal is to ensure that 30% of total domestic automotive production consists of Zero-Emission Vehicles (ZEVs) by 2030 (B.E. 2573. To realize this, the government has deployed a comprehensive and aggressive set of financial incentives targeting both the supply side (industry) and the demand side (market/consumers), most recently solidified under the EV3.5 Package (2024-2027).

4.2.2. Financial Incentives

4.2.2.1. Excise Tax

Thailand's excise tax system is structured around factors closely linked to fuel economy and environmental performance, with carbon dioxide (CO_2) emissions serving as a key tax base, alongside other product characteristics such as the installation of Advanced Driver Assistance Systems (ADAS). This design aims to incentivize both manufacturers and consumers to adopt vehicles with higher energy efficiency, lower emissions, and enhanced safety features.

Under this framework, vehicles with relatively high CO_2 emissions are generally subject to higher excise tax rates than those with lower emissions, including New Energy Vehicles (NEVs), which are considered to have significantly lower environmental impacts compared with internal combustion engine (ICE) vehicles. The excise tax structure that favors NEVs therefore functions as an important demand-side policy instrument, complementing purchase subsidies and investment incentives in supporting the expansion of the NEV market in Thailand.

For passenger Plug-in Hybrid Electric Vehicles (PHEVs), excise tax rates are determined based on a combination of factors, including engine displacement, electric driving range, and CO_2 emissions. From 2026 onward, excise tax rates for passenger PHEVs range between 5% and 30%, which is substantially lower than the rates applied to passenger ICE vehicles, typically ranging from 13% to 50%. This differential reflects preferential tax treatment for vehicles that partially rely on electric propulsion and emit lower levels of greenhouse gases.

In the case of PHEV pickup trucks, the excise tax structure from 2026 sets rates between 5% and 50%, depending on engine size, CO_2 emissions, and ADAS installation. For example, a PHEV pickup truck equipped with an engine exceeding 3,250 cc and failing to meet efficiency or safety-related criteria

would be subject to the maximum excise tax rate of 50%, comparable to that applied to high-performance ICE pickup trucks.

For Battery Electric Vehicles (BEVs)—both passenger cars and pickup trucks—excise tax rates are set at a distinctly low level. Vehicles equipped with ADAS are subject to an excise tax rate of 2%, while those without ADAS are taxed at 10%. This structure underscores the use of excise taxation not only to promote zero-emission vehicle adoption but also to encourage the diffusion of advanced safety technologies.

Similarly, Fuel Cell Electric Vehicles (FCEVs), which are also zero-emission vehicles, receive even more favorable tax treatment. Excise tax rates are set at 1% for vehicles equipped with ADAS and 5% for those without ADAS, reflecting Thailand's long-term policy orientation toward facilitating advanced vehicle technologies, despite the currently limited commercial deployment of FCEVs.

Beyond the baseline excise tax structure that inherently favors low-emission vehicles, the implementation of EV 3.0 and EV 3.5 further strengthened excise-tax-based incentives in a targeted manner, particularly for battery electric vehicles (BEVs), to accelerate early market adoption.

Under EV 3.0, the excise tax rate for eligible BEVs was reduced from the pre-2026 standard rate of approximately 8% to 2%, representing a substantial reduction in the tax burden compared with ICE vehicles in comparable price segments. For locally produced electric pickup trucks, EV 3.0 provided even stronger incentives by reducing the excise tax rate from approximately 10% to 0%, reflecting the government's strategic objective to promote domestic investment and production in the pickup segment, which is a cornerstone of Thailand's automotive industry.

In the subsequent phase, EV 3.5 (2024–2027) maintains low excise tax rates for BEVs while recalibrating incentives to align more closely with industrial development objectives. Specifically, electric pickup trucks benefit from a 0% excise tax rate during 2024–2025, which is then adjusted upward to 2% during 2026–2027. Despite this increase, the rate remains significantly lower than that applied to ICE pickup trucks. This phased adjustment illustrates the use of excise taxation as a dynamic policy instrument, shifting from short-term market stimulation toward longer-term support for domestic production and industrial sustainability.

4.2.2.2. Purchase Subsidies

Policy and incentives have proved pivotal in Thailand's electric vehicle (EV) ascent. Earlier support, primarily via tax breaks and investment promotion, targeted a broader "xEV" category including hybrids and plug-in electrics. The real inflection point came with the EV 3.0 program (2022–2025), which introduced direct purchase subsidies—a crucial departure from previous policy, setting the foundation for rapid initial market growth. Under this phase, passenger BEVs priced under 2 million THB were eligible for subsidies ranging from approx. THB 70,000 to 150,000 (USD 2,221 – 4,760) depending on battery capacity, and pickup truck received up to approximately THB 150,000.

The current phase, EV 3.5 (2024–2027), maintains consumer incentives but reflects a strategic pivot towards industrial localization and sustainability. EV 3.5 continues purchase subsidies for BEVs, but with a reduced and time-phased structure: subsidies for passenger EVs decline over the period (e.g., from THB 50,000–100,000 (USD 1,587 – 3,174) in 2024 to lower amounts in later years), and some benefits become contingent on local assembly in later years. In addition, EV 3.5 introduces dedicated subsidies such as THB 100,000 for locally manufactured electric pickup trucks.

Crucially, the government employs a mandatory production offset mechanism to enforce this shift: manufacturers benefiting from comprehensive incentives must commit to domestic output. Under EV 3.5, the required import-to-local production ratios increase over time (e.g., 1:2 in 2026 and 1:3 in 2027), encouraging localization of both vehicle assembly and, increasingly, key components

4.2.2.3. Import Duty

Beyond excise tax incentives and direct subsidies, Thailand's EV 3.0 (2022–2025) and EV 3.5 (2024–2027) schemes incorporate significant import duty reductions for Completely Built-Up (CBU) units. These measures aim to bolster the competitiveness of imported electric vehicles and provide a clear, conditional pathway for international automakers to enter the Thai market. Under EV 3.0, the government granted import duty cuts of up to 40% for BEVs with a suggested retail price not exceeding 2 million THB. This strategic reduction was instrumental in lowering the barrier to entry for mid-to-low-range EVs during the market's critical early development phase.

The transition to EV 3.5 continues these import duty incentives through 2024 and 2025 for vehicles within the same 2-million-THB price ceiling. However, these benefits are strictly tied to a production offset mechanism, requiring automakers to balance their imports with domestic manufacturing to ensure long-term industrial localization. To guarantee safety and quality, eligible vehicles must also comply with rigorous technical standards, including Thai Industrial Standards Institute (TISI) certification and testing at the Automotive and Tyre Testing, Research and Innovation Center (ATTRIC).

4.2.3. Non-Financial Measures

Non-financial measures supporting the NEV market are limited in Thailand. While financial incentives are well-developed through EV 3.0/3.5, non-financial supports such as dedicated BEV road access privileges, preferential parking, or strict national fuel-economy/zero-emission standards have yet to be systematically integrated into the national strategy. Policy attention remains primarily on market stimulation and industrial development, with non-financial demand-side measures (e.g., infrastructure mandates, access priority) still emerging and generally under discussion rather than formally enacted at scale.

4.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility

4.3.1. New Energy Vehicles (NEVs)

This NEV transition is being supported by the ongoing improvement and development of relevant regulations and standards to build consumer confidence in safety. More importantly, this effort is aimed at establishing Thailand as a key production base for electric vehicles and essential components in Southeast Asia, which is a strategic national objective. The main agencies responsible for this push are the Thai Industrial Standards Institute (TISI) and the Department of Land Transport (DLT). The cooperation between TISI (which sets production standards) and the DLT (which controls operational safety and registration) creates a comprehensive legal ecosystem for electric vehicles in Thailand.

4.3.1.1. Thai Industrial Standards (TIS)

Thai Industrial Standards (TIS) related to Electric Vehicles (EVs) in Thailand are predominantly referenced and adapted from international standards such as ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission). This ensures compliance with international trade and global technology trends, covering everything from the vehicle body and batteries to charging systems. Certain standards and regulations are outlined below.

1) Safety and Charging System Interconnection

These standards are crucial for the safety of users and the stability of the electrical grid. They specify the required electrical safety characteristics for connecting the EV to an external power supply and charging system.

- TIS 2776–2560 (2017) Electric Road Vehicles – Connection to an external power supply – Safety requirements (Referencing ISO 17409:2015) This standard specifies the electrical safety requirements for the conductive charging connection of electric vehicles to an external power supply using vehicle inlets or outlets. It emphasizes Electrical Shock Protection and Thermal Hazard Protection while the vehicle is connected for charging. It covers the power supply circuits of the vehicle that have Class B high-voltage electrical circuits, which is vital for ensuring safe charging operations.
- TIS 61851 Series (Referencing IEC 61851) Conductive charging system for electric vehicles: This series includes.
    - TIS 61851 Part 1 General requirements: Covers all types of EV Supply Equipment and various charging modes (Mode 1, Mode 2, Mode 3, Mode 4). Currently, Mode 1 (connection to the AC mains supply socket outlet without any control device and rated up to 16 A) is prohibited in Thailand based on TIS 61851 Part 1.
    - TIS 61851 Part 23 (Under preparation): Specifies requirements for DC Electric Vehicle Supply Equipment, which is important for DC Fast Charging, as it sets the requirements for DC charging stations that deliver power directly to the EV, a technology that significantly reduces charging time.
- TIS 2911 (Referencing IEC 62752) In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD): This standard provides specifications for the control and protection devices used in portable charging cables, a key component for Mode 2 charging, which is typically used for home charging.

2) Battery and Powertrain

The battery is the core of the electric vehicle, so standards focus on the safety and performance of the Rechargeable Electrical Energy Storage System (REESS)[41].

- TIS 2952-2561 (2018). Specific requirements for an electric power train: This standard sets requirements for the REESS of Category L vehicles (such as electric motorcycles and mopeds), which is a critical measure for regulating the safety of batteries used in small vehicles.
- Standards Referencing UNECE R100. TISI is accelerating the development of EV battery standards based on UN Regulation No. 100 (UNECE R100), which covers the electrical safety and operational safety of the REESS for Category M (passenger cars) and Category N (light commercial vehicles).
- TIS 3265-2564 (2021) Electric Road vehicles – Energy consumption and range – Test procedure for passenger cars and light commercial vehicles: This standard specifies the test procedure for measuring the reference energy consumption rate and reference driving range of electric vehicles. This enables consumers to compare EV performance data in a standardized and transparent manner.

[41] Thai Automotive Institute (TAI). (2025). Standard ADAS (Advanced Driver Assistance Systems). https://data.thaiauto.or.th/component/tags/tag/standard-adas.html

4.3.1.2. The Department of Land Transport (DLT)

The Department of Land Transport (DLT) has also issued several announcements to regulate the registration and use of electric vehicles in the country. Key regulations include. The Motor Vehicle Act B.E. 2522 (1979) and related announcements. These specify the qualifications and characteristics of electric-powered automobiles and motorcycles, including the criteria for the type of approval of electric power generating units, referencing international standards like UN R100 and UN R136. Vehicle Modification (Retrofitting). Vehicles modified to become EVs must obtain permission from the registrar. The parts and equipment used must comply with stipulated safety standards and be certified by an engineer and Vehicle Inspection Principles and methods for inspecting EVs are established to ensure the electrical safety of users and equipment.

These regulations focus on the safety and technical standards of electrically driven vehicles.

Table 4-3: Key DLT Regulation for Essential Content Related to NEV

No.	Key DLT Regulation	Essential Content Related to NEV
1	DLT Announcement Re. Determination of the electric motor power used to drive vehicles. B.E. 2560 (2017)[42]	Specifies the electric power criteria (kW) of the motor for classifying electric automobiles and motorcycles under the law, crucial for registration and controlling vehicle size appropriate for use.
2	DLT Announcement Re: Determination of qualifications, characteristics, operating system, and performance of rechargeable electric energy storage systems for automobiles. B.E. 2565 (2022)[43]	Mandates that the Rechargeable Energy Storage System (REESS) in automobiles must comply with international safety standards (e.g., UN R.100), covering tests for flammability, explosion, and electrical safety.
3	(Draft) DLT Announcement Re: Principles, methods, and conditions for modifying vehicles to be driven by electric motors. B.E. 2566 (2023)[44]	Defines the procedures and technical standards for internal combustion engine vehicles being retrofitted with electric motor drivetrains. This requires permission from the registrar and certification by an engineer.

[42] Department of Land Transport, Thailand. (2017, January 2). Announcement of the Department of Land Transport Re: Determination of the electric motor power used to drive vehicles under the Motor Vehicle Act, B.E. 2560 (2017). https://legal.dlt.go.th/repository/attachments/180_261.pdf

[43] Department of Land Transport, Thailand. (2022, March 23). Announcement of the Department of Land Transport Re: Determination of qualifications, characteristics, and criteria, methods, and conditions for the type approval of electric power generating units used to drive vehicles, B.E. 2565 (2022). Royal Thai Government Gazette, 139(68 D, Special Issue), 5. https://legal.dlt.go.th/repository/attachments/805_662.pdf

[44] Department of Land Transport, Thailand. (2023). Draft announcement of the Department of Land Transport Re: Principles, methods, and conditions for modifying vehicles to be driven by electric motors under the Motor Vehicle Act, B.E. 2566 (2023). Legal Repository of the Department of Land Transport. https://legal.dlt.go.th/repository/attachments/1104_ร่างประกาศ%20การดัดแปลงรถให้เป็นระบบที่ขับเคลื่อนด้วยมอเตอร์ไฟฟ้า.pdf

No.	Key DLT Regulation	Essential Content Related to NEV
4	DLT Regulation Re: Inspection of vehicles for the electric system of electric automobiles [45]	Establishes inspection criteria for electric vehicles exceeding the required age, focusing on the safety check of the High Voltage System, such as battery damage, integrity of the orange high-voltage cables, and the functionality of the Service Plug (disconnecting plug).
5	Royal Decree on the Reduction of Annual Tax Rate for Electrically-Driven Vehicles [46]	A promotional measure to encourage EV adoption by reducing the annual road tax by 80% for a specified period.

Source: Authors (2025).

4.3.2. Vehicle Emission Standards

Air pollution, particularly Particulate Matter (PM), is a major global concern, often stemming from forest fires, industrial emissions, and incomplete combustion sources. A significant contributor is the exhaust from motor vehicles, especially those equipped with Compression Ignition (Diesel) Engines. To combat this, governments, including Thailand, are adopting stricter air quality standards. The Thai Industrial Standards Institute (TISI), under the Ministry of Industry, has been progressively upgrading its mandatory engine emission standards, Upgraded from Euro 3 to Euro 4 in 2013 and near future planning to upgrade from the current Euro 4 level to Euro 5 and Euro 6.

Table 4-4: TISI has already announced four general standards to support the upcoming Euro 5 and Euro 6 levels.

Standard	Engine Type	Emission Level	Corresponds to
TIS.3016-2563	Light-Duty Positive Ignition (Gasoline)	Level 9	Euro 5
TIS.3017-2563	Light-Duty Positive Ignition (Gasoline)	Level 10	Euro 6
TIS.3018-2563	Light-Duty Compression Ignition (Diesel)	Level 8	Euro 5
TIS.3019-2563	Light-Duty Compression Ignition (Diesel)	Level 9	Euro 6

These new standards (referencing UN/ECE Regulation No. 83 Rev.4) are considerably more stringent than the current Euro 4 standards (TIS. 2540-2554 and TIS. 2550-2554, referencing UN/ECE Regulation No. 83 Rev.3), mandating new product inspections and plant assessments for quality control.

[45] Department of Land Transport, Thailand. (2012, September 20). Regulation of the Department of Land Transport Re: Inspection of vehicles by inspection officers under the Land Transport Act, B.E. 2555 (2012). https://legal.dlt.go.th/index.php?action=download&file=61_75.pdf

[46] Thailand. (2022). Land traffic act (No. 13), B.E. 2565 (2022). Royal Thai Government Gazette, 139(69 A), 51. https://www.ratchakitcha.soc.go.th/DATA/PDF/2565/A/069/T_0051.PDF

4.3.3. Smart Mobility

Smart Mobility or Intelligent Transport Systems (ITS) is a broad concept covering technologies that enhance the safety, efficiency, and sustainability of transport. The relevant TIS standards focus on Advanced Driver-Assistance Systems (ADAS) and Vehicle-to-Grid (V2G) communication. Certain standards and regulations are outlined below.

1) Advanced Driver-Assistance Systems (ADAS)

TISI has announced several standards related to ADAS[47] to ensure these systems function correctly and reliably in reducing accidents, thereby enhancing future vehicle safety.

- TIS 3193-2564 (2021): Intelligent transport systems – Curve Speed Warning Systems (CSWS) – Performance requirements and test procedures
- TIS 3194-2564 (2021): Intelligent transport systems – Lane Keeping Assist Systems (LKAS) – Performance requirements and test procedures
- TIS 3195-2564 (2021): Intelligent transport systems – Adaptive Cruise Control Systems (ACC) – Performance requirements and test procedures
- TIS 3196-2564 (2021): Intelligent transport systems – Forward Vehicle Collision Warning Systems – Performance requirements and test procedures
- TIS 3254-2564 (2021): Intelligent transport systems – Pedestrian Detection and Collision Mitigation Systems (PDCMS) – Performance requirements and test procedures
- TIS 3256-2564 (2021): Intelligent transport systems – Partially Automated Parking Systems (PAPS) – Performance requirements and test procedures

The existence of these standards lays the technical foundation for future Autonomous Vehicles by setting necessary performance criteria and test procedures. This ensures that ADAS systems installed in vehicles sold in Thailand are effective and operate as expected.

2) Vehicle-to-Grid (V2G) Communication

V2G technology is a vital part of Smart Mobility, utilizing EVs as a sort of "backup battery" that can sell electricity back to the grid when needed or power a home (Vehicle-to-Home: V2H). TIS 3381 Part 1-2565 (2022) Electric road vehicles – Vehicle to grid communication interface – Part 1: General information and use case definition: This standard forms the basis for the ISO 15118 standard series[48], which specifies general requirements and use cases for High-Level Communication (HLC)—both conductive and wireless—between the Electric Vehicle Communication Controller (EVCC) and the Supply Equipment Communication Controller (SECC). This communication is essential for bi-directional power transfer, allowing the EV to become not just an energy consumer but also a part of the smart energy management system, marking a significant step towards a Smart Grid and Smart Mobility in creating energy resilience and security.

[47] Thai Automotive Institute (TAI). (2025). Standard ADAS (Advanced Driver Assistance Systems). https://data.thaiauto.or.th/component/tags/tag/standard-adas.html

[48] International Organization for Standardization. (2015). ISO 9001:2015. Quality management systems—Requirements. https://www.iso.org/standard/69113.html

4.4 Energy Policy

Thailand aims to peak its greenhouse gas emissions by 2030, achieve carbon neutrality and net-zero emissions by 2050, in line with its Nationally Determined Contributions (NDCs). The NDC sets a 30% unconditional and 40% conditional GHG emissions reduction target by 2030 relative to the BAU scenario.

The energy sector accounts for around 70% of Thailand's total GHG emissions, with the transport sector contributing nearly 30% of this amount. As such, decarbonizing transport is a central pillar of Thailand's climate strategy.

Under the NDC framework, Thailand has identified a comprehensive set of mitigation measures in the transport sector, including:

- Electrification of mobility, supported by the "30@30" target — achieving 30% of total vehicle production as NEVs by 2030.
- Expansion of public charging infrastructure, NEV buses, and low-emission logistics systems.
- Biofuel blending policies, maintaining E10/B10 as standard blends and scaling up E20/B20.
- Introduction of Sustainable Aviation Fuel (SAF) with blending targets starting around 1% in 2026, increasing toward 2036–2037.
- Early development of hydrogen applications for freight and long-haul transport.
- Modal shift and efficiency improvements through investments in mass rapid transit, rail freight, and intelligent transport systems (ITS).

These measures are expected to deliver 20–25 $MtCO_2e$ of emission reductions by 2030, making transport one of the largest contributing sectors to Thailand's NDC targets. Thailand's power generation remains heavily dependent on natural gas, which accounted for approximately 58% of total electricity production in 2024. This reliance underscores the country's vulnerability to fossil fuel dependency. To address this, Thailand's Power Development Plan (PDP) aims to reduce the share of natural gas to 49% by 2037 while increasing renewable energy to 51%, marking a major shift toward a cleaner and more secure energy system.

The promotion of NEVs is closely linked to this clean energy transition. As renewable energy (particularly solar and wind) expands, NEVs act as demand-side flexibility resources, supporting grid stability, reducing fossil fuel use, and lowering lifecycle emissions from the transport sector. By integrating transport decarbonization with power sector reforms, Thailand aims to deliver on its NDC and net-zero commitments.

4.4.1. Policy and Regulation

4.4.1.1. National Energy Plan (NEP)

To achieve carbon neutrality by 2050 and net-zero emissions by 2065, Thailand has prioritized reducing CO_2 emissions from the energy sector, which remains the country's largest source of greenhouse gas emissions. In response, the Ministry of Energy launched the National Energy Plan (NEP) 2022, designed to guide the country's transition toward a cleaner and more sustainable energy system. The NEP is structured into three phases: a short-term plan (2022-2027), a mid-term plan (5-10 years), and a long-term strategy spanning 20 years.

The NEP integrates key sectoral strategies across electricity, renewable energy, energy efficiency, and fossil fuel management. It is built around four central policy pillars to drive the transition to carbon neutrality:

1) **Power sector:** Increase the share of clean and renewable energy in new generation capacity by at least 50%.
2) **Transport sector:** Promote electric vehicle adoption under the 30@30 policy, aiming for 30% of total vehicle production to be zero-emission vehicles by 2030.
3) **Energy efficiency:** Improve efficiency through advanced energy management and digital solutions.
4) **Enabling energy transition:** Advance the "4D1E" approach- Digitalization, Decarbonization, Decentralization, Deregulation, and Electrification- to support structural reforms and innovation in the energy system.

4.4.1.2. Generation Capacity Planning in Thailand

Electricity generation planning in Thailand is centrally guided by the Power Development Plan (PDP), which serves as the main strategic framework for aligning the power sector with national development goals and energy transition priorities. The PDP is complemented by four other key strategic energy plans under the NEP framework. The latest public drafts of these plans, which set targets through 2037, are summarized below:

- PDP 2024 (draft): Thailand aims to increase total installed generation capacity to 112 GW by 2037. The generation mix will consist of approximately 50% from renewable energy, including 17% from solar PV, 1% from small nuclear modular reactors (SMRs), 41% from natural gas, and 7% from coal-fired power plants. Additionally, the draft introduces hydrogen co-firing, targeting a 5% hydrogen blend with natural gas for power generation by 2030.
- Low-Carbon Transport Fuels under AEDP 2024-2037: In addition to renewable electricity, the AEDP outlines a clear pathway to decarbonize the transport sector through biofuels, Sustainable Aviation Fuel (SAF), and hydrogen. Thailand will continue to promote E10 and B10 as primary blends, with increased uptake of E20/B20 in targeted applications to reduce fossil fuel dependence. For aviation, the plan sets SAF blending milestones starting around 1% in 2026, increasing steadily toward 2036-2037, with a target production of approximately 553,000 tons of crude oil equivalent SAF by 2037. This supports Thailand's alignment with international aviation decarbonization goals. The plan also identifies hydrogen as a strategic future low-carbon fuel, particularly for heavy-duty and long-haul transport, supported by regulatory frameworks and investment incentives. These fuels are intended to complement NEV deployment by addressing segments that are harder to electrify in the near term.
- Gas Plan 2024 (draft): The draft gas plan anticipates a declining share of natural gas in the generation mix, falling from 36% to 41% of installed capacity, due to the rising share of renewables in the electricity sector. Nonetheless, gas remains a key transition fuel in the medium term.
- EEP 2024 (draft): The Energy Efficiency Plan sets a target to reduce national energy intensity (energy consumption per unit of GDP) by 36% from the 2010 baseline by the year 2037. This goal supports broader efforts to enhance energy productivity and reduce greenhouse gas emissions across all sectors, particularly in industry and transport.

- Oil Plan 2024 (draft): The plan promotes the use of biofuels by establishing Gasohol E10 (95) and E20 as primary gasoline alternatives. It also includes the development of a regulatory framework and investment incentives to support the future adoption of hydrogen fuel, particularly for long-haul transport and industrial applications.

4.4.1.3. Low Priority Rate Policy

Thailand has introduced a Low Priority Rate Policy for public charging stations under both the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) to support the expansion of NEV charging infrastructure and enable more flexible grid operations. Under this scheme, charging operators who agree to allow the utility to curtail or reduce power during peak demand periods can access significantly lower electricity tariffs, currently around 2.9162 Baht/kWh flat or discounted ToU rates (2.59–2.80 Baht/kWh off-peak and 5.20–5.41Baht/kWh peak). This policy functions as a regulatory demand-side management tool, providing operators with clear financial incentives while allowing system operators the flexibility to stabilize the grid during periods of high load. By linking tariff incentives with controllable load, the Low Priority Rate Policy enhances grid reliability, lowers operational costs for charging operators, and supports Thailand's broader goal of integrating NEVs into a cleaner and more flexible energy system. As NEV adoption grows, this policy is expected to play a key role in grid planning, peak load management, and incentivizing private investment in charging infrastructure.

4.4.2. Supporting Measures

To accelerate NEV adoption, Thailand has implemented a range of financial support measures aimed at lowering costs for both NEV users and charging operators.

4.4.2.1. Financial supporting measures

Thailand employs a range of financial measures to lower NEV charging costs and encourage infrastructure investment. These include Time-of-Use (ToU) pricing, preferential tariffs, and tax incentives, which help make NEV ownership more affordable, support grid management, and accelerate the country's clean transport transition.

1) ToU pricing incentive – Personal (residential) charging

In Thailand, ToU pricing for personal (residential) NEV charging is designed to encourage households to charge their electric vehicles during off-peak hours when electricity demand and prices are lower. Under this scheme, the electricity tariff is typically higher during peak hours (09:00–22:00 on weekdays) and significantly lower during off-peak periods (22:00–09:00 on weekdays and all day on weekends and public holidays). For residential consumers, the peak rate is around 5.80 baht/kWh, while the off-peak rate is approximately 2.64 baht/kWh, depending on the utility provider. This price differential allows NEV owners to reduce their charging costs by shifting most of their charging to nighttime or weekend hours.

To benefit from ToU tariffs, residential users need to opt into the program, and they may need to install a smart or ToU-capable meter. Both the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA) currently offer the program. However, widespread adoption is still limited due to metering requirements, upfront installation costs, and a lack of consumer awareness. For many households, the cost of upgrading to a smart meter, typically ranging from THB 3,000 to 6,000 depending on the meter type, installation complexity, and utility service area that acts as a financial barrier. Metering requirements also pose challenges: the meter must support multi-period recording, remote reading, and accurate time-stamped consumption data. Households using legacy single-rate meters cannot access ToU without replacement. In addition, awareness of ToU benefits is low, and

many users are unsure whether their charging behavior or appliances can shift sufficient load to off-peak hours to justify the investment.

Strengthening ToU incentives, for example, by subsidizing meter upgrades, integrating smart charging technologies, or providing off-peak charging rebates, could make NEV charging more affordable for households and help reduce peak electricity demand. In the long run, residential ToU pricing plays a crucial role in supporting grid flexibility and accelerating Thailand's clean energy transition.

2) ToU pricing incentive – Public charging stations

In Thailand, ToU pricing for public NEV charging stations is designed to reduce operating costs for charging operators and help manage grid demand more efficiently. Under this tariff structure, the electricity price is higher during peak hours (09:00–22:00 on weekdays) and lower during off-peak periods (22:00–09:00 on weekdays and all day on weekends and public holidays). For example, for low-priority public charging connections, the peak rate is about 5.20–5.41 baht/kWh, while the off-peak rate is around 2.59–2.80 baht/kWh, with a fixed service charge of 312.24 baht per month. This significant price difference encourages operators to shift charging activity to off-peak hours, lowering both their electricity expenses and pressure on the power grid.

In addition to TOU pricing, Thailand has introduced a "Low Priority" tariff scheme for NEV charging stations, which allows operators to access lower rates (as low as 2.9162 baht/kWh flat) in exchange for agreeing that their power supply can be curtailed during times of grid stress. This mechanism provides an extra economic incentive for investors and operators while helping utilities manage peak demand more effectively. The scheme is already in effect under both the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) and plays a key role in making NEV charging infrastructure more financially viable, supporting the country's broader clean transport and energy transition goals.

3) Charging financial incentive - Personal use

In Thailand, charging financial incentives for personal (residential) NEV users are currently centered around electricity tariff structures and tax incentives on NEV purchases, but direct financial support for home charging infrastructure remains limited. Residential users can benefit from ToU tariffs offered by utilities such as the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA), which allow NEV owners to charge at significantly lower electricity rates during off-peak hours (approximately 2.6 baht/kWh) compared to peak hours (around 5.8 baht/kWh). This pricing difference serves as an indirect financial incentive, helping households save on monthly charging costs if they schedule charging overnight or on weekends.

In addition to tariff benefits, the government also provides import duty exemptions and excise tax reductions for NEVs and charging equipment, lowering the upfront cost of vehicle ownership. However, there are no direct subsidies for installing home chargers, such as rebates or grants, as seen in some other countries. To enhance residential NEV adoption, energy experts have recommended introducing targeted incentives—such as rebates for home charger installation, low-priority off-peak charging discounts, or smart charging subsidies—to complement existing ToU tariffs. Strengthening these financial incentives would make NEV charging more affordable for households and support Thailand's broader goals for transport electrification and peak load management.

4) Charging financial incentive – Public station

In Thailand, financial incentives for public NEV charging stations are primarily provided through a combination of preferential electricity tariffs and investment promotion measures. On the tariff side, operators can benefit from Time-of-Use (ToU) pricing, which offers lower rates during off-peak periods

(around 2.59–2.80 baht/kWh) compared to peak periods (around 5.20–5.41 baht/kWh), helping to reduce operational costs and encouraging load shifting to off-peak hours. Additionally, operators who opt for low-priority connections can access a flat electricity rate of approximately 2.9162 baht/kWh, which provides further cost savings in exchange for allowing utilities to curtail power during grid peak periods.

On the investment side, the Board of Investment (BOI) offers tax incentives for companies developing charging stations. Projects that meet certain requirements, such as installing at least 40 chargers with 25% quick chargers[lxxxix], can receive up to five years of corporate income tax exemption and import duty exemptions on machinery. These measures reduce both capital and operational expenses, making charging business models more financially attractive. Although Thailand does not yet provide direct per-station subsidies like some countries, these combined tariff and investment incentives play a key role in accelerating private sector investment, expanding nationwide charging infrastructure, and supporting the country's NEV transition goals.

4.4.2.2. Non-Financial Supporting Measures

Thailand is also advancing non-financial measures to create an enabling environment for NEV adoption and grid integration. These include regulatory support, pilot programs, and technology development aimed at improving grid flexibility, encouraging new business models, and fostering innovation. Such measures complement financial incentives by addressing market readiness and regulatory gaps, supporting a more sustainable and scalable NEV ecosystem.

1) Regulatory Support for Electricity Arbitrage

In Thailand, regulatory support for electricity arbitrage in NEV charging is still in an early stage of development, allowing operators to buy electricity during off-peak hours at lower rates and sell charging services at standard or higher rates. While the ToU and Low Priority Rate schemes provide a pricing structure that could enable arbitrage opportunities, there is currently no dedicated regulatory framework governing the resale of electricity or dynamic pricing by private charging operators. Existing regulations allow charging stations to function as service providers, but the Energy Regulatory Commission (ERC) still regulates and approves electricity sales.

This regulatory structure limits operators' flexibility to fully leverage price differentials and develop more advanced business models such as dynamic pricing, demand response participation, or vehicle-to-grid (V2G) integration. However, the policy direction is gradually shifting, with discussions underway to enable new business models that support grid flexibility and private sector participation. Making regulatory support for electricity arbitrage stronger would help charging operators run their businesses better, make more money, and manage energy use more efficiently as Thailand adopts more new energy vehicles (NEVs) and increases its use of renewable energy sources.

2) V2G and Smart Charging Pilot Programs

In Thailand, Vehicle-to-Grid (V2G) and smart charging initiatives are still in the early pilot phase, with growing interest from both public and private sectors. V2G technology enables bidirectional power flow between electric vehicles and the grid, allowing NEVs to act as flexible energy storage assets that can support grid stability, peak shaving, and renewable energy integration. Although there is currently no nationwide regulatory framework for V2G, several pilot projects are being explored by the Energy Regulatory Commission (ERC), the Electricity Generating Authority of Thailand (EGAT), and academic institutions to assess technical feasibility, grid interoperability, and economic value.

Smart charging—through time scheduling, demand response, and real-time control—is being gradually promoted in connection with Time-of-Use (ToU) tariffs and Low Priority Rate schemes. These pilots

aim to demonstrate how managed NEV charging can reduce peak load, increase off-peak utilization, and provide flexibility services to the power system. Scaling up V2G and smart charging will require regulatory updates, including clear rules on electricity resale, interconnection standards, and aggregation models. Over time, these technologies are expected to become key enablers of Thailand's clean energy transition, supporting both NEV adoption and grid decarbonization.

4.5 Infrastructure Related to New Energy Vehicle and Smart Mobility

4.5.1. Energy Infrastructure

Thailand's energy infrastructure plays a critical role in supporting the rapid growth of NEVs and ensuring the reliability of the national power system during the transition to clean mobility. As vehicle electrification accelerates, the expansion of public charging networks, the evolution of smart grid capabilities, and the increasing involvement of private operators have become key enablers of this shift. The following sections provide an overview of Thailand's current charging infrastructure, its adequacy in meeting growing NEV demand, and how smart grid integration will enhance flexibility, efficiency, and long-term system resilience.

4.5.1.1. Charging Infrastructure Development

Thailand's public charging infrastructure has grown rapidly in response to rising NEV adoption, with both the public and private sectors playing a central role. As of June 2025, there are approximately 12,149 charging connectors nationwide. Of these, 6,686 are DC fast chargers, 410 are DC CHAdeMO, and 5,053 are AC Type 2 connectors, reflecting a strong emphasis on fast charging to support intercity travel and commercial fleet operations. These connectors are installed at around 4,015 charging stations nationwide.

The distribution of these stations is uneven across the country, reflecting the early stage of network development. Around 50 % of charging stations are in the Bangkok Metropolitan Region, which is the largest NEV market and home to most early adopters. The central region accounts for 16%, followed by the northern region and the southern region with 12% each, and the northeastern region with 10 %. This concentration around major cities and highways mirrors Thailand's initial infrastructure rollout strategy, which prioritizes urban centers, expressways, and tourism corridors to enable long-distance NEV travel.

Private companies largely operate the charging network, acting as the main drivers of its expansion. The largest operator is EV Station PluZ, which alone manages over 1,262 stations and 3,356 connectors, followed by EA Anywhere with 478 stations and 2,618 connectors. Other major players include PEA Volta, Sharge, Evolt, and Elex by EGAT, each contributing several hundred stations nationwide. Smaller operators such as MG, Altervim, Espro, Onion, MEA NEV, and Phithan Green provide coverage in specific corridors and cities. This market-driven development model has accelerated network rollout and diversified service options for NEV drivers.

Charging station operators are increasingly focusing on DC fast charging, with typical outputs ranging between 125 and 360 kW, suitable for highway corridors and high-turnover urban locations. DC charging rates range from THB 7.5 to 9.0 per kWh during peak hours and about THB 6.5 per kWh during off-peak hours, reflecting the higher cost structure of fast charging compared to residential tariffs.

Looking forward, Thailand is also diversifying its clean mobility infrastructure. Hydrogen refuelling stations are being developed alongside NEV charging networks. Pilot projects are underway, including the introduction of Toyota Mirai hydrogen fuel cell vehicles for airport shuttle services, and investments by Bangkok Industrial Gas (BIG) in a hydrogen refueling station in Chonburi Province.

Thailand's infrastructure roadmap targets 12,000 DC fast chargers and 1,450 battery swapping stations for electric motorcycles by 2030, ensuring that infrastructure expansion keeps pace with NEV adoption. This is part of a broader strategy to secure an accessible, reliable, and balanced energy supply network that supports the country's clean transport transition.

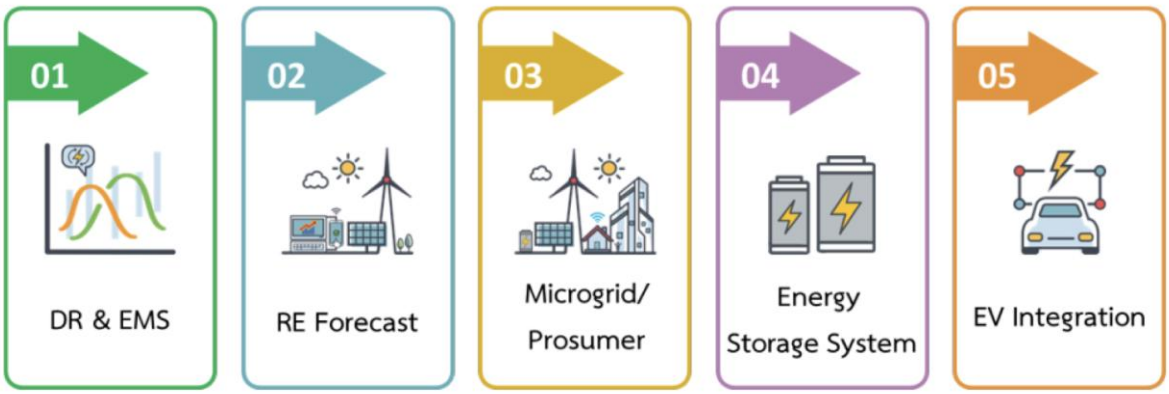
Table 4-5: Thailand's National Targets for ZEV Passenger Cars and DC Fast Charging Infrastructure (2025–2035)

Year	ZEV Passenger Car Target (mil units)	DC Quick Charger Target
2025	0.4	2,200-4,400
2030	2.0	12,000
2035	6.4	36,500

4.5.1.2. Smart Grid Development and NEV Integration

Thailand has recognized that the successful transition to a low-carbon transport and energy system depends on a modern, flexible, and digitalized power grid. To guide this transition, the government has established the Thailand Smart Grid Development Master Plan (2015–2036), which lays out the long-term vision for modernizing the power system and aligning technological advancements with national energy and climate goals. Building on this foundation, the Smart Grid Implementation Plan (2022–2031) provides a more detailed and actionable roadmap for accelerating the adoption of smart grid technologies and ensuring the grid can support the rising penetration of renewable energy and NEVs.

The medium-term implementation plan is structured around **five strategic pillars**:



Pillar 1: Demand Response (DR) and Energy Management Systems (EMS) for enhancing flexibility and optimizing energy use on the demand side.

Pillar 2: Renewable Energy Forecasting (RE Forecast) for improving grid integration of renewables through accurate forecasting.

Pillar 3: Microgrids and Prosumers to promoting decentralized energy models and empowering consumer participation in electricity generation.

Pillar 4: Energy Storage Systems (ESS) to strengthening grid reliability and resilience via battery storage solutions.

Pillar 5: NEV Integration to supporting NEV adoption through smart charging, load management, and grid-service capabilities. Although still in its early stages, smart grid planning also aims to enable advanced NEV charging coordination, including fast-charging optimization and potential vehicle-to-grid (V2G) applications.

Under Pillar 5, the plan highlights the importance of upgrading both the power and digital infrastructure to enable advanced NEV participation in the energy system, as shown in Figure 2-1. As NEV numbers increase, smart grid capabilities must evolve to support smart charging, load coordination, and eventually Vehicle-to-Grid (V2G) and Vehicle-to-Everything (V2X) services. Thailand has laid out a phased strategy to achieve this, beginning with the integration of small household NEVs, followed by the inclusion of commercial fleets and later, heavy-duty vehicles such as buses and trucks. This progression supports a sustainable, decentralized energy resource model that leverages NEVs as both transportation and storage assets.

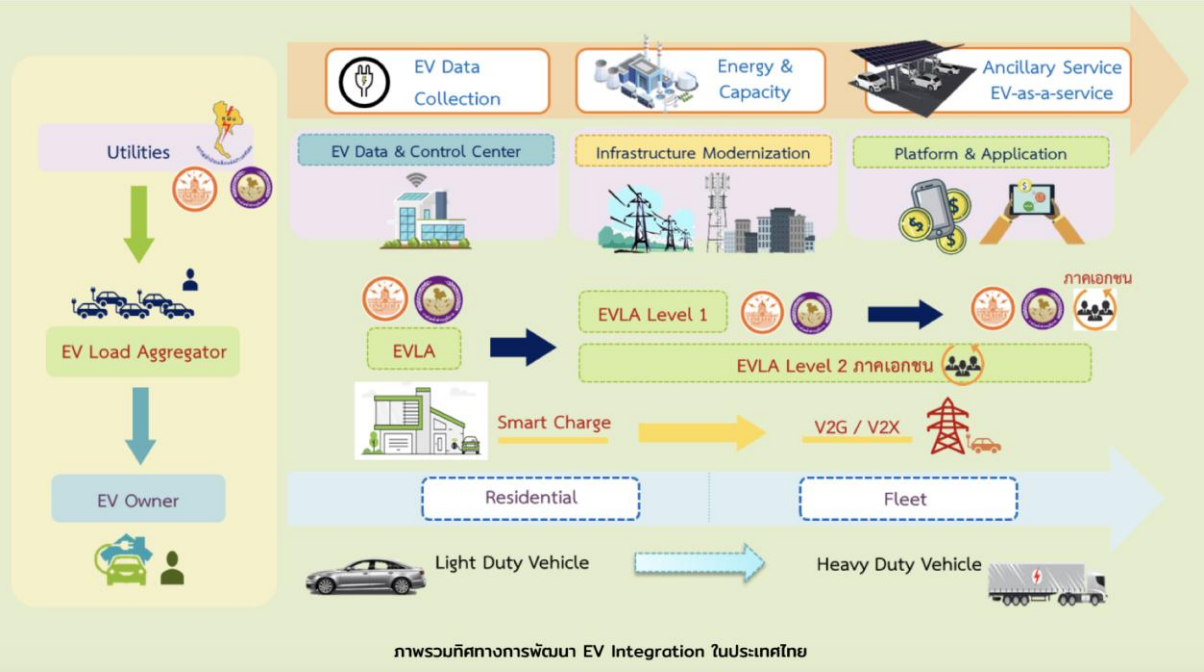


Figure 4-5: Thailand's NEV Integration Development Direction

Source: Thailand Smart Grid Plan (2022)[xc]

A key institutional feature of Thailand's smart grid strategy is the introduction of NEV Aggregators (Electric Vehicle Load Aggregators – EVLAs). In the initial phase, the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) will act as Level 1 aggregators, managing national scale charging infrastructure and overseeing data integration and access. Private operators will be able to register as Level 2 aggregators, managing localized networks such as charging hubs, fleet operations, or microgrids. Level 2 entities may be upgraded to Level 1 status based on performance, technical capacity, and compliance with regulatory standards. This aggregator model will be central to implementing smart charging strategies, enabling NEV charging to be optimized in real

time in response to grid conditions. Over time, aggregators will also play a role in demand response programs, frequency regulation, and renewable energy integration, allowing the transport sector to contribute to grid stability and decarbonization.

4.5.1.3. NEVs to Charging Piles (AC/DC) ratio

By mid-2025, Thailand has registered a cumulative total of 371,570 NEVs, consisting of 74,757 PHEVs, and 296,813 BEVs. With approximately 12,149 charging connectors, equivalent to around 6,000 charging piles (based on an average of two connectors per pile), the NEV-to-charging pile ratio stands at roughly 62 NEVs per pile. At first glance, this ratio might suggest a shortage of charging infrastructure However, Thailand's charging behavior provides important context. A substantial share of BEV users relies predominantly on home charging rather than public stations, enabled by widespread access to off-street parking in residential areasIn addition, residential electricity tariffs, especially under Time-of-Use pricing, make overnight home charging significantly cheaper than public fast charging. Simple installation procedures for home chargers further encourage private charging, helping ease pressure on public networks despite the rising number of NEVs.

As a result, public charging infrastructure currently serves a complementary role, supporting long-distance travel, fleet operations, and urban users without home charging options, such as condominium residents. This pattern has allowed the system to remain functionally adequate even with a relatively modest number of public stations.

4.5.1.4. Smart Grid Readiness

Smart grid readiness is a critical factor in ensuring that Thailand's power system can effectively support the rapid expansion of NEV charging infrastructure. According to the Smart Grid Index (SGI) developed by SP Group, Thailand achieved a smart grid readiness score of 73.2%, placing it among the higher-performing countries in ASEAN in terms of grid modernization. This score reflects notable progress in grid digitalization, integration of renewable energy, and deployment of enabling technologies, but it also underscores the need for continued investment in advanced infrastructure and interoperability frameworks.

This level of readiness provides a strong foundation for Thailand to enable smart charging, demand response, and, in the future, vehicle-to-grid (V2G) capabilities. Aligning EVSE development with smart grid planning will ensure the charging network is future proof, supports system flexibility, and enhances grid reliability as NEV adoption accelerates.

4.5.1.5. Charging Communication Protocol Standard – Single Platform

Currently, Thailand does not yet have a fully unified national communication platform for NEV charging, and most charging networks are operated through proprietary platforms developed by individual private operators. As a result, interoperability between networks is still limited, with separate applications, authentication systems, and billing interfaces for different charging providers. While many major operators such as EV Station PluZ, EA Anywhere, and Sharge have already adopted OCPP (Open Charge Point Protocol) to some extent, this has not yet been formalized into a national standard or centralized system.

Recognizing these challenges, the government and the Energy Regulatory Commission (ERC) are working with industry stakeholders to develop a common communication protocol and backend system that will serve as a single platform for EVSE integration. The objective is to standardize data exchange between charging stations, utilities, and regulators, enabling features such as smart charging, demand response, and vehicle-to-grid (V2G) readiness. In the future, this single platform is expected to link private operators with the national grid, provide universal access and payment options for users, and allow regulators to monitor real-time system performance.

4.5.1.6. Licensing and Permitting of EVSE Operators

1) EVSE Permitting and Standards

The regulatory framework for the operation of electric vehicle supply equipment (EVSE) in Thailand is established under the Energy Industry Act B.E. 2550 (2007). According to Section 47 of this Act, the operation of NEV charging stations is classified as an energy business and therefore generally requires a license from the Energy Regulatory Commission (ERC). This ensures that EVSE operators comply with technical, safety, and grid connection standards, while supporting fair competition and consumer protection in the emerging NEV charging market.

However, the ERC has introduced regulatory exemptions to promote investment and lower barriers for small-scale operators. Small-scale NEV charging operations, defined as installations with total transformer or inverter capacity below 1,000 kVA, are exempt from licensing requirements under the Royal Decree on Energy Business Operation B.E. 2552 (2009), as amended by later notifications. Instead, these operators are only required to notify the ERC of their activities. This "license-light" approach aims to accelerate infrastructure rollout while maintaining oversight and system reliability.

2) NEV Charging Station Operation Types and Licensing Requirements

To provide clarity for market participants, the ERC categorizes NEV charging station operations into four types, based on their electricity sources and infrastructure configuration. Each type has different licensing obligations related to electricity production and/or distribution under the Energy Industry Act.

Table 4-6: NEV Charging Station Licensing Requirements (ERC)

No.	NEV Charging Station Type	Requires Production License	Requires Distribution License
1	Grid-connected charging station	✗	✓
2	Grid-connected station combined with off-grid renewable energy source	✓	✓
3	Grid-connected station with battery energy storage system	✗	✓
4	Grid-connected station with both off-grid renewable source and battery energy storage system	✓	✓

Source: Energy Regulatory Commission (Thailand) (2024)

These distinctions determine the regulatory pathway for operators. Simple grid-connected charging stations are classified as distributors and require only a distribution license, while those integrating renewable energy generation or battery storage must obtain both production and distribution licenses. This framework allows the ERC to manage technical integration and grid stability while enabling innovation in business models, such as renewable-powered charging and energy storage integration.

4.5.2. Road Infrastructure

According to the World Economic Forum (WEF) Global Competitiveness Report, Thailand's road quality is assessed via an Executive Opinion Survey on a scale of 1 (extremely poor) to 7 (excellent). In 2019, Thailand scored 4.4, matching its 2018 performance and remaining above the global average of 4.07 across 141 economies. However, this score sits slightly below Thailand's historical average of 4.74 (2006–2019), indicating that while the network is robust, there is significant room for improvement to meet the highest international benchmarks.

While Thailand boasts an extensive network—featuring modern, well-maintained elevated expressways in Bangkok and key economic corridors—the overall rating is tempered by inconsistent standards elsewhere. Business leaders generally perceive the infrastructure as moderate to good, but issues such as surface degradation on rural roads, varying maintenance quality, and urban congestion prevent the country from reaching the upper tiers of global efficiency. The stable yet lower-than-average historical score suggests that future efforts must prioritize the extensiveness and consistency of maintenance to elevate the network to a truly world-class standard.

1) Road Environment

Thailand's foundational road environment is governed by the Road Traffic Act, B.E. 2522 (1979), providing the legal and physical consistency essential for Autonomous Vehicle (AV) perception systems.

1.1) Highway Classification and Measurement

Infrastructure is managed through a tiered system—National Highways (DOH and DRR) and Local Highways. The DOH tracks the network using "Actual Distance" (geographical reach) and "Distance per 2 Traffic Lanes" (operational capacity). The focus has shifted from mere expansion to widening projects, creating multi-lane corridors that are more conducive to high-speed autonomous navigation.

Traffic classification in Thailand is generally based on Highway Classification Standards, established by key agencies such as the Department of Highways, the Department of Rural Roads, and local administrative organizations. These standards are divided into two main categories: National Highway Classification Standards, which are overseen by the Department of Highways and the Department of Rural Roads, and Local Highway Classification Standards , which are overseen by local administrative organizations. Understanding these road classifications and standards provides an overview of Thailand's transportation infrastructure and serves as a crucial basis for considering its suitability and potential to support future developments in automotive and intelligent transportation technologies.

Table 4-7: National Highway Classification Standards

Path	Special	1	2	3	4	5	Urban Area	Parallel Road
1. Average Daily Traffic Volume	More than 8,000	4,000 - 8,000	2,000 - 4,000	1,000 - 2,000	300 - 1,000	Less than 300		
2. Design Speed Limits (km/h)								
- Flat Roads		90 - 110			70 - 90	60 - 80	60	70 - 90
- Slope Roads		80 - 110			55 - 70	50 - 60	60	70 - 80
- Hill Roads		70 - 90			40 - 55	30 - 50	60	60 - 70
3. Maximum Slope (%)								
- Flat Roads	4		4		4	4	Depending on the terrain	4
- Slope Roads	6		6		8	8	Depending on the terrain	6
- Hill Roads	6		8		12	12	Depending on the terrain	8
4. Recommended road surface type and shoulder		High	Medium - High			gravel	High	Medium - High
- Road surface width (meters)	At least 7.00 m per side	7	7	7	7	8	3.00-3.50 m per lane	3.00-3.50 m per lane
- Pavement width (meters)	Left 2.50-3.00, Right 1.00-1.50	2.5	2	1.5	1	-	2.50 or a sidewalk	at least 2.00 m or a sidewalk
- Bridge surface width (meters)	11	12	11	11	11	11	Bridge width according to Ultimate Design or at least 11.00 m	

Path	Special	1	2	3	4	5	Urban Area	Parallel Road
- Right way width (meters)	60-80		40-60		30-40		as appropriate	-
5. Maximum flattening				10%			6%	10%

Notes:

1. Shoulder Width: Shoulders are generally provided with a standard width for most sections. However, their width can be increased in specific sections if required.
2. Road Surface Separation: A curb separates the road surface from the shoulders.
3. Bridge Sidewalks: Bridges that include sidewalks must have a minimum width of 1.50 meters on each side for pedestrian use.
4. Bridge Width on Class 4 and 5 Roads: For Class 4 and 5 roads where the road grade standards are not expected to be upgraded in the short term, the bridge width may be reduced, but it must not be less than 9.00 meters.
5. Embankment Slope: The embankment slope typically ranges from 4:1 to 6:1. In specific necessary sections, a steeper slope of 2:1 to 3:1 may be used, depending on the particular situation.
6. Highway Recommendation: Class 4 and 5 road standards are not recommended for highways.

Source: National Highway Classification Standards (2017)

Table 4-8: Local Highway Classification Standards. In urban and community areas

Details	Special Class	Class 1	Class 2	Class 3	Class 4
Traffic Surface	Concrete/Asphalt				
Load Capacity (Tons)	As announced by the Local Highway Director				
Number of Lanes per Direction (Lanes)	≥ 3	≥ 2	≥ 2	≥ 1	≥ 1
Lane Width (m)	≥ 3.25	≥ 3.25	≥ 3.25	≥ 3.00	≤ 3.00
Sidewalk/Shoulder Width (m)	≥ 2.50	≥ 2.00	≥ 1.50	≥ 1.00	Not specified
Drainage way	Yes				Should have
Highway Area (m)	≥ 45.00	≥ 30.00	≥ 16.00	≥ 8.00	As appropriate
Design Speed (Flat-Slope-Hill) (km/h)	≤ (90-80-70)			≤ (60-50-30)	≤ (50-40-30)
SUPER ELEVATION (%)	≤ 4				

Details	Special Class	Class 1	Class 2	Class 3	Class 4
Road Slope (Flat-Slope-Hill) (%)	≤ (4-6-8)			Depending on the terrain (≤ 12)	Depending on the terrain (≤ 15)
Radius of Curve Connections or Intersections (m)	≥ 5.00				
Vertical Clearance (m)	≥ 5.00				
Department of Rural Roads Announcement	Sections 8	Sections 9	Sections 10	Sections 11	Sections 12

Source: Local Highway Classification Standards (2021).

Table 4-9: Local highway standards, outside the city/outside the community

Details	Special Class	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Traffic Surface	Concrete/Asphalt					Concrete/Asphalt/Gravel	
Load Weight (Tons)	As announced by the Local Highway Director						
Number of lanes per direction (lanes)	≥ 3	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥ 1
Lane width (m)	≥ 3.25	≥ 3.25	≥ 3.25	≥ 3.25	≥ 3.00	≥ 3.00	≤ 3.00
Sidewalk/Shoulder width (m)	≥ 2.50	≥ 2.00	≥ 2.00	≥ 1.50	≥ 1.00	Not specified	
Highway area (m)	≥ 45.00	≥ 30.00	≥ 25.00	≥ 15.00	≥ 10.00	As appropriate	
Design speed (Flat-Slope-Hill) (km/h)	≤ (100-90-70)			≤ (90-80-70)	≤ (80-60-50)	≤ (60-50-30)	
SUPER ELEVATION (%)	≤ 10						
Road Slope (Flat-Slope-Hill) (%)	≤ (4-6-8)				≤ (4-8-12)		
Radius of Curves, Connections, or Intersections (m)	≥ 5.00						
Vertical Clearance (m)	≥ 5.00						
Department of Rural Roads Announcement	Sections 13	Sections 14	Sections 15	Sections 16	Sections 17	Sections 18	Sections 19

Source: Local Highway Classification Standards (2021)

1.2) Precision in Road Markings

Thailand adheres to strict national standards for longitudinal and transverse markings. For instance, "No-Passing" zones are demarcated by solid yellow lines (0.10m thick), while lane lines utilize specific dash-to-gap ratios (e.g., 3m line/9m gap for rural highways). These high-contrast markings provide the reliable benchmarks required for camera-based Lane Keep Assist (LKA) and sensor fusion.

1.3) Structured Motorcycle Separation

Unlike many mixed-traffic environments, Thai law mandates that slow-moving motorcycles occupy the outermost left lane and prohibits them from high-speed expressways. This legal and physical segregation simplifies the "object detection" requirements for AVs on major corridors by reducing the unpredictability of two-wheeler behavior.

2) Systematic Signaling and Intelligent Traffic Management

Autonomous readiness depends on the ability of a vehicle to interpret and respond to traffic controls. Thailand's system is designed for high recognition and is moving toward real-time connectivity.

- Universal Traffic Signals: Thailand utilizes the standard Red-Yellow-Green protocol, supplemented by specific signals like blinking red (stop) and blinking yellow (caution). For AVs, the precision of "stop-and-go" decisions is critical; the transition from fixed-timer lights to digital-ready systems is already underway.
- Adaptive Traffic Signal Systems: As of June 2025, the Bangkok Metropolitan Administration (BMA) has successfully implemented an Adaptive Traffic Signal System at 72 key intersections. Using image-processing cameras and AI, this system adjusts signal timing based on real-time traffic volume. This infrastructure serves as a precursor to V2I (Vehicle-to-Infrastructure), where signal status can be broadcasted directly to a vehicle's onboard computer to optimize speed and energy consumption.
- Bilingual and Standardized Signage: Mandatory, warning, and guidance signs follow international color-coding (e.g., Blue for mandatory, Yellow for warning, Green/Blue for guidance). Most national routes feature bilingual (Thai-English) signage, facilitating easier integration for international AV software platforms.

3) Strategic Testing and Smart Mobility Initiatives

Thailand is actively creating "Regulatory Sandboxes" and specialized zones to pilot high-level autonomous driving (Level 3-4).

- EXAT Expressway Sandbox: The Expressway Authority of Thailand (EXAT) is spearheading the "Chalong Rat Expressway Sandbox." This project focuses on V2X (Vehicle-to-Everything) communication and infrastructure upgrades specifically for autonomous cars. Research includes Wireless Charging on Smart Roads and mobile charging units to ensure sustainable AV operations.
- Wang Chan Valley & HD Mapping: In collaboration with PTT and Chulalongkorn University, EXAT uses Wang Chan Valley as a closed testbed. Here, advanced technologies such as 3D Modeling using Cloud Point techniques and High-Definition (HD) maps are developed to ensure vehicles can navigate with centimeter-level accuracy.
- Smart Mobility Cities: The government has certified 14 "Smart Mobility" cities. These hubs are developing integrated ecosystems that include Mobility as a Service (MaaS), real-time public transit tracking (GPS-enabled buses), and AI-driven parking management. For example,

Chulalongkorn University's commercial area already features EV charging stations and shared mobility applications that serve as micro-models for wider urban deployment.

Table 4-10: Smart City and Road Design

No.	City	Solutions	Technology	Output/Outcome
1	Chiang Mai Smart City Through Smart Old Town	Smart City Parking Management Project	1. CCTV 2. IoT 3. Application to notify officials when a vehicle is parked in a no-parking zone. 4. Sensors to issue warnings in no-parking zones.	1. Public satisfaction with the no-parking warning system is no less than 80%. Note: The satisfaction survey is based on the following: - The accuracy of parking alerts in no-parking zones. - Vehicles are parked in compliance with traffic regulations, leading to smoother traffic flow on the roads. 2. The proportion of vehicles parked in no-parking zones has decreased.
		Development of a Digital Urban Parking Management System	1. LED signs providing real-time information 2. IoT 3. Application for finding city parking 4. Cloud computing	Public satisfaction with the parking management system is no less than 80%. Note: The satisfaction survey measures the efficiency and accuracy of the LED signs in providing parking information.
		Project on Developing a Low-Carbon City through a Sustainable Public Transport Service Management System	1. Urban Transit application 2. Smart payment 3. GPS vehicle tracking	1. No less than 35% of the public has access to public services. 2. The city serves as a model for a city where the public has access to a variety of public transportation systems.

No.	City	Solutions	Technology	Output/Outcome
				3. Public satisfaction with the application's usage is no less than 80%. Note: The satisfaction survey is based on the following: - Accuracy of bus schedules. - Convenience and efficiency of the application's features. - Access to a variety of travel information. 4. Greenhouse gas emissions are reduced by at least 20% compared to the baseline year.
		Smart Traffic Management through E-School Bus	1. Public Electric Vehicle Technology 2. Vehicle Tracking Technology System 3. Application for Student Tracking	1. Public satisfaction with smoother traffic flow is no less than 85%. 2. Student and parent satisfaction with the application's usage is no less than 80%. Note: The satisfaction survey is based on the following: - The efficiency and accuracy of the student tracking system. - The feeling of safety provided by the student tracking system. - The convenience and efficiency of the application's functions. 3. Greenhouse gas emissions from travel are reduced by 20%.

No.	City	Solutions	Technology	Output/Outcome
2	CMU Smart City	Intelligent Mass Transit Information System Project	1. mobile application 2. Smart signs 3. Image processing detection system 4. Solar Panel 5. Smart gate	1. Reduced waiting time at bus stops by at least 700 minutes per day. 2. Reduced the number of empty mass transit trips by at least 100 trips per day (from 1,500 trips per day). 3. Reduced exhaust emissions, fuel consumption, and electricity usage at the installation sites by at least 3%.
		Social Network-based Emergency Notification and Monitoring System	1. Smart Control System 2. Smart CCTV 3. Notification system protocol	1. A security system is in place in the form of a social network. At least 50% of the local population has access to and receives alerts from the system. 2. There is also a Security and Vehicle Usage Management Center.
		Smart Parking Guidance System Project	1. Smart Monitoring 2. War room center 3. Smart Station Signs 4. Parking Guidance System	The travel time to find parking is reduced by at least 5 minutes per vehicle.
		Project to Improve Chiang Mai University's Urban Planning into a Smart City	1. Urban design utilizes the Checklist based on the standard V-TOD 2.1 from the ITDP (Institute for Transportation & Development Policy). 2. Smart Gate system and smart transportation system displays.	1. Transportation connectivity every 500 meters. 2. Waiting pavilions every 500 meters. 3. Smart public transport signs every 500 meters.
		Green Vehicle Project within Chiang Mai University	1. Electric-powered public transportation system.	1. The service area for the public transportation system within Chiang Mai University has been increased to 100%.

No.	City	Solutions	Technology	Output/Outcome
			Compress Biomethane Gas system	2. Fuel consumption has been reduced by at least 5,000 liters per day, resulting in a decrease in fuel usage and carbon dioxide emissions.
3	Samyan Smart City	Project to Develop a Comprehensive Public Transportation Network	1. Public transportation system 2. Vehicle location tracking system 3. Application based alerts for an approaching vehicle	Public transportation is accessible within a 500-meter walking distance.
		Project to Develop First & Last Mile Travel Options	1. EV Car Sharing 2. EV Car Rental	More than two first & last mile travel options are available, which are eco-friendly and based on shared usage.
		Project to Develop a Public Transit Tracking System within the Area	GPS system in all public buses within the area	1. GPS is installed on every bus in the public transit system within the area. 2. An application provides real-time bus routes and locations.
		Travel Information Provision Project	Application	There is one real-time application for providing bus route information, covering 80% of public transport users.
		Traffic Management Project	Intelligence Transport System	Traffic flow within the area has improved.
		Parking Management Project	System for providing information on available parking spaces	There is a system that provides real-time information on the number of available parking spaces.
		Project to Promote Ride-Sharing via Application	Application Liluna	A private group exists within the Liluna application specifically for ride-sharing to and from Chulalongkorn University.

No.	City	Solutions	Technology	Output/Outcome
		Project to Promote the Use of Eco-Friendly Vehicles	Electric vehicle charging stations	There are 10 EV charging stations covering the commercial area of Chulalongkorn University. The service is used 1,500 times per year (by 2025).

4.5.3. Digital Infrastructure

4.5.3.1. Testing Center for Connected and Automated Vehicles (T-CAVs)

The Testing Center for Connected and Automated Vehicles (T-CAVs) serves as a testing ground for modern automotive systems. It focuses on evaluating autonomous driving systems, Advanced Driver Assistance Systems (ADAS), and C-V2X (Cellular Vehicle-to-Everything) communication systems via telecommunications networks. T-CAVs offers performance and safety testing services for driving assistance systems in modern vehicles, autonomous cars, and outdoor/field mobile robots, among others, supporting product research and development. It also provides testing results in accordance with standards, regulations, or rules such as ADAS EURO NCAP, UNECE, and ISO.

Located on an area of 32 Rai, 2 Ngan, and 43 Square wa, the Connected Vehicle and Autonomous Driving Test Center is equipped with a certified ADAS EURO NCAP test surface. It features state-of-the-art testing equipment, including radar soft targets, autonomous platforms, driving robots, and a fully configurable 5G private network.



Figure 4-6: Testing Center for Connected and Automated Vehicles (T-CAVs

Source: Wangchan Valley[62]

[62] Wangchan Valley. (2021). Testing Center for Connected and Automated Vehicles (T-CAVs). Wangchan Valley. Retrieved November 4, 2025, from https://www.wangchanvalley.com/~/SiteVisit/SiteVisit/?keys=K1ztjSGNpPw=

4.5.3.2. Intelligent Transportation Systems (ITS)

This involves system development focused on integrating various technologies, such as communication technology, automatic data collection technology, computer technology and big data analysis programs, control technology, and information technology. The goal is to facilitate convenient, safe, and economical travel for transportation and traffic system users, particularly commuters.

Based on a review of ITS system operations in Thailand[63], the following six categories of ITS operations in Thailand and in the table below:

1. Traffic Management Systems
2. Traveler Information Systems
3. Commercial Vehicle Operations System (CVO)
4. Public Transportation Management System
5. Vehicle Safety and Emergency Management Systems
6. Electronic Payment Systems (for tolls and fares)
7. Table of ITS systems in Thailand

Table 4-11: ITS system development operations

No.	ITS system development operations	Traffic Management	Traveler Information	Commercial Vehicle	Public Transportation	Vehicle Safety and Emergency	Electronic Fare and Toll Payment
Government agencies							
1	**Office of Transport and Traffic Policy and Planning (OTP)**						
	1.1 Common ticket system						•
2	**Bangkok**						
	2.1 Area Traffic Signal Control System	•					
	2.2 Closed-Circuit Television (CCTV) System					•	
	2.3 Traffic Signal Countdown Timers		•				
	2.4 Smart Traffic Sign System		•				
	2.5 Smart Pedestrian Signal System						•
	2.6 Bus Rapid Transit (BRT) System				•		
3	**Metropolitan Police Bureau**						
	3.1 Closed-Circuit Television (CCTV) System					•	
	3.2 Red Light Camera System (for traffic signal violations)					•	
	3.3 Thai Intelligent Traffic Information Center		•				

[63] Project to study and develop a master plan for the development of intelligent public transport systems in Bangkok and its vicinity, Executive summary report, Office of Transport and Traffic Policy and Planning (OTP) Ministry of Transport, March 2018, https://www.otp.go.th/uploads/tiny_uploads/ProjectOTP/2560/Projcet02/ITS-FinalReport.pdf

No.	ITS system development operations	Traffic Management	Traveler Information	Commercial Vehicle	Public Transportation	Vehicle Safety and Emergency	Electronic Fare and Toll Payment
4	**The National Electronics and Computer Technology Center (NECTEC)**						
	4.1 Bus Information System				●		
5	**Office of the Permanent Secretary, Ministry of Transport**						
	5.1 TRAMS System		●				
	5.2 Online Mapping Service System		●				
	5.3 Travel Planning Assistance System		●				
	5.4 National Multimodal Transport Integration Center		●	●	●		
6	**DEPARTMENT OF HIGHWAYS**						
	6.1 Traffic Advisory System		●				
	6.2 Intersection Traffic Control System	●					
	6.3 Incident Management System for Roadways	●					
	6.4 Automatic Toll Collection System						●
7	**DEPARTMENT OF RURAL ROADS**						
	7.1 Accident Reporting Management System (ARMS)		●				
	7.2 Traffic Control System for Sompoch Chiang Mai 700 Pi Road	●					
	7.3 Automatic Drainage Control System	●					
	7.4 Automatic Road Barrier and Warning Light System	●					
	7.5 Closed-Circuit Television (CCTV) System		●				
	7.6 Truck Weighing System			●			
	7.7 Variable Message Sign (VMS) System for Displaying User Speed					●	
	7.8 Road Condition Monitoring System					●	
8	**Expressway Authority of Thailand**						
	8.1 Closed-Circuit Television (CCTV) System					●	
	8.2 Emergency Telephone System					●	
	8.3 Variable Message Sign (VMS) System		●				
	8.4 Automatic Fare Collection System						●
	8.5 Web-Based Traffic Condition Reporting System		●				
	8.6 Project for Establishing a Traffic Information Center	●	●				
9	**Department of Land Transport**						
	9.1 Thai Truck Center System			●			
	9.2 Bus and Freight Truck Tracking System			●	●		

No.	ITS system development operations	Traffic Management	Traveler Information	Commercial Vehicle	Public Transportation	Vehicle Safety and Emergency	Electronic Fare and Toll Payment
Private sector agencies							
1	**Don Muang Tollway Public Co., Ltd.**						
	1.1 Traffic Information System via Variable Message Signs		●				
	1.2 Closed-Circuit Television (CCTV) System					●	
	1.3 Emergency Telephone System					●	
2	The Intelligent Traffic Information Center (iTIC)		●				
3	Google Maps / Google Transit		●	●	●	●	
4	Longdo Map / Traffic		●	●	●	●	
5	GlobeTech / Nostra Map		●			●	
6	AAPICO	●	●	●			
7	NuMAP		●				
8	TomTom		●	●	●	●	
9	Here		●	●	●	●	
10	TTET / T-Square			●	●		
11	Mappoint Asia		●	●	●	●	
12	GRAB				●		
13	ALLTHAI				●		

4.5.3.3. Digital Infrastructure Development in Expressway

The Expressway Authority of Thailand (EXAT)[64] organized an academic seminar on developing infrastructure to support autonomous vehicles. This included studies on the use of automated driving systems on expressways and V2I smart tolling systems that can communicate with vehicles, demonstrating EXAT's efforts to upgrade infrastructure to accommodate this new technology.

On August 28, 2023, EXAT held its 12th academic seminar, "Infrastructure Development to Support Autonomous Cars," at Auditorium 0101, EXAT Expressway Management Center Building. The event showcased Level 3 autonomous vehicles from the Department of Science Service and PTT Public Company Limited, as well as electric vehicles from Don Muang Tollway Public Company Limited and A Siam Infra Co., Ltd., displayed in front of the Expressway Management Center Building.

Additionally, exhibition booths were set up in front of Auditorium 0101. These included a prototype test vehicle display from EXAT's Research and Development Division, which is collaborating with Chulalongkorn University to study automated driving systems. Various other agencies also featured exhibition booths, Technology and Rescue Equipment on Expressways from the Traffic Control Division, Expressway Construction Technology from the Expressway Construction Division, Automatic License Plate Recognition/Traffic Control Systems and 3D Modeling using Cloud Point

[64] Autonomous Car, 28 August 2023, https://www.exat.co.th/seminar-autonomous-car-28082566/

Technique by SAM Technology Support Co., Ltd., Digital Mobility Solutions - Smart Traffic Management using Aimsun Live by Burapha University in collaboration with the Road Traffic Research and Development Division, by Thanathon Co., Ltd. and Exhibition booths from Don Muang Tollway Public Company Limited and A Siam Infra Co., Ltd.

4.5.3.4. Smart City and Road Design

The Smart City Office has updated the structure of the committees responsible for certifying the smart city logo. The previous three committees, the Smart City Development Steering Committee, the Smart City Project Driving and Management Subcommittee, and the Working Group for Evaluating the 7th Smart City plans have been replaced[65]. The new structure includes 14 cities designated as Smart Mobility cities, all of which are related to automobiles.

4.5.3.5. Other Digital Infrastructures

Digital infrastructure serves as the essential bedrock of modern society, acting as a "digital highway" that facilitates the seamless exchange of data and services. Within this framework, 5G coverage is the critical catalyst for smart mobility, offering the ultra-low latency and massive bandwidth required for vehicles and infrastructure to "talk" to one another in real-time. By providing a connection that is nearly as instantaneous as the human nervous system, 5G enables the high-speed decision-making necessary for autonomous driving and intelligent traffic management.

Thailand has positioned itself as a regional leader in this transition, being an early adopter of commercial 5G services in the ASEAN region. By utilizing key spectrum bands like 700 MHz, 2600 MHz, and 26 GHz, the nation has built a formidable digital foundation characterized by the following:

- Ubiquitous Urban Connectivity: 5G coverage is now extensive, approaching 99% in the Bangkok Metropolitan Area (BMA) and the Eastern Economic Corridor (EEC). This nationwide expansion is driven by intense competition between major operators like AIS and True Corporation, ensuring that smart mobility solutions can operate reliably across major economic hubs.
- Strong Performance: Mobile connection speeds are robust, with average national 5G download speeds frequently exceeding 100 Mbps. These peak speeds and high throughput make the network perfectly suited for data-intensive applications, such as streaming high-definition (HD) maps or processing real-time sensor data from autonomous fleets.
- V2X Foundation: Ultimately, the high capacity and ultra-low latency of the Thai 5G network are fundamental. They provide the reliable backbone required for real-time Vehicle-to-Everything (V2X) communication, allowing vehicles to anticipate hazards, sync with traffic signals, and navigate complex urban environments with centimeter-level precision.

[65] Approved by the Smart City Project Driving and Management Subcommittee on September 23, 2021. https://www.depa.or.th/th/smart-city-plan/existing-smart-city

4.6 Consumer Preferences and Trends

4.6.1. Vehicle Ownership

According to aggregated passenger vehicle registration data, Thailand has demonstrated a steady and continuous rise in vehicle ownership between 2018 and 2024. The total number of registered passenger vehicles increased from 16.50 million in 2018 to 19.77 million in 2024, reflecting consistent growth in private mobility demand. When adjusted for population, the number of passenger cars per 1,000 inhabitants rose from 231 units in 2018 to 276 units in 2024, indicating a significant expansion of motorization across the country. This upward trend aligns closely with Thailand's socio-economic development, rising income levels, and expanding urbanization.

Thailand's economic performance over this period further supports the growth in private vehicle ownership. The country's GDP increased from 451 billion USD in 2018 to approximately 471 billion USD in 2024, while GDP per capita (in 2015 USD prices) rose from 6,314 USD to 6,573 USD, suggesting a gradual but stable improvement in national income levels. Although GDP growth fluctuated, declining in 2020 due to the COVID-19 pandemic, it rebounded in subsequent years, maintaining moderate expansion rates between 1.5-2.5% annually. This economic resilience underpinned household purchasing power and sustained consumer demand for vehicles.

Demographic and social transformations have also influenced vehicle ownership trends. Thailand's population remained relatively stable, increasing slightly from 71.38 million in 2018 to 71.67 million in 2024. However, the country is experiencing a gradual demographic transition characterized by population aging. The proportion of individuals aged 65 years and older rose from 11.78% in 2018 to 15.36% in 2024, while the working-age population (15-64 years) declined marginally from 71.28% to 69.89%. Concurrently, the share of the youth population (0-14 years) continued to fall, dropping from 16.94% to 14.75%. These demographic shifts suggest a maturing society, which may influence future mobility preferences and transportation demand.

On the education front, Thailand demonstrated steady progress, particularly in higher education attainment. Gross tertiary enrollment fluctuated slightly from 46.17% in 2018 to 44.98% in 2024, reflecting both demographic changes and structural shifts in the education system. Despite minor variations, the overall trend underscores continued government investment in human capital and the expansion of access to higher education. Meanwhile, secondary education enrollment remained consistently high at over 80% throughout the period, supporting the country's transition toward a more skilled and knowledge-based economy.

Urbanization remains a critical factor driving motorization. The share of the population residing in urban areas rose from 49.95% in 2018 to 54.32% in 2024, with the urban population expanding from 35.65 million to 38.93 million. This spatial transformation has fueled demand for private transport, particularly in large metropolitan regions such as Bangkok and its surrounding provinces, where public transportation infrastructure faces persistent congestion challenges.

The increase in Thailand's passenger vehicle ownership reflects the country's broader socio-economic progress and urban expansion. Nevertheless, the continuing rise in private vehicle numbers poses challenges related to traffic congestion, energy consumption, and environmental sustainability. As Thailand advances toward higher levels of motorization, future transportation policies will need to balance economic aspirations with sustainable mobility strategies to mitigate the social and environmental costs of growing vehicle ownership.

Growing consumer interest in alternative mobility models has become increasingly evident across Southeast Asia, signaling a gradual transition from vehicle ownership toward more flexible mobility solutions.

Concurrently, growing awareness of subscription-based mobility models is expected to gradually reshape Thailand's transportation ecosystem. Southeast Asian consumers place the greatest value on attributes such as convenience (49%), transparent and predictable monthly fees (45%), and vehicle availability (44%). These preferences correspond closely with Thailand's ongoing urbanization process, particularly in metropolitan regions like Bangkok, where traffic congestion, limited parking capacity, and changing lifestyle patterns have enhanced the appeal of flexible, short-term vehicle access.

Nonetheless, several structural barriers continue to restrict the broader adoption of vehicle subscription models within Thailand and the wider region. Most consumer concerns include higher monthly fees compared to leasing (45%), vehicle availability or waiting times (44%), and the overall cost of ownership (41%). These factors highlight the gap between the conceptual appeal of subscription-based mobility and its current operational and economic limitations, particularly regarding affordability and accessibility.

In the longer perspective, as Thailand advances toward a more digitalized, service-oriented, and sustainability-driven mobility framework, vehicle subscription models are likely to evolve as a complementary alternative rather than a replacement for private ownership. Their successful integration will depend on enhancing operational efficiency, achieving cost competitiveness, and expanding service coverage. Supported by appropriate policy measures and technological innovation, subscription-based mobility could play a meaningful role in reducing household ownership burdens, alleviating urban congestion, and fostering a more sustainable transport system aligned with Thailand's socio-economic development trajectory.

4.6.2. Consumer Preferences

4.6.2.1. Environmental Awareness

As environmental sustainability becomes an increasingly influential factor in consumer decision-making, awareness of corporate responsibility and low-carbon production has emerged as a key driver of vehicle brand perception in Southeast Asia, including Thailand. Growing public concern over climate change, air pollution, and energy efficiency has encouraged consumers to favor brands that demonstrate visible commitment to environmental protection and sustainable practices.

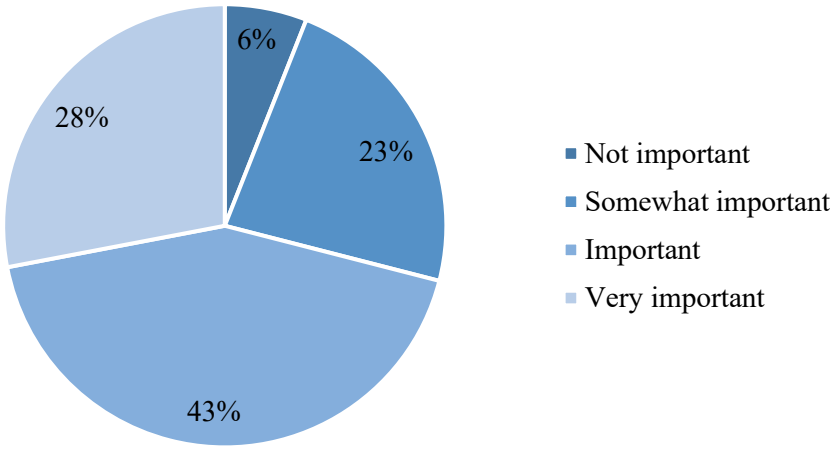


Figure 4-7: Importance of a vehicle brand committing to sustainable practices in Thailand 2024

Source: Deloitte (2025)

According to the Deloitte Global Automotive Consumer Study Southeast Asia perspectives (2025)[67], illustrates how respondents of Thai consumers[68] value a vehicle brand's commitment to sustainability. The results show that a significant majority, 66%, considered such a commitment either "Very Important" (28%) or "Important" (43%) in their purchasing decisions. Meanwhile, 23% viewed it as "Somewhat Important", and only 6% regarded it as "Not Important." These findings highlight a strong environmental awareness among consumers, who increasingly associate sustainable production, eco-friendly materials, and carbon reduction initiatives with brand credibility and long-term value. Overall, the data indicate that in Thailand, consistent with broader regional trends, sustainability has become a defining component of consumer expectations and automotive brand reputation.

[67] https://www.deloitte.com/southeast-asia/en/Industries/automotive/perspectives/global-automotive-consumer-study-2025.html

[68] which included a sample of 1,017 respondents from Thailand.

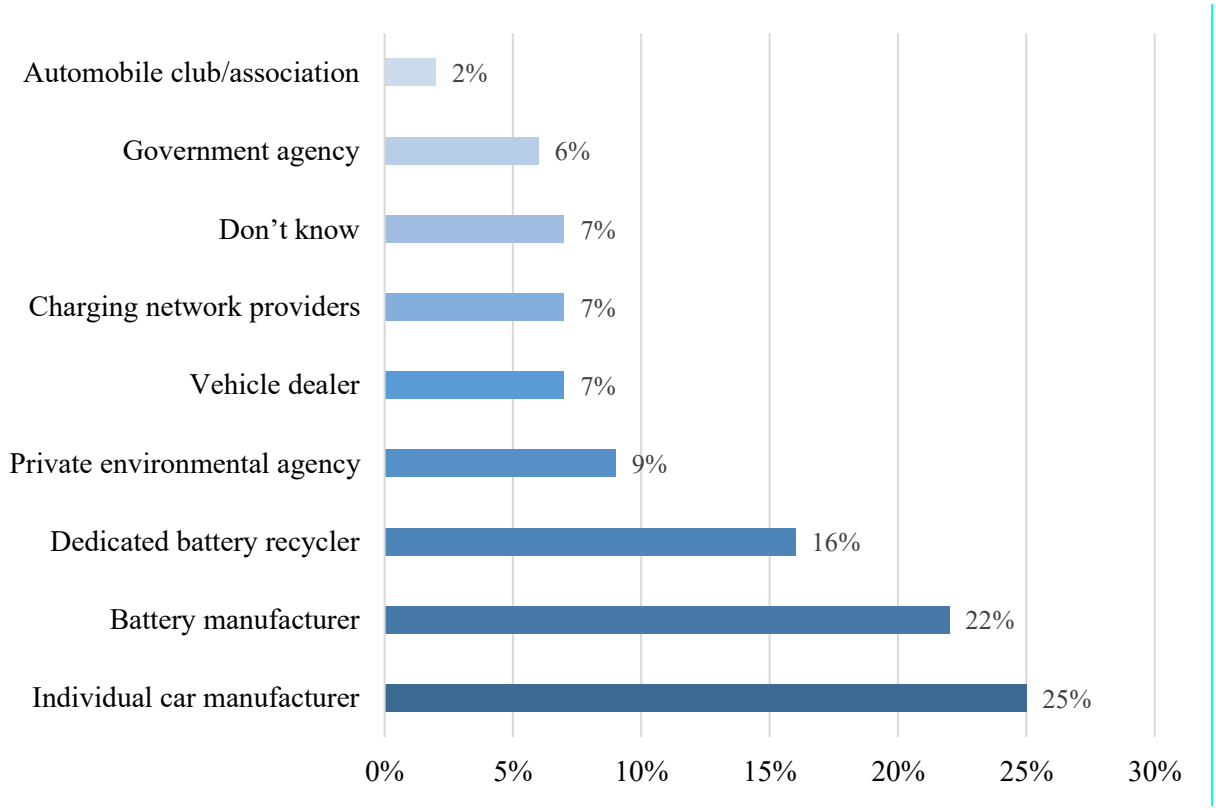


Figure 4-8: Consumer preference for EV battery recycling responsibility in Thailand 2024

Source: Deloitte (2025)

Figure 4-8 illustrates consumer preferences regarding who should bear responsibility for EV battery recycling in the region. The results reveal that respondents most frequently identified individual car manufacturers (25%) as the most suitable party, followed by battery manufacturers (22%) and dedicated battery recyclers (16%). These preferences suggest a strong expectation for specialized and industry-led recycling systems that ensure safety and environmental compliance. Meanwhile, private environmental agencies (9%), vehicle dealers (7%) and charging network providers (7%) were viewed as secondary actors, while government agencies (6%) were considered less central to the process. Overall, the findings indicate that Southeast Asian consumers—including those in Thailand—believe EV battery recycling should primarily be managed by technical experts and producers, highlighting growing awareness of the need for a formal, industry-based circular economy framework in the electric mobility sector.

Overall, the findings highlight that sustainability awareness among Thai consumers is not limited to product choice but extends to expectations for responsible end-of-life management. This growing consciousness emphasizes the need for automakers and policymakers to strengthen sustainability governance, recycling systems, and eco-innovation to ensure that the transition to electric mobility is both environmentally and economically sustainable.

4.6.2.2. Perceived Product Attributes

Product attributes play a crucial role in influencing consumer attitudes toward battery electric vehicles (BEVs), particularly in terms of range, performance, and convenience. As Thai consumers become more familiar with EV technology, their expectations increasingly reflect practical driving habits and mobility needs, shaped by local travel behavior and infrastructure readiness.

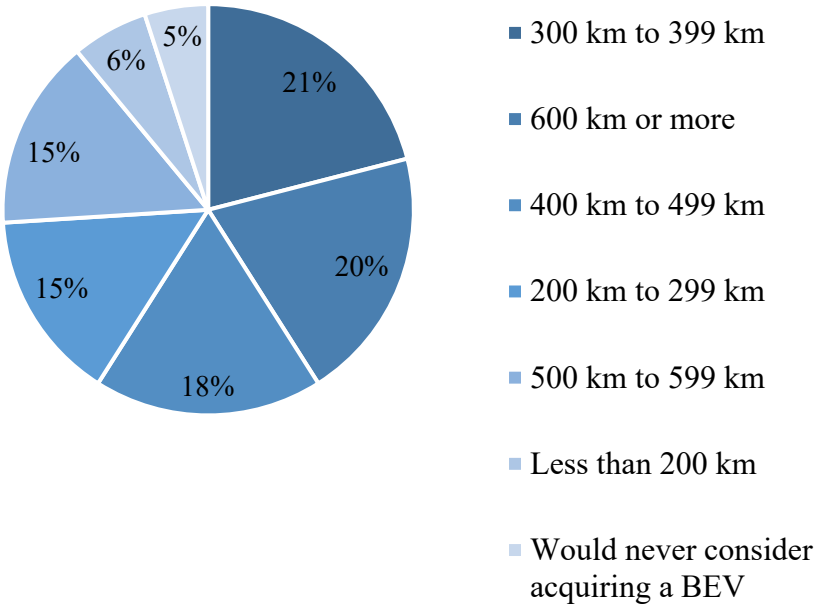


Figure 4-9: Consumer expectations on BEV driving range in Thailand 2024

Source: Deloitte (2025)

Figure 4-9 illustrates consumer expectations regarding BEV driving range in the region. The results show that most respondents expect BEVs to deliver a range of 300–499 km per charge (39%), while 20% seek 600 km or more, and 15% expect a range between 500–599 km. Only 5% of respondents stated they would never consider purchasing a BEV. These findings indicate that Thai consumers prioritize mid to long-range vehicles, reflecting concerns about travel distance and charging accessibility factors that remain central to purchasing decisions in emerging EV markets.

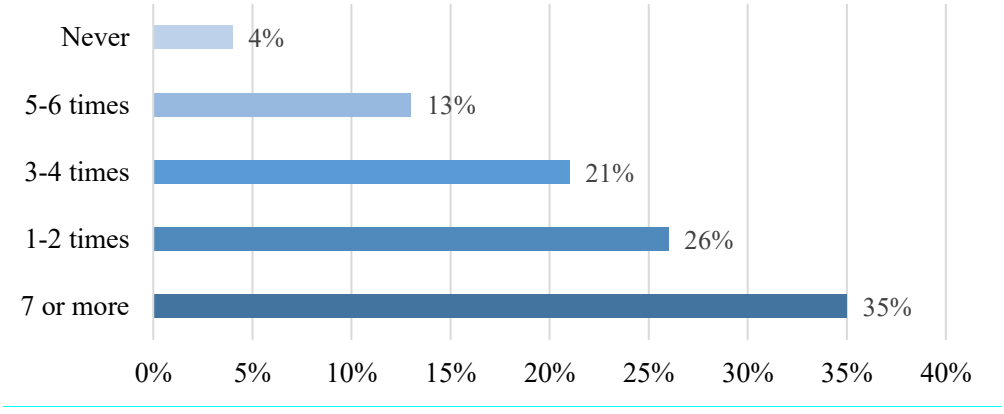
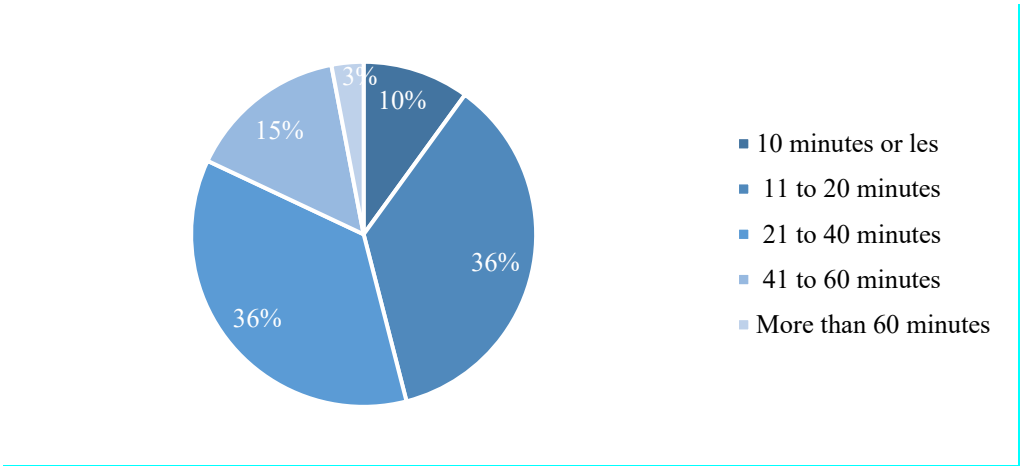


Figure 4-10: Frequency of trips exceeding 100 km from home in the past month in Thailand 2024

Source: Deloitte (2025)

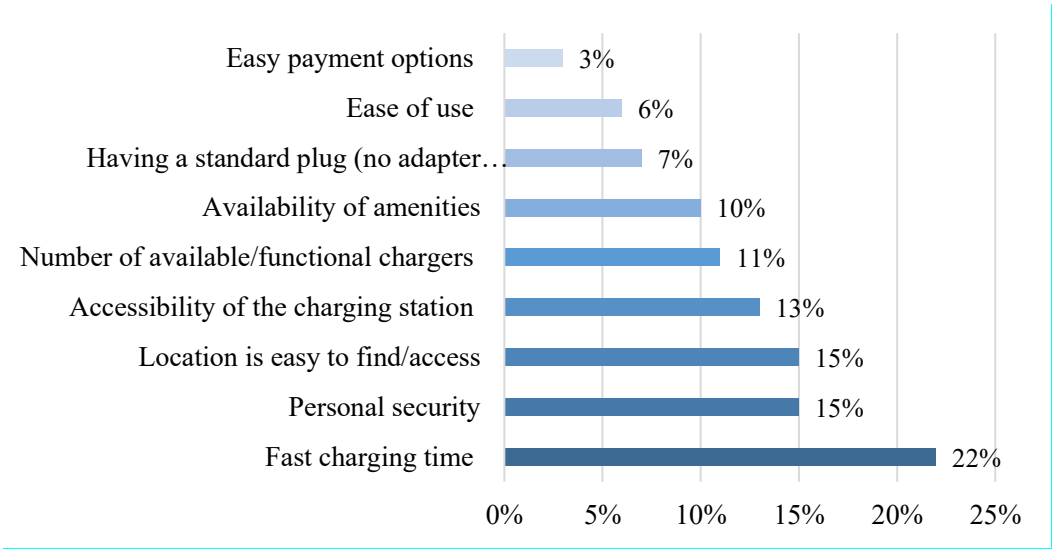
Meanwhile, Figure 4-10 presents data on the frequency of trips exceeding 100 km from home in the past month. Around 35% of respondents reported taking such trips seven or more times, while 26% did so 1-2 times, suggesting that long-distance travel is relatively common in the region. These mobility patterns align with the high range expectations shown in Figure 4-9, underscoring consumers' desire for EVs capable of supporting longer intercity and leisure travel without frequent recharging. Overall, the data demonstrates that perceived range capability remains one of the most critical factors shaping consumer confidence and willingness to adopt BEVs in Thailand.



Note: Percentages may not add up to 100 due to rounding.

Figure 4-11: Expected wait time to charge an EV at public charging stations from empty to 80% in Thailand 2024

Source: Deloitte (2025)



Note: Percentages may not add up to 100 due to rounding.

Figure 4-12: Most important factors of BEV charging experience in Thailand 2024

Source: Deloitte (2025)

Figure 4-11 andFigure 4-12 highlight regional consumer expectations regarding EV charging time and the factors shaping their charging experience. The results show that most respondents expect to charge their EVs from empty to 80% within 11–40 minutes (72%), followed by 41–60 minutes (15%), indicating a strong preference for fast and efficient charging solutions. Only a small portion of consumers (3%) are willing to wait more than an hour, reflecting growing impatience with long charging durations. In terms of experience, fast charging time (22%) was identified as the single most important factor, followed by personal security (15%) and easy-to-find location (15%), underscoring the importance of convenience and efficiency in public charging networks. Overall, these findings reveal that Thai consumers, especially those in urban markets place the highest value on charging speed and accessibility, suggesting that the success of EV adoption will depend heavily on the development of a well-distributed, high-speed charging infrastructure.

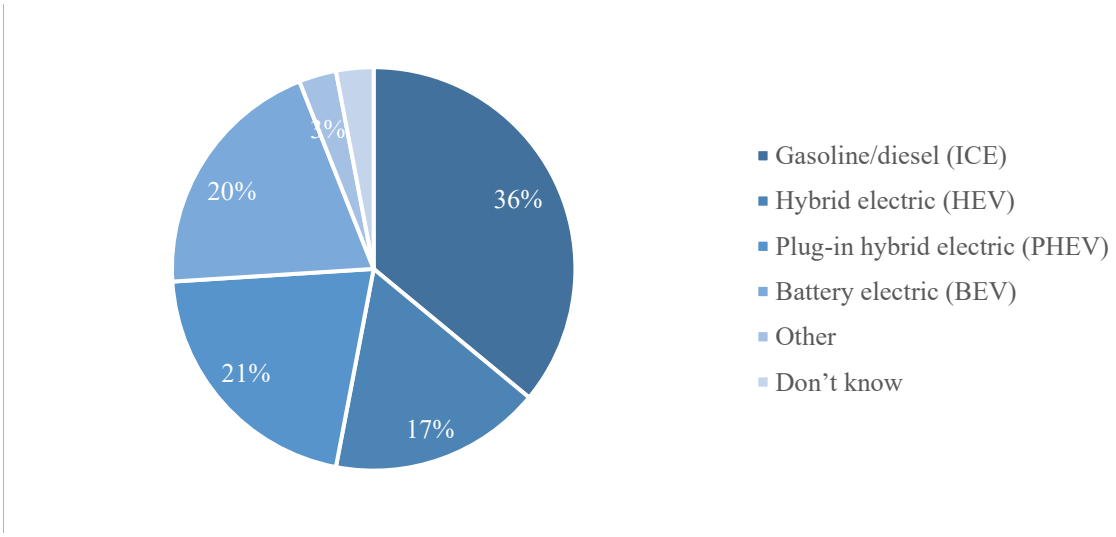


Figure 4-13: Preference for type of engine in next vehicle in Thailand 2024

Source: Deloitte (2025)

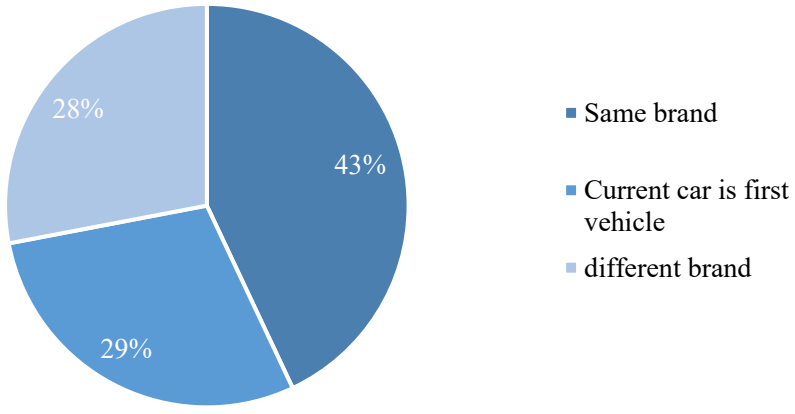
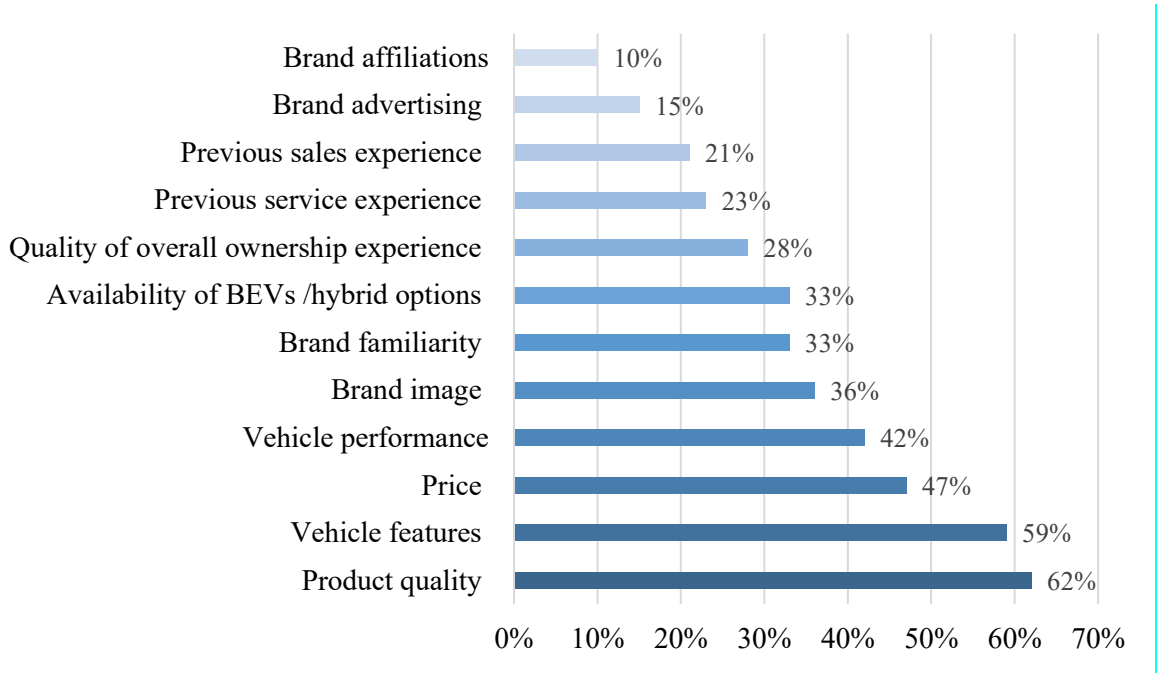


Figure 4-14: Consumers using same brand as previous cars in Thailand 2024

Source: Deloitte (2025)



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 4-15: Most important factors driving the choice of brand for next vehicle in Thailand 2024

Source: Deloitte (2025)

Figure 4-13 to Figure 4-15 provide insight into evolving consumer preferences for vehicle type and brand loyalty in Thailand. The findings reveal that a majority of respondents (36%) still prefer internal combustion engine (ICE) vehicles for their next purchase, while 21% favor plug-in hybrid models (PHEV), 20% plan to purchase Battery electric (BEV), and only 17% prefer Hybrid electric (HEV), reflecting the region's gradual but cautious transition toward electrification. In terms of brand loyalty, 43% of consumers intend to purchase the same brand as their current vehicle, while 29% are first-time car owners, and 28% plan to switch brands.

However, brand-switching intentions are high (67%), suggesting intensifying competition in the regional market. The most influential factors driving brand selection are product quality (62%), vehicle features (59%), and price (47%), indicating Thai consumers prioritize tangible value and reliability over brand legacy. Overall, the results highlight a market in transition where practical considerations and quality perceptions continue to dominate purchasing behavior, even as interest in electrified vehicles grows steadily.

Taken together, these findings indicate that Thai consumers are gradually embracing electric mobility, but their purchasing behavior continues to be shaped by practical considerations such as driving range, charging speed, affordability, and product quality. While awareness of sustainability and environmental benefits is increasing, widespread EV adoption will depend on the region's ability to address infrastructure challenges, improve charging efficiency, and enhance consumer confidence through reliable performance and value-driven offerings.

4.6.2.3. Infrastructure Availability

As Thailand's EV market continues to develop, the availability and accessibility of charging infrastructure play a decisive role in shaping consumer confidence and adoption. Adequate home, workplace, and public charging options are essential to support the transition from conventional vehicles to BEVs. Consumer expectations in Thailand reflect growing demand for convenience, reliability, and integration of charging solutions into daily life and travel routines.

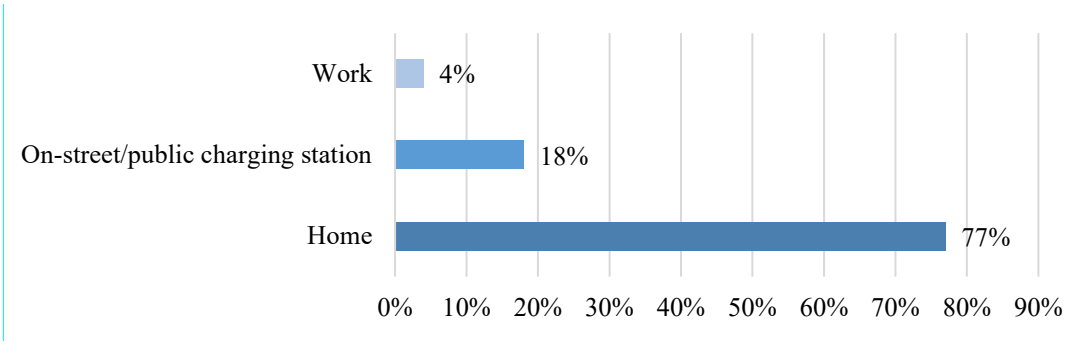


Figure 4-16: BEV charging expectation in Thailand 2024

Source: Deloitte (2025)

According to the Deloitte Global Automotive Consumer Study Southeast Asia perspectives (2025), Figure 4-16 illustrates the preferred locations for BEV charging in Thailand. The majority (77%) expect to charge their vehicles primarily at home, reflecting a preference for convenience and cost efficiency. Meanwhile, 18% anticipate using on-street or public charging stations, and 4% plan to charge at work, suggesting that while home charging remains dominant, public and workplace infrastructure still play an important complementary role in supporting daily EV use.

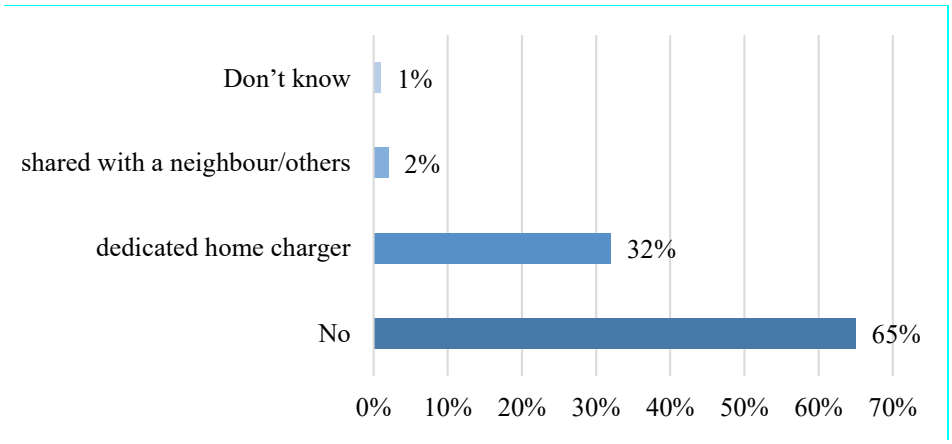
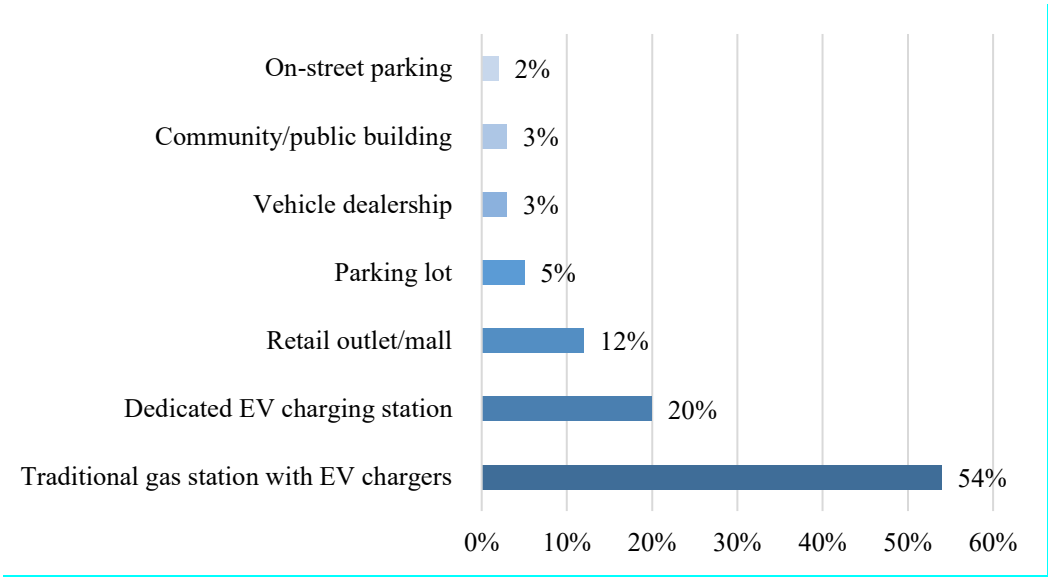


Figure 4-17: Home BEV charger plan in Thailand 2024

Source: Deloitte (2025)

Figure 4-17 presents consumers' plans for home BEV chargers. More than half of respondents (65%) stated they do not plan to install a home charger, while 32% intend to set up a dedicated home charger and 2% plan to share chargers with neighbors or others. The remaining 1% were unsure. These responses highlight the challenge of limited residential charging accessibility, particularly for apartment

dwellers, and emphasize the need for public-private initiatives to expand convenient home-charging solutions across the region.



Note: Percentages may not add up to 100 due to rounding.

Figure 4-18: Preference for public BEV charging location in Thailand 2024

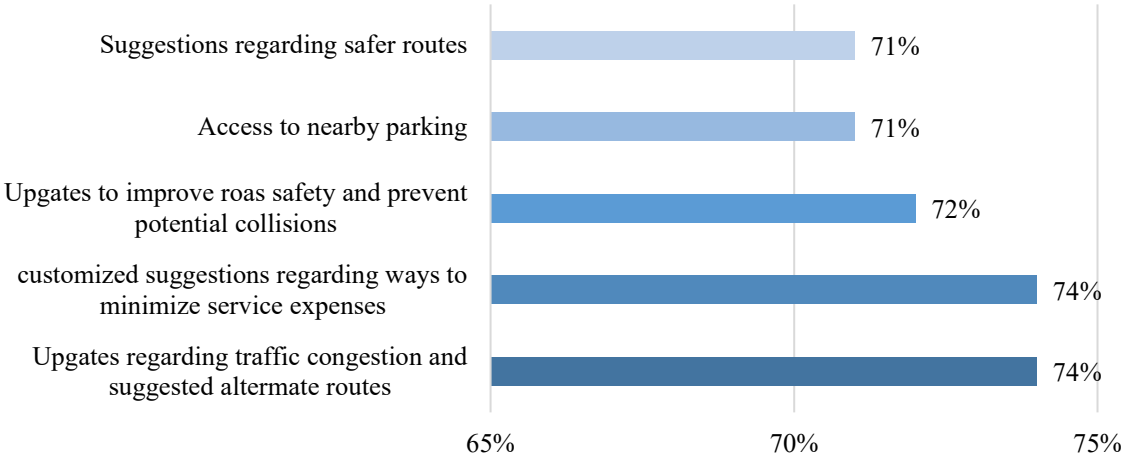
Source: Deloitte (2025)

Figure 4-18 shows consumer preferences for public BEV charging locations. The most favored options is traditional gas stations with EV chargers (54%) follow by dedicated EV charging stations (20%), indicating a continued reliance on familiar refueling environments during the transition to electrification. Other preferred sites include retail outlets or malls (12%) and parking lots (5%), where drivers can conveniently charge while engaging in other activities. These findings demonstrate that Thai consumers value accessibility and integration of charging points within existing mobility and lifestyle patterns, reinforcing the importance of strategically located public charging infrastructure.

Overall, the survey findings suggest that for Thailand, accelerating EV adoption will depend heavily on expanding both home and public charging accessibility, enhancing charging speed, and improving interoperability across networks. Strengthening these infrastructure foundations will be key to supporting consumer confidence and ensuring a smooth, large-scale transition toward sustainable mobility.

4.6.2.4. Experience with NEV

As NEVs evolve beyond electrification, the integration of smart and connected technologies has become a major factor influencing consumer experience and satisfaction. Features that enhance convenience, safety, and cost efficiency are increasingly shaping consumer perceptions of value and driving interest in next-generation vehicles. This trend reflects the broader regional shift toward intelligent mobility ecosystems, where connectivity complements sustainability as a core element of automotive innovation.



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 4-19: Level of consumer interest in connected vehicle features in Southeast Asia 2023

Source: Deloitte (2024)

According to the Deloitte Southeast Asia Consumer Survey, Figure 4-19 illustrates the level of consumer interest in connected vehicle features. The findings reveal consistently high interest across various functionalities, with 74% of respondents valuing real-time updates on traffic congestion and alternate routes, as well as customized suggestions to minimize service expenses. Similarly, 72% expressed interest in features improving road safety and collision prevention, while 71% favored access to nearby parking and safer route suggestions. These results demonstrate that Southeast Asian consumers prioritize digital solutions that enhance driving efficiency and safety. For Thailand, this trend underscores a growing appetite for connected vehicle ecosystems that merge electrification with intelligent mobility—marking a key step toward the country's broader smart transportation vision.

4.6.2.5. Information Access & Awareness

Access to accurate information and trust in data management play a central role in shaping consumer confidence toward electric and connected vehicles. As the Thai automotive market transitions toward greater digitalization and electrification, consumers increasingly expect transparency, safety, and personal engagement throughout the purchasing and ownership experience.

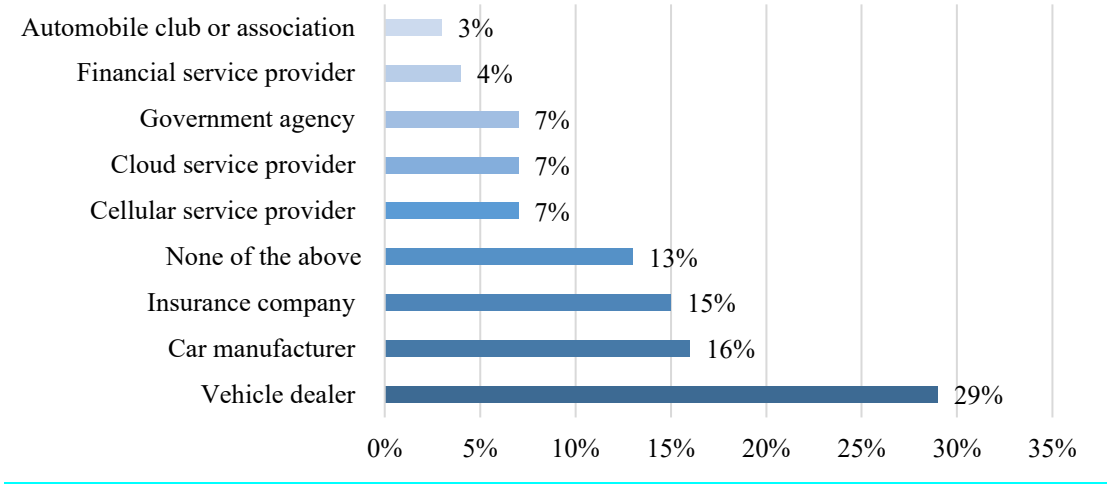
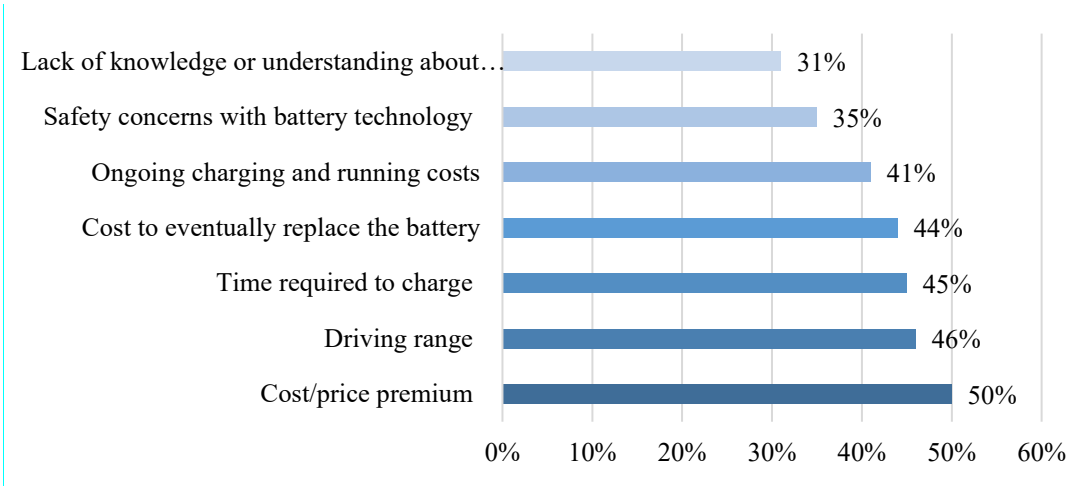


Figure 4-20: Percentage of most trusted entity for managing vehicle data in Thailand 2024

Source: Deloitte (2025).

According to the Deloitte Global Automotive Consumer Study Southeast Asia perspectives (2025), Figure 4-20 highlights the level of trust consumers place in different entities for managing vehicle data. The results show that vehicle dealers (29%) are viewed as the most trusted entities, followed by car manufacturers (16%) and insurance companies (15%). Other organizations, such as government agencies (7%), cellular service providers (7%) and cloud service providers (7%) receive moderate trust, while financial service providers and automobile associations rank the two lowest. These findings emphasize that consumers place the greatest confidence in entities directly linked to their vehicles, particularly those with established reputations for reliability and accountability.



Note: Sum of the percentages exceed 100% as respondents can select multiple options.

Figure 4-21: The concern on BEVs usages in Thailand 2024

Source: Deloitte (2025)

Figure 4-21 presents key concerns related to BEV usage in Thailand. The top issues cited include cost or price premium (50%), driving range (46%), and time required to charge (45%), followed by concerns about battery replacement costs (44%) and ongoing charging/running cost (41%). These findings underline that convenience and long-term affordability remain primary obstacles to BEV adoption,

reinforcing the need for continued investment in fast-charging infrastructure, transparent maintenance policies, and consumer education.

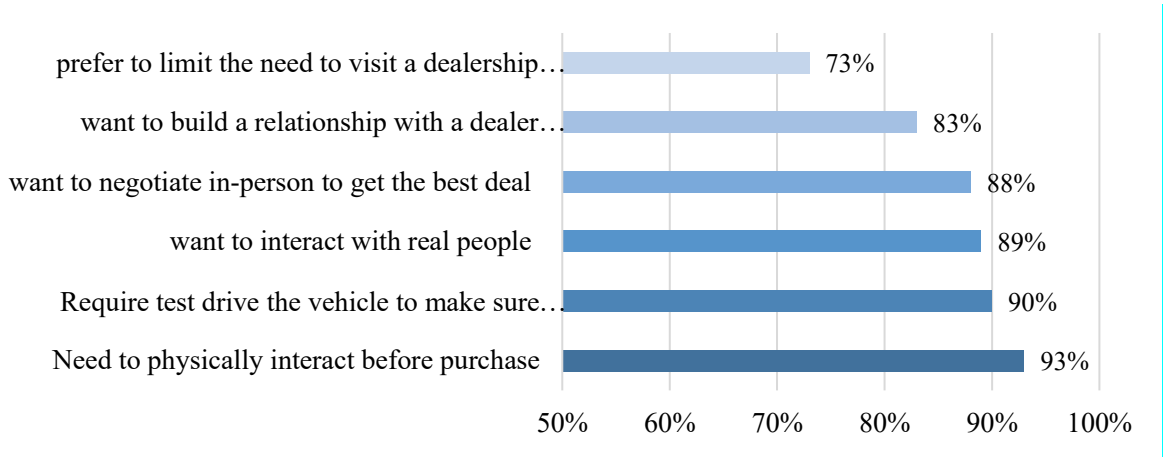


Figure 4-22: Level of agreement on purchase experience aspects in Thailand 2024

Source: Deloitte (2025)

Meanwhile, Figure 4-22 explores consumer preferences regarding the purchase experience. The vast majority of respondents (93%) expressed the need for physical interaction before purchase, with 90% requiring a test drive and 88% preferring in-person negotiation. Despite the rise of online sales channels, 89% still value human interaction, and 83% emphasize long-term relationships with dealers, while only 73% prefer minimal dealership visits. These results suggest that while digital engagement is expanding, in-person experiences continue to be vital in building consumer trust and satisfaction in the automotive market.

Overall, the findings indicate that Thai consumer confidence in NEVs and connected vehicles depends not only on technological reliability but also on transparency, data trust, and the quality of personalized interactions throughout the purchase journey.

4.6.2.6. Intelligent Connected Vehicle Services

The rise of intelligent and connected vehicle technologies marks the next frontier in Thailand's mobility transformation. As the country advances toward digital integration, artificial intelligence (AI), connectivity, and automation are increasingly shaping both consumer expectations and willingness to pay for advanced in-vehicle services. These trends highlight how digital trust, perceived value, and technological readiness are influencing the pace of adoption, particularly in emerging markets such as Thailand.

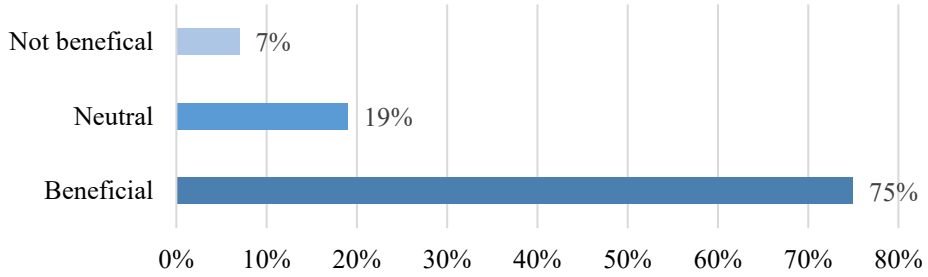


Figure 4-23: Perceived benefit of AI in vehicle systems in Thailand 2024

Source: Deloitte (2025)

According to the Deloitte Global Automotive Consumer Study Southeast Asia perspectives (2025), Figure 4-23 shows that a significant majority of consumers (75%) perceive AI in vehicle systems as beneficial, while 19% remain neutral and only 7% view it as not beneficial. This demonstrates strong consumer confidence in AI-driven applications such as predictive maintenance, adaptive safety systems, and intelligent navigation, which are increasingly seen as essential components of next-generation mobility.

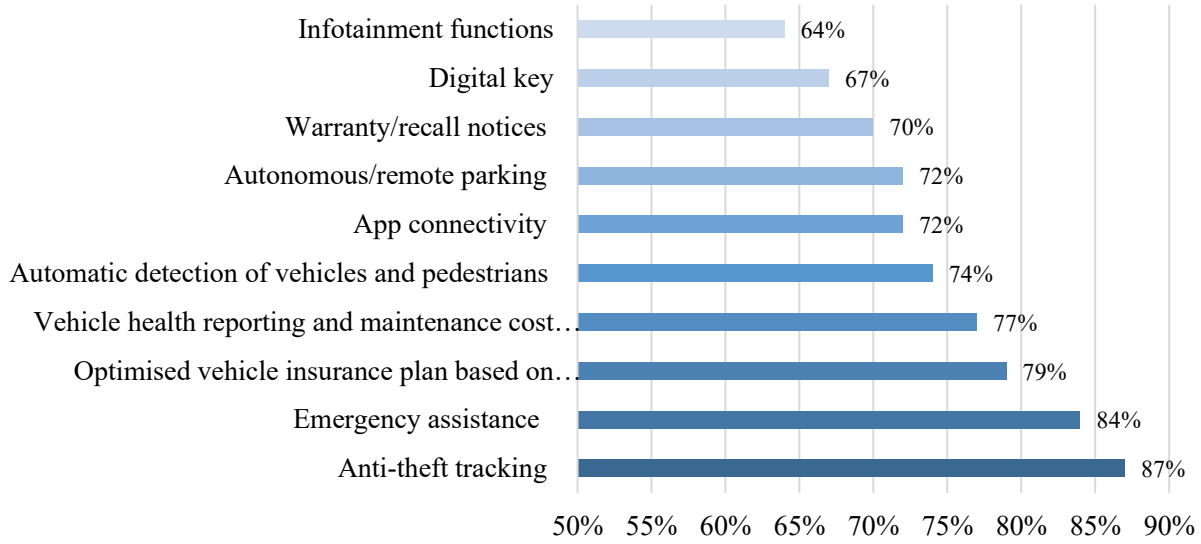


Figure 4-24: Willingness to pay extra for connected vehicle services in Thailand 2024

Source: Deloitte (2025)

Figure 4-24 further illustrates consumers' willingness to pay extra for connected vehicle services, revealing particularly strong interest in features that enhance security and reliability. The top priorities include anti-theft tracking (87%), emergency assistance (84%), and optimised vehicle insurance plan based on driving habits (79%), followed closely by vehicle health monitoring and automatic detection of vehicles and pedestrians. This willingness reflects growing acceptance of technology-based value propositions, suggesting that Thai consumers increasingly view connected services not as luxury add-ons but as core to modern vehicle ownership.

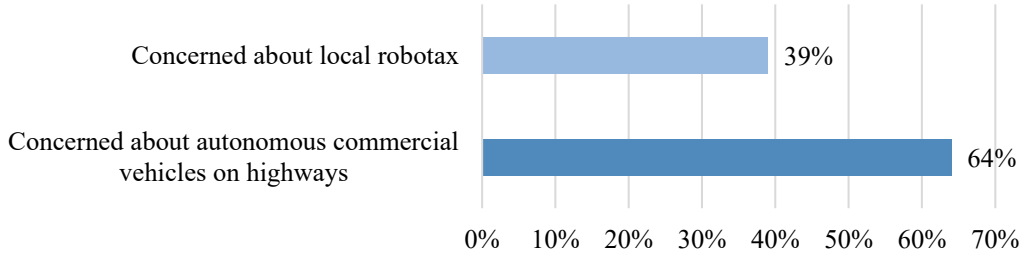


Figure 4-25: Concerned about local robotaxi services and autonomous commercial vehicles on highways in Thailand 2024

Source: Deloitte (2025)

Meanwhile, Figure 4-25 highlights concerns surrounding autonomous mobility, with 64% of respondents expressing apprehension about autonomous commercial vehicles on highways and 39% voicing concern about local robotaxi services. These figures underscore ongoing skepticism about safety, reliability, and regulatory readiness in the region's transition toward automated driving.

Overall, the findings indicate that Thailand is increasingly receptive to AI-enabled and connected vehicle technologies, yet remains cautious about full automation. Building consumer trust through clear regulation, robust safety standards, and transparent communication will be essential for advancing intelligent mobility and accelerating the region's path toward smart transportation ecosystems.

4.7 Assessment of NEV & Smart Mobility Market Preparedness (TU)

4.7.1. Country Assessment

Thailand's Market Readiness Index has an overall score of 2.8, reflecting a moderate level of preparedness to support the development of NEV market and its related ecosystem. Across the five evaluated dimensions (Figure 4-26:), road and digital infrastructure exhibit the highest readiness (3.2), indicating that Thailand possesses a supportive foundation for EV adoption. Vehicle technology also achieves a relatively strong score (3.0), reinforcing the country's growing position as a regional production base. Policy readiness is moderate (2.7), mainly driven by the readiness of certain financial incentives for NEV adoption and charging infrastructure for both personal use and public station. The market status score (2.7) signals that Thailand remains in an early stage of EV adoption, with limited market penetration. The lowest score is observed in energy infrastructure (2.3), emphasizing the need for increased investment in charging networks and energy capacity.

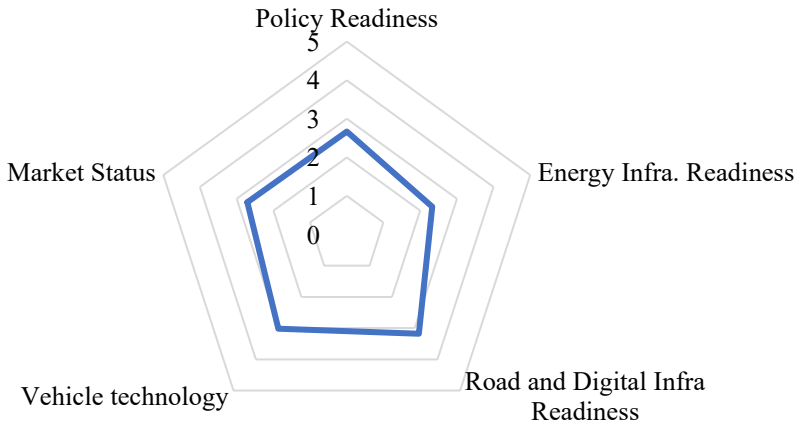


Figure 4-26: Market Readiness Index in Thailand

Source: Author's calculation.

4.7.1.1. Market Status Index

The Market Status index is constructed using annual data reported by the Department of Land Transportation (2025), providing a standardized basis for subsequent index score analysis. The BEV Penetration, the PHEV, REEV Penetration, and the ICV Penetration (L2 Autonomous) indices are calculated from the ratio of BEV/ PHEV, REEV/ICV sales to total sales in 2024 using annual data reported by the Department of Land Transportation (2025) and Statista Market Insights (2024).The motorization rate index is calculated from car ownership per 1,000 people using data reported from PwC Automotive ASEAN (2025). In addition, the DC Fast Charging Share Index measures the proportion of public EV charging connectors that are DC fast chargers by using data from EV-roads (2024). Finally, the BEV Price and PHEV, REEV Price indices are computed as the ratios of BEV/ PHEV, REEV to ICE prices by model segment using car prices from the Electric Vehicle Association of Thailand (EVAT) (2025).

Thailand's market readiness remains in the early stages of transitioning from conventional internal combustion engine (ICE) vehicles to new energy mobility. The country's Market Status Index (2.7) is primarily driven by significant developments in DC fast-charging infrastructure (5.0), followed by moderate performance in BEV penetration (3.0), BEV price competitiveness (3.0), ICV penetration (3.0), and the motorization rate (3.0).

Currently, DC fast chargers account for nearly 50% of all national charging points, providing a vital alternative for Bangkok residents in high-rise dwellings with limited home-charging access. Furthermore, the expanding nationwide network has effectively reduced range anxiety and bolstered driver confidence for long-distance travel across all regions.

Thailand's BEV penetration (3.0) is moderately high, signaling the emergence of an early majority market. This growth is propelled by robust government incentives under the EV 3.0 and EV 3.5 frameworks, alongside substantial investments from Chinese Original Equipment Manufacturers (OEMs) such as BYD, Great Wall Motor, MG, and GAC. Simultaneously, BEV price competitiveness (3.0) has improved as several electric models reach price parity with, or even undercut, comparable gasoline vehicles in both entry-level and premium segments. This price convergence has lowered adoption barriers, making BEVs increasingly accessible to domestic consumers.

In contrast, ICV penetration (3.0) (Level 2 automation) remains modest, indicating that Thailand is still maturing its regulatory and technological frameworks for autonomous driving. Similarly, the motorization rate (3.0) reflects an expanding but still developing automotive base.

However, the PHEV and REEV segments (1.0) are in the nascent stages of development, as most manufacturers have yet to prioritize their commercialization. In 2024, these vehicles accounted for only 1% of total sales, with price competitiveness (1.0) remaining a significant hurdle. PHEV and REEV models carry a substantial price premium—approximately 20–50% higher than internal combustion engine vehicles—which severely weakens the economic incentive for consumer adoption and constrains short-term growth potential.

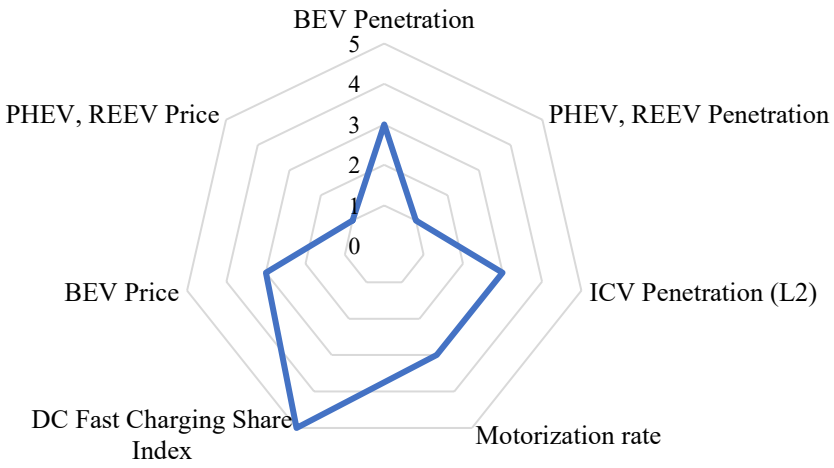


Figure 4-27: Market Status Index in Thailand

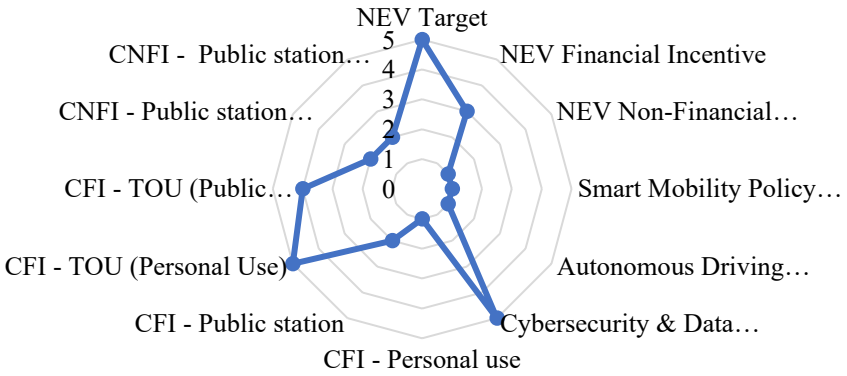
Source: Author's estimation

4.7.1.2. Policy Readiness Index

Thailand's Policy Readiness Index (2.7) reflects a diverse landscape of strategic strengths and significant regulatory gaps across eleven key dimensions. The nation's highest performance is found in NEV Targets (5.0), which mirrors clear national ambitions for electrification, and Cybersecurity & Data Privacy (5.0), underscoring a robust focus on safeguarding the digital infrastructure of EVSE and CAV systems. Furthermore, Thailand excels in Charging Financial Incentives – ToU for Personal Use (5.0); by offering off-peak electricity rates that are 55% lower than peak prices, the government has created a highly effective mechanism for optimizing grid utilization and reducing costs for residential users. This is complemented by a strong Charging ToU – Public Stations (4.0) framework, where operators utilize the "Low Priority Program" and time-based tariffs to manage operational expenses, though full optimization still relies on the adoption of advanced energy management technologies.

Despite these successes in tariff structures, other fiscal and experimental areas show more moderate progress. NEV Financial Incentives (3.0) remain steady due to tax reductions and import duty exemptions, while Charging Financial Incentives – Public Stations (2.0) provide tax-based support through the BOI for large-scale installations but lack direct operational subsidies. Emerging technologies such as Energy Arbitrage (2.0) and Vehicle-to-Grid (V2G) (2.0) remain in the nascent pilot phase, constrained by high hardware costs and the absence of a formalized regulatory framework, even as they appear in the national smart grid roadmap.

Significant underperformance persists in areas critical to the broader mobility ecosystem. Both NEV Non-Financial Measures (1.0) and Smart Mobility Policy Focus (1.0) indicate a lack of integrated urban planning or preferential access incentives. Furthermore, the absence of a structured regulatory framework for Autonomous Driving Pilot Licensing (1.0) hinders the testing and deployment of self-driving technologies. Finally, the lack of Charging Financial Incentives for Personal Use (1.0) remains a primary barrier, as no direct subsidies exist for individual residential charger installations. For Thailand to move toward a fully electrified ecosystem, comprehensive policy reinforcement is required to bridge these gaps in residential support and autonomous vehicle regulation.



Note: CFI - Charging Financial Incentive; CNFI - Charging non-Financial Incentive

Figure 4-28: Policy Index in Thailand

Source: Author's calculation.

4.7.1.3. Energy Infrastructure Readiness Index

Thailand's Energy Infrastructure Readiness Index evaluates the national energy system's capacity to support the transition to new energy mobility across three core dimensions. The country demonstrates a high level of Smart Grid Readiness (4.0), supported by a 2024 Smart Grid Index score of 73.2. This leading position within ASEAN is underpinned by the deployment of advanced metering infrastructure (AMI), grid digitalization, and demand-side management programs. These advancements enhance system intelligence and automation, allowing the grid to better accommodate rising EV charging demands and the future integration of distributed energy resources (DERs), such as renewable energy and battery storage systems.

In contrast, the Standardization of Charging Communication Protocols (2.0) remains a significant hurdle. While foundational technical standards like the Open Charge Point Protocol (OCPP) have been partially adopted, Thailand lacks a unified national communication platform. The current landscape is fragmented, with major providers—such as NEV Station PluZ, EA Anywhere, and Sharge—operating proprietary digital applications and billing systems. This absence of formal regulatory enforcement for centralized harmonization impedes seamless interoperability between vehicle-side communication and charging network operations, which is essential for a mature ecosystem.

The most critical challenge identified is the NEVs per Charging Pile Ratio (1.0), highlighting a substantial gap between rapid vehicle adoption and infrastructure rollout. As of mid-2025, Thailand has registered 903,151 cumulative NEVs, yet only approximately 12,149 charging connectors (roughly

6,000 piles) are available. This results in an imbalanced ratio of 150 NEVs per charging pile, indicating potential constraints in infrastructure availability during peak periods and uneven spatial distribution across regions. While the expansion of stations has accelerated in major cities, the current trajectory falls short of demand. Moving forward, Thailand must prioritize strengthening regulatory frameworks for platform standardization and accelerating both AC and DC infrastructure deployment to ensure a resilient and scalable NEV system.

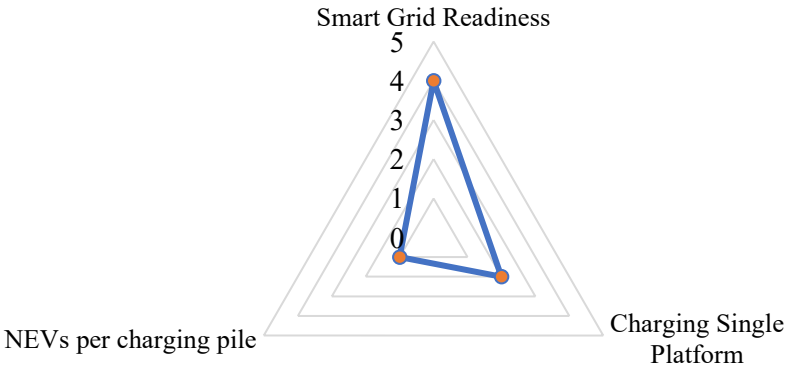


Figure 4-29: Energy Infrastructure Index in Thailand

Source: Author's calculation.

4.7.1.4. Road and Digital Infrastructure Readiness Index

Thailand's Road and Digital Infrastructure Readiness Index evaluates the capacity of the national transport and communication systems to support New Energy Vehicles (NEVs) across five dimensions. The nation achieves its highest readiness in 5G Coverage and Mobile Connection Speed (4.8), reflecting a robust digital infrastructure that positions Thailand as a regional frontrunner. This high level of connectivity is a critical foundation for vehicle-to-infrastructure (V2I) communication and the future deployment of automated driving technologies. Additionally, the Road Environment (4.0) dimension demonstrates strong readiness, driven by successful government efforts to upgrade street lighting, signage, and roadside safety facilities, which benefit both conventional and electric vehicles.

However, the assessment reveals significant weaknesses in technical traffic management and physical road infrastructure. Traffic Management Systems (1.0) score at the lowest level, indicating that Intelligent Transportation System (ITS) implementation is largely confined to isolated metropolitan pilot projects rather than a systematic nationwide network. This lack of coordination hinders real-time mobility services and the ecosystem integration required for advanced NEV operations. Similarly, Traffic Separation (3.0) remains moderate; while some areas utilize designated lanes, the infrastructure is insufficient to systematically reduce congestion or enhance safety for heterogeneous traffic flows on a national scale.

The physical quality of the network also presents a mixed outlook. Road Quality (3.1) is rated as moderate, as significant variations in surface integrity and maintenance standards persist between developed highway corridors and regional roads. These discrepancies pose operational risks and necessitate targeted infrastructure improvements to ensure safe and efficient NEV travel. Overall, while Thailand's digital foundation is exceptionally strong, the full operationalization of NEVs is currently impeded by underdeveloped traffic management systems and uneven road standards, requiring a shift toward more integrated and intelligent transportation planning.

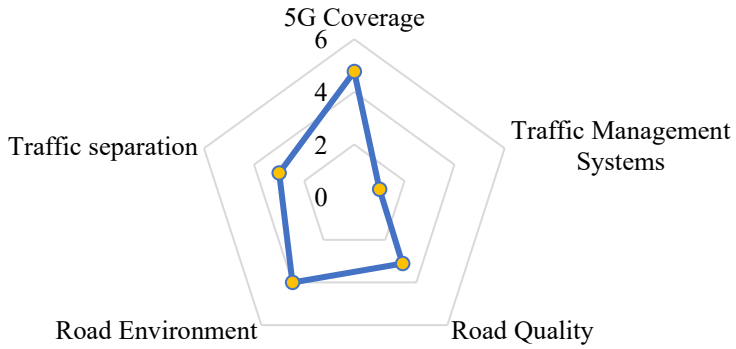


Figure 4-30: Road and Digital Infrastructure Index in Thailand

Source: Author's calculation.

4.7.1.5. Vehicle technology Readiness Index

Thailand's Vehicle Technology Index evaluates the performance and maturity of electrified offerings across five key indicators. The country exhibits a moderate level of technology readiness, with a Market Experience (3.0) score reflecting approximately five years of systematic development since the implementation of the EV 3.0 policy framework in 2022. As of 2025, Thailand has reached a significant milestone by transitioning from a trial import market to domestic EV production. This policy-driven momentum is further reflected in the strong BEV Product Offering (Range Distance) (4.3) score, as battery technology has advanced to provide an average driving range of 400–500 kilometers. These improvements are bolstered by the entry of global manufacturers, particularly from China, who have introduced high-performance models that meet the diverse needs of Thai consumers.

The diversification of the market is evidenced by a moderate BEV Model Variety (3.0), with product offerings expanding beyond passenger cars to include electric pickup trucks and various body styles. This variety significantly lowers adoption barriers by providing accessible options across multiple vehicle segments. However, a notable contrast exists within the hybrid markets; PHEV and REEV Product Performance (3.0) and Model Variety (2.0) remain underdeveloped. The electric-only range for these vehicles typically stays between 60 and 100 kilometers, and the limited selection of models suggests that manufacturers continue to prioritize BEVs. This secondary role of hybrid technologies in the national strategy constrains consumer choice and indicates that while Thailand is a regional leader in battery-electric technology, the broader spectrum of electrified powertrains has yet to reach full maturity.

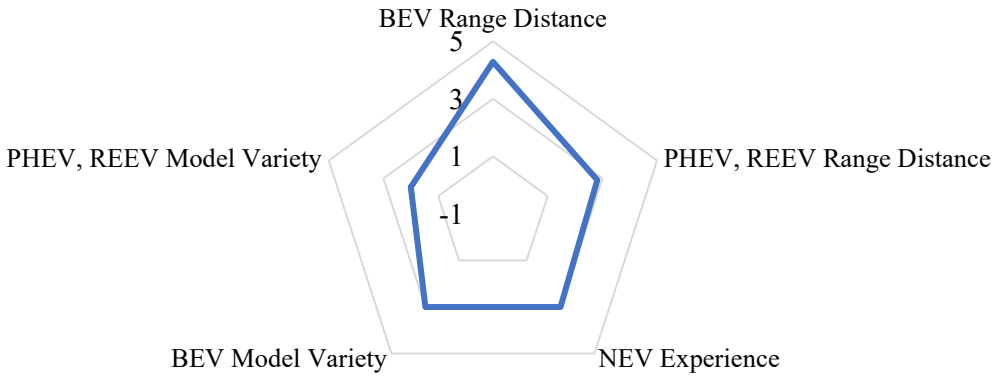


Figure 4-31: Vehicle Technology Index in Thailand

Source: Author's estimation

4.7.2. Key Success Factors and Gap Analysis

4.7.2.1. Key Success Factors

These are factors as the "engines" driving Thailand's leadership in the NEV landscape.

1) Aggressive Policy "Carrots" (EV 3.0 & 3.5): The government's decisive subsidy programs (up to THB 150,000) and tax incentives have been the single most effective trigger for market seeding. This has not only lowered the "entry barrier" for consumers but also forced global OEMs to commit to local production by 2026 to avoid penalties.
2) The "ToU" Tariff Advantage: A standout success is the Time-of-Use (ToU) (5.0) electricity pricing. By offering a ~55% discount for off-peak charging, Thailand has successfully used price signals to manage grid load while simultaneously making the "Total Cost of Ownership" (TCO) for BEVs significantly lower than gasoline alternatives.
3) Strategic OEM "China-Plus" Partnership: Thailand has successfully positioned itself as the primary regional production hub for Chinese EV giants (BYD, GWM, MG, GAC). This partnership has rapidly solved the Model Variety (3.0) and Price Competitiveness (3.0) issues that typically plague emerging markets.
4) Digital Connectivity Leadership: With 5G Coverage (4.77) being a regional frontrunner, Thailand has the "high-speed nervous system" ready for the next phase of mobility. The digital infrastructure is already capable of supporting Vehicle-to-Infrastructure (V2I) and Smart Grid data flows.

4.7.2.2. Gap Analysis

Despite moderate overall readiness, three critical "bottlenecks" prevent Thailand from reaching an advanced, self-sustaining ecosystem:

1) Infrastructure Sufficiency & Interoperability Gaps
   - Density Crisis: The NEVs per Charging Pile (1.0) ratio remains a primary threat. With roughly 150 NEVs per pile, the infrastructure rollout has failed to keep pace with the 618% CAGR in vehicle sales. This gap is most acute in high-rise urban clusters (Bangkok) and rural regional corridors, maintaining high levels of range anxiety.

- Platform Fragmentation: The charging landscape is "digitally siloed." Most operators utilize proprietary platforms (2.0), lacking a unified national standard. This fragmentation restricts digital monitoring, prevents seamless user billing across networks, and delays the adoption of Vehicle-to-Grid (V2G) and energy arbitrage technologies.

2) Weak Policy & Governance Architecture
   - Incentive-Centric vs. System-Centric: Thailand's policy architecture remains focused on financial "carrots" (subsidies) rather than "systemic sticks" or regulatory frameworks.
   - Governance Silos: There is a notable weakness in inter-agency coordination across the Ministry of Energy, transport authorities, and digital regulators. This results in the absence of Autonomous Vehicle (AV) pilot regulations (1.0) and a lack of support for residential charging development, which is vital as the market moves beyond early adopters to high-rise residents.
3) The "Intelligent" Integration Gap
   - Passive vs. Active Technology: While digital infrastructure is strong, its translation into Intelligent Transport Systems (ITS) (1.0) is minimal. Thailand has the 5G "pipe" but lacks the "application" for real-time traffic coordination, lane management, and traffic separation.
   - Regional Disparity: A "Road Quality Gap" (3.11) persists, where regional surface conditions and safety infrastructure vary wildly, undermining the operational safety of sophisticated ADAS systems in cross-regional use cases.
4) Fragile Consumer Confidence
   - The After-Sales "Service Desert": Local confidence is currently suppressed by a perceived lack of long-term reliability in the service ecosystem. Consumers report high anxiety regarding extended lead times for spare parts, with some documented cases of vehicles remaining inoperative for months while waiting for specialized components. This "spare parts black hole" has fundamentally challenged the narrative of EVs as a lower-maintenance alternative to ICE vehicles.
   - Warranty and Insurance Volatility: In 2025, the market was rattled by rising insurance premiums (up 20–25%) and unclear battery warranty conditions. For many households, these hidden costs have eroded the "low cost of ownership" advantage. Additionally, the rapid price reductions by competing OEMs—while improving affordability—have negatively impacted resale values, leaving early buyers feeling "shortchanged" and undermining overall market trust.
   - The "Orphan Car" Fear: The financial instability of certain early-entrant brands has fueled fears of "orphan cars" (vehicles with no manufacturer support). Strengthening consumer confidence will require more than just lower prices; it necessitates the implementation of "Lemon Laws" and mandatory service center density regulations to protect buyers during the vehicle's entire lifecycle.

4.8 Policy Recommendations

Thailand has established a solid foundation for NEV development, driven by strong fiscal incentives, growing domestic production, and advanced digital connectivity. However, the readiness assessment and gap analysis indicate that future progress will depend less on market seeding and more on systemic integration, infrastructure sufficiency, regulatory coordination, and consumer confidence. Policy priorities should therefore shift from incentive-led expansion toward ecosystem consolidation and intelligent mobility integration.

1) Strengthening Local Production, Technology Localization, and Model Diversification

Thailand should deepen the localization of NEV manufacturing beyond final vehicle assembly by prioritizing upstream and midstream components, including battery module and pack assembly, electric drivetrains, power electronics, and vehicle software systems. Building on the success of BOI incentives that have attracted global OEMs, future incentive schemes should explicitly reward technology transfer, local supplier development, and workforce upskilling. Joint ventures between foreign manufacturers and Thai firms should be encouraged, particularly in battery systems, thermal management, and embedded software, to enhance domestic value creation. Furthermore, policy support should promote diversification beyond BEVs to include PHEVs and REEVs as transitional technologies, especially for long-distance and commercial applications where charging constraints remain. This approach would strengthen Thailand's resilience as a regional production hub and reduce overdependence on a single powertrain pathway.

2) Accelerating Charging Infrastructure Deployment and Regional Equity

Thailand must urgently address the imbalance between NEV growth and charging infrastructure availability, as reflected by the high NEVs-per-charging-pile ratio. Policy should prioritize the accelerated deployment of both DC fast chargers and destination-based AC chargers through a combination of direct subsidies, concessional financing, and streamlined permitting. Strategic corridors—such as Bangkok–Chiang Mai, Bangkok–Eastern Economic Corridor (EEC), and cross-border logistics routes—should be designated as national fast-charging backbones to support long-distance travel, freight movement, and tourism. In addition, regional and municipal governments should be empowered with co-funding mechanisms to deploy chargers in secondary cities and rural areas, reducing spatial inequality and preventing EV adoption from becoming an exclusively urban phenomenon.

3) Mandating Interoperability and Digital Platform Harmonization

The fragmentation of charging platforms and proprietary applications presents a structural bottleneck for Thailand's NEV ecosystem. National interoperability standards should be mandated to ensure seamless roaming, unified payment systems, and standardized data exchange across charging networks. Regulatory enforcement of open communication protocols—such as OCPP and ISO 15118—should be strengthened, with clear compliance timelines for operators. A centralized national charging data platform, potentially managed by a neutral public entity, could support real-time monitoring, planning, and integration with smart grid operations. This harmonization is essential for enabling advanced applications such as smart charging, energy arbitrage, and future Vehicle-to-Grid (V2G) services.

4) Integrating NEVs with Renewable Energy and Grid Modernization

NEV expansion must be more closely aligned with Thailand's renewable energy and power development strategies. Charging demand forecasts should be systematically incorporated into PDP and AEDP planning processes to ensure grid adequacy and avoid localized congestion. Policies should incentivize co-location of charging hubs with renewable generation sources, particularly solar PV,

complemented by battery energy storage systems. At the consumer and fleet levels, on-site solar-plus-storage solutions should be promoted through investment incentives and net-metering reforms. This integrated approach would reduce lifecycle emissions, enhance energy security, and position NEVs as an asset rather than a burden to the power system.

5) Expanding and Refining Time-of-Use (ToU) and Smart Charging Incentives

Thailand's ToU tariff structure is a proven success but remains underutilized outside residential users and large operators. The scope of ToU and Low Priority Rate schemes should be expanded to include fleet depots, logistics hubs, and small commercial operators, with stronger price signals to encourage off-peak charging. Complementary incentives for smart chargers, energy management systems, and demand-response participation should be introduced to maximize grid benefits. Over time, dynamic pricing models could be piloted in urban areas to reflect real-time grid conditions, paving the way for a more responsive and efficient charging ecosystem.

6) Establishing a Formal Regulatory Framework for Aggregators and V2G

While sandbox initiatives have enabled early experimentation with V2G and energy aggregation, Thailand lacks a formal regulatory structure to scale these solutions. The government should define clear licensing regimes, technical standards, and market participation rules for aggregators, including their role in demand response, ancillary services, and grid stabilization. Pilot projects should be transitioned into regulated commercial operations, particularly for public fleets, logistics operators, and corporate campuses. Formalizing this framework would unlock the latent value of NEVs as distributed energy resources and support long-term grid resilience.

7) Strengthening Smart Mobility and Intelligent Transport Systems (ITS)

Despite strong digital connectivity, Thailand's smart mobility deployment remains limited to isolated pilots. The government should prioritize large-scale ITS investments, including real-time traffic management, adaptive signal control, lane management, and vehicle-to-infrastructure (V2I) communication. National guidelines for smart mobility architecture should be developed to ensure interoperability across regions and agencies. Designated smart mobility pilot zones—such as urban cores, logistics hubs, and tourism destinations—could serve as testbeds for integrated NEV, CAV, and digital mobility solutions, accelerating learning and policy refinement.

8) Improving Policy Coordination and Governance Capacity

NEV and smart mobility policies are currently fragmented across energy, transport, industry, and digital agencies. Establishing a high-level National NEV and Smart Mobility Taskforce would enhance coordination, align incentives, and reduce regulatory inconsistencies. This body should oversee roadmap implementation, monitor performance indicators, and facilitate cross-sector data sharing. Stronger governance integration is essential to transition from incentive-driven market stimulation toward a mature, system-oriented mobility ecosystem.

9) Reinforcing Consumer Protection and After-Sales Service Ecosystems

Finally, sustaining consumer confidence requires addressing weaknesses in after-sales service, warranty clarity, and insurance stability. Minimum service center density requirements, spare parts availability obligations, and transparent battery warranty standards should be introduced for NEV manufacturers and importers. Consumer protection mechanisms—such as lemon laws or escrow requirements for new market entrants—would mitigate the risk of "orphan vehicles" and enhance trust. In parallel, workforce development programs for EV technicians and service personnel should be expanded to ensure long-term operational reliability across the country.

10) Priority Actions 2025–2030

As Thailand moves from infrastructure build-out to system integration, the period 2025–2030 will be decisive for shaping how NEV adoption aligns with clean energy goals. Policy efforts should focus on deepening market participation, reinforcing regional grid capacity, standardizing technical systems, and improving institutional coordination.

10.1) Strengthen Energy–Transport Integration

NEV charging development should be systematically linked to renewable energy expansion under PDP 2024 and AEDP 2024. Prioritizing corridor charging development near renewable zones will help ensure transport electrification contributes to emissions reduction rather than increasing fossil generation dependence.

10.2) Scale Up Aggregator Regulation and V2G Participation

The ERC should move from pilot projects under its regulatory sandbox to formal regulatory frameworks for aggregators. Clear rules for participation, technical standards, and data exchange will allow aggregators to provide flexibility services and participate in demand response markets.

10.3) Upgrade Regional Grid Capacity

Grid modernization must extend beyond metropolitan areas to PEA's service territories. Investment in digital monitoring, control infrastructure, and automated distribution systems is needed to support equitable access to fast charging and ensure reliability during peak demand periods.

10.4) Establish National Interoperability Standards

A single national communication platform for NEV charging should be formalized and fully operational by 2030. This will standardize protocols, enable smart charging and V2G operations, enhance user experience, and facilitate system monitoring and regulatory oversight.

10.5) Enhance Investment Incentives and Private Participation

BOI incentives should be more explicitly tied to smart charging technologies, interoperability compliance, and renewable integration. Clear long-term policy signals and stable tariff structures will help sustain private investment momentum and accelerate infrastructure rollout.

10.6) Strengthen Institutional Coordination

A National NEV–Energy Transition Taskforce should be established to coordinate policy, investment, and regulation among ERC, DEDE, BOI, EGAT, MEA, PEA, and the private sector. This coordination will improve policy coherence, reduce regulatory uncertainty, and accelerate implementation.

Chapter 5 State of Preparedness of Lao PDR

5.1 Market and Adoption Status

5.1.1. NEV Market Trend

5.1.1.1. NEV Registration

According to vehicle registration data from the Ministry of Public Works and Transport (MPWT)[71], motorcycles continue to serve as the dominant mode of transport in the Lao PDR. Cumulative national registration records from 2020 to 2024 show that a total of 7,228 electric vehicles (EVs) have been registered, the majority of which are sport utility vehicles (SUVs), accounting for 4,983 units. This category constitutes the largest share of EVs, representing approximately 5.3% relative to internal combustion engine (ICE) SUVs, as presented in Table 5-1.

Table 5-1: EV Registration 2020 – 2024 in Lao PDR

Vehicles type	EV	Normal (ICE)	Share of EV
Car	1,920	107,278	1.79%
Pick up	200	390,709	0.05%
SUV	4,983	94,042	5.30%
Bus	88	44,212	0.20%
Truck	25	102,771	0.02%
Big bus	12	6,584	0.18%
Total	7,228	745,596	0.97%

Note: EV Registration excludes HEV which has very small sale in the Lao market

Source: Author's compilation from Ministry of Public Works and Transport of Lao PDR

Geographically, the majority of EV registrations are concentrated in the capital city, Vientiane, reflecting both higher income levels and the relatively greater availability of charging facilities and dealership networks compared to other provinces. This pattern suggests that early EV adoption in Lao PDR remains primarily urban-centered, concentrated around major administrative and economic hubs.

Between 2024 and July 2025, the number of registered EVs continued to grow steadily. In 2024, total cumulative registrations stood at 7,228 units, and monthly growth averaged 6–7%. By July 2025, the cumulative total had reached approximately 11,390 units, as illustrated in Figure 5-1. This upward trend demonstrates the growing public interest and gradual diffusion of EVs within the Lao market, supported by early policy signals and emerging consumer awareness of electric mobility.

[71] https://mpwt.gov.la/en/

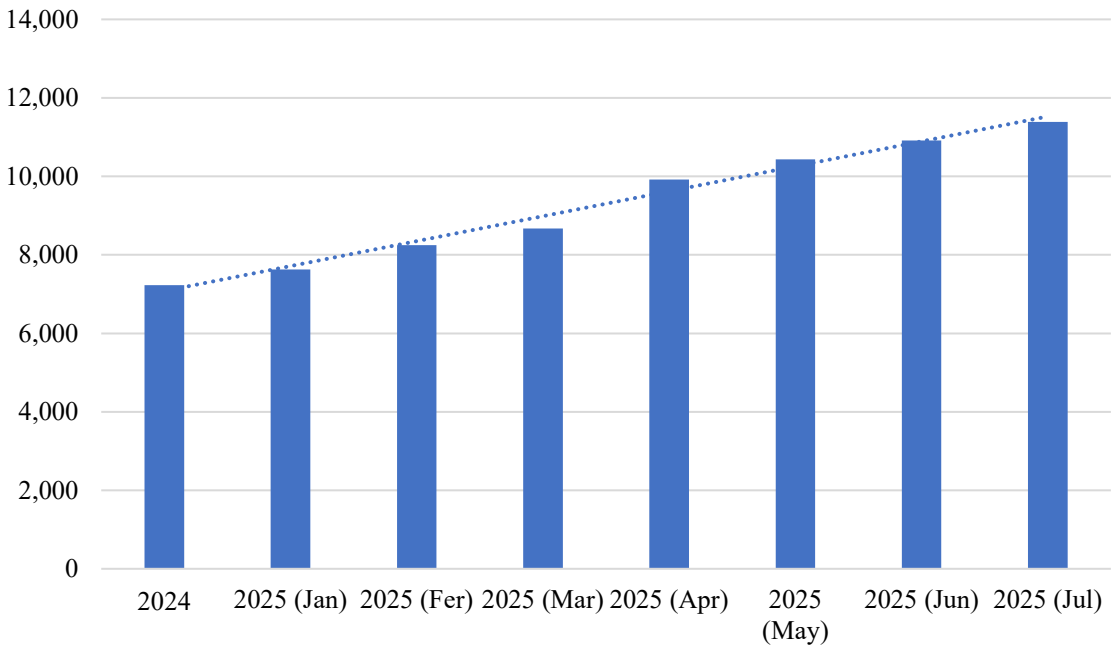


Figure 5-1: EV Registrations (Cumulative volume) in the Lao PDR, 2024–July 2025

Source: Author's compilation from Ministry of Public Works and Transport of Lao PDR.

5.1.1.2. NEV Sales

Lao PDR's vehicle market is relatively small and remains heavily reliant on imports, with limited local industrial activity in automotive manufacturing. According to available market estimates, annual vehicle registrations in Lao PDR range between 20,000 to 22,000 units, primarily consisting of passenger cars, light trucks, and motorcycles. The majority of these vehicles are imported from neighboring countries such as Thailand, China, and Vietnam, as Lao PDR does not currently host any significant domestic vehicle production or assembly operations. The electric vehicle (EV) segment is in an early phase of development but is showing encouraging signs of growth, particularly in urban areas where environmental awareness, rising fuel prices, and energy security concerns are influencing consumer interest.

While precise figures on EV penetration are limited, it is estimated that electric vehicles account for approximately 1–2% of the current vehicle fleet, with the majority being electric motorcycles and small battery electric vehicles (BEVs). The government's National EV Roadmap targets 30% EV penetration by 2030, indicating a substantial scaling-up effort in the coming years. Chinese automakers, particularly BYD, Dongfeng, and Wuling, have entered the Lao market with affordable models that appeal to cost-conscious consumers. These vehicles are typically sold through private dealerships, often bundled with charging solutions or promoted as energy-efficient alternatives to gasoline-powered cars and motorbikes.

In terms of infrastructure, public EV charging stations are still limited, with an estimated 50 to 60 operational units nationwide, mostly concentrated in Vientiane Capital and a few other urban hubs. The government, through the Ministry of Public Works and Transport, has outlined plans to significantly expand this network, aiming for 10,000 charging stations by 2030, although implementation is still at a preliminary stage. While four-wheel EV adoption remains constrained by cost, infrastructure, and range anxiety, the electric two-wheeler segment has more potential for rapid growth due to affordability, simplicity, and its alignment with local commuting patterns.

Currently, the lack of a structured domestic EV manufacturing base, limited financing options, and low public awareness remain major constraints on market expansion. However, the government's alignment of EV development with its renewable energy strategy—centered on abundant hydropower resources—provides a long-term economic and environmental rationale for electrification. With the right policy support, increased infrastructure rollout, and continued interest from international EV brands, Lao PDR is positioned to make steady, if gradual, progress in transforming its vehicle market.

5.1.1.3. NEV Import

As Lao PDR currently lacks domestic production capacity for electric vehicles, all EVs available in the market are imported. According to data from the Lao Automotive Industry Association (LAIA)[72], imports of New Energy Vehicles (NEVs)—including both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)—have increased steadily over the past several years. In 2019, Lao PDR imported only nine NEVs (eight BEVs and one PHEV), marking the very early stage of EV market entry.

Subsequent years saw gradual but notable expansion. Imports grew from 121 units in 2021 to 1,436 units in 2022, representing a more than tenfold increase within a year. The trend continued upward, reaching 5,695 NEVs in 2024, comprising 5,141 BEVs and 554 PHEVs, highlighting the rapid pace of electrification despite the absence of local manufacturing.

Nevertheless, NEV imports remain modest compared to conventional internal combustion engine (ICE) vehicles, which totaled 27,035 units in 2024, including both completely built-up (CBU) and incomplete/complete knock-down (IDK–CKD) vehicles. As shown in Figure 5-2, ICE vehicles continue to dominate Lao PDR's import portfolio, though the rising share of BEVs indicates growing diversification of the automotive market and increasing consumer acceptance of electric mobility.

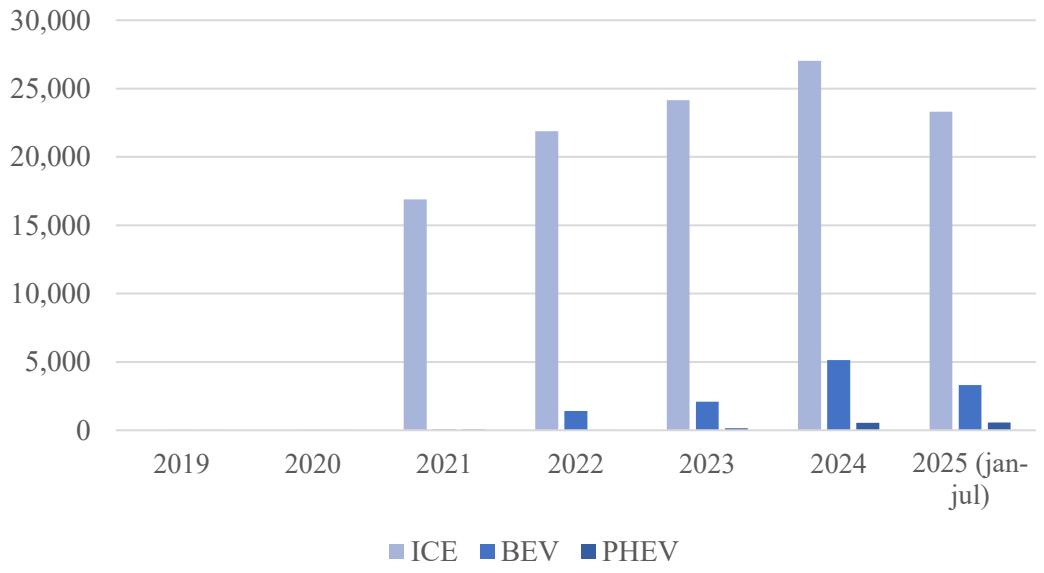


Figure 5-2: Number of Imported Vehicles in the Lao PDR

Source: Author's compilation from Lao Automotive Industry Association (LAIA) report 2025

[72]Annual Conference 2025 of Lao Automotive Industry Association

5.1.1.4. Model Availability

Although Lao PDR does not have official data on each brand's market share, the brand with the largest number of models available in 2025 is Land Rover, offering up to 14 models, most of which are SUVs designed for travel distances of around 200 kilometers. This indicates a preference among Lao consumers for vehicles suitable for medium-distance travel. Furthermore, it can be observed that SUVs dominate the vehicle models available in Lao PDR, as shown in Table 5-2.

Table 5-2: NEV Models in Lao PDR in 2025

Brand	**Engine type**	**Model**	**Distance range (km.)**			
			0-200	201-400	401-700	>700
BMW	BEV	Sedan/Hatchback			3	
		SUVs			2	
BYD	BEV	Sedan/Hatchback			1	
		SUVs			1	2
	PHEV	SUVs	1			
CHANGAN	PHEV	SUVs	2			
DEEPAL	BEV	SUVs			1	
GAC Motor	PHEV	MPV	3			
		SUVs	2			
Geely	BEV	Sedan/Hatchback			1	
		SUVs			2	
Hyundai	BEV	Sedan/Hatchback			1	
JAC	BEV	SUVs			1	
Kia	BEV	SUVs			1	
Land Rover	PHEV	SUVs	14			
MG	BEV	Sedan/Hatchback			1	
	PHEV	SUVs	1			
Nissen	BEV	SUVs				1
Volkswagen	BEV	SUVs			2	
WELTMEISTER	BEV	SUVs			2	
Total			23	0	19	3

Source: Author's compilation from the NEV models in Lao PDR in 2025.

5.1.1.5. Affordability

The Total Cost of Ownership (TCO) analysis for Lao PDR offers a comprehensive evaluation of the economic feasibility and long-term affordability of Battery Electric Vehicles (BEVs) relative to Internal Combustion Engine Vehicles (ICEs) across major market segments. Positioned within the context of Lao PDR's evolving automotive landscape, this assessment aims to illustrate the cost implications of vehicle electrification for consumers and policymakers alike. To ensure methodological consistency and comparability, the analysis is conducted based on the following standardized assumptions: (1) a vehicle lifespan of seven years; (2) an average annual driving distance of 20,000 kilometres; (3) one tire replacement during the ownership period; (4) constant fuel and electricity prices throughout the analysis period; (5) identical license plate fees for all vehicle types, though NEV are subject to a 30% reduction in annual motor-vehicle tax compared to ICE vehicles; (6) a uniform depreciation rate of 20% across all vehicle types[73]; and (7) identical insurance costs for BEV and PHEV vehicles is 50 percent higher than ICE vehicles.

Based on these assumptions, the TCO comparison across three representative categories; Sedan/Hatchback Segment B, Sedan/Hatchback Segment D, and SUV-D demonstrates a clear cost advantage for BEVs among all analyzed segments (Figure 5-3). In the Sedan/Hatchback Segment B, BYD e2 (BEV) has a total ownership cost of approximately 453 million Kip, which is significantly lower than Honda City (ICE) at around 607 million Kip. This notable difference primarily reflects the lower electricity expenses and the reduced motor-vehicle tax for BEVs, despite the relatively similar upfront purchase prices between the two vehicle types.

A similar pattern emerges in the Sedan/Hatchback Segment D, where Geely Emgrand (BEV) has a total ownership cost of approximately 430 million Kip less than half of Honda Accord (ICE), which amounts to about 985 million Kip. The pronounced cost gap in this higher segment is largely attributed to the combination of reduced energy costs and lower taxation for NEVs, compounded by substantial fuel consumption of ICE vehicles over the seven-year ownership period.

The SUV-D segment further reinforces this trend. XPeng G6 (BEV) has a total ownership cost of about 698 million Kip, compared to that of Mazda Toyota Fortuner (ICE) which is approximately at 1.49 billion Kip. This difference of nearly 700 million Kip underscores the long-term cost efficiency of BEVs, particularly in large vehicle categories where fuel expenditure plays a dominant role in overall ownership costs. While BEVs require an additional initial investment for home charger installation (around 17 million Kip) (Table 5-3), this cost remains marginal relative to the overall energy savings accumulated over the vehicle's lifespan.

Overall, the TCO analysis for Lao PDR reveals that BEVs consistently have the lowest ownership costs among all market segments, primarily due to reduced energy expenditures and favourable tax treatment compared to ICE vehicles. These findings highlight the growing economic viability of BEVs in the Lao automotive market, even in the absence of substantial direct purchase subsidies. From a policy perspective, the existing tax reduction framework already provides meaningful cost advantages for NEV owners; however, further measures such as infrastructure development for public charging and targeted incentives for lower-priced BEV models could play a crucial role in accelerating broader BEV adoption across both entry-level and premium vehicle segments.

[73] VDB Loi Co., Ltd. (2022, September). Laos Tax Booklet 2022-2023. https://www.vdb-loi.com/wp-content/uploads/2022/09/Laos-Tax-Booklet_2022-2023.pdf

Table 5-3: Total cost of ownership (TCO) in Lao PDR (Kip)

Costs (Kip)	**Sedan/Hatchback comparison (Segment B)**		**Sedan/Hatchback comparison (Segment D)**		**SUV (Segment SUV-D)**	
	BEV (BYD e2)	ICE (Honda City)	BEV (Geely Emgrand)	ICE (Honda Accord)	BEV (XPeng G6)	ICE (Toyota Fortuner)
Car Prices	510,069,000	550,800,000	474,273,408	972,000,000	799,118,208	1,491,600,000
Fuel/ Electricity Costs	8,556,540	151,468,800	13,125,566	192,040,800	14,537,810	275,889,600
Maintenance cost	3,300,000	3,300,000	3,300,000	3,300,000	10,220,000	10,220,000
Basic Insurance	15,960,000	10,640,000	15,960,000	10,640,000	15,960,000	10,640,000
Motor-vehicle tax	735,000	1,050,000	980,000	1,400,000	1,470,000	2,100,000
License Plate Fee	219,000	219,000	219,000	219,000	219,000	219,000
Install EV Charger cost	17,000,787	-	17,000,787	-	17,000,787	-
Depreciation	102,013,800	110,160,000	94,854,682	194,400,000	159,823,642	298,320,000
TCO (Kip)	453,826,526	607,317,800	430,004,079	985,199,800	698,702,163	1,492,348,600

Source: Author's calculation

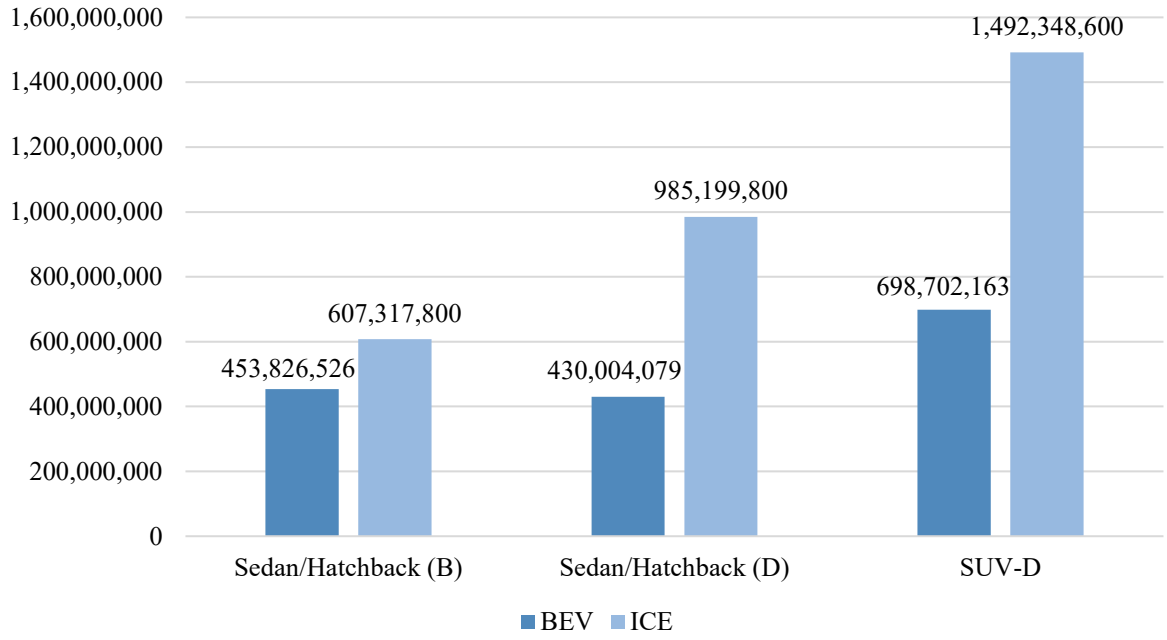


Figure 5-3: The total cost of ownership comparison in Lao PDR

Source: Author's calculation

5.1.1.6. Years of NEV Experience

Lao PDR' experience with New Energy Vehicles (NEVs) is still at an early stage, reflecting a policy-driven approach focused on analysis, planning, and infrastructure development. Prior to 2020, Lao PDR had no formal policies or programs to promote NEVs, although there was growing awareness of the need to reduce dependence on imported petroleum, particularly for gasoline- and diesel-powered transport. In 2020, the Ministry of Energy and Mines published the Lao PDR Energy Outlook 2020, which projected that the country would continue to rely on imported oil, with imports potentially rising to 26% of total energy demand by 2040. The report suggested that promoting electric vehicles powered by domestic hydropower could reduce carbon emissions and lower energy costs.

In 2021, Lao PDR collaborated with the Economic Research Institute for ASEAN and East Asia (ERIA) to produce the Assessment of Electric Vehicle Penetration in the Lao PDR[74], which analyzed the potential impacts of NEV adoption and outlined strategies for future development. The study emphasized the importance of building supporting infrastructure, such as charging stations, and upgrading the electricity system to accommodate NEV use. Despite these initiatives, actual NEV adoption remains extremely limited, and the consumer market is largely unfamiliar with electric vehicles.

Overall, Lao PDR' NEV development reflects an initial stage of planning and preparation, with a strong focus on energy security and sustainability. The country is gradually laying the groundwork for future NEV deployment by combining policy analysis, infrastructure development, and energy system planning, but widespread consumer adoption is still in the early conceptual phase.

[74] Kimura, S., Purwanto, A. J., Ueda, K., & Hiruma, T. (Eds.). (2022, March). Assessment of electric vehicle penetration in the Lao People's Democratic Republic (ERIA Research Project Report FY2021 No. 26). Economic Research Institute for ASEAN and East Asia. https://www.eria.org/uploads/media/Research-Project-Report/RPR-2021-26/Assessment-of-Electric-Vehicle-Penetration-in-the-Lao-PDR.pdf

5.1.2. Smart Mobility Trend

5.1.2.1. Shared & Multimodal Services

The shared and multimodal transport landscape in Lao People's Democratic Republic (Lao PDR) remains in an early stage of development, characterised by the dominance of traditional informal mobility and minimal penetration of digitally enabled platforms. The market for shared mobility is highly underdeveloped, with limited diversification of services and low technological integration compared to neighbouring Southeast Asian countries[75].

Lao PDR's shared mobility ecosystem is primarily represented by LOCA, a locally developed ride-hailing platform that serves as the country's sole operational provider in the digital mobility space. LOCA's services are concentrated in Vientiane Capital and a few other urban centers, with a user base exceeding 50,000 registered users. The platform functions in a market environment characterised by low competition, as international operators such as Grab or Gojek have not entered the Lao market due to its limited urban density, modest consumer demand, and infrastructural constraints.

Despite the emergence of LOCA, the majority of urban and peri-urban mobility continues to rely on traditional informal modes, including motorcycle taxis, tuk-tuks, and shared minivans, which operate without formal scheduling or regulatory oversight. These modes provide essential last-mile connectivity in areas where public transport infrastructure is either underdeveloped or absent. Cash-based payments remain predominant, reflecting the broader limitations of digital payment systems and financial inclusion in the country.

At present, Lao PDR lacks a formal regulatory framework governing shared and ride-hailing mobility services. The sector operates in a largely unregulated environment, with no specific legislation addressing driver licensing, vehicle standards, fare regulation, or data governance. This regulatory vacuum has resulted in the coexistence of informal operators and digital platforms without coherent integration or oversight mechanisms. Although government policy discussions have acknowledged the growing role of digital transport solutions, implementation remains nascent, and institutional capacity for regulation is still limited.

The development of multimodal transport in Lao PDR is also constrained by limited infrastructure and institutional coordination. Public transport provision is minimal and fragmented, with only small-scale bus services operating in Vientiane and a few provincial towns. Consequently, multimodal connectivity such as integrated ticketing, fare systems, or coordinated terminals remains absent. Informal mobility thus performs a compensatory role, offering flexible, demand-responsive services that partially fill the gap left by formal systems.

However, as urbanisation and regional connectivity advance under the ASEAN transport cooperation framework, Lao PDR holds potential for gradual integration of informal and shared modes into a more structured multimodal system. Such progress will depend on the enhancement of digital infrastructure, policy reform, and institutional strengthening, enabling a transition from fragmented, operator-led services to an organised and sustainable shared mobility ecosystem.

Shared and multimodal services in Lao PDR are embryonic but evolving, with LOCA representing an initial step toward digitalisation within an otherwise informal transport landscape. The country's

[75] Chalermpong, S., Ratanawaraha, A., & Uchiyama, Y. (2025). Informal and shared mobility: Status, challenges, and opportunities in Southeast Asia (Volvo Research and Educational Foundations Report). Volvo Research and Educational Foundations. https://vref.se/wp-content/uploads/2025/03/Informal-and-Shared-Mobility-Status-Challenges-and-Opportunities-in-Southeast-Asia.pdf

mobility ecosystem remains dominated by non-digital, small-scale operators providing affordable and flexible services. Moving forward, the successful expansion and formalisation of shared mobility in Lao PDR will require comprehensive policy support, investment in digital and physical infrastructure, and capacity-building initiatives to foster equitable, efficient, and sustainable urban mobility.

5.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption

5.2.1. NEV Promotion Policy

The Lao government has woven EV development tightly into its broader decarbonization, economic modernization, and energy-security agenda. Key strategy documents, including the National Policy on Electric Vehicle Development (2024–2030), set an ambitious target of 30% EV penetration among the vehicle fleet by 2030, with a long-term vision aligned with the country's Long-Term Strategy for Carbon Neutrality by 2050. This aligns with scenarios from the ERIA "Assessment of EV Penetration in the Lao PDR," which model EV shares of 10%, 30%, and 50% by 2040 to assess impacts on fuel consumption, emissions, and GDP. The EV goals are supported by national clean energy policy to expand its charging-station network dramatically (targeting 10,000 stations by 2030) and intends to rely increasingly on hydropower to meet rising electricity demand, reducing dependence on imported petroleum.

5.2.2. Financial Incentives

To encourage consumer uptake, the Lao government provides import-duty relief: EVs and related components imported through official channels benefit from 0% import duty. According to published reports, EV users also enjoy a 30% reduction in annual road tax compared to petrol vehicles of equivalent engine displacement. The Ministry of Energy and Mines and the Ministry of Industry and Commerce are encouraging foreign and domestic investment in EV production and charging infrastructure, with policies that include tax-preferential treatment for EV parts factories and EV-charging station development. Despite limited public reporting of large-scale purchase subsidies, studies (such as ERIA's) emphasize the necessity of policy support for EV uptake given the lack of cost competitiveness without intervention.

5.2.3. Non-Financial Measures

There are some non-financial regulatory measures, though they remain modest. Under national EV policy, the Lao government has removed import limits for EVs, but requires imported EVs to meet international standards for quality, safety, after-sales service, maintenance, and battery-waste management. This aims to ensure safety and environmental responsibility in EV adoption.

To support infrastructure, Electricité du Laos (EDL), the state-owned utility, was tasked with building charging stations nationally, and the policy reportedly instructs that EDL should not charge a meter fee for users at EV charging points, reducing operating costs for EV users.

Finally, environmental regulation is on the agenda: the Ministry of Industry and Commerce is coordinating with natural-resources agencies to develop a waste-battery management framework, requiring strategies for end-of-life battery recycling.

5.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility

5.3.1. New Energy Vehicles (NEVs)

Lao PDR has clearly demonstrated a strong commitment to promoting the use of Electric Vehicles (EVs). This initiative is part of measures to address the nation's economic and financial conditions, reduce fuel imports, and decrease greenhouse gas emissions. This commitment is aligned with the National Green Growth of Laos Strategy and the Sustainable Development Goals.

The government prioritizes the establishment of technical standards and regulations to accommodate EVs. The key governing bodies responsible for this are the Ministry of Public Works and Transport (MPWT) and the Ministry of Energy and Mines.

5.3.1.1. Technical Standards for Vehicles

Technical standards for EVs in the Lao PDR mandate that vehicles imported and sold in the country must comply with international standards for technical quality and safety. This principle is stipulated in Government Resolution No. 08/GM of 2021 to ensure consumer confidence and manage safety risks, particularly those related to the EV's electrical and battery systems.

Specifically, the Ministerial Circular of the Ministry of Public Works and Transport (MPWT) on Electric Vehicle Safety Standards No. 702/YTK dated November 12, 2021, outlines specific safety requirements for electric vehicles.

5.3.1.2. Battery and Waste Management Regulations

Beyond vehicle safety standards, there are significant regulations concerning Battery Lifecycle Management.

- Waste Management System: Importers and distributors are required to establish a system for the disposal and management of used and scrap batteries in accordance with established laws and regulations. This is crucial for preventing environmental and social impacts from hazardous waste disposal.
- Hazardous Waste: Lithium-ion batteries used in EVs are classified as hazardous waste. Therefore, having a proper management system is a critical condition for obtaining a business license, ensuring that batteries are not disposed of improperly. This aligns with the country's Green Growth policy.

In addition to the core vehicle and battery standards, the government has established a supporting framework of regulatory and operational requirements to ensure the successful integration and management of EVs as follows;

1) After-Sales Service and Warranty Obligations

To safeguard consumer interests and ensure the longevity of EV investments, distributors are mandated to take responsibility for comprehensive post-sale support. This obligation requires the establishment of dedicated after-sales service centers capable of providing professional maintenance, repairs, and component replacements. Furthermore, distributors must provide robust quality guarantees that cover both the primary vehicle body and the critical high-voltage battery system, ensuring all components consistently meet national safety and performance standards.

2) Vehicle Identification and Traffic Management

To streamline administrative procedures and enhance traffic management, the government has mandated specific measures for the easy identification of electric vehicles. This includes the assignment

of special license plates or distinct markings (such as the green plates widely adopted in markets like China) that serve as a clear visual symbol of a vehicle's electric status. These markings allow traffic officials and the general public to instantly distinguish EVs, facilitating the seamless granting of special privileges—such as preferential parking or access to restricted low-emission zones—and enabling more effective urban mobility planning.

3) Ongoing Regulatory Development

The Ministry of Public Works and Transport (MPWT) is actively modernizing the regulatory environment to ensure that national standards keep pace with the rapid evolution of electric vehicle technology. Central to this initiative is the ongoing refinement of licensing procedures and technical inspection protocols, which are being updated to reflect the unique requirements of EV powertrains and high-voltage battery systems. By aligning these rules with regional ASEAN standards and international safety benchmarks, the ministry aims to create a consistent, high-quality framework that facilitates the safe deployment of EVs while ensuring that technical certifications remain relevant in an increasingly connected and automated automotive landscape.

5.3.2. Vehicle Emission Standards

Lao PDR is actively working towards strengthening its vehicle emission regulations, primarily driven by concerns over air quality, energy security, and commitments to regional harmonization and climate change mitigation.

1) Current Regulatory Status and Policy Context

The specific, technically defined emission standards (e.g., equivalent to Euro standards) are in the process of being adopted and implemented. Historically, Lao PDR has used less stringent standards than some of its neighbors.

- Existing Legislation: Vehicle technical requirements and environmental standards are regulated under several key decrees and laws. These include the Motor Vehicle Law (2021) and the Decree on National Environment Standard (No: 81/PM, 2017), which provide the framework for regulating vehicle technical standards and emissions control.
- Fuel Quality: As of reports from recent years, Lao PDR still permits relatively high sulfur content in vehicle fuels, such as 500 ppm for gasoline and 2,500 ppm for diesel. These levels are less strict compared to countries that have adopted Euro 4/IV standards (typically requiring 50 ppm or less).
- Emission Testing: The country has a system of nationwide inspection centers (around 22 centers) where Emission and Safety Tests are compulsory for vehicles. This is governed by regulations such as Minister's Circular No: 4312/MPTCP (2001) and subsequent updates.
- Import Restrictions: Lao PDR has implemented measures to control pollution from the vehicle fleet, notably by prohibiting the import of used passenger cars (under Decree No 78/PM, 2012) and introducing stricter age and emission standards for other imported used vehicles, such as those from Japan.

2) Move Towards Stricter Standards and Harmonization

Lao PDR is committed to regional efforts within the Association of Southeast Asian Nations (ASEAN) to standardize vehicle regulations.

- ASEAN Harmonization: Lao PDR is working toward adopting United Nations Regulations (UNR) under the ASEAN Mutual Recognition Arrangement (MRA) on Automotive Products. Relevant UNRs under consideration for adoption include those for exhaust emissions (e.g., UN Regulation Nos. R40, R49, and R83).
- Targeting Euro Standards: There is a recognized plan to upgrade vehicle emission and fuel standards. Efforts are being made to advance towards implementing Euro 4/IV standards and eventually moving towards Euro 6/VI to align with ASEAN's goal of "soot-free transport."
- Promotion of Electric Vehicles (EVs): A major policy direction to reduce emissions and dependence on imported fuel is the aggressive promotion of EVs.
    - Goal: The government has set ambitious targets, including achieving a 30% Electric Vehicle (EV) penetration rate by 2030 and reaching Net-Zero Emissions by 2050.
    - Legislation: This effort is supported by the Resolution on Electric Vehicle Promotion in Lao PDR (No: 08/GOL, 2021).

5.4 Energy Policy

The government has integrated its national NEV policy into its broader energy and climate strategy, aligning with its Nationally Determined Contribution (NDC) target for the energy sector to reduce 28.75 $MtCO_2e$ compared to the business-as-usual scenario. The transport sector plays a central role in this strategy through two key measures: increasing biofuel use to 10% of the total fuel mix and promoting NEV adoption for two-wheelers and passenger cars, aiming for a 30% penetration rate by 2030[xci]. The goals are based on the National Green Growth Strategy and the Government Agreement on NEV Promotion, which make electric transport a key focus to cut down on oil imports, save money, and lessen environmental harm.

The government has also set a near-term target of at least 1% NEV share by 2025, scaling up to 30% by 2030. To achieve this, Lao PDR provides preferential treatment for NEV imports and sales, including tax and tariff incentives for vehicles, parts, and components, while also committing to lead by example through the deployment of NEVs in public fleets and transport services. In parallel, the government supports investment in charging infrastructure, including electricity pricing incentives for charging stations, and has tasked relevant ministries with developing policy, regulatory guidelines, and technical standards to accelerate NEV promotion in line with the country's clean energy and decarbonization goals.

Lao PDR is endowed with abundant renewable energy resources and has positioned itself as a major electricity exporter within the Greater Mekong Subregion (GMS). The country's extensive waterways, including the Mekong River and its tributaries, provide an important natural advantage for hydropower generation, which forms the backbone of its energy sector. Hydropower exports to neighboring countries have made a significant contribution to national income, underscoring the strategic role of sustainable energy development in supporting long-term economic growth and energy security.

The Ministry of Energy and Mines has set ambitious targets for the power sector under the National Power Development Strategy (2022–2030) and the Ninth Five-Year Energy and Mines Development Plan (2021–2025). These include (1) improving power supply efficiency—achieving 75% for hydropower, 14% for thermal power, and 11% for other renewable energy sources; (2) ensuring

domestic electricity supply while maintaining export commitments, supported by the development of transmission networks for both local supply and cross-border trade; (3) improving power distribution systems and service quality; (4) expanding rural electrification to 98% by 2025; (5) promoting green energy in the transport sector with the aim of electric vehicles accounting for 15% of the vehicle fleet by 2025; and (6) reducing national energy consumption by 10% by 2030 through enhanced energy efficiency[xcii].

Figure 5-4 illustrates the energy mix in Lao PDR, showing that the country's electricity generation is predominantly sourced from hydropower, followed by an increasing share from solar power. This abundant renewable energy base offers a strong foundation for developing a clean vehicle (NEV) ecosystem. In 2020, Lao PDR produced approximately 52,217.8 GWh of electricity, of which 72%- equivalent to 37,596.8 GWh- was exported to neighboring countries, including Thailand, Viet Nam, and Cambodia[xciii]. While this export capacity significantly contributes to national income, it also means that a large share of renewable electricity is not available for domestic use, potentially posing a challenge for meeting future electricity demand from NEV integration.

Although the national electrification rate is near 100%, challenges remain, especially in rural and remote areas where the quality and reliability of electricity access need improvement. To support widespread NEV adoption, Lao PDR must not only ensure that sufficient electricity remains available domestically but also invest in expanding and upgrading grid infrastructure, deploying charging networks, and enhancing energy distribution systems.

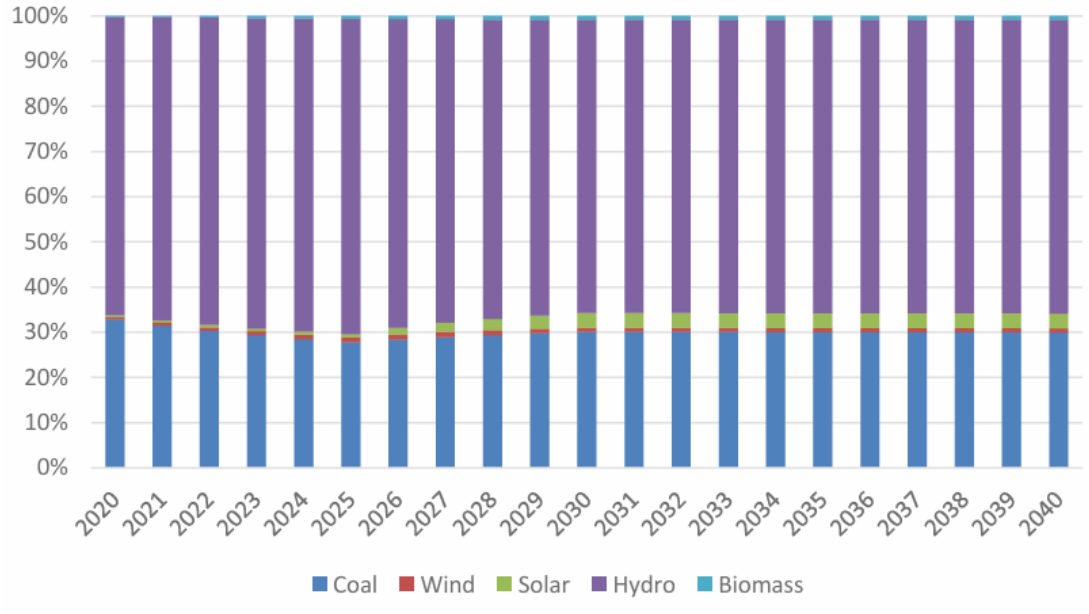


Figure 5-4: Energy mix in Lao PDR

Source: The Ministry of Energy and Mines (2021)[xciv,xcv]

5.4.1. Policy and Regulation

Lao PDR is in the early stages of developing a formal policy and regulatory framework to support NEV adoption. Current measures are embedded within broader energy and transport strategies rather than stand-alone NEV legislation. The government's policy direction focuses on three main priorities: (1) promoting NEV adoption to reduce fossil fuel dependency, (2) leveraging abundant domestic renewable energy resources—particularly hydropower—to support transport electrification, and (3) establishing financial and regulatory conditions to encourage private sector participation in charging infrastructure development.

5.4.1.1. Resolution on Electric Vehicle Promotion No. 08/GOL (2021)

This resolution serves as the primary policy instrument guiding the development of the NEV ecosystem in Lao PDR. It aims to promote the utilization of electric vehicles to reduce fossil fuel consumption, lower greenhouse gas emissions, and increase the use of domestically produced renewable electricity, mainly hydropower. The policy sets national targets of achieving 1% NEV penetration by 2025 and 30% by 2030, along with the establishment of at least 50 charging stations by 2025 and over 100 by 2030. It also links directly with the country's Nationally Determined Contribution (NDC), which commits Lao PDR to reducing GHG emissions by 60% by 2030 and achieving net-zero by 2050 (Department of Transport, Ministry of Public Works and Transport).

5.4.1.2. Energy Policy and Renewable Integration for Transport Electrification

Lao PDR's energy sector policies are closely tied to its vast hydropower potential, which contributes over 80% of total electricity generation. The government aims to leverage this renewable base to power transport electrification sustainably and affordably. Under the Ministry of Energy and Mines (MEM) and Electricité du Laos (EDL), discussions are underway to develop Time-of-Use (ToU) pricing structures for NEV charging. These reforms are designed to manage load demand and promote efficient grid use as NEV adoption grows. The integration of NEVs aligns with national energy efficiency goals and supports clean power exports to neighboring ASEAN countries

5.4.1.3. Technical Regulations and Vehicle Safety Framework

A series of draft Ministerial Circulars are being developed under the Ministry of Public Works and Transport (MPWT) to govern vehicle type approval (VTA), battery and charging safety standards, and import-export procedures for NEVs[xcvi,xcvii].. These include:

- Vehicle Safety Regulation (2023) – defines certification mechanisms, including Type Approval (TA), Conformity of Production (COP), and Vehicle Type Approval (VTA).
- Motor Vehicle Registration and Management Regulation (2024) – establishes technical requirements for registration, number plates, and inspection standards for NEVs.
- Vehicle Inspection Regulation – introduces standardized tests for battery safety, braking, emissions, and electrical components.

The country has also ratified the ASEAN Mutual Recognition Arrangement (MRA) on Automotive Products (2023) to harmonize its technical standards with regional partners

5.4.1.4. Institutional Coordination and Awareness Strategy

To improve public awareness and coordination across agencies, the National NEV Communication Strategy (2024), jointly developed by MPWT and the Global Green Growth Institute (GGGI), was launched. This strategy emphasizes:

- Raising awareness of NEV benefits and available models.
- Public education on charging infrastructure, safety, and maintenance.

- Strengthening institutional collaboration between ministries, financial institutions, and private investors.

Implementation of this strategy is phased from 2024–2035, complementing the NEV promotion resolution by ensuring behavioral and institutional readiness for a low-carbon transport transition.

5.4.2. Supporting measures

5.4.2.1. Financial Supporting Measure

Financial support measures play a crucial role in lowering the cost of NEV ownership and encouraging early adoption. Lao PDR's favorable energy mix creates opportunities for targeted pricing and fiscal incentives, even though there are currently no dedicated NEV tariff structures.

1) ToU pricing incentive – Personal (residential) charging

At present, the Lao PDR does not implement a formal ToU electricity tariff for NEV charging at the residential level. Electricity for personal use, including home charging, is billed at a flat rate of approximately 5,000 kip/kWh, and no preferential tariff has been introduced specifically for NEV users. While NEV charging remains relatively affordable due to the country's hydropower-dominated energy mix, the lack of ToU pricing means there is no price signal to encourage off-peak charging or load shifting. This creates potential challenges as NEV adoption increases, especially in residential areas where grid stability is already limited in some provinces. Introducing ToU tariffs—such as lower rates during nighttime hours that could help optimize grid demand, improve system reliability, and enhance the economic case for NEV adoption. Such pricing mechanisms are consistent with regional best practices and could be an effective next step in aligning energy and transport policy to support the Lao PDR's NEV transition.

2) Time-of-Use (ToU) pricing incentive – Public charging stations

Currently, the Lao PDR does not have a ToU tariff mechanism or a differentiated electricity pricing scheme for public NEV charging operators. All charging stations purchase electricity at the standard commercial flat rate from the utility, with no incentive for charging during off-peak periods. Public charging is typically priced at around 6 THB/kWh, roughly 2.5 times higher than the residential tariff, as private operators apply a markup to cover infrastructure and operational costs. This flat tariff structure provides no grid-management benefits and may limit the competitiveness of NEV charging compared to conventional fuels. Given the growing number of NEVs and the country's abundant hydropower resources, introducing a ToU tariff for public charging—for example, lower wholesale rates during nighttime off-peak hours—could reduce station operating costs, enable lower end-user prices, and help balance system load. Such a measure would also provide a clear policy signal to private investors, supporting the expansion of charging networks beyond Vientiane and improving grid integration of transport electrification.

3) Charging financial incentive - Personal use

Lao PDR currently does not provide direct financial incentives for individuals to install home NEV charging equipment. While NEV import duties are set at 0% under the NEV Promotion Policy No. 08/GOL (2021), this incentive only applies to vehicles and parts, not to home charging infrastructure. Residential customers are charged a flat tariff of around 5,000 kip/kWh, with no installation subsidies, tax rebates, or preferential rates for NEV owners. As a result, households must bear the full cost of purchasing and installing chargers, which may limit NEV uptake outside major urban centers. Introducing targeted financial measures—such as rebates per charger, reduced electricity tariffs for

registered NEV users, or low-interest financing—could help lower the upfront investment barrier, support wider residential adoption, and align with Lao PDR's clean energy transition goals.

4) Charging financial incentive – Public station

In the Lao PDR, public charging station operators benefit from a fixed wholesale electricity tariff, but there is no formal ToU pricing in place. Operators purchase electricity from EDL at a commercial tariff of around 3,000 kip/kWh (approximately 0.15 USD or 4 THB), which is lower than the residential rate of about 5,000 kip/kWh. They typically resell charging to NEV users at around 6 THB/kWh (0.17 USD/kWh), allowing a margin to cover infrastructure investment, operation, and maintenance expenses. While this fixed price advantage supports the financial viability of charging stations, it does not provide any incentive to shift charging to off-peak hours, since the tariff remains the same throughout the day. As NEV adoption grows, introducing a ToU pricing structure could strengthen demand management, reduce peak load pressures, and further support private investment in charging infrastructure.

5.4.2.2. Non-Financial Supporting Measure

Non-financial measures are critical for creating an enabling environment that supports NEV market development and integration into the power system. While Lao PDR is still at an early stage, emerging opportunities exist to strengthen regulatory frameworks, pilot smart charging programs, and enable new business models that enhance system flexibility and encourage private sector participation.

1) Regulatory Support for Electricity Arbitrage

At present, Lao PDR does not have regulatory mechanisms that enable or support electricity arbitrage for NEV charging operators. Since the electricity tariff structure is flat throughout the day, operators cannot take advantage of buying power at a low price during off-peak hours and selling at a higher price during peak hours, which is a common business model in more advanced NEV markets. Charging station operators benefit from a lower commercial tariff compared to residential users, but this is a fixed rate, not a dynamic pricing framework. In addition, no clear regulatory guidelines or market mechanisms exist to allow participation in demand response programs or to provide financial incentives linked to grid flexibility. The absence of such regulatory support limits opportunities for price-based load shifting, system optimization, and new business models such as smart charging or vehicle-to-grid (V2G). Establishing a ToU pricing framework or introducing regulations for electricity resale and arbitrage could create stronger economic signals for private investment and improve overall grid management as NEV adoption expands.

2) V2G and Smart Charging Pilot Programs

Lao PDR does not currently have any official pilot programs for V2G or smart charging. Existing NEV charging networks are relatively small and operate on basic plug-and-charge models without time-based controls, dynamic pricing, or communication protocols that would enable bidirectional energy flows. Regulatory frameworks also remain underdeveloped: there are no provisions for aggregators, grid services, or compensation mechanisms for feeding electricity back to the grid. However, the Lao PDR has strong potential to explore V2G and smart charging due to its hydropower-based energy system, which provides stable and low-cost electricity. Pilot projects, particularly in urban centers like Vientiane or tourism hubs such as Luang Prabang, could demonstrate how smart charging This approach can shift NEV demand to off-peak hours and demonstrate how V2G technology can provide ancillary services to the grid. Launching such programs would require coordinated action between the energy regulator, EDL, and private charging operators, as well as the adoption of interoperable communication standards and supportive pricing mechanisms. These steps would lay the groundwork for a more flexible and modern NEV charging ecosystem in the country.

5.5 Infrastructure Related to New Energy Vehicle and Smart Mobility

5.5.1. Energy Infrastructure

The development of NEV charging infrastructure in Lao PDR is guided by the Government Resolution on Electric Vehicle Promotion No. 08/GOL (2021). This resolution sets national targets of at least 50 public charging stations by 2025 and over 100 stations by 2030, aiming to support broader transport electrification and the government's NEV penetration targets (1% by 2025 and 30% by 2030). While the resolution provides high-level direction, the charging network is currently driven primarily by private investment, with limited direct public sector funding or subsidy mechanisms. The Ministry of Energy and Mines (MEM) and Electricité du Laos (EDL) are responsible for ensuring energy supply stability and integrating NEV charging demand into the grid, but no dedicated infrastructure roadmap or corridor development plan has been formally issued.

5.5.1.1. Charging Infrastructure Deployment

As of early 2025, Lao PDR has developed a modest but growing NEV charging network consisting of approximately 57 public charging stations with around 200 charging heads nationwide. The market is dominated by two key private operators—LOCA, which manages about 51 stations, and DiscoverLaos, which operates around 6 stations. The charging network is highly concentrated in Vientiane Capital and major tourism hubs such as Luang Prabang and Vang Vieng, reflecting a deployment strategy focused on urban centers and high-traffic corridors. In contrast, coverage in secondary cities and rural provinces remains limited, and there is currently no national charging corridor to support long-distance travel. All existing charging stations are grid-connected, with no off-grid or renewable-powered charging systems reported to date.

Lao PDR employs a mix of AC and DC charging technologies, with AC slow chargers being the most common due to their lower installation costs and simpler operation. DC fast chargers, typically in the 120–240 kW range, are installed mainly in urban hubs, with 2–4 charging heads per site to support higher power demand. In terms of technical standards, LOCA predominantly uses CCS2 connectors, while some stations also support GB/T to accommodate Chinese NEV models. However, the lack of full standardization across the network increases infrastructure costs and complicates interoperability between operators and vehicle types.

For two-wheelers, DiscoverLaos is piloting battery swapping systems, installing swap units at selected stations to support e-motorbike fleets. This approach may help accelerate NEV adoption in the two-wheeler segment by reducing upfront battery costs and addressing charging convenience. Overall, while the current network provides a foundation for NEV growth, expanding coverage, standardizing technology, and integrating renewable energy sources will be essential for scaling up Lao PDR's NEV charging infrastructure.

5.5.1.2. NEVs to Charging Piles (AC/DC) ratio

The NEVs-to-charging piles ratio provides an indication of whether the existing charging infrastructure can adequately support the number of electric vehicles on the road. In Lao PDR, with an estimated 15,000 registered NEVs in 2025 and with 51 public charging stations (equivalent to around 200 charging piles), the current ratio stands at roughly 300 vehicles per station or 75 vehicles per charging pile (75:1).

This figure reflects a high vehicle-to-charger load compared to more mature NEV markets, indicating that the expansion of charging infrastructure is not yet keeping pace with the country's growing NEV fleet. While the current network dominated by private operators provides a solid starting point for NEV

deployment, its urban concentration and limited coverage in rural and secondary areas mean that accessibility remains uneven.

5.5.1.3. Smart Grid Readiness

Lao PDR's smart grid readiness is currently at an early stage of development, characterized by a conventional, one-way power flow structure and limited digitalization. The power system benefits from a renewable energy-dominated generation mix and a centralized single-buyer model under EDL, which supports coordinated planning and stable operations. However, grid modernization remains limited, with only partial SCADA deployment and smart metering pilots concentrated in urban areas such as Vientiane.

There is currently no nationwide Advanced Metering Infrastructure (AMI), no Time-of-Use (ToU) tariffs, and no demand response mechanisms in place. The absence of a regulatory framework for two-way power flows means that smart charging and vehicle-to-grid (V2G) applications are not yet technically or legally enabled. While the existing grid can accommodate early-stage NEV charging, it lacks the flexibility and visibility required to manage larger charging loads efficiently. To strengthen readiness, Lao PDR will need to develop a national smart grid roadmap, expand AMI and SCADA/EMS coverage, and introduce ToU tariffs to support load shifting. Establishing clear regulations and operational frameworks for smart charging and V2G will be essential to enable flexible NEV-grid integration and enhance power system resilience in the future.

5.5.1.4. Charging Communication Protocol Standard – Single Platform

Lao PDR does not yet have a dedicated charging communication protocol standard or unified national platform for NEV charging. Current charging infrastructure is still in its early development phase, and most existing charging stations operate on basic plug-and-charge models without standardized communication protocols between chargers, vehicles, and the grid.

There is no formal adoption of international standards such as OCPP (Open Charge Point Protocol) or ISO 15118, which are commonly used to enable interoperability, smart charging, and future V2G applications. Most of the charging stations installed by private operators (e.g., LOCA, DiscoverLaos) are stand-alone units that support AC and DC fast charging but rely on proprietary or locally adapted communication systems.

To support future large-scale NEV integration, Lao PDR will need to adopt a single national communication protocol platform—preferably one aligned with international standards. This would ensure interoperability among different charging station operators, facilitate real-time monitoring and load management, and enable advanced services such as smart charging and V2G. Establishing a common platform would also allow for data integration with EDL's grid management systems, improving planning, system efficiency, and user experience.

5.5.2. Road Infrastructure

The road infrastructure in Lao is the backbone of its internal and regional connectivity, driven by the national strategy to transform the country from a land-locked to a land-linked nation. Despite significant investment and improvement, the network remains relatively underdeveloped compared to its neighbours, facing considerable challenges related to maintenance, surfacing, and all-weather accessibility. Road transport is the dominant mode, carrying over 80-90% of both freight and passenger traffic.

Road Network Statistics by Surface Type (Lao PDR) follow Table 5-4. The most comprehensive breakdown available in public reports is for the year 2018, when the total road network length was approximately 60,560 kilometers.

Table 5-4: Road Network Statistics by Surface Type

Surface Type Category	Sub-Type	Length (km)	Share of Total Network (%)
Paved Roads	**Paved Roads (Total)**	**11,668.75**	**19.27%**
	1. Cement Concrete (CC)	552.02	0.91%
	2. Asphalt Concrete (AC)	1,203.13	1.99%
	3. DBST (Double Bituminous Surface Treatment)	9,913.60	16.37%
Unpaved Roads	**Unpaved Roads (Total)**	**48,891.00**	**80.73%**
	1. Gravel / Lateritic	23,185.79	38.29%
	2. Earth Construction (Unpaved)	25,705.00	42.45%
Grand Total		**60,559.75**	**100.00%**

Source: Data adapted from MPWT 2018 statistics, cited in various academic and development reports.

According to the World Economic Forum (WEF) 2019 Global Competitiveness Report, road quality in Lao PDR is rated at 3.7 out of 7, signaling a poor to moderate state of infrastructure. While this reflects a marginal recovery from the 2018 low of 3.2, the score remains below the global average of 4.07 and significantly trails regional leaders like Singapore (6.5) and Thailand (4.4). Business executives surveyed cited persistent challenges in connectivity and surface integrity, particularly regarding the maintenance of provincial roads.

Lao PDR's Road Environment reflects a foundational adherence to international standards that is often undermined by inconsistent implementation and behavioral challenges. While the country utilizes the Vienna Convention framework for signage and the standard three-color traffic signal system, the practical application of these features remains geographically limited.

In central Vientiane and on major newly constructed highways, the road environment meets moderate standards. Directional signage is typically bilingual (Lao and English), and lane markings—such as solid white lines for no-crossing zones and dashed lines for passing—follow global conventions. However, as one moves toward secondary or rural routes, the presence of stoplights, road signs, and clear markings becomes highly inconsistent.

5.5.2.1. Hierarchical Classification of the Road Network

The Lao PDR Road network is systematically structured into a hierarchy defined by the Ministry of Public Works and Transport (MoPWT), reflecting their functional importance, connectivity, and administrative responsibility. Road Law (1999) formally established this classification, which typically includes six main categories

1. National Roads (NRs)

These are the primary arterial routes of the country. They connect the capital city, Vientiane, to provincial capitals, major economic centers, and international border crossings. They are critical for national defense, trade, and integration into the regional ESCAP's Asian Highway (AH) Network and the Greater Mekong Subregion (GMS) corridors. They are the highest priority for government and donor funding (e.g., World Bank, ADB, JICA). National Route 13 (NR13) is the single most important and heavily traveled corridor, running North-South along the Mekong River, connecting the Chinese border in the north to the Cambodian border in the south, and passing through major cities like Luang Prabang, Vientiane, and Pakse. While prioritized, a significant proportion of National Roads, historically over 50%, have not met the all-weather standard, consisting of gravel or earth surfaces, though this proportion is constantly improving through rehabilitation projects. Directly managed and maintained by the central government (MoPWT).

2. Provincial Roads (PRs)

These roads are strategically important for regional development, linking provincial capitals to district centers and connecting between provinces. They serve as the secondary layer of connectivity, distributing traffic from the National Road network to local economic zones. They are generally expected to be trafficable for passenger cars all year round, although heavy vehicle access may be restricted during the peak rainy season (May-October) due to poor drainage and surface conditions. Managed by the Provincial Public Works and Transport Departments (PPTDs).

3. District Roads (DRs) and Rural Roads (RRs)

These form the local road network, providing essential connectivity for the rural population. District Roads connect district centers to sub-district centers and important core villages. And Rural Roads link individual villages to the district or provincial core networks. They are vital for poverty alleviation and enabling market access for agricultural products. This segment represents the largest portion of the network in length but has the lowest surface quality and the highest vulnerability. A large percentage of these roads are lateritic/gravel or earth, becoming largely inaccessible during the rainy season. Maintenance of these roads is often complex, involving limited government budgets, a reliance on community/village maintenance committees (VMCs), and donor support focused on improving all-weather access. Responsibility is often decentralized to District-level authorities, sometimes with resource limitations.

4. Urban Roads and Special Roads

Urban Roads are within city and municipal boundaries, managed by the respective local authorities. Special Roads are those constructed for specific purposes, such as industrial, mining, or defense use, often managed by the relevant user entity.

5.5.2.2. Pavement and Structural Characteristics

The overall quality of the Lao road network is characterized by a low percentage of paved roads, leading to high maintenance needs and travel costs, particularly during the wet season.

1. Surface Conditions and Pavement Types

Low Paving Rate, the total road network length is estimated at nearly 60,000 km, but historically, less than 25% is paved (concrete or tarred). The majority consists of gravel (lateritic) and earth roads. And Pavement Structure on National Roads often utilize. DBST (Double Bituminous Surface Treatment). A thin, asphalt-like layer suitable for moderate traffic. Base and Subbase, typically constructed with

locally available materials such as laterite gravel, sometimes mixed with sand or aggregate. Lime or cement stabilization is rarely used, which contributes to lower durability.

2. Geometric Design and Load Capacity

Much of the core network was initially constructed before the 1940s and was not designed for modern heavy commercial vehicles. And Axle Load Limits, the primary segments of the trunk route (NR13) were often designed with an axle load capacity of around 8.2 tonnes. This is lower than the regional norm (often 10.0–11.0 tonnes) and leads to rapid road deterioration, especially with persistent truck overloading issues near mines and commercial centers, despite increased enforcement.

5.5.2.3. Challenges and Management

The management of the road infrastructure is continually being modernized, but significant challenges remain:

1. Road Maintenance

The system traditionally relies on a reactive maintenance approach, fixing roads only after deterioration reaches a critical state. Limited funding for the Road Maintenance Fund (RMF) and difficulties in allocating resources efficiently, particularly to the vast and fragmented rural road network, complicate efforts.

2. Climate Vulnerability

The tropical monsoon climate with high annual rainfall (1,500 mm. to 3,000 mm.) between May and October makes the majority of earth and gravel roads highly vulnerable to erosion, washouts, and flooding, leading to an overall high National Road Vulnerability Index ranking.

3. Safety Standards

The Ministry of Public Works and Transport and the National Road Safety Committee have implemented a 2021-2030 National Road Safety Strategy, targeting that a majority of travel on major roads should be on at least 3-Star roads (iRAP rating) by 2025/2030, a clear recognition of the historically low safety and design standards.

The ongoing development, supported by international financial institutions and bilateral partners, focuses on upgrading the main corridors, improving climate resilience in maintenance practices, and operationalizing a modern Road Management System (RMS) to shift towards a more proactive and sustainable asset management model.

5.5.3. Digital Infrastructure

Lao PDR's ambition to transition its transport sector to e-mobility and integrate smart mobility solutions is intrinsically linked to its broader national digital transformation agenda. The nation is leveraging its energy surplus and strategic location to facilitate this shift, primarily focusing on electric vehicles (EVs) as the first step towards a connected, data-driven transport system. While the core digital infrastructure is still developing, the government has set clear policy foundations that anticipate the needs of future vehicles.

Lao PDR is undergoing a significant digital transformation, primarily focused on establishing a foundational high-speed mobile network. While 5G coverage and mobile speeds are advancing in key urban centers, the adoption of sophisticated smart transportation technologies like fully Driverless (L4-L5) vehicles and complex Vehicle-to-Infrastructure (V2I) systems is still in its nascent stages, largely confined to initial planning or potential future projects linked to foreign investment.

1) 5G Coverage and Mobile Connection Speed

Lao PDR has made progress in its mobile network infrastructure, with the primary focus being the expansion of 4G and the gradual introduction of 5G by major operators.

- 5G Deployment: Operators like Unitel and Lao Telecom have launched 5G services, but coverage is currently concentrated in the capital, Vientiane, and select major cities and tourist spots (e.g., Luang Prabang). Unitel is often recognized for having the widest overall network coverage, including rural areas, leveraging 4G and earlier technologies.
- Mobile Connection Speed: While specific 5G speed data for Lao PDR can vary, the country's median mobile download speeds are competitive within the region, typically in the range of 75-85 Mbps, according to global speed indices. This performance, largely driven by 4G and initial 5G rollout, provides the foundation for general digital services.
- Coverage Distribution: Coverage remains strongest in urban hubs, the country's central corridor, and along major economic routes. Rural and remote areas often rely on older technologies (3G or 2G), posing a challenge for nationwide deployment of data-intensive mobility services.

2) Driverless (L4-L5) Vehicle Development

The development and deployment of SAE Level 4 (High Automation) and Level 5 (Full Automation) driverless vehicles are not currently a primary focus in Lao PDR.

- Current State: The market predominantly utilizes vehicles equipped with basic to intermediate Advanced Driver-Assistance Systems (ADAS), typically classified as Level 1 or Level 2 (Partial Automation).
- Focus Areas: Lao PDR's transport strategy centers on improving road quality, logistics, and conventional public transport. L4/L5 projects are currently not publicly reported or prioritized, as the country addresses more fundamental issues related to road safety, regulation, and standard vehicle fleet modernization.
- Regulatory Status: There is no known, dedicated legal or regulatory framework for the operation of fully autonomous (L4/L5) vehicles on public roads, reflecting the very early stage of this technology nationally.

3) Traffic Management Systems and V2I

The implementation of advanced traffic solutions and connected vehicle technology remains highly targeted and largely aspirational, with development focused on basic traffic control modernization.

- Traffic Management Systems (TMS): Urban areas, particularly Vientiane, are moving towards modernizing traffic control. Efforts are directed at replacing outdated systems with more sophisticated ones, such as Adaptive Traffic Signal Control (ATSC), which uses sensors to optimize traffic light timing based on real-time flow.
- V2I (Vehicle-to-Infrastructure): The concept of V2I is generally limited by the cost of installing Roadside Units (RSUs) and the necessary 5G network density.
- ADAS Compliment: While the theoretical benefit of V2I is to enhance L2-L3 ADAS by providing non-line-of-sight hazard warnings and traffic light timing information, the practical deployment is not yet widespread. The complexity and high investment required for V2I systems present a significant barrier compared to the more pressing infrastructure needs in Lao PDR.

5.5.3.1. Policy and Vision for Smart Transport

The digital framework for future mobility in Lao PDR is guided by national economic and environmental imperatives, notably reducing reliance on imported fossil fuels and achieving the ambitious 30% EV penetration rate by 2030.

1) National Digital Economy Vision (2021–2040): This high-level document, spearheaded by the Ministry of Technology and Communications (MTC), is the central pillar. It explicitly targets the 4th Industrial Revolution technologies, including Artificial Intelligence (AI), Internet of Things (IoT), and Big Data, which are fundamental requirements for Connected and Autonomous Vehicles (CAVs) and Smart Mobility.

2) National Green Growth Strategy & 9th NSEDP (2021-2025): These plans prioritize the e-mobility transition to address macro-economic issues (trade deficit from fuel imports) and environmental goals (GHG emissions reduction).

Smart City Initiatives: Vientiane Capital and Luang Prabang are part of the ASEAN Smart Cities Network (ASCN). Projects here focus on initial smart mobility concepts, including:

- AI-based Traffic Management Centers (proposed).
- Digital Urban Infrastructure for enhanced city planning and management.
- Development of an all-electric Bus Rapid Transit (BRT) fleet in Vientiane (planned for 2026), which will inherently require digital fleet management and real-time passenger information systems.

5.5.3.2. Digital Infrastructure for Electric Vehicles (EVs)

The immediate digital requirements center on managing the transition to EVs and their associated charging infrastructure.

1) EV Technical Standards and Regulation: The Ministry of Public Works and Transport (MPWT), with support from the Global Green Growth Institute (GGGI), has updated transport-related regulations to incorporate EVs. This includes refining the "Regulation on Ground Vehicles Registration and Management" and developing technical standards for EVs and charging infrastructure. These regulations create the necessary digital framework for EV identification, certification, and control.

2) Charging Infrastructure Network: The rollout of charging stations requires digital monitoring and management. Lao Telecommunication (LTC) and the electric power utility Electricité du Laos (EDL) are key partners in piloting charging stations and developing technology to efficiently integrate EVs into the grid. This involves:

- Smart Grid Integration: Necessary to manage the significant estimated increase in electricity demand (up to 2,000 GWh by 2030) from a large EV fleet and potentially utilize EVs for renewable energy programs.
- Digital Payment Systems: Adoption of e-payment systems (like BCELOne) for charging is crucial, linking the EV infrastructure to the national digital financial ecosystem.

3) Information Platforms: Government-supported electric vehicle websites and communication platforms are being established to provide technical standards, policy information, and education to the public, building the digital knowledge base for mass EV adoption.

5.5.3.3. Core Digital Foundation for Future Mobility Technologies

Connected and Autonomous Vehicles (CAVs) and advanced Smart Mobility systems require a robust underlying digital infrastructure that is still in development across Laos.

Laos has begun laying basic digital foundations for smart mobility—4G/LTE is widely deployed, the country ran 5G trials and launched initial commercial 5G services in Vientiane in 2024–2025, and the government is investing in data-center/cloud capacity through its Digital Government/transformational agenda. These building blocks create potential for ITS, real-time traffic management and mobility data platforms, but service quality and low-latency coverage remain uneven (especially in rural areas) and institutional capacity for transport-digital integration is still developing. At the same time, the government has set modest EV targets (e.g., ~1% EV share by 2025 and higher ambitions for 2030) and launched small charging-station pilots—signals of intent but not large-scale rollouts—while several diagnostics note that institutional guidelines, technical standards and EV regulation in Lao PDR remain incomplete.

On Connected and Autonomous Vehicles in particular, there is no evidence of a national CAV strategy, formal testing/regulatory sandbox program, or commercial robotaxi/autonomous logistics deployments comparable to regional leaders. High-level digital plans and fiber-backbone capacity exist and could support future CAV pilots (e.g., IoT/AI encouragement under the national digital strategy), but Lao PDR currently lacks the detailed technical standards, low-latency V2X rollouts, and multi-agency frameworks needed to enable safe, large-scale CAV demonstrations or commercialization. In short: pilots and enabling infrastructure work are underway, but Lao PDR remains in an early exploratory phase rather than an implementation phase for smart mobility and CAVs.

5.5.3.4. Challenges and Future Digital Gaps

The realization of advanced digital mobility is constrained by several persistent gaps in Lao PDR's digital landscape, Data and Cybersecurity Framework, A robust and fully enforced cybersecurity framework is vital for protecting sensitive vehicle data and the control systems of smart transport networks from cyber threats. While laws exist, continuous updating and institutional capacity building are required. Digital Skills Shortage, the lack of sufficient human capital in specialized ICT fields (AI, data science, network engineering) limits the government and private sector's ability to develop, manage, and maintain complex Smart Mobility systems domestically. Regulatory Readiness for CAVs, While EV regulations are advancing, the legal and liability frameworks for testing and deploying Level 4/5 autonomous vehicles are still nascent and require significant technical and legal work.

5.6 Consumer Preferences and Trends in Vehicle Ownership

5.6.1. Vehicle Ownership

Lao PDR has experienced a gradual yet steady increase in passenger vehicle ownership between 2018 and 2023, reflecting the country's ongoing economic expansion, demographic transition, and urban development. The total number of registered passenger vehicles rose from 135,370 thousand units in 2018 to 186,080 thousand units in 2023, demonstrating a consistent upward trajectory in private mobility demand. Correspondingly, the number of passenger cars per 1,000 inhabitants grew from 18.99 units in 2018 to 24.28 units in 2023, suggesting a moderate but notable rise in motorization rates nationwide.

This expansion in vehicle ownership aligns closely with improvements in the national economy. Between 2018 and 2024, Lao PDR's Gross Domestic Product (GDP) increased from 17.53 billion USD to an estimated 21.17 billion USD, indicating sustained economic growth despite regional and global

challenges. GDP per capita (in 2015 USD prices) similarly increased from 2,459 USD in 2018 to 2,724 USD in 2024, reflecting gradual gains in income levels and purchasing power. Although GDP growth fluctuated during this period, declining to 2.53% in 2020 due to the impacts of the COVID-19 pandemic, it rebounded to an average rate of 2-4% in subsequent years, signaling economic resilience and continued recovery.

Population dynamics have also influenced the growth of vehicle ownership. The total population expanded from 7.13 million in 2018 to 7.77 million in 2024, accompanied by a gradual shift in demographic structure. The working-age population (15-64 years) accounted for approximately 63.65% of the total population in 2018 and increased slightly to 65.14% in 2024, indicating a stable labour force base. Meanwhile, the share of the elderly population (aged 65 and over) rose from 4.13% to 4.67%, highlighting the onset of population aging, though at a slower pace than in neighbouring countries. The proportion of children aged 0-14 years declined modestly from 32.22% to 30.20%, consistent with regional demographic trends of declining fertility.

Education levels have continued to improve during this period, supporting broader human capital development. Gross secondary enrollment rates, although declining from 66.15% in 2018 to 51.85% in 2024, remain relatively strong, while tertiary enrollment increased from 14.50% in 2018 to 14.88% in 2023. These figures suggest a gradual expansion of access to higher education and an emerging pool of skilled labour that can contribute to the country's economic diversification and modernization.

Urbanization represents another key driver of increasing vehicle ownership. The proportion of the population living in urban areas rose from 35% in 2018 to 38.91% in 2024, with the urban population expanding from 2.50 million to 3 million during the same period. As Lao PDR's cities, such as Vientiane, Savannakhet, and Pakse, continue to expand economically and spatially, demand for private vehicles is expected to rise further, particularly in regions where public transportation networks remain limited.

The upward trajectory of vehicle ownership in Lao PDR reflects the country's broader economic and urban development. The combination of income growth, urban expansion, and demographic stability has fostered increasing private vehicle use. However, this trend also brings challenges related to traffic congestion, fuel dependency, and environmental pressures. To ensure sustainable mobility, policy measures focusing on public transport improvement, road infrastructure development, and cleaner vehicle technologies will be essential to balance mobility needs with environmental and social sustainability.

5.6.2. Consumer Preferences

In Lao PDR, the study of consumer preferences for NEVs offers key insights into how awareness and perception are shaping the shift toward cleaner mobility. As the market evolves, understanding the motivations and concerns of different stakeholders is essential. The following discussion considers perspectives from three groups: non-EV consumers, EV users, and EV dealers to provide a broad view of attitudes toward electric mobility in the Vietnamese context.

5.6.2.1. Informational Requirements

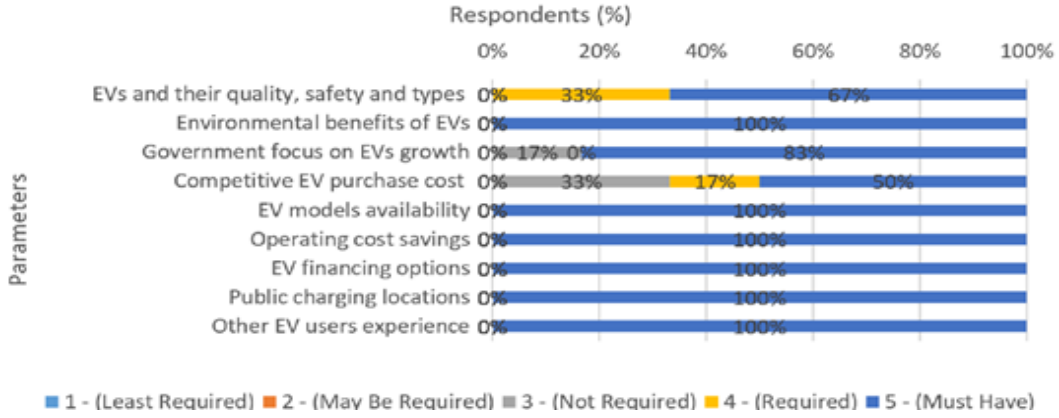


Figure 5-5: Informational Requisites by Non-EV Consumers in Lao PDR in 2024

Source: GGGI (2024)[76]

According to the survey, Figure 5-5 illustrates the informational requisites identified by non-EV consumers in Lao PDR in 2024. The results highlight that potential buyers place strong emphasis on obtaining clear and trustworthy information about EV models, their environmental benefits, operating cost savings, and public charging options all of which were rated as "Must Have" by nearly all respondents. Likewise, details concerning vehicle quality, safety, and available types were viewed as essential, with two-thirds marking them as high-priority information needs. In contrast, factors such as government policies on EV promotion and competitive purchase cost received more moderate attention, suggesting that consumers in Lao PDR currently prioritize practical and performance-related information over policy or price incentives. Overall, the findings indicate that increasing public access to reliable product knowledge and charging-related data remains crucial for improving consumer confidence and stimulating EV adoption in the Lao market.

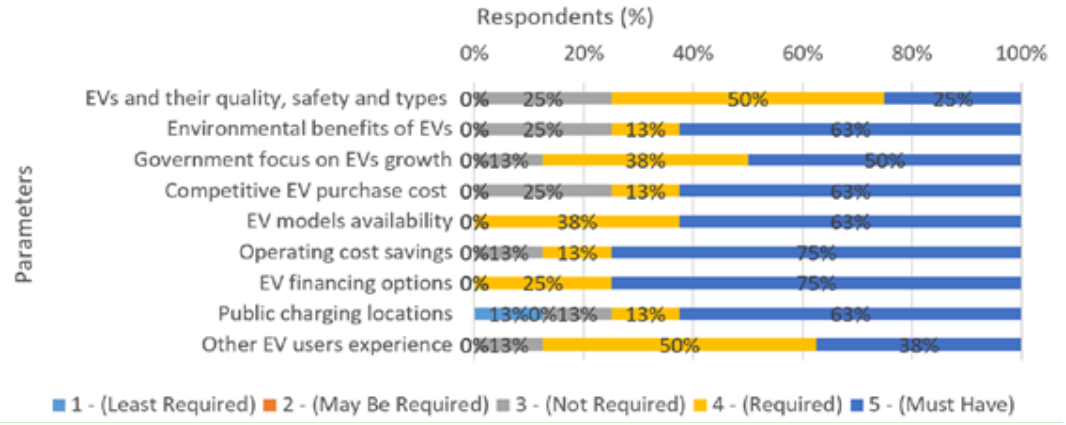


Figure 5-6: Informational Requisites by EV customers in Lao PDR 2024

Source: GGGI (2024)

[76] GGGI. (2024). National Electric Vehicle Communication Strategy for Lao PDR.

According to the survey, Figure 5-6 presents the informational requisites identified by EV customers in Lao PDR in 2024. The results reveal that current EV users continue to prioritize information on vehicle models, cost savings, and charging locations, with most respondents rating these factors as "Must Have." Information related to environmental benefits and product quality also remained highly valued, reflecting growing consumer awareness of sustainability and safety aspects. Compared with non-EV consumers, EV users showed greater interest in peer experience and government efforts to promote EV adoption, indicating a shift from basic knowledge needs toward ecosystem-related considerations. Overall, the findings suggest that experienced users seek more comprehensive and practical information to enhance their ownership experience and maintain confidence in the expanding EV market.

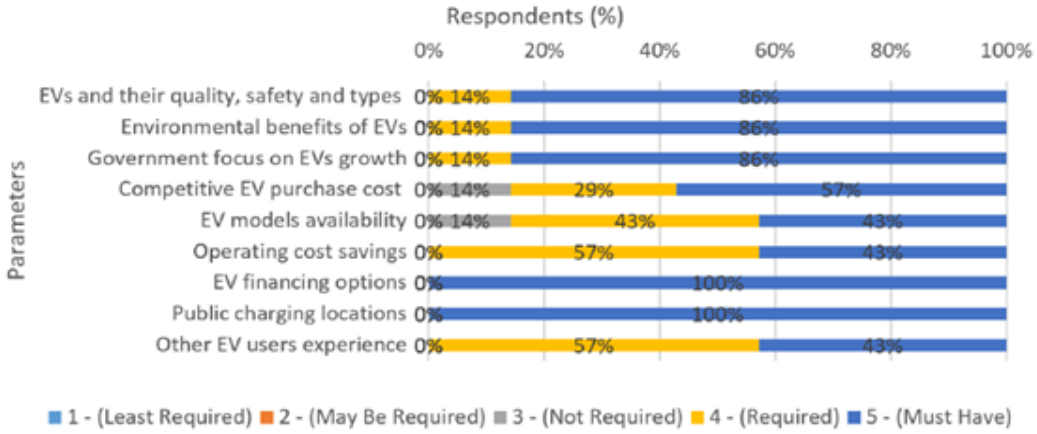


Figure 5-7: Informational Requisites EV dealers' analysis in Lao PDR 2024

Source: GGGI (2024)

According to the survey, Figure 5-7 illustrates the informational requisites identified by EV dealers in Lao PDR in 2024. The results indicate that dealers consider information on EV financing options and public charging infrastructure as the most critical, with all respondents marking these as "Must Have." Similarly, information related to vehicle quality, environmental benefits, and government support was also highly prioritized, reflecting the dealers' awareness of key factors influencing customer confidence. Meanwhile, elements such as operating cost savings and peer user experience were seen as moderately important, suggesting that dealers focus more on structural and market-enabling information rather than user perceptions. Overall, the findings highlight that strengthening dealer access to accurate and updated information—particularly on financing schemes and charging networks is essential to support consumer guidance and accelerate EV market growth in Lao PDR.

Overall, the combined results reveal that clear, consistent, and credible information is a key enabler of EV market growth in Lao PDR. While consumers and users focus on product performance, cost, and charging access, dealers emphasize financing and infrastructure details. Strengthening these informational links across all groups is essential to build trust and accelerate the country's transition toward electric mobility.

5.6.2.2. Perceived Product Attributes

Findings from the Global Green Growth Institute (GGGI) 2024 survey reveal that non-EV consumers in Lao PDR hold mixed perceptions toward EV product attributes. Many view EVs as environmentally friendly and appreciate their quiet, smooth driving experience, recognizing these as key advantages. However, some remain skeptical about claims of lower maintenance costs, indicating uncertainty about long-term affordability. Overall, the study suggests that a limited understanding of EV benefits persists,

highlighting the need for stronger public education and outreach to enhance consumer awareness and confidence in electric mobility.

5.6.2.3. Barriers to EV Adoption

As the EV market in Lao PDR remains at an early stage of development, several barriers continue to hinder widespread adoption among consumers and industry participants. These obstacles vary across stakeholder groups but share common structural and informational challenges particularly relating to cost, financing, and infrastructure readiness.

Insights from the Global Green Growth Institute (GGGI) 2024 survey show that non-EV consumers in Lao PDR face several key barriers to EV adoption. The most prominent challenges include the high upfront purchase cost, limited financing availability, and insufficient public charging infrastructure. Concerns about driving range and unfamiliarity with EV technology also persist, while a general lack of awareness and real-life experience continues to hinder consumer readiness. Overall, these factors contribute to cautious attitudes and slow adoption among potential EV buyers.

According to the same survey, existing EV users identified inadequate public charging networks and limited model variety as the main obstacles to broader adoption. Restricted financing options and concerns over spare parts availability were also cited as ongoing challenges. Interestingly, most users did not view high vehicle purchase cost as a major issue, implying that firsthand experience with operational savings may reduce price sensitivity and reshape perceptions of value over time.

Results from the GGGI 2024 survey indicate that EV dealers regard limited financing mechanisms and insufficient charging infrastructure as their most significant challenges. Lesser issues such as high purchase prices, range differences, battery degradation, and long charging times were not widely seen as barriers to sales. Overall, the responses suggest that dealers are primarily constrained by structural and market-enabling factors, highlighting the importance of stronger financial support and infrastructure development to accelerate EV market growth in Lao PDR.

Therefore, the findings from all three groups reveal that charging infrastructure and financing access remain the most persistent barriers across the EV ecosystem in Lao PDR. While perceptions differ in degree and focus, improving these foundational conditions together with enhanced public awareness will be essential to strengthen consumer confidence and support a smoother national transition toward electric mobility.

5.6.2.4. Experience with NEV

As Lao PDR continues its gradual shift toward electric mobility, understanding user and dealer experiences with NEVs provides valuable insight into how perceived benefits shape acceptance and market confidence. These experiences reflect both the practical advantages of EV ownership and the evolving awareness among key market participants.

Findings from the Global Green Growth Institute (GGGI) 2024 survey show that most EV users in Lao PDR reported positive experiences with their vehicles, recognizing multiple advantages in performance, technology, and convenience. The majority highlighted advanced technology and innovation, environmental friendliness, and the convenience of home charging as key benefits. Many also appreciated the smooth, quiet driving experience and lower operating costs, which reinforced satisfaction with EV ownership. However, some users still showed limited understanding of the long-term maintenance savings compared to internal combustion engine (ICE) vehicles, suggesting the need for better communication of EV cost advantages.

According to the GGGI 2024 survey, most EV dealers in Lao PDR strongly agreed with the key benefits of EVs, emphasizing technological advancement, environmental value, cost efficiency, and smooth driving performance as major strengths. These views largely align with those of EV users, reflecting a shared recognition of the advantages of electric mobility. Nonetheless, a few dealers were not fully aware that EVs are generally lighter in weight than ICE vehicles, indicating a need for continued technical training and updated product knowledge to enhance sales capability and customer engagement.

Therefore, the overall findings suggest that both EV users and dealers in Lao PDR have developed a largely positive perception of NEVs, grounded in technology, convenience, and environmental benefits. Strengthening technical knowledge and communicating long-term cost advantages will be essential to deepen understanding and sustain confidence in the country's growing EV market.

5.6.2.5. Preferred Communication Channels

As EV adoption in Lao PDR continues to progress, understanding how consumers and dealers access and value different communication channels is essential for effective market outreach. Communication preferences reveal not only the most trusted sources of information but also the pathways through which awareness, perception, and purchasing decisions are shaped.

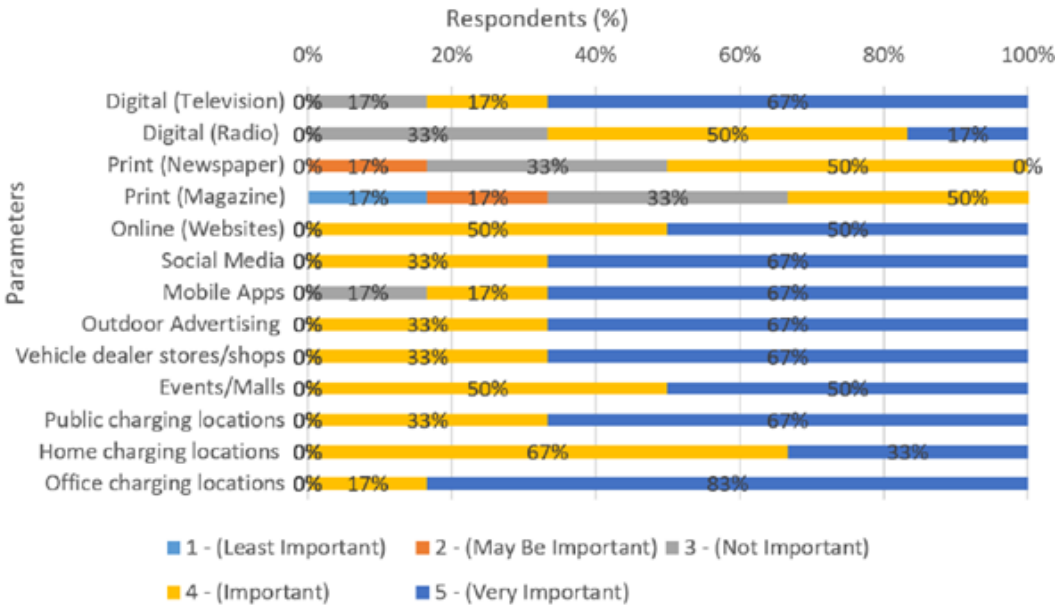


Figure 5-8: Communication channel preferences non-EV customer analysis in Lao PDR 2024

Source: GGGI (2024)

According to the survey, Figure 5-8 illustrates the preferred communication channels among non-EV consumers in Lao PDR in 2024. The findings show that respondents placed the greatest importance on home and public charging locations as key points for receiving EV-related information, with the majority rating them as "Very Important." Among media sources, digital television, online platforms, social media, and outdoor advertising were also highly valued, suggesting that visually engaging and easily accessible formats are most effective in reaching potential consumers. In contrast, traditional print media such as newspapers and magazines were viewed as moderately important, while radio and mobile apps received lower emphasis. Overall, the results indicate that communication strategies should prioritize digital and location-based channels, supported by visible information at charging stations and vehicle dealerships, to enhance public awareness and promote EV adoption in Lao PDR.

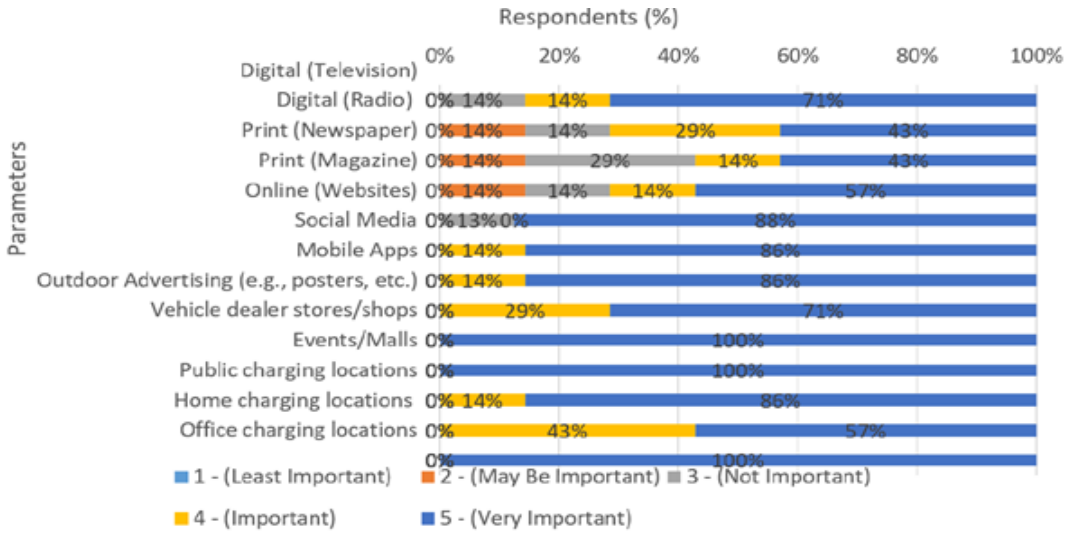


Figure 5-9: Communication channel preferences EV customer analysis in Lao PDR 2024

Source: GGGI (2024).

According to the survey, Figure 5-9 illustrates the preferred communication channels among EV customers in Lao PDR in 2024. The results show that social media, online platforms, and outdoor advertising were considered the most effective and influential channels, with a large majority rating them as "Very Important." Respondents also highlighted public and home charging locations as key physical touchpoints for receiving EV-related information. In contrast, traditional media including newspapers, magazines, and radio were viewed as less significant, indicating a clear shift toward digital engagement. Overall, the findings suggest that communication strategies targeting EV users should prioritize interactive digital media and on-site information at charging and dealership locations, as these are the most trusted and visible sources for this consumer group.

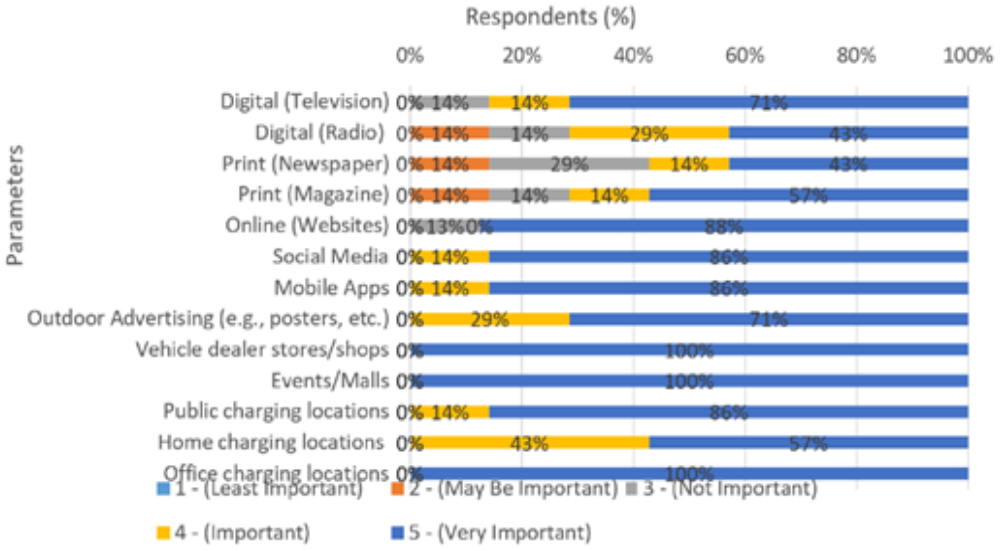


Figure 5-10: Communication channel preferences EV dealer analysis in Lao PDR 2024

Source: GGGI (2024).

According to the survey, Figure 5-10 illustrates the preferred communication channels among EV dealers in Lao PDR in 2024. The findings show that vehicle dealer stores, events or malls, and charging locations both public and home-based were rated as the most important platforms for engaging with customers, with all respondents marking these as "Very Important." Among media channels, social media, online platforms, and mobile apps were also viewed as highly effective tools for marketing and information dissemination. In contrast, traditional media such as newspapers, magazines, and radio received lower importance, indicating a strong shift toward direct interaction and digital engagement. Overall, the results suggest that EV dealers rely heavily on on-site promotions and digital communication channels to reach potential buyers and strengthen visibility within the growing EV market in Lao PDR.

In addition to communication preferences, the survey also explored future intentions toward EV adoption. Among non-EV consumers, 67% indicated that they might consider purchasing an EV in the future, and all respondents (100%) agreed that the EV market in Lao PDR will grow significantly within the next 5–10 years. Similarly, 63% of current EV users expressed their likelihood of purchasing another EV, with 100% sharing the same optimistic outlook on market expansion. These results reflect a strong sense of confidence in the long-term potential of EVs in Lao PDR, suggesting that consumer awareness and acceptance are steadily increasing alongside expectations of continued market growth.

Therefore, the findings across all three groups demonstrate a clear preference for digital and location-based communication channels, with strong trust in information delivered through charging points, dealerships, and social media platforms. This consistent pattern together with growing optimism about future market expansion underscores the need for strategic communication efforts that enhance visibility, strengthen awareness, and build consumer confidence in the development of Lao PDR's emerging EV ecosystem.

5.7 Assessment of NEV & Smart Mobility Market Preparedness

5.7.1. Country Assessment

5.7.1.1. Market Readiness index

Overall, Lao PDR's Market Readiness is low, with a total score of 1.8. The most prominent area of readiness is Vehicle Technology Readiness, which registers at a moderate level (2.6). This is a result of relying on NEVimports, primarily from China, meaning the technology of NEVs in Lao PDR, such as in terms of driving range per charge, is comparable to that of China, the main exporter.

The secondary dimension of readiness, Road and Digital Infrastructure, is still at a low level (1.9), encompassing road conditions, road quality, and comprehensive traffic management across the country. A key driver supporting readiness in this area is 5G coverage.

Meanwhile, Market Status is also currently low (1.9) due to NEVs still being in their nascent stage in Lao PDR. One positive factor contributing to Lao PDR's readiness in this dimension is the relatively competitive price of BEVs largely resulting from supportive policies like exemptions from import and other taxes.

In terms of Policy Readiness (1.7), Lao PDR's policies and strategies are not yet fully comprehensive, particularly concerning the development of energy infrastructure. While there is a clear policy focus and targets related to the market, no significant smart mobility initiatives have been introduced.

In the final dimension, which is also the greatest gap of the market readiness for this country, the Energy Infrastructure readiness is the lowest (1.0). This is due to the lack of sufficient charging stations relative to the number of NEVs, as well as the absence of a comprehensive Charging Platform and Smart Grid.

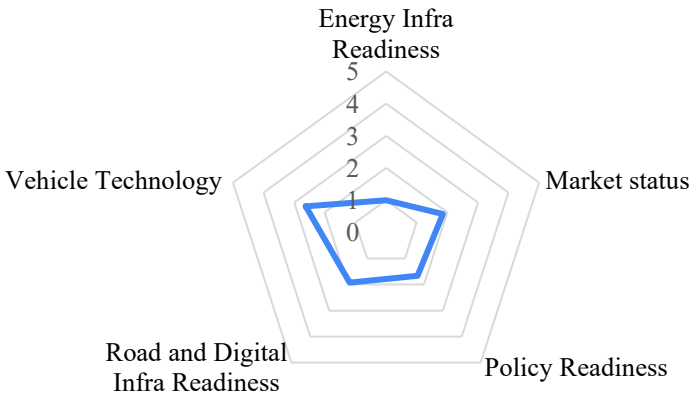


Figure 5-11: Market Readiness Index of Lao PDR

5.7.1.2. Market Status Index

The Market Status index is constructed using annual data reported by the Ministry of Public Works and Transport of Lao (2025), providing a standardized basis for subsequent index score analysis. The BEV Penetration, the PHEV, REEV Penetration, and the ICV Penetration (L2 Autonomous) indices are calculated from the ratio of BEV/ PHEV, REEV/ICV sales to total sales in 2024. The motorization rate index is calculated from car ownership per 1,000 people. In addition, the DC Fast Charging Share Index measures the proportion of public EV charging connectors that are DC fast chargers. Finally, the BEV Price and PHEV, REEV Price indices are computed as the ratios of BEV/ PHEV, REEV to ICE prices by model segment using car prices from the official websites of the respective automotive manufacturers (2025).

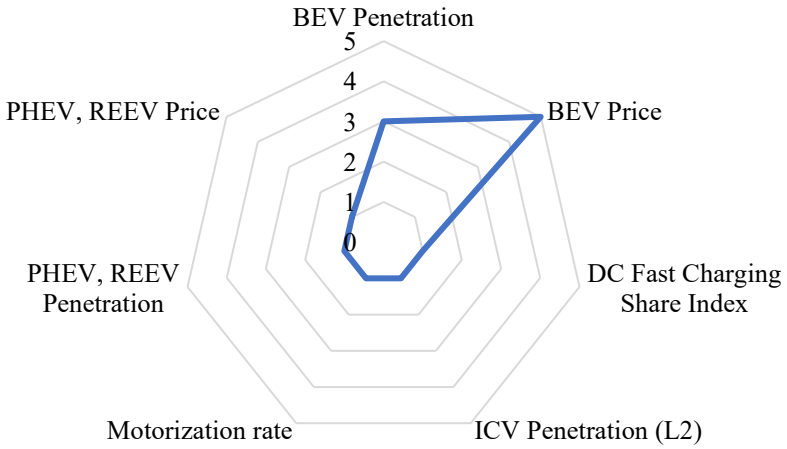


Figure 5-12: Market Status Index of Lao PDR

The Market Status Readiness Index evaluates Lao PDR's current capacity and progress in adopting NEVs. The results reveal that Lao PDR remains in the early stage of market development, representing only 1.9 scores in this indicator.

Lao PDR has a very small automotive market compared with the broader regional context, with total annual vehicle sales not exceeding approximately 50,000 units. However, in 2024, the country faced heightened inflationary pressures and elevated fuel prices, which significantly influenced consumer purchasing behavior. As a result, a large share of consumers shifted toward electric vehicles, leading to BEV sales accounting for approximately 19 percent of total vehicle sales in 2024. This development is reflected in the moderate assessment score for BEV penetration (3.0).

The Lao automotive market is predominantly import-based, with electric vehicles mainly sourced from China through both authorized Chinese-brand dealerships and independent distributors. Intense price competition among importers has played a critical role in reducing vehicle prices, enabling Chinese-imported BEVs to compete effectively with internal combustion engine vehicles. This strong price competitiveness is captured by the highest assessment score for BEV price (5.0), highlighting price affordability as a key driver of BEV adoption in the Lao market.

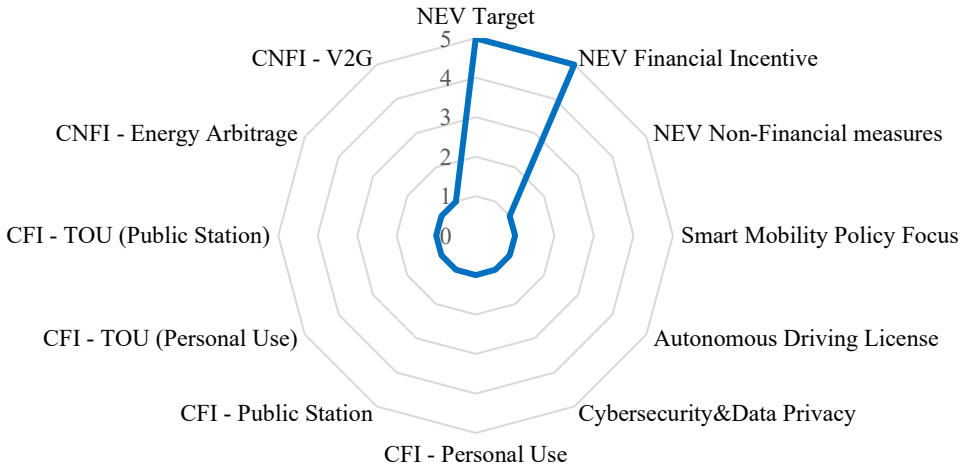
Nevertheless, the current status of PHEV and REEV penetration, PHEV and REEV price competitiveness, the DC Fast Charging Share Index, and ICV penetration in Lao PDR remains extremely low (1.0). PHEV and REEV adoption are minimal, as the domestic market relies predominantly on imported BEVs, particularly low-cost electric scooters and small city-oriented BEVs from China. Consequently, the availability of PHEV and REEV models is very limited, offering consumers only a narrow range of choices.

With respect to charging infrastructure, DC fast chargers are heavily concentrated in Vientiane Capital and a few key economic zones. The absence of nationwide charging coverage constrains consumer confidence and limits the scalability of NEV usage beyond major urban areas. Although Lao PDR has approximately 180–200 charging ports nationwide—most of which are DC fast chargers—the overall assessment score remains low (1.0) due to the small number of charging stations and their limited spatial distribution. This situation poses a significant barrier to long-distance travel and cross-regional NEV usage.

Furthermore, the Intelligent Connected Vehicle (ICV), particularly Level 2 autonomous driving technologies, is virtually absent from the Lao market. Combined with a relatively low motorization rate compared with neighboring ASEAN countries, this indicates that private vehicle ownership in Lao PDR is still expanding gradually and that the broader NEV ecosystem remains in an early stage of development.

5.7.1.3. Policy Readiness Index

The radar profile clearly shows Lao's high readiness for NEV targets and fiscal incentives, contrasted by low scores in non-financial measures, charging-related incentives, and digital mobility regulations, reflecting a policy landscape that is strategically ambitious but operationally nascent.



Note: CFI - Charging Financial Incentive; CNFI - Charging non-Financial Incentive

Figure 5-13: Policy Readiness Index of Lao PDR

At the policy level, Lao PDR demonstrates strong commitment to transport electrification through the Resolution on Electric Vehicle Promotion (No. 08/GOL, 2021) and the National Policy on Electric Vehicle Development 2024–2030. These frameworks establish clear national targets of 1% NEV penetration by 2025 and 30% by 2030, supported by plans to install at least 50 charging stations by 2025 and over 100 by 2030. These measures earn Lao PDR a maximum score (5.0) for the NEV Target Index, positioning the country as one of the more policy-forward actors in the Mekong region in terms of setting long-term electrification goals.

Fiscal measures are also relatively advanced. Lao PDR provides 0% import duties for NEVs and components and applies a 3% purchase tax for BEVs, resulting in a high score (5.0) for the NEV Financial Incentive Index. However, non-financial incentives such as preferential parking, dedicated plates, or restricted-zone access are not yet implemented, yielding a low readiness score (1.0).

The government has not yet announced a comprehensive smart-mobility strategy, and policies addressing autonomous vehicles, connected mobility infrastructure (V2I/V2X), or digital transport systems remain under development. Similarly, cybersecurity and data-privacy regulations for electric-vehicle supply equipment (EVSE) and connected-vehicle data have not been formalized, indicating another low-readiness area.

In the charging ecosystem, Lao PDR currently offers no direct or indirect financial support for either personal or public charger installations, nor does it provide ToU tariffs for residential or public NEV charging. As a result, the indicators for Charging Financial Incentive – Personal Use, Charging Financial Incentive – Public Station, and ToU-based tariffs each score at 1.0. Furthermore, non-financial mechanisms, including energy arbitrage and V2G integration are absent due to the country's

flat electricity tariff structure and the lack of enabling regulations for aggregators, grid services, or bidirectional power exchange.

The radar chart thus Illustrates a dual-character policy landscape: high-level ambition and fiscal readiness at the strategic level, juxtaposed with low operational readiness in regulatory, infrastructural, and digital domains. To transition from policy commitment to implementation, Lao PDR will need to strengthen charging infrastructure incentives, introduce differentiated tariff structures, and develop standards for smart-mobility, data security, and grid integration. Expanding beyond fiscal levers toward a comprehensive ecosystem-based policy framework will be essential to achieve sustained NEV market growth and long-term transport decarbonization.

5.7.1.4. Energy Infrastructure Readiness Index

The Energy Infrastructure Readiness Index assesses Lao PDR's ability to support large-scale NEV deployment through its power system modernization, charging network interoperability, and infrastructure coverage. As shown in Figure 5-13, the radar chart presents three key indicators: Smart Grid Readiness, Charging Communication Protocol Standard – Single Platform, and NEVs per Charging Pile – Cumulative AC/DC. The radar shape highlights that while policy and institutional awareness of smart grid development is emerging, the country's infrastructure and communication standards remain at an early stage of readiness, resulting in uniformly low scores across all dimensions.

Lao PDR's Smart Grid Readiness is currently rated at the initial level (1.0), characterized by a conventional, one-way power flow system and limited grid automation or digitalization. The national utility, Electricité du Lao PDR (EDL), has initiated several pilot programs involving Advanced Metering Infrastructure (AMI) and limited-scale grid modernization projects, but these remain fragmented and concentrated in urban areas. The absence of a national smart grid roadmap or performance benchmarking (such as a Smart Grid Index equivalent) further underscores the early developmental status of Lao PDR's grid modernization efforts.

In terms of charging communication protocols, Lao PDR has not yet adopted a unified national standard or established a centralized charging platform to enable interoperability between vehicles, chargers, and grid systems. Most existing charging points operate on basic plug-and-charge configurations, lacking communication protocols such as OCPP (Open Charge Point Protocol) or ISO 15118 that support smart charging, user authentication, and grid data exchange. This limitation constrains operational efficiency, monitoring, and data sharing, resulting in a readiness score of 1.0 for this indicator.

The NEVs per Charging Pile ratio further reflects infrastructure constraints. With approximately 180–200 charging ports nationwide serving around 9,000 NEVs, the ratio stands at roughly 90–100 NEVs per charging pile, assuming an average of two ports per pile. This figure is significantly higher than regional benchmarks, indicating limited accessibility and uneven distribution of charging stations, which are largely concentrated in Vientiane Capital and select economic corridors. Consequently, Lao PDR also scores 1.0 for this indicator.

Overall, the radar chart illustrates that energy infrastructure readiness in Lao PDR is in its formative stage, with uniformly low scores indicating substantial room for improvement. While hydropower resources provide a clean energy foundation, the country lacks the smart grid infrastructure, communication standards, and dense charging network necessary to support widespread NEV adoption. To enhance readiness, Lao PDR should prioritize grid modernization and digitalization, establish national charging standards and data protocols, and expand geographically balanced charging infrastructure, forming the backbone for a resilient and smart NEV energy ecosystem.

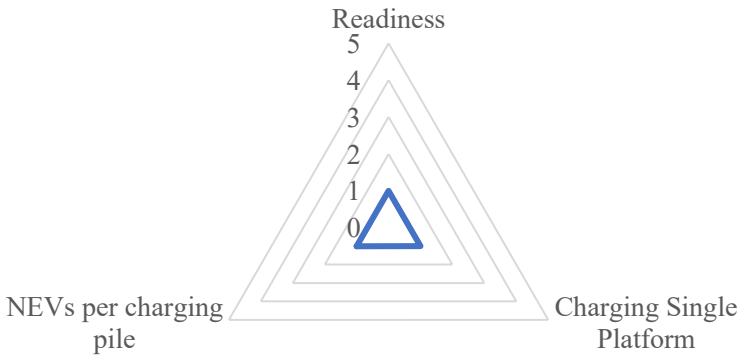


Figure 5-14: Energy Infrastructure Index in Lao PDR

5.7.1.5. Road and Digital Infrastructure Readiness Index

The Road and Digital Infrastructure Readiness Index evaluates Lao PDR's capacity to support advanced and connected vehicle operations through both physical transport infrastructure and digital connectivity systems. As illustrated in Figure 5-14, the radar chart visualizes readiness across five key indicators: 5G coverage and mobile connection speed, traffic management systems, road quality, road environment, and traffic separation. The shape of the radar indicates that while digital connectivity performance is relatively strong, other indicators, particularly road environment and traffic separation remain at an early development stage.

Lao PDR performs best in 5G coverage and mobile connection speed, scoring 4.3 out of 5, reflecting steady progress in the telecommunications sector and national efforts to strengthen broadband infrastructure under the Lao ICT Vision 2030. This robust connectivity foundation enhances the potential for future deployment of V2I and Vehicle-to-Everything (V2X) communication systems that underpin autonomous and smart mobility applications.

However, other infrastructure dimensions lag behind. Traffic management systems capable of supporting Level 2–3 autonomous vehicle functions, such as real-time data exchange between vehicles and roadside infrastructure (traffic lights, cameras, or sensors), has readiness score of 1.0. Urban traffic control relies primarily on fixed-time or manually operated signals, and no integrated digital traffic monitoring platform currently exists to manage congestion or safety data.

The road quality index, rated at 2.3 by the World Economic Forum, reflects moderate conditions, with many provincial and rural roads suffering from poor surface maintenance and uneven standards. Similarly, the road environment, including lane markings, standardized traffic signs, and signal systems, remains limited and inconsistent across regions, resulting in a low score of 1.0. The traffic separation indicator, which assesses the enforcement of laws or infrastructure for segregating motorcycles from larger vehicles, also scores 1.0, as there is little evidence of formal separation measures or consistent enforcement.

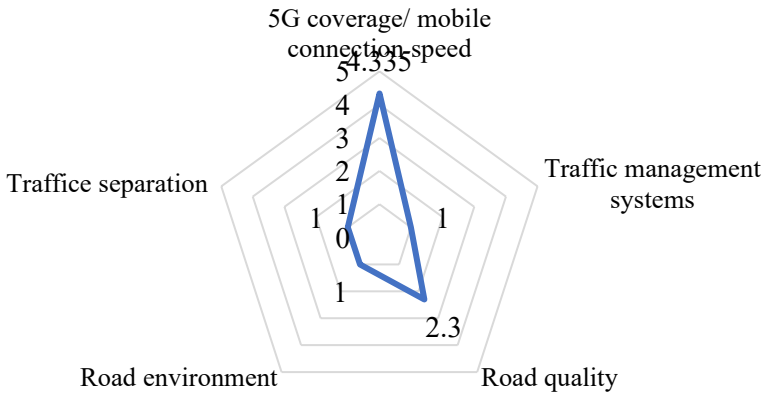


Figure 5-15: Road and Digital Infrastructure Readiness Index in Lao PDR

5.7.1.6. Vehicle Technology Readiness Index

The Vehicle Technology Readiness index assesses the technological capabilities of new energy vehicles (NEVs) using annual data from the official websites of the respective automotive manufacturers (2025). The BEV Product Offering (range distance) index is calculated from the average driving range of BEV models in the market, weighted by the number of models, while the PHEV, REEV Product Offering (range distance) index draws on the average BEV-mode range of PHEV and REEV models, similarly weighted. The NEV experience (years) index measures the number of years since the country initiated its national NEV action plans, capturing the policy-driven timeline of market development. In addition, the BEV Model variety and the PHEV, REEV Model variety indices are computed as the ratios of BEV and PHEV/REEV models to ICE models, respectively, reflecting the diversification of electrified product offerings.

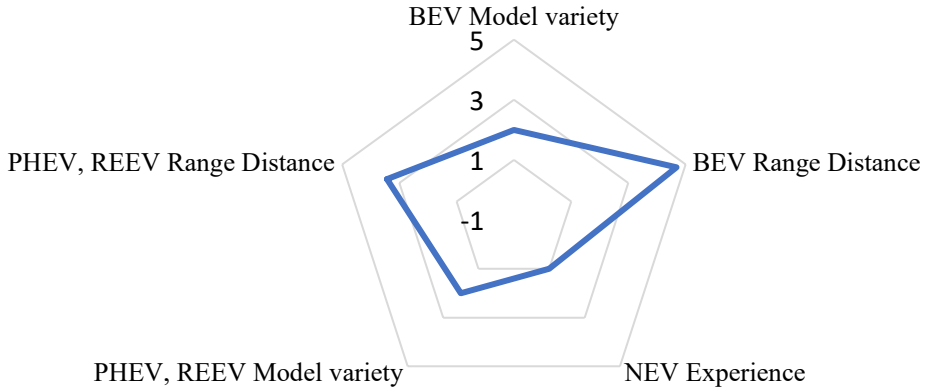


Figure 5-16: Vehicle Technology Readiness in Lao PDR

The product offering (range distance) of BEV (4.7) and PHEV/REEV (3.4) are the main contributors to Lao PDR's moderate level of vehicle technology readiness. The country performs relatively well in BEV product technology, with average driving ranges of approximately 400–500 kilometers. This performance is largely attributable to the importation of BEV models from Chinese manufacturers such as BYD, Dongfeng, and Wuling, which offer competitive technological specifications that are well suited to small and price-sensitive markets. In parallel, the product performance of PHEV and REEV models has also improved, with electric-only driving ranges typically between 60 and 100 kilometers.

Nevertheless, Lao PDR remains at an early stage of NEV market development and records low assessment scores in several structural dimensions, including NEV market experience (1.0), BEV model variety (2.0), and PHEV/REEV model variety (2.0). The country has only begun implementing policies to promote electric vehicle adoption within the past two years, primarily through reductions in import duties and excise taxes to encourage a shift away from oil consumption during periods of elevated fuel prices. As a result, domestic user experience and familiarity with NEVs remain limited.

Moreover, the NEV market in Lao PDR is almost entirely import-dependent, with vehicles sourced predominantly from China. Combined with the small size of the domestic automotive market, this constrains the scale and diversity of BEV and PHEV/REEV imports. Consequently, consumers face limited choices in terms of vehicle types and model variety, which continues to restrict broader market development despite improving vehicle technology performance.

5.7.2. Key Success Factors and Gap Analysis

5.7.2.1. Key Success Factors

Lao PDR's emerging transition toward smart and sustainable mobility is supported by several structural and policy advantages that create a strong foundation for future growth. The combination of abundant renewable energy, clear government direction, and regional integration makes the country well-positioned to accelerate electric vehicle (EV) adoption in the coming decade.

1) Strong Policy Commitment and Clear National Targets

Lao PDR has established a clear national NEV target under the *National Policy on Electric Vehicle Development (2024–2030)*, aiming for 30% NEV penetration by 2030 and the installation of over 100 public charging stations. This commitment aligns with broader national frameworks such as the *Green Growth Strategy* and the *Long-Term Strategy for Carbon Neutrality 2050*, providing a long-term policy anchor for e-mobility transition.

2) Favorable Fiscal Incentives and Competitive Vehicle Prices

Import duties for NEVs and components are set at 0%, and BEV purchase tax is capped at 3%, significantly reducing the price gap between BEVs and conventional ICE vehicles. This has supported the entry of affordable Chinese BEV brands such as BYD, Dongfeng, and Wuling, resulting in competitive vehicle prices (scoring 3–4 in the Market Readiness Index).

3) High Digital Connectivity Readiness

With a 5G coverage score of 4.3/5, Lao PDR ranks relatively high among Mekong countries in mobile connectivity. This provides a strong foundation for future deployment of V2I/V2X communication systems, digital traffic management, and smart-mobility innovation.

4) Abundant Renewable Energy Potential

The country's hydropower-dominated energy mix offers a clean electricity backbone for NEV charging. This provides a natural advantage in reducing life-cycle emissions and integrating NEVs into a renewable-heavy power system.

5) Growing International Partnerships and Pilot Projects

Collaboration with Chinese, Japanese, and development partners (e.g., JICA, UNDP) has enabled pilot deployments of EV charging infrastructure, EV bus fleets, and capacity-building programs, creating early institutional experience that can be scaled up.

5.7.2.2. Gap Analysis

While Lao PDR has demonstrated strong policy commitment and early fiscal incentives to promote transport electrification, significant structural, technical, and institutional barriers continue to impede large-scale implementation. These challenges limit infrastructure expansion, smart mobility integration, and private-sector participation. The key gaps identified across policy, infrastructure, and governance dimensions are outlined below:

1) Limited Charging Infrastructure and Low Accessibility

Lao PDR's charging network remains extremely limited, with roughly 180–200 ports nationwide serving an estimated 9,000 NEVs, equating to about 90–100 vehicles per charging pile, one of the highest ratios in ASEAN. Infrastructure is concentrated mainly in Vientiane Capital, leaving secondary cities, tourism zones, and border areas with inadequate coverage. This uneven distribution restricts long-distance mobility and undermines consumer confidence in EV adoption.

2) Lack of Technical Standards and Smart Grid Integration

The absence of national charging communication protocols such as OCPP or ISO 15118, along with the lack of a unified data management platform, results in fragmented charging systems and weak interoperability. The electricity grid remains conventional, operating with one-way power flows and minimal digitalization. Without smart grid roadmaps or automated demand management, Lao PDR cannot yet optimize charging behavior or support large-scale renewable energy integration.

3) Underdeveloped Road, Traffic, and Digital Infrastructure

Despite relatively strong mobile and 5G connectivity, physical transport infrastructure remains weak. Road quality averages a score of 2.3, and lane marking, traffic separation, and traffic signal standardization are minimal. Intelligent traffic management systems are not yet in place, limiting the country's readiness for connected, autonomous, and data-driven mobility systems.

4) Weak Institutional Coordination and Regulatory Frameworks

Responsibilities for NEV development are divided among multiple ministries—MEM, MPWT, MONRE, and MOIC, without a formal inter-ministerial mechanism. The absence of a central coordinating authority results in overlapping mandates, slow policy harmonization, and limited private-sector engagement. Regulatory clarity on licensing, tariffs, and data management for charging operators is still lacking.

5) Limited Industrial Capacity and Technical Workforce

Lao PDR remains fully dependent on imported EVs, batteries, and charging equipment, as there is no local manufacturing or component assembly. The lack of domestic R&D and workforce training programs limits opportunities for technology transfer, after-sales service capability, and green job creation. This dependency also exposes the sector to supply chain and cost volatility.

6) Insufficient Financial Mechanisms and Data Governance

The absence of differentiated electricity tariffs such as ToU or dynamic pricing reduces incentives for efficient charging and discourages private investment. Similarly, there are no tailored financial instruments such as EV leasing, low-interest loans, or charging infrastructure subsidies. Moreover, data privacy and cybersecurity regulations for EVSE systems and connected vehicles remain undefined, creating potential risks as digital mobility systems expand.

5.8 Policy Recommendations

Overall, the benefits of NEV growth and Lao PDR's energy security goals are quite clearly aligned. However, policy support is not yet comprehensive enough, covering neither the market nor the various infrastructure needs. Therefore, setting the NEV target at 30% by 2030 remains a significant challenge.

Lao PDR's transition toward clean and connected mobility requires an integrated policy framework that links transport electrification, digitalization, and infrastructure modernization. While the country has established clear targets for NEV adoption and provided fiscal incentives, progress toward smart mobility, encompassing intelligent transport systems, digital infrastructure, and data governance remains nascent. The following recommendations outline strategic actions to strengthen Lao PDR's readiness for smart-mobility development.

1) Strengthen NEV Market Adoption and Affordability

Lao PDR should improve Access to financing and reduce upfront costs as High upfront purchase cost remains a substantial obstacle for non-EV consumers, compounded by limited access to suitable financing mechanisms for both buyers and dealers. To address this, the government should collaborate with banks to establish EV-specific loan products, offering longer tenors, preferential interest rates, and reduced collateral requirements.

Moreover, Lao PDR should adopt a set of focused, demand-driven incentive schemes that directly address consumer needs and existing structural constraints. Priority measures include subsidies for home-charger installation to lower initial cost barriers and support the strong consumer preference for convenient charging. Fleet-transition programs for taxis, government vehicles, logistics operators, and delivery services can help create an early critical mass of NEVs, increasing visibility and normalizing their use. Urban initiatives such as low-emission zones or priority lanes for EVs would further reinforce public awareness while signaling clear, long-term government commitment to cleaner mobility. In addition, pilot projects in tourism hubs—such as EV rentals, electric shuttle services, or integrated e-mobility centers—can showcase the practical benefits of NEVs to both residents and international visitors. Together, these targeted incentives would not only stimulate early demand but also provide strong market signals of sustained policy support for NEV development in Lao PDR.

2) Develop a National Smart Mobility Master Plan

Lao PDR should establish a comprehensive Smart Mobility Master Plan (2025–2035) to coordinate policies across the transport, energy, and digital sectors. This plan should define national targets for smart and connected vehicle deployment, digital traffic management, and data infrastructure integration. It should also identify key smart corridors such as the Vientiane–Luang Prabang and Vientiane–Pakse routes for pilot projects involving intelligent transport systems and real-time mobility data collection. By integrating mobility planning with the Digital Economy Vision 2040 and the Green

Growth Strategy, Lao PDR can ensure consistency between transport electrification, renewable-energy use, and long-term economic goals.

3) Accelerate Charging Infrastructure Expansion

Expanding charging coverage is central to enabling large-scale NEV adoption. The government should implement a National Charging Infrastructure Plan extending beyond Vientiane Capital to major cities, logistics hubs, and cross-border routes. Public–private partnerships (PPPs) can be used to deploy DC fast-charging stations along highways, industrial zones, and tourism areas. To attract investment, the government should provide regulatory clarity and fiscal incentives for private developers while ensuring equitable access to charging services across provinces.

4) Introduce Smart Tariff Structures and Financial Incentives

Lao PDR should introduce ToU electricity tariffs to encourage EV charging during off-peak hours, reduce system costs, and improve grid efficiency. Complementary fiscal incentives, such as import-duty exemptions for smart chargers and concessional financing for infrastructure operators, would enhance private-sector participation. These financial mechanisms should be linked to grid planning to ensure sustainable growth in electricity demand and to support both public and household-level charging investments.

5) Adopt Technical and Interoperability Standards

The absence of unified charging and communication standards presents a key barrier to scaling smart mobility. Lao PDR should adopt internationally recognized standards such as the Open Charge Point Protocol (OCPP) and ISO 15118 to ensure interoperability among chargers, vehicles, and grid systems. Early adoption of these standards will prevent system fragmentation and facilitate regional compatibility within the ASEAN framework. Additionally, safety and data standards for charging equipment and vehicle connectivity should be formalized to enhance user confidence and operational reliability.

6) Strengthen Institutional Coordination and Governance

The governance of smart mobility development requires clear institutional mandates and effective inter-agency coordination. A National Smart Mobility Coordination Committee should be established, chaired jointly by the Ministry of Energy and Mines (MEM), the Ministry of Public Works and Transport (MPWT), and Electricité du Lao PDR (EDL). This body should oversee policy implementation, tariff design, and licensing for EV infrastructure operators. It should also facilitate integration between energy and transport planning while promoting transparent data governance and regulatory oversight.

7) Build Human Capital and Technological Capacity

A successful smart mobility transition depends on skilled human resources and strong local technical capacity. Training programs for EV maintenance, charging-station operation, and smart-grid management should be developed in partnership with universities and vocational institutions. The government should support pilot projects and start-ups working on e-mobility services, fleet optimization, and digital data platforms. Strengthening partnerships with regional institutions will accelerate knowledge transfer and enable Lao PDR to adopt best practices in digital and energy innovation.

8) Priority Actions for 2025–2030

Between 2025 and 2030, Lao PDR should prioritize infrastructure expansion, regulatory reform, and capacity building. The immediate focus should be on expanding the public charging network to reach at least 500 stations nationwide, particularly along strategic economic and tourism corridors. Intelligent traffic systems should be piloted in Vientiane and major cities to lay the groundwork for connected-vehicle deployment. Regulatory frameworks for ToU tariffs, licensing, and charging-station operation must be finalized to stimulate private investment. At the same time, smart metering and data-monitoring initiatives should begin to prepare for future grid integration. By 2030, Lao PDR should aim to establish a functional ecosystem that links electric mobility, digital infrastructure, and renewable energy, transforming the country from an early adopter into a regional model for smart and sustainable transport.

Chapter 6 State of Preparedness of Vietnam

6.1 Market and Adoption Status

6.1.1. NEV Market Trend

6.1.1.1. NEV Registration

The growth of vehicle registrations in Vietnam from 2015 to 2024 reflects the market's dynamic response to the government's vision and incentive measures outlined in the previous section. The total number of registered vehicles in the country has risen steadily from 208,572 units in 2015 to 450,147 units in 2024, with internal combustion engine (ICE) vehicles continuing to dominate the market. However, a major structural shift began following the introduction of targeted EV support policies—most notably the 100% registration fee exemption for battery electric vehicles (BEVs), first implemented in 2022 and later extended to 2027.

This policy intervention has clearly catalyzed the rapid growth of NEV adoption. Registrations surged from only six units in 2020 and 167 units in 2021 to 4,040 units in 2022, before accelerating dramatically to 79,781 units in 2024. This exponential rise demonstrates the effectiveness of financial incentives in lowering upfront costs and stimulating consumer demand for NEVs. Consequently, NEVs accounted for approximately 17.7% of total vehicle registrations in 2024. As shown in Figure 6-1.

Beyond the immediate effect on consumer adoption, this growth trajectory also signals a structural transformation within Vietnam's automotive ecosystem. The expanding NEV market has begun to attract significant interest from both domestic and foreign investors, particularly in battery production, component manufacturing, and charging infrastructure development. Local firms such as VinFast have leveraged this momentum to expand manufacturing capacity and introduce BEV models for both domestic and export markets. Meanwhile, Vietnam's Ministry of Transport and Vietnam Register have actively implemented national standards and technical regulations—30 TCVNs (national standards) and 7 QCVNs (technical regulations)—aligned with ISO and ECE frameworks, to ensure safety, interoperability, and environmental protection.

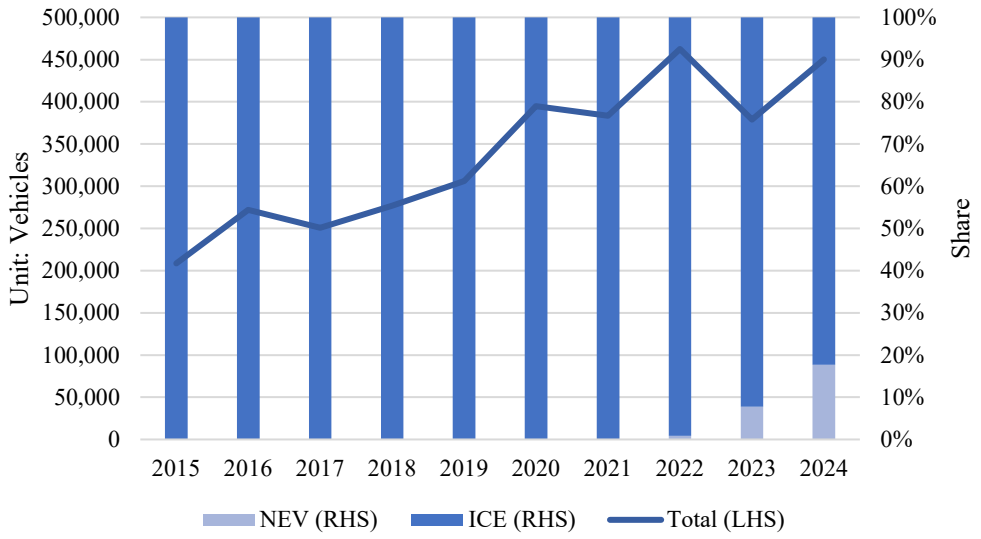


Figure 6-1: Annual NEV Registrations in the Vietnam, 2015–2024

Source: Author's compilation from Vietnam Register (2022)[77] and Ai Hân (2025)[78]

6.1.1.2. NEV Sales

Vietnam's automotive industry is undergoing a significant transformation, with rapid growth in both conventional and electric vehicle segments. The total vehicle production is forecast to grow by approximately 22% in 2025, positioning Vietnam among the fastest-growing automotive markets in Southeast Asia. This growth is driven by a combination of rising income levels, urbanization, government incentives, and increasing consumer awareness of environmental issues.

In 2024, Vietnam's auto market recorded at 450,147 new vehicle sales, comprising approximately 70% of domestically assembled and 30% of imported vehicles, indicating a strong domestic manufacturing base complemented by growing import demand. This foundation is essential for supporting the country's ambitions to scale electric vehicle (EV) production and adoption.

The electric vehicle segment, especially battery electric vehicles (BEVs), is gaining traction. In 2023, BEV sales reached approximately 29,281 units, representing about 7.73% of the total vehicle market, and this share is expected to rise steadily in the coming years. By early 2025, hybrid electric vehicle (HEV) sales had added another 10,000 units, reflecting growing interest in electrified transportation alternatives across multiple income segments.

A key player driving EV growth in Vietnam is VinFast, the country's leading EV manufacturer, which has rapidly scaled both production and infrastructure. VinFast not only leads in domestic BEV sales but has also developed the most extensive EV charging network in the country, with over 150,000 charging ports spanning all 63 provinces. This infrastructure backbone enhances consumer confidence in EV usability and addresses one of the primary adoption barriers: range anxiety.

[77] Vietnam Register Trend and Development of Electrical Vehicles in Vietnam (2022), https://www.unescap.org/sites/default/d8files/event-documents/32%20_Viet%20_Nam%20_Register%2C%20_Trend%20_and%20_Development%20_of%20_EVs%20_in%20_Viet%20_Nam.pdf

[78] Ai Han (2025), Số lượng ô tô điện tại Việt Nam tăng gần 20 lần trong 3 năm, VinFast dẫn đầu thị trường khi bán hơn 87.000 xe trong năm 2024

In addition to domestic leadership, Vietnam's EV market is attracting increasing foreign investment and competition. Several international automakers—including Hyundai, Toyota, Kia, Tesla, Mercedes-Benz, and BYD—have launched EV and hybrid models tailored to Vietnamese consumers, with several brands exploring local assembly partnerships. Notably, Chinese manufacturers such as Geely, GAC Aion, and BYD are making strategic moves into the market.

For instance, Geely is planning to establish a local assembly facility with an annual capacity of 75,000 units, signaling a shift from merely exporting EVs to building localized supply chains in Vietnam. These moves not only diversify the available EV offerings but also strengthen Vietnam's position as a future EV manufacturing hub in the region.

Despite these promising trends, challenges remain. EVs still account for a relatively small share of total auto sales, and infrastructure outside major cities remains underdeveloped. Moreover, while vehicle production is rising, the share of EVs within that production remains low relative to ICE vehicles, suggesting that deeper structural and supply-side adjustments are still required to support long-term electrification goals.

Nonetheless, with rising demand, expanding model diversity, and policy incentives in place, Vietnam's EV market is poised for substantial growth. Industry forecasts project that the EV market—valued at approximately USD 3.5 billion in 2024—could expand to over USD 14 billion by 2032, reflecting a compound annual growth rate (CAGR) of around 17.5%. This trajectory underscores the dynamic nature of Vietnam's EV transition and highlights its growing relevance in the global automotive landscape.

6.1.1.3. Model Availability

As Vietnam's only major domestic automaker specializing exclusively in electric mobility, VinFast held a 19% market share in 2024, with total sales reaching approximately 87,000 units. This performance positioned VinFast as the top-selling automotive brand nationwide, surpassing established global players such as Toyota (14%) and Hyundai (13%), while other international brands accounted for between 5% and 8% each, as illustrated in Figure 6-2.

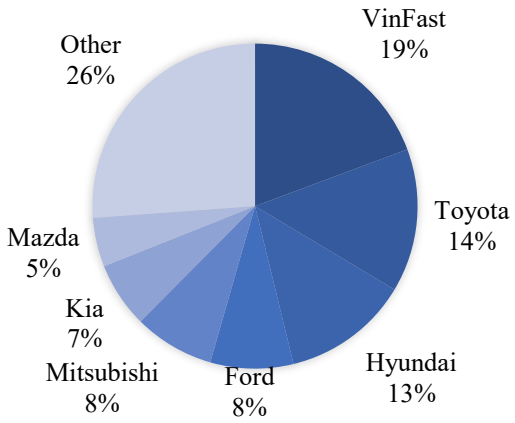


Figure 6-2: Share of Automotive Brands in Vietnam, 2024

Source: Author's compilation from MarkLine Report (2024)[79]

[79] https://www.marklines.com/en/vehicle_preset/search/graph?mode=3&numberCategory=1&isMonthly=false&nationCode=VNM&fromYear=2015&toYear=2024

VinFast's market leadership reflects the success of its strategy to focus entirely on Battery Electric Vehicles (BEVs). The company has introduced a comprehensive range of BEV models across multiple segments, aligning closely with the Vietnamese government's pro-EV policies—particularly Decision No. 876/QD-TTg (2023), which emphasizes EV promotion and green transformation. This synergy between corporate direction and national policy underscores the country's growing momentum toward electrification. It also illustrates the rising sense of technological nationalism, with many Vietnamese consumers consciously choosing locally made vehicles as a matter of pride and confidence in domestic innovation.

By contrast, international brands such as Toyota and Hyundai remain strong competitors, leveraging long-established reputations, customer trust, and extensive dealership networks. While their product portfolios are still dominated by internal combustion engine (ICE) and hybrid electric vehicle (HEV) models, these brands continue to attract consumers seeking proven reliability and traditional powertrains. Their sustained market presence indicates that Vietnamese car buyers retain diverse preferences, balancing interest in new electric technologies with continued demand for conventional vehicles.

Overall, the coexistence of a robust domestic BEV producer (VinFast) and strong foreign ICE/HEV players (Toyota, Hyundai, and others) has created an increasingly competitive and diversified automotive market in Vietnam. Consumers benefit from a wider range of choices across price segments and vehicle functions, while the market structure reflects both technological transition and evolving consumer behavior—factors that are shaping Vietnam's automotive ecosystem as it advances toward a more electrified future.

Based on Table 6-1, the NEV market in Vietnam is clearly dominated by BEVs, with a strong concentration in the SUV segment and mid-to-long driving ranges. Most BEV models offered by leading brands fall within the 401–700 km per charge category, indicating that manufacturers are prioritizing practical driving ranges suitable for daily use and intercity travel.

Among all brands, VinFast plays a leading role, offering the largest number of BEV SUV models, particularly in the 201–400 km and 401–700 km ranges, reinforcing its position as Vietnam's flagship BEV manufacturer. Other major brands—such as Hyundai, Ford, and Kia—also focus predominantly on BEV SUVs within the 401–700 km range, while Toyota maintains a more diversified portfolio that includes BEV sedans/hatchbacks and PHEV models across SUVs and MPVs.

Table 6-1: NEV Models for TOP 5 Brands in Vietnam in 2025

Brand	**Engine type**	**Model**	**Distance range (km.)**			
			0-200	201-400	401-700	>700
VinFast	BEV	SUVs		4	5	
Toyota	BEV	Sedan/Hatchback	2			1
		SUVs		1	2	
	PHEV	MPVs	1			
		SUVs	5			1
Hyundai	BEV	Sedan/Hatchback		1	2	
		SUVs		5	5	
Ford	BEV	SUVs		1	5	
	PHEV	SUVs				2
Kia	BEV	SUVs		1	7	
	PHEV	SUVs	4			

Source: Author's compilation from the NEV models in Vietnam in 2025

6.1.1.4. Affordability

The Total Cost of Ownership (TCO) assessment for Vietnam offers a detailed evaluation of the economic performance of Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Internal Combustion Engine (ICE) vehicles across major passenger car segments. Situated within a rapidly developing automotive market, this analysis investigates long-term financial implications of adopting electrified vehicles for both consumers and policymakers. To maintain consistency and comparability, the TCO calculations are based on the following assumptions: (1) a vehicle lifespan of seven years; (2) an annual driving distance averaging 20,000 kilometres; (3) a single tire replacement throughout the ownership period; (4) constant fuel and electricity prices; (5) differences in registration and license plate fees between NEVs and ICE vehicles; (6) a resale value of 30% for vehicles aged 6-10 years80, regardless of engine type; (7) an insurance premium for BEV and PHEV vehicles is 50 percent higher than ICE vehicles; and (8) inspection fees based on seating capacity.

[80]Nguyen Hanh, V. (2025, March 11). Vietnam extends EV registration fee exemption until 2027. Vietnam Briefing. https://www.vietnam-briefing.com/news/vietnam-extends-ev-registration-fee-exemption-until-2027.html/

Applying these assumptions, the TCO comparison spans three representative segments: Sedan/Hatchback Segment B, Sedan/Hatchback Segment D, and SUV-D, revealing notable variations in cost efficiency across powertrain types. In the Sedan/Hatchback Segment B, BEVs exhibit a clear advantage, with BYD Dolphin (BEV) having the lowest ownership cost at approximately VND 595 million, in contrast to VND 664 million for Toyota Vios (ICE). This difference of over VND 100 million is largely driven by lower electricity expenditures and reduced maintenance needs, which offset the slightly higher purchase price of Dolphin.

In the Sedan/Hatchback Segment D, the TCO disparity between BEVs and ICE vehicles becomes less pronounced. BYD Han (BEV) has an estimated total cost of VND 1.35 billion, slightly above VND 1.22 billion for Toyota Camry (ICE) (Figure 6-3:). This smaller gap is mainly due to the higher initial price of mid-size BEVs in Vietnam, which counterbalances the savings from reduced energy and maintenance expenses (Figure 6-2). However, ongoing domestic production and potential scale efficiencies are expected to narrow this difference in the future.

For the SUV-D segment, a different trend emerges. VinFast VF 8 (BEV) has the lowest TCO at approximately VND 1.13 billion, followed by Mazda CX-8 (ICE) at VND 1.14 billion, while Kia Sorento (PHEV) has the highest total ownership cost at VND 1.20 billion. The comparatively higher TCO of the PHEVs reflect their elevated upfront cost and limited fiscal benefits relative to BEVs, indicating that plug-in hybrids are less economically attractive under current market conditions.

The findings indicate that BEVs currently offer the most favourable ownership costs across both entry-level and higher-end segments, driven by affordable electricity, manageable maintenance costs, and the expansion of domestic production that could further lower retail prices. However, the total cost of ownership (TCO) of plug-in hybrid electric vehicles (PHEVs) remains relatively higher than that of internal combustion engine (ICE) vehicles and battery electric vehicles (BEVs), as PHEV models available in Vietnam are primarily in larger segments, such as SUV-D. Consequently, the purchase price of PHEVs in Vietnam remains high. From a policy standpoint, enhancing fiscal incentives and expanding charging infrastructure will be crucial to reinforce the long-term economic viability of BEVs and promote a broader transition toward sustainable transportation in Vietnam.

Table 6-2: Total cost of ownership (TCO) in Vietnam

Costs (VND)	Sedan/Hatchback comparison (Segment B)		Sedan/Hatchback comparison (Segment D)		SUV (Segment SUV-D)		
	BEV (BYD Dolphin)	ICE (Toyota Vios)	BEV (BYD Han)	ICE (Toyota Camry)	BEV (VinFast VF 8)	ICE (Mazda CX-8)	PHEV (Kia Sorento)
Car Prices	548,000,000	545,000,000	1,489,000,000	1,220,000,000	1,199,000,000	1,149,000,000	1,295,926,910
Fuel/ Electricity Costs	38,571,225	173,153,260	49,155,169	194,686,800	42,582,632	176,988,000	47,196,800
Maintenance cost	12,440,000	12,440,000	12,440,000	12,440,000	12,440,000	12,440,000	12,440,000
Basic Insurance	128,596,950	85,731,300	217,612,800	145,075,200	205,241,760	136,827,840	205,241,760
Motor-vehicle tax	10,561,200	10,561,200	10,561,200	10,561,200	10,561,200	10,561,200	10,561,200
License Plate Fee	-	1,000,000	-	1,000,000	-	1,000,000	-
Install EV Charger cost	20,730,974	-	20,730,974	-	20,730,974	-	20,730,974
Depreciation	164,400,000	163,500,000	446,700,000	366,000,000	359,700,000	344,700,000	388,778,073
TCO (VND)	594,500,349	664,385,760	1,352,800,143	1,217,763,200	1,130,856,566	1,142,117,040	1,203,319,571

Source: Author's calculation

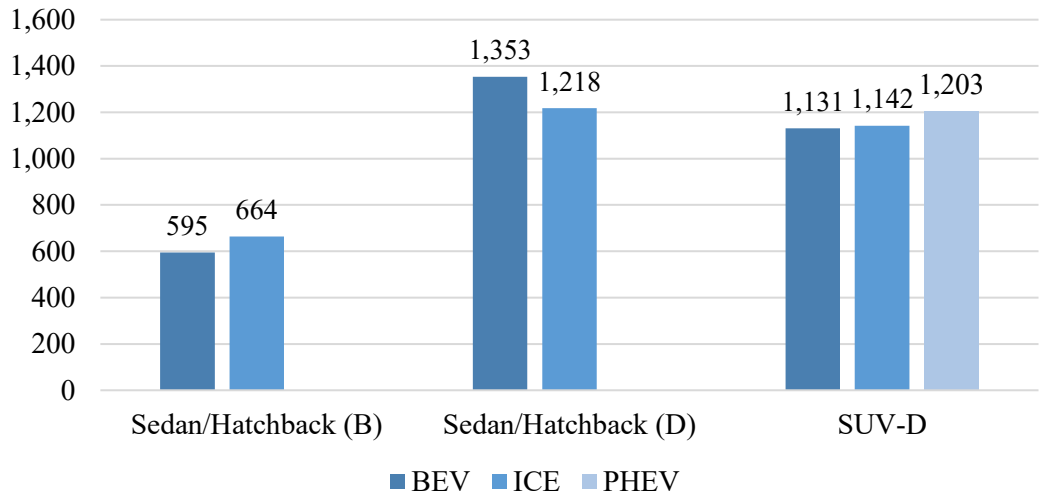


Figure 6-3: The total cost of ownership comparison in Vietnam (million VND)

Source: Author's calculation

6.1.1.5. Years of NEV Experience

Vietnam's experience with New Energy Vehicles (NEVs) is relatively recent, with significant developments occurring over the past few years. In 2022, the Vietnamese government introduced the Action Program on Green Energy Transition and Reducing Carbon and Methane Emissions in the Transport Sector, aiming for net-zero emissions in the transport sector by 205081. This program outlines a phased approach: from 2022 to 2030, the focus is on promoting the production, assembly, import, and use of electric vehicles (EVs) and developing charging infrastructure; from 2031 to 2050, the goal is to end the production, assembly, and import of fossil-fueled vehicles for domestic use by 2040, and to have 100% of road motorized vehicles powered by electric and green energy by 2050.

Despite these ambitious goals, as of 2022, Vietnam had not yet implemented policies supporting the development of EV charging infrastructure. The lack of investment, incentives, and technical regulations presents challenges to the widespread adoption of EVs. Vietnam has approximately 1–2 years of active engagement in NEV development, focusing on policy planning and setting long-term goals. However, the country is still in the early stages of implementing the necessary infrastructure and incentives to support widespread EV adoption.

6.1.2. Smart Mobility Trend

6.1.2.1. Intelligent Connected Vehicles (ICVs)

In Vietnam, the market for Advanced Driver Assistance Systems (ADAS) and Intelligent Connected Vehicles (ICVs) has been expanding rapidly alongside the country's economic growth and increasing vehicle ownership. The Vietnamese ADAS market was valued at USD 810 million in 2023 and is projected to reach USD 1.62 billion by 2029, growing at a compound annual growth rate (CAGR) of 12.1%[82]. This growth is driven by rising disposable incomes, the liberalization of automobile tariffs under the EU–Vietnam Free Trade Agreement (EVFTA), and the growing popularity of private car ownership, particularly in urban centres such as Ho Chi Minh City. Despite this progress, the acceptance of ADAS and ICV technologies among Vietnamese drivers remains moderate but positive, with users perceiving such systems as useful, compatible with their driving habits, and easy to operate. However, the study found that social influence (subjective norm) plays a stronger role in shaping technology acceptance in Vietnam compared to Western contexts.

This reflects the collectivist nature of Vietnamese society, where individuals' decisions are often influenced by peer approval and community norms rather than personal attitudes alone. Economically, Vietnam's GDP per capita remains relatively low (USD 4,346.8 in 2023) compared to European countries, but its rapid GDP growth of around 5.5% annually and the expanding middle class are key enablers of technological diffusion in the automotive sector.

With an estimated 61 passenger cars per 1,000 inhabitants, Vietnam remains in an early phase of motorisation, but the upward trajectory of income levels and consumer innovativeness indicates substantial potential for ICV adoption. Consequently, the study suggests that policymakers should

[81]Le, H., & Posada, F. (2022, December). Promoting the development of electric vehicles in Vietnam. International Council on Clean Transportation. https://theicct.org/wp-content/uploads/2022/12/asia-pacific-evs-promoting-development-evs-vietnam-dec22-2.pdf

[82]Brijs, K., Vu, A. T., Trinh, T. A., Nguyen, D. V. M., Pham, N. H., Khattak, M. W., Tran, T. M. D., & Brijs, T. (2024). A comparative study of factors influencing ADAS acceptance in Belgium and Vietnam. Safety, 10(4), 93. https://doi.org/10.3390/safety10040093

prioritize measures that facilitate affordability, accessibility, and user education, rather than focusing solely on attitudinal change, to accelerate the widespread integration of ADAS and ICV technologies into Vietnam's evolving mobility landscape.

6.1.2.2. Shared & Multimodal Services

Vietnam's informal and shared mobility (ISM) sector is characterised by rapid digitalisation, ongoing electrification, and growing efforts toward multimodal integration. The country's mobility landscape combines widespread use of petrol-powered motorcycles, traditional xe ôm services, and expanding ride-hailing platforms, reflecting the transition from informal to semi-formalised shared mobility systems.

In major urban centres such as Hanoi and Ho Chi Minh City, motorcycles remain the dominant mode of personal and shared transport. Their extensive use contributes significantly to urban air and noise pollution. To address these environmental challenges, the Vietnamese government has introduced policies promoting electric vehicle (EV) adoption, particularly targeting electric two-wheelers as a practical and sustainable alternative.

Ride-hailing applications such as Grab and Be operate extensively across the country, offering motorcycle and car-hailing services. These platforms have transformed traditional xe ôm practices into digitally managed services, introducing fare transparency, digital payments, and route optimisation. However, competition among operators has intensified, and regulatory changes continue to influence cost structures and driver participation.

Expert interviews conducted in Ho Chi Minh City and Hue identify a diverse ISM ecosystem, comprising traditional xe ôm, ride-hailing motorcycle taxis, ride-hailing cars, and emerging electric taxi services. Younger commuters and tourists tend to prefer platform-based services, while older residents continue to rely on conventional motorcycles and public buses[83].

Vietnam is actively pursuing electrification within its ISM sector. The national push for EV adoption is supported by the rapid expansion of VinFast, a subsidiary of VinGroup, which produces a wide range of electric scooters and vehicles tailored to domestic demand. VinFast's efforts include developing charging infrastructure and expanding the EV manufacturing ecosystem to support the transition to sustainable mobility.

Despite these developments, several constraints remain. High initial costs of electric motorcycles pose barriers to adoption, particularly among low- and middle-income users. The second-hand EV market remains underdeveloped, and concerns about battery degradation and the lack of standardised replacement systems reduce consumer confidence. Moreover, charging networks in major cities such as Hanoi and Ho Chi Minh City require further expansion, while rural areas continue to experience limited charging access, restricting the scalability of EV-based shared mobility.

Vietnam's approach to shared and multimodal mobility is closely linked to environmental and sustainability objectives. National policies support the transition to zero-emission transport by 2050, aligning shared mobility with broader climate commitments. The government promotes public bicycle-sharing initiatives and EV taxi schemes as part of its green transport strategy.

[83] Chalermpong, S., Ratanawaraha, A., & Uchiyama, Y. (2025). Informal and shared mobility: Status, challenges, and opportunities in Southeast Asia. Volvo Research and Educational Foundations. https://vref.se/wp-content/uploads/2025/03/Informal-and-Shared-Mobility-Status-Challenges-and-Opportunities-in-Southeast-Asia.pdf

However, affordability and income stability remain critical concerns for ISM workers. Studies and reports highlight that Vietnamese ISM drivers face unstable incomes and limited access to social security, reflecting persistent precarity within the sector. Informal driver associations play an important role by providing mutual aid and advocacy, contributing to greater empowerment and solidarity among workers.

Vietnam's ISM sector demonstrates potential for multimodal integration, particularly in dense urban areas. Digital penetration has improved operational efficiency, while EV and bike-sharing initiatives are emerging as complementary modes supporting first- and last-mile connectivity. Nonetheless, experts emphasise that urban planning frameworks still undervalue ISM's role within formal mobility systems. Achieving sustainable integration requires policies that bridge informal operations, digital platforms, and public transport services.

Shared and multimodal services in Vietnam are undergoing a transition toward electrified, digitally integrated, and socially inclusive mobility. The coexistence of traditional xe ôm services with platform-based ride-hailing and emerging EV initiatives illustrates a hybrid and adaptive mobility system. Although infrastructure and affordability barriers persist, Vietnam's commitment to green mobility and digital transformation positions its ISM sector as a critical component of future sustainable urban transport.

6.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption

6.2.1. NEV Promotion Policy

Vietnam has adopted a strongly strategic approach to promoting battery electric vehicles (BEVs) as part of its green-transport and climate ambitions. The centerpiece is Decision 876/QĐ-TTg (2022), which establishes a national Action Program for green energy transition in the transport sector, putting the country on a path toward net-zero road transport emissions by 2050.

Under this plan, targets include: by 2025, all newly purchased buses will use electricity or green energy; by 2030, at least 50% of new vehicles are to be powered by electricity or green energy and 100% of new taxis; and by 2050, full electrification of buses, taxis, and other transport modes is envisioned.

The decision also supports developing charging infrastructure along national highways, in urban areas, and at transport hubs (ports, airports, bus stations), clearly signaling long-term institutional commitment.

6.2.2. Financial Incentives

Vietnam has established a highly competitive fiscal framework to accelerate the transition from internal combustion engine (ICE) vehicles to battery electric vehicles (BEVs). This strategy utilizes a combination of aggressive tax reductions for electric models and substantial protective tariffs on imported fossil-fuel vehicles.

6.2.2.1. Consumer-Side Incentives and Registration Exemptions

Under Decree 10/2022/ND-CP, Vietnam introduced a 0% registration fee for BEVs to reduce the initial financial barrier for buyers. This zero-fee period, originally set for three years, has been extended by Decree 51/2025 and will now remain in effect through February 28, 2027. Following this period, the registration fee will be maintained at a preferential rate equal to 50% of the fee applied to ICE vehicles of the same seat capacity.

6.2.2.2. Special Consumption Tax (SCT) Reductions

To further enhance price parity, the government has sharply reduced the Special Consumption Tax (SCT) for electric models. For BEVs with nine seats or fewer, the SCT rate is set at just 3% (applicable from March 1, 2022, to February 28, 2027). In contrast, imported ICE vehicles face a significantly higher SCT—often reaching 35%—creating a major price advantage for electrified options.

6.2.2.3. Supply-Side Protection and Local Manufacturing

Vietnam's taxation structure is designed to favor domestic production over foreign imports, particularly those from outside the ASEAN trade bloc. While imports from ASEAN countries benefit from customs duty exemptions, imported ICE vehicles from other regions (such as China) face a combined tax burden that can reach 2.5 times the factory price due to a 55% customs duty, SCT, and a 12% registration tax.

Conversely, domestically produced EVs are largely shielded from these costs. By coupling high import barriers for ICE vehicles with zero-registration fees for local EVs, Vietnam's policy architecture effectively lowers the upfront cost of ownership, encourages infrastructure investment, and incentivizes global manufacturers to establish local production hubs to remain competitive in the Vietnamese market.

6.2.3. Non-Financial Measures

Vietnam has begun introducing non-financial regulatory measures aimed at supporting clean vehicle adoption and steering traffic away from high-emission vehicles, particularly in major urban centers. One of the most notable developments is the planned establishment of Low Emission Zones (LEZs) in Hanoi. In December 2024, the Hanoi People's Council approved a resolution to introduce LEZ regulations restricting or banning vehicles that fail to meet specified emission standards in central districts such as Hoan Kiem and Ba Dinh starting January 1, 2025. The LEZ framework is being rolled out in stages, with broader enforcement expected between 2025 and 2031 in increasingly large portions of the city; after 2031, all areas that meet certain pollution criteria are to implement the LEZ restrictions. Within these zones, vehicles that do not comply with emission standards, including older ICE motorcycles and cars, face circulation limitations or bans during specified times or in specific locations to improve air quality. The policy is designed not only to reduce pollution but also to encourage the uptake of low- or zero-emission vehicles by making cleaner vehicles the only permissible option in restricted areas.

A related major national step is reflected in the Directive No. 20/CT-TTg issued by the Prime Minister in July 2025, which assigns urgent tasks to address environmental pollution, including specific timelines for restricting fossil-fuel motorcycles and vehicles in urban centers. Under this directive, Hanoi is set to ban the operation of fossil fuel-powered motorcycles and mopeds within Ring Road 1 from July 1, 2026, with broader restrictions on petrol/diesel vehicles planned for later phases (expanding to Ring Roads 2 and 3 by 2030). This directive firmly ties local restrictions to broader national environmental and transport objectives, signaling a shift toward regulatory measures that make NEV adoption a practical necessity — not just a consumer choice

Another non-financial measure under active discussion extends beyond urban bans. The draft Hanoi policy also proposes parking, land use, and urban planning incentives tied to EV infrastructure: for example, requiring that minimum proportions of parking spaces in existing and new developments be equipped with EV chargers (15% by 2030 and 30% for new facilities), and the incorporation of charging station planning into broader urban infrastructure programs. These requirements help normalize EV usage in daily life and reduce reliance on fossil vehicles without directly using financial subsidies

6.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility

6.3.1. New Energy Vehicles (NEVs)

6.3.1.1. Mandatory Technical Standards for Safety and Quality

The Vietnamese government has issued National Technical Regulations (Quy chuẩn kỹ thuật quốc gia - QCVN) related to electric two-wheelers, focusing on critical components that affect safety and performance, specifically:

- Technical Standard for Electric Bicycles (QCVN 68/2013/BGTVT): This is a mandatory standard specifically controlling the quality and safety of electric bicycles. It covers issues such as braking system performance, structural strength, and the safety of the electrical propulsion system, ensuring that products sold in the market are reliable and safe for users.
- Standards Related to Propulsion and Energy Systems: These include:
    - QCVN 90:2019/BGTVT (Motor Standard): Controls the standards for electric motors used in electric motorcycles to ensure quality, performance, and durability.
    - QCVN 91:2019/BGTVT (Battery Standard): Sets safety and performance standards for batteries used in E-2W, which is critical for preventing issues such as overheating and short circuits.

These standards indicate that Vietnam recognizes that the safety of batteries and electric propulsion systems is central to environmental-friendly quality control, while also addressing potential risks.

Although Vietnam demonstrates a strong commitment to the transition to electric vehicles, the specific technical regulations and standards for electric cars remain under development and are being integrated into the existing motor vehicle legal framework. As specific laws for electric cars are not yet complete, electric cars must comply with the overall vehicle safety and quality requirements supervised by the Ministry of Transport (MOT) and related agencies:

- Safety Standards in Manufacturing and Assembly: Every electric car manufactured, assembled, imported, or sold in Vietnam must undergo basic safety inspection and testing according to the Vietnamese National Technical Regulations (QCVN), similar to conventional internal combustion engine (ICE) vehicles. These cover:
    - Crash Safety testing, to ensure passenger safety in the event of an accident.
    - Braking and Stability Control systems, certifying that critical vehicle systems operate efficiently and safely.
    - Control of Parts and Components, adhering to standards for various critical vehicle parts.
- Quality and Environmental Regulation (QCVN 09:2024/BGTVT): This regulation covers the quality control of new vehicles sold domestically, including environmental requirements regarding material use and design, which electric cars must comply with as a vehicle type.

6.3.1.2. Corporate Average Fuel Consumption (CAFC) Standards

The Corporate Average Fuel Consumption (CAFC) standard is an environmental policy tool adopted by the Vietnamese government to indirectly compel the automotive industry to reduce carbon dioxide (CO_2) emissions. This mechanism does not stipulate how fuel-efficient each individual car must be but rather sets a maximum average fuel consumption for all vehicles sold by a specific manufacturer or importer annually.

The key principle is that if a company sells highly fuel-efficient vehicles (such as electric or hybrid cars), it helps offset the average consumption of larger, less fuel-efficient vehicles, significantly forcing companies to adjust their sales and production strategies.

The draft CAFC requirements proposed by the Vietnamese government are highly stringent and progressive, aiming to reduce the average fuel consumption for passenger cars to just 4.83 liters per 100 kilometers by the year 2030. This goal has been heavily criticized by the Vietnam Automobile Manufacturers' Association (VAMA) as an overly stringent standard. This is because most gasoline-powered cars currently on the market have an average consumption significantly higher than the set criteria. If this standard were enforced according to the draft, over 96% of conventional fuel-powered vehicles might face financial penalty for selling in the market, forcing manufacturers to accelerate investment in high-efficiency technology severely and rapidly. Therefore, CAFC represents Vietnam's strategic mechanism for using environmental regulations as a primary driving force to rapidly shift the automobile market from fossil fuels to electric power, leveraging strict corporate-level average fuel consumption targets.

6.3.2. Vehicle Emission Standards

Vietnam is in the process of formalizing a phased vehicle emission standard regime that progressively tightens limits on exhaust pollutants to improve air quality and reduce transport emissions. In December 2024, the Government promulgated Decision No. 19/2024/QĐ-TTg, establishing a detailed roadmap for applying emission standards to both imported and domestically manufactured vehicles. This roadmap distinguishes multiple emission levels (1–5) equivalent to Euro 1 through Euro 5 standards, gradually replacing older, less stringent rules.

Under that roadmap, **Level 4 (equivalent to Euro 4) becomes mandatory for vehicles manufactured from 2022 onwards starting March 1, 2026, and **Level 5 (Euro 5) will take effect nationally from January 1, 2032. In Hanoi and Ho Chi Minh City, which suffer higher pollution, the timeline is accelerated: Euro 5 will apply to vehicles from 2022 onwards beginning January 1, 2028. From January 1, 2029, all vehicles in these two cities must meet Level 2 or higher emissions.

Supporting this phased roadmap, the Ministry of Agriculture and Environment has issued Circular 06/2025/TT-BNNMT, formalizing the National Technical Regulation QCVN 85:2025/BNNMT on emissions from in-use automobiles. This regulation—which takes effect from December 16, 2025—gives legal force to emission limits for operational vehicles in traffic and sets the foundation for future enforcement as the roadmap unfolds.

Vietnam's current emission roadmap—targeting Euro 4 nationwide by 2026 and Euro 5 by the early 2030s—places it mid-range among ASEAN countries. For example, Thailand implemented Euro 5 from early 2025, albeit with differences in fuel quality and enforcement intensity.

Singapore and Malaysia have also advanced toward Euro 5 or Euro 6 emissions levels on new vehicles, with Singapore requiring Euro 6 for new passenger cars and Malaysia phasing in Euro 4 and Euro 5 standards in sequence. Compared with these peers, Vietnam's roadmap is ambitious in its long-term Euro 5 timeline but potentially slower in enforcement for nationwide application. Its current approach also ties pollutant control to vehicle age and geography — with stricter requirements in urban centers — reflecting both developmental priorities and technical capacity constraints.

6.4 Energy Policy

E-mobility plays a limited role in achieving the 2030 NDC targets but will be critical for achieving the 2050 net-zero target. Vietnam sets the GHG emissions reduction target[xcviii] by 2030 as 15.8% of unconditional contribution and 43.5% of conditional contribution. Additionally, the implement commitment level in the NDC[xcix,c] is, firstly, self-performed by decreasing 9% of GHG emissions, and secondly, supported internationally by decreasing 27% of GHG emissions.

In the transport sector, green mobility is a key pillar of this strategy. The roadmap includes the full transition to electric and green energy for all road vehicles by 2050, the phase-out of fossil fuel vehicle imports and manufacturing by 2040, and a requirement that 100% of new or replacement urban buses (by 2025) and taxis (by 2030) use electricity or green energy. Recognizing the high mitigation potential of NEVs, the government estimates emission reductions of 22.7 $MtCO_2e$ under unconditional and 34.12 $MtCO_2e$ under conditional scenarios. To support this transition, Ho Chi Minh City has been selected as the first locality to pilot e-transportation development, laying the foundation for nationwide NEV deployment and integration into the national climate strategy.

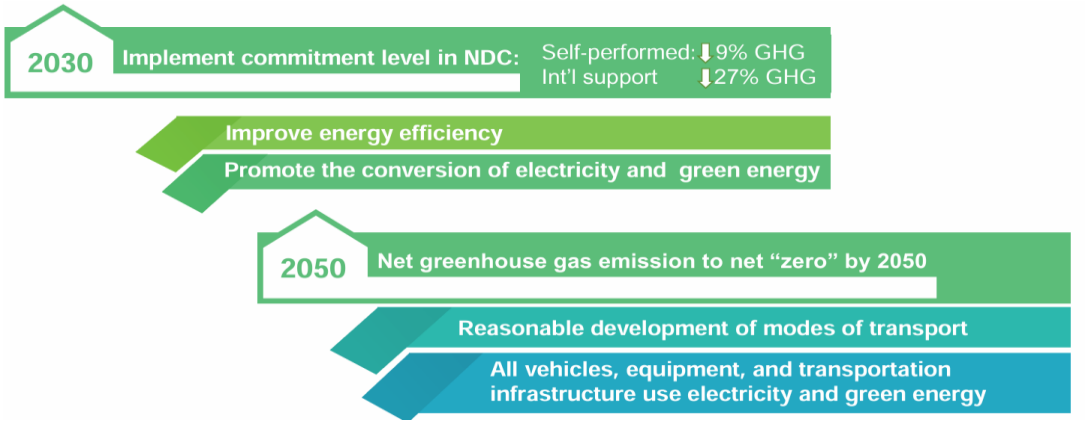


Figure 6-4: The NDC target of Vietnam by 2030 and 2050

Source: The Ministry of Transport (2022)

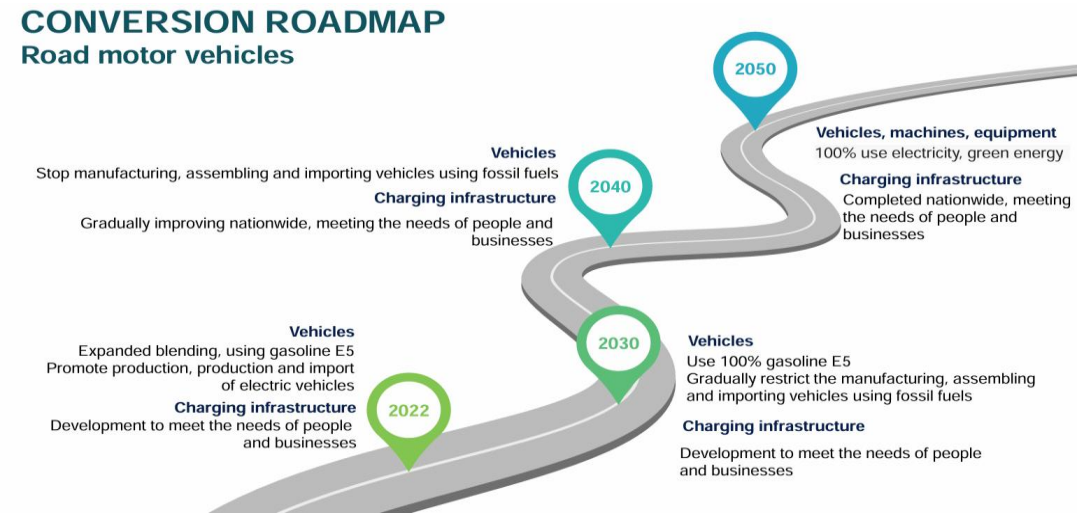


Figure 6-5: Conversion Roadmap: Road motor vehicles

Source: The Ministry of Transport (2022)[ci]

Moreover, in Figure 6-5 according to the Analysis Study of Current Transportation Status in Vietnam's Urban Traffic and the Transportation to Electric Two-Wheelers Mobility, the electrification is prone to private cars, scooters and bikes, cycles, the Skytrain in urban areas, specific-purpose vehicles, and buses.

Vietnam's power sector development plan (PDP8), which was approved in May 2023, complements this transition by scaling up the deployment of renewable energy. The government projects that total power generation will reach 567 TWh with a 90.5 GW peak load by 2030 and up to 1,378 TWh with a 209 GW peak load by 2050. Large-scale NEV adoption will add further load, requiring up to 28% additional generation capacity by 2050 to meet charging demand. To mitigate grid pressure, policies emphasize smart charging, ToU tariff incentives, modal shifts, and efficiency improvements.

In addition, according to PDP8 (Decision 500/QD-TTg), Vietnam's projected power installed capacity mix for 2030 (Figure 4-3) shows a significant contribution from renewable energy sources, which together account for more than 37% of total installed capacity.

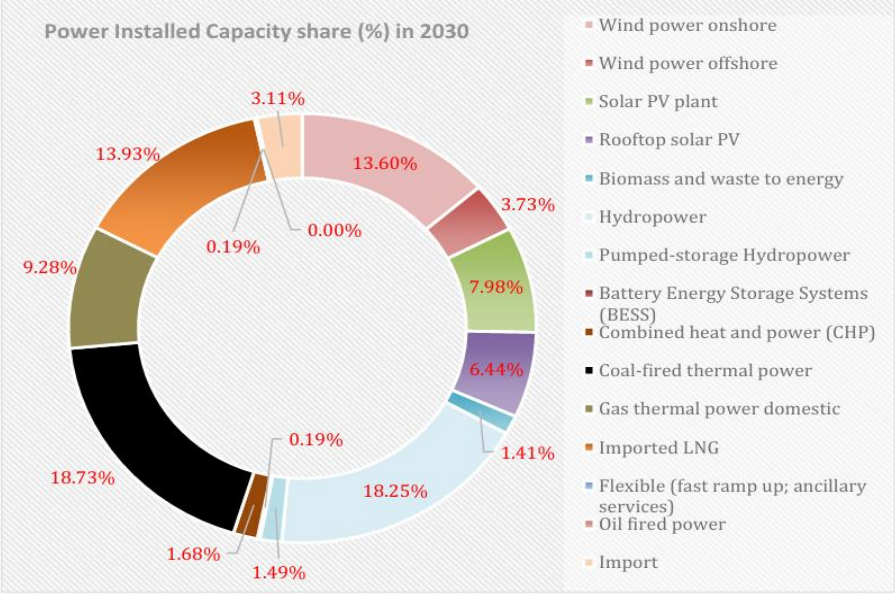


Figure 6-6: Vietnam projected energy mix in 2030

Source: IES & EWEC (2023)[cii]

This increasing share of renewables reflects a strong national commitment to cleaner energy and a more sustainable power system. The shift toward low-carbon generation also enhances the power sector's readiness to support large-scale NEV integration. As more electricity is generated from renewable sources, the environmental benefits of NEVs increase correspondingly, since charging from a low-carbon grid leads to deeper greenhouse gas emission reductions compared to conventional internal combustion vehicles. This clean energy transition, combined with grid modernization under the Smart Grid Roadmap, provides a solid foundation for expanding NEV charging infrastructure in a way that supports both decarbonization and grid stability.

6.4.1. Policy and Regulation

Vietnam's NEV policy framework has evolved from isolated transport-sector initiatives toward a comprehensive national strategy that links clean mobility with energy transition, climate action, and industrial development. Several key policy milestones mark this strategic shift[ciii].

6.4.1.1. National Roadmap for Green Transport Transition

A major policy milestone in Vietnam's decarbonization pathway is Decision No. 876/Q*f*ê-TTg (July 2022), which approved the Action Program on Green Energy Transition and Reduction of Carbon and Methane Emissions in the Transport Sector. This roadmap establishes clear transport decarbonization targets with NEV adoption as the central strategy to achieve them. The roadmap sets a two-phase transition plan:

- Phase 1 (2022-2030): Promote the production, import, and use of NEVs, expand charging infrastructure, and pilot electrified public transport (e.g., buses and taxis).
- Phase 2 (2031-2050): Gradually restrict and phase out fossil-fuel vehicle production and imports by 2040, and ensure that by 2050, 100% of road motor vehicles operate on electricity or other green energy sources, supported by a nationwide charging and refueling network.

These targets cover the entire transport sector, including private vehicles, two-wheelers, buses, taxis, and freight vehicles. While they are framed as transport decarbonization goals, the widespread adoption of NEVs-especially two-wheelers in the early stages and passenger cars after 2035-is the primary pathway to meet them.

6.4.1.2. Integration with Power Sector Planning (PDP8)

Vietnam's power sector development plan (PDP8, approved May 2023) is a cornerstone of the country's NEV transition strategy. It aligns transport electrification with energy supply planning by:

- Expanding renewable energy capacity to support the growing NEV charging demand.
- Projecting total electricity generation to reach 567 TWh by 2030 and 1,378 TWh by 2050.
- Anticipating that NEV charging could increase power demand by up to 28% by 2050.
- Implementing policies to manage grid impact, including smart charging, time-of-use (ToU) tariff incentives, modal shift strategies, and efficiency improvements.

According to Decision No. 500/QĐ-TTg, renewable energy will contribute over 37% of installed capacity by 2030, increasing the environmental benefits of NEVs as charging becomes greener.

6.4.1.3. Strategic Energy and Climate Policy Alignment

Vietnam's NEV policy is reinforced by broader energy and climate commitments:

- Resolution 55/NQ-TW (2020) – the National Energy Development Strategy to 2030 with a vision to 2045 — is the first energy policy to explicitly promote e-mobility and energy storage. It positions transport electrification as a key element of the national energy transition.
- National Green Growth Strategy (NGGS) – adopted in 2012 and updated for 2021–2030 — integrates vehicle electrification into the national climate agenda. Provincial Green Growth Action Plans mirror this direction: for example, Hanoi targets 5% e-motorcycle penetration by 2030, and Nha Trang aims to deploy 200 e-buses by 2025.

This alignment underscores a system-level approach that links transport decarbonization with clean power development and energy security.

6.4.1.4. Transport and Industrial Development Measures

Decision 1095/Q*ƒ*ê-BGTVT (2022-2023) - National Transportation Vehicle Development Strategy - supports the adoption of environmentally friendly vehicles, aligning with NEV goals. The National Automobile Development Strategy (2021-2050), proposed by VAMA, projects domestic NEV manufacturing capacity to reach 3.5 million units by 2040, integrating industrial policy with energy system readiness. Policy instruments also focus on two-wheeler electrification as an entry point for mass adoption. With targeted policy interventions, electric two-wheelers could grow from 12% today to 75% by 2035, followed by rapid growth in passenger NEVs from 2036 onward.

6.4.1.5. National Roadmap Recommendations

According to the national roadmap, by 2030, half of all urban vehicles — and 100% of buses and taxis — should run on electricity or other green energy sources. By 2050, the goal is a complete transition of all road vehicles to clean energy. This vision is supported by Vietnam's Smart Grid Roadmap, which aims to modernize the grid to handle rising NEV charging demand while maintaining reliability.

Moving on to the infrastructure roadmap, the Vietnamese government clearly set a strategic vision for NEV development and transportation sector decarbonisation, contributing to a developing need for specific policies, regulations, and standards that cover NEV charging.

Box 6-1: Recommendation to the National Roadmap and Action Plan for the Electric Mobility Transition

By 2030, half of all urban vehicles should be powered by electricity or green energy, with 100% of urban buses and taxis meeting this requirement. Looking ahead to 2050, the goal is for all road vehicles in Vietnam to operate on electricity or green energy, marking a complete transition to low-emission transport across the country.

Box 6-2: Recommendation to the National Roadmap and Action Plan for the Electric Mobility Transition

Two-wheeled vehicles will initially drive Vietnam's transition to NEVs. The World Bank projects that, with targeted policy interventions, the share of electric two-wheelers could rise from 12% today to 75% by 2035. Beyond 2035, passenger cars are expected to overtake two-wheelers, with electric cars projected to account for 93% of car sales between 2036 and 2050. Public and commercial vehicles, while making up only 2% of registered vehicles, contribute 65% of transport-related emissions—highlighting the need for strong policy measures to boost ridership, establish standards, and ensure financial viability. Electrifying small commercial trucks under 5 tonnes is seen as a promising step. Vietnam's power sector must scale up significantly to meet rising demand for NEV charging. While grid pressure is expected to remain manageable until 2030, demand will grow sharply thereafter. By 2035, electricity generation will need to expand by up to 5% and network capacity by 4%. By 2050, these figures are expected to rise to 30% and 15%, respectively, to meet NEV adoption targets

6.4.2. Supporting measures

Vietnam currently offers limited but growing policy support for NEV adoption, with most measures taking the form of financial and regulatory incentives rather than direct subsidies. These incentives are primarily aimed at lowering charging costs and reducing upfront vehicle purchase costs, thereby encouraging consumer uptake and supporting early market development.

6.4.2.1. Financial supporting measures

Vietnam is in the process of developing financial and pricing mechanisms to support NEV adoption and charging infrastructure expansion. Current measures focus on tariff reforms, particularly the planned introduction of Time-of-Use (ToU) pricing, and fiscal incentives such as tax and fee reductions to lower the total cost of NEV ownership. These evolving policies aim to encourage off-peak charging, reduce operational costs, and attract private investment in the charging network to accelerate transport electrification.

1) Time-of-Use (ToU) pricing incentive – Personal (residential) charging

Currently, Vietnam does not yet apply ToU pricing for residential consumers, including private NEV owners. Households are billed under a progressive block tariff, with electricity prices ranging from VND 1,984/kWh for the first 50 kWh to VND 3,460/kWh for consumption above 400 kWh per month. This structure does not provide a price signal to encourage off-peak NEV charging. However, under the government's draft tariff reform plan, a three-tier ToU structure is being prepared, with off-peak rates at 71%, mid-level rates at 118%, and peak rates at 174% of the average retail price (VND 2,204.07/kWh). Once implemented, this would create a price spread of nearly 60% between peak and off-peak hours, encouraging households to shift NEV charging to nighttime periods (22:00–06:00), reduce electricity costs, and support grid flexibility. This upcoming reform is expected to play a key role in demand-side management and affordable NEV ownership, aligning residential charging behavior with Vietnam's net-zero and electrification goals.

2) Time-of-Use (ToU) pricing incentive – Public charging stations

Vietnam is currently in a transition phase toward formal ToU pricing for public NEV charging stations. While no nationwide ToU tariff has been fully implemented yet, the Ministry of Industry and Trade (MOIT) has issued draft tariff policies proposing rates between 71% and 195% of the average retail electricity price (VND 2,204.07/kWh), depending on voltage level and time of use. This structure would set off-peak rates at approximately VND 1,565/kWh, mid-level rates at VND 2,600/kWh, and peak rates at VND 3,835/kWh, creating a strong economic signal to shift charging to low-demand nighttime periods. In practice, private operators such as VinFast (V-Green) and EcoFast have already introduced ToU-like pricing, with rates ranging from VND 3,800 to over VND 9,000/kWh, reflecting charging speed and time of day. ToU pricing is expected to reduce grid congestion, lower operational costs, and improve investment viability for charging networks. Combined with planned subsidies and separate tariff classes for NEV charging stations, this evolving policy framework is a key enabler of Vietnam's charging infrastructure expansion and transport decarbonization strategy.

3) Charging financial incentive - Personal use

Currently, Vietnam does not provide direct financial subsidies for residential NEV charging, but several indirect incentives are in place to reduce costs for personal NEV users. A key measure is VinFast's free charging program, which allows NEV owners to charge at V-Green stations without cost until 2027, helping lower early adoption expenses. In addition, the government has introduced registration fee incentives, granting a 100% exemption for the first three years and a 50% reduction for the following two years for NEV buyers, indirectly lowering total ownership costs. Looking ahead, the government's

tariff reform plan includes the introduction of ToU pricing for households, which would offer cheaper off-peak electricity rates for NEV charging. Together, these measures aim to make NEV ownership more affordable, support charging cost reduction for households, and encourage off-peak charging behavior, aligning with Vietnam's broader green transport and net-zero goals.

4) Charging Financial Incentive – Public Station

Vietnam is in the early stages of implementing financial incentive mechanisms to support public NEV charging station deployment. At present, there are no direct subsidies or feed-in-like schemes for charging operators, but several policy measures are being developed to lower costs and attract private investment. The Ministry of Industry and Trade (MOIT) has issued draft tariff policies proposing preferential Time-of-Use (ToU) electricity rates for charging stations — ranging from 71% to 195% of the average retail price (VND 2,204.07/kWh)— to encourage off-peak charging and reduce operating costs. In addition, the government is considering targeted electricity subsidies and separate tariff classifications for NEV charging operators to make tariffs more competitive. In practice, major private operators such as VinFast (V-Green) and EcoFast are already offering flexible pricing structures, while benefiting indirectly from preferential electricity procurement rates compared to general commercial tariffs. These evolving financial mechanisms are intended to reduce operational costs, stimulate private investment, and accelerate the nationwide rollout of charging infrastructure, supporting Vietnam's 2050 net-zero transport target.

6.4.2.2. Non-Financial Supporting Measures

In addition to financial and fiscal incentives, Vietnam is introducing regulatory and technical measures that aim to enable smart charging, strengthen grid flexibility, and prepare the power system for large-scale NEV integration. These measures focus on creating an enabling environment rather than providing direct subsidies, laying the groundwork for future business models such as electricity arbitrage and vehicle-to-grid (V2G) applications.

1) Regulatory Support for Electricity Arbitrage

Vietnam's regulatory framework for electricity arbitrage—that is, buying power during low-price off-peak hours and selling or using it during peak periods—is still in its early development stage, but emerging policies are laying important groundwork. Under the 2025 retail electricity tariff reform, the government plans to implement Time-of-Use (ToU) pricing, with a 59% differential between peak (174%) and off-peak (71%) rates of the average retail price (VND 2,204.07/kWh). This price spread provides an economic basis for arbitrage through battery energy storage systems (BESS) or managed charging at public stations. While there is no explicit regulatory mechanism yet allowing third-party operators to trade or resell stored energy, tariff reforms, PDP8 targets, and Decision 876/QĐ-TTg all emphasize demand-side management, system flexibility, and private sector participation in grid services. This creates policy space for future arbitrage models, including charging stations with co-located storage, virtual power plants, and vehicle-to-grid (V2G) applications. To enable this, upcoming regulatory updates are expected to clarify grid code requirements, define market participation rules, and introduce incentive mechanisms that allow operators to monetize flexibility while supporting grid stability and renewable integration

2) V2G and Smart Charging Pilot Programs

Vietnam is actively advancing V2G and smart charging solutions through a combination of pilot projects, research initiatives, and policy planning to support its sustainable energy and transport transition. A notable example is the VOLTERRA smart charging system developed by VinUni's Center for Environmental Intelligence (CEI), which integrates bi-directional V2G capabilities and smart scheduling algorithms to optimize NEV charging based on energy costs and renewable energy

availability, particularly from solar and wind power. At the policy level, the country's National Smart Grid Roadmap sets clear strategic objectives to integrate NEV charging stations into the grid, explore microgrid concepts, and deploy advanced load management systems to maintain grid stability as NEV penetration grows.

In parallel, EVN and private operators such as VinFast and EcoFast are exploring early-stage smart charging pilots at public charging hubs and fleet depots to test dynamic load management and time-based optimization. Supporting infrastructure, including advanced metering (AMI), SCADA/EMS/DMS systems, and the upcoming ToU tariff reform, provides an enabling environment for managed charging and future V2G deployment. As grid codes and market participation rules are gradually updated, these pilot programs are expected to generate regulatory and technical evidence for scaling up flexibility services, vehicle aggregation, and demand response programs, contributing to Vietnam's broader smart grid and net-zero goals[cvi].

6.5 Infrastructure Related to New Energy Vehicle and Smart Mobility

6.5.1. Energy Infrastructure

6.5.1.1. Charging Infrastructure Development

Vietnam's NEV charging network has grown rapidly recently but remains far below the level needed to meet projected demand. As of 2025, the country has approximately 15,000 charging stations with more than 150,000 ports in operation, the majority of which are developed and managed by VinFast through its subsidiary V-Green. VinFast distributes these stations across all 63 provinces and cities, forming the backbone of the current national charging network. V-Green has announced plans to expand its infrastructure to one million ports by 2028. According to projections from the World Bank, Vietnam will require approximately 800,000 chargers by 2030, increasing to around 6.3 million chargers by 2050 to support the country's NEV adoption targets[cvii].

The plans to support this growth aim to get private companies involved by changing fees and making service costs clear, while also including charging stations in city planning and road development. The charging network is being developed with a mix of capacity levels ranging from 11 kW AC chargers to 250 kW DC fast chargers to accommodate different usage patterns and ensure efficient service delivery. Geographic expansion is also a priority to ensure more equitable access across urban centers, intercity corridors, and rural areas.

VinFast currently dominates the market through a franchise model managed bV-Green operates approximately 15,000 stations nationwide, while other market actors remain comparatively small. Ford operates 53 dealership-based stations and plans to increase this number to 275, while Geely has a minimal presence. Premium brands such as Porsche and Audi operate only a few showroom-based stations in urban areas, which limits their competitiveness and network impact.

While infrastructure investment remains the primary driver of network expansion, regulatory measures play an important enabling role by ensuring safety, compatibility, and standardization across the charging ecosystem. Recent updates to national technical regulations have strengthened the foundation for NEV and charging infrastructure development. On February 14, 2025, the Ministry of Science and Technology (MOST) issued Circular No. 01/2025/TT-BKHCN, promulgating *the National Technical Regulation* QCVN 25:2025/BKHCN on electrical equipment for household electrical installations and similar installation systems. This regulation sets safety and management requirements for low-voltage distribution equipment up to 440V AC, providing a standardized framework for both home and public charging installations[cviii] .

The development of NEV charging infrastructure has so far been led primarily by the private sector, with VinFast taking a central role through its early investment strategy and free charging program for NEV users, available until May 2027. VinFast is also pursuing new business models that include nationwide network expansion through V-Green franchises and financial collaborations with international banks such as EastWest Bank and BDO. Other automotive companies, including Ford (53 stations in operation, 275 planned), Porsche, Geely, and Audi, have started installing chargers at dealerships and showrooms, but their coverage remains limited compared to VinFast's extensive network. This concentration illustrates both the strength of early large-scale private investment and the need for more market entrants to ensure long-term accessibility and competition.

As of 2024, Vietnam has an estimated 300,000 NEVs and approximately 150,000 charging ports, resulting in an NEV-to-charging pile ratio of around 2:1. This ratio indicates that while charging infrastructure has been deployed rapidly, the market is entering a phase where vehicle adoption is beginning to catch up with infrastructure expansion. This infrastructure-first approach, which is led primarily by VinFast/V-Green, has created a highly accessible charging network across the country, ensuring minimal congestion and good coverage during the early stages of NEV deployment. However, as the number of NEVs grows, this ratio will likely increase further, bringing attention to the strategic scaling of charging infrastructure in line with vehicle growth. Maintaining an optimal ratio of five to ten NEVs per charging pile over the medium term will be critical to ensuring efficient infrastructure investment, grid reliability, and a positive charging experience

6.5.1.2. Smart Grid Development

Although the Smart Grid Roadmap (Decision 4602/QD-BCT) does not explicitly mention NEVs, its objectives directly align with the enabling conditions required for large-scale NEV integration. The roadmap focuses on enhancing power quality and supply reliability, improving demand-side management, optimizing energy resource use, and ensuring national energy security. These objectives inherently support the scaling of NEV charging infrastructure, particularly as charging demand becomes a more significant component of total electricity consumption.

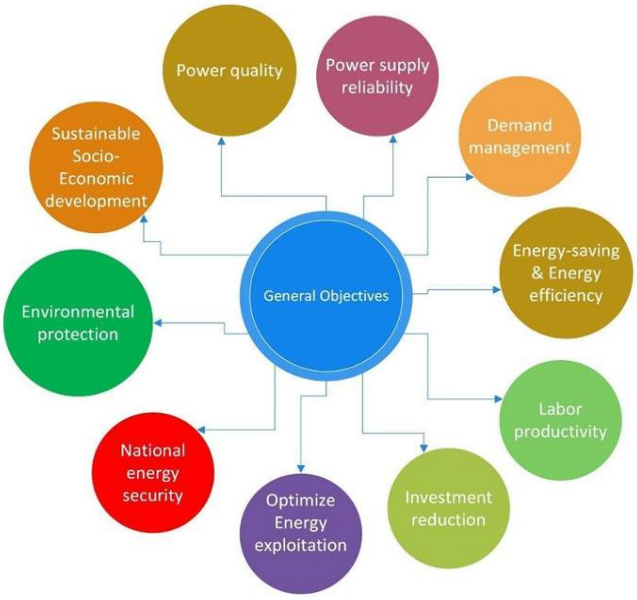


Figure 6-7: General Objectives of Vietnam's Smart Grid Roadmap

Source: IES & EWEC (2023)[cii]

For example, improvements in power quality and grid reliability are essential for ensuring stable, uninterrupted charging services. The inclusion of demand-side management enables smart charging strategies and load shifting, which can help reduce peak demand pressures as the NEV-to-pile ratio increases. Similarly, resource optimization measures can enable NEVs to act as distributed energy resources (DERs), supporting grid flexibility and stability.

The Smart Grid Roadmap outlines specific implementation measures such as SCADA/EMS and SCADA/DMS systems at the National Load Dispatch Centre, regional dispatch centres, and distribution companies. These upgrades include remote control and switching systems for transmission and distribution operators, as well as the modernization of metering infrastructure to enhance operational efficiency. These upgrades provide the technological backbone for integrating NEV charging into grid operations. By aligning NEV charging infrastructure development with the modernization agenda of the Smart Grid Roadmap, Vietnam can move from an infrastructure-first approach toward a smart, coordinated, and grid-integrated charging ecosystem. This integration will be essential to maintain an optimal NEV-to-pile ratio, avoid grid congestion, enhance system flexibility, and support national decarbonization goals.

To support the growing momentum of NEV adoption, Vietnam is also beginning to strengthen its digital and system-level enablers to ensure that the power system and charging ecosystem can accommodate future demand. While current smart grid readiness provides a solid technical backbone, emerging efforts around communication protocol standardization and interoperability are positioning Vietnam to better manage large-scale charging operations, enable smart charging, and prepare for future V2G integration.

6.5.1.3. NEVs to Charging Piles (AC/DC) ratio

As of 2024, Vietnam has an estimated 300,000 NEVs and approximately 150,000 charging ports, resulting in an NEV-to-charging pile ratio of around 2:1. This ratio indicates that while charging infrastructure has been deployed rapidly, the market is entering a phase where vehicle adoption is beginning to catch up with infrastructure expansion. This infrastructure-first approach, which is led primarily by VinFast/V-Green, has created a highly accessible charging network across the country, ensuring minimal congestion and good coverage during the early stages of NEV deployment. However, as the number of NEVs grows, this ratio will likely increase further, bringing attention to the strategic scaling of charging infrastructure in line with vehicle growth. Maintaining an optimal ratio of five to ten NEVs per charging pile over the medium term will be critical to ensuring efficient infrastructure investment, grid reliability, and a positive charging experience.

6.5.1.4. Smart Grid Readiness

While Vietnam's general smart grid readiness score of 80.4% (as per external benchmarks like the SPGroup SGI for one regional utility, EVNCPC) suggests significant foundational progress in modernizing its power system, this readiness is currently uneven and primarily supports one-way power flow, which has mixed implications for NEV charging and V2G arbitrage. The high score is due to the successful use of SCADA/EMS systems, distribution automation, and the widespread use of electronic meters that can collect data from afar (99.3% success rate for one regional utility). These are all important for real-time monitoring, grid reliability, and integrating high-voltage renewable energy sources. This established infrastructure directly enables smart charging arbitrage based on existing Time-of-Use (ToU) tariffs for NEV operators. However, the existing grid structure and regulatory environment still face key gaps that limit the full commercial potential of two-way flexibility: the lack of a widespread rollout of Advanced Metering Infrastructure (AMI)/true smart meters with two-way communication to all customers, and critically, no clear legal or tariff mechanism that explicitly permits charging operators to sell power back to the grid (V2G arbitrage). Therefore, while the 80.4% readiness strongly supports the technical and operational backbone for managed NEV charging, the regulatory

and market framework for V2G remains incomplete, confining current arbitrage opportunities to the simpler model of buying cheap, off-peak power to charge vehicles and avoiding expensive, peak-time charging.

6.5.1.5. Charging Communication Protocol Standard – Single Platform

The National Technical Regulation (QCVN) has introduced foundational mandatory technical and safety standards to address the lack of standardization and the dominance of proprietary systems in Vietnam's nascent new electric vehicle (NEV) charging market, aligning largely with IEC 61851 and ISO 15118. While QCVN requires operators to declare the communication protocol used, it does not yet explicitly mandate a single legal network protocol such as OCPP (Open Charge Point Protocol) for back-end management. Nevertheless, OCPP has become the industry's de facto standard, with local operators—including VinFast and emerging charging providers—adopting OCPP and OCPI compliance in their systems.

This convergence on OCPP effectively establishes a unified "single platform" for managing charging infrastructure nationwide. It enables interoperability between diverse hardware and operators, supports smart charging, facilitates roaming, and allows for future grid integration and V2G applications. As Vietnam's charging network expands toward its 2030 and 2050 targets, this de facto standardization will play a crucial role in ensuring scalability, cost efficiency, and a seamless user experience.

6.5.2. Road Infrastructure

Vietnam's road infrastructure, while undergoing rapid modernization, is now facing the complex challenge of accommodating the transition to Electric Vehicles (EVs) and the eventual adoption of Connected and Autonomous Vehicles (CAVs). The country's commitment to becoming a high-income nation by 2045, coupled with its focus on the 4th Industrial Revolution (Industry 4.0), necessitates a fundamental shift from traditional road planning to a smart, digital, and resilient transport system.

The World Economic Forum (WEF) Global Competitiveness Report uses an Executive Opinion Survey to rate the Quality of Roads on a scale from 1 (poor/underdeveloped) to 7 (extensive/efficient). Vietnam achieved a road quality score of 3.6 points in the 2019 report. This score placed Vietnam below the global average (approximately 4.07 points) and below most of its key ASEAN neighbors, reflecting the challenging state of its extensive but often poorly maintained road network. The 3.6 rating suggests that, according to surveyed business leaders, the overall condition of roads, including surface smoothness and maintenance, is considered poor to moderate. While major cities and newly constructed national highways (e.g., North-South Expressway segments) show improvements, the extensive network of local and provincial roads, crucial for economic activity, often suffers from congestion and poor upkeep.

Vietnam's road environment adheres to basic international standards, though implementation and enforcement are often variable. Vietnam utilizes the standard Red, Yellow (Amber), and green light systegreenaffic signals are widely used in urban centers (Hanoi, Ho Chi Minh City) but are less common in rural areas. Directional signage is generally adequate in urban areas and on main national routes, often including English text. Where present, lane markings generally follow international conventions: solid lines for restriction, dashed lines for permission to change lanes or overtake.

However, in practice, lane markings are frequently obscured, faded, or ignored. The immense volume of motorcycles often renders standard lane division ineffective, particularly in heavy traffic where vehicles spill across multiple marked lanes. Traffic management is severely challenged by the sheer density of vehicles and pervasive issues with driver adherence. Traffic flow is often chaotic, even at regulated intersections, requiring high caution from all road users. The Law on Road Traffic of Vietnam

dictates lane usage, mandating that slower vehicles which include most motorcycles must travel in the rightmost lane or the service lane of multi-lane roads, creating a de facto separation. Traffic police actively enforce laws, focusing heavily on helmet use and general violations. While enforcement for adhering to the rightmost lane rule is present, the sheer volume of traffic often makes perfect compliance and enforcement impractical in congested urban areas.

Fines are regularly issued for moving into prohibited lanes or using expressways. Despite these efforts, the high number of motorcycle-related accidents confirms the ongoing difficulty in effectively separating and managing the dominant two-wheeled traffic flow.

6.5.2.1. National Road Network Hierarchy and Modernization

Vietnam's road network is vast and classified by the Ministry of Transport (MoT). Future mobility depends on upgrading the existing structure, particularly the backbone highways.

1) Expressways and National Highways

These form the primary arterial network, critical for linking economic hubs and facilitating regional trade. Significant investment is being directed towards. Standardization, Upgrading the technical standards (pavement quality, lane width, signage) of key Expressways (e.g., North-South Expressway) to support higher speeds and eventually, the technical requirements for CAVs (e.g., high-quality lane markings), and Toll Road Modernization: Implementing Electronic Toll Collection (ETC) across the national network. This is a foundational digital step, as it requires the deployment of vehicle-to-infrastructure (V2I) communication technology and the creation of a centralized data collection system, which can be leveraged for future Smart Mobility applications.

2) Provincial and Urban Roads

These roads carry the bulk of daily traffic and are the priority for initial Smart City deployments. Congestion in major urban centers like Hanoi and Ho Chi Minh City drives the need for digital solutions.

6.5.2.2. Road Infrastructure for Electric Vehicles (EVs)

The immediate demand for physical and digital road infrastructure is the integration of EVs, a process largely driven by domestic manufacturers like VinFast and supporting policies.

1) Integration of Charging Infrastructure

The road network must physically accommodate an extensive, strategically located charging station network (both fast-charging along highways and slow-charging in urban areas). Regulations mandate specific land use and safety standards for integrating charging poles and battery swapping stations into existing rest stops and urban parking facilities. Power Grid Interconnection, This physical infrastructure requires digital connectivity to the national power grid (EVN). Charging stations must be connected via fiber or 5G to enable, Load Management. Real-time communication with the smart grid to manage charging during off-peak hours and prevent localized power overloads, And Dynamic Pricing: Enabling smart charging based on grid demand and time-of-day tariffs.

2) Digital Roadside Units (RSUs)

The shift includes replacing passive road signs with dynamic digital signage that provides real-time information (e.g., congestion, accidents, nearest charging station status) to both human drivers and connected EV systems.

6.5.2.3. Digital Road Infrastructure for Connected and Autonomous Vehicles (CAVs)

The long-term vision requires a comprehensive upgrade of the physical road structure with advanced digital components to enable highly automated driving.

1) Connectivity at the Roadside

5G/V2X Deployment, The physical road corridors, particularly on designated Smart Highways and in urban test zones, must be equipped with high-density 5G base stations and dedicated Roadside Units (RSUs). These RSUs facilitate:

- V2I (Vehicle-to-Infrastructure) Communication: Allows CAVs to receive real-time updates on traffic lights, construction zones, and road hazards.
- Low-Latency Data Exchange: Essential for safety applications (e.g., collision avoidance) that require latency under 100 milliseconds.

2) Advanced Pavement and Geomatics

Pavement Quality and Markings, Autonomous vehicles rely heavily on machine vision and sensor fusion. This mandates that paved surfaces maintain:

- High-Quality, Reflective Lane Markings: Consistent and durable markings are essential for lane-keeping and localization algorithms.
- Consistent Road Geometry: Deviation in road geometry must be minimized to match the expectations of pre-loaded high-definition (HD) maps.

Digital Road Surveying, The physical roads must be mirrored by High-Definition (HD) Digital Maps with centimeter-level accuracy. This requires continuous surveying and updating of the road network using Lidar and advanced GIS technology, forming a crucial digital layer of the road infrastructure.

3) Traffic Management Centers (TMCs)

Physical vs. Digital Control: Modern Road infrastructure shifts control from scattered physical signals to centralized, digital Traffic Management Centers (TMCs). These centers are equipped with AI and Big Data analytics capabilities to:

- Optimize Flow: Adjust signal timings dynamically based on real-time traffic sensor data.
- Incident Detection: Use video analytics and IoT sensors (embedded in the road or adjacent structures) to automatically detect accidents, debris, or flooding.

4) Challenges and Future Infrastructure Gaps

The transformation of Vietnam's road structure for future mobility faces distinct technical and structural hurdles.

- Heterogeneous Traffic Mix: One of the most significant challenges is the dominance of motorcycles and the resulting chaotic, mixed-flow environment. Current road rules and infrastructure are not standardized to handle automated vehicles sharing space safely with a high volume of unorganized motorcycle traffic. This requires:
    - Physical Segregation: Creating dedicated lanes or zones for different vehicle types.
    - Enhanced Sensor Systems: Developing roadside systems capable of accurately tracking and predicting the movements of non-standard vehicles (motorcycles, bicycles).
- Climate Resilience and Maintenance: Vietnam's road network is highly vulnerable to seasonal floods and erosion. Digital infrastructure (RSUs, sensors) deployed along the roads must be ruggedized and maintain operational reliability despite harsh weather conditions.

- Data Integration and Ownership: Establishing protocols for standardizing and sharing data collected from vehicles, roadside sensors, and TMCs across different government agencies (MoT, MIC, local authorities) and private operators remains a critical institutional challenge.

Vietnam's strategic approach is to implement pilot projects within its Smart Cities and along key economic corridors, using these controlled environments to refine the integration of the physical road structure with advanced digital technologies before national-scale deployment.

6.5.3. Digital Infrastructure

Vietnam is rapidly positioning itself as a leader in Southeast Asia for digital transformation and advanced manufacturing, making it a pivotal location for the future of the automotive sector, particularly Electric Vehicles (EVs) and Smart Mobility. The shift is driven by ambitious governmental policies and the emergence of strong domestic players like VinFast, which necessitate a robust and reliable digital infrastructure to support Connected, Autonomous, Shared, and Electric (CASE) technologies.

Vietnam is aggressively developing its digital infrastructure, particularly in 5G technology, positioning itself as a leader in Southeast Asia for mobile speeds. This strong network foundation supports the national goal of adopting Intelligent Transportation Systems (ITS) and the ambitious domestic development of Level 4 (L4) autonomous vehicles by local manufacturers like VinFast and technology groups. The focus is on leveraging Cellular V2X (C-V2X) capabilities to enhance road safety through improved Traffic Management Systems and V2I communications.

1) 5G Coverage and Mobile Connection Speed

Vietnam has prioritized the deployment of high-speed networks, with major operators like Viettel and VNPT (VinaPhone) competing strongly in the 5G space.

- Network Performance: Vietnam currently ranks highly in ASEAN for mobile internet speed, surpassing several regional neighbors. Recent reports show average national 5G download speeds reaching approximately 447 Mbps, with very low latency (around 0.024 seconds).
- 5G Deployment & Coverage: Operators have rapidly expanded their infrastructure, with Viettel alone installing thousands of 5G base stations across many provinces and cities. The nation aims for 99% population coverage by 2030, ensuring a robust, low-latency backbone crucial for mobility applications.
- Strategic Spectrum: Vietnam's meticulous planning and auction of mid-band spectrum (e.g., 2.6 GHz and 3.8 GHz bands) are key drivers behind its impressive high-speed and widespread 5G rollout.

2) Driverless (L4-L5) Vehicle Development

Vietnam's autonomous vehicle (AV) development is unique due to the proactive involvement of domestic tech conglomerates.

- L4 Prototype Production: Vietnamese groups, including Vingroup (VinFast/VinBigdata) and Phenikaa Group, have successfully developed and piloted Level 4 (L4) autonomous vehicle prototypes. These vehicles are typically designed for operation within specific geo-fenced areas (campuses, industrial zones) or in controlled traffic conditions.
- Domestic Manufacturing: VinFast has partnered with foreign tech firms to manufacture L4 self-driving vehicle models, equipped with extensive sensor suites (LiDAR, cameras, radar), reinforcing Vietnam's capability in this high-tech field.

- Regulatory Context: Despite technological readiness in prototypes, widespread commercial deployment of L4 and Level 5 (L5) vehicles remains restricted. The Ministry of Public Security acknowledges that Vietnam's highly complex and mixed road conditions (heavy motorbike traffic, unpredictable pedestrian movement) currently necessitate restrictions, requiring operational permits for fully autonomous vehicles.

3) Traffic Management Systems (TMS)

Urban centers like Hanoi and Ho Chi Minh City are implementing advanced solutions to manage severe traffic congestion.

- Intelligent Traffic Systems (ITS): There is a growing focus on deploying Intelligent Transportation Systems (ITS) to replace older, fixed-time traffic light systems.
- AI Integration: New systems leverage Artificial Intelligence (AI) and edge computing at the roadside to perform real-time traffic monitoring, license plate recognition, and dynamic analysis of flow. This enables central command centers to control self-responsive traffic lights, thus improving efficiency through Adaptive Traffic Signal Control (ATSC).

4) Vehicle-to-Infrastructure (V2I) for Complimenting ADAS (L2-L3)

The high-speed 5G network provides the essential technological platform for future V2I communications.

- C-V2X Focus: Vietnam's strategy aligns with global trends favoring Cellular V2X (C-V2X), which utilizes the 4G LTE and 5G cellular network backbone for reliable, low-latency communication.
- V2I Purpose: The two-way data exchange enabled by V2I is designed to enhance the performance and safety of commercially available ADAS (L2-L3) features (like Adaptive Cruise Control or Lane Keeping Assist). Roadside Units (RSUs) will broadcast critical information (e.g., Signal Phase and Timing (SPAT), warnings for congestion or hazards) directly to the vehicle's onboard units.

Safety Enhancement: By integrating this real-time infrastructure data, the vehicle's ADAS can proactively make better decisions, providing more timely warnings to the driver and contributing to overall road safety and reduced congestion.

6.5.3.1. National Strategy and Regulatory Foundation

Vietnam's digital and transportation strategies are intertwined, aiming to leapfrog traditional industrial stages and directly embrace the 4th Industrial Revolution (Industry 4.0).

- National Digital Transformation Program (2025/2030): This program, led by the Ministry of Information and Communications (MIC), is the cornerstone, prioritizing the development of digital infrastructure, digital government, and digital economy. The program explicitly targets key enabling technologies for future mobility: 5G, IoT, AI, and Big Data.
- National Energy Development Strategy (until 2030, Vision 2045): This strategy provides the regulatory push for e-mobility, aiming to electrify the transport sector to meet environmental and energy security goals. This includes policies supporting EV manufacturing, tax incentives, and the development of the necessary grid infrastructure.
- Smart City Development: Major cities like Hanoi, Ho Chi Minh City, and Da Nang are actively pursuing Smart City initiatives, integrating digital infrastructure to manage traffic, improve public transport, and pilot initial smart mobility solutions (e.g., smart parking, AI-based surveillance).

6.5.3.2. Telecommunications and Connectivity Backbone

Vietnam's telecommunications infrastructure is a critical enabler for the future of high-performance mobility, providing the high-speed, low-latency foundation required for next-generation vehicle ecosystems. The following three pillars define the nation's digital readiness:

1) 5G Network Deployment

Vietnam has established itself as a regional pioneer in 5G technology, with major domestic operators—Viettel, VNPT, and MobiFone—executing an aggressive nationwide rollout. As of late 2025, 5G coverage has expanded significantly beyond urban centers; for instance, Viettel alone has deployed over 30,000 5G stations, achieving approximately 90% outdoor coverage nationwide. This infrastructure is vital for future mobility, as 5G's ultra-low latency is indispensable for real-time decision-making in autonomous driving and Vehicle-to-Everything (V2X) communication. Furthermore, the government's focus on "Make in Vietnam" technology—evidenced by the use of domestically developed 5G equipment—ensures greater national control over the security and speed of the network deployment.

2) Fiber Optic and Fixed Broadband

The reliability of Vietnam's digital ecosystem is supported by an extensive fiber optic backbone that boasts a household penetration rate of over 85%, far exceeding the global average. This high-capacity network provides the essential link for processing massive volumes of data generated by connected vehicles, supporting cloud-based software updates and centralized Traffic Management Systems (TMS). International connectivity has also been significantly bolstered; by late 2025, Vietnam operates seven major submarine cable systems—including the newly commissioned ADC and SJC2—with plans to expand to 15 cables by 2030. This ensures the resilient, high-speed global data flow necessary for modern vehicle services and large-scale data center operations.

3) IoT and Sensor Networks

Vietnam is rapidly maturing its Internet of Things (IoT) ecosystem, with a specific focus on integrating these technologies into smart transport infrastructure. Under recent government mandates, IoT sensor infrastructure is being installed on at least 50% of major expressways and ring roads to monitor traffic flow, road incidents, and environmental conditions in real time. These sensor networks are the building blocks of an Intelligent Transportation System (ITS) that allows vehicles to digitally interact with their surroundings. By leveraging the low-latency 5G network, Vietnam is advancing communication protocols for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) interactions, creating a synchronized environment where data-driven insights enhance both road safety and traffic efficiency.

6.5.3.3. Digital Infrastructure for E-Mobility

Vietnam's digital landscape is undergoing a strategic transformation to support the rapid electrification of its transport sector. Driven by the global ambitions of domestic manufacturers like VinFast, the nation is prioritizing a digitally managed ecosystem to ensure the reliability and efficiency of its burgeoning NEV market.

1) Smart Charging Network Management

The cornerstone of Vietnam's E-Mobility strategy is the deployment of sophisticated digital platforms to manage its charging infrastructure. The national power utility, Vietnam Electricity (EVN), alongside private providers, now utilizes connected software platforms to facilitate Real-Time Data monitoring. These systems allow for the instantaneous tracking of station availability, power consumption metrics, and automated fault detection. Furthermore, this digital layer enables a seamless user experience

through integrated mobile applications that handle remote booking, automated billing, and secure digital payments, reducing friction for the end-user.

2) Smart Grid Integration and Load Balancing

As EV adoption scales toward the mass market, Vietnam is upgrading its digital infrastructure to support Smart Grid Integration. To prevent grid instability during peak demand, the government and EVN are investing in Advanced Metering Infrastructure (AMI) and SCADA (Supervisory Control and Data Acquisition) systems. These technologies are essential for managing the increased load and provide the necessary foundation for future Vehicle-to-Grid (V2G) capabilities. By utilizing smart charging optimization, the grid can intelligently distribute power, ensuring that the surge in EV energy demand is balanced with national supply capabilities.

3) Data Aggregation and Performance Analytics

The transition to E-Mobility has turned vehicles into significant data generators, necessitating robust platforms for Data Aggregation and Analytics. Vietnam is developing secure digital frameworks to collect and analyze vast datasets, including battery health diagnostics, geographic usage patterns, and energy efficiency metrics. This "big data" approach is critical for the long-term health of the ecosystem; it allows manufacturers and policymakers to refine battery technology, optimize the placement of future charging hubs, and enhance the overall performance of the EV fleet through predictive maintenance and data-driven insights.

6.5.3.4. Digital Infrastructure for Future Mobility Technologies (CAVs)

Vietnam's digital infrastructure is rapidly evolving to accommodate the intensive data and security requirements of Connected and Autonomous Vehicles (CAVs). By the end of 2025, the nation has moved beyond foundational connectivity to establish specialized systems for high-performance mobility, anchored by three critical technological pillars:

1) Hyperscale Cloud and AI Computing

The transition to CAVs is inherently a data-processing challenge, with a single autonomous vehicle capable of generating up to 4 TB of sensor data daily. To handle this, Vietnam has catalyzed an "explosive growth" phase in its data center market, with capacity projected to jump from 45 MW in 2024 to 525 MW by the end of 2025. A major milestone was the official launch of the National Data Centre on August 19, 2025, which serves as a strategic hub for high-performance computing (HPC) and cross-agency data sharing. Furthermore, the government's $310 million National HPC Strategy (2026–2035) aims to place Vietnam among the top three ASEAN leaders for AI infrastructure. This provides the localized "computational muscle" required to train the complex machine learning models that govern vehicle perception, navigation, and real-time decision-making.

2) Precision Mapping and Positioning (GNSS/RTK)

Safe autonomous operation requires centimeter-level localization that standard GPS cannot provide. Vietnam is aggressively bridging this gap by investing in Geographic Information System (GIS) and High-Definition (HD) Mapping capabilities. Recent developments include a significant expansion of GNSS Augmentation through Real-Time Kinematic (RTK) networks, which correct atmospheric errors to ensure lane-level accuracy. By late 2025, the Ministry of Public Security (MoPS) has begun implementing refined traffic laws that specifically categorize "smart vehicles" (Levels 1–3), mandating technical inspection standards that verify the integrity of these positioning systems. This infrastructure ensures that CAVs can maintain precise orientation even in dense urban environments or under challenging weather conditions.

3) Advanced Cybersecurity and Data Sovereignty

As vehicles become "mobile data hubs," they present unprecedented cybersecurity risks. Vietnam has responded by significantly elevating its legal framework, passing a comprehensive New Cybersecurity Law in December 2025 (effective July 2026). This law, paired with the Law on Personal Data Protection (PDP Law) effective January 1, 2026, establishes strict protocols for "Sensitive Personal Data," which now explicitly includes individual digital identities and location history. For the CAV ecosystem, this necessitates high-level encryption and secure V2X communication protocols to prevent remote hijacking. Furthermore, the law grants property rights to data owners, ensuring that the massive volumes of mobility data collected by fleet operators are managed with transparency and protected against unauthorized commercial exploitation.

6.6 Consumer Preferences and Trends

6.6.1. Vehicle Ownership

Vietnam has witnessed a remarkable rise in passenger vehicle ownership from 2018 to 2020, reflecting the nation's rapid economic expansion, urban growth, and improving living standards. The total number of registered passenger vehicles increased from 1.76 million units in 2018 to 2.43 million units in 2020, representing a strong upward trajectory in private mobility demand. Correspondingly, passenger car ownership per 1,000 inhabitants rose from 18.25 units in 2018 to 24.77 units in 2020, suggesting accelerated motorization as household income levels improved and urbanization advanced across the country.

The growth of vehicle ownership has been closely linked to Vietnam's robust economic performance. The country's Gross Domestic Product expanded from 293 billion USD in 2018 to 406 billion USD in 2024, while GDP per capita (in 2015 USD prices) increased from 3,050 USD to 4,027 USD during the same period. Despite the temporary slowdown in 2020 caused by the COVID-19 pandemic, GDP growth remained positive, averaging 5–8% annually and underscoring Vietnam's strong economic fundamentals. This consistent growth, driven by industrialization, export-oriented manufacturing, and rising domestic consumption, has strengthened household purchasing power, thereby supporting sustained growth in private vehicle ownership.

Demographic trends further support the expansion of the vehicle market. Vietnam's population grew steadily from 96.24 million in 2018 to 100.99 million in 2024, with the working-age group (15-64 years) comprising around 68-69% of the total population throughout the period. The share of young people (aged 0–14 years) declined slightly from 24.58% in 2018 to 23.22% in 2024, while the elderly population (aged 65 years and above) rose from 6.98% to 9.05%, signalling gradual population aging. This demographic shift suggests an expanding middle-income population with growing mobility needs and purchasing capacity, alongside emerging challenges related to aging in the long term.

In terms of education, Vietnam has made significant progress, maintaining one of the highest secondary education enrollment rates in the region more than 90% throughout 2018-2024. Tertiary education enrollment also increased notably, from 30.22% in 2019 to 37.59% in 2024. These educational gains are likely to contribute to greater labour productivity, higher income levels, and increasing demand for private transport.

Urbanization has played a critical role in driving motorization. The proportion of the population residing in urban areas grew from 35.92% in 2018 to 40.20% in 2024, with the urban population rising from 34.57 million to 40.59 million. This shift reflects rapid spatial transformation in major economic centers

such as Hanoi, Ho Chi Minh City, and Da Nang, where income growth and urban sprawl have intensified the demand for private vehicles.

The expansion of passenger vehicle ownership in Vietnam mirrors the country's sustained economic growth, urban expansion, and rising household affluence. However, the increasing number of vehicles also poses challenges, including traffic congestion, air pollution, and infrastructure strain in major urban areas. As Vietnam advances toward higher levels of motorization, the government's transportation and environmental policies will play a vital role in promoting sustainable mobility solutions, such as cleaner vehicle technologies, public transport enhancement, and improved urban planning.

6.6.2. Consumer Preferences

The adoption of NEVs in Vietnam has gradually increased as consumers become more conscious of environmental sustainability, fuel efficiency, and the long-term cost benefits of electric mobility. However, purchasing decisions remain shaped by a combination of economic, infrastructural, and behavioral factors. This section explores the evolving patterns of consumer preferences in Vietnam's NEV market, with a particular focus on BEVs, as most survey data and market insights are concentrated in this category.

6.6.2.1. Purchase Decision Factors

As Vietnam's vehicle market continues its transition toward electrification, understanding the factors influencing consumer purchase decisions provides valuable insight into emerging buyer behavior and market dynamics. These factors reflect not only cost and convenience considerations but also consumers' growing expectations for trust, transparency, and supportive infrastructure in both traditional and EVs segments.

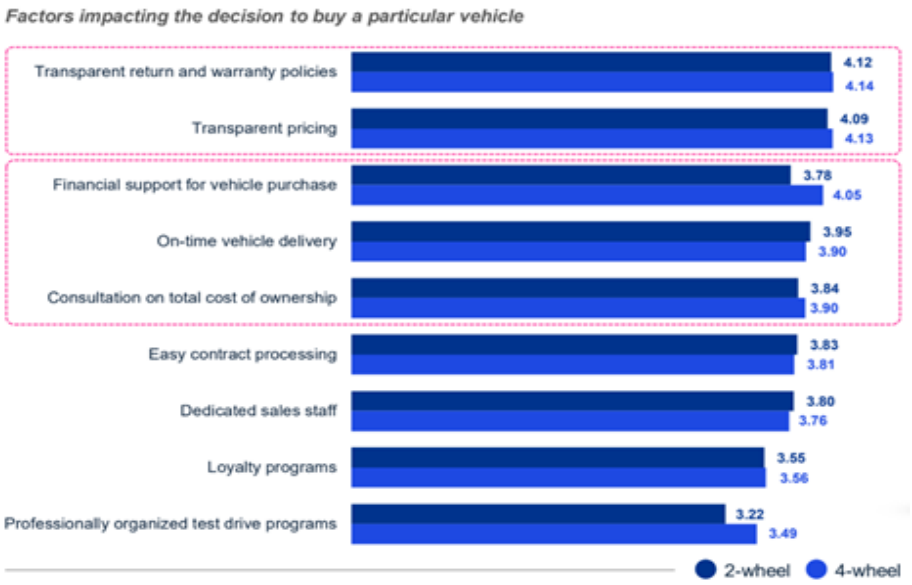


Figure 6-8: Factors impacting the decision to buy a particular vehicle in Vietnam 2024

Source: KPMG (2024)84

[84] KPMG. (2024). The EV 2024 Report: Vietnam's Market. https://kpmg.com/vn/en/home/insights/2024/07/the-ev-landscape-in-vietnam.html

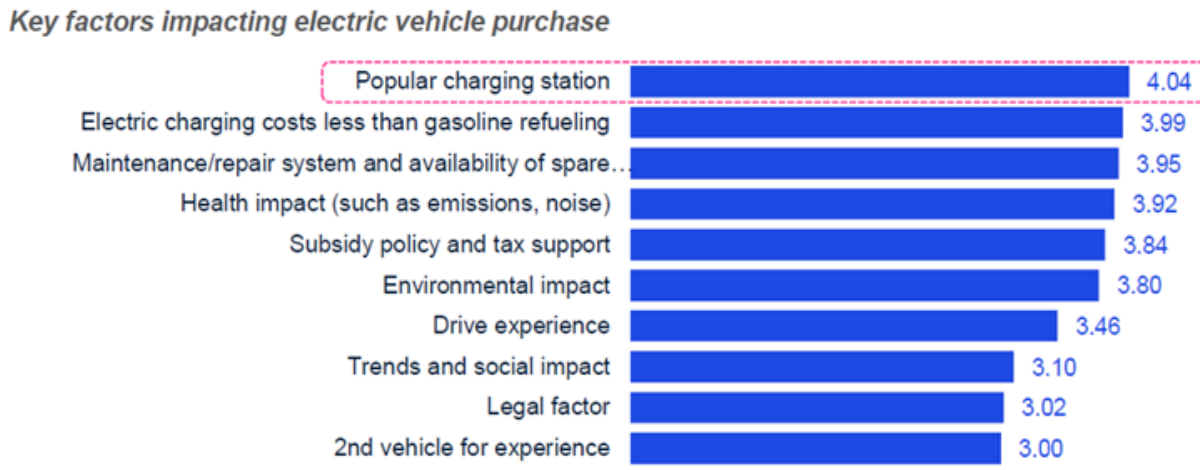


Figure 6-9: Key factors impacting electric vehicle purchase in Vietnam 2024

Source: KPMG (2024)

81% of 4-wheel buyers

Factors	18-24	25-34	35-44	>=45	Total
Durability/Low maintenance issues	15%	22%	22%	23%	21%
Performance (e.g., fuel consumption/range/speed/handling)	12%	14%	17%	10%	15%
Interior & vehicle space	15%	13%	10%	10%	12%
Resale value	12%	9%	9%	13%	10%
Pricing and financial services support	7%	11%	10%	10%	10%
Ownership experience (e.g., after-sales service/regular maintenance/repair and availability of replacement parts)	10%	10%	9%	10%	10%
Total cost of ownership	8%	6%	10%	6%	8%
Features (e.g., driver assistance technology)	7%	6%	6%	5%	6%
Vehicle purchase experience	10%	6%	3%	5%	5%
Brand & manufacturer reputation	4%	3%	5%	7%	4%

Figure 6-10: Factors Influencing the Decision to Purchase a Four-Wheel Vehicle in Vietnam 2024

Source: KPMG (2024)

According to the KPMG 2024 consumer survey, Figure 6-8 to Figure 6-10 present the main factors influencing vehicle purchase decisions in Vietnam. The findings reveal that transparency and financial considerations play the most decisive roles for both conventional and electric vehicle buyers. Transparent return and warranty policies, clear pricing, and financial support for vehicle purchases ranked as the top priorities, emphasizing consumers' demand for trust and clarity in transactions. For electric vehicles, the availability of popular charging stations, lower charging costs compared to gasoline, and reliable maintenance and repair services emerged as the strongest motivators, reflecting a growing focus on cost efficiency and convenience. Moreover, analysis by age group indicates that durability, performance, and pricing support remain key determinants across all segments particularly among consumers aged 25–44, who represent the majority of four-wheel vehicle buyers. Overall, the results from the KPMG 2024 survey suggest that trust, affordability, and supportive infrastructure are critical to shaping consumer preferences and will continue to drive purchasing behavior in Vietnam's evolving vehicle market.

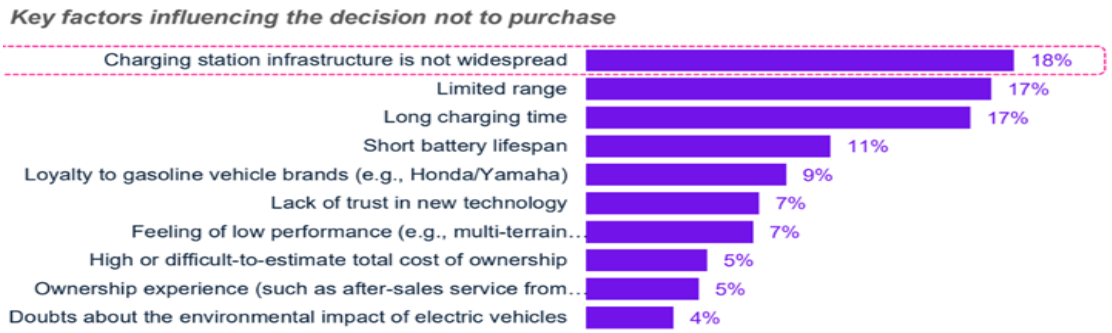


Figure 6-11: Key factors influencing the decision not to purchase in Vietnam 2024

Source: KPMG (2024).

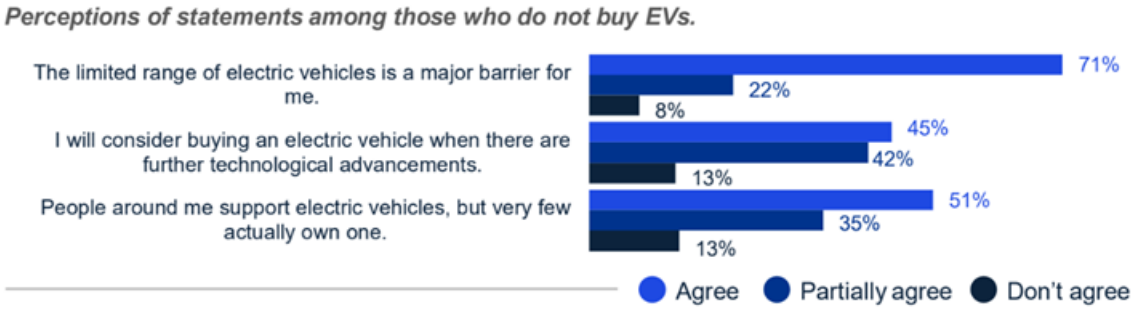


Figure 6-12: Perceptions of statements among those who do not buy EVs in Vietnam 2024

Source: KPMG (2024).

Moreover, findings from the KPMG survey, shown in Figure 6-11: and Figure 6-12: illustrate the key barriers and perceptions among Vietnamese consumers who have not yet purchased EVs. The findings show that the limited availability of charging infrastructure is the most significant obstacle, cited by 18% of respondents, followed by concerns about limited driving range and long charging time. Other factors such as short battery lifespan, brand loyalty to gasoline vehicles, and lack of trust in new technology also influence hesitation toward EV adoption. Additionally, perceptions data reveal that 71% of non-EV consumers view limited driving range as a major barrier, while nearly half stated they would consider buying an EV once technological advancements further improve performance and reliability. Moreover, although many respondents acknowledge social support for EV adoption, few people in their social circles currently own one. Overall, these results highlight that infrastructure development, technological improvement, and trust-building measures are critical for encouraging broader EV adoption in Vietnam.

Therefore, the findings from the KPMG survey reveal that consumer purchasing behavior in Vietnam is shaped by two key dynamics: a strong emphasis on trust, affordability, and financial transparency when deciding to buy, and persistent concerns over charging infrastructure, range limitations, and technology reliability when considering EV adoption. Strengthening these areas through better infrastructure and clearer communication will be essential to build confidence and accelerate the transition toward electric mobility in Vietnam.

6.6.2.2. Purchase Intentions and Preferences

As the transition toward vehicle electrification accelerates in Vietnam, analyzing consumer purchase intentions and preferences becomes essential to understanding shifting market dynamics. These insights reveal how income levels, age groups, lifestyle patterns, and technological expectations are influencing the growing interest in electric and hybrid vehicles. The following section discusses consumers' future purchasing intentions and the main features that drive EV choices across various demographic segments.

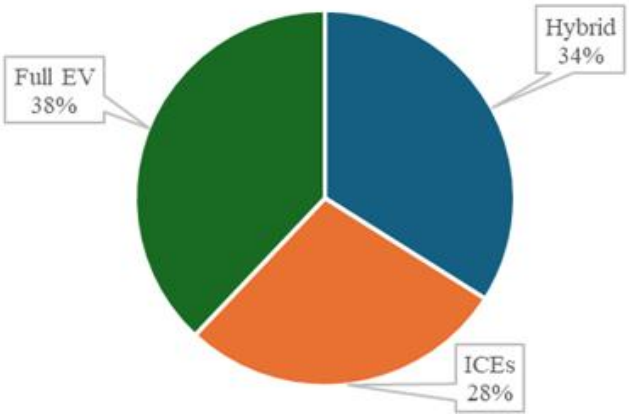


Figure 6-13: Consumers' Intended Vehicle Type for Future Purchase in Vietnam 2024

Source: KPMG (2024).

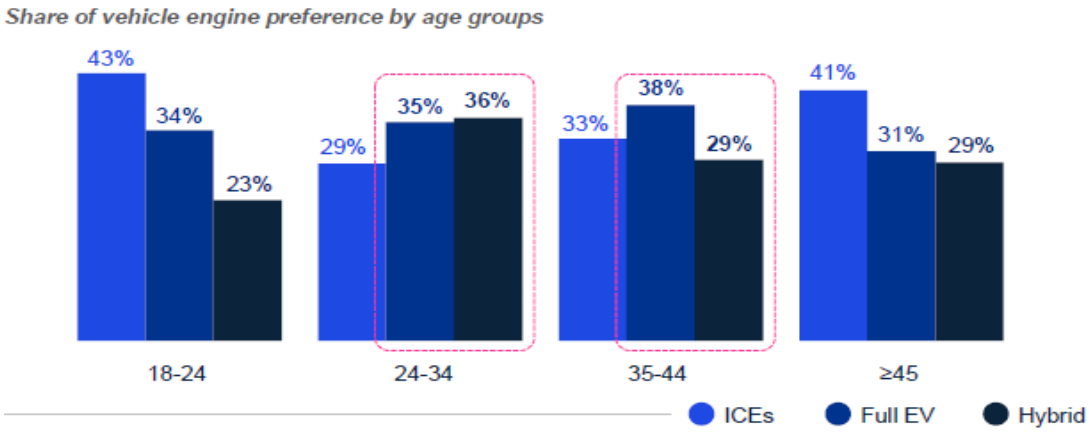


Figure 6-14: Share of vehicle engine preference by age groups

Source: KPMG (2024)

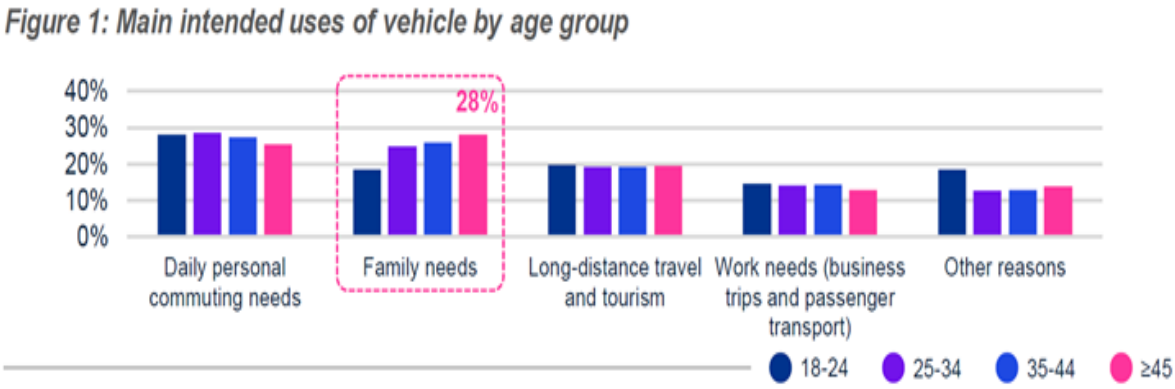


Figure 6-15: Main intended uses of vehicle by age group in Vietnam 2024

Source: KPMG (2024).

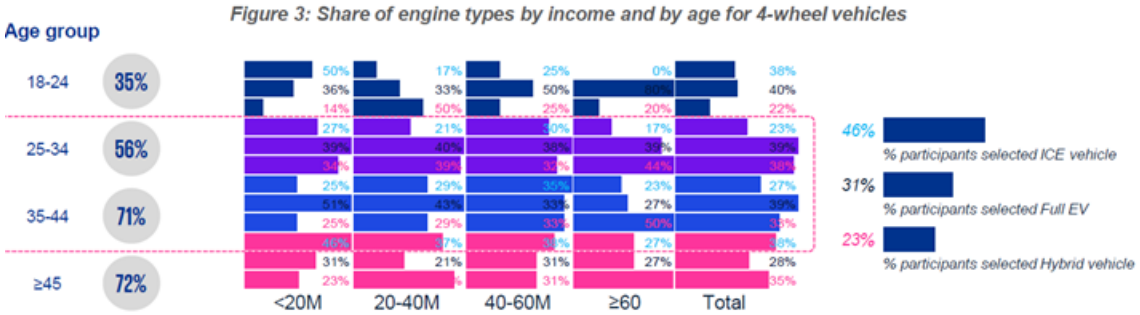


Figure 6-16: Share of engine types by income and by age for 4-wheel vehicles in Vietnam 2024

Source: KPMG (2024)

According to the KPMG 2024 survey, Figure 6-13: to Figure 6-16: illustrate consumer purchase intentions and preferences in Vietnam in 2024. The data show that Full EVs (38%) are the most preferred vehicle type for future purchases, followed by hybrids (34%) and internal combustion engine vehicles (28%), reflecting growing consumer readiness for electrification. Age-based comparisons indicate that younger consumers (18–24) still lean toward conventional vehicles, while middle-aged groups (25–44) show a stronger inclination toward EVs and hybrids. In terms of intended use, vehicles are primarily purchased for daily commuting and family needs, suggesting practicality remains a key motivation.

Moreover, analysis by income level reveals that higher-income consumers are more likely to choose EVs, whereas lower-income groups still prefer ICE vehicles due to affordability. Overall, the findings suggest that EV adoption in Vietnam is accelerating, driven by increasing awareness, rising income levels, and the growing appeal of cleaner and more efficient mobility options.

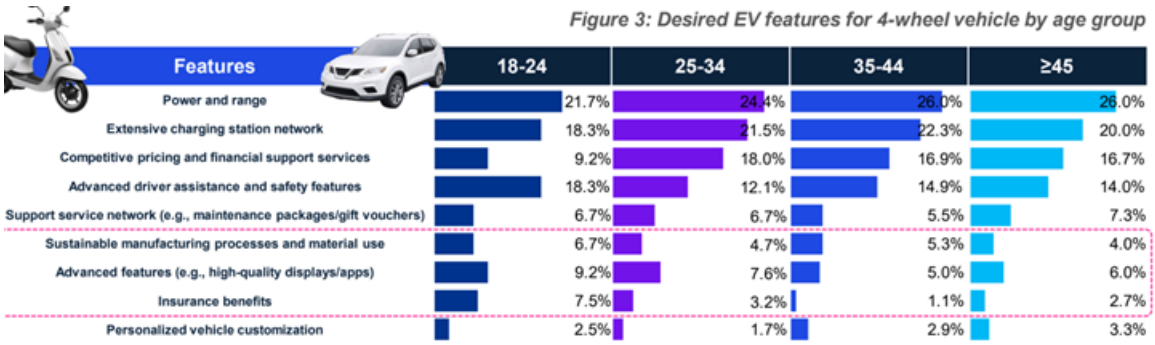


Figure 6-17: Desired EV features for 4-wheel vehicle by age group in Vietnam 2024

Source: KPMG (2024).

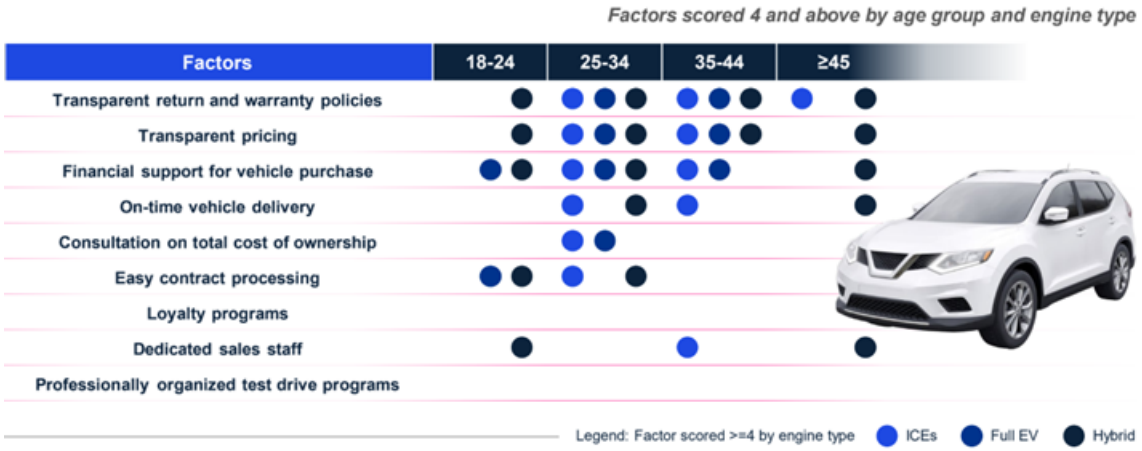


Figure 6-18: Factors scored 4 and above by age group and engine type in Vietnam 2024

Source: KPMG (2024).

Moreover, findings from KPMG survey, shown in Figure 6-17: and Figure 6-18: highlight the specific features and decision factors that influence EV purchasing preferences among different age groups in Vietnam in 2024. The data show that across all age segments, power and range, extensive charging networks, and competitive pricing with financial support are the most desired EV features, reflecting consumers' focus on practicality and affordability. Younger buyers (18–24) tend to value advanced technology and safety features, while older groups (35–45 and above) place greater emphasis on vehicle performance and charging accessibility. Meanwhile, purchasing factors scored 4 and above reveal a consistent prioritization of transparent pricing, clear warranty policies, and financial support across all age groups and engine types, with slightly stronger attention from middle-aged consumers.

Overall, these findings suggest that improving pricing transparency, financing schemes, and charging infrastructure, while promoting technological innovation and reliability, will be key to appealing to a broader base of Vietnamese EV buyers.

Therefore, the combined results indicate that Vietnam's consumers are increasingly open to electrification but remain motivated by affordability, reliability, and convenience. Strengthening charging infrastructure, enhancing financial accessibility, and emphasizing trust through transparency and technology will be critical to sustaining momentum and encouraging broader EV adoption across income and age groups.

6.6.2.3. Charging Behavior

As Vietnam advances toward transportation electrification, understanding charging behavior is vital to assessing the readiness of both consumers and infrastructure for large-scale EV adoption. This section provides an overview of how users interact with the charging ecosystem covering their charging habits, preferences, waiting time expectations, and perceptions of charging network effectiveness to better capture the evolving dynamics of Vietnam's emerging EV landscape.

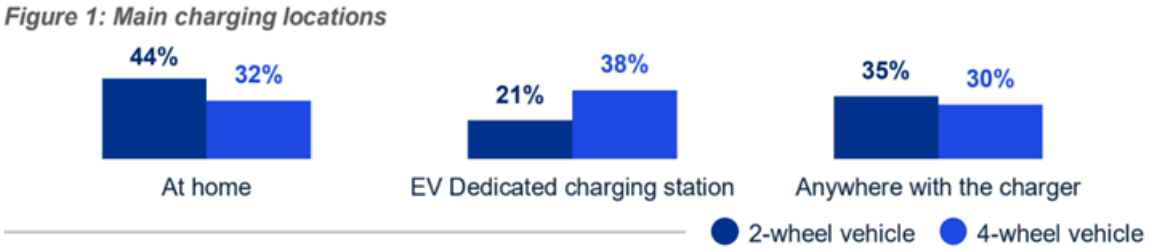


Figure 6-19: Main charging locations in Vietnam 2024

Source: KPMG (2024)

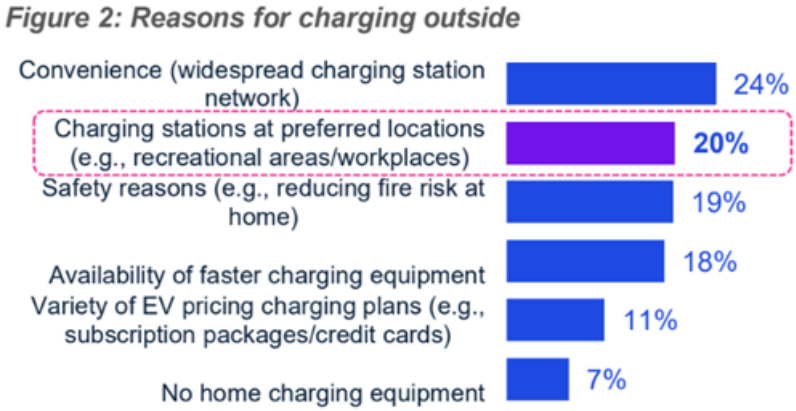


Figure 6-20: Reasons for charging outside in Vietnam 2024

Source: KPMG (2024)

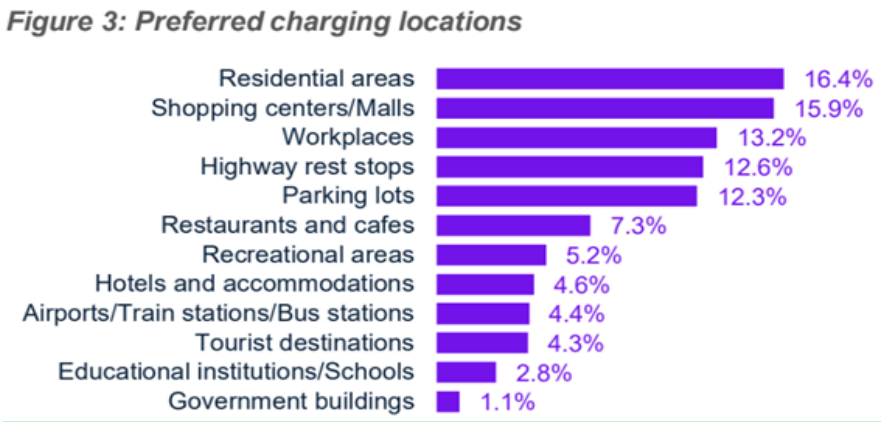


Figure 6-21: Preferred charging locations in Vietnam 2024

Source: KPMG (2024)

According to the KPMG 2024 survey, Figure 6-19: to Figure 6-21: illustrate the charging behavior and preferences of four-wheel EV users in Vietnam in 2024. The findings indicate that the majority of users primarily charge at home (32%), followed by dedicated charging stations (38%), and charging anywhere with a portable charger (30%). Among those who charge outside, the main reasons include convenience due to a widespread charging network (24%), availability of charging points at preferred locations such as workplaces and recreational areas (20%), and safety concerns related to home charging (19%).

In terms of preferred locations for public charging infrastructure, respondents ranked residential areas, shopping centers or malls, and workplaces as the top three, followed by highway rest stops and parking lots. Overall, the results highlight that accessibility, convenience, and safety are key determinants of charging behavior, emphasizing the need to expand Vietnam's urban and workplace charging networks to meet growing demand from four-wheel EV users.

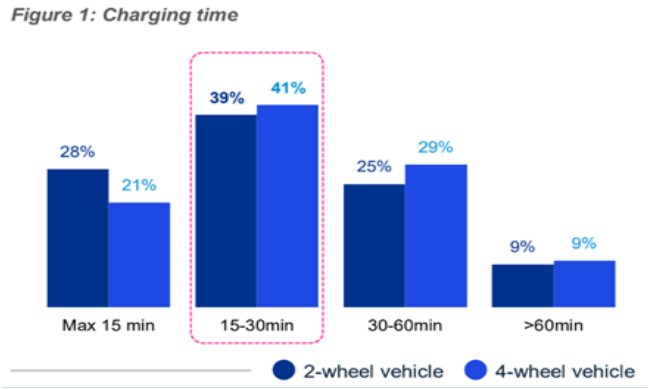


Figure 6-22: Expected wait time for charging in Vietnam 2024

Source: KPMG (2024)

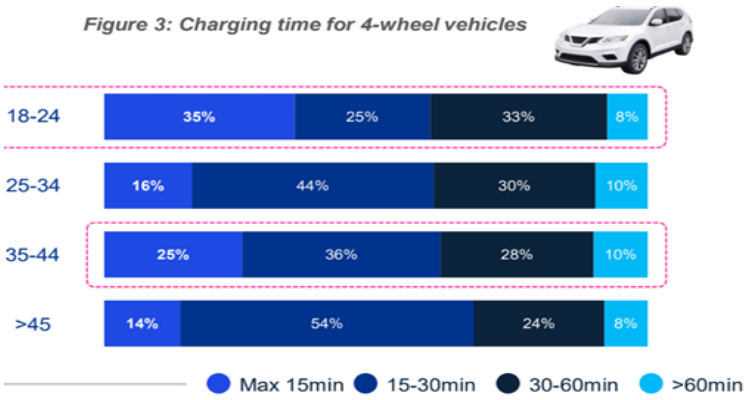


Figure 6-23: Expected wait time for charging for 4-wheel vehicles in Vietnam 2024

Source: KPMG (2024)

According to the KPMG 2024 survey, Figure 6-22 and Figure 6-23 illustrate the expected charging time preferences among EV users in Vietnam in 2024, with a focus on four-wheel vehicles. The data show that the majority of users prefer a charging duration of 15–30 minutes (41%), followed by 30–60 minutes (29%), indicating a strong expectation for fast and efficient charging services. When analyzed by age group, younger consumers (18–24) tend to expect shorter charging times up to 15 minutes while middle-aged users (25–44) most commonly prefer 15–30 minutes. Older drivers (aged 45 and above) show greater tolerance for longer charging periods, with over half indicating satisfaction with 15–30 minutes. Overall, these findings suggest that rapid-charging capabilities are increasingly seen as a key factor in enhancing user satisfaction and promoting broader EV adoption across Vietnam's emerging electric mobility market.

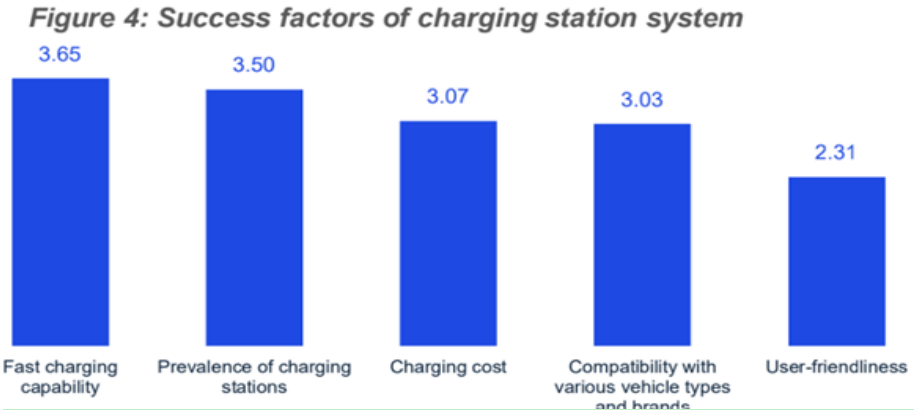


Figure 6-24: Success factors of charging station system in Vietnam 2024

Source: KPMG (2024)

Moreover, findings from KPMG survey, shown in Figure 6-24 shows that the main success factors for Vietnam's EV charging system in 2024 are fast charging capability (3.65) and widespread station availability (3.50). These highlight consumers' strong preference for convenience and efficiency. Charging cost and compatibility across vehicle types are also valued, while user-friendliness is seen as less critical. Overall, the results emphasize that improving charging speed and network coverage is essential to strengthen Vietnam's EV infrastructure.

Therefore, the combined findings highlight that charging speed, accessibility, and network expansion are the most crucial elements shaping EV users' charging experiences in Vietnam. Strengthening these areas together with improvements in affordability and system reliability will be vital to support the country's growing EV ecosystem and sustain consumer confidence in electric mobility.

6.6.2.4. Purchase Experience & Information Channels

As Vietnam's automotive market becomes increasingly consumer-driven, examining purchase experience and information channels offers key insights into buyer expectations and decision-making behavior. This section explores how consumers perceive delivery timelines and where they seek information during the vehicle purchasing process, reflecting the growing importance of transparency and accessibility in shaping trust and satisfaction.

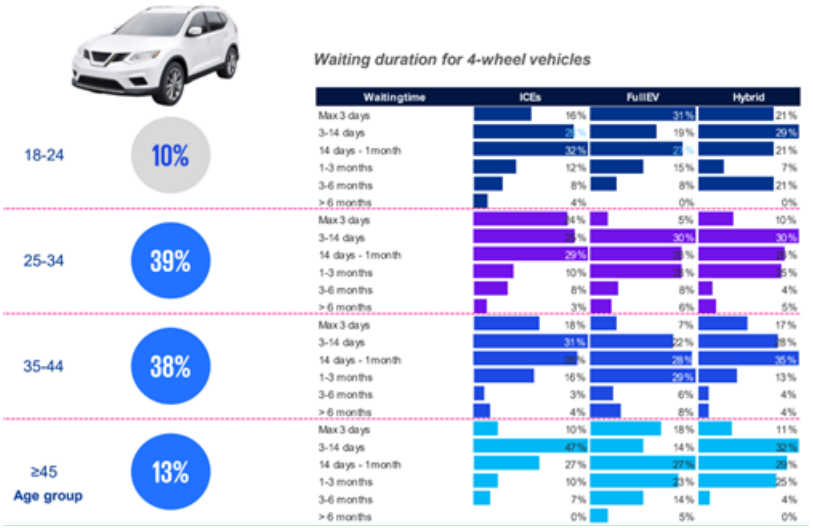


Figure 6-25: Expected Waiting duration for 4-wheel vehicles in Vietnam 2024

Source: KPMG (2024)



Figure 6-26: Preferred information channels in Vietnam 2024

Source: KPMG (2024)

According to the KPMG 2024 survey, Figure 6-25 and Figure 6-26 illustrate consumers' expected waiting time for vehicle delivery and their preferred information channels in Vietnam. The findings show that most four-wheel vehicle buyers expect a delivery period of 3–14 days (around 30%), especially for full EVs and hybrid models, while some are willing to wait up to one month depending on availability. Middle-aged consumers (25–44) represent the largest share of those expecting moderate

waiting times. In terms of information access, respondents most preferred showrooms (3.64), followed by manufacturer websites (3.61), direct sales interactions (3.60), and social media platforms (3.46) as the main sources of reliable information. Overall, these insights suggest that Vietnamese consumers value timely delivery and transparent communication, highlighting the importance of efficient supply coordination and multi-channel engagement to enhance the overall purchase experience.

Therefore, these findings underscore that customer experience, delivery efficiency, and credible information access are becoming decisive factors in Vietnam's competitive vehicle market. Strengthening coordination between digital platforms and physical sales channels will be essential for automakers to meet evolving consumer expectations and sustain trust in the country's fast-growing EV and hybrid segments.

6.7 Assessment of NEV & Smart Mobility Market Preparedness

6.7.1. Country Assessment

Vietnam's Market Status Readiness Index shows an overall score of around 2.7, indicating a moderately advanced NEV ecosystem with strong recent progress across several dimensions. The market status (1.9) reflects accelerating NEV uptake driven by VinFast's domestic presence, expanding charging infrastructure, and growing consumer acceptance, although adoption is still concentrated in major cities. Policy readiness (2.8) is strengthened by Vietnam's ambitious long-term electrification targets, proactive fiscal incentives, and a clear commitment to phasing out ICE vehicles by 2050. Energy-infrastructure readiness (3.7) performs relatively well, supported by rapid network expansion by V-Green and improving grid modernization, though interoperability and standardization gaps remain. Road and digital infrastructure (2.6) emerge as the strongest dimension, driven by extensive 5 G coverage and improving digital-connectivity systems that can support future V2X applications, even as physical road quality and traffic-management systems still require upgrades. Vehicle-technology readiness (3.1) remains moderate, reflecting strong BEV performance but limited model diversity and relatively short NEV experience compared with leading markets. Overall, Vietnam demonstrates solid upward momentum and a strengthening ecosystem foundation, but continued improvements in technology diversity, digital-mobility systems, and interoperable charging standards will be essential to reach higher levels of market maturity.

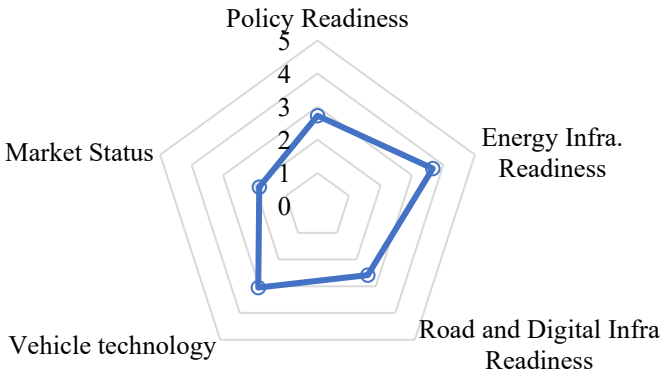


Figure 6-27: Market Readiness Index of Vietnam

6.7.1.1. Market Status Index

The Market Status index is constructed using annual data reported by the Vietnam Register (2022), providing a standardized basis for subsequent index score analysis. The BEV Penetration, the PHEV, REEV Penetration, and the ICV Penetration (L2 Autonomous) indices are calculated from the ratio of BEV/ PHEV, REEV/ICV sales to total sales in 2024. The motorization rate index is calculated from car ownership per 1,000 people using data reported from PwC Automotive ASEAN (2025). In addition, the DC Fast Charging Share Index measures the proportion of public EV charging connectors that are DC fast chargers by using data from Hanoi University of Science and Technology (2025). Finally, the BEV Price and PHEV, REEV Price indices are computed as the ratios of BEV/ PHEV, REEV to ICE prices by model segment using car prices from the official websites of the respective automotive manufacturers (2025).

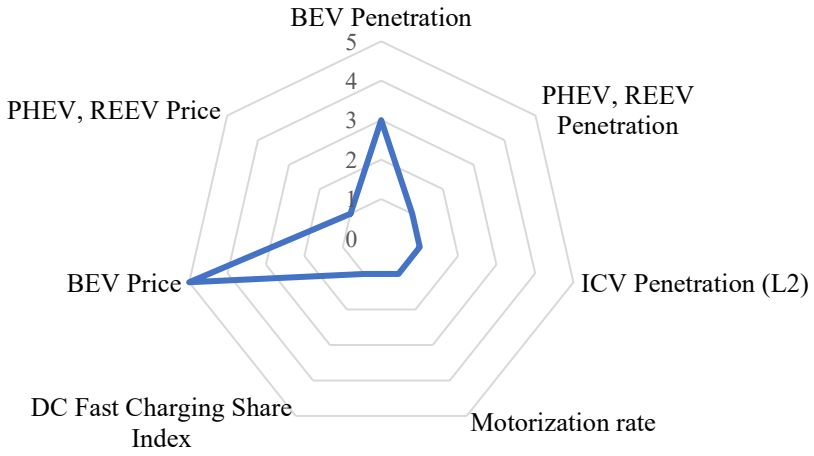


Figure 6-28: Market Status Index of Vietnam

The Market Status Index for Vietnam assesses the current adoption state of New Energy Vehicle (NEV). The upper radar chart presents the Market Status Index, which includes six indicators—BEV penetration, PHEV/REEV penetration, ICV (L2 autonomous) penetration, motorization rate, DC fast charging share index, and BEV/PHEV price ratios compared to ICE vehicles. The score of market status readiness index for Vietnam is 1.9. This score is relatively low compared to China and Thailand. The high readiness performance results from BEV price (5.0) and BEV penetration (3.0).

In Vietnam, BEV penetration accounts for approximately 22 percent of total vehicle sales, indicating that the electric vehicle market has entered the early majority phase. This development reflects the rapid expansion of the domestic manufacturer VinFast, alongside growing consumer interest in electric vehicles, particularly in major urban centers such as Hanoi and Ho Chi Minh City. In parallel, Chinese automakers have begun to actively explore and expand their presence in the Vietnamese EV market, with companies such as BYD and Chery showing increasing interest.

The expansion of the BEV market has also been strongly supported by the policy environment. The Vietnamese government's Decision No. 876/QĐ-TTg (2022) and the Power Development Plan VIII (PDP8) have accelerated the establishment of a comprehensive policy framework for NEV adoption, with the dual objectives of reducing transport-sector emissions and improving national energy efficiency.

Moreover, the average price of BEVs in Vietnam has become increasingly competitive with internal combustion engine vehicles. Several BEV models are priced more than 20 percent below comparable gasoline vehicles, significantly stimulating consumer demand over the past year. Importantly, a key market player, VinFast, has implemented an aggressive marketing strategy by offering free charging services until 2027. This initiative has further encouraged consumer adoption of BEVs across both private vehicle use and commercial transport services, particularly in the taxi segment.

Nevertheless, several dimensions of Vietnam's Market Status readiness continue to face significant challenges, resulting in low assessment scores (1.0) for PHEV and REEV penetration, PHEV and REEV price competitiveness, ICV penetration, the motorization rate, and the DC Fast Charging Share Index.

PHEV and REEV adoption remain limited, as the market has largely prioritized BEVs over hybrid powertrain alternatives. In parallel, the Intelligent Connected Vehicle (ICV), particularly Level 2 autonomous driving technologies, is still in its infancy, with only minimal deployment of advanced driver-assistance systems across the vehicle fleet. Although Vietnam's motorization rate remains lower than that of Thailand or Malaysia, it is rising rapidly in line with economic growth and the expansion of the middle-income population. As of the most recent estimates, car ownership in Vietnam stands at approximately 97 vehicles per 1,000 people.

Also, Vietnam's DC fast-charging share is gradually improving but remains heavily concentrated along major urban corridors and within VinFast's proprietary charging network. Importantly, the absolute number of DC fast-charging ports remains very limited, approximately 3,000 ports out of a total of around 150,000 charging points nationwide. Moreover, the lack of interoperability across different charging operators constrains user convenience and poses a structural barrier to the nationwide scalability of BEV adoption.

6.7.1.2. Policy Readiness Index

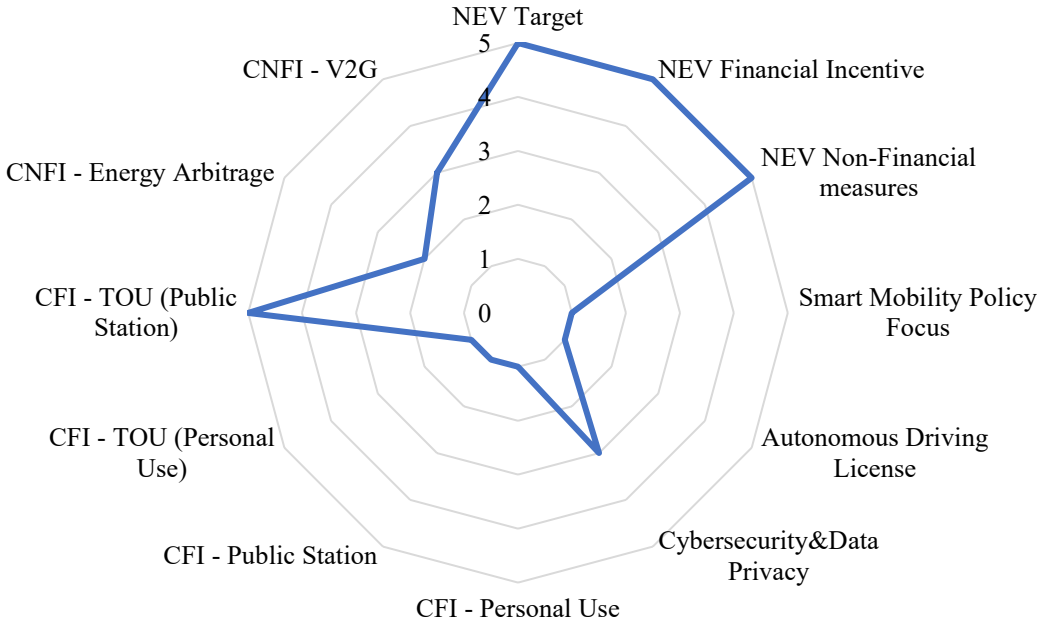
The Policy Readiness Index evaluates Vietnam's institutional and regulatory preparedness to enable NEV) adoption. As illustrated in Figure 6-29, the radar chart presents eleven key policy dimensions: (1) NEV target, (2) NEV financial incentive, (3) NEV non-financial measures, (4) Smart Mobility Policy Focus, (5) Autonomous Driving Pilot License, (6) Cybersecurity & Data Privacy, (7) Charging Financial Incentive – Personal Use, (8) Charging Financial Incentive – Public Station, (9) Charging Financial Incentive – ToU (Personal Use), (10) Charging Financial Incentive – ToU (Public Station), (11) Charging non-Financial Incentive – Public Station (Energy Arbitrage), and (12) Charging non-Financial Incentive – Public Station (V2G). The radar profile clearly shows high readiness for NEV targets, fiscal incentives, non-financial measures, and charging related incentives for public charging stations.

At the policy level, Vietnam's government has taken a notably proactive stance in promoting battery electric vehicles (BEVs). It has set ambitious national targets, including the complete phase-out of internal combustion engine (ICE) vehicles by 2050, alongside a range of measures aimed at accelerating electric-vehicle adoption across both public and private sectors. These commitments earn Vietnam the maximum score (5.0) on the NEV Target Index, positioning the country as one of the most policy-forward actors in the Mekong region in terms of long-term electrification planning.

Vietnam's fiscal incentives are also relatively advanced. The Special Consumption Tax (SCT) on BEVs has been reduced to just 3%, compared to 35% or higher for ICE vehicles, and registration fees for new BEVs are fully waived (0%), while ICE buyers pay roughly 12%. This substantial tax differential creates an immediate and significant cost advantage for electric vehicles, resulting in a top score (5.0) for the NEV Financial Incentive Index.

However, Vietnam has not yet introduced a comprehensive smart-mobility strategy, and policies related to autonomous vehicles or digital transport systems remain in early development, yielding a score of 1.0 for these indices. Cybersecurity and data-privacy regulations for electric-vehicle supply equipment (EVSE) are still at the planning stage, providing a moderate readiness score of 3.0.

In the charging ecosystem, Vietnam performs strongly in terms of financial incentives for public charging, supported by favourable time-of-use (ToU) tariffs that result in a score of 5.0. However, financial incentives for other components—such as personal charging and support for charging-station investment—remain limited, scoring only 1.0. Non-financial mechanisms, particularly those related to energy arbitrage, are also largely absent due to the country's flat electricity tariff structure (1.0). Nonetheless, Vietnam is actively advancing V2G and smart-charging initiatives to support its broader sustainable energy and transport objectives, achieving a score of 3.0 in this emerging domain.



Note: CFI - Charging Financial Incentive; CNFI - Charging non-Financial Incentive

Figure 6-29: Policy Readiness Index of Vietnam

6.7.1.3. Energy Infrastructure Readiness Index

The Energy Infrastructure Readiness Index assesses Vietnam's ability to support large-scale NEV deployment through its power system modernization, charging network interoperability, and infrastructure coverage. As shown in Figure 6-30, the radar chart presents three key indicators: Smart Grid Readiness, Charging Communication Protocol Standard – Single Platform, and NEVs per Charging Pile – Cumulative AC/DC.

Vietnam achieved a smart grid readiness score of 80.4 in the 2024 assessment, suggesting significant foundational progress in modernizing its power system. This high readiness score, which reflects strong technical and operational capability, strongly supports the backbone necessary for managed NEV charging within the power system. Based on this achievement, Vietnam scores a 5.0 in the Smart Grid Readiness Index.

For Charging communication protocol standard. The National Technical Regulation (QCVN) has introduced foundational mandatory technical and safety standards to address the lack of standardization and the dominance of proprietary systems in Vietnam's nascent new electric vehicle (NEV) charging market, aligning largely with IEC 61851 and ISO 15118. While QCVN requires operators to declare the communication protocol used, it does not yet explicitly mandate a single legal network protocol such as OCPP (Open Charge Point Protocol) for back-end management. This readiness scores 1.0.

Vietnam's NEV charging landscape is heavily dominated by VinFast through its subsidiary V-Green. This operator manages the core of the national network, which comprises approximately 15,000 charging stations offering over 150,000 ports distributed across all 63 provinces and cities. In contrast, other players maintain a minimal presence: Ford operates 53 dealership stations with expansion plans for 275, while Geely, Porsche, and Audi maintain only select, showroom-based charging points, primarily in urban areas. Reflecting this infrastructure growth, Vietnam had approximately 300,000 NEVs against 150,000 charging ports in 2024. This resulted in a highly favorable NEV-to-charging pile ratio, earning the country score of 5.0 in the NEVs per Charging Pile – Cumulative AC/DC Index.

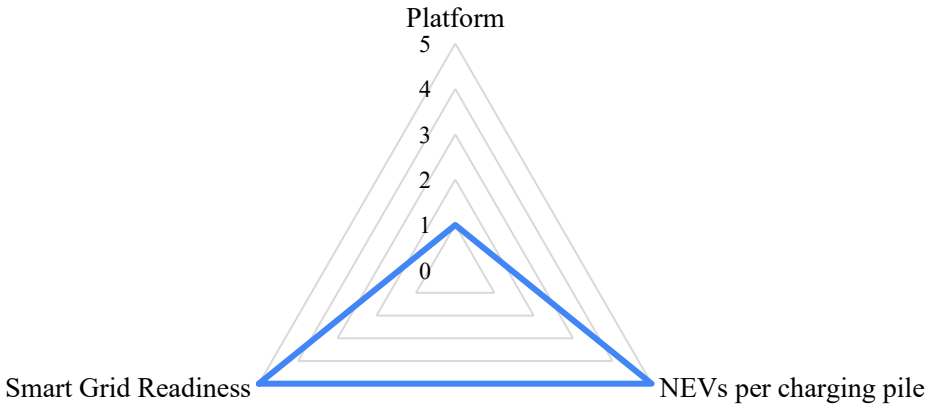


Figure 6-30: Policy Readiness Index of Vietnam

6.7.1.4. Road and Digital Infrastructure Readiness Index

The Road and Digital Infrastructure Readiness Index evaluates Lao PDR's capacity to support advanced and connected vehicle operations through both physical transport infrastructure and digital connectivity systems. As illustrated in Figure 6-31, the radar chart visualizes readiness across five key indicators: 5G coverage and mobile connection speed, traffic management systems, road quality, road environment, and traffic separation.

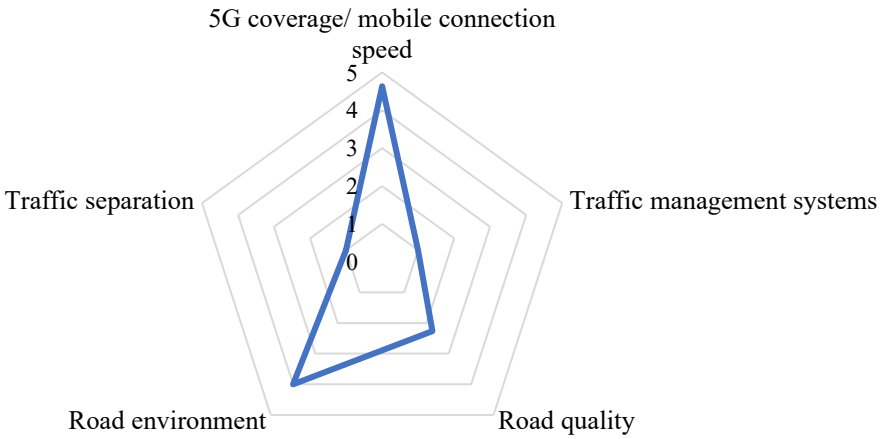


Figure 6-31: Policy Readiness Index of Vietnam

Vietnam performs strongly in 5G coverage and mobile connection speed, achieving a score of 4.6, which reflects steady advancements in the telecommunications sector and ongoing national investment in broadband infrastructure. This robust digital-connectivity foundation enhances Vietnam's potential for future deployment of Vehicle-to-Infrastructure (V2I) and Vehicle-to-Everything (V2X) communication systems—critical enablers of autonomous driving and smart mobility applications.

However, several other infrastructure dimensions remain underdeveloped. With no existing V2I deployment, Vietnam receives a score of 1.0 in the Traffic Management Systems Index. Road quality also continues to be a constraint: the World Economic Forum's score of 2.3 indicates only moderate conditions, particularly as many provincial and rural roads exhibit poor surface maintenance and inconsistent construction standards. In contrast, Vietnam performs better in terms of road environment, earning 4.0, reflecting standardized signage and reasonably organized roadway elements. Yet, the absence of formal regulations or enforcement mechanisms to separate motorcycles from general traffic leads to a score of 1.0 in the Traffic Separation Index.

Overall, Vietnam's Road and Digital Infrastructure Readiness Index profile is characterized by strong digital connectivity but limited physical and operational preparedness for advanced mobility systems. While high 5G performance provides a solid foundation for future V2X applications, the absence of V2I deployment, inconsistent road quality, and weak traffic-management digitalization hinder progress toward a connected and autonomous transport ecosystem. To enhance its readiness, Vietnam will need to prioritize investments in intelligent traffic systems, enforce multimodal traffic separation, and improve nationwide road-quality standards. Strengthening these areas will be crucial for enabling safer, more efficient, and future-ready mobility solutions.

6.7.1.5. Vehicle technology Readiness Index

The Vehicle Technology Readiness index assesses the technological capabilities of new energy vehicles (NEVs) using annual data from the official websites of the respective automotive manufacturers (2025). The BEV Product Offering (range distance) index is calculated from the average driving range of BEV models in the market, weighted by the number of models, while the PHEV, REEV Product Offering (range distance) index draws on the average BEV-mode range of PHEV and REEV models, similarly

weighted. The NEV experience (years) index measures the number of years since the country initiated its national NEV action plans, capturing the policy-driven timeline of market development. In addition, the BEV Model variety and the PHEV, REEV Model variety indices are computed as the ratios of BEV and PHEV/REEV models to ICE models, respectively, reflecting the diversification of electrified product offerings.

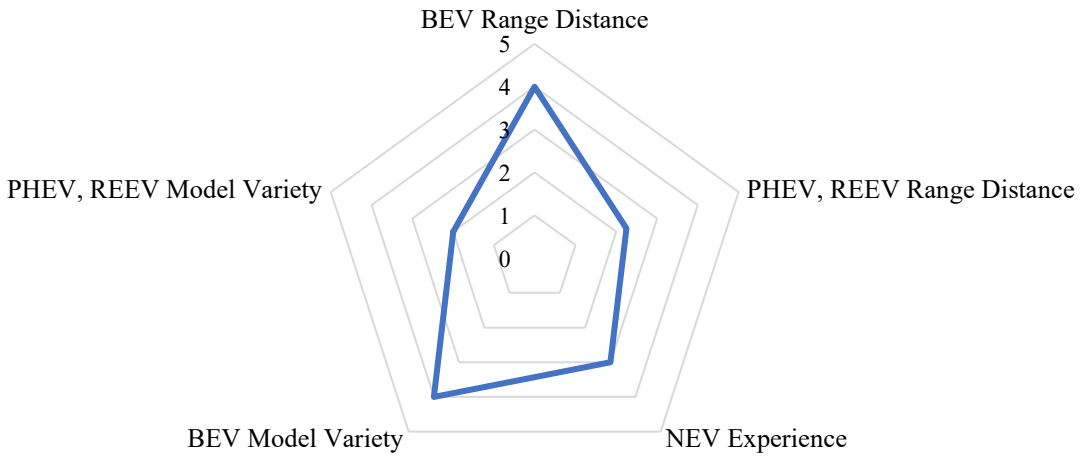


Figure 6-32: Vehicle Technology Readiness in Vietnam

Figure 6-32 presents the Vehicle Technology Index, which evaluates five indicators: BEV product offering (range distance), PHEV/REEV product offering (range distance), NEV experience (years), and model variety for both BEV and PHEV/REEV categories. The score of vehicle technology index in Vietnam is moderate, with overall scores of 3.1.

The main drivers of Vietnam's vehicle technology readiness are BEV product offering (range distance) (4.0), BEV model variety (4.0), and accumulated NEV market experience (3.0). The average BEV driving range is relatively high, at approximately 400–499 kilometers, reflecting the adoption of modern lithium-ion battery technologies in both domestically produced and imported vehicles.

In addition, BEV model variety in Vietnam has expanded steadily, supported by a growing selection of both local and imported models. Nevertheless, the market remains concentrated in the sedan and SUV segments, which correspond to the most popular vehicle categories among Vietnamese consumers.

With respect to NEV market experience, Vietnam attains a moderate score of 3.0, reflecting approximately four years of accumulated experience since the government and private sector began making coordinated investments in EV infrastructure and local production. Notably, the establishment of VinFast in 2017 and its subsequent expansion into electric passenger vehicles and electric scooters have played a pivotal role in shaping Vietnam's national NEV ecosystem and accelerating consumer familiarity with electric mobility solutions.

However, PHEV and REEV performance indicators—particularly driving range and model variety—are assessed at relatively low levels at 2.3 and 2.0, respectively. Within the Vietnamese market, PHEV and REEV models remain niche products compared with BEVs, which continue to dominate NEV development and consumer adoption.

As a result, the range of available PHEV and REEV models is limited, constraining consumer choice and preventing economies of scale. Consequently, average prices of PHEV and REEV vehicles remain higher than those of comparable internal combustion engine vehicles, while the number of available models remains significantly lower than in the ICE segment. These structural limitations continue to hinder broader adoption of PHEV and REEV technologies in Vietnam's current NEV market landscape.

6.7.2. Key Success Factors and Gap Analysis

Vietnam's NEV success is driven by strong domestic industrial leadership, decisive fiscal incentives, rapid infrastructure deployment, and robust digital foundations. However, imbalanced technology development, weak interoperability, underdeveloped smart-mobility systems, and governance fragmentation continue to limit ecosystem maturity. Addressing these gaps will be essential for Vietnam to transition from rapid market expansion to a resilient, integrated, and intelligent mobility system.

6.7.2.1. Key Success Factors

Vietnam's NEV market development is underpinned by several strong structural and policy-driven success factors that together explain its rapid recent momentum despite a relatively short development history.

1) Strong domestic industrial leadership has played a decisive role. The emergence of VinFast as a vertically integrated domestic NEV manufacturer has significantly accelerated market formation. Its ability to simultaneously deploy vehicle production, charging infrastructure (through V-Green), and bundled service offerings has reduced entry barriers for consumers and mitigated early-stage ecosystem coordination failures. This domestic anchor has also strengthened national supply-chain confidence and attracted increasing interest from foreign OEMs seeking market entry or partnership opportunities.
2) Aggressive and coherent fiscal policy signals have created clear market incentives. Vietnam's long-term commitment to phasing out ICE vehicles by 2050, combined with substantial tax advantages for BEVs over ICE vehicles, has established a strong economic case for electrification. These fiscal measures have successfully narrowed—and in some cases reversed—the price gap between BEVs and conventional vehicles, accelerating consumer acceptance and moving the market into an early majority phase within a short period.
3) Rapid expansion of charging infrastructure has reduced range anxiety and supported nationwide usability. The extensive rollout of charging stations across all provinces, led primarily by V-Green, has resulted in a relatively favorable vehicle-to-charger balance compared with many peer countries. This dense coverage has been particularly effective in supporting urban adoption, fleet services, and intercity travel, reinforcing consumer confidence and enabling commercial use cases such as taxis and ride-hailing.
4) Vietnam benefits from a strong digital connectivity foundation. Widespread 5G coverage and improving mobile network performance provide a critical enabling layer for future smart mobility applications, including vehicle connectivity, fleet management, and potential V2X services. Although these capabilities are not yet fully utilized, the underlying digital infrastructure positions Vietnam favorably for the next stage of intelligent transport development.
5) BEV technology performance has reached a competitive level. The availability of BEV models with driving ranges comparable to regional benchmarks, combined with an expanding—though still concentrated—model lineup, has helped normalize EV ownership among consumers. Growing familiarity with electric scooters and cars has further accelerated public acceptance of electric mobility as a mainstream transport option.

6.7.2.2. Gap Analysis

Despite strong momentum, Vietnam's NEV market and smart mobility ecosystem continue to face several structural, technological, and governance-related gaps that constrain long-term scalability and system maturity.

1) Market diversification and technological balance are explicitly the gap for Vietnam. While BEVs have advanced rapidly, alternative electrified powertrains such as PHEVs and REEVs remain underdeveloped. Limited model availability, higher relative prices, and weak manufacturer focus have constrained consumer choice and reduced flexibility for users with varying driving patterns. This narrow technology pathway increases reliance on a single solution and may expose the market to risks related to infrastructure readiness and grid constraints.
2) Interoperability and standardization within the charging ecosystem remain a critical weakness. Although charging coverage is extensive, the ecosystem is heavily dominated by a single operator and characterized by proprietary platforms. The absence of a mandated national backend communication standard limits cross-network interoperability, data integration, and user convenience. This fragmentation also delays the adoption of advanced functions such as smart charging, dynamic pricing, and grid-interactive services.
3) Smart mobility and intelligent transport systems represent one of the most underdeveloped areas. Despite strong digital connectivity, the practical application of digital technologies in traffic management remains minimal. There is little deployment of vehicle-to-infrastructure systems, real-time traffic coordination, or integrated mobility platforms. As a result, Vietnam's transport system remains largely conventional, limiting efficiency gains and constraining readiness for higher levels of vehicle automation.
4) Physical road infrastructure and traffic organization present persistent operational constraints. While signage and road environments are relatively standardized, road quality varies significantly across regions, particularly outside major urban centers. Moreover, the lack of systematic traffic separation—especially between motorcycles and cars—poses safety risks and limits the effective deployment of advanced driver-assistance and autonomous features.
5) Institutional and regulatory gaps further constrain ecosystem integration. Vietnam currently lacks a comprehensive smart-mobility strategy that links NEV deployment with urban planning, digital transport governance, and autonomous vehicle development. Regulatory frameworks for autonomous driving pilots, data governance for connected vehicles, and coordinated inter-agency implementation remain fragmented or at an early stage, reducing policy effectiveness beyond fiscal incentives.
6) Limited consumer exposure to diversified NEV use cases restricts demand depth. Although early adoption has been strong in major cities, penetration remains uneven across regions and income groups. Without stronger non-financial measures—such as preferential access policies, urban low-emission zones, or fleet-transition mandates—the market risks plateauing before reaching full mass adoption.

6.8 Policy Recommendations

Vietnam's rapid progress in the NEV market—anchored by strong political commitment, decisive fiscal incentives, and private-sector leadership in charging deployment—has positioned the country as a regional frontrunner in electric mobility. However, as the market transitions from early expansion to system-wide scaling, Vietnam must move beyond incentive-driven growth toward a more coordinated regulatory, infrastructural, and digital mobility framework. The following policy recommendations address the most critical structural gaps while reinforcing Vietnam's existing strengths to ensure sustainable, nationwide NEV and smart-mobility development.

1) Establish Mandatory National Interoperability Standards for Charging Networks

Vietnam should formalize legally binding national interoperability standards for all public and semi-public EV charging infrastructure. While international protocols such as OCPP and ISO 15118 are already widely referenced under the national technical regulation framework (QCVN), their application remains voluntary and fragmented. Making these standards mandatory would prevent vendor lock-in, enable seamless cross-network roaming, and support the entry of new charging operators. In parallel, the government should issue clear guidelines on data governance, authentication, cybersecurity, and real-time data exchange to ensure that charging networks can support smart charging, load management, and future Vehicle-to-Grid (V2G) services in a secure and scalable manner.

2) Diversify Charging-Market Participation Through Pro-Competition Regulation

Vietnam's charging ecosystem is currently characterized by strong private investment but high market concentration. To enhance system resilience and long-term competition, the government should introduce pro-competition regulatory measures that lower entry barriers for additional operators. These measures may include transparent grid-connection procedures, non-discriminatory access to public and high-traffic locations, competitive tenders for public charging sites, and targeted incentives for third-party operators in underserved regions. Encouraging a more diverse operator landscape will reduce systemic dependency on a single provider, improve service quality, and foster price competition as NEV adoption accelerates.

3) Expand NEV Adoption Beyond Major Cities Through Targeted Regional Programs

Although NEV adoption in Vietnam is advancing rapidly, it remains heavily concentrated in major urban centers. To ensure balanced national development, Vietnam should implement region-specific NEV and charging expansion programs targeting secondary cities, industrial zones, tourism hubs, and strategic logistics corridors. Policy instruments may include concessional financing, location-based capital subsidies, and co-investment schemes with provincial governments. Strengthening regional infrastructure will enhance long-distance travel reliability, support commercial fleet electrification, and broaden the consumer base beyond metropolitan areas.

4) Develop a Comprehensive Smart-Mobility and Autonomous-Vehicle Roadmap

Vietnam's strong digital connectivity provides a solid foundation for smart mobility, yet this potential remains underutilized due to the absence of a coherent regulatory framework. The government should formulate a national smart-mobility and autonomous-vehicle roadmap, covering Vehicle-to-Infrastructure (V2I) and Vehicle-to-Everything (V2X) deployment, integrated traffic-management platforms, and designated autonomous-vehicle pilot zones. Establishing clear institutional responsibilities, data-sharing mechanisms, and technical standards—particularly among transport, digital, and urban authorities—will enable Vietnam to transition from connectivity readiness to operational smart-mobility systems that improve safety, efficiency, and traffic management.

5) Strengthen Smart-Charging Incentives and Expand Time-of-Use (ToU) Tariffs

Vietnam should move beyond static electricity pricing by expanding Time-of-Use (ToU) tariffs to residential users, fleet operators, and commercial charging facilities. A unified national ToU framework—aligned with distribution utilities and smart-grid development—would encourage off-peak charging, reduce system stress, and improve overall charging affordability. Complementary measures such as incentives for smart chargers, off-peak rebates, fleet charging contracts, and clear participation rules for aggregators would further support grid-flexible NEV integration and prepare the system for future demand-response and V2G applications.

6) Enhance Vehicle-Technology Maturity Through Diversification and Workforce Development

Vietnam's NEV ecosystem has benefited significantly from strong domestic BEV leadership, but long-term resilience requires greater technology and market diversification. Policymakers should encourage multi-brand participation, joint ventures, and localized production of key components such as batteries, power electronics, and charging equipment. In parallel, establishing national training and certification programs for EV technicians, battery specialists, and digital-mobility engineers will strengthen after-sales service capacity and reduce operational bottlenecks. Investing in human capital alongside industrial diversification is essential for sustaining consumer confidence and supporting the next phase of NEV market maturity.

7) Priority Actions for 2025–2030

Between 2025 and 2030, Vietnam's NEV strategy should transition from rapid market expansion toward the consolidation of a resilient, interoperable, and nationwide electric-mobility ecosystem. A central priority is the introduction of mandatory national interoperability standards for charging infrastructure, including legally binding requirements aligned with OCPP and ISO 15118. These standards should be complemented by clear rules on EVSE data exchange, cybersecurity, and user authentication to prevent long-term platform fragmentation, enable cross-network roaming, and support future smart-charging and V2G applications.

At the same time, NEV adoption and charging deployment must be extended beyond Hanoi and Ho Chi Minh City to ensure balanced national development. This requires targeted regional programs that combine location-specific incentives with public–private co-investment models for strategic intercity corridors, industrial clusters, logistics hubs, and tourism routes. Such measures would strengthen long-distance travel reliability, reduce regional disparities, and broaden the consumer base for NEVs.

Strengthening smart-charging governance and electricity pricing is another critical action. Vietnam should expand Time-of-Use tariff frameworks to residential users and fleet operators, supported by incentives for smart-charger installation and managed-charging participation. Aligning NEV charging demand with renewable-energy availability through ToU pricing and demand-response mechanisms will improve grid efficiency, reduce system stress, and enhance the long-term sustainability of transport electrification.

In parallel, Vietnam should formalize a comprehensive smart-mobility and V2X development roadmap. This roadmap should define institutional responsibilities, technical standards, and implementation timelines for vehicle-to-infrastructure deployment, integrated traffic-management platforms, and autonomous-vehicle pilot zones. By moving from connectivity readiness to operational deployment, Vietnam can fully leverage its strong digital infrastructure to improve road safety, traffic efficiency, and future mobility innovation.

Finally, diversifying the vehicle-technology ecosystem and strengthening human-capital development will be essential for long-term market resilience. Policies should encourage broader OEM participation, localized component manufacturing, and technology partnerships beyond a single dominant player. In parallel, targeted investment in EV workforce development—including technician training, battery management expertise, and digital-mobility skills—will help address after-sales capacity constraints, enhance consumer confidence, and support the sustainable scaling of Vietnam's NEV market.

Chapter 7 State of Preparedness of Cambodia

7.1 Market and Adoption Status

7.1.1. NEV Market Trend

7.1.1.1. NEV Registration

Cambodia has long been recognized as a motorcycle-dominant nation, where two-wheelers remain the primary mode of transport for the majority of its population. However, when focusing solely on the automobile segment, data from the Ministry of Public Works and Transport (MPWT)[85] reveals a notable upward trend in light vehicle ownership over the past decade. In 2016, the country recorded 365,446 light vehicles and 203,802 heavy trucks, showing a relatively narrow gap between the two categories. Yet, as years progressed, this gap widened significantly—by 2023, registrations had reached 797,867 light vehicles and 295,095 heavy trucks. Nevertheless, despite this steady growth in automobile registrations, motorcycles continue to dominate Cambodia's vehicle fleet by a wide margin, as evidenced by their substantially larger stock relative to both light vehicles and heavy trucks in Figure 7-1.

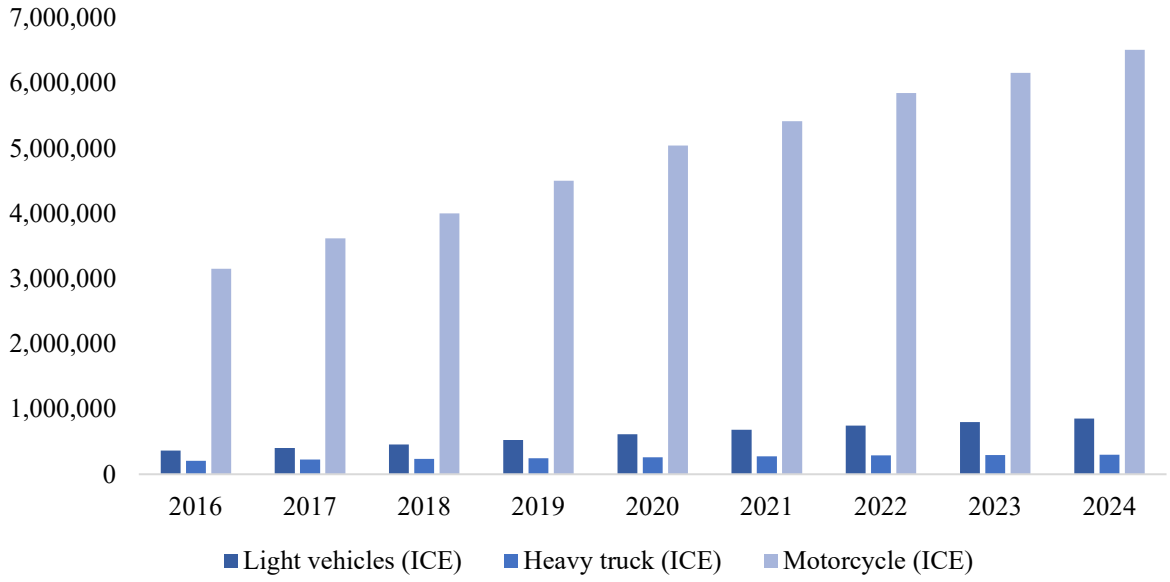


Figure 7-1: ICE Vehicles Registration (Cumulative Volume) in Cambodia

Source: Author's compilation from Ministry of Public Works and Transport (MPWT)

With respect to electric vehicles (EVs), the Ministry of Public Works and Transport (MPWT) of Cambodia defines EVs as including battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs). Cambodia's adoption has only recently gained momentum. The turning point came in 2024, following the implementation of the National Policy on Electric Vehicle Development 2024–2030, which set ambitious national targets and introduced fiscal incentives for both producers and consumers. As a result, the number of newly registered electric

[85] https://mpwt.gov.kh/kh/documents/other/847

vehicles surged to 3,676 units in 2024[86], up from 757 units in 2023 and 663 units in 2022[87], reflecting a sharp acceleration in market uptake after the policy came into force. This shift is visualized in Figure 7-2.

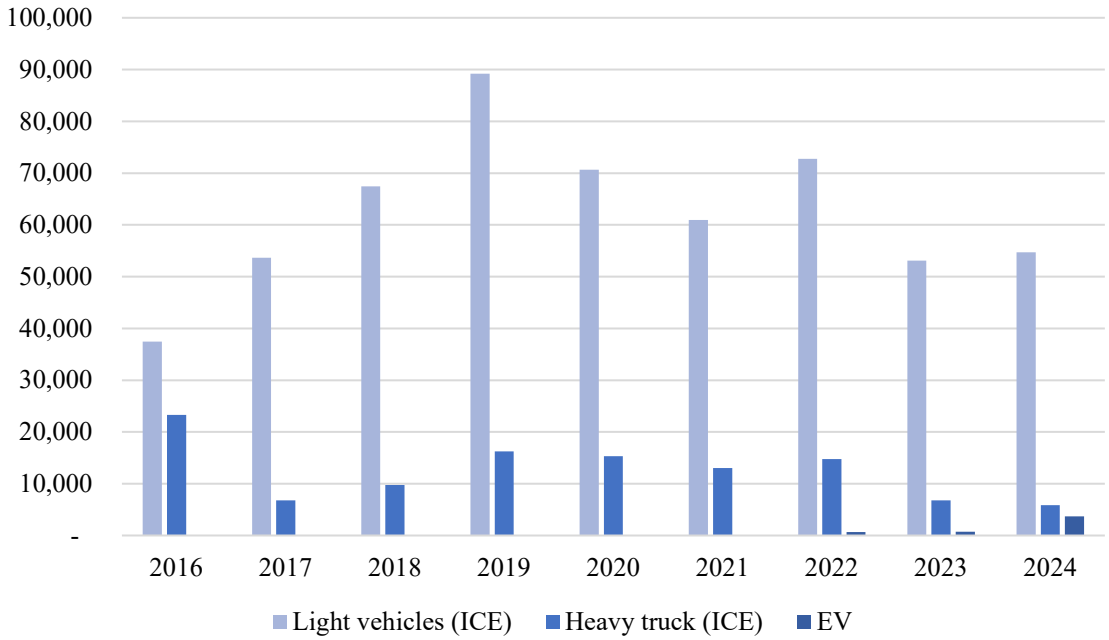


Figure 7-2: Annual Vehicles Registration (Stock volume) in Cambodia

Source: Author's compilation from Ministry of Public Works and Transport (MPWT)

Nevertheless, the share of EVs in Cambodia's overall vehicle fleet remains relatively small compared to internal combustion engine (ICE) vehicles. As shown in Figure 7-3. Even though the cumulative total of EVs in 2024 reached 5,165 units, their proportion within total vehicle registrations remains minimal. Despite this, the steady upward trajectory marks an important early milestone in Cambodia's transition toward electric mobility. With continued policy support, local assembly expansion, and consumer awareness initiatives, the country is beginning to lay the groundwork for broader EV adoption in the years ahead.

[86] Cambodia's EV Market on Rise with Nearly 4k EVs & 21 Charging Stations by August 2024 - Construction & Property News

[87] https://mpwt.gov.kh/kh/documents/other/816

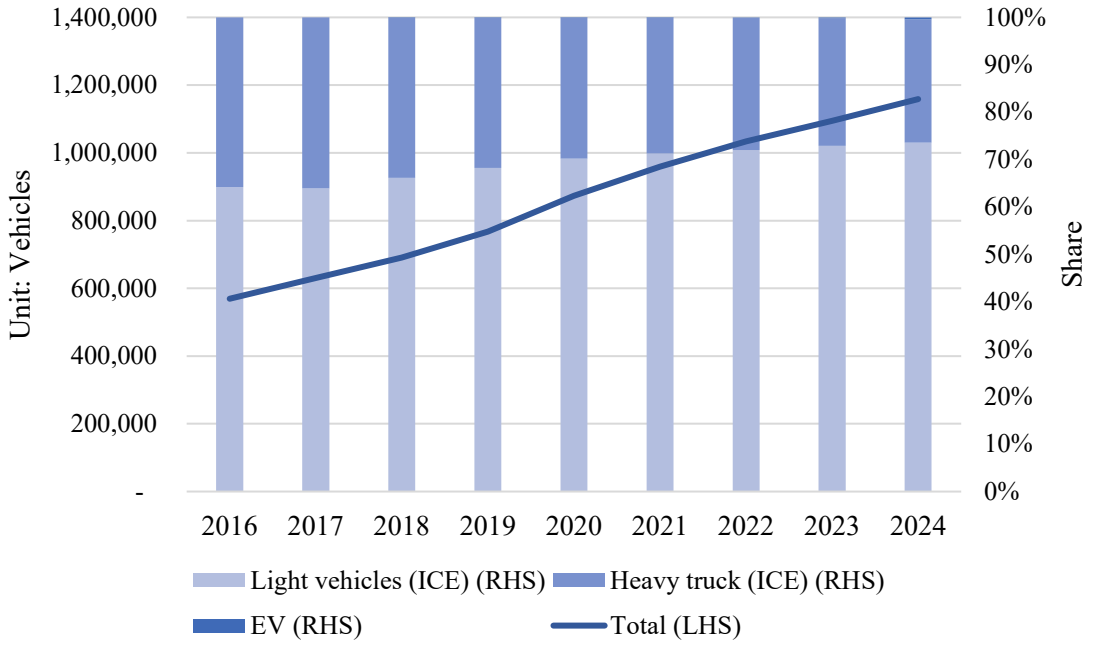


Figure 7-3: Vehicles Registration (Cumulative Volume) in Cambodia

Source: Author's compilation from Ministry of Public Works and Transport (MPWT)

7.1.1.2. NEV Sales

Cambodia's automotive market is still in its early development stage but is undergoing gradual transformation as the country introduces electric mobility into its broader industrial and environmental strategies. In 2023, the total volume of domestic vehicle sales stood at approximately 59,929 units for four-wheel vehicles and 310,648 units for motorcycles, reflecting a post-pandemic recovery that has yet to reach the peak levels seen in 2019.

A significant portion of the market remains dominated by used vehicles, which account for nearly 50% of total car sales, posing both a challenge and an opportunity for electric vehicle (EV) penetration.

On the production side, Cambodia has made modest strides, with 11,865 units produced in 2023, consisting of passenger cars and commercial vehicles. The country currently hosts a small number of vehicle assemblers including RMA Automotive (Ford), Toyota Tsusho, Camko Motor (Hyundai), and Daehan Auto (SsangYong) with an estimated combined annual production capacity exceeding 10,000 vehicles. Although actual utilization rates remain limited due to constrained domestic demand and the absence of a national car program. EV-specific production is still minimal, but government incentives have begun to attract investment in the assembly of electric two- and three-wheelers, with plans to scale up as market demand grows.

From an import perspective, Cambodia's policy reforms have started to impact BEV dynamics positively. Through Sub-Decree No. 122 (2023) and Sub-Decree No. 18 (2021), the government reduced the special tax on BEV passenger cars and trucks to 10%, a significant drop from prior rates of 30–40%, enhancing the affordability and competitiveness of EVs relative to internal combustion engine (ICE) vehicles.

Although detailed disaggregated import figures for BEVs remain scarce, this policy shift is expected to increase import volumes in the coming years. Supporting infrastructure for EVs is still in its infancy; as of early 2024, Cambodia had only 18 EV charging station locations nationwide, a number far below the

level needed for widespread adoption but indicative of early-stage progress. The government has recognized the need to expand this infrastructure as part of its National Policy on Electric Vehicle Development, which sets a clear goal of registering 770,000 electric vehicles by 2030. Notably, the most aggressive growth target lies in the motorcycle segment, which is central to Cambodian daily transportation and represents a promising entry point for EV diffusion.

While full BEV adoption in the four-wheel segment remains a long-term objective, the combination of supportive fiscal measures, industrial assembly initiatives, and environmental commitments provides a framework for gradual transformation. However, the pace of change will depend heavily on the expansion of charging infrastructure, the availability of affordable vehicle models, and the ability to localize more components within Cambodia's evolving automotive value chain.

7.1.1.3. Model Availability

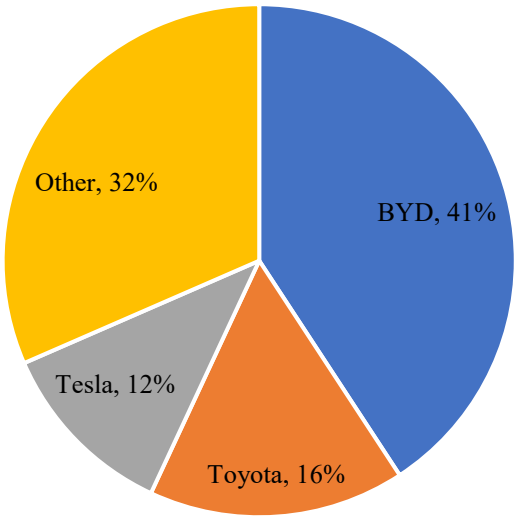
Cambodia's most popular automotive brand is Ford[88], primarily due to its establishment of the country's largest automotive manufacturing plant since 2022. By 2025, Ford accounted for more than 70% of pickup truck sales in the Cambodian market. The second most popular brand is Toyota, which also enjoys a strong market presence. However, both brands are leaders in internal combustion engine (ICE) vehicles.

In contrast, new energy vehicles (NEVs) account for approximately 11% of the total automotive market in Cambodia. More than 80% of the NEV market share is dominated by BYD. This dominance is largely driven by the purchasing preferences of the expatriate population residing in Cambodia, who show a strong inclination toward BYD battery electric vehicles (BEVs). Looking ahead, BYD plans to further penetrate the Cambodian market through the establishment of a local manufacturing facility.

Other electric vehicle brands present in Cambodia include Tesla, GAC (under the Aion brand), and NETA Auto (marketed as SNKH in Cambodia); however, their respective market shares have not been clearly disclosed.

As illustrated in Figure 7-4, which presents the market share of electric vehicles as of June 2024, BYD has been the market leader from 2024 through 2025. Although Toyota appears to hold a share of the EV market, its offerings consist exclusively of hybrid electric vehicles (HEVs). These vehicles are included in EV statistics because the Ministry of Public Works and Transport (MPWT) of Cambodia defines EVs as encompassing BEVs, PHEVs, and HEVs.

[88] https://orkunsantepheap.com/chinese-evs-in-cambodia/



Note: According to the MPWT of Cambodia, EVs include BEVs, PHEVs, and HEVs

Figure 7-4: EV market share June 2024

Source: Author's compilation from Ministry of Public Works and Transport

From Table 7-1, battery Electric Vehicles (BEVs) are the dominant engine type, particularly in the mid-range distance category of 401-700 km, which accounts for the majority of available models across all brands, including BYD, Tesla, Aion, BMW, Deepal, DENZA, MG, and Zeeker. Notably, BYD and BMW are the only brands listed that offer Plug-in Hybrid Electric Vehicles (PHEVs), with these models concentrated in the lower 0-200 km range, and exclusively in the SUV segment. BYD and Tesla, two major players, show a strong focus on the 401-700 km range for both their Sedan/Hatchback and SUV BEVs, with Tesla leading in the Sedan/Hatchback count with 9 models in that bracket.

Table 7-1: NEV Models in Cambodia in 2025

Brand	**Engine type**	**Model**	**Distance range (km.)**			
			0-200	**201-400**	**401-700**	**>700**
BYD	BEV	Sedan/Hatchback			5	
		SUVs	1		1	1
	PHEV	SUVs	1			
Tesla	BEV	Sedan/Hatchback			9	
		SUVs			2	
Aion	BEV	Sedan/Hatchback			1	
		SUVs			3	
BMW	BEV	Sedan/Hatchback			2	
		SUVs			3	
	PHEV	SUVs	1			
Deepal	BEV	Sedan/Hatchback			1	
		SUVs			1	
DENZA	BEV	MPV			1	

Brand	Engine type	Model	Distance range (km.)			
			0-200	201-400	401-700	>700
MG	BEV	Sedan/Hatchback			1	
		SUVs			1	
Zeeker	BEV	Sedan/Hatchback			1	
		SUVs			2	

Source: Author's compilation from the NEV models in Cambodia in 2025.

7.1.1.4. Affordability

A comprehensive assessment of the Total Cost of Ownership (TCO) for passenger vehicles in Cambodia reveals economic differences between Battery Electric Vehicles (BEVs) and Internal Combustion Engine (ICE) vehicles across key market segments. By examining three representative categories: Sedan/Hatchback Segment B, Sedan/Hatchback Segment D, and SUV-D, the analysis evaluates long-term financial implications for Cambodian vehicle owners. The study is based on the following assumptions: (1) a vehicle service life of seven years; (2) annual driving distance of 20,000 kilometres; (3) a single tire replacement during the ownership period; (4) stable fuel and electricity prices; (5) uniform license plate fees, while annual vehicle taxes vary between BEVs and ICE vehicles; (6) a standard depreciation rate of 25%89; and (7) an insurance premium for BEV and PHEV vehicles is 50 percent higher than ICE vehicles.

The findings indicate that BEVs hold a distinct economic advantage in the entry-level Sedan/Hatchback Segment B, BYD Dolphin (BEV), has the lowest TCO, significantly below that of Toyota Vios (ICE) (Figure 7-5). This cost difference is largely attributed to Dolphin's lower energy consumption, which offsets its higher initial purchase price (Table 7-2).

In the mid-size Sedan/Hatchback Segment D, the TCO gap remains evident, though it is somewhat narrower. Deepal L07 (BEV) maintains a substantial cost advantage over BMW 320i (ICE), primarily due to lower cumulative energy expenditures, while maintenance and insurance costs remain broadly comparable. Within the SUV-D segment, BEVs also sustain the financial edge. Aion Hyptec HT (BEV) has lower operational costs compared to Toyota Fortuner (ICE), driven predominantly by reduced electricity consumption. Other cost components including maintenance, insurance, and registration are largely similar. The installation cost of EV chargers, applied across all BEV segments, represents a minor share of the total TCO and does not materially diminish the economic benefits of electrification.

The Cambodian TCO assessment suggests that BEVs are generally the most cost-effective option among both compact and large vehicle segments. Key factors supporting BEV competitiveness include lower electricity consumption, reduced depreciation relative to ICE vehicles, and modest differences in vehicle taxation. Policy interventions, such as targeted incentives and expanded charging infrastructure, could further enhance the financial attractiveness of BEVs and support a faster transition to electrified mobility in Cambodia.

[89] PwC Cambodia. (2025, September 8). Cambodia - Corporate - Deductions. PwC Worldwide Tax Summaries. https://taxsummaries.pwc.com/cambodia/corporate/deductions

Table 7-2: Total cost of ownership (TCO) in Cambodia

Costs (KHR)	Sedan/Hatchback comparison (Segment B)		Sedan/Hatchback comparison (Segment D)		SUV (Segment SUV-D)	
	BEV (BYD Dolphin)	ICE (Toyota Vios)	BEV (Deepal L07)	ICE (BMW 320i)[90]	BEV (Aion Hyptec HT)	ICE (Toyota Fortuner)
Car Prices	99,410,800	135,888,150	179,981,650	428,909,500	276,137,548	262,556,750
Fuel/Electricity Costs	11,016,600	27,664,000	11,187,400	45,220,000	12,810,000	54,264,000
Maintenance cost	2,458,590	2,458,590	2,458,590	2,458,590	2,500,590	2,500,590
Basic Insurance	239,067	159,378	239,067	159,378	239,067	159,378
Motor-vehicle tax	700,000	1,050,000	3,500,000	1,400,000	5,600,000	4,200,000
License Plate Fee	125,000	125,000	125,000	125,000	125,000	125,000
Install EV Charger cost	3,139,029	-	3,139,029	-	3,139,029	-
Depreciation	24,852,700	33,972,038	44,995,413	107,227,375	69,034,387	65,639,188
TCO (KHR)	92,236,386	133,373,080	155,635,324	371,045,093	231,516,847	258,166,530

Source: Author's calculation

[90] No new ICE models are available in the D-segment sedan category, the BMW 320i is used as a point of comparison. However, given that the BMW 320i is priced considerably higher than the Deepal L07, its inclusion may render the TCO of ICE vehicles seemingly much higher than that of BEV.

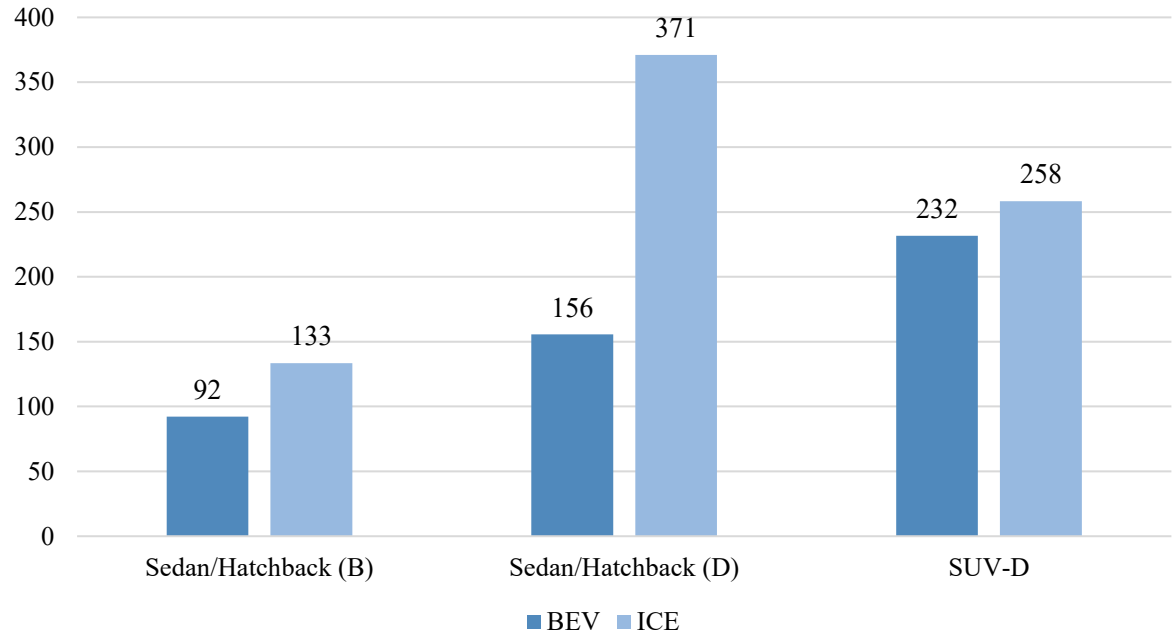


Figure 7-5: The total cost of ownership comparison in Cambodia (Million KHR)

Source: Author's calculation

7.1.1.5. Years of NEV Experience

Cambodia has been developing its experience with new energy vehicles (NEVs) since 2020, beginning with only five registered electric vehicles. The adoption of NEVs has grown steadily over the years, reaching 604 registered vehicles by 2024. This growth has been supported by government policies aimed at promoting electric mobility and reducing carbon emissions. Looking forward, Cambodia has set ambitious targets for 2050, aiming for 40% of cars and 70% of motorcycles to be electric, reflecting the country's commitment to sustainable transportation and environmental sustainability.

7.1.2. Smart Mobility Trend

7.1.2.1. Shared & Multimodal Services

Cambodia's informal and shared mobility (ISM) sector remains a crucial component of the national transport system, providing affordable, flexible, and demand-responsive mobility options in both urban and peri-urban areas. The sector is characterised by the coexistence of traditional informal transport modes and emerging platform-based services, shaped by rapid urbanisation, limited formal public transport, and growing digital adoption.

The Cambodian ISM landscape consists primarily of motorcycle taxis (motodops), tuk-tuks, and three-wheeled motorised rickshaws, which serve as the main modes of urban and suburban transport. These informal services continue to dominate due to their accessibility, affordability, and adaptability to local travel demand.

Over the past few years, the sector has experienced a notable digital transformation, driven by the introduction of ride-hailing platforms such as PassApp and Grab. These applications have formalised parts of the informal sector, particularly in Phnom Penh, by digitising trip bookings, improving fare transparency, and facilitating cashless payments. PassApp, a locally based platform, has become a key player in the market, offering ride-hailing services for tuk-tuks and cars, and contributing to the gradual formalisation of informal transport operations.

Despite these advancements, traditional informal operators remain prevalent, particularly outside the capital and in rural areas, where smartphone access and internet connectivity are limited. The co-existence of app-based and non-digital services reflects a dual mobility structure, where digitalisation complements rather than replaces existing informal systems.

Cambodia's regulatory environment for shared mobility remains nascent and partially defined. While app-based ride-hailing services operate under general business licensing provisions, there is no dedicated regulatory framework governing informal or platform-based transport operators. This absence of clear policy guidelines contributes to operational uncertainty and limited integration with formal transport systems.

The report[91] highlights that, although the government has recognised the role of ISM in meeting daily mobility needs, policy coordination between local and national authorities remains limited. Enforcement practices and data collection on informal transport activities are inconsistent, constraining effective planning and monitoring.

In Phnom Penh, informal and shared mobility modes play a critical role in complementing formal public transport, particularly the city's bus network. Motodops, tuk-tuks, and ride-hailing services provide essential first- and last-mile connectivity, especially in areas not covered by formal routes. However, full multimodal integration has yet to materialise due to the absence of coordinated fare systems, route planning, and institutional linkages between informal and formal operators.

Digital platforms such as PassApp have begun to introduce elements of coordination by enabling data-driven service management and digital payment options. Nevertheless, multimodal system development remains at an early stage, and the sector's growth continues to depend heavily on informal market mechanisms.

The ISM sector in Cambodia provides significant employment opportunities, particularly for low-income and semi-skilled workers. For many drivers, informal and platform-based transport constitutes their primary or supplementary income source. However, challenges related to income instability, long working hours, and lack of social protection persist. The report also notes that the increasing use of ride-hailing platforms has altered the traditional employment relationships between drivers and operators, introducing new forms of dependency on platform algorithms and commission-based payment structures.

Cambodia's shared and multimodal mobility system remains informal in structure but increasingly digital in operation. The introduction of app-based platforms such as PassApp represents a significant step toward formalisation and service improvement, while traditional ISM modes continue to provide indispensable urban mobility. Despite limited regulatory clarity and weak institutional integration, the sector demonstrates strong adaptive capacity and serves as a foundation for future multimodal development.

In essence, Cambodia's experience reflects a hybrid mobility transition, where informal and digital systems coexist, interact, and gradually evolve toward a more structured and potentially sustainable shared mobility framework.

[91]Chalermpong, S., Ratanawaraha, A., & Uchiyama, Y. (2025). Informal and shared mobility: Status, challenges, and opportunities in Southeast Asia. Volvo Research and Educational Foundations. https://vref.se/wp-content/uploads/2025/03/Informal-and-Shared-Mobility-Status-Challenges-and-Opportunities-in-Southeast-Asia.pdf

7.2 Industrial and Market Incentives for NEV and Smart Mobility Adoption

7.2.1. NEV Promotion Policy

Cambodia has articulated a clear and ambitious national strategy to accelerate electric mobility through the National Policy on the Development of Electric Vehicles (2024–2030), officially launched on 29 May 2024 by the Ministry of Public Works and Transport (MPWT). This policy sets an expansive roadmap to transform the transportation sector, reduce urban emissions, diversify the economy, and enhance energy security. Under the roadmap, the government targets registering 770,000 electric vehicles by 2030, comprising approximately 25,000 passenger BEVs, 5,000 commercial EVs, 20,000 electric tricycles (tuk-tuks), and 720,000 electric motorcycles. These targets are aligned with Cambodia's Long-Term Strategy for Carbon Neutrality by 2050, which envisions 40% of cars and urban buses and 70% of motorcycles transitioned to electric power by mid-century, contributing to climate goals and improved urban air quality. The NEV policy is also coordinated with the 2022–2040 Power Development Plan, emphasizing cleaner electricity generation to ensure that increased EV charging demand is met with sustainable power sources.

7.2.2. Financial Incentives

Cambodia has introduced a suite of financial incentives to reduce the cost barriers associated with NEVs and to stimulate early market development:

1) Import Duty and Tax Reductions:

Under Sub-Decree No. 122 (2023), the government significantly reduced customs duties and special taxes (excise) on electric vehicles. Excise taxes on BEVs have been slashed—sometimes from around 40% down to approximately 10%—making electric cars and trucks much more competitive relative to conventional ICE vehicles. This regime aims to support both consumer uptake and commercial fleet deployment.

2) Investment Law Incentives:

Under the 2021 Investment Law, EV-related manufacturing and assembly investments benefit from favorable fiscal treatment. Companies that set up local assembly operations for electric two- and three-wheelers can access import-duty waivers on parts and equipment and income-tax exemptions of up to nine years, which help attract industrial capability building and reduce dependence on fully imported vehicles.

3) Annual Vehicle Tax Reform:

In August 2025, the Ministry of Economy and Finance issued Notification 009, amending the Tax on Means of Transportation for EVs under Prakas 738. The reform sets revised annual tax rates based on horsepower and vehicle age categories, reducing the tax burden on EVs and aligning maintenance costs more favorably against traditional vehicles.

4) Charging Price Support:

Through regulatory adjustments implementing Prakas No. 0389 (2025), Cambodia has lowered EV charging tariffs. As of July 2025, the Electricity Authority of Cambodia (under the Prakas framework) set maximum charging rates at KHR 1,050 per kWh for AC charging and KHR 1,350 per kWh for DC charging, reducing operational costs for users and enhancing affordability.

These financial incentives are intended to improve total cost of ownership, bolster market entry of new EV models, and encourage early adopters, while also signaling the government's long-term support for the sector.

7.2.3. Non-Financial Measures

Cambodia is also building the regulatory infrastructure to support its EV ambitions, though non-financial measures remain in formation. In June 2025, the Ministry of Mines and Energy (MME) issued a Prakas (regulation) on overseeing and licensing EV charging services (Prakas No. 0389), defining roles for government agencies, setting technical and safety standards, and establishing five categories of charging stations: home, semi-public (e.g., workplaces), public, and standalone stations.

The regulation also mandates that the Electricité Authority of Cambodia (EAC) oversee charging-service licensing and tariff-setting, while Electricité du Cambodge (EDC) ensures reliable grid integration.

On the environmental side, the national EV policy references the need for battery recycling and end-of-life management, although stakeholders and reports (including from the World Bank) note that battery disposal regulation remains underdeveloped.

7.3 Vehicle Regulation Related to New Energy Vehicle and Smart Mobility

Cambodia has proactively adopted a set of international standards, specifically the United Nations Regulations (UNRs), to serve as its national vehicle standards. This move is formalized under Ministerial Decree No. 266 MISTI dated October 9, 2020, which officially recognizes 19 UNRs to improve vehicle quality, safety, and to accommodate the emerging segment of NEVs.

7.3.1. New Energy Vehicle (NEV) Safety Standards

For NEVs, Cambodia has adopted certain international safety standards:

- UNR100: This regulation sets the safety requirements for electric passenger and commercial vehicles.
- UNR136: This is the specific safety standard for electric motorcycles (E-motorcycles).

The adoption of these UNRs is essential for ensuring that electric vehicles imported into or assembled in Cambodia meet recognized global safety benchmarks, thereby building consumer confidence and promoting mass adoption.

7.3.2. Electric Vehicle (EV) Charging Standards

To control the safety, compatibility, and interoperability of the national EV charging system, Cambodia has also adopted standards published by the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO):

- IEC 62196 series (2014–2022): Pertains to the specifications for plugs, socket-outlets, vehicle connectors, and vehicle inlets for conductive charging of electric vehicles.
- IEC 61851 series (2017–2022): Defines the EV charging system and the communication protocols between the EV and the Electric Vehicle Supply Equipment (EVSE).
- IEC 62893 series: Covers the requirements for charging cables used with electric vehicles.
- IEC 62752: Specifies the system for Residual Current Devices (RCDs) used for Mode 2 charging (charging from a standard household outlet).
- ISO 17409:2022: Addresses general safety guidelines for the charging process of NEVs.

This comprehensive set of standards ensures that the charging infrastructure developed in Cambodia will be safe and accessible to a wide range of electric vehicles from various international manufacturers.

7.3.3. Vehicle Identification Standards

To enhance transparency and facilitate vehicle tracking and registration, Cambodia uses international ISO standards for vehicle identification:

- ISO 3779:2009 (Vehicle Identification Number - VIN): Adopts the international standard VIN for chassis numbering.
- ISO 3780:2009 (World Manufacturer Identifier - WMI): Adopts the WMI code, a standardized identifier for the vehicle manufacturer.

7.3.4. Vehicle Emission Standards

ambodia is implementing stringent measures to control vehicle emissions, aligning with international standards. The guidelines are set forth in Government Circular No. 01 dated January 2, 2020, focusing on preventing and reducing air pollution by adopting the European Emission Standards (Euro Standard).

The implementation timeline is phased, targeting both gasoline and diesel vehicles:

Table 7-3: Euro Emission Standard Implementation in Cambodia

Standard	Fuel Type	Pollutants	Enforcement Date
Euro 4	Gasoline	CO ≤1.0g/km HC ≤0.1g/km NOx ≤0.08g/km	January 1, 2022
Euro 4	Diesel	CO ≤0.5g/km HC+NOx ≤0.3g/km NOx ≤0.25g/km PM ≤ 0.025g/km	January 1, 2022
Euro 5	Gasoline	CO ≤1.0g/km HC ≤0.1g/km NOx ≤0.06g/km PM ≤ 0.005g/km	January 1, 2027
Euro 5	Diesel	CO ≤0.5g/km HC+NOx ≤0.23g/km NOx ≤0.18g/km PM ≤ 0.005g/km	January 1, 2027

Source: Ministry of Public Works and Transport[92]

This phased approach demonstrates Cambodia's intent to gradually clean up its vehicle fleet, making the transition from Euro 4 to Euro 5 mandatory for newly imported and registered vehicles, which will further encourage the shift towards NEVs and cleaner ICE technologies.

[92]https://www.unescap.org/sites/default/d8files/event-documents/Day1_Session2.2_Cambodia.pdf

7.4 Energy Policy

This chapter presents an overview of Cambodia's energy policy and the current state of infrastructure readiness to support the adoption of NEVs. The information compiled in this chapter is based on a comprehensive literature review and data collection from relevant national agencies and institutions. Furthermore, an analysis is provided to assess how current policies and infrastructure either align with or pose challenges to NEV adoption in the Cambodian context. The chapter is structured into two main sections:

1) Energy policy – providing the strategic direction for energy transition and transport electrification, and
2) Infrastructure Related to New Energy Vehicle and Smart Mobility – assessing charging networks, grid flexibility, and smart grid development needed to support large-scale NEV deployment.

Cambodia's energy policy is closely aligned with its broader climate commitments and economic development agenda. Under the Long-Term Strategy for Carbon Neutrality (LTS4CN), the country has articulated a clear vision to achieve carbon neutrality by 2050, with the energy sector playing a central role in this transition. Cambodia's Power Development Master Plan (PDMP 2022–2040) outlines a pathway to diversify its energy mix, reducing reliance on coal while increasing the share of solar and hydropower. By 2030, the country aims to reach approximately 18% solar and 28% hydro in its domestic capacity mix. At the same time, Cambodia is expanding its regional electricity integration through power imports from neighboring countries such as Lao PDR and Vietnam to enhance system flexibility and energy security.

7.4.1. Policy and Regulation

7.4.1.1. Long-Term Strategy for Carbon Neutrality (LTS4CN) – 2021

Under the Long-Term Strategy for Carbon Neutrality (LTS4CN)[cix], submitted to the UNFCCC in 2021, Cambodia has set out a comprehensive vision to transition its economy toward carbon neutrality by 2050. The strategy outlines clear sectoral pathways to reduce greenhouse gas emissions while ensuring energy security and economic growth.

In the energy sector, the government has committed to no new coal generation capacity beyond already approved projects, marking a major shift away from carbon-intensive power sources. Natural gas is positioned as a transitional and dispatchable fuel, supporting grid stability during the renewable energy scale-up. The strategy includes investments in LNG import terminals, storage facilities, and related infrastructure, enabling flexible generation capacity. Renewable energy particularly solar, hydro, biomass, and other clean technologies—is targeted to account for 35 % of the generation mix by 2050, with 12 % expected to come from solar power alone. To enable this transformation, Cambodia plans to invest in grid modernization, energy storage systems, and flexibility measures, coupled with energy efficiency programs in buildings and industry. Further measures include fuel switching to electricity for cooking and the gradual substitution of coal in both power and industrial sectors.

In the transportation sector, the strategy emphasizes both a modal shift and technological transition. Cambodia aims to increase the share of public transportation to 30 % of urban travel by 2050, helping to reduce congestion and emissions from private vehicles. A moderate but impactful electrification of the vehicle fleet is envisioned, targeting 70 % of motorcycles and 40 % of cars and urban buses to be electric by 2050. Alongside electrification, the country plans to improve fuel efficiency standards for internal combustion engine vehicles and expand the use of rail for both freight and passenger transport.

For heavy-duty vehicles, compressed natural gas (CNG) is expected to play a transitional role, with a target of 80 % penetration for interregional buses and trucks.

Taken together, these measures reflect Cambodia's pragmatic and phased approach to decarbonization. By combining renewable energy expansion, fuel switching, energy efficiency, and targeted transport electrification, the LTS4CN provides a clear and strategic pathway to achieving carbon neutrality while maintaining economic competitiveness and system reliability.

7.4.1.2. Power Development Master Plan (2022–2040)

Cambodia's Power Development Master Plan (PDP) 2022–2040 outlines a long-term strategy to ensure a reliable, affordable, and cleaner power system that supports both economic growth and the country's energy transition goals. The plan focuses on diversifying the generation mix, modernizing the grid, and integrating renewable energy to meet rising electricity demand driven by urbanization, industrialization, and transport electrification. Key priorities include expanding solar, wind, and biomass capacity; strengthening transmission and distribution networks; enhancing grid flexibility; and promoting cross-border power trade with neighboring countries to ensure system stability. The PDP also aligns with the Long-Term Strategy for Carbon Neutrality, limiting new coal development and encouraging cleaner dispatchable sources like natural gas and imported hydropower.

Importantly, the plan integrates NEV charging infrastructure and smart grid readiness to support future NEV growth. By 2040, Cambodia aims to achieve a secure, flexible, and low-carbon power system, enabled through public–private partnerships and international investment.

7.4.1.3. National Energy Efficiency Policy (2022–2030)

The National Energy Efficiency Policy (NEEP) 2022–2030 is a central component of Cambodia's broader strategy to achieve a low-carbon economy and meet its national climate targets. Adopted to operationalize the goals set out in the Long-Term Strategy for Carbon Neutrality (LTS4CN), this policy provides a comprehensive framework for improving energy use across all major sectors residential, commercial, industrial, public, and transport. The primary objective is to reduce the country's total energy consumption by 19 % by 2030 compared to the Business-as-Usual (BAU) scenario.

The policy outlines sector-specific energy efficiency targets: 34% for the residential sector, 25% for commercial buildings, 29% for the public sector, 20% for industry, and 5% for the transport sector. Although the transport target is modest compared to other sectors, it reflects the structural challenges of decarbonizing this segment, including rapid motorization, limited public transport infrastructure, and dependence on imported fossil fuels. Nonetheless, the policy identifies transport as a priority area for intervention, particularly through improved vehicle efficiency, fuel switching, and progressive electrification.

A key feature of the NEEP is its institutional framework, which ensures coordinated implementation. The Economic and Financial Policy Committee (EFPC) oversees overall policy direction, while the Ministry of Mines and Energy (MME) acts as the lead implementing agency. Sectoral ministries such as the Ministry of Industry, Science, Technology and Innovation (MISTI), the Ministry of Land Management, Urban Planning and Construction (MLMUPC), and the Ministry of Public Works and Transport (MPWT) are responsible for integrating energy efficiency actions into their respective sectors. This multi-agency governance model is designed to enable cross-sectoral collaboration and ensure that energy efficiency measures are embedded in development planning.

For the transport sector, the policy introduces several regulatory and strategic measures. These include the gradual introduction of fuel economy standards, the promotion of modal shift to more efficient public transport systems, and support for electrification of vehicles as part of the transition to clean

mobility. The policy also emphasizes the development of charging infrastructure and the use of financial incentives to make electric vehicles more accessible. These measures align closely with the National Policy on Electric Vehicles (2024–2030), creating a reinforcing policy environment for NEV adoption.

In addition to sectoral actions, the policy provides for legal and regulatory instruments such as Minimum Energy Performance Standards (MEPS), energy management programs for designated consumers, financial and fiscal incentives, and monitoring, reporting, and verification (MRV) systems to track progress. These instruments aim to establish an enabling environment for both public and private sector investment in energy-efficient technologies.

Overall, the National Energy Efficiency Policy 2022–2030 plays a strategic role in Cambodia's energy transition. By setting measurable targets, strengthening institutional coordination, and integrating energy efficiency into multiple sectors, it supports both emissions reduction and energy security objectives. In the transport sector, the policy lays the groundwork for NEV deployment, infrastructure development, and cleaner mobility systems that align with the country's long-term decarbonization pathway.

7.4.1.4. Electricity Law and Regulatory Structure (EAC & EDC)

The Electricity Law of Cambodia, enacted in 2001, provides the legal foundation for the organization, regulation, and operation of the country's power sector. The law defines the roles and responsibilities of key institutions, establishes regulatory mechanisms, and sets the framework for private sector participation in electricity generation and supply. Under this legal structure, Cambodia has adopted a single-buyer electricity market model, in which the Electricité du Cambodge (EDC) acts as both the system operator and the sole purchaser of electricity from Independent Power Producers (IPPs). This centralized arrangement has historically played an important role in enabling investment in generation and transmission projects by providing revenue certainty through long-term Power Purchase Agreements (PPAs) and reducing market risks for investors.

The Electricity Authority of Cambodia (EAC) is the independent regulatory agency tasked with overseeing the sector's operations. EAC is responsible for licensing generation, transmission, distribution, and retail operators; approving tariffs and connection charges; and setting technical and operational standards. It also manages consumer protection mechanisms and ensures compliance with sectoral regulations. This institutional division — with EDC as operator and single buyer, and EAC as regulator — provides a clear governance structure that has facilitated the rapid electrification of the country and the expansion of grid-connected power generation over the past two decades.

However, this centralized market structure now faces increasing pressure to evolve as Cambodia moves toward a cleaner, more flexible, and more decentralized energy system. The country's energy transition goals — including integrating a higher share of variable renewable energy such as solar, promoting distributed energy resources (DER), and supporting the electrification of the transport sector — require regulatory adaptation. Under the current model, all generation must sell to EDC, which may limit the ability of distributed producers, such as rooftop solar prosumers, to participate directly in the market. Similarly, the development of NEV charging infrastructure requires new regulatory mechanisms to allow private sector participation, tariff differentiation, and technical standards that support smart charging, grid stability, and demand management.

EAC's role will be increasingly critical in this transition. The regulator will need to update connection codes, licensing frameworks, and tariff structures to accommodate distributed generation and new forms of demand such as NEV charging. Establishing clear grid interconnection standards and streamlined permitting processes will be essential to ensure that new technologies can be deployed efficiently while maintaining grid reliability. Moreover, tariff reform — including the introduction of time-of-use (ToU)

pricing or other dynamic pricing mechanisms — could help manage new demand patterns associated with transport electrification and renewable integration.

EDC, as the system operator, will also need to modernize its operational and planning capabilities to integrate intermittent renewable generation and NEV demand at scale. This includes investments in grid flexibility, demand forecasting, and digital infrastructure to enable more dynamic and decentralized power flows. Future reforms may explore mechanisms such as open access, third-party participation, or public-private partnerships to accelerate investment in renewable energy and NEV infrastructure while maintaining overall system stability.

7.4.2. Supporting measures

Cambodia's supporting measures for NEV adoption currently focus on tariff incentives and pricing reforms rather than direct subsidies. These measures aim to lower charging costs, encourage NEV use, and support future infrastructure expansion.

7.4.2.1. Financial supporting measures

Cambodia's financial measures center on electricity tariff incentives to reduce charging costs and support early NEV adoption. While direct subsidies are not yet in place, ToU pricing for operators and lower retail charging rates provide a foundation for future financial support mechanisms.

1) Time-of-Use (ToU) pricing incentive – Personal (residential) charging

Currently, Cambodia's ToU tariffs are available only for medium- and high-voltage consumers, mainly large commercial and industrial users. Residential customers connected to low-voltage networks are charged based on a flat or block tariff structure with no time differentiation. This means personal NEV owners currently do not have financial incentives to shift charging to off-peak periods. For residential customers connected to low-voltage networks, the tariff is flat or block-based, depending on monthly consumption (380–730 Riels/kWh), with no ToU differentiation

However, introducing residential ToU pricing could be an effective policy instrument to support NEV adoption and optimize power system operation. Off-peak charging would help flatten the national load curve, reduce pressure on the grid during peak hours, and potentially increase the use of solar generation during midday. For households, lower off-peak tariffs would reduce the total cost of owning and operating an NEV, making NEVs more attractive.

2) Time-of-Use (ToU) Pricing Incentive – Public Charging Stations

Cambodia applies Time-of-Use (ToU) tariffs to medium- and high-voltage users, which include public NEV charging station operators, allowing them to benefit from lower electricity rates during off-peak hours. According to EAC Decision No. 014 (2021), the applicable ToU rates are:

- Peak period (07:00–21:00): USD 0.147/kWh
- Off-peak period (21:00–07:00): USD 0.0740/kWh
- Capacity charge: USD 7.39/kW/month

In addition to these wholesale tariffs for operators, the Cambodian government has also lowered end-user NEV charging prices to make NEV adoption more attractive. Since August 2024, the regulated charging price has been reduced from 1,600 riel/kWh to:

- 1,050 riel/kWh for AC charging, and
- 1,350 riel/kWh for DC fast charging.

This price reduction is aimed at encouraging wider NEV usage, improving affordability for drivers, and supporting the growth of charging infrastructure nationwide. While no dedicated NEV tariff structure exists yet, this combination of ToU incentives for operators and retail price adjustments for users provides a practical foundation for stimulating market growth. Over time, further tariff reform—such as dedicated NEV charging rates or enhanced off-peak incentives—could strengthen grid management and align charging demand with renewable energy availability.

3) Charging financial incentive - Personal use

In Cambodia, there are currently no direct financial incentives specifically designed to support the installation of home NEV chargers for individual users. Unlike some countries where governments provide subsidies, rebates, or tax credits for residential charging infrastructure, Cambodia's current incentive framework focuses primarily on reducing NEV import duties and charging tariffs rather than on home charging equipment.

This means personal NEV owners are responsible for covering the full cost of purchasing and installing home charging systems. However, as the NEV market expands, future incentive measures—such as targeted subsidies, tax deductions, or soft financing programs for home charger installation—could play a key role in encouraging broader NEV adoption.

Introducing such incentives would align with Cambodia's transport electrification and energy transition goals, enabling more households to charge conveniently and cost-effectively at home, while helping shift charging demand toward off-peak periods if combined with future Time-of-Use (ToU) pricing.

4) Charging financial incentive – Public station

In Cambodia, the financial incentives for public charging stations currently focus on tariff measures rather than direct investment or operating subsidies. The government reduced the end-user charging price from 1,600 riel/kWh (August 2023) to 1,050 riel/kWh for AC charging and 1,350 riel/kWh for DC fast charging, making public charging more affordable and encouraging higher utilization rates.

On the operator side, public charging stations benefit from Time-of-Use (ToU) electricity tariffs applicable to medium- and high-voltage consumers. These rates are USD 0.0740/kWh during off-peak hours and USD 0.1475/kWh during peak hours, with a capacity charge of USD 7.39/kW/month. This structure lowers operational costs for providers and can make charging businesses more financially sustainable, particularly when demand is managed efficiently.

However, Cambodia currently does not offer direct government subsidies for charging infrastructure investment or operating costs. There are no formal grant programs, per-station subsidies, or coverage-based incentives at this stage. Future policy development could include investment subsidies, tax incentives, or soft financing to support network expansion and equitable coverage beyond major urban areas.

7.4.2.2. Non-Financial Supporting Measures

Cambodia's non-financial measures focus on regulatory groundwork and future pilot programs to enable smart charging and electricity arbitrage. While no formal V2G or smart charging schemes exist yet, time-based tariffs and the National NEV Policy (2024–2030) provide a foundation for future grid flexibility and market development.

1) Regulatory Support for Electricity Arbitrage

At present, Cambodia does not have a dedicated regulatory framework that explicitly enables electricity arbitrage — such as time-shifting electricity consumption or selling stored energy back to the grid — for NEV charging operators or prosumers. The country's power sector remains centralized, with

Electricité du Cambodge (EDC) acting as the single buyer and system operator, and the Electricity Authority of Cambodia (EAC) overseeing tariff setting, licensing, and technical standards.

However, the existing regulatory structure provides an important foundation for introducing future arbitrage mechanisms. Cambodia already applies time-based pricing schemes for certain large and medium consumers connected at medium and high voltage, through "payment by time and capacity" options. This allows electricity buyers to benefit from lower off-peak tariffs (USD 0.074/kWh) and higher peak tariffs (USD 0.1475/kWh), which can be leveraged in the future to support NEV charging arbitrage business models, especially for public charging stations and fleet operators.

2) V2G and Smart Charging Pilot Programs

Currently, Cambodia does not yet have formal Vehicle-to-Grid (V2G) or smart charging pilot programs in operation. The existing electricity market structure—centered on a single-buyer model managed by Electricité du Cambodge (EDC)—limits the ability of private charging operators or prosumers to actively participate in energy markets or provide grid services. However, the technical and policy direction of Cambodia's energy transition provides a strong foundation for the future introduction of V2G and smart charging schemes, especially as NEV adoption accelerates.

From a regulatory standpoint, Time-of-Use (ToU) tariffs for medium- and high-voltage users already exist, offering lower off-peak rates (USD 0.074/kWh) and higher peak rates (USD 0.1475/kWh). These time-differentiated prices could support basic forms of charging load shifting—a precursor to more advanced smart charging applications. If expanded to residential users, this could create incentives for off-peak home charging and load management at scale.

The National Policy on Electric Vehicles (2024–2030) emphasizes the need for infrastructure and regulatory readiness to support advanced charging technologies. While not explicitly mentioning V2G, it encourages the adoption of smart charging solutions and investments in digital grid modernization, both of which are essential enablers of V2G functionality.

In the near term, potential pilot programs in Cambodia could include:

- Smart charging demonstration projects at public charging hubs or commercial fleets to manage load profiles and align charging with off-peak periods or high solar generation.
- Behind-the-meter storage or bidirectional charging pilots at government facilities, universities, or industrial parks.

Partnerships with regional development agencies and donors to build capacity, test V2G technologies, and assess regulatory adjustments needed for implementation.

Establishing pilot programs would allow Cambodia to test technical standards, tariff mechanisms, and regulatory frameworks in controlled settings before scaling to a national level. In the long term, V2G integration could provide valuable flexibility services to the grid, support renewable integration, and enhance the overall resilience of Cambodia's power system.

7.5 Infrastructure Related to New Energy Vehicle and Smart Mobility

7.5.1. Energy Infrastructure

As of infrastructure related to NEV supported by the National Policy on the Development of Electric Vehicles 2024-2030, the comprehensive and reliable network of NEV charging stations across the country is encouraged, including public charging stations in urban areas, on main highways, and in workplaces and residential buildings[cxi,cxii]. The Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia, with the deployment of the charging station, is growing rapidly following the financial incentives provided by the government, the higher public awareness and technological advancement[cxiii].

Roadmap for the Development of an Electric Vehicle Charging Station Network in Cambodia

The Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia provides a strategic framework for nationwide charging infrastructure deployment to meet the country's NEV targets under the National Policy on the Development of Electric Vehicles (2024–2030). It emphasizes building a comprehensive and reliable network that ensures convenient access to charging stations across urban areas, major highways, and residential and workplace locations, supporting both personal and commercial NEV use.

Deployment is being driven by three main factors:

- Government incentives such as reduced retail tariffs and investment-friendly measures,
- Rising consumer awareness of NEV benefits, and
- Technological advancements that lower costs and improve charging speed.

The roadmap underscores the importance of grid readiness and smart charging technologies, requiring close coordination with EDC to ensure adequate capacity, flexibility, and reliability of power supply. It also lays the groundwork for future regulatory and investment tools such as public–private partnerships (PPPs), tariff incentives, and planning standards to accelerate.

To support the projected NEV growth, total investment needs are estimated at USD 168–576 million by 2050, with USD 0.5–2 million annually during 2022–2030. About 45% of this investment will go to fast-charging infrastructure, reflecting its role in enabling long-distance travel and commercial operations. By 2040–2050, annual investment is projected at USD 3.4–11.5 million for slow chargers and USD 6.0–20.5 million for fast chargers. For electric motorcycles, battery swapping stations will be key, with investment increasing from USD 70,000 (2022–2025) to USD 4.6 million by 2050. These projections highlight the need for early financial planning, supportive regulation, and strong public–private partnerships to ensure nationwide coverage, affordability, and system reliability.

Table 7-4: Yearly capital investment in charging infrastructure

Period / Scenario	Slow chargers (NEV1)	Slow chargers (NEV2)	Slow chargers (NEV3)	Fast chargers (NEV1)	Fast chargers (NEV2)	Fast chargers (NEV3)	Battery swapping (NEV1)	Battery swapping (NEV2)	Battery swapping (NEV3)
2022–2025	$50k	$100k	$180k	$90k	$180k	$310k	$70k	$130k	$440k
2025–2030	$130k	$270k	$460k	$240k	$480k	$810k	$210k	$420k	$1.3m
2030–2040	$1.3m	$2.6m	$4.3m	$2.3m	$4.5m	$7.7m	$1.4m	$2.7m	$5.2m
2040–2050	$3.4m	$6.8m	$11.5m	$6.0m	$12.1m	$20.5m	$1.7m	$3.3m	$4.6m

7.5.1.1. Charging Infrastructure Development

Cambodia's NEV charging infrastructure has expanded rapidly in recent years, establishing itself as a key enabler of the country's NEV transition. Although the network remains in its early development stage, it has demonstrated strong growth momentum over the past two years. As of mid-2024, Cambodia had around 21 operational public charging station locations, primarily concentrated in Phnom Penh and other major urban centers. By April 2025, this number had increased to 154 public charging stations nationwide, marking a significant leap in deployment. Phnom Penh leads with 60 stations, featuring a mix of AC, DC, and AC/DC chargers, followed by Siem Reap and Preah Sihanouk with 19 stations each, and Kampot with 11 stations. The remaining stations are distributed across other provinces, highlighting both the notable progress in charging infrastructure rollout and the uneven regional coverage that continues to favor urban and tourism-driven areas.

The Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia provides the strategic framework to accelerate deployment and ensure broader coverage. It focuses on expanding charging points in urban centers, along major highways, and in residential and workplace locations to support both personal and commercial NEV use. The government has reduced retail charging tariffs to 1,050 riel/kWh for AC and 1,350 riel/kWh for DC and offers ToU electricity pricing (USD 0.0740/kWh off-peak, USD 0.1475/kWh peak) to lower operating costs for station owners.

Private operators are playing a critical role in infrastructure expansion. Charge+ Cambodia plans to install 1,000 AC chargers and 500 DC fast chargers, while PTT Cambodia is rapidly rolling out fast-charging facilities across its service stations. According to long-term projections, Cambodia will need 6,500–22,000 AC chargers and 1,700–5,900 DC chargers by 2050 to meet growing demand.

Total investment requirements are estimated at USD 168–576 million by 2050, with USD 0.5–2 million annually during the early phase (2022–2030). Nearly 45% of this investment will go toward fast-charging infrastructure, underscoring its strategic importance for long-distance travel and commercial NEV fleets. Achieving these targets will require early financial planning, supportive regulations, and public–private partnerships to ensure charging infrastructure is accessible, reliable, and evenly distributed nationwide.

7.5.1.2. Smart Grid Development Plan

The expansion of Cambodia's NEV charging network is closely tied to the country's broader Smart Grid Development Plan, which aims to modernize the power system and improve its ability to integrate renewable energy, manage growing demand, and enable advanced charging technologies such as smart charging and vehicle-to-grid (V2G) services.

The Electricité du Cambodge (EDC), under the guidance of the Ministry of Mines and Energy (MME), has identified grid modernization as a strategic priority to support the government's long-term carbon neutrality goals by 2050. The smart grid plan focuses on enhancing system flexibility, improving real-time monitoring and control, and integrating digital technologies into grid operations. This will be essential as NEV adoption increases and the charging load becomes more dynamic. Key components of Cambodia's smart grid development direction include:

- Advanced metering infrastructure (AMI) to enable real-time energy use tracking, ToU pricing, and demand response;
- Grid automation and digital control systems to improve reliability and resilience;
- Integration of distributed energy resources (DER) such as rooftop solar and energy storage, enabling bidirectional power flows;
- Load forecasting and management tools to anticipate and manage NEV charging demand;
- Support for smart charging and potential V2G services, allowing NEVs to contribute to grid stability.

The National Energy Efficiency Policy (2022–2030) and Cambodia's Long-Term Strategy for Carbon Neutrality both emphasize smart grid development as a critical enabler of a low-carbon power system. While Cambodia's smart grid deployment is still at an early stage, pilot programs in advanced metering and system automation have been initiated, particularly in urban areas.

As charging infrastructure expands, smart grid investment will play a crucial role in ensuring grid reliability, managing peak demand, and maximizing the use of renewable energy. In the long term, a well-coordinated smart grid will be key to enabling dynamic NEV charging, tariff-based load shifting, and grid services from NEV fleets, supporting both energy transition and transport decarbonization objectives.

7.5.1.3. NEV to Charging Piles (AC/DC) ratio

As of April–May 2025, Cambodia's NEV ecosystem is expanding quickly, with approximately 7,610 registered NEVs and an estimated 385 charging piles nationwide, based on a moderate average of 2.5 piles per station across 154 public charging stations. This translates to a NEV-to-pile ratio of about 20:1, which, although improved from station-based estimates, still points to infrastructure lagging behind vehicle adoption. Cambodia's current ratio highlights the need to accelerate investment in both AC and DC charging infrastructure to meet future demand. Ongoing and planned expansions—through private operators such as Charge+ and PTT Cambodia, combined with government initiatives—will be key to closing this infrastructure gap and supporting nationwide NEV adoption.

7.5.1.4. Smart Grid Readiness

Cambodia's smart grid readiness is at an early development stage, though progress has been made in strengthening transmission and distribution networks and integrating digital solutions. Unlike some advanced ASEAN power systems, Cambodia's current grid remains highly centralized, with limited automation and smart meter penetration.

While Cambodia has not yet been assigned an official Smart Grid Index (SGI) score by SP Group, its current infrastructure would likely place it in the lower readiness tier of the ASEAN region. In recent SGI reports, countries with similar grid structures typically score between 60–70% overall, reflecting strong electrification rates but limited advanced digitalization, system flexibility, and distributed energy integration.

7.5.1.5. Charging communication protocol standard - Single platform

Cambodia currently does not yet have a dedicated national standard for NEV charging communication protocols, but the policy direction strongly supports the establishment of a unified platform to ensure interoperability, security, and scalability of charging infrastructure. As the number of charging stations grows, a single communication protocol standard will be essential to enable seamless connectivity between charging stations, grid operators, and service providers. The National Policy on the Development of Electric Vehicles (2024–2030) identifies the need to standardize charging interfaces and communication systems, which would facilitate integration with smart grid functions, enable real-time monitoring and billing, and support the future rollout of smart charging and V2G (vehicle-to-grid) services. A single platform would also make it easier for NEV users to access and pay across different charging networks, improving convenience and user experience. In the near term, the government is expected to adopt international best practices—such as OCPP (Open Charge Point Protocol)—to serve as the backbone of its national system. This approach would align Cambodia with regional and global interoperability standards, reduce system fragmentation, and encourage private investment by ensuring technical compatibility. Establishing a single charging communication protocol will therefore be a critical enabler for efficient infrastructure expansion, grid integration, and the development of a competitive charging services market in Cambodia.

7.5.2. Road Infrastructure

The World Economic Forum (WEF) Global Competitiveness Report uses an Executive Opinion Survey to rate the Quality of Roads on a scale from 1 (poor/underdeveloped) to 7 (extensive/efficient). Cambodia's road quality score was 3.6 points in the 2019 report. This score placed Cambodia below the regional average and slightly below neighboring Vietnam and Lao PDR. It indicates that the country's road network, though expanding, is considered by business leaders to be in a poor to moderate condition overall. The 3.6 rating reflects the significant discrepancy between newly constructed national highways (often financed by foreign investment) and the vast network of rural and provincial roads, which frequently suffer from poor surfacing, lack of maintenance, and extreme deterioration, particularly during the wet season. The WEF score highlights infrastructure deficiencies impacting business efficiency and connectivity.

Road Environment, Marked Lanes and Standard Traffic Signals. Cambodia's road environment is rapidly modernizing in urban centers, but rural areas lag behind in standardization and enforcement. Cambodia utilizes the internationally recognized Red, Yellow (Amber), and green traffic signal system. These signals are concentrated primarily in the capital, Phnom Penh, and major provincial cities. Directional and regulatory signage is present on national highways, often in both Khmer and English. On newly paved national roads and key urban arteries, lane markings (solid and dashed white/yellow lines) are present and generally follow international standards. However, in most urban and rural settings, markings are often faded, nonexistent, or rendered irrelevant by the density and chaotic nature of mixed traffic flow. Despite the presence of standard signals, driver discipline is low. Traffic rules are frequently ignored, and intersections are often managed by a mix of signals, traffic police, and driver negotiation, leading to significant congestion and hazard. The high volume of two-wheeled vehicles contributes significantly to the blurring of lane boundaries.

Cambodia's road network structure is primarily categorized into three main types is National Roads, Provincial Roads, and Rural Roads. The total length of roads in Cambodia is approximately 39,704 kilometers, which is segmented into 5,263 kilometers of national highways, 6,441 kilometers of provincial roads, and approximately 28,000 kilometers of rural roads.[cxiv]

7.5.2.1. National Road Networks

These are the principal routes connecting major cities and provinces, as well as providing links to neighboring countries such as Thailand, Vietnam, and Lao PDR. These roads are typically numbered, for example, National Road No. 1 to No. 8, and include the Ring Roads around Phnom Penh. Most of these roads are paved and generally in good condition.

Table 7-5: National Roads

No.	Name	distance (km.)	Connection point
1	National Highway 1	167.10	It connects the capital of Phnom Penh, through Prey Veng Province, with Bavet, Svay Rieng Province on the border with Vietnam, and continues in Vietnam as the QL22 Highway to Ho Chi Minh City in the southeast.
2	National Highway 2	120.60	NH2 leads south out of Phnom Penh, through Kandal Province, and enters the Tram Kak District of Takéo Province. It continues south through Kiri Vong District in the province, where it veers due east and meets the border with Vietnam.
3	National Highway 3	202	it connects the capital of Phnom Penh with Veal Renh. The road underwent significant refurbishment in 2008 and forms part of an international "North-South economic corridor" from Kunming in China to Bangkok in Thailand.
4	National Highway 4	230	It connects the capital of Phnom Penh with Sihanoukville in the south-west
5	National Highway 5	407.45	It connects the capital of Phnom Penh with Thailand.
6	National Highway 6	416	It connects the capital of Phnom Penh with Banteay Meanchey through Siem Reap on the north shore of the Tonlé Sap. It terminates merging into National Highway 5.
7	National Highway 7	509.17	It connects Skuon with Trapeang Kreal, international border checkpoint with Lao PDR.
8	National Highway 8	90	The road begins at a junction with National Highway 6, then crosses over the Mekong River on the Prek Tamak Bridge. It turns east towards the village of Amphil, near the Cambodia–Vietnam border and then ends at a junction with National Highway 7.

Source: Author's, National Roads.

These roads connect various districts within the same province and play a crucial role in facilitating transportation links between secondary towns and rural areas.[cxv]

Table 7-6: Provincial Roads

No.	Name of Capital, Province	Distance from Phnom Penh to provincial capitals (km)	Cities, Districts, Khans
1	Banteay Meanchey	359	Poipet City
2	Battambang	291	Banan District
3	Kampong Cham	124	Prey Chhor District
4	Kampong Chhnang	91	Boribo District
5	Kampong Speu	48	Kong Pisey District
6	Kampong Thom	168	Baray District
7	Kampong	143	Chhouk District
8	Kandal	11	Muk Kampul District
9	Koh Kong	271	Koh Kong District
10	Kratie	315	Sambo District
11	Mondulkiri	521	Oraing District
12	Phnom Penh	0	Khan Chamkarmon
13	Church	294	Choam Ksan District
14	Prey Veng	90	Pearang District
15	Pursat	189	Bakan District
16	Rattanakiri	588	Banlung City
17	Siem Reap	314	Siem Reap City
18	Sihanoukville	230	Stung Hav District
19	Stung Treng	455	Siem Bok District
20	Svay Rieng	122	Kampong Rot District
21	Takeo	78	Prey Kabbas District
22	Bored	174	Kep City
23	Pailin	371	Pailin City
24	Oddor Meanchey	469	Chongkal District
25	Bee	144	Ponhea Krek District

Source: Author's, Provincial Roads.

Rural Roads are roads that connect villages and communities in remote areas. Most of them are still laterite (gravel) or dirt roads, and accessibility can be difficult during the rainy season.

The Expressway network of Cambodia currently consists of one expressway in operation, one expressway under construction, and one under feasibility study. The government has noted three goals for developing an expressway network[93]

[93] Expressways Ministry of public works and transport, (2025). https://www.mpwt.gov.kh/kh/public-works/expressways

- Regional Integration with neighboring countries
- Linking the wealthier Phnom Penh with other cities to let other provinces benefit from the development
- Improving transportation in Cambodia, reducing congestion and allowing more suitable roads for heavy trucks

Table 7-7: Expressway

Number	Shield	Name	Origin	Terminus	Length (Kilometers)	Began Construction	Operation Status
E1		Phnom Penh-Bavet Expressway	Phnom Penh	Bavet	138	June 2023	Construction began in June 2023
E4		Phnom Penh-Sihanoukville Expressway	Phnom Penh	Sihanoukville	190.6	March 2019	Open for Public use in October 2022
E6		Phnom Penh-Siem Reap-Poi Pet	Phnom Penh	Poi Pet	Approx. 400	TBD	Under detailed study, began Jun 2023

Source: Author's, Expressway.

7.5.3. Digital Infrastructure

Cambodia's digital infrastructure development is primarily focused on strengthening its existing 4G network to handle increasing data demand. While the country is making strides in general mobile connectivity, advanced smart mobility technologies remain largely in the conceptual or very early pilot phase.

- 5G Coverage & Speed: Commercial 5G rollout has been relatively slower compared to its regional neighbors. Current mobile performance relies heavily on a robust 4G LTE network, which provides generally adequate speeds in major urban centers like Phnom Penh and Siem Reap. Wide-scale 5G deployment, required for low-latency V2X, is not yet ubiquitous.
- Driverless (L4-L5) Vehicles: There is no public or private L4/L5 development or testing currently underway in Cambodia. The focus remains on conventional vehicle fleet modernization and improving standard road safety and infrastructure, with most vehicles featuring basic L1 or L2 ADAS at best.
- Traffic Management Systems (TMS): Urban traffic management is undergoing modernization, but the adoption of sophisticated Adaptive Traffic Signal Control (ATSC) driven by real-time AI and sensors is limited. Efforts are concentrated on basic digital control and infrastructure updates to manage increasing congestion.
- V2I for ADAS (L2-L3): The necessary conditions for Vehicle-to-Infrastructure (V2I) communication specifically a high-speed, low-latency 5G network and a nationwide deployment of roadside intelligent sensors (RSUs) are not yet in place. Consequently, V2I technology is not a current factor in complementing existing ADAS operations. The country is building its foundational digital infrastructure first.

7.5.3.1. Policy and Strategic Framework

Cambodia's digital infrastructure development for transport and mobility is primarily guided by economy-wide digitalization policies, rather than sector-specific smart-mobility or connected-vehicle strategies. The most relevant national framework is the Digital Government Policy 2022–2035, which sets long-term objectives for expanding digital connectivity, improving data governance, and strengthening ICT infrastructure across public services. While the policy does not explicitly target smart mobility or connected and autonomous vehicles (CAVs), it establishes critical enabling conditions—such as nationwide broadband expansion, data platforms, and digital public services—that are foundational for future NEV-related digital applications.

At present, Cambodia's mobility digitalization strategy remains focused on foundational connectivity and traffic management modernization, rather than advanced vehicle automation or V2X systems. There is no dedicated national roadmap for smart mobility, CAV deployment, or vehicle-to-infrastructure (V2I/V2X) integration. Consequently, digital infrastructure planning for transport is incremental and infrastructure-led, prioritizing road standardization, basic traffic digitization, and network capacity upgrades over advanced real-time vehicle communication.

7.5.3.2. Measures in Developing Digital Infrastructure

Cambodia's current digital infrastructure development relevant to NEVs and smart mobility centers on three core pillars: mobile connectivity, road standardization, and traffic data systems.

First, mobile network development remains heavily reliant on a relatively robust 4G LTE network, which provides adequate coverage and data speeds in major urban centers such as Phnom Penh and Siem Reap. Commercial 5G rollout is progressing slowly compared with regional peers, and nationwide low-latency coverage—required for advanced V2X and autonomous driving applications—is not yet available. Nevertheless, the government has explicitly identified accelerated 5G deployment as a strategic priority under the Digital Government Policy 2022–2035, recognizing its importance for future digital services, including transport and logistics.

Second, road and infrastructure standardization has improved significantly in recent years, particularly on newly constructed expressways. Projects such as the Phnom Penh–Sihanoukville Expressway feature standardized lane markings, signage, and road geometry. These improvements are critically important for the effective operation of Level 2–Level 3 Advanced Driver-Assistance Systems (ADAS), which rely heavily on camera-based perception and consistent visual cues rather than external connectivity. While Cambodia does not yet deploy digital roadside units (RSUs), these physical infrastructure upgrades represent an important preparatory step toward V2I-ready environments.

Third, traffic management systems (TMS) are gradually incorporating digital technologies. In Phnom Penh, Area Traffic Control Systems (ATCS) use CCTV cameras and video vehicle detectors to collect real-time traffic data and dynamically adjust signal timings from centralized control centers. Although these systems currently function as closed-loop traffic optimization tools, they generate data streams that could eventually support V2I applications—such as signal phase and timing (SPaT) information—once communication standards and vehicle interfaces are established. In parallel, smart LED streetlight projects in Phnom Penh and Siem Reap, initially deployed for energy efficiency, could serve as future platforms for sensors or communication equipment.

7.5.3.3. Pilot Projects and Early Digital Applications

Cambodia remains at a very early pilot stage in smart mobility applications, with no active testing of Level 4–Level 5 autonomous vehicles and no commercial V2I deployments. Vehicle technology in the market is largely limited to conventional models with basic safety features, and at best L1–L2 ADAS in imported vehicles.

However, several infrastructure and planning initiatives demonstrate early experimentation with digital tools. The Phnom Penh–Bavet Expressway project, for example, reportedly applies digital twin technology for traffic simulation and infrastructure planning, indicating growing institutional interest in data-driven transport management. Additionally, Cambodia has collaborated with international partners—including China, Japan, and multilateral development institutions—on transport infrastructure projects that incorporate modern ICT components, creating potential entry points for future pilot V2I or smart-corridor demonstrations.

On the user side, widespread use of navigation applications such as Google Maps and Waze already provides Cambodian drivers with real-time congestion information and route optimization, indirectly contributing to traffic efficiency. The government has also worked with international partners, including the World Bank, to apply Geographic Information Systems (GIS) for nationwide road condition mapping and maintenance planning, strengthening the data foundation for future intelligent transport systems.

7.5.3.4. Future Outlook and Key Challenges

Looking forward, Cambodia's digital infrastructure for NEVs and smart mobility is best characterized as foundational but incomplete. The country is prioritizing basic connectivity, standardized infrastructure, and centralized traffic control rather than advanced vehicle automation or real-time V2X integration. As a result, V2I and V2X technologies are not yet operational factors in enhancing ADAS or supporting higher-level automation.

Several challenges remain critical. Limited 5G coverage, especially outside major cities, constrains the feasibility of low-latency vehicle-infrastructure communication. The absence of a dedicated smart-mobility or CAV regulatory framework also limits private-sector experimentation and pilot deployment. In addition, Cambodia's traffic environment—characterized by a very high share of motorcycles—poses unique digital and behavioral challenges. While traffic laws require lane discipline and vehicle segregation, enforcement remains inconsistent, and mixed traffic behavior continues to increase accident risks and complicate the deployment of sensor-dependent vehicle technologies.

Nevertheless, ongoing investments in expressways, traffic digitization, and national digital governance suggest that Cambodia is laying the groundwork for future smart-mobility integration, even if current efforts remain focused on conventional transport modernization. Over the medium to long term, accelerated 5G rollout, stronger enforcement of traffic rules, and targeted pilot corridors could enable Cambodia to transition from foundational digital infrastructure toward more advanced NEV- and connectivity-enabled mobility systems.

7.6 Consumer Preferences and Trends

7.6.1. Vehicle Ownership

Cambodia has experienced a moderate but consistent growth in passenger vehicle ownership between 2018 and 2024, mirroring the country's economic development and gradual urban expansion. The total number of registered passenger vehicles increased from 67,423 thousand units in 2018 to 73,000 thousand units in 2023, before declining slightly to 54,000 thousand units in 2024. Despite short-term fluctuations, the overall trend indicates a steady increase in private mobility over the past several years. In terms of vehicle density, the number of passenger cars per 1,000 inhabitants rose from 4.14 units in 2018 to 3.06 units in 2024, highlighting the early stages of motorization in the country.

Cambodia's economic growth has played a pivotal role in driving the expansion of vehicle ownership. The nation's Gross Domestic Product (GDP) grew from 30.67 billion USD in 2018 to 38.52 billion

USD in 2024, while GDP per capita (in 2015 USD prices) increased from 1,884 USD to 2,183 USD during the same period. Despite the contraction in 2020 due to the global COVID-19 pandemic, Cambodia's economy rebounded strongly in the following years, maintaining a growth rate of 3-6% annually. This sustained economic progress reflects the country's ongoing industrialization, diversification of exports, and rising household incomes, all of which have contributed to increasing demand for private vehicles.

Demographic factors have also influenced vehicle ownership trends. The total population grew from 16.27 million in 2018 to 17.64 million in 2024, with the majority belonging to the working-age group (15-64 years), which accounted for approximately 63-64% of the total population. The share of the younger population (aged 0-14 years) declined slightly from 31.53% in 2018 to 29.79% in 2024, while the elderly population (aged 65 years and over) increased gradually from 5.09% to 6.16%. These demographic shifts, characterized by a growing working-age population and a gradual rise in the elderly cohort, indicate potential for continued vehicle demand driven by rising economic activity and urban employment.

Educational development has progressed during this period, with secondary education enrollment increasing from 50.2% in 2018 to 58.79% in 2024, and tertiary enrollment also rose from 13.27% to 21.44%. These improvements reflect Cambodia's continuing investment in human capital and expanding access to education, particularly in urban centers.

Urbanization remains a major factor influencing private vehicle growth. The proportion of the population residing in urban areas expanded from 23.39% in 2018 to 26.04% in 2024, corresponding to an increase in the urban population from 3.81 million to 4.59 million. As cities such as Phnom Penh, Siem Reap, and Battambang continue to urbanize and modernize, demand for personal vehicles has increased, particularly in areas with limited public transport infrastructure.

Cambodia's vehicle ownership trends reflect broader socio-economic improvements and ongoing urban development. The steady increase in registered passenger vehicles corresponds with income growth, urban expansion, and demographic shifts toward a larger working-age population. However, the growing number of private vehicles presents emerging challenges related to traffic congestion, fuel consumption, and environmental management. To ensure sustainable urban mobility, policy efforts will need to focus on enhancing public transportation systems, promoting cleaner vehicle technologies, and improving road infrastructure to accommodate rising transport demand while minimizing environmental impacts.

7.6.2. Consumer Preferences

As Cambodia's electric vehicle (EV) market is still in its early stage, understanding consumer preferences is essential to identify key factors driving BEV adoption. This section analyzes major determinants—covering awareness, product perception, cost, infrastructure, and policy—based on insights from 39 experts across the public, private, academic, and non-government sectors, including both local and regional specialists, to reflect Cambodia's current readiness for electric mobility.

Based on the findings of Sotha Keo (2023)[94], the expert evaluation revealed that six key factor categories influence BEV adoption for four-wheel vehicles in Cambodia, reflecting a multifaceted perspective on market readiness. Among these, government support emerged as the most influential factor (21.51%), followed closely by economic considerations (18.41%) and electricity supply

[94] Sotha Keo. (2023). Evaluation of Factors Associated with Battery Electric Vehicles Adoption- Cambodia Case. https://s-space.snu.ac.kr/handle/10371/196535

reliability (17.94%). Infrastructure (15.71%) and technological aspects (15.86%) were also viewed as important but secondary drivers, while consumer-related factors ranked lowest (10.57%). These results indicate that experts perceive Cambodia's BEV adoption as primarily dependent on strong institutional and structural support—particularly through government incentives, stable energy provision, and affordable ownership conditions—rather than consumer-driven market demand at this stage.



Figure 7-6: Factor Category Prioritization (4-wheel vehicles)

Source: Sotha Keo (2023)

7.6.2.1. Awareness and Attitude toward BEV Adoption

Awareness and public perception toward electric mobility play a crucial role in shaping the pace of BEV adoption. In emerging markets such as Cambodia, where electric vehicle infrastructure and market presence are still developing, consumer understanding of EV technology, environmental benefits, and long-term economic advantages remains limited. Building awareness and shaping positive attitudes through education, demonstration projects, and effective policy communication are therefore critical to fostering early acceptance and confidence in EV technology.

According to the study by Sotha Keo (2023), Cambodian consumers remain at an early stage of awareness and understanding regarding battery electric vehicles. The study found that public knowledge of BEV technology, including aspects such as battery performance, safety, and maintenance, is still relatively low, w h ich priority weight of 15.86%. Therefore, the study emphasizes that targeted awareness campaigns and consistent government communication are essential to enhance public understanding and promote a more favorable attitude toward BEV adoption in Cambodia.

7.6.2.2. Perceived Product Attributes

Technological performance and product characteristics are key determinants in the adoption of BEVs, as consumers closely evaluate aspects such as range, battery durability, and charging efficiency. These

factors directly affect perceptions of convenience, reliability, and long-term value—especially in markets like Cambodia, where electric mobility is still developing and consumer exposure remains limited. The perceived capability of BEVs to meet daily transportation needs without frequent charging or performance degradation is therefore essential in shaping purchasing intentions.

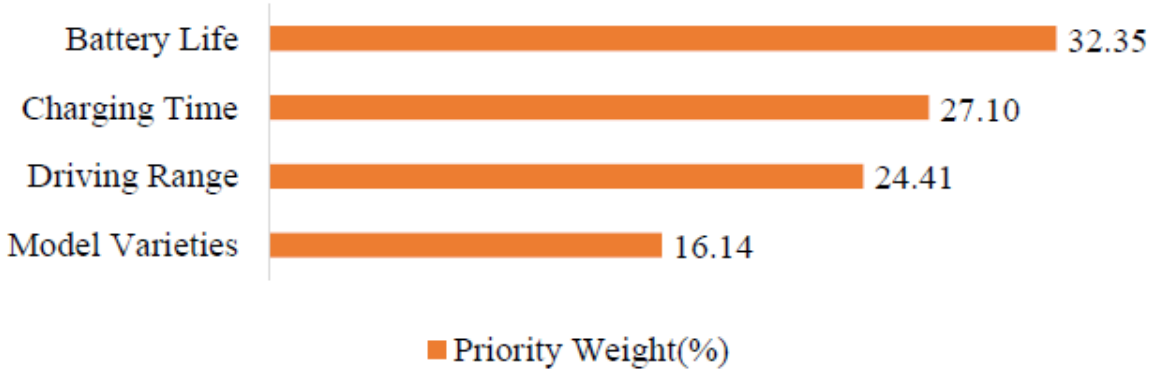


Figure 7-7: Factors' Priority Weight within the Technology Category (4-wheel Vehicles)

Source: Sotha Keo (2023).

According to Sotha Keo (2023), the analysis of the Technology category for four-wheel BEVs revealed that battery life ranked as the most influential factor, with a priority weight of 32.35%, followed by charging time (27.10%), and driving range (24.41%). Model variety, at 16.14%, was identified as the least significant factor. These findings indicate that consumers in Cambodia prioritize battery performance and charging convenience above other technological considerations, reflecting concerns about vehicle reliability and usability under current infrastructure limitations.

Overall, the study highlights that enhancing BEV technology—particularly through extended battery lifespan and faster charging solutions—will be central to building consumer confidence in Cambodia's electric mobility transition. The availability of diverse models may become more influential over time as awareness and accessibility increase.

7.6.2.3. Economic Considerations and Cost Sensitivity

Economic factors play a central role in influencing BEV adoption, particularly in developing markets such as Cambodia, where affordability remains a major barrier. The total cost of ownership, including purchase price, operational expenses, maintenance, and potential resale value—directly affects consumer decision-making. High upfront costs and uncertainty about long-term maintenance often discourage adoption, while economic incentives and reductions in running costs can serve as powerful motivators for transition.

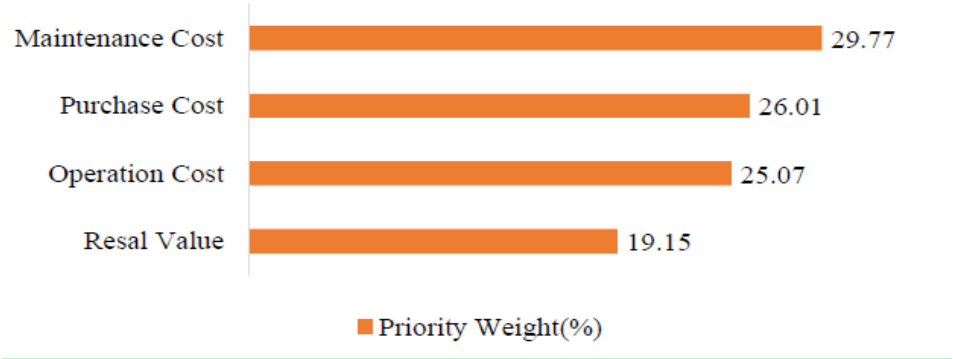


Figure 7-8: Factors' Priority Weight within the Economic Category (4-wheel Vehicles)

Source: Sotha Keo (2023).

According to Sotha Keo (2023), the economic evaluation of BEV adoption for four-wheel vehicles highlights that maintenance cost holds the highest priority weight at 29.77%, followed by purchase cost (26.01%) and operation cost (25.07%). Resale value, at 19.15%, is considered the least influential factor. These findings indicate that Cambodian consumers are most concerned about the ongoing expenses of maintaining and operating BEVs, rather than the initial purchase alone.

Overall, the results underscore the need for policies that reduce total ownership costs—such as maintenance subsidies, battery replacement programs, and affordable financing options—to make BEVs more accessible to middle-income consumers. Addressing economic sensitivity will be key to driving broader BEV adoption and achieving long-term sustainability in Cambodia's electric mobility market.

7.6.2.4. Infrastructure Availability and Charging Accessibility

The availability and accessibility of infrastructure form the backbone of successful BEV adoption, as consumers' willingness to transition from conventional vehicles is heavily dependent on the reliability and convenience of charging networks. In Cambodia, the limited number of public charging stations and service facilities remains one of the most significant barriers to widespread EV uptake. Infrastructure development not only facilitates daily vehicle use but also builds long-term confidence among potential buyers, particularly in regions where electric mobility is still emerging.

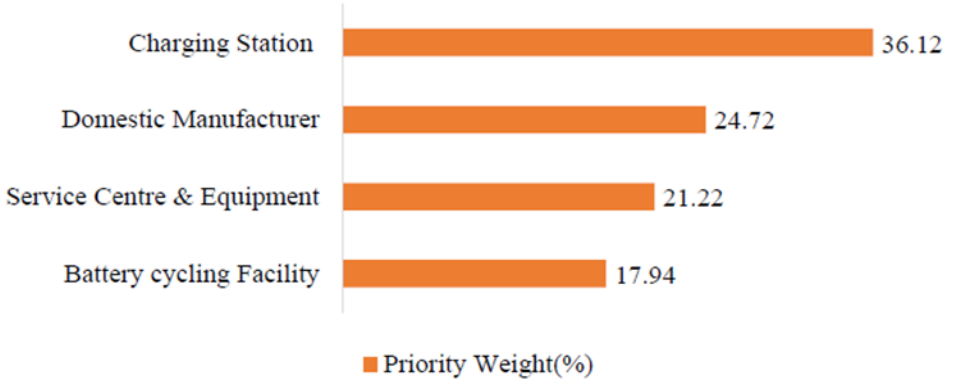


Figure 7-9: Factors' Priority Weight within Infrastructure Category (4-wheel Vehicles)

Source: Sotha Keo (2023).

According to Sotha Keo (2023), expert evaluations in the infrastructure category indicate that charging stations hold the highest priority weight at 36.12%, highlighting their critical role in promoting BEV adoption. This is followed by domestic manufacturers (24.72%) and service centers and equipment (21.22%), while battery recycling facilities rank lowest at 17.94%. These results suggest that experts consider charging availability the most immediate necessity, while local production capability and after-sales service infrastructure are also essential for long-term sustainability.

Overall, the findings underscore that strengthening Cambodia's EV infrastructure—through nationwide charging networks, local manufacturing partnerships, and service facility development—is crucial to supporting market readiness. As accessibility improves and operational support expands, consumer confidence in BEV ownership is expected to grow significantly, accelerating the country's transition toward sustainable electric mobility.

7.6.2.5. Government Incentives and Policy Influence

Government policies and incentives play a decisive role in shaping the early adoption of BEVs, particularly in emerging markets where private investment and consumer readiness remain limited. Well-designed fiscal and non-fiscal measures—such as tax exemptions, import duty reductions, charging subsidies, and public procurement programs—can significantly reduce the initial cost barrier while signaling long-term government commitment to clean mobility. Moreover, the establishment of clear technical standards, safety regulations, and infrastructure development plans helps strengthen consumer confidence and encourage broader participation from the private sector.

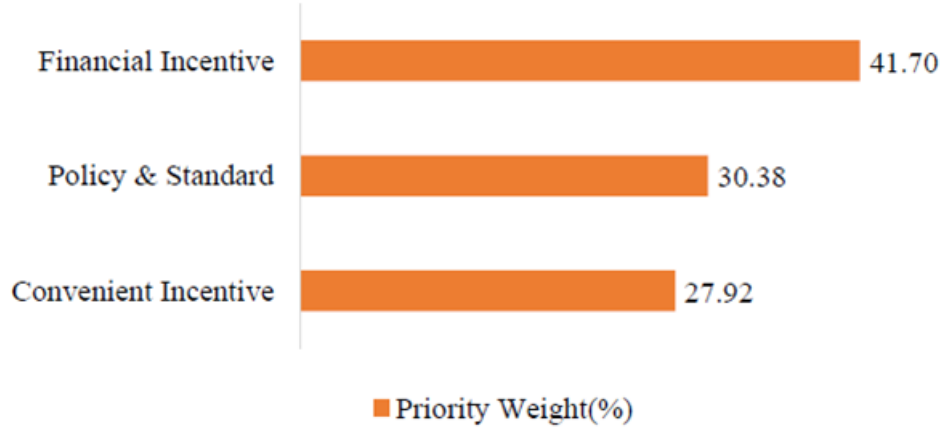


Figure 7-10: Factors' Priority Weight within Government Support Category (4-wheel Vehicles)

Source: Sotha Keo (2023).

According to the findings of Sotha Keo (2023), within the government support category, financial incentives were identified as the most influential factor for BEV adoption in Cambodia, carrying the highest priority weight of 41.70%. This was followed by policy and standard frameworks (30.38%) and convenient incentives such as simplified registration or parking privileges (27.92%). These results underscore that direct financial measures—such as tax reductions, import duty waivers, and purchase subsidies—are perceived as the most effective means of stimulating BEV demand, while supportive regulations and convenience measures serve as complementary enablers.

Overall, the findings suggest that the Cambodian government's active role in providing strong fiscal incentives and establishing a coherent policy framework will be essential for accelerating BEV market development. As consumer awareness and infrastructure gradually improve, sustained and transparent government engagement will remain the cornerstone of long-term EV adoption and industry growth in Cambodia.

7.6.2.6. Consumer Trust, Knowledge, and Social Influence

Consumer-related factors—such as trust in product reliability, awareness of technology, and social influence—play an essential role in shaping BEV adoption, particularly in emerging markets where electric mobility is still a relatively new concept. A lack of consumer confidence in performance, safety, and long-term maintenance often slows the transition toward electric vehicles. Similarly, limited public knowledge and exposure to BEV technology can hinder acceptance, as potential buyers rely heavily on peer influence and observed experiences to form their opinions.

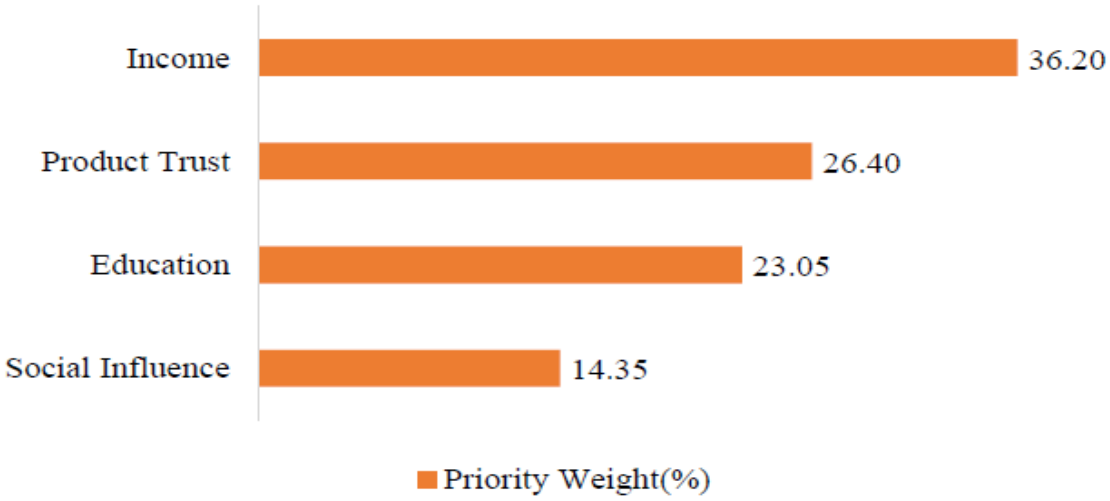


Figure 7-11: Factors' Priority Weight within Consumer Category (4-wheel Vehicles)

Source: Sotha Keo (2023)

According to the findings of Sotha Keo (2023), the expert assessment revealed that income is the most influential consumer factor affecting BEV adoption, accounting for 36.20% of the total priority weight. This is followed by product trust (26.40%) and education (23.05%), while social influence has the lowest weight at 14.35%. These results indicate that affordability and purchasing power remain the strongest determinants of BEV adoption among Cambodian consumers, while trust in product quality and access to knowledge also play supportive roles.

Overall, the findings suggest that enhancing consumer trust through quality assurance, product demonstration, and education campaigns—alongside improving affordability through financial support—will be crucial in expanding BEV adoption in Cambodia. Social influence remains limited at this stage but is expected to grow as early adopters begin to shape perceptions within their communities.

7.7 Assessment of NEV & Smart Mobility Market Preparedness

7.7.1. Country Assessment

Cambodia's Market Readiness Index records an overall score of 2.2, reflecting a moderate-to-low level of preparedness to support the development of the New Energy Vehicle (NEV) market and its associated ecosystem. Across the five evaluated dimensions (Figure 7-12), Vehicle Technology achieves the highest score (2.8), indicating that Cambodia has begun integrating NEV technology through vehicle imports and basic maintenance services. The Road and Digital infrastructure index also perform relatively well (2.6), suggesting that the country's road network and digital connectivity provide a functional foundation for NEV adoption.

The policy readiness index registers a moderate level (2.2), reflecting Cambodia's initial steps toward NEV promotion, mainly through tax reductions and import incentives. The market status index is comparatively low (1.7), highlighting that NEV adoption is still concentrated in urban centers. The lowest performance is observed in energy infrastructure (1.3), underscoring the scarcity of charging stations, reliability concerns.

Overall, Cambodia demonstrates emerging but uneven readiness for NEV development. The country shows promising progress in vehicle technology and road infrastructure, yet it requires substantial investment in energy infrastructure, market accessibility, and policy integration to enhance nationwide adoption. Strengthening coordination between NEV deployment and national charging networks will be crucial to accelerating consumer confidence and supporting long-term market growth.

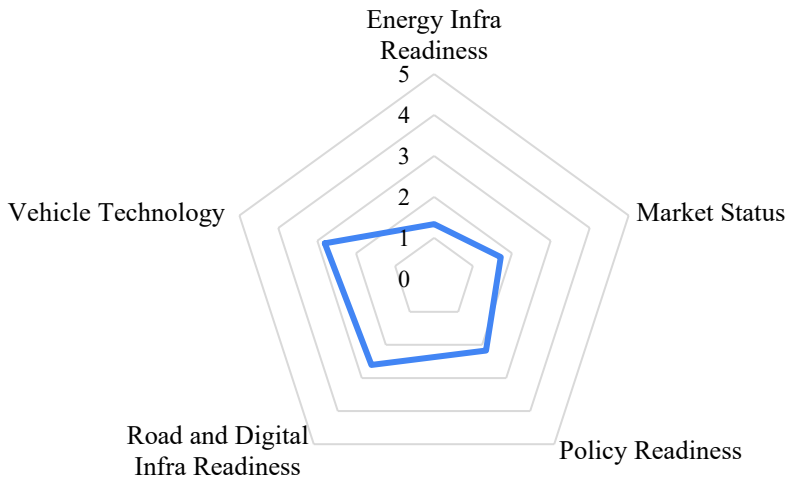


Figure 7-12: Market Readiness Index in Cambodia

Source: Author's calculation

7.7.1.1. Market Status Readiness Index

The Market Status index is constructed using annual data reported by the Ministry of Public Works and Transport of Cambodia (2025), providing a standardized basis for subsequent index score analysis. The BEV Penetration, the PHEV, REEV Penetration, and the ICV Penetration (L2 Autonomous) indices are calculated from the ratio of BEV/ PHEV, REEV/ICV sales to total sales in 2024. The motorization rate index is calculated from car ownership per 1,000 people. In addition, the DC Fast Charging Share Index

measures the proportion of public EV charging connectors that are DC fast chargers. Finally, the BEV Price and PHEV, REEV Price indices are computed as the ratios of BEV/ PHEV, REEV to ICE prices by model segment using car prices from the official websites of the respective automotive manufacturers (2025).

The radar chart shows the Market Status Readiness Index, which includes six key indicators: BEV penetration, PHEV/REEV penetration, ICV (L2 autonomous) penetration, motorization rate, DC fast charging share index, and BEV/PHEV price competitiveness. Cambodia's Market Status Readiness Index records a low overall score of approximately 1.7, broadly comparable to the levels observed in Vietnam and Lao PDR. The highest-performing indicator within this dimension is BEV price competitiveness (5.0), while most other indicators are assessed at relatively low levels.

In the BEV segment, the share of electric vehicles has increased markedly over the past two years, reaching approximately 11 percent of total vehicle sales. At present, Cambodia's electric vehicle market remains largely import-dependent, with Chinese manufacturers playing a dominant role. Nevertheless, several Chinese and South Korean automakers are accelerating investments in local production facilities in response to the growing domestic EV market.

In addition, the prices of imported BEVs are lower than those of comparable internal combustion engine vehicles, creating a strong incentive for consumers to shift toward electric vehicles. Looking ahead, Cambodia's automotive market is expected to undergo a structural transition from a heavy reliance on second-hand vehicle imports toward increased purchases of new vehicles. This transition suggests significant growth potential for the domestic automotive market, including further expansion of the BEV segment in the medium to long term.

PHEV and REEV penetration in Cambodia remains minimal (1.0), as the domestic market lacks targeted incentives for hybrid vehicles and has limited dealership networks offering diverse PHEV and REEV model options. Consequently, average prices of PHEV and REEV models remain higher than those of comparable internal combustion engine vehicles. Overall, Cambodia has increasingly become a destination market for BEV exports from China. Given that Chinese manufacturers have prioritized BEV development over PHEV and REEV technologies—where cost competitiveness with ICE vehicles remains weaker—the availability of PHEV and REEV models in the Cambodian market is highly limited.

Charging infrastructure also remains underdeveloped. The DC fast-charging network consists of only a small number of stations, primarily located in Phnom Penh and along major highways, while most charging activities rely on household outlets or slow-charging systems. This infrastructure constraint further limits the practicality of long-distance BEV use.

In addition, the Intelligent Connected Vehicle (ICV), particularly Level 2 autonomous driving technologies, is virtually absent from the Cambodian market. The motorization rate, measured as vehicles per 1,000 people, remains relatively low compared with neighboring countries such as Thailand and Vietnam, indicating limited household vehicle ownership. This condition is further compounded by high income inequality, which restricts private vehicle ownership for a large share of the population. Consequently, NEV adoption opportunities are currently concentrated among middle-income households, particularly those employed by foreign companies in the capital city.

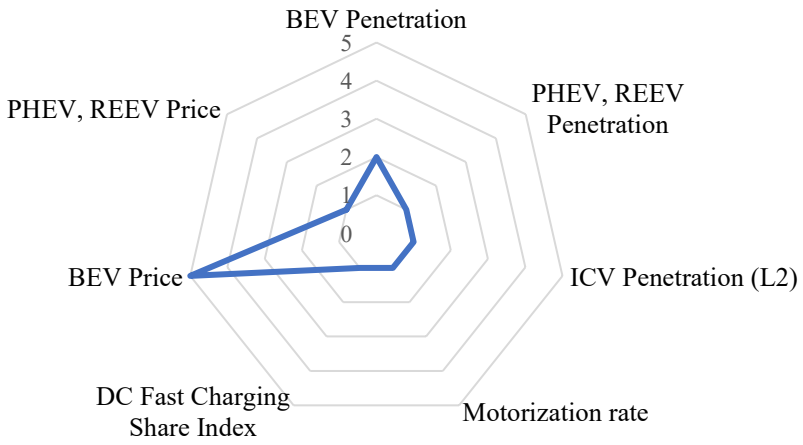


Figure 7-13: Market Status Index in Cambodia

Source: Author's calculation

Overall, Cambodia's market readiness is characterized by low adoption and infrastructure development but early signs of affordability and growing public interest in electric vehicles.

7.7.1.2. Policy Readiness Index

Overall, Cambodia records a low Policy Readiness Index score of 2.2, indicating that while foundational policy signals are emerging, the national framework for NEV and smart mobility development remains at an early stage.

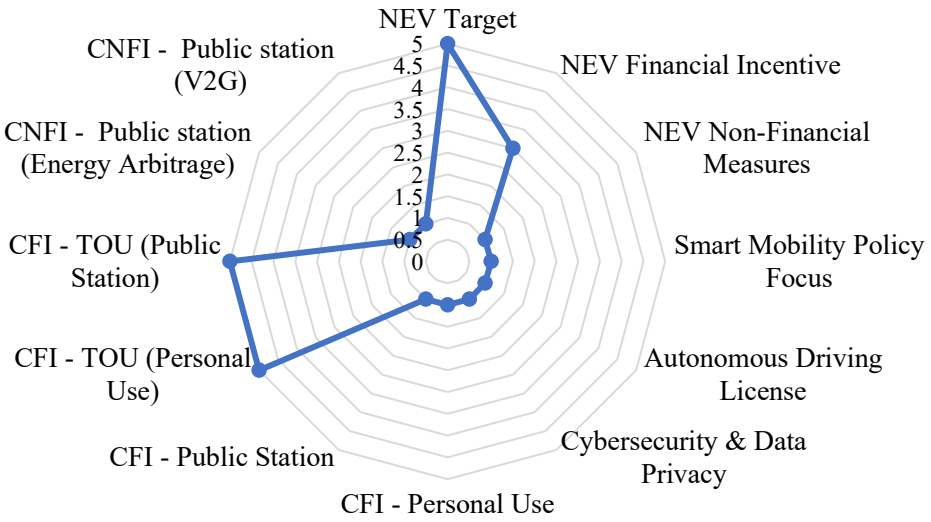
Cambodia demonstrates its strongest performance in NEV targets (5.0), reflecting a clear and quantifiable national commitment under the National Policy on Electric Vehicle Development (2024–2030). This commitment is particularly concentrated on electric motorcycles, which account for the majority of targeted vehicle registrations and align with Cambodia's transport structure. Another high-scoring area is Charging Financial Incentives – ToU (Public Station) (5.00). Under EAC Decision No. 014 (2021), public charging operators benefit from a substantial electricity price differential between peak (USD 0.1475/kWh) and off-peak hours (USD 0.0740/kWh), representing a reduction of approximately 49.8% when charging is shifted to off-peak periods. This large price gap provides a strong operational incentive for public charging infrastructure operators to optimize charging behavior and reduce grid stress.

In contrast, Cambodia's performance in NEV Financial Incentives (3.0) is assessed at a moderate level. Import duty reductions for NEVs—from rates as high as 30–40% down to around 10%—have helped improve vehicle affordability and stimulate early market entry. However, these incentives remain focused on vehicle imports and do not yet extend comprehensively to charging infrastructure or end-user adoption support.

Most other policy dimensions score at a low level (1.0), underscoring significant gaps in Cambodia's NEV and smart mobility governance framework. NEV non-financial measures (1.0) remain limited, with few regulatory tools such as preferential access, zoning policies, or fleet mandates in place. Smart mobility policy focus (1.0) is still nascent, as Cambodia lacks an integrated national strategy for connected, automated, or data-driven mobility systems. Similarly, autonomous driving pilot licensing (1.0) has not yet been established, and there are no formal regulatory pathways for testing or deploying autonomous or highly automated vehicles.

Institutional readiness for digital mobility is also weak. Cybersecurity and data privacy frameworks for EVSE and CAV (1.0) are largely absent, creating regulatory uncertainty for future deployment of connected charging systems and vehicles. Charging infrastructure development faces additional constraints. Charging Financial Incentives – Personal Use (1.0) remain underdeveloped, as there are no subsidies, rebates, or tax incentives for residential charger installation. Likewise, Charging Financial Incentives – Public Station (1.0) are limited to tariff-based measures, with no direct capital subsidies or operational support for charging station developers.

Time-of-Use incentives further highlight structural imbalances. While public charging stations benefit from differentiated tariffs, Charging Financial Incentives – ToU (Personal Use) (1.0) remain unavailable to most households, as residential users are subject to flat or block tariffs without time-based differentiation. On the non-financial side, Cambodia scores 1.0 for both Charging Non-Financial Incentives – Public Station (Energy Arbitrage) and Charging Non-Financial Incentives – Public Station (V2G). There is no formal regulatory framework enabling electricity arbitrage, bidirectional charging, or participation of charging operators and prosumers in energy markets. The single-buyer electricity market structure managed by Electricité du Cambodge (EDC) further constrains experimentation with advanced smart-charging or V2G models.



Note: CFI - Charging Financial Incentive; CNFI - Charging non-Financial Incentive

Figure 7-14: Policy Index in Cambodia

Source: Author's calculation.

7.7.1.3. Energy Infrastructure Readiness Index

The Figure 7-15: present the Energy Infrastructure Index, which includes 3 key indicators: Smart Grid Readiness, Charging communication protocol standard - Single platform, NEVs per charging pile – cumulative AC/DC.

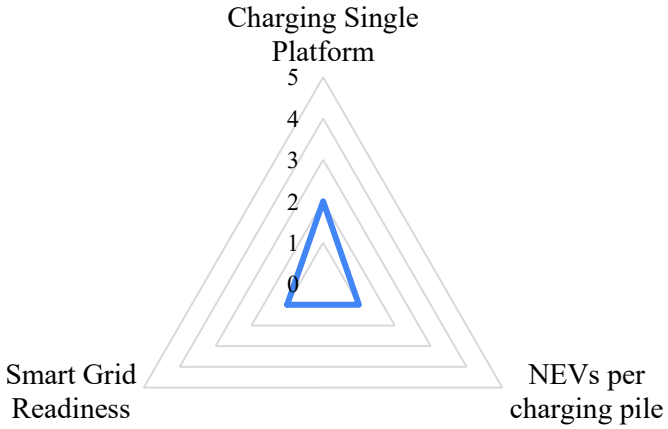


Figure 7-15: Energy Infrastructure Index in Cambodia

Source: Author's calculation.

Cambodia's smart grid readiness is currently in an early developmental phase. Progress has been observed in the reinforcement of transmission and distribution networks and the initial integration of digital solutions. Due to this developmental status, there is limited publicly accessible data regarding the Smart Grid Index (SGI) as reported by the SPP group for the nation. Nevertheless, benchmarking against countries possessing comparable grid structures suggests that Cambodia's overall readiness score likely falls within the 60% to 70% range.

Cambodia also currently lacks a dedicated national standard governing NEV charging communication protocol. However, the overarching policy direction demonstrates strong support for establishing a unified platform to guarantee interoperability, security, and scalability across charging infrastructure. Specifically, the National Policy on the Development of Electric Vehicles (2024–2030) mandates the standardization of charging interfaces and communication systems. It is anticipated that in the near term, the government will adopt international best practices, such as OCPP (Open Charge Point Protocol), to form the foundation of this national framework. Based on this stage—where the need for standardization is acknowledged in policy, but formal mandatory action or widespread deployment is pending—Cambodia is assigned a score of 2.0 in the Charging Communication Protocol Standard - Single Platform Index.

Moreover, the NEV charging infrastructure has demonstrated rapid expansion in recent years, becoming a pivotal element in the national transition to New Energy Vehicles. As of April–May 2025, the ecosystem comprised approximately 7,610 registered NEVs serviced by an estimated 385 charging piles nationwide. This estimation is derived from 154 public charging stations, assuming a moderate average of 2.5 charging piles per station. This configuration yields a NEV-to-pile ratio of approximately 20:1. Consequently, based on this ratio, Cambodia is assessed as having a score of 1.0 in the NEVs per Charging Pile – Cumulative AC/DC Index.

7.7.1.4. Road and Digital Infrastructure Readiness Index

The Road and Digital Infrastructure Index includes 5 key indicators: 5G Coverage / Mobile connection speed, Traffic Management Systems, Road Quality, Road Environment, Traffic separation.

Cambodia demonstrates a high level of 5G coverage and mobile connection speed (around level 4.7), reflecting a well-established nationwide network that supports digital connectivity across both urban and rural areas. Similarly, the Road Environment indicator also scores high (4.0), indicating the presence of locally standardized traffic lights, road signs, and signaling systems throughout the country.

However, Road Quality remains relatively low.According to the World Economic Forum (2019), Cambodia recorded a Quality of Road Infrastructure (QRI) score of 3.33, which corresponds to approximately 2.4 under this study's evaluation scale. This suggests that the condition and maintenance of road surfaces are not yet consistent or comprehensive nationwide.

In contrast, both Traffic Management Systems and Traffic Separation indicators remain at low levels (1.0). Cambodia has yet to develop a Vehicle-to-Infrastructure (V2I) communication system that enables data exchange between vehicles and traffic signals. Moreover, the country lacks a clear separation between motorcycles and cars, as motorcycles remain the dominant mode of transportation. Government policies even encourage the expansion of electric motorcycle usage rather than restricting it.

Overall, Cambodia's Road and Digital Infrastructure Readiness Index remain at a moderate level (2.6). While the country shows strong digital network coverage and a standardized road environment, the absence of V2I integration and limited traffic separation continue to constrain its readiness to support New Energy Vehicles (NEVs) and intelligent transport systems soon.

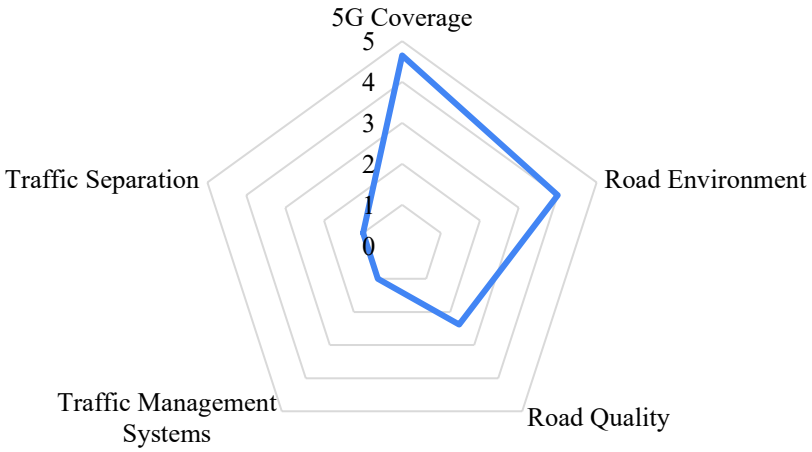


Figure 7-16: Road and Digital Infrastructure Index in Combodia

Source: Author's calculation.

7.7.1.5. Vehicle technology Readiness Index

The Vehicle Technology index assesses the technological capabilities of new energy vehicles (NEVs) using annual data from the official websites of the respective automotive manufacturers (2025). The BEV Product Offering (range distance) index is calculated from the average driving range of BEV models in the market, weighted by the number of models, while the PHEV, REEV Product Offering (range distance) index draws on the average BEV-mode range of PHEV and REEV models, similarly weighted. The NEV experience (years) index measures the number of years since the country initiated its national NEV action plans, capturing the policy-driven timeline of market development. In addition, the BEV Model variety and the PHEV, REEV Model variety indices are computed as the ratios of BEV and PHEV/REEV models to ICE models, respectively, reflecting the diversification of electrified product offerings.

The radar chart presents the Vehicle Technology Readiness Index, evaluating BEV product offering (range distance), PHEV/REEV product offering, NEV experience, and model variety for both BEV and PHEV/REEV segments. Overall, Cambodia demonstrates a relatively favorable level of vehicle technology readiness, with an overall score of 2.8, largely driven by market competition among Chinese, Japanese, and Korean automotive manufacturers.

The key contributors to this readiness are BEV product offering (score of 4.5), BEV model variety (3.0), and accumulated NEV market experience (3.0).

In terms of product performance, imported BEVs in Cambodia typically offer driving ranges of approximately 400–500 kilometers, indicating access to advanced vehicle technologies through imports from China and Korea. BEV model variety is assessed at a moderate level, as consumers can choose from multiple models across key vehicle segments. However, given the relatively small size of the Cambodian automotive market, the breadth of available BEV models remains narrower than in larger regional markets such as Thailand.

NEV market experience remains limited, as both policy frameworks and market activity have only recently gained momentum. This development has been guided primarily by the Cambodia Electric Mobility Strategy (2023–2030), which sets targets of achieving 40 percent electric motorcycle adoption and 10 percent electric car penetration by 2030. As a result, Cambodia's vehicle technology readiness is supported more by imported technology and competitive market entry than by long-standing domestic experience or a mature policy ecosystem.

The driving range and model variety of PHEV and REEV vehicles are assessed at 2.5 and 1.0, respectively, as these vehicle types remain rare in the Cambodian market due to limited consumer awareness and the absence of well-established dealership representation. As a result, both market visibility and product diversity for PHEV and REEVs are constrained.

Nevertheless, the available PHEV models in the market exhibit electric-only driving ranges of approximately 30–100 kilometers, a performance level that is generally suitable for daily urban commuting. Despite this technical suitability, the lack of supporting policies, limited marketing efforts, and low consumer familiarity continue to hinder broader adoption of PHEV and REEV technologies in Cambodia.

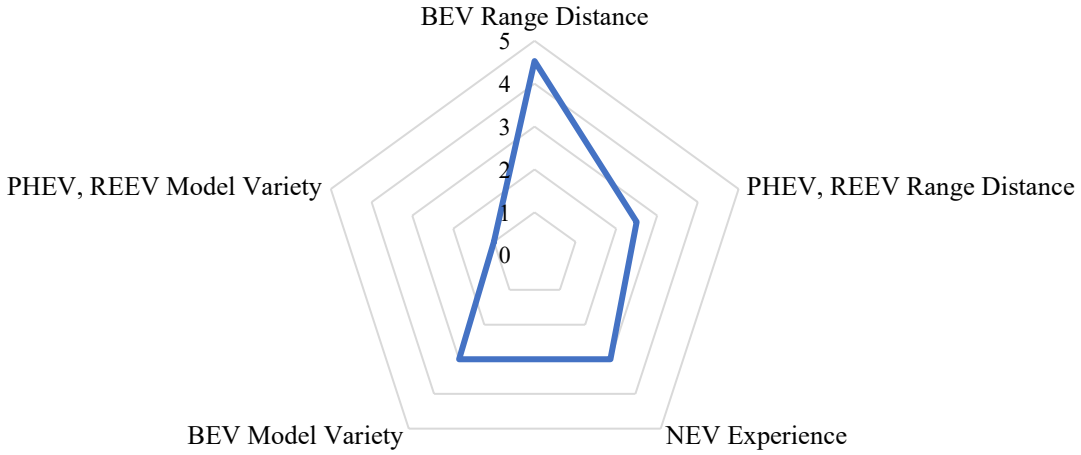


Figure 7-17: Vehicle Technology Index in Cambodia

Source: Author's calculation.

7.7.2. Key Success Factors and Gap Analysis

7.7.2.1. Key Success Factors

Cambodia's transition toward New Energy Vehicles (NEVs) and smart mobility is supported by several structural and emerging strengths that provide a foundational platform for future development, despite the market's early stage. One of the most important success factors is the rapid improvement in vehicle technology availability driven by imports. The Cambodian NEV market has benefited from strong competition among Chinese, Japanese, and Korean manufacturers, resulting in the availability of battery electric vehicles (BEVs) with relatively advanced specifications. Imported BEVs commonly offer driving ranges of 400–500 kilometers and are available across multiple vehicle segments, allowing Cambodian consumers access to modern NEV technology without requiring domestic manufacturing capacity. This import-led technology diffusion has helped lower entry barriers and accelerate early market exposure.

A second key success factor is price competitiveness, particularly in the BEV segment. Due to reduced import duties and favorable tax treatment, the retail prices of BEVs are often lower than or comparable to internal combustion engine (ICE) vehicles in the same class. This unusual price inversion, combined with rising fuel costs, has created a strong economic rationale for consumers to consider BEVs. As a result, BEV adoption has increased rapidly in recent years, reaching a meaningful share of new vehicle sales despite the absence of extensive charging infrastructure.

Cambodia also benefits from a relatively strong road environment and digital connectivity foundation. Nationwide mobile network coverage and high mobile connection speeds provide a basic digital backbone that can support future smart mobility applications. In parallel, the presence of standardized traffic signs, signals, and road markings—particularly on newly constructed expressways—supports the

safe operation of modern vehicles and camera-based driver assistance systems. These conditions form an essential baseline for more advanced connected and intelligent transport systems in the future.

On the policy side, Cambodia has demonstrated clear strategic intent through quantified national NEV targets, especially for electric motorcycles, which align well with the country's transport structure and income levels. The National Policy on the Development of Electric Vehicles (2024–2030) provides a formal policy anchor and signals long-term government commitment. In addition, differentiated Time-of-Use (ToU) electricity tariffs for public charging stations create strong operational incentives for charging operators to shift demand to off-peak periods, helping to manage grid stress and reduce operating costs.

Finally, Cambodia's NEV transition is supported by early institutional learning and policy experimentation. Although still limited in scope, recent regulatory steps—such as licensing and oversight of charging services and references to standardization in national policy documents—indicate growing awareness of system-level requirements, including interoperability and grid integration. These early actions provide a foundation upon which more comprehensive frameworks can be built.

7.7.2.2. Gap Analysis

Despite these emerging strengths, Cambodia faces significant and interrelated gaps that constrain the scalability, inclusiveness, and long-term sustainability of its NEV market and smart mobility ecosystem. The most critical gap lies in energy and charging infrastructure readiness. While the number of registered NEVs has grown rapidly, the expansion of charging infrastructure has not kept pace. Public charging stations remain limited in number and are heavily concentrated in Phnom Penh and a small number of highway corridors. The resulting imbalance between vehicle growth and charging availability increases range anxiety, restricts long-distance travel, and undermines consumer confidence outside major urban areas.

A second major gap is the absence of comprehensive smart grid and charging system integration. Cambodia's electricity system remains largely conventional, with limited digitalization and no formal mechanisms for advanced demand management. Residential users lack access to Time-of-Use pricing, reducing incentives for efficient home charging. Furthermore, there is no regulatory framework enabling electricity arbitrage, bidirectional charging, or Vehicle-to-Grid (V2G) participation. The single-buyer electricity market structure further limits experimentation with flexible charging and grid services, constraining the system's ability to accommodate large-scale NEV penetration in the future.

Policy and institutional gaps also remain substantial. While vehicle import incentives and national targets provide important signals, non-financial policy instruments are largely underdeveloped. Cambodia lacks regulatory tools such as preferential access schemes, fleet electrification mandates, low-emission zones, or urban priority measures that could stimulate demand beyond early adopters. In addition, there is no integrated national strategy for smart mobility, connected vehicles, or data-driven transport systems, limiting cross-sector coordination between transport, energy, and digital authorities.

Another critical weakness is the limited development of cybersecurity and data governance frameworks. As charging infrastructure and vehicles become increasingly connected, the absence of clear rules governing data ownership, privacy, and system security creates regulatory uncertainty for investors and technology providers. This gap poses long-term risks to system reliability and public trust, particularly if Cambodia seeks to adopt smart charging, connected vehicle services, or digital traffic management platforms.

From a market perspective, NEV adoption remains narrowly concentrated. While BEVs have gained traction, this growth is largely confined to urban, middle-income consumers, often employed by foreign firms. PHEV and REEV adoption remains minimal due to limited model availability, weak dealership

networks, and the absence of targeted incentives. Low motorization rates and income inequality further constrain mass-market expansion, while reliance on second-hand ICE vehicle imports continues to shape consumer behavior.

Finally, Cambodia faces a structural capacity gap in human capital and domestic industry development. The NEV ecosystem remains fully dependent on imports, with limited local technical expertise in EV maintenance, battery diagnostics, or charging system operation. Workforce training programs, R&D capacity, and domestic value-chain participation remain underdeveloped, limiting opportunities for technology transfer, job creation, and long-term cost reduction.

7.8 Policy Recommendations

Cambodia's NEV and smart mobility transition is at an early but strategically important stage. While the country benefits from improving vehicle technology availability, competitive BEV pricing, and relatively strong digital connectivity, progress is constrained by weak energy infrastructure, fragmented policy instruments, and limited market depth outside major urban areas. To translate early momentum into sustained and inclusive growth, Cambodia should pursue a sequenced and integrated policy approach focused on five priority areas.

1) Accelerate Nationwide Charging Infrastructure Development Through Public–Private Coordination

The most critical constraint on Cambodia's NEV market is the limited availability and uneven distribution of charging infrastructure. The government should move beyond tariff-based incentives and introduce targeted capital support mechanisms for public and semi-public charging deployment, particularly along national highways, border crossings, tourism corridors, and secondary cities. Public–private partnership (PPP) models—co-financed by development partners—can help reduce upfront investment risks while accelerating network scale. In parallel, clear licensing procedures and standardized technical requirements under the EV charging Prakas should be complemented by transparent grid-connection rules to encourage private operator participation.

2) Extend Charging Incentives to Residential Users and Enable Smart-Charging Mechanisms

Current electricity pricing incentives mainly benefit public charging stations, leaving residential NEV users without direct cost signals to shift charging behavior. Cambodia should gradually introduce Time-of-Use (ToU) tariffs for low-voltage residential customers, beginning with voluntary pilot programs for NEV owners. This should be accompanied by incentives for smart chargers capable of load management. Over time, enabling regulatory provisions for energy arbitrage and vehicle-to-grid (V2G) pilots—starting with fleet applications—would enhance grid flexibility and prepare the energy system for higher NEV penetration.

3) Strengthen Policy Coordination and Expand Non-Financial NEV Measures

While Cambodia has articulated clear NEV targets, policy implementation remains fragmented across institutions. Establishing an inter-ministerial coordination mechanism—linking transport, energy, environment, and digital governance agencies—would improve policy coherence and accelerate decision-making. Beyond fiscal tools, Cambodia should introduce non-financial measures such as government fleet electrification mandates, preferential access or parking for electric vehicles in urban areas, and pilot low-emission zones in Phnom Penh and major tourism cities. These measures would create visible demand signals and strengthen consumer confidence without imposing significant fiscal burdens.

4) Build Foundations for Smart Mobility and Connected Transport Systems

Cambodia's relatively strong mobile connectivity provides a foundation for gradual smart mobility development, even if advanced CAV applications remain a long-term objective. Priority should be given to upgrading traffic management systems in major cities through data integration, adaptive signal control, and centralized traffic monitoring. New expressway and urban infrastructure projects should adopt "V2X-ready" design principles, including standardized lane markings, sensor-compatible traffic signals, and digital mapping. Establishing regulatory frameworks for data governance, cybersecurity, and future pilot testing will be essential to ensure safe and scalable deployment.

5) Develop Human Capital and Local Industrial Capability

Cambodia's NEV market currently relies almost entirely on imported vehicles and technologies. To improve long-term resilience, the government should promote workforce development programs for EV technicians, charging infrastructure maintenance, and battery handling. Investment incentives under the Investment Law should be more explicitly aligned with EV assembly, component manufacturing, and recycling activities, particularly for electric two- and three-wheelers where Cambodia has strong market potential. Strengthening local capacity will support after-sales services, reduce operational risks, and create green employment opportunities.

Chapter 8 Summary

8.1 Country Benchmarking and Key Finding

8.1.1. Market Readiness: Comparative Country Assessment

The assessment of market readiness within the Lancang-Mekong subregion reveals that China possesses a distinct advantage, emerging as the most prepared nation with a score of 4.2 out of 5.0. In contrast, Thailand and Vietnam exhibit comparable levels of moderate readiness, scoring 2.8 and 2.7, respectively. Cambodia and Laos demonstrate lower readiness levels, with scores of 2.2 and 1.8, respectively. These findings serve as a critical basis for evaluating the future growth potential of New Energy Vehicles (NEVs) and smart mobility across these subregional markets.

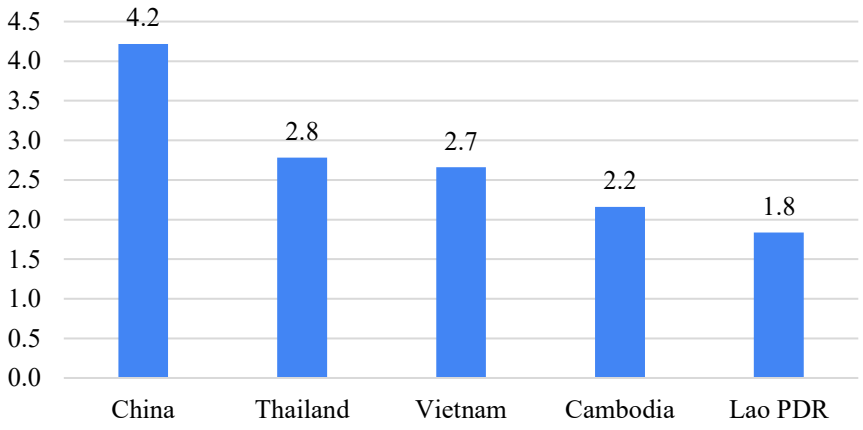


Figure 8-1: Comparative Country Assessment of Market Readiness

8.1.1.1. Market Status Readiness

China's NEV market is the most mature, with broad model availability, widespread fast-charging deployment, and a diversified mix of powertrain technologies. Thailand demonstrates moderate market development, supported by improving BEV penetration and fast-charging availability, though advanced powertrain options remain limited. Vietnam, Cambodia, and Lao PDR show similar early-stage characteristics, where affordability of BEVs is relatively favorable but overall market depth is constrained by low fast-charging penetration, limited model diversity, and low motorization levels. In these emerging markets, electric two-wheelers and entry-level BEVs play a more dominant role than passenger cars or advanced electrified vehicles.

8.1.1.2. Policy Readiness

China stands out for its comprehensive and well-coordinated policy framework, encompassing financial and non-financial incentives, smart mobility strategies, cybersecurity and data governance, and regulatory support for advanced charging technologies such as V2G. Vietnam and Thailand occupy a transitional position, with strong NEV targets and selective financial incentives, but weaker coverage in areas such as autonomous driving regulation, smart mobility integration, and non-financial charging incentives. Cambodia has articulated clear NEV targets and introduced some tariff-based incentives, particularly related to electricity pricing, yet broader institutional frameworks—covering smart mobility, cybersecurity, and advanced charging regulation—remain underdeveloped. Lao PDR shows

the greatest policy gaps, with limited regulatory instruments beyond high-level targets and fiscal incentives.

8.1.1.3. Energy Infrastructure Readiness

China clearly leads in energy infrastructure readiness, supported by a fully integrated national charging platform, strong smart-grid capabilities, and a balanced ratio between NEVs and charging piles. Vietnam follows, benefiting from relatively strong grid preparedness and a more favorable charger-to-vehicle balance, although platform integration remains fragmented. Thailand occupies a middle position, with reasonable smart-grid development but weaker coordination across charging systems and lower charger availability relative to vehicle growth. Cambodia and Lao PDR remain at an early stage, characterized by limited smart-grid functionality, fragmented charging deployment, and insufficient charging density, which constrains large-scale NEV adoption.

8.1.1.4. Road and Digital Infrastructure Readiness

China benefits from a highly developed digital and transport ecosystem, combining extensive 5G coverage, advanced traffic management systems, and strong road quality, which collectively support smart mobility and automated driving applications. Thailand performs relatively well in road conditions and digital connectivity, but lags in intelligent traffic management and traffic separation systems. Vietnam and Cambodia display comparable readiness levels, with adequate basic road infrastructure and widespread mobile coverage, yet limited deployment of digital traffic management platforms. Lao PDR trails the group, constrained by weaker road conditions and limited intelligent transport infrastructure, which poses challenges for scaling smart mobility solutions.

8.1.1.5. Vehicle Technology Readiness

China maintains a strong advantage in vehicle technology, with extensive BEV model variety, mature user experience, and competitive range performance across multiple vehicle segments. Vietnam and Thailand show growing technological readiness, supported by improving model availability and competitive driving ranges, although consumer exposure to advanced NEV features remains uneven. Cambodia demonstrates reasonable range performance and basic model availability but lacks depth in advanced vehicle technologies and powertrain diversity. Lao PDR remains at an early stage, with limited model offerings and minimal exposure to advanced NEV technologies, despite acceptable range performance in a narrow set of vehicles.

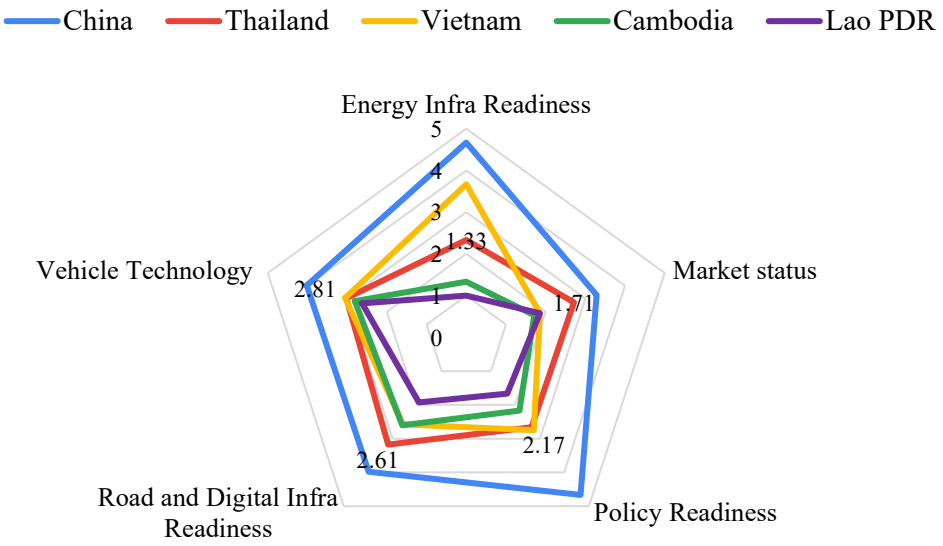


Figure 8-2: Comparative Country Assessment of Key Indices

8.1.2. Gaps and Challenges

With the exception of China, Thailand, Vietnam, Cambodia, and Lao PDR share a common transition challenge: moving from early-stage NEV promotion—focused on targets, basic incentives, and initial infrastructure—toward a systems-oriented NEV ecosystem that integrates charging, power markets, digital governance, and smart mobility. The most critical shared gaps are not in ambition or basic policy direction, but in advanced regulatory design, institutional coordination, and market mechanisms, which will increasingly determine the pace and quality of NEV and smart-mobility adoption in the next phase of development.

1) Advanced Charging Policy and Market Mechanisms

The most consistently shared gap across all four countries lies in advanced charging-related policy instruments and market mechanisms. While basic charging deployment is progressing unevenly, regulatory readiness for energy arbitrage, Vehicle-to-Grid (V2G), and smart charging integration remains weak. None of the four countries has fully established a regulatory framework that enables charging operators or vehicle owners to actively participate in electricity markets, provide grid services, or monetize flexibility. This reflects both institutional constraints—often linked to single-buyer electricity market structures—and limited coordination between transport and energy regulators. As a result, charging infrastructure is largely treated as passive load rather than as a system asset.

2) Autonomous Driving Governance and Smart Mobility Frameworks

A second major shared challenge is the absence of comprehensive smart mobility and autonomous driving policy frameworks. Thailand, Vietnam, Cambodia, and Lao PDR generally lack clear licensing regimes, defined pilot zones, or inter-agency governance structures for autonomous vehicles and connected mobility systems. While some countries have expressed strategic interest in smart mobility, implementation remains fragmented or conceptual. This limits opportunities to integrate NEVs into broader intelligent transport systems and constrains innovation in logistics, public transport, and urban mobility services.

3) Cybersecurity and Data Governance for NEVs and Charging Networks

Another prominent shared weakness is cybersecurity and data privacy governance related to NEVs, EVSE, and connected vehicles. Unlike more mature markets, these four countries have not yet translated general digital or cybersecurity laws into sector-specific requirements for charging infrastructure, vehicle data exchange, or vehicle-to-everything (V2X) communications. This gap increases long-term risks related to system interoperability, consumer trust, and cross-border roaming, and may become more critical as charging networks scale and digitalization deepens.

4) Limited Consumer-Level Charging Incentives, Especially for Home Charging

Across Thailand, Vietnam, Cambodia, and Lao PDR, consumer-facing financial incentives for residential charging infrastructure are largely absent or underdeveloped. Policy support tends to focus on vehicle import duties or public charging tariffs rather than on household charger installation, smart charger deployment, or demand-response participation. This common gap slows mass-market adoption, particularly outside urban centers and among private vehicle owners who rely on home charging as the primary use case.

5) Uneven DC Fast-Charging Network Development

All four countries also share a gap in high-power DC fast-charging deployment, especially along highways and intercity corridors. Charging infrastructure growth has tended to prioritize urban or pilot locations, with limited coverage for long-distance travel. This constrains consumer confidence and reinforces the perception that NEVs are suitable mainly for short-range or urban use. While the degree of this gap varies, it remains a common structural limitation across the region.

6) Early-Stage Market Depth Beyond Entry-Level NEVs

At the market level, the four countries exhibit a shared challenge in limited NEV ecosystem depth, particularly beyond entry-level or two-wheeler segments. Passenger BEV penetration, model diversity, and advanced vehicle features remain constrained, while plug-in hybrid and range-extender segments are underdeveloped. This reflects both demand-side affordability issues and supply-side limitations, including smaller domestic markets and lower OEM localization.

7) Institutional Coordination Between Energy and Transport Sectors

Finally, a more moderate yet persistent shared gap lies in cross-sector coordination between energy, transport, and digital authorities. While policies exist in parallel—such as power development plans and EV roadmaps—integration remains limited. This affects grid planning for charging, deployment of smart charging, and alignment between mobility electrification and renewable energy integration.

8.2 Policy Recommendations

Across the five assessed countries, NEV markets are at different stages of maturity, but a common structural challenge emerges: the transition from policy-driven adoption to a systems-oriented NEV ecosystem integrating vehicles, energy, digital infrastructure, and mobility services.

Importantly, not all gaps identified through the readiness assessment warrant direct government intervention. In markets where NEV technologies are already cost-competitive and widely available—most notably China—continued heavy-handed intervention risks distorting price signals and crowding out private innovation. Conversely, in Thailand, Vietnam, Cambodia, and Lao PDR, targeted public action remains essential to address coordination failures, infrastructure externalities, and regulatory voids that markets alone cannot resolve.

Accordingly, policy recommendations are structured under two complementary approaches. First, country-specific policy priorities, reflecting each market's readiness level and structural gaps. Second, sub-regional cooperation, leveraging China's system maturity to support ecosystem development in neighboring markets.

8.2.1. China: Market-Driven Maturity with Strategic System Alignment

China's NEV ecosystem has reached a stage where product competitiveness, scale economies, and consumer acceptance are largely secured. The primary policy challenge is no longer adoption, but system optimization and inclusiveness.

Policy priorities should therefore shift toward:

1) Market-aligned affordability improvements, particularly through continued battery innovation (e.g., LFP and sodium-ion technologies) to reduce lifecycle costs without direct consumer subsidies.
2) Scaling smart mobility and autonomous driving, maintaining regulatory flexibility via local pilots while strengthening national standards for safety, interoperability, and cybersecurity.
3) Deep integration of NEVs with renewable energy systems, embedding charging demand forecasts into provincial grid and renewable planning, and enabling market-based mechanisms such as carbon trading and V2G participation.
4) Modernizing energy infrastructure beyond coastal regions, ensuring that inland provinces can accommodate rising NEV loads and benefit equitably from smart-grid investments.
5) Institutional coordination and green finance, shifting from fiscal subsidies toward market instruments that mobilize private capital and reward system flexibility.

China's role thus evolves from market creator to system architect, with policy focused on alignment, resilience, and regional spillovers.

8.2.2. Thailand: From Incentive-Led Growth to Ecosystem Consolidation

Thailand has successfully stimulated NEV adoption and attracted global manufacturers, but the next phase requires ecosystem coherence rather than additional incentives.

Key priorities include:

1) Deepening local value creation, moving beyond assembly toward batteries, power electronics, vehicle software, and workforce upskilling.
2) Correcting infrastructure imbalance, particularly the high NEVs-per-charger ratio, through accelerated deployment along national corridors and in secondary cities.
3) Mandating charging interoperability, eliminating platform fragmentation and enabling smart charging, roaming, and future V2G services.
4) Aligning NEVs with renewable energy and grid modernization, ensuring electrification supports—not strains—the power system.
5) Formalizing aggregator and V2G regulation, transitioning from sandbox pilots to scalable market participation.
6) Strengthening smart mobility and ITS deployment, moving from isolated pilots to integrated urban and logistics systems.
7) Improving governance and consumer protection, especially after-sales service, warranties, and workforce readiness.

Thailand's transition challenge is institutional rather than technological: integrating energy, transport, and digital systems into a unified mobility framework.

8.2.3. Vietnam: From Rapid Expansion to Competitive and Interoperable Systems

Vietnam's NEV growth has been fast and decisive, supported by strong policy commitment and private investment. However, rapid scaling has exposed risks of market concentration and future system fragmentation.

Policy priorities should focus on:

1) Mandatory national interoperability standards, ensuring charging networks remain open, competitive, and V2G-ready.
2) Pro-competition regulation, reducing dependency on a single dominant charging operator and encouraging diversified private participation.
3) Geographically balanced expansion, extending NEV adoption beyond major metropolitan areas through targeted regional programs.
4) A formal smart-mobility and autonomous-vehicle roadmap, translating strong digital readiness into operational ITS and V2X systems.
5) Expanded smart-charging and ToU tariffs, aligning charging demand with grid capacity and renewable availability.
6) Technology and workforce diversification, strengthening after-sales capacity and reducing long-term systemic risk.

Vietnam's key task is to consolidate early success into a resilient, interoperable, and competitive ecosystem

8.2.4. Cambodia: Laying the Foundations for System Readiness

Cambodia's NEV transition remains at an early stage, where basic infrastructure and institutional coordination are the binding constraints.

Priority actions include:

1) Accelerating nationwide charging deployment, moving beyond tariff incentives to capital support and PPP models, especially along highways and tourism corridors.
2) Extending charging incentives to residential users, gradually introducing ToU tariffs and smart-charging pilots for households.
3) Strengthening policy coordination and non-financial measures, including government fleet electrification and visible urban incentives.
4) Building smart-mobility foundations, starting with traffic management systems, V2X-ready infrastructure, and data governance frameworks.
5) Developing human capital and local capabilities, particularly for EV maintenance, charging operations, and two- and three-wheeler manufacturing.

For Cambodia, the priority is not advanced technologies but sequencing—ensuring infrastructure, regulation, and capacity develop in parallel.

8.2.5. Lao PDR: Aligning Energy Strengths with Mobility Readiness

Lao PDR's clean-energy endowment creates strong alignment between NEVs and national energy goals, yet policy and infrastructure remain fragmented.

Key priorities include:

1) Improving market affordability and access to finance, through EV-specific loans, fleet programs, and targeted consumer incentives.
2) Developing a national smart-mobility master plan, linking transport electrification with digital and energy strategies.
3) Expanding charging infrastructure beyond Vientiane, using PPPs to support highways, logistics hubs, and tourism areas.
4) Introducing smart tariffs and basic ToU structures, improving grid efficiency and investment signals.
5) Adopting international standards early, preventing fragmentation and enabling regional interoperability.
6) Strengthening institutional coordination and human capital, ensuring policy implementation capacity keeps pace with ambition.

Lao PDR's transition hinges on policy coherence and capacity building, rather than technology availability.

8.2.6. Sub-Regional Cooperation

Beyond national policies, the readiness assessment highlights a strong case for sub-regional cooperation, particularly between China and the four ASEAN neighbors.

1) Regional Charging and Interoperability Standards

China can support the adoption of interoperable charging and communication standards (e.g., OCPP-based platforms, ISO-aligned protocols) across the sub-region, reducing fragmentation and enabling cross-border mobility.

2) Infrastructure and Grid Modernization Support

Through development finance, concessional lending, and joint PPP models, China can help accelerate charging corridors, grid upgrades, and smart-metering deployment in Thailand, Vietnam, Cambodia, and Lao PDR.

3) Technology Transfer and Industrial Collaboration

Joint ventures, supplier development programs, and workforce training initiatives—particularly in batteries, power electronics, and charging equipment—can strengthen local value chains while integrating them into regional supply networks.

4) Smart Mobility and ITS Knowledge Sharing

China's experience with large-scale ITS, autonomous driving pilots, and V2X deployment provides valuable templates for phased implementation in less mature markets.

5) Regional Pilot Projects and Demonstration Corridors

Cross-border NEV freight corridors, electric tourism routes, and smart-logistics pilots could serve as tangible demonstrations of integrated mobility systems, accelerating learning and policy convergence.

Chapter 9 Qualitative Data Collection and Field Study Visit

9.1 China

9.1.1. List of Visited Companies and Organization

No.	Company/Organization	Visit/Date
1.	BYD Headquarters	June 23rd, 2025
2.	CATARC Shenzhen and EV Charging Service Providers	June 23rd, 2025
3.	Shenzhen Future Mobility Experience	June 24th, 2025
4.	Huawei Shenzhen Base Flagship Store	June 24th, 2025
5.	CATARC Automotive Test Center (Guangzhou) Co., Ltd.	June 25th, 2025
6.	Xpeng Headquarters	June 26th, 2025
7.	GAC Group and R&D Center	June 26th, 2025
8.	Pony.ai	June 26th, 2025

9.1.2. Lists of Participants (Thailand)

No.	Name	Position	Organization
1.	Mr. Passakorn Chairat	Director General	OIE
2.	Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level	OIE
3.	Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level	OIE
4.	Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level	OIE
5.	Dr. Kriengsak Wongpromrat	President	TAI
6.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI
7.	Mr. Sunthorn Tunmuntong	Senior Specialist, Entrepreneur and Industry Development Division	TAI
8.	Ms. Chalida Donjuk	Staff, Entrepreneur and Industry Development Division	TAI
9.	Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics	TU
10.	Dr. Phimsupha Kokchang	Researcher, Energy Research Institute	CU
11.	Mr. Suroj Sangsnit	President	EVAT
12.	Mr. Chaiyaphruek Narongkool	Secretary	EVAT
13.	Mr. Lin Yuqing	Manager Representative SEA office	CATARC
14.	Mr. Chinnawut Ngiamngamsri	Marketing Representative SEA office	CATARC

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute
TU: Thammasat University
CU: Chulalongkorn University
EVAT: Electric Vehicle Association of Thailand
CATARC: China Automotive Technology and Research Center Co., Ltd.

9.1.3. Summary of Key Points from the Trip

9.1.3.1. BYD Headquarter

Founded in November 1994, BYD is one of China's largest EV and PHEV manufacturers, now a global NEV leader. In 2023, BYD became the world's top-selling NEV brand, selling over 3 million units and surpassing Tesla in Q4.

Headquartered in Shenzhen, China, BYD's strength lies in its vertical integration, a rarity in the auto industry. Its supply chain spans manufacturing, battery technology, electric powertrains, and smart mobility innovations, encompassing in-house production of batteries (including the innovative Blade Battery), motors, chips, and vehicle platforms. This strategy enables efficient cost control and rapid innovation.

In Thailand, BYD participates in the EV3.0/3.5 incentive programs and has built its first overseas EV factory, a 18 billion THB (approximately $500 million USD) investment with a capacity of 150,000 units per year. BYD dominates Thailand's EV market, topping registrations with 27,005 units in 2024 and 9,615 units from January-April 2025.

Host Organization

1. Mr. Ketsu	Deputy General Manager of BYD APAS
2. Ms. Donna Wei	Project Supervisor, Asia-Pacific Auto Sales Division
3. Ms. Cassie Xu	Senior Sales Manager, Thailand Branch, Asia-Pacific Auto Sales Division

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1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

CATARC (SEA office)

1. Mr. Lin Yuqing	Manager Representative
2. Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 10.00 AM

Summary of Key Points

BYD has not only grown in scale but expanded strategically across adjacent technologies to build a vertically integrated green mobility ecosystem. Starting with batteries for electronic devices, the company moved into car manufacturing, initially producing ICE vehicles, before advancing into electric vehicles powered by its own developed high-performance batteries. It later expanded electrification to public transport, including electric buses and urban rail systems, as part of its broader green mobility vision. This evolution has been driven by BYD's strong R&D capabilities. Today, it is the Chinese automaker with the most extensive international footprint among its domestic peers.

1) From Battery Maker to Green Mobility Provider

Founded in 1995 in Shenzhen, BYD began as a manufacturer of rechargeable batteries, quickly pivoting to lithium-ion technology. Within just a few years, it became a key battery supplier to global telecom giants such as Motorola and Nokia. Around the same time, BYD also ventured into semiconductors, laying the foundation for vertical integration. In 2003, BYD expanded into the automotive sector, and by 2005 had launched its first internal combustion vehicle, the F3, which became the first Chinese model to break the 10,000-unit-per-month sales mark. In 2008, BYD introduced its first plug-in hybrid (F3DM), showcasing its ambition in electrified mobility. While BYD gained prominence in autos, its vision has always extended beyond — positioning itself as a leader in the broader new energy industry, encompassing electric vehicles, batteries, solar power, and zero-emission transport solutions. By 2009, it had entered the electric bus and forklift market, and by 2011 launched its first commercial electric bus. In 2016, BYD expanded further into urban rail transit with the introduction of its SkyRail system. Today, BYD's four core business pillars — Electronics, Automotive, New Energy, and Rail Transit — reflect a bold, integrated approach to accelerating the transition toward sustainable urban living, consistently turning vision into commercial reality at an unmatched pace.

2) China's Leading Auto Exporter

Unlike legacy automakers from the U.S., Europe, and Japan, Chinese carmakers are relatively new to the global market, and exports remain a key challenge. BYD, however, has managed to overcome this hurdle, exporting around one in every four vehicles it produced. In 2024, BYD emerged as China's top vehicle exporter, shipping approximately 1.1 million units out of its total production of 4.27 million. Key export markets include South America, Europe, Southeast Asia, and Australia.

3) Ability to innovate and commercialise at speed

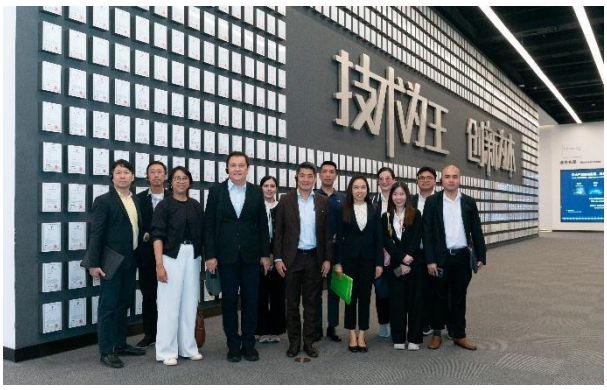
The company holds over 64,000 patents and invests around 50 billion yuan annually in R&D to build a technology pool for future products. Its agility was evident during

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting













As of 23 June 2025

9.1.3.2. CATARC Shenzhen and EV Charging Service Providers

CATARC (China Automotive Technology & Research Center), a state-administered research institution founded in 1985, is crucial to advancing China's automotive industry. It provides essential services like product testing, certification, technical consulting, and R&D, helping manufacturers meet Chinese regulatory requirements for safety, environmental standards, and innovation.

CATARC Shenzhen serves as a major regional hub, accelerating New Energy Vehicle (NEV) and intelligent vehicle development in southern China. Located in Pingshan District, it offers comprehensive services including Intelligent Vehicle Testing and Certification, Safety and Emissions Evaluation, and Proving Ground Facilities for durability and performance. As a government-backed technical body, it also provides policy consulting and regulatory support for automotive standards.

The Bay Area Intelligent Connectivity Test Field within CATARC Shenzhen is a vital ICV proving ground. Spanning 645 acres, it supports Full-Scenario Testing, including V2X (Vehicle-to-Everything), ADAS (Advanced Driver-Assistance Systems), and autonomous driving. It integrates "Car-Road-Cloud-Network-Map" systems, simulating real-world conditions with traffic intersections and diverse environments. The facility also enables land–air testing with drones for future "Low-Altitude Mobility." Supported by CATARC, the Shenzhen government, and industry players, this test field is key to piloting real-world projects like Meituan drone delivery and Robotaxis, accelerating autonomous mobility commercialization across the Greater Bay Area.

Goldpower is a growing domestic charging operator known for its focus on grid-integrated EV charging solutions. Active in multiple urban centers, Goldpower plays a vital role in supporting regional electrification plans, especially for public fleets and logistics. Its emphasis on smart energy platforms and partnerships with grid operators enhances charging efficiency and aligns with China's goals for energy-smart transportation infrastructure.

Sunwoda EV Charging, a subsidiary of battery manufacturer Sunwoda, develops intelligent charging infrastructure paired with energy storage solutions. By integrating battery expertise into charging networks, Sunwoda supports fast, stable charging while enabling grid load balancing. Its operations strengthen the synergy between EV batteries, storage, and smart mobility, making it a strategic player in the evolving energy-transport nexus.

Host Organization

1. Otni Chan	Shenzhen Gold Power Tech Co., Ltd.
2. Ruson Yan	Investment Director, Sundowa Smart Energy Co., Ltd.
3. Lightman Lai	Public Affairs Industrial Development, Sundowa Smart Energy Co., Ltd.

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4. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

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2. Mr. Chinnawut Ngiamngamsri — Manager Representative

Meeting Commenced at: 2.00 PM

Summary of Key Points

- Over the past five years, EV charging station business in China has grown alongside the rapid expansion of the new energy vehicle (NEV) market. China has installed more than 6 million charging points nationwide; however, this is still insufficient to meet demand in large urban areas. This expansion is driven by the energy transition trend, government policy support, and major private sector investment.
- A unique characteristic of urban society in China is that people predominantly live in high-rise apartments rather than detached houses, making it difficult for EV users to install private chargers. Public charging stations have therefore become essential infrastructure. China has focused on developing centralized charging station models with high utilization, smart management systems, and diverse revenue streams such as charging fees, parking fees, and time-of-use electricity sales (energy arbitrage).
- The EV charging station business in China is experiencing high growth, primarily using the Solar PV + BESS model and China's GB/T standards, while also being designed to support vertical city living.
- China will end central government subsidies for NEVs by 2030 and shift the support role to local governments.
- Key success factors behind the growth of EV charging stations in China include strong policy direction, sustained financial support, competitive private sector involvement, and declining technology costs.
- Chinese private sector actors recommend that Thailand consider adopting Chinese standards to facilitate compatibility with Chinese charging technology.

Supporting Points

1) Centralized Public Charging to Support High-Density Urban Living

China has developed charging station infrastructure tailored to vertical urban environments, where the majority of the population resides in high-rise apartment buildings without access to private parking or the ability to install personal EV chargers. As a result, public charging stations have become the backbone of the EV charging ecosystem. The strategy emphasizes the deployment of medium-to large-scale centralized charging stations capable of supporting high utilization rates. These stations are strategically distributed across key urban zones, including residential complexes, commercial districts, and highway service areas. This centralized model not only accommodates limited space but also enhances operational efficiency and accessibility, making it a critical enabler of China's widespread EV adoption.

2) GB/T Standards and the Solar + BESS Model as Core Infrastructure

China has adopted the GB/T standard as its national framework for EV charging infrastructure. While it aligns in some respects with European standards, GB/T has been specifically adapted to suit China's local operating conditions. It covers all essential components, including charging connectors, control cabinets, and load management systems, enabling a highly interoperable and standardized charging network. This standardization allows for faster, more cost-effective deployment of charging stations across the country.

In parallel, China has widely implemented a charging station model based on the integration of solar photovoltaics (Solar PV) and battery energy storage systems (BESS). This model addresses peak

demand challenges by enabling stations to store electricity generated during off-peak hours or from solar energy and dispatch it during periods of high demand. As a result, it reduces stress on the main power grid and enhances the resilience of local energy supply.

A notable example is TechOne's hybrid charging station solution, which integrates Solar PV, BESS, and ultra-fast charging heads with capacities ranging from 30 kW to 640 kW. This configuration supports high-density urban deployment, providing flexible and rapid charging services to meet growing EV demand. The system is designed not only for operational efficiency but also for economic viability.

The key advantages of this model include grid independence, the ability to perform peak shaving and energy arbitrage, and a short payback period—typically within three years. This is achieved through a combination of lower electricity costs and diversified revenue streams such as parking fees, advertising, and smart energy management services. Overall, this model demonstrates a scalable and sustainable pathway for EV infrastructure that countries like Thailand could learn from.

3) Diversified Revenue Streams and Rising Pressure to Scale Infrastructure

The revenue model of EV charging stations in China is highly diversified. Service providers generate income not only from electricity sales but also from parking fees, energy arbitrage (storing electricity when prices are low and selling during peak demand), advertising, and retail operations within the station premises. This multifaceted approach enhances financial sustainability and allows operators to recoup investments more quickly.

As the number of new energy vehicles (NEVs) grows rapidly—especially in major urban centers, the demand for charging services has surged in parallel. This trend is placing increasing pressure on both public and private stakeholders to accelerate investments in charging infrastructure and ensure adequate station coverage. Without timely expansion, the risk of congestion, user dissatisfaction, and underutilized EV potential could rise significantly.

Meeting adjourned at: 5.00 PM

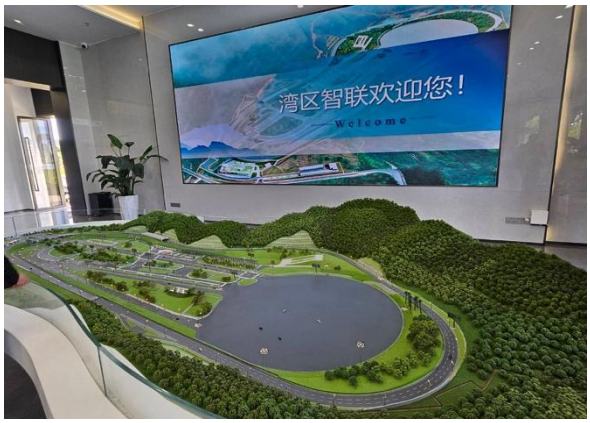
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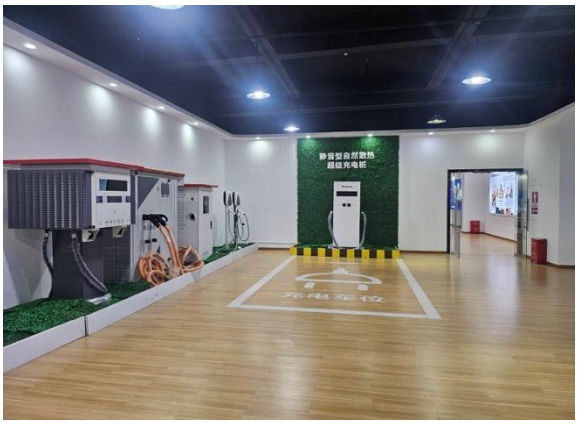












As of 23 June 2025

9.1.3.3. Shenzhen Future Mobility Experience

The Shenzhen Future Mobility Experience was organised to give delegates first-hand exposure to real-world services related to future mobility in the city. Unlike many countries where such technologies remain in the testing phase, Shenzhen has moved ahead by rolling out robotaxi and drone delivery services in several areas under actual traffic conditions.

While some critics argue that Shenzhen's advanced mobility developments are more hype than reality, noting that services often operate within restricted geofenced zones, the city still marks a significant step forward. Beyond technology, a key factor in China's future mobility push is cost. As Robin Li, CEO of Baidu, remarked, "We are moving towards a future where taking a robotaxi will be half the cost of taking a taxi today."

Drone delivery is also part of China's broader Low-Altitude Economy initiative—aimed at unlocking economic potential in airspace below 1,000 metres. Shenzhen, with its strong capabilities in drone manufacturing and development, has earned the nickname "Sky City."

Participants

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1.	Mr. Passakorn Chairat	Director General
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CATARC (SEA office)

1.	Mr. Lin Yuqing	Manager Representative
2.	Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 09.00 AM

Summary of Key Points

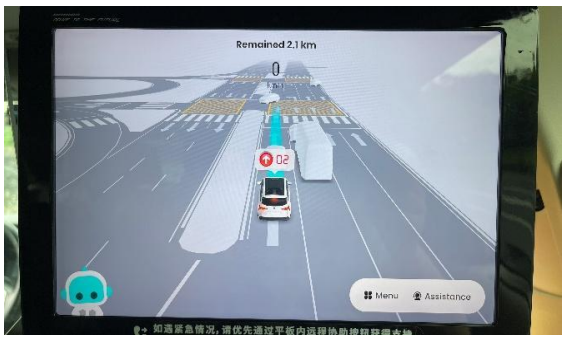
- Robotaxi rides in Shenzhen are currently limited to the Nanshan District, as it is the only area officially authorized for such services.
- As part of the robotaxi experience, a representative from the delegation took a ride from the pick-up point near Taoyuan Toad to Talent Park, covering a distance of approximately 6 kilometers. They observed that the driverless vehicle's performance closely resembled that of a human driver, handling traffic decisions well. The car was able to connect with traffic signals, for example, at intersections with traffic lights—demonstrating real-time coordination with road infrastructure.
- Inside the vehicle, the front and rear seating areas were clearly separated. The second-row passenger area featured display screens on both sides, showing safety instructions, emergency procedures, and exit guidance. The screens also provided a live map of the journey to the destination.
- The robotaxi used in the ride was a hybrid Lexus model. When asked, the service provider Pony.ai explained that this particular Lexus model was selected because it is easier to integrate with autonomous driving control systems.
- Drone deliveries are limited to specific food brands and must be picked up only at designated drop-off points. Our team tested ordering iced tea, which was delivered to a pickup locker at Talent Park — a white-and-yellow cabinet resembling two telephone booths combined side by side.
- When the drone approaches, the customer receives a phone call — not from a human, but from an automated voice system, informing them that the package is on its way. Upon arrival, the customer uses a provided code to open the locker compartment and retrieve their order.

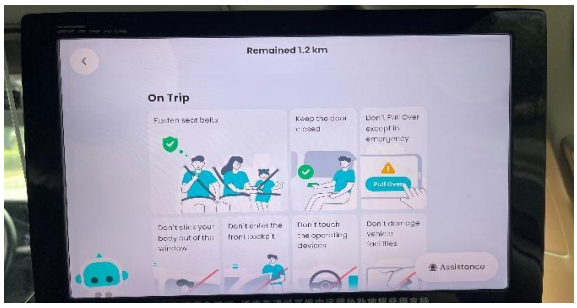
- All delivery boxes carried by the drones are the same size; each box can hold only three cups of iced tea. Next to the pickup locker, there is a return box where customers can place the used delivery container for reuse and refilling.
- The delivery fee for one box via drone is about 10 yuan, which is still considered relatively expensive compared to other delivery methods such as riders.

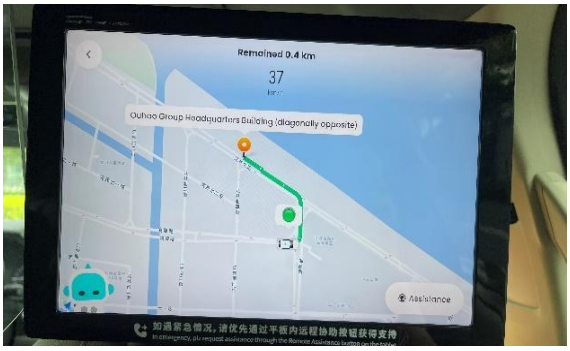
Meeting adjourned at: 11.30 AM

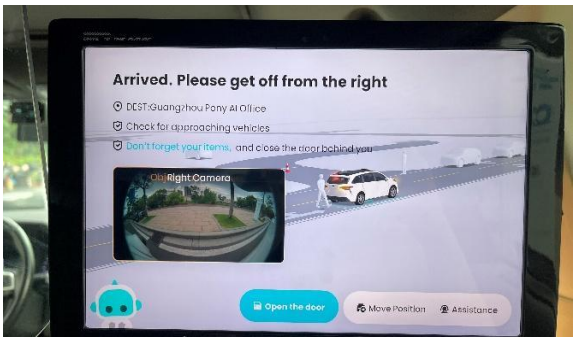
Illustrative Photos from the activities















As of 24 June 2025

9.1.3.4. Huawei Shenzhen Base and Flagship Store

Huawei is a key Chinese developer and provider of intelligent automotive software and hardware solutions, collaborating with major automakers like BAIC, Changan, SAIC, BYD, and BMW. Beyond system software, Huawei produces critical hardware such as LiDAR, radar, and domain controllers, essential for intelligent driving systems.

Huawei's strategy is to be the "Bosch of China," choosing not to manufacture its own vehicles. Instead, it aims to be a global "Tier 0" supplier or "System Integrator," offering comprehensive, integrated core systems and components for smart cars, enabling automakers to readily adopt these advanced solutions.

The company's flagship is the Qiankun Platform, an all-in-one system encompassing elements from the digital chassis and smart cockpit to autonomous driving features. A highlight is Qiankun ADS 4.0, which supports Level 3 autonomous driving on highways. The Qiankun Platform is already being commercially deployed in various partner vehicles, including Aito and Luxeed models, showcasing its market readiness. Huawei's significant presence is transforming the automotive landscape.

Host Organization

1. Mr. Ma Xinchun (Ethan)	Director Outbound Business, Huawei APAC Region
2. Mr. Ye Ray	Digital Power Charging network CSO
3. Mr. Ye Yurui (Ray)	Digital Power Charging network CSO
4. Mr. Ralph Pattanatit Chutikul	Digital Power Charging network Thailand
5. Mr. Libingbo	Huawei cloud – HMS
6. Mr. Zhouweijing	Huawei cloud – HMS

Participants

The Office of Industrial Economics

1. Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level
2. Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level
3. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Chalida Donjuk	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics Thammasat

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

CATARC (SEA office)

1. Mr. Lin Yuqing	Manager Representative
2. Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 02.00 PM

Summary of Key Points

1. Huawei's Charging Technology & Solutions
   1.1. Liquid-Cooled Ultra-Fast Charging Platform
   - Huawei's charging solution is designed for high performance, reliability, and future-proof scalability.
   - Supports up to 720 kW per power unit, enabling megawatt-level fast charging when multiple units are combined: 7-minute charging time to deliver 800 km range (depending on vehicle model and battery capacity). However, the Ultra-fast charging speed (720 KW per power unit) is imposed by Huawei. No reason explains this Ultra-fast charging speed.
   - Liquid Cooled charging reduces heat stress and prolongs the lifespan of equipment and reduce the physical weight and size of the connector. This makes it easier and safer to operate for end users.
   - Dual connector charging allows multiple vehicles to charge simultaneously with dynamic power sharing.

   1.2. Integrated System Features
   - Huawei delivers a full-stack platform that ensures seamless charging operations and consistent user experience.

- Develop One Platform for All Scenarios: Applicable for urban areas, highways, logistics hubs, ports, and fleet depots. Supports both private vehicles and fleet operators with varying power needs.
- Develop End-to-End Charging Ecosystem:
  - Hardware: Power units, ultra-fast dispensers, liquid-cooled connectors.
  - Software: Charging management system, remote monitoring, dynamic load control.
  - Data & Analytics: Real-time reporting, billing integration, energy forecasting.

2. Charging Station Trend in China and Huawei's plan in Thailand
   2.1. DC fast charging is experiencing strong growth in line with the maturing EV market in China.
   2.2. In China, Fast and ultra-fast chargers are designed for four-wheeled passenger vehicles, while the megawatt charging capability—up to 1.5 MW and 2,400 A—is intended for future heavy-duty vehicles.
   2.3. Huawei's 4-Model: The Last Mile of Logistics Charging Network

- Huawei proposes a structured model to build a comprehensive and efficient EV charging network for logistics, from local to regional scale.

1. Point (Intercity Logistics Hub): Short-distance focus (<300 km) in ports, industrial parks, and logistics zones

2. Line (Intra-city Logistics Center): Midrange logistics (300–800 km), connects major urban and industrial areas within cities.

3. Network (Community Logistics Distribution): Last-mile delivery infrastructure, Located in residential or community areas.

4. One Network: Urban and Logistics Convergence.

   2.4. In 2035, Shenzhen's "7+30+N" layout with: 7 intercity logistics hubs, 30 intra-city centers, Numerous community-level nodes (N). This layout platform helps charging providers improve proper technological and charging station locations towards all EV users in logistic network.
   2.5. Compared to China, Thailand's charging station development is 3–4 years behind China. However, Huawei considers Thailand to have the leading EV charging infrastructure outside of China.
   2.6. Huawei has 3 operational stations: (1) PTT Kingkaew Taxi Hub (Bangkok), (2) LCB Heavy Truck Station (Pattaya port), (3) Passenger & Taxi Station (Bangkok). Also, Huawei plans to expand 50+ stations planned across Thailand in 2025.

3. Huawei's software
   3.1. HMS (Huawei Mobile Services) is Huawei's in-vehicle smart ecosystem, offering a full suite of apps and services for intelligent connected vehicles (ICVs). It includesPetal Maps, Celia Voice Assistant, AppGallery, Huawei Music & Video, Health, Smart Home, and more.
   3.2. Huawei provides software development and smart cockpit solutions for various automakers. Notably, the company has partnered with more than 15 automotive brands to pre-install its HMS for Car system in mass-produced vehicles sold in the Chinese market.
   3.3. The HMS for Car system consists of four core modules:

- Map Box: An intelligent navigation and mapping system (e.g., Petal Maps)
- AI Box: A smart voice assistant and in-car AI interaction platform
- App Box: An application hub for multimedia, entertainment, and essential services
- Net Box: A global in-vehicle connectivity solution powered by eSIM and optimized data services

   3.4. China is taking the lead as the global market sees rapid growth in intelligent connected vehicle (ICV) adoption. In this context, in-vehicle infotainment (IVI) systems have become a key competitive advantage for OEMs seeking to expand their presence internationally.
   3.5. In 2025, ICV penetration development rate in Chaina is 75.9%, while global ICV penetration development rate is 59.4%. The criteria of ICV penetration in Huawei perception is that the vehicles employs only at least one of four core modules.

3.6. Autonomous driving systems in China are currently in the pilot testing phase, with the government designating specific areas for controlled trials. However, despite the technological readiness of some automakers to deploy Level 3 autonomous driving, the Chinese government strictly prohibits any form of advertising or public promotion of Level 3 capabilities in vehicles.

Meeting adjourned at: 5.00 PM

Illustrative Photos from the Visit / Meeting













As of 24 June 2025

9.1.3.5. CATARC Automotive Test Center (Guangzhou) Co., Ltd.

CATARC Guangzhou (South China Base) is a cornerstone of CATARC's "1 HQ + 4 Regional Centers" network, specifically designed to serve Guangdong's booming automotive market. Located in Zengcheng District, the facility spans nearly 95 acres and was developed with a ¥1.85 billion investment to house specialized labs for NEV components, emissions, spare parts, and a trial-run runway and test square.

Unlike the Shenzhen branch, which focuses more on intelligent vehicle certification, smart lighting systems, ADAS, and policy consulting, CATARC Guangzhou emphasizes comprehensive product testing, R&D services, and engineering design. Its core business units include emissions and energy-saving testing, parts and components validation, NEV research, crash and EMC labs, and technical consulting—all tailored to support OEMs in the Pearl River Delta.

Host Organization

CATARC Automotive Test Center (Guangzhou) Co., Ltd.

1. Mr. Li Haibin	General Manager
2. Mr. Zhang Zhibo	Director of the General Affairs Department
3. Mr. Lin Yunqing	Business Director

China Automotive Technology & Research Center (CATARC)

1. Mr. Xu Yaozong	Deputy Secretary-General, China Automobile Enterprise International Development Innovation Alliance; Deputy Director, China Automotive Strategy and Policy Research Center, CATARC
2. Mr. Chinnawut Ngiamngamsri	Marketing Representative SEA office

Participants

The Office of Industrial Economics

1. Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level
2. Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level
3. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Chalida Donjuk	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics Thammasat

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

Meeting Commenced at: 02.30 PM

Summary of Key Points

- The New Energy Vehicle (NEV) market in China has experienced rapid growth, particularly in the Battery Electric Vehicle (BEV) segment, which is projected by CATARC to account for as much as 62% of the total vehicle market by 2035. This success reflects a systemic approach—combining long-term strategic planning, early-stage subsidies, and a gradual shift toward market-based mechanisms. In recent years, the government has phased out direct purchase subsidies and prioritized infrastructure investment, especially in expanding EV charging networks, with support for AC, DC, and ultra-fast solutions tailored to local needs.
- In parallel, China is accelerating the development of the Intelligent Connected Vehicle (ICV) industry by establishing technical standards, legal frameworks, and investing in road-cloud-vehicle integration technologies to support safe and autonomous driving.
- This comprehensive policy framework—spanning R&D, manufacturing, tax incentives, infrastructure, and market promotion—positions China as a global reference point for clean, smart, and safe mobility. For Thailand, which is at a critical turning point in shaping its future automotive industry, China's experience offers practical lessons in areas such as promoting PHEVs, reforming tax systems, and fostering cross-border cooperation.
- Strengthening EV collaboration between Thailand and China—through platforms such as ASEAN Expo 2025—was recommended to support mutual innovation and shared growth in the regional EV ecosystem.

Supporting points:

1) Development of China's NEV Industry Policy

China has been promoting the development of the New Energy Vehicle (NEV) industry since 2009 through the "Ten Cities, Thousand Vehicles" policy. This initiative laid the foundation for a four-stage development roadmap: (1) a pilot phase (2009–2012), (2) a scale-up phase (2013–2015), (3) a period of financial support for NEV application and technology (2016–2020), and (4) the transition to a "market-driven phase" starting from 2021.

The Chinese government has implemented a comprehensive policy framework covering R&D, manufacturing, infrastructure, regulatory oversight, and taxation. Initially, production and purchase subsidies played a central role. Over time, the focus shifted to raising technical standards while gradually phasing down subsidies. Direct purchase subsidies were officially ended in 2023, with policy support redirected toward infrastructure investment instead.

Tax policies supporting NEVs include exemptions from excise tax, reductions in vehicle purchase tax (up to 30,000 yuan, applicable until 2027), and annual vehicle and vessel tax exemptions for BEVs and FCEVs.

As a result of these policies, by 2024, China had over 31.4 million NEVs on the road, with a market share reaching 40.9%. The total NEV market value exceeded RMB 2.08 trillion, generating more than RMB 3.24 trillion in added value across the industrial supply chain. Additionally, the adoption of NEVs

helped China reduce oil consumption by over 27 million tons and carbon emissions by more than 84 million tons annually. China's NEV industry development is underpinned by a comprehensive and systematic policy system that spans six key dimensions:

- Scientific and Technological Innovation
- Strategic Planning
- Financial Subsidies
- Tax Incentives
- Industry Management
- Infrastructure

This framework demonstrates China's holistic approach, linking every component of the ecosystem to accelerate the transition and build long-term industrial competitiveness.

2) ICV Policy and Infrastructure Integration

China has pursued Intelligent Connected Vehicle (ICV) development in coordination with ministries such as MIIT, Ministry of Transport, and the Ministry of Natural Resources. Legal, technical, and sandbox systems are being institutionalized.

By 2025, China aims to develop over 100 ICV standards for driver assistance and autonomous driving (L3–L4), increasing to 140 by 2030. Real-world testing areas span 32,000 km with cumulative testing over 120 million km. In Beijing, autonomous vehicles have already logged over 1.79 million km in actual operation.

China places strong emphasis on the continuous development of electric vehicle charging infrastructure, especially in remote areas, highways, and rural regions. As of May 2025, the country had accumulated more than 14.4 million charging piles, with a vehicle-to-pile ratio of 3:1.

The government actively supports the deployment of all types of charging equipment (AC, DC, and ultra-fast chargers), ensuring suitability based on local conditions and user accessibility. Incentives and subsidies are provided to infrastructure providers based on factors such as the number of installed chargers, power capacity, and service coverage area.

In addition, China promotes the development of charging stations that integrate solar PV systems with battery energy storage systems (BESS). This model helps reduce long-term operational costs and contributes to environmental sustainability.

3) Vehicle-to-Grid (V2G) and Energy Usage Models

Due to lower electricity rates at night (approximately RMB 0.5/kWh during the day and RMB 0.4/kWh during the night), China promotes nighttime EV charging. Surplus energy stored in EVs can be discharged back to the grid during the day through V2G systems. Pilot projects are currently being implemented in 10 major cities, including Shenzhen, Beijing, and Chongqing, with compensation mechanisms in place for participating users. Importantly, these V2G pilots are not isolated technological trials they form part of a national push toward grid-interactive, low-carbon transport systems. The pilots are aligned with China's broader digital grid modernization efforts and are coordinated by key agencies such as the Ministry of Industry and Information Technology (MIIT) and state-owned grid operators. According to China's latest policy direction outlined in the 2023 "Guiding Opinions on Further Building a High-Quality Charging Infrastructure System," the country is accelerating the integration of V2G technologies by promoting smart, bi-directional charging infrastructure and encouraging the construction of integrated "charging-storage-discharge" stations. These stations combine photovoltaic generation, battery energy storage systems (BESS), and V2G-compatible EV chargers to support local energy resilience and load balancing. The policy also supports pilot demonstrations and R&D in grid-friendly intelligent charging as part of the strategic coordination between the new energy vehicle

industry and energy systems. As such, V2G is seen not only as a technical innovation, but as a cornerstone of China's strategy to build an intelligent, flexible energy system that aligns transport electrification with carbon neutrality and digital transformation goals.

4) Market Trends and Policy Shifts

CATARC forecasts NEV sales will comprise 40–50% of the market by 2025 and 50–70% by 2030. BEVs are projected to dominate (62% by 2035), though PHEVs and FCEVs will remain important in specific segments.

China is shifting from NEV credits and CAFC targets to full-lifecycle carbon footprint assessments, beginning with batteries and scaling to entire vehicles. The "Electricity = Zero Emission" principle supports this transition.

5) Policy Recommendations for Thailand

China's electric vehicle industry is increasingly aligned with its net-zero carbon emissions goal. This includes the integration of intelligent driving systems, incorporation of renewable energy (RE), adoption of Vehicle-to-Grid (V2G) technologies, and the development of solid-state batteries.

As for policy suggestions for Thailand, China recommends relaxing local production requirements—such as allowing the use of vehicle platforms already deployed in China—to increase flexibility for investment and manufacturing. Furthermore, Thailand is encouraged to expand support to other vehicle types, including PHEVs, REEVs, and electric commercial vehicles, as well as to implement a "trade-in" policy to incentivize the replacement of old internal combustion engine vehicles with EVs. Participants also recommended advancing bilateral and multilateral cooperation in the EV industry through platforms such as ASEAN Expo 2025.

Meeting adjourned at: 5.00 PM

Minutes recorded by: Dr. Phimsupha Kokchang

Illustrative Photos from the Visit / Meeting



As of 25 June 2025

9.1.3.6. Xiaopeng Motors Technology Co., Ltd. (XPeng Motor)

Xpeng was founded in 2014 and is committed to developing future vehicles, including flying cars, to meet the needs of driving comfort. The core of the system is the XPILOT autonomous driving system, which combines Lidar (3D laser imaging) and radar (speed and location detection) technologies, along with cameras, to provide the car with in-depth information. XPENG's battery is developed by CATL, China's largest battery manufacturer. XPENG also develops its own Advanced Driver Assistance Systems (ADAS) and Intelligent In-Car Operating System (Xmart OS) to differentiate itself. XPENG focuses on using technology and intelligent driving experience as its key features to attract customers who are looking for electric vehicles (EVs) that are not only energy-saving but also come with cutting-edge functions and meet the needs of modern lifestyles.

Host Organization

1. Mr. Tobias Ye	Overseas After-Sales Service Senior Manager
2. Mr. Wang Mengzhou	Autonomous Driving Product Expert
3. Mr. Eason Yan	Intelligent Cabin (or Smart Cockpit) Product Expert

Participants

The Office of Industrial Economics

1. Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level
2. Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level
3. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Chalida Donjuk	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics Thammasat

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

CATARC (SEA office)

1. Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 09.30 AM

Summary of Key Points

1. Market competition in China
   1.1. The automotive market in China is highly competitive and is expected to remain so over the next three years. New car manufacturers will continue to enter the market, typically launching only two to three NEV models to test market viability and profitability. If these companies fail to achieve profits or sustain operations, they are likely to exit the market.
   1.2. The intelligent driving is rolling-out rapidly in China due to
   - Competition drives innovation
   - Policy enables – government allows pilot areas for testing intelligent driving.
   - Market need – consumer needs convenient technological driving.

   1.3. In Xpeng's view, autonomous driving level 3 will be adopted in the next 5 years for China market.
   1.4. Charging Infrastructures are well developed in China. Consumers typically need to drive only around 20 minutes to find a charging station.
2. Consumer Acceptance for NEV
   2.1. The NEV market in China has entered the "late majority" phase in terms of technology adoption. Most NEV buyers are young adults aged between 25 and 40 years. Key factors attracting this consumer segment include:
   - Reasonable Price – NEV prices are now comparable to those of internal combustion engine (ICE) vehicles. Additionally, buyers have benefited from exemptions on license plate purchase costs over the past 3–4 years.
   - Advanced and Convenient Technology – Young consumers are drawn to NEVs equipped with user-friendly driving technologies. For instance, many female drivers express satisfaction with features such as automatic parking assistance systems.
   - Enhanced Safety and Standardization – As NEVs become safer and more standardized, consumer confidence in driving these vehicles has significantly increased.
3. Xpeng's Technology and business trend
   3.1. Xpeng offers a diverse range of BEV models with NCM and LFP battery—including sedans, SUVs, and MPVs—to meet varying market demands in China. Xpeng has economy vehicles and luxury vehicles.
   3.2. In 2024, Xpeng decided to develop a Range-Extended Electric Vehicle (REEV) model to address market needs, particularly for consumers in long-distance driving areas.
   3.3. Xpeng positions itself as a direct competitor to Tesla and focuses primarily on developing autonomous driving systems based on pure vision camera technology. Although the company had previously explored Lidar-based autonomous driving systems, it has since shifted its emphasis. Xpeng has also invested in the development of various driving-related databases—for example, in 2023, it launched HD map–based autonomous driving services in several cities without requiring additional fees. Also, Xpeng already launched its autonomous driving in Hong Kong such as the U-turn system.
   3.4. Xpeng develops its own autonomous driving, AI infrastructure, and Chip.
   3.5. Xpeng has developed its own fast-charging infrastructure, including both charging outlets and battery swapping stations, with charging outlets being the top priority. To support this expansion, Xpeng has formed strategic partnerships with several companies such as Volkswagen and BP Pulse to broaden its charging network.
   3.6. Xpeng plans to sell its BEV in overseas markets to build its reputation and market acceptance.

3.7. Xpeng needs to do autonomous driving tests in oversea markets. However, oversea markets may not allow Xpeng to do autonomous driving tests. Also, Xpeng has misunderstood the differences in traffic behavior between China and Thailand.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Site Visit / Meeting



As of 26 June 2025

9.1.3.7. GAC Group and R&D Center

GAC International Automobile Sales Service Co., Ltd. is a subsidiary of Guangzhou Automobile Group Co., Ltd. (GAC Group), a prominent Chinese state-owned automobile manufacturer headquartered in Guangzhou, Guangdong. GAC Group was incorporated in June 1997 and consistently ranks among the Fortune Global 500 companies (165th in 2023) and GAC Motor International Limited is specifically responsible for the international business of GAC Group. GAC Motor made its initial foray into overseas markets in 2013 and has since expanded its presence across the Middle East, Southeast Asia, Eastern Europe, Africa, and America, operating in a total of 30 countries and regions worldwide. GAC International is actively pursuing a global expansion strategy, evidenced by initiatives like "ONE GAC 2.0" and the "Thailand Action" plan, aiming to enhance its global and local operations. The company plans to expand its footprint to 100 global markets with an export target of 500,000 vehicles by 2027. GAC is recognized for its industry-leading electrification and intelligent connectivity technologies. It was listed among the "2023–2024 Global Intelligent Vehicles Brands Top 10," highlighting its commitment to innovation in smart mobility. The company invests heavily in R&D, with a dedicated R&D Center established in 2006.

Host Organization

1. Mr. Masato Katsumata	Chief Technical Management Master, GAC R&D Center

Participants:

The Office of Industrial Economics

1. Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level
2. Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level
3. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Chalida Donjuk	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics Thammasat

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

CATARC (SEA office)

1. Mr. Lin Yuqing	Manager Representative
2. Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 02.00 PM

Summary of Key Points

Chinese automaker GAC (Guangzhou Automobile Group) is showcasing the emerging possibilities of future mobility, not only through next-generation vehicles but also through aerial mobility technologies such as drones and aviation platforms, many of which are now entering the early stages of commercialization in Hong Kong.

In the realm of Battery Electric Vehicles (BEVs), GAC continues to prioritize battery performance, focusing on faster charging and extended driving range. Meanwhile, alternative powertrain technologies like hydrogen combustion and ammonia-powered engines are already on the development roadmap.

In the area of Intelligent Connected Vehicles (ICVs), GAC's latest advancements reinforce a clear trend in China: the transition toward software-driven vehicles, where vehicle architecture is shaped increasingly by digital platforms rather than mechanical systems.

Supporting Points:

GAC Group employed a total of 86,451 people in 2024. In the same year, the company produced approximately 1,916,600 vehicles. Its aggregate operating income reached 401.648 billion yuan.

1.) Intelligent Vehicle Data and Monitoring

GAC has developed a robust data connectivity infrastructure for its vehicles operating in China. While this functionality may not yet be available in other countries including GAC's vehicle in Thailand due to differing regulations, it offers a glimpse into the future of integrated mobility services. Real-time data captured includes:

- Daily Vehicle Metrics: Total mileage and intelligent driving distance per day
- Fleet Status: Number of total and online vehicles
- Charging Indexes: Daily charging volume (kWh) and installed capacity
- Environmental Impact: Carbon emissions reduced and afforestation equivalents
- Autonomous Driving Safety: Number of intelligent driving vehicles and collision avoidance events
- Real-Time Monitoring: Early warning systems for vehicle health
- Battery System Lifecycle: End-to-end battery performance and safety tracking

2.) Battery Innovation

GAC continues to enhance battery technologies for improved range and charging speed. For example, a 5-minute charge can add up to 204 kilometers of driving range. Key developments include:

- Integrating graphene conductive materials into the cathode of NCM batteries
- Adding nano-silicon materials to the anode
- Researching solid-state electrolytes for next-generation battery stability

In terms of safety, GAC demonstrated its latest NCM battery technology capable of withstanding nail penetration and torsional force without catching fire, marking a major step forward in battery safety.

3.) Powertrain and Integration Technologies

Motor development focuses on multi-function integration, such as 4-in-1 or broader N-in-1 systems, to streamline vehicle design and performance.

4.) Software-Defined Vehicles

China's automotive future is increasingly software-defined. GAC is adopting new electronic and electrical architectures where software governs the entire vehicle system. This allows, for instance, reduction of physical components by 20 controllers, decrease in wiring harnesses by 40%, boost in system performance, including 10x increase in transmission speed and 50x increase in computing power.

5.) Beyond Battery Electric

GAC is also investing in non-electric technologies, including Hydrogen internal combustion engines and ammonia-blended fuels, which have been shown to reduce carbon emissions by up to 90%.

6.) High-Efficiency Production Benchmark

One major Chinese automotive plant demonstrated high-speed manufacturing capability, producing one fully assembled vehicle every 53 seconds. This highlights the level of industrial efficiency now achievable in the country's advanced EV production lines.

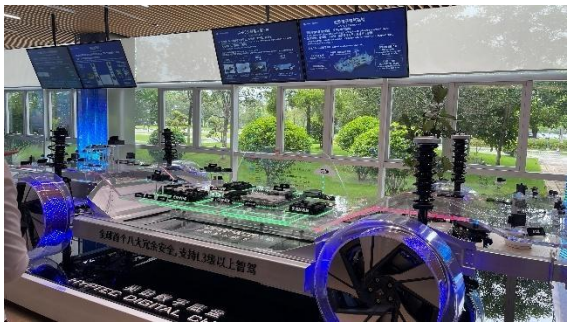
Meeting adjourned at: 4:00 PM

Illustrative Photos from the Site Visit











As of 26 June 2025

9.1.3.8. Pony.ai

Pony.ai was founded in 2016 in Silicon Valley, California, United States. Shortly after its founding, Pony.ai quickly became a global leader in autonomous driving technology and a pioneer in expanding autonomous driving services and technologies to various parts of the world. Pony.ai operates in three areas: Robotaxi (autonomous taxi), Robotruck (autonomous truck), and Personally Owned Vehicle (POV). The company is considered a leader in the commercialization of autonomous driving and is committed to developing the safest autonomous driving capabilities on a global scale.

In 2017, Pony.ai established a research and development center in Guangzhou, China. It then partnered with GAC Group and launched the first fleet of autonomous vehicles to operate on public roads in China, specifically in the Guangzhou area. In addition to Guangzhou, Pony.ai has also obtained licenses to test autonomous taxi and autonomous truck services in several other locations, such as Beijing, Shenzhen, and Shanghai.

Host Organization

1. Dr. Jun Peng	Chief Executive Officer

Participants

The Office of Industrial Economics

1. Ms. Wilawan Rittikarn	Plan and Policy Analyst, Senior Professional Level
2. Ms. Thitapa Chotisangsri	Plan and policy analyst, practitioner level
3. Mr. Nontiwat Sarmanbutra	Plan and policy analyst, practitioner level

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Chalida Donjuk	Staff

Electric Vehicle Association of Thailand

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Thammasat University

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Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher of Energy Research Institute

CATARC (SEA office)

1. Mr. Lin Yuqing	Manager Representative
2. Mr. Chinnawut Ngiamngamsri	Manager Representative

Meeting Commenced at: 04.30 PM

Summary of Key Points

1.) Company profile

- Pony.ai is a global leader in large-scale autonomous driving and commercial deployment, serving both passenger and logistics markets.
- The company has established R&D centers and operations in Beijing, Shanghai, Guangzhou, Shenzhen, and also internationally in the U.S., Europe, Middle East, and Asia-Pacific.
- Business Segments
    - Robotaxi Services: Deployed in over four major Chinese cities, providing safe and efficient urban transportation.
    - Robotruck Logistics: Focused on long-haul and trunk logistics using autonomous trucks (CYANTRON).
    - Technology Licensing & Applications: Offers virtual driver platforms and domain controller software to OEMs and partners.
- Global Deployment
    - First in China to launch Robotaxi services and operate in top-tier cities.
    - Operating in all weather and all scenarios, including public roads.
    - Deployment locations include:
        - China: Beijing (50 Robotaxi) , Shanghai, Guangzhou, Shenzhen
        - International: Fremont (U.S.), Seoul (South Korea), Singapore, Riyadh, Abu Dhabi, and Luxembourg.
- 7th-Generation Robotaxi Platform (Launch: April 2025) and cost efficiency
    - 100% vehicle-grade components with a 600,000 km lifecycle.
    - Complies with ISO26262 functional safety standards.
    - Software and hardware are deeply optimized for mass production.
    - The Bill of Materials (BOM) cost for Robotaxi has dropped by 70%, with: 80% reduction in computing unit cost and 68% reduction in LiDAR system cost
- Poni AI. Platform is designed for support integration with multiple car models and now is collaborated with (1) Toyota: bZ4X Robotaxi, (2) BAIC: Arcfox Alpha T5 Robotaxi, GAC Aion: Hyper GT Robotaxi.
- Poni Ai already succeed in a small scale commercialization, now it is going to expand towards large scale commercialization in China and international markets with its cost competition and well developed software and solutions.

2.) Policy Implementation

- The government supports the budget for start-up companies and allows other companies to compete in the market. In this case, the government has supported Pony AI (Startup) for developing Robotaxi. This approach aims to accelerate product development while simultaneously allowing domestic market players to compete freely. Such a policy fosters innovation-driven competition within the country.
- The government has provided regulatory flexibility to establish pilot zones for testing autonomous driving systems in both taxis and trucks. This has enabled companies to conduct trials and achieve rapid progress in product development. For example, in autonomous truck testing, convoys are allowed where the lead truck must have a human driver onboard to ensure safety during operations.

3.) Experience in taking Robotaxi

- The Robotaxi is designed with comfortable seating and user-friendly monitor-based controls, enhancing passengers' sense of safety when riding in a driverless taxi. The in-vehicle screen

displays the route, current speed, and integration with traffic signal systems (e.g., traffic lights). It also supports complex maneuvers such as U-turns. However, the current test environment involves wide roads with low traffic density, which limits the experience of riding in a Robotaxi under real-world conditions such as traffic congestion or high vehicle density.

Site Visit Adjourned at: 5.30 PM

Illustrative Photos from the Visit / Meeting











As of 26 June 2025

9.1.4. Fieldwork Observations in China

The study visit to **Shenzhen and Guangzhou** offered a vivid picture of how quickly China has transformed its mobility landscape and how deeply electric mobility has become part of everyday urban life.

1) Shenzhen: A Mega-City Fully Electrified

Shenzhen stands out as a large, vibrant mega-city that has embraced electrification at an extraordinary scale. A noticeable feature from the moment one arrives is that electric vehicles use green license plates, making them easy to identify. These green plates dominate the city's roads—most private cars, taxis, and ride-hailing vehicles are now electric. In addition, nearly 100% of motorcycles and scooters in Shenzhen are electric, resulting in a quieter, cleaner, and more efficient urban environment. The extensive electrification of two-wheelers is a strong reflection of Shenzhen's proactive policies, strict controls on ICE motorcycles, and commitment to green mobility.

2) Guangzhou: Industrial Strength and Large-Scale EV Deployment

Guangzhou, while equally modern, presents a slightly different but complementary perspective. As one of China's major automotive and industrial centers, the city demonstrates the strength of China's manufacturing ecosystem, from vehicle assembly to testing, certification, and component production. Guangzhou reflects the industrial backbone that allows China not only to innovate quickly but also to scale technologies to mass production with remarkable speed. Together, Shenzhen and Guangzhou illustrate both the *innovation engine* and the *industrial engine* behind China's mobility transition.

A consistent impression throughout the visit is how incredibly fast China can adapt and transform. Policy, infrastructure, industry, and consumer behavior move in the same direction, resulting in rapid change that many countries would take decades to achieve. Charging networks expand rapidly, new models are released at high frequency, and cities implement regulations swiftly. This speed is not just technological but institutional, China's ability to plan, mobilize, and execute is unusually agile for a system of its size.

Another striking insight is the nature of competition among Chinese EV companies. Industry leaders frequently described the market as a "bloodbath," referring to the intense pressure that forces companies to innovate continuously or risk disappearing. Each year, new EV brands emerge while others exit; price competition is fierce, and product cycles are extremely short. Yet this intensity is precisely what drives China's rapid advancement in EV technology, batteries, software, and autonomous driving. Only the strongest companies, those with vertical integration, advanced software capabilities, and efficient production systems, can survive in this environment.

3) Urban Acoustic Environment

A notable observation in Shenzhen and Guangzhou is the significant mitigation of noise pollution, a direct consequence of the high penetration of new energy vehicles (NEVs). The transition from internal combustion engines to electric drivetrains has resulted in a remarkably quieter urban soundscape, particularly when compared to metropolitan areas like Bangkok. This acoustic shift is especially prominent due to the near-total electrification of the motorcycle fleet, which has eliminated much of the noise typically associated with urban traffic.

4) Integrated Traffic Management

A sophisticated integration between urban traffic management systems and mobile applications was observed, significantly enhancing travel efficiency and laying the groundwork for Robotaxi deployment. A primary example of this is the real-time synchronization of traffic signal countdowns with both in-vehicle displays and smartphone interfaces. This feature allows commuters to predict wait

times with high precision and enables Robotaxis to optimize their driving maneuvers for smoother operation. Notably, this level of advanced digital infrastructure and V2X (Vehicle-to-Everything) connectivity was not observed in other participating countries within this study, marking a distinct technological maturity in the local field sites.

Overall, the findings from Shenzhen and Guangzhou highlight a mobility ecosystem that is not only electrified but exceptionally dynamic. Electric vehicles are the norm, two-wheelers are almost entirely electric, cities are deeply engaged in driving mobility transformation, and competition pushes the entire sector forward. The visit demonstrates that rapid transformation is possible when urban leadership, industry competitiveness, and national policy align. For countries in the Lancang–Mekong region, the experience offers valuable lessons on how city-level ambition, clear regulatory signals, and coordinated planning can accelerate the shift toward cleaner and smarter mobility systems.

9.2 Thailand

9.2.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	PTT Kingkaew 40	August 6th, 2025
2.	Tri Petch Isuzu Sales Company Limited (1st)	September 18th, 2025
3.	Tri Petch Isuzu Sales Company Limited (2nd)	October 22nd, 2025

9.2.2. Lists of Participants (Thailand)

The list of Thai delegates participating in interviews and various site visits is provided below. Please refer to each specific appointment for further details.

9.2.3. Summary of Key Points from the Trip

9.2.3.1. PTT Kingkaew 40

PTT Kingkaew 40 is widely regarded as one of the most advanced electric vehicle charging hubs in Bangkok, representing a significant step forward in Thailand's EV infrastructure. Located behind the NGV station at the PTT Kingkaew 40 service area in Samut Prakan, the site operates as a high-capacity EV Taxi Hub, featuring Huawei Ultra-Fast DC chargers with a combined 720 kW output across multiple charging points, including liquid-cooled and air-cooled units that support fast charging for modern EVs. The facility is designed to serve numerous vehicles simultaneously and is integrated with the OneCharge platform for seamless user management, payment, and real-time monitoring. The hub's capacity and technology make it one of the largest and most powerful charging installations in Thailand's public network, aligning with broader national efforts to expand EV charging infrastructure.

Host Organization

One Charge Solution

1. Mr. Thiraphat Titisottikul — CEO

Winnergy Company

1. Ms. Natthinee Fookan — Station Manager

Huawei Company

1. Mr. Ralph Pattanatit Chutikul	Digital Power Charging network Thailand

Participants

Thailand Automotive Institute

1. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2. Mr. Sunthorn Tunmuntong	Senior Specialist
3. Mr. Sedtawud Larbwisuthisaroj	Specialist
4. Ms. Chalida Donjuk	Staff
5. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Ms. Kanlayanee Kaewmee	Research Assistant

Chulalongkorn University

1. Dr. Phimsupha Kokchang	Researcher
2. Dr. Surapad Larbwisuthisaroj	Researcher

Meeting Commenced at: 02.00 PM

Summary of Key Points

1) One Charge serves around 25% of EVs in Thailand, including home charging, and offers free scheduled home charging via its platform. Public station revenues are shared, with One Charge retaining 5–8% and the remainder going to station owners; Winnergy is the main investor. Tariffs have been simplified to a flat 6.9 THB/kWh, with Winnergy stations receiving a low-priority rate that allows MEA to curtail demand.
2) Typical stations have 720 kW capacity with 12 connectors, each up to 480 kW, and average 28 kWh consumption per vehicle. While Thailand uses mainly standalone chargers (99%), Winnergy adopts split-type chargers for better power management. Installation accounts for 50–70% of investment and chargers for 40–50%, with a 720 kW split-type system costing 9–10 million THB. Chargers have 2–5 year warranties and ~10-year design life.
3) The OCPI protocol is still new, with a few major players expected to dominate. The platform can detect vehicle IP addresses, supporting monitoring and analytics. Winnergy does not plan PV integration due to low-priority tariffs and rooftop space limits, while PTT stations use PV under FiT schemes. Current incentives are limited to outdated BOI support, with recommendations to introduce targeted incentives for highway and main-road stations to speed up EV infrastructure deployment.

Subpoint 1.1: One Charge's Market Position and Business Model

One Charge operates as one of Thailand's leading Charge Point Operators (CPOs), currently serving around 25% of the country's EV market, including both home and public charging users. Its digital platform offers scheduled home charging at no cost to users, enhancing convenience while encouraging EV adoption. For public charging stations, One Charge applies a revenue-sharing model, retaining 5–8% of station revenue, with the remainder going to the station owner or landlord. The primary investor in these stations is Winnergy, whose capital enables rapid network expansion without overburdening One Charge's balance sheet. Charging tariffs have been streamlined from a two-tier structure—7.7

THB/kWh during peak hours and 6.0 THB/kWh off-peak—to a uniform 6.9 THB/kWh, simplifying pricing for consumers. Winnergy stations also benefit from a low-priority electricity rate, allowing the Metropolitan Electricity Authority (MEA) to curtail power demand, when necessary, which reduces operating costs while supporting grid stability.

Subpoint 1.2: Infrastructure Scale, Technical Specifications, and Cost Structure

Typical One Charge stations are equipped with 720 kW charging systems and 12 charging connectors, each capable of delivering up to 480 kW. The average energy consumption per vehicle is around 28 kWh. Average electricity consumption per vehicle is around 28 kWh, which translates to a total daily electricity consumption of approximately 6,000–7,000 kWh for a fully operating station, equivalent to serving roughly 215–250 EVs per day. While 99% of chargers in Thailand are standalone units, Winnergy employs split-type chargers, commonly used in China and Europe—for more efficient power management. Laem Chabang serves as a flagship example of successful expansion, driven by high EV truck demand following the decommissioning of CNG fleets. Installation costs account for 50–70% of total investment, with chargers representing 40–50%. A 720 kW split-type setup with 12 connectors (six chargers) typically costs 9–10 million THB, of which 5–6 million THB is for the chargers themselves. Each charger averages about 1 million THB in cost. Chargers generally have warranties of 2–5 years and a design life of approximately 10 years, guiding long-term maintenance planning and asset replacement cycles.

Subpoint 1.3: Technology Adoption, Renewable Integration, and Policy Gaps

The OCPI protocol, which facilitates interoperability among charging networks, is still in its early stages in Thailand, with only 3–4 major players expected to dominate the market. One Charge's platform is capable of detecting vehicle IP addresses, supporting network security and potential advanced analytics for user behavior and operational optimization. While PTT stations currently integrate solar PV systems and sell electricity under Feed-in Tariff (FiT) schemes, Winnergy does not plan to deploy PV at its stations due to the cost-effectiveness of the low-priority electricity tariff and rooftop space limitations, which cap PV installation at 70% coverage. From a policy perspective, the market currently lacks significant government incentives beyond outdated Board of Investment (BOI) support. Stakeholders suggest introducing targeted incentives for highway-side or main-road stations to accelerate the rollout of EV charging infrastructure nationwide, which could be a key driver in supporting Thailand's broader EV adoption target

Meeting adjourned at: 3.30 PM

Illustrative Photos from the Visit / Meeting










As of 6 August 2025

9.2.3.2. Tri Petch Isuzu Sales Company Limited (1st meeting)

Tri Petch Isuzu Sales Company is one of Thailand's leading manufacturers and distributors of pickup trucks, with an established market presence in Laos. Building upon the primary data collected during the field visit to Laos, this interview sought to extract deeper strategic insights into the Laotian NEV (New Energy Vehicle) market. By leveraging company's extensive operational experience as a Thai-based exporter, the study aims to triangulate fieldwork findings with the perspective of a key industry player.

Host Organization

1.	Mr. Jirayut Adithepnarangkun	Advisor, Tripetch Isuzu Sale Laos Co., Ltd.
2.	Orn Raktiprakorn	Director, Tripetch Isuzu Sale Laos Co., Ltd.
3.	Ms. Chutaruck Chitrojanaruck	President, Tripetch Isuzu Sale Laos Co., Ltd.

4. Ms. Taweeporn Kunakorntiramit	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.
5. Mr. Sirawit Phongphornchettha	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.
6. Ms. Sasisom Phu-yu	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.

Participants

Thailand Automotive Institute

1. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2. Mr. Sunthorn Tunmuntong	Senior Specialist
3. Mr. Sedtawud Larbwisuthisaroj	Specialist
4. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kokchang	Researcher

Meeting Commenced at: 02.00 PM

Summary of Key Points

- Lao PDR has faced financial difficulties since the Covid-19 pandemic, which led to the depreciation of the kip and insufficient U.S. dollar reserves. As a result, the government struggled to import essential goods, particularly fuel, and was forced to impose fuel quota restrictions.
- To stabilize the kip, the Lao government adopted a dual-track policy by promoting the use of electric vehicles while simultaneously increasing taxes on internal combustion engine vehicles. The electric vehicles promotion measures include purchasing tax reduction, import duty exemption, unrestricted import quotas, and low road tax. The electric vehicles promotion measures have an objective to leverage abundant on hydro power electricity of Lao PDR. On the other hand, the Lao government rise high barrier for internal combustion engine by increase purchasing tax up to 220% comparing with previous rate and, restricted import of internal combustion engine vehicle that have value more than 50,000 USD to reduce foreign currency dependency.
- The structure of the Lao automotive market is similar to that of Thailand, with the proportion of pickup trucks (PU) and passenger cars (PC) being nearly equal, although PUs holds a slightly larger share. Within the PC segment, sport utility vehicles (SUVs) are the most popular choice, primarily because of Laos' poor road conditions, which make SUVs more practical and suitable for daily use.
- Although the Lao automotive market and the currency situation have shown signs of recovery, the growth of the Lao vehicle market still faces several challenges, including:
    - BEV tax advantage from import tax exemption and purchasing tax reduction.
    - ICE vehicles with big engines are facing higher purchasing tax rates.
    - The price gap between new and second-hand vehicles.
    - The increase in interest rates.

Subpoint 1.1: Financial Crisis and BEV promotion measure

Lao PDR is a highly import-dependent economy, with petroleum, chemicals, vehicles, and machinery as its major imports. This reliance on external sources makes the country vulnerable to global market fluctuations and currency volatility. In 2022, the Lao kip depreciated sharply, driving inflation and weakening household purchasing power. At the same time, the country's public debt rose to approximately USD 13.8 billion, a significant burden relative to its economic size. The situation was further complicated by debt repayment pressure from China, one of Laos's major creditors, which intensified the financial strain during the crisis.

As foreign currency reserves fell to critically low levels, Lao PDR faced difficulties in securing sufficient fuel supplies, leading to nationwide shortages. The government responded by imposing fuel quota restrictions to manage consumption, but this measure only provided temporary relief. The combined challenges of high public debt, heavy import reliance, declining reserves, and creditor pressure revealed the country's deep structural vulnerabilities. These conditions highlight the urgent need for comprehensive reforms to strengthen fiscal stability, diversify the economy, and enhance resilience against external shocks.

In response to these challenges, the Lao government launched a set of short-term crisis management policies. These included the introduction of a "Dual Track Policy" aimed at reducing reliance on imported fossil fuels as well as leveraging abundant hydropower resources, alongside a ban on the import of luxury vehicles valued above USD 50,000 in order to conserve scarce U.S. dollar reserves. While these measures provided partial relief, they underscored the structural fragility of the Lao economy and reinforced the imperative for long-term strategies to ensure financial stability and sustainable development.

Although the Lao government is attempting to leverage its abundant hydropower resources, the country still carries significant debt from investments in hydropower infrastructure. This financial burden has led to an order to increase electricity prices during 2025–2029, which appears to contradict efforts to promote EV adoption. It remains to be seen how consumers will respond to the higher electricity costs and whether the rising energy expenses will affect the perceived benefits of owning and operating electric vehicles.

Subpoint 1.2: Lao vehicle market status

The structure of the Lao automotive market closely resembles that of Thailand, with pickup trucks (PU) and passenger cars (PC) accounting for nearly equal shares, though PUs maintains a slightly larger proportion. Within the PC segment, sport utility vehicles (SUVs) dominate consumer preference. This is largely attributed to Laos' underdeveloped road infrastructure, where SUVs offer greater practicality, durability, and suitability for everyday use compared to other passenger car types.

In 2022, during the financial crisis, electric vehicles (EVs) gained significant popularity in Laos. Most of these vehicles were imported from China through unauthorized dealers, which meant that consumers had limited access to after-sales services and spare parts. Nevertheless, the Lao automotive market is highly price sensitive, and the government's imposition of fuel purchase quotas further encouraged consumers to shift toward EVs. As a result, despite the risks associated with unauthorized imports, many consumers opted for EVs as a more affordable and practical alternative to conventional fuel-powered vehicles.

Despite the growing interest in EVs and the government's commitment to sustainable mobility, the Lao automotive market continues to face several structural and financial challenges that could hinder its development:

- Battery Electric Vehicles (BEVs) benefit from tax advantages, including import tax exemptions and reductions in purchase taxes
- Internal Combustion Engine (ICE) vehicles with larger engines are subject to higher purchase tax rates.
- The price gap between new and second-hand vehicles might lead to a shift in consumer preference toward used cars, reducing demand for new vehicle sales.
- The increase in interest rates may reduce consumers' ability to access vehicle financing, thereby weakening overall demand in the automotive market.

Meeting adjourned at: 4.00 PM

Illustrative Photos from the Visit / Meeting





As of 19 September 2025

9.2.3.3. Tri Petch Isuzu Sales Company Limited (2nd Meeting)

As a follow-up to the initial consultation, this second session was conducted to elicit further qualitative insights into Cambodia's NEV market. The interview focuses on the perspectives of an established market operator with extensive experience in the Cambodian automotive sector. This longitudinal approach ensures a deeper understanding of market evolution and the strategic nuances specific to the Cambodian context.

Host Organization

1. Mr. Jirayut Adithepnarangkun	Advisor, Tripetch Isuzu Sale Laos Co., Ltd.
2. Orn Raktiprakorn	Director, Tripetch Isuzu Sale Laos Co., Ltd.
3. Ms. Chutaruck Chitrojanaruck	President, Tripetch Isuzu Sale Laos Co., Ltd.
4. Ms. Taweeporn Kunakorntiramit	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.
5. Mr. Sirawit Phongphornchettha	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.
6. Ms. Sasisom Phu-yu	Cambodia & Laos Region, Tripetch Isuzu Sale Co., Ltd.

Participants

Thailand Automotive Institute

1.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2.	Mr. Sunthorn Tunmuntong	Senior Specialist
3.	Mr. Sedtawud Larbwisuthisaroj	Specialist
4.	Ms. Lalida Nuikhong	Staff

Thammasat University

1.	Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics

Energy Research Institute, Chulalongkorn University

1.	Dr. Phimsupha Kokchang	Researcher

Meeting Commenced at: 02.30 PM

Summary of Key Points

1) Cambodia's GDP continues to show strong growth momentum, expanding by 7.9% in 2024—an increase from 4.8% in the previous year. This growth has been driven by the industrial, tourism, and agricultural sectors, as well as the development of major infrastructure projects such as Techo International Airport, Sihanoukville Port, Phnom Penh Port, and the Phnom Penh–Sihanoukville Expressway, most of which are supported by Chinese investment. Cambodia also maintains a clear ambition to transition from a low-income country to a high-income country, with rapid progress observed since the post-COVID-19 period.
2) Cambodia's automotive industry has continued to expand, supported primarily by financial institutions offering low-interest auto loans. These financing mechanisms have significantly increased consumers' ability to purchase new vehicles. Currently, vehicle purchases are financed approximately 50% through loans and 50% through personal funds. This has led to notable growth in the new car market, making it an important driver of the national economy.
3) Automotive Market Structure (Automotive Ecosystem) Cambodia's automotive market consists of three major segments: authorized new car dealers, the grey market for independent imports, and the used-car market. Historically, the used-car market held the dominant share of the country's automotive industry.
4) Consumer Behavior and Perceptions For many Cambodian consumers, purchasing a car is perceived as a symbol of social status. Consumers tend to prioritize top-tier models or vehicles with full-feature packages, and they often prefer products that can be "shown off" or that reflect their social standing.
5) Chinese Consumer Segment Chinese consumers in Cambodia generally prefer Chinese automotive brands. Moreover, many showrooms specifically cater to this group by employing Chinese sales staff or personnel proficient in the Chinese language to better meet their needs.

Subpoint 1.1: Automotive Market and Consumer Behavior

The automotive market in Cambodia has experienced continuous growth, with total sales reaching approximately 50,000 units in 2024. The market structure encompasses a diverse range of vehicle types. SUVs account for the largest share at 48%, reflecting Cambodian consumers' preference for vehicles that offer strong performance, versatility, and an image that enhances social status. Pickup trucks follow with a 20% share, meeting both personal and professional needs, particularly in rural areas where durable vehicles capable of handling diverse road conditions are essential. xEVs (electric and alternative

fuel vehicles) represent about 12% of the market, indicating the early growth of electric and alternative mobility solutions in the country. Vans, PPVs, sedans, and trucks account for 11%, 5%, and 3% of the market, respectively.

In terms of market competition, leading manufacturers include Ford and Toyota, which maintain strong brand reputations, durability, and after-sales service. These qualities align with Cambodian consumers' preference for vehicles that "look good" and clearly reflect social status. For Cambodian consumers, purchasing a vehicle is not merely about mobility; it also symbolizes achievement, social recognition, and pride in owning top-tier or fully featured models. Consequently, the best-selling vehicles are often premium versions or those enhanced with additional features to increase luxury and distinctiveness.

Although vehicle prices in Cambodia remain relatively high compared to average household incomes, the electric vehicle market has shown notable development due to more accessible price points. Most electric vehicles are priced between USD 19,000 and USD 30,000, with the BYD brand being particularly popular, averaging around USD 20,000. Consumers have a variety of options in terms of size, performance, and energy efficiency. These factors contribute to the sustained growth potential of Cambodia's electric vehicle market in the coming years. Moreover, advancements in EV charging infrastructure, with increasing coverage and accessibility, support practical adoption and create an environment conducive to the future development of the electric vehicle industry.

Subpoint 1.2: Promotion of the Automotive Industry

The Cambodian government places significant emphasis on developing the next-generation automotive industry, particularly by promoting the adoption of electric vehicles (EVs) in line with modern urban development and transportation systems. A key policy measure has been the substantial reduction of import duties on EVs, from approximately 30% down to 10%. In addition, the government has lowered the Special Tax rate, resulting in a total tax burden on electric vehicles of around 63%, which is significantly lower than that of internal combustion engine (ICE) vehicles.

For ICE vehicles, the total tax burden is approximately 123%, making their overall price notably higher than that of EVs. Consequently, electric vehicles have become a more accessible option for consumers compared to traditional ICE vehicles. This tax policy not only facilitates EV adoption but also reflects the Cambodian government's broader strategy to promote clean automotive technologies, reduce pollution, and encourage private-sector investment across the related industrial supply chain.

	ICE	EV
Custom Duties	35%	35%
Special tax	50%	10%
VAT	10%	10%
Total	122.79%	63.38%

Subpoint 1.3: Infrastructure

In terms of infrastructure to support the growth of Electric Vehicles (EVs), Cambodia has defined clear targets, aiming to develop 1,500 charging stations by 2030. This goal is set to ensure service readiness and accommodate the expected steady increase in the number of electric vehicles. Currently, Cambodia has 153 charging stations distributed across 13 key cities, primarily installed within petrol stations and car brand showrooms. This strategic placement helps improve accessibility to charging services for EV users, even during this early phase of development. However, the stability of the domestic electrical system remains a challenge. While not severely deficient, the grid is not yet considered stable enough to support the high volume of electrical power consumption anticipated with the future growth of the EV market. Nevertheless, Cambodia can import electricity from neighboring countries, which allows the power system to maintain continuous and appropriate operation, thereby mitigating the risk of domestic power shortages. Furthermore, the government and the private sector are collaboratively and continuously working to develop the electrical infrastructure in preparation for the expected high expansion of the EV market in the future.

Meeting adjourned at: 4.00 PM

Illustrative Photos from the Visit / Meeting



As of 22 October 2025

9.2.4. Fieldwork Observations in Thailand

<u>Mobility Transition and Clean Transport Landscape</u>

The field observations and meetings conducted across Thailand reveal a mobility system that is in the early stages of transformation, with clear momentum toward electrification but still facing structural and institutional challenges. Unlike the fully electrified environments seen in major Chinese cities, Thailand's transition is more gradual, shaped by differences in policy direction, consumer behavior, and city-level implementation capacity.

1) Limited Visibility of NEVs in Active Traffic

In major urban centers such as Bangkok, the presence of NEVs has grown noticeably, driven by strong consumer interest, competitive pricing from new market entrants, and government incentives. However, EVs remain a minority on the streets, and the city continues to be dominated by internal combustion engine (ICE) cars. Unlike Shenzhen, where green license plates make EVs visibly dominant, EVs in Thailand blend into the existing vehicle landscape, reflecting a transition that is still at an early but accelerating stage.

Thailand's two-wheeler market, one of the largest and most important segments for urban transport, has begun to show signs of electrification, but electric motorcycles remain far from mainstream. This stands in contrast to China, where almost all urban motorcycles are electric. The Thai market still depends heavily on traditional ICE motorcycles due to cost considerations, limited charging options, and established consumer habits. The potential for electrification remains high, especially in delivery services and urban commuting, but targeted policy support will be crucial.

2) Accelerated Growth and Regional Imbalance of Charging Networks

Across the country, charging infrastructure has expanded rapidly, supported by both public and private investment. Major highways now feature fast-charging stations at regular intervals, and urban charging points are increasingly available in malls, offices, and residential buildings. However, the pace of deployment remains uneven, and some regions outside major cities still lack sufficient coverage. Operators are also navigating uncertainties related to tariffs, grid readiness, and long-term business models.

3) Inter-Agency Coordination

One of the notable findings from interactions with Thai stakeholders is the need for stronger coordination between national agencies, utilities, cities, and the private sector. While policies such as investment incentives, excise tax adjustments, and zero-emission vehicle targets exist, implementation varies across regions. Cities in Thailand do not yet play the same decisive role in driving EV adoption as leading cities in China. Municipal-level leadership—particularly in Bangkok, Chiang Mai, Khon Kaen, and Phuket, could be a powerful lever for accelerating electrification, improving public transport, and introducing urban EV policies.

4) Import Surge and Local Manufacturing Resilience

Another important insight is that Thailand's automotive industry is simultaneously facing both opportunities and pressures. The rise of EV imports has lowered costs for consumers but has also created competitiveness challenges for local manufacturers. Industry stakeholders frequently note that Thailand must navigate an increasingly competitive EV environment, sometimes described as a "mini-bloodbath" in Southeast Asia, where rapid changes in technology and pricing require constant adaptation. Thailand's strong industrial foundation gives it strategic advantages, but upgrading supply chains, skills, and testing capabilities will be essential.

Overall, the travel findings highlight that Thailand is on the path of transition, with the foundations in place but with significant room to accelerate. With coordinated action across government, industry, and cities, Thailand can move toward a more sustainable, electrified, and competitive mobility future.

9.3 Vietnam (Activity 1)

9.3.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	Hanoi University of Science and Technology	August 19th, 2025
2.	OMODA & JAECOO Vietnam	August 20th, 2025
3.	Academy of Construction Strategy and Cadres Training (ACST)	August 20th, 2025
4.	FPT Software Company Limited	August 21st, 2025
5.	Vietnam-based ICCT Researcher	August 21st, 2025
6.	EV Charging Station	August 22nd, 2025

9.3.2. Lists of Participants (Thailand)

No.	Name	Position	Organization
1.	Mr. Passakorn Chairat	Director General	OIE
2.	Dr. Kriengsak Wongpromrat	President	TAI
3.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI
4.	Mr. Sunthorn Tunmuntong	Senior Specialist, Entrepreneur and Industry Development Division	TAI
5.	Ms. Smitha Suttabustya	Specialist, Marketing and customer relations Division	TAI
6.	Ms. Lalida Nuikhong	Staff, Entrepreneur and Industry Development Division	TAI
7.	Mr. Akanit Thongklueng	Staff, Standard and Conformity Assessment Division	TAI
8.	Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics	TU
9.	Asst. Prof. Dr. Nuksit Noomwongs	Professor, Faculty of Engineering	CU
10.	Mr. Suroj Sangsnit	President	EVAT
11.	Mr. Chaiyaphruek Narongkool	Secretary	EVAT

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute
TU: Thammasat University
CU: Chulalongkorn University
EVAT: Electric Vehicle Association of Thailand

9.3.3. Summary of Key Points from the Trip

9.3.3.1. Hanoi University of Science and Technology

Hanoi University of Science and Technology (HUST), established in 1956, is the first multidisciplinary technical university and a leading engineering institution in Vietnam. Recognized as a National Key University, it plays a pivotal role in producing high-quality engineers and scientists to support the country's development. The university currently has over 37,000 students, including approximately 36,450 undergraduates and 1,405 graduate students, supported by around 1,250 academic staff, among whom are 25 professors and 250 associate professors. HUST offers more than 150 academic programs across bachelor's, master's, and doctoral levels, including advanced and international joint programs, with over 70% of graduates securing employment within three months after graduation. Located at No. 1, Dai Co Viet Street, Hai Ba Trung District, Hanoi, the campus spans over 25 hectares and features teaching and research facilities, laboratories, a national-standard football stadium, a multi-purpose gymnasium, swimming pools, and a variety of amenities to support both academic and student life.

In addition, HUST offers the Advanced Automotive Engineering Programme, designed to provide highly qualified human resources for both regional and international automotive markets. The program particularly focuses on next-generation vehicles powered by new energy sources such as electric vehicles (EVs), hybrid electric-internal combustion engine vehicles, fuel cell vehicles, and smart automobiles. It aims to address the growing demand for skilled engineers in the global automotive industry as major manufacturers continue to invest in the development of future vehicle technologies.

Graduates of the programme are well-prepared for positions as Research and Development Engineers at HUST and partner universities in Japan, Korea, and Germany, or as Design, Manufacturing, and Operation Engineers in leading automobile corporations such as Tesla Motors, Volkswagen, Toyota, Nissan, Peugeot, Renault, VinFast, and Truong Hai. Career opportunities also extend to research institutes, universities, technology transfer centers, and state agencies engaged in the management and regulation of new-generation automobiles.

Host Organization

1. Assoc. Prof. Dr. Hoang Hong Hai	Vice Rector, School of Mechanical Engineering
2. Assoc. Prof. Dr. Nguyen The Luong	Advanced Automotive Engineering Program Director Deputy Head, Research Center for Propulsion Systems and Autonomous Vehicles, School of Mechanical Engineering
3. Prof. Dr. Tuyen Pham Huu	Head of Research Center for Propulsion Systems and Autonomous Vehicles, School of Mechanical Engineering, Hanoi University of Science and Technology

Participants

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist

4. Ms. Smitha Suttabustya — Specialist
5. Ms. Lalida Nuikhong — Staff
6. Mr. Akanit Thongklung — Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit — President
2. Mr. Chaiyaphruek Narongkool — Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyaku — Professor, Faculty of Economics

Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs — Professor, Faculty of Engineering

Meeting Commenced at: 02.00 PM

Summary of Key Points

1. Automotive Market Overview

- Vietnam's automotive market has grown steadily from 352,000 units in 2018 to 510,000 units in 2024, though with noticeable annual fluctuations due to economic conditions.
- Domestic vehicle production reached approximately 389,000 units, still below market demand, leading to continued import dependence.
- Vehicle ownership is only 63 per 1,000 people, significantly below regional peers. This suggests strong long-term expansion potential.
- The localization policy remains limited in effectiveness.

2. Industry Direction & Production Footprint

- The Vietnamese automotive sector is relatively new, with most investments initiated only recently (particularly after VinFast entered the market).
- Industry constraints include:
  - Small market size, fragmented product lineup (around 100 models).
  - Low localization (around 10% vs ASEAN average 40%).
  - Weak domestic supply chains.
  - Lack of standardized EV charging infrastructure.
- Strategic goals:
  - By 2030:
    - 900,000–1 million vehicle sales
    - 600,000–700,000 units produced annually
    - 18–22% eco-friendly vehicles (HEV, PHEV, BEV)
    - Localization rate increased to 55–60%
  - By 2050:
    - 80–85% eco-friendly vehicle share
    - Deep integration into the global automotive value chain

3. EV Ecosystem & Innovation

- VinFast leads the BEV segment, with nearly full local assembly (99% domestic assembly) and 60–70% localization depending on the model.

- VinFast has heavily invested in battery development, operating two factories that manufacture its own battery cells and collaborating with global partners (e.g. Samsung, CATL) for additional supply.
- Around 15,000 charging stations with over 150,000 ports have been deployed nationwide, mostly owned by VinFast under the V-Green franchise model. Expansion target: 1 million charging ports by 2028 (both AC & DC).
- Free charging policy for VinFast vehicles until May 1, 2027.
- The ecosystem is evolving, supported by emerging software development collaborations, including those by FTP Group providing digital solutions for VinFast.

4. Policy Landscape & Government Role

- The government is actively working on a zero-emissions roadmap, acknowledging that policy will be critical for EV transition.
- Eco-friendly vehicle targets cover HEV, PHEV, and BEV, with BEV expected to dominate going forward.
- There are indications that Vingroup indirectly supports the EV ecosystem through cross-business investment strategies, accelerating sectoral growth.

5. Consumer & Market Behavior

- Consumers, particularly younger generations, increasingly prefer BEVs over ICE vehicles, perceiving them as modern, technologically advanced, and environmentally responsible.
- Charging station availability is the most influential factor in EV purchase decisions.
- Consumers are typically comfortable with 15–30 minutes charging wait time, provided stations are located in preferred areas.
- Car purchase financing is predominantly cash-based (around 60%), with payment culture remaining conservative.

6. Challenges & Risks Highlighted

- High vehicle taxes remain a major barrier.
- US–Vietnam tariff arrangements have minimal impact, but tariffs still pose structural constraints.
- Traffic congestion, especially in Hanoi, is a growing concern.
- Limited current adoption of intelligent transportation systems (ITS)—mostly used only for information dissemination (e.g., traffic reports).
- Grey market import issues persist (not discussed extensively here, but important).
- Risk associated with heavy reliance on VinFast: If VinFast fails, the domestic EV transition may slow significantly.
- Among younger customers, full BEV preference is notably strong.
- The automotive sector in Vietnam is still emerging, particularly in the EV segment.
- Domestic expertise is evolving, driven by technology transfers and international partnerships.
- If VinFast faces market failure, there is a possibility of significant industry restructuring.

Meeting adjourned at: 4.30 PM

Illustrative Photos from the Visit / Meeting



As of 19August 2025

9.3.3.2. OMODA & JAECOO Vietnam

OMODA & JAECOO Vietnam was established as a joint venture between Geleximco Group (Vietnam) and Chery Automobile Co. Ltd. (China). The company's primary business focuses on importing, distributing, and providing after-sales services for vehicles under the OMODA & JAECOO brands in Vietnam. Currently, it imports completely built-up (CBU) vehicles from Indonesia, including models such as the Omoda C5 and Jaecoo J7. In addition, the company is undertaking the construction of an automobile manufacturing plant in Thai Binh Province, valued at over USD 800 million. The plant is expected to have an annual production capacity of 200,000 units, with the initial phase scheduled for completion and production commencement in the first quarter of 2026.

OMODA & JAECOO has officially announced a proactive development strategy for the Vietnamese market, with a key objective to expand its dealership network based on the 3S standard: Sales, Service, and Spare Parts. This aims to deliver complete purchasing and after-sales service experience for customers. Currently, OMODA & JAECOO operates 16 dealerships in major cities across the country, with plans to increase the number to 40 dealerships by 2025.

Host Organization

1.	Mr. Nguyen Dang Quang	Deputy GD of sale divisions
2.	Mr. Le Thanh Lam	Deputy GD of administrative
3.	Mr. Nguyen Dinh Hoa	Product manager
4.	Mr. Tran Minh Tung	Strategy manager
5.	Mr. Nguyen Van Quang	Head of Charging Station Management

Participants

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Smitha Suttabustya	Specialist
5. Ms. Lalida Nuikhong	Staff
6. Mr. Akanit Thongklung	Staff

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyaku	Professor, Faculty of Economics

Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs	Professor, Faculty of Engineering

Meeting Commenced at: 10.00 AM

Summary of Key Points

1) Market Dynamics and the Electric Vehicle Sector

The electric vehicle (EV) market in Vietnam is currently dominated by the domestic player, VinFast. The company holds a significant market share of the New Energy Vehicle (NEV) segment, estimated at 30% in 2024. Projections suggest this share could increase to 60% in the future, provided the current level of government support is maintained.

In contrast, several Chinese brands, including BYD, Lynk & Co, GAC, and MG, are focusing on the hybrid (HEV) and internal combustion engine (ICE) segments.

The rapid growth of VinFast is directly attributable to favorable government support policies. However, the company's long-term competitive position remains uncertain due to the nature of the "long game" in the automotive industry, particularly concerning vehicle durability. Reports indicate that VinFast users have expressed ongoing concerns regarding this aspect. The primary market for VinFast is currently the taxi sector, where the vehicles function as essential income-generating tools for drivers.

2) Consumer Preferences and Trends

Vietnamese consumers traditionally hold Japanese and South Korean vehicles in high regard, associating them with superior quality compared to Chinese automobiles. Historical attempts by Chinese brands to enter the market were unsuccessful due to perceived quality deficits.

However, current trends show a gradual increase in Vietnamese acceptance of Chinese vehicles, particularly in the small and medium-sized segments. The primary competitive advantage of Chinese cars over their Japanese, Korean, and domestic counterparts is their modernity and technological integration. Chinese models are consistently equipped with a wider array of standard features across all trim levels, enhancing convenience, entertainment, safety, and driving performance.

- Generational Divide: Generation Z in Vietnam demonstrates a higher openness to new car brands compared to the older demographic (approximately 40 years and above), who exhibit a stronger brand loyalty.

- Infrastructure Impact: The prevalence of narrow roads and alleys in major Vietnamese cities creates a market opportunity for small-sized vehicles. While 7-seater vehicles are also popular, they are often used at full capacity only a few times per year.
- Pickup Trucks: Demand for pickup trucks is bifurcated: one segment uses them strictly for commercial purposes, while the other treats them similarly to Sport Utility Vehicles (SUVs) for intercity travel. Use within congested cities is less convenient due to infrastructure constraints, including narrow roads and limited parking availability.

Key Barriers for Foreign Electric Vehicles

Foreign EV manufacturers face two major structural obstacles in the Vietnamese market:

- Charging Infrastructure Readiness: Over 95% of the country's existing charging stations belong to VinFast and are exclusively compatible with VinFast vehicles. This severely limits access to public charging for owners of other EV brands. Home charging is not a viable option for many consumers due to the small size and lack of sufficient parking space in typical Vietnamese homes. Furthermore, VinFast's policy of offering free charging for the first two years constitutes a significant competitive advantage.
- Taxation Measures: The cost of importing both ICE and electric vehicles into Vietnam is subject to substantial tariffs and taxes.
    - For imported ICE vehicles from China, the total cost can be 2.5 times the factory price due to:
        - Customs duty: 55%
        - Special Consumption Tax (SCT): 35%
        - Registration tax: 12% (Note: Imports from ASEAN countries are exempt from customs duty).
    - In contrast, domestically produced EVs benefit from tax exemptions, such as a 0% registration tax.

3) Market Outlook and Corporate Strategy

The company maintains confidence in its ability to compete with VinFast in the Battery Electric Vehicle (BEV) sector, positing that the market leader is primarily focused on fleet vehicles (buses, taxis) and low-cost, low-option models. The company's strategy is to target the private passenger vehicle segment with superior technology, materials, and features. In the HEV and ICE segments, the company is confident in its ability to compete effectively against established Japanese and Korean brands.

- **ASEAN Production Strategy**: The production plan for the ASEAN region involves specialized manufacturing by vehicle segment:
    - Vietnam will focus on producing small and medium-sized left-hand drive vehicles.
    - Thailand and Malaysia will focus on producing premium medium and large-sized vehicles.
- **Vietnam Manufacturing Investment:** The company is currently constructing its first Complete Knock-Down (CKD) assembly plant in Thai Binh province, with an initial capacity of approximately 50,000 units per year, scalable to 100,000 units. Completion is scheduled for July 2026.
- **Export Strategy and Local Content:** The Vietnamese production base is intended for export markets. The company is investing to establish a manufacturing base and is actively encouraging Chinese component suppliers to achieve a Local Content ratio exceeding 40%. This strategy is designed to leverage Vietnam's extensive network of Free Trade Agreements

(FTAs), which offer a significant competitive advantage in terms of trade benefits compared to manufacturing in Thailand.

- **Infrastructure Investment:** The company will develop its own charging infrastructure by co-locating charging stations with showrooms. The long-term goal is to establish 1,000 showrooms and collaborate with third-party companies to invest in and operate an additional 750 charging stations, as no government support is available for this component of the infrastructure.

4) Other Considerations

Ongoing US-Vietnam tariff negotiations are not expected to impact the automotive industry. This is because the Vietnamese government primarily utilizes non-tariff barriers to regulate market access, insulating the domestic auto market from the direct effects of the tariff discussions.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting






As of 20 August 2025

9.3.3.3. Academy of Construction Strategy and Cadres Training (ACST)

The Academy of Construction Strategy and Cadres Training (ACST) is an institution under the Ministry of Construction of the Socialist Republic of Vietnam, with a core mission to conduct strategic research, provide policy consultancy, and enhance the capacity of high-level personnel in the fields of construction, urban planning, and infrastructure development. ACST was formed through a government restructuring process that merged several strategic and infrastructure development institutions, including the Transport Development and Strategy Institute (TDSI), to create a more integrated approach to construction and transportation planning in Vietnam. The Academy plays a pivotal role in formulating national and regional urban development strategies, drafting sustainable infrastructure policies, and supporting the planning of transportation, logistics, and construction systems aligned with Vietnam's economic growth and environmental protection objectives. ACST's focus includes climate-resilient infrastructure and low-carbon development pathways.

In the area of training, ACST offers a diverse portfolio of academic and practical programs covering topics such as sustainable urban development, transportation management and road safety, public infrastructure management, urban planning, and public administration. These programs aim to equip mid- and senior-level officials from both the public and private sectors with the knowledge, skills, and strategic management capabilities needed to address the challenges of modern infrastructure development. ACST also actively engages in international cooperation, such as its Memorandum of Understanding with HDF Energy to promote green hydrogen technologies for rail and maritime transportation. These initiatives reflect the Academy's commitment to fostering innovation in infrastructure and clean energy to support Vietnam's Net Zero ambitions.

Host Organization

1. Ms. Nguyen Thi Phuong Hien	Deputy Director of ACST
2. Mr. Le Van Dat	Deputy Director of ACST
3. Mr. Nguyen Hung Cuong	Deputy Head of Forecast – Database Division
4. Ms. La Tra Linh	Researcher of Demand Forecast – Database Division
5. Mr. Pham Ngoc Son	Head of Urban and Rural Transport Division
6. Mr. Nguyen Vinh Phong	Deputy Head of Transportation and Traffic Safety Division
7. Ms. Cao Thi Thu Huong	Deputy Head of Environment and Climate Change Division

Participants

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Smitha Suttabustya	Specialist
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Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs — Professor, Faculty of Engineering

Meeting Commenced at: 02.00 PM

Summary of Key Points

The Vietnamese government has assigned specific responsibilities to various ministries to ensure the effective and concrete implementation of the country's transition toward electric vehicles (EVs). These responsibilities include:

- Ministry of Transport: Oversees vehicle transition policies, promotes the adoption of EVs within public transportation fleets, and develops automotive standards.
- Ministry of Planning and Investment: Attracts investment to develop the EV industry and supports the advancement of new technologies.
- Ministry of Finance: Responsible for tax measures, fees, and the procurement of EVs for government agencies.
- Ministry of Industry and Trade: Oversees the production of EVs, the development of charging infrastructure, and electricity pricing for EV charging.
- Ministry of Construction: Issues regulations related to the installation of charging stations in buildings and urban areas.
- Provincial and Municipal People's Committees: Develop and implement local-level policies, particularly plans to transition local bus fleets to electric vehicles by 2030.

1. Vietnam's Roadmap for the Transition to Electric and Green Energy Vehicles

Vietnam has established a long-term vision to achieve a net-zero transport system by 2050, as outlined in its updated 2022 Nationally Determined Contribution (NDC). The road transport sector accounts for nearly 80% of the country's greenhouse gas emissions, making the reduction of vehicular pollution a critical national priority. To address this, the government has introduced a phased transition timeline. By 2025, all newly registered buses must operate on electric or green energy. By 2030, all newly registered taxis are required to be fully electric. By 2050, all newly registered vehicles across all categories must utilize electric or green energy technologies.

This roadmap is accompanied by nationwide efforts to expand EV charging infrastructure to meet the needs of consumers and businesses. Vietnam's approach reflects a systemwide strategy to decarbonize the transport sector, focusing not only on vehicle electrification but also on the supporting energy network and infrastructure essential for a comprehensive and sustainable transition.

2. Policies to Promote the EV Industry and the Adoption of Electric Vehicles in Vietnam

Vietnam's EV policies are designed with an integrated approach that addresses both supply and demand, aiming to accelerate the development of a comprehensive electric vehicle ecosystem. These policies target industrial expansion, investment attraction, and cost reduction for EV users.

2.1 Policies to Promote EV Manufacturing, Assembly, and Importation

The Vietnamese government places strong emphasis on developing the domestic EV industry through tax incentives and regulatory measures that attract investment from both domestic companies—such as VinFast—and foreign manufacturers entering the market, including Thanh Cong and Truong Hai. Key measures include:

- 0% import duty exemption for EV parts used in domestic production (through 2027), reducing overall manufacturing costs.
- Preferential import tariffs on raw materials that cannot yet be produced domestically for supporting industries in the automotive sector (2020–2024).
- A specialized tariff framework for automotive imports and exports to improve market competitiveness.
- Incentives for battery production and hydrogen technologies, including corporate income tax reductions, land-use incentives, and import tax exemptions for necessary equipment.

These measures demonstrate Vietnam's intention to build a complete EV value chain—from key component manufacturing and battery production to charging infrastructure and vehicle assembly positioning the country as a potential regional EV production hub in the future.

2.2 Policies to Promote EV Adoption by Consumers and Businesses

The government aims to reduce the financial burden of EV purchases through highly attractive economic measures, particularly reforms in the Special Consumption Tax (SCT) and vehicle registration fees. Key policies include:

- Significant reductions in SCT for battery electric vehicles (BEVs):
  - For passenger cars with up to nine seats: 1 - 3% until February 2027, increasing to 11% thereafter.
  - This rate is substantially lower than the 35 - 150% SCT applied to conventional internal combustion engine (ICE) vehicles.
- Exemption from registration fees for the first three years, followed by a 50% reduction for the subsequent two years, substantially lowering the total cost of vehicle ownership.
- Support for domestic production of batteries and fuel cell technologies to reduce long-term costs and strengthen technological readiness.

These policies collectively reduce EV ownership costs significantly, making EVs a more attractive and competitive option relative to ICE vehicles particularly in major urban centers seeking to address air pollution and noise reduction.

3. Current Development of Electric Vehicles and Charging Infrastructure in Vietnam

Vietnam has experienced rapid growth in electric vehicles (EVs), particularly after 2020, across both private passenger cars and public transportation. Major cities such as Hanoi, Ho Chi Minh City, and Phu Quoc Island have begun deploying electric buses along public routes as part of broader efforts to modernize and decarbonize urban mobility.

The primary market player is VinFast, which functions both as the country's leading EV manufacturer and as the operator of the most extensive charging network nationwide. VinFast's charging stations are widely distributed across parking facilities, commercial buildings, bus terminals, and even fuel stations along major highways.

Another emerging operator is EBOOST, which manages more than 850 smart charging points and enables broader participation by private sector providers. The entry of new players indicates increasing market competition—a positive signal of a maturing and dynamically expanding EV ecosystem in Vietnam.

Regarding pricing, VinFast's charging rate is approximately 3,858 VND/kWh, while EBOOST charges around 8,900 VND/kWh. These differences reflect the varying cost structures, technologies, and intended use cases of each company's charging systems.

Meeting adjourned at: 4.00 PM

Illustrative Photos from the Visit / Meeting



As of 20 August 2025

9.3.3.4. FPT Software Company Limited

FPT Software Company Limited was established in 1999 as a subsidiary of FPT Corporation, a leading information and communication technology company in Vietnam. Headquartered in Hanoi, FPT Software operates as a global IT service provider with over 80 offices and development centers across more than 30 countries. The company plays a significant role in driving digital transformation for organizations worldwide, including more than 91 companies listed in the Fortune Global 500. FPT Software offers a diverse range of IT services and solutions such as smart factories, digital platforms, robotic process automation, artificial intelligence (AI), Internet of Things (IoT), cloud computing, augmented reality/virtual reality (AR/VR), and business process outsourcing (BPO).

Committed to becoming a global technology leader, FPT Software emphasizes innovation, talent development, and building a sustainable future by applying advanced technologies to enhance quality of life and drive business success. The company fosters a corporate culture centered on resilience and creativity and has been recognized as a "Great Place to Work" in multiple countries, alongside certifications for quality and information security standards.

Host Organization

1. Mr. Tran Nhat Minh	FPT Software Head of Global Partnership
2. Ms. Nguyen Khanh Van	FPT Software Government Relations Assistant to Executive
3. Ms. Tran Thi Phuong Thao	FPT software Thailand Head of Business Enabling

Participants

The Office of Industrial Economics (OIE)

1. Mr. Passakorn Chairat	Director General

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Smitha Suttabustya	Specialist
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Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyaku	Professor, Faculty of Economics

Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs	Professor, Faculty of Engineering

Meeting Commenced at: 09.45 AM

Summary of Key Points

Overview of FPT Software Company

- Vietnam was highlighted as a strategic hub for technology and innovation. The country is currently the fastest-growing digital economy in ASEAN, maintaining more than 20% annual growth from 2022 to 2025. Its GDP grew by 7.09% in 2024, with the government setting an ambitious target of at least 8% for 2025. Vietnam has a strong ICT workforce with over 560,000 software engineers and 60,000 new IT graduates annually. It ranks first globally in high-tech exports, benefits from extensive 4G and 5G coverage, and is emerging as an important player in the global semiconductor supply chain. With political stability and multiple free trade agreements covering 60 economies, Vietnam continues to attract significant foreign investment.

- FPT Corporation was presented as Vietnam's market leader in technology. Founded in 1988 and listed on the HOSE exchange in 2006, the corporation employs more than 80,000 people (54,000+ in core business area) and generated USD 2.47 billion in revenue in 2024. Its core businesses span across technology, telecommunications, education, and retail. In technology, FPT leads in IT services, AI, semiconductors, and automotive solutions. In telecommunications, it operates the country's number one cloud and data center business while also running VnExpress, Vietnam's most popular online newspaper. The education arm supports more than 170,000 students at various levels, while its retail operations dominate the pharmacy and laptop markets. A notable case study was presented on Long Chau Pharmacy, which achieved rapid growth and efficiency through FPT's digital transformation solutions, including cloud migration, AI-driven inventory management, and improved customer service.
- FPT Software, the corporation's global IT services arm, was emphasized as a major growth driver. Established in 1999, FPT Software reached USD 1.22 billion in revenue in 2024. The company employs over 33,000 staff and operates 88 offices across 30 countries. It serves more than 1,100 clients, including over 130 Fortune 500 companies, and has maintained strong growth from USD 62 million in 2011 to its current scale. Partnerships with leading technology organizations such as NVIDIA, Mila (Canada), Landing AI, Meta, and IBM further reinforce its global credibility.
- The company places strong emphasis on people and corporate culture. Employees are offered opportunities to work on global projects, receive competitive compensation packages, and participate in continuous learning and development programs. FPT Software is recognized as one of the top 10 large workplaces in Vietnam by Great Place to Work. Its culture is innovation-driven, with more than 3.4 million learning hours completed annually and strong integration of AI-assisted education to enhance productivity and skills development.

FPT Automotive

1) FPT Automotive, established in December 2023 as a subsidiary of FPT Software, is dedicated to advancing the global transition to Software-Defined Vehicles (SDVs). The company provides comprehensive engineering services to OEMs, Tier-1 suppliers, and chipmakers, focusing on automotive software, digital integration, and electric vehicle technologies. Its core expertise spans AUTOSAR frameworks, cockpit domain controllers, ECU and virtual ECU development, ADAS and autonomous driving, functional safety, cybersecurity, and verification services, alongside cloud solutions, CAD/CAE design, and EV systems such as onboard chargers and battery management.
2) FPT Automotive is organized into four specialized business units. The Automotive Software Unit develops core in-vehicle platforms including AUTOSAR, cockpit domain controllers, ECUs, ADAS/Autonomous Driving, and safety–cybersecurity solutions with validation services. The Digital Services Unit delivers connected vehicle solutions through cloud architecture, APIs, and mobile/web applications to integrate vehicles with digital ecosystems. The Mechanical Engineering Unit provides CAD and CAE design expertise to accelerate and optimize automotive product development. The Electrical Engineering Unit focuses on EV technologies such as onboard chargers and battery management systems to support the industry's electrification transition.
3) Leveraging nearly two decades of FPT's automotive software experience, the company operates with compliance to international standards including ISO 26262 and Automotive-SPICE Level 3. By the end of 2024, FPT Automotive employed about 4,000 engineers worldwide, with plans to expand to 5,000 by 2025. Its talent pool includes more than 1200

AUTOSAR specialists and 500 cockpit domain controller experts, underscoring its strong technical foundation.

4) While its initial business has been anchored in infotainment and connectivity, FPT Automotive is rapidly expanding into autonomous driving and full SDV platforms. With this trajectory, it is positioning itself not only as a trusted technology supplier but also as a future Tier-1 partner within the global automotive value chain. Supported by FPT Software's global presence and partnerships with leading technology firms, FPT Automotive is set to play a key role in shaping next-generation mobility.

key message

- **Insights from the Interview**
  - FPT Automotive main clients are OEM and Tier 1. Their work is based on clients' requirements and can be classified in two end-to-end groups, such as digital services, mechanical/electrical engineering group and automotive software group. Their business model is fundamentally demand-driven, meaning the scope of work is tailored to the requirements of each client project rather than standardized offerings. This flexibility allows FPT Automotive to embed itself as an engineering partner, rather than just a subcontractor, aligning deliverables with OEM/Tier-1 strategic goals.
  - FPT and VinFast collaborate under a strategic partnership established in April 2024 aimed at advancing Vietnam's green transformation. As part of this agreement, VinFast gives priority to using FPT's automotive software and IT infrastructure, while FPT supports the promotion of VinFast's electric vehicles through internal communication, test-driving campaigns and special discounts for FPT staff. Currently, there are 100 FPT staff working for VinFast.
  - FPT Software Thailand has long specialized in banking and finance IT services but is now expanding into the automotive sector, working mainly with Japanese OEMs such as Honda, Toyota, and Mitsubishi. Its automotive projects in Thailand focus on CAD/CAE design engineering and field testing, serving as engineering support for local R&D and manufacturing operations. However, automotive software development linked to Thai projects is handled primarily in Japan, with the Thai branch acting as a supporting extension of these client relationships. This structure positions FPT Thailand as a regional engineering base with strong OEM access, while highlighting the need to build local software capabilities if it is to move up the value chain.
  - FPT Corporation has invested heavily in education, building a system that spans from elementary and secondary schools to international schools and universities. At the university level, students are eligible to take part in internships at FPT starting from their second year, which creates an early pipeline for practical industry experience. Around 30 percent of FPT University graduates go on to work within FPT, demonstrating the corporation's strategy of using its education ecosystem to nurture talent and secure a steady workforce for its expanding businesses.
  - In Vietnam, the development of Intelligent Transportation Systems (ITS) and Smart Mobility remains limited, with ITS still relying on conventional systems and Smart Mobility mainly represented by ride-hailing platforms. VinFast is the key local player driving initiative in this space, while FPT currently has little involvement in ITS and Smart Mobility projects.

Meeting adjourned at: 11.30 AM

Illustrative Photos from the Visit / Meeting



As of 21 August 2025

9.3.3.5. International Council on Clean Transportation (ICCT)

The International Council on Clean Transportation (ICCT) is an independent, non-profit research organization that provides technical and policy analysis on transportation, energy, and the environment. Its mission is to reduce air pollution and greenhouse gas emissions from the transport sector.

In Vietnam, ICCT is based in Hanoi and works with government agencies and local partners to support policy development, particularly focusing on motorcycles and light-duty vehicles, which are widely used in the country. The organization also promotes the transition to electric vehicles (EVs) and the adoption of stricter vehicle emission standards.

Key activities in Vietnam include building a fuel consumption database for motorcycles, conducting research on emission reduction strategies, and participating in regional workshops in Southeast Asia to advance cleaner vehicle and fuel standards.

Host Organization

1. Mr. Tran Dinh Son	Researcher

Participants

The Office of Industrial Economics (OIE)

1. Mr. Passakorn Chairat	Director General

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Smitha Suttabustya	Specialist
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Electric Vehicle Association of Thailand

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Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyaku	Professor, Faculty of Economics

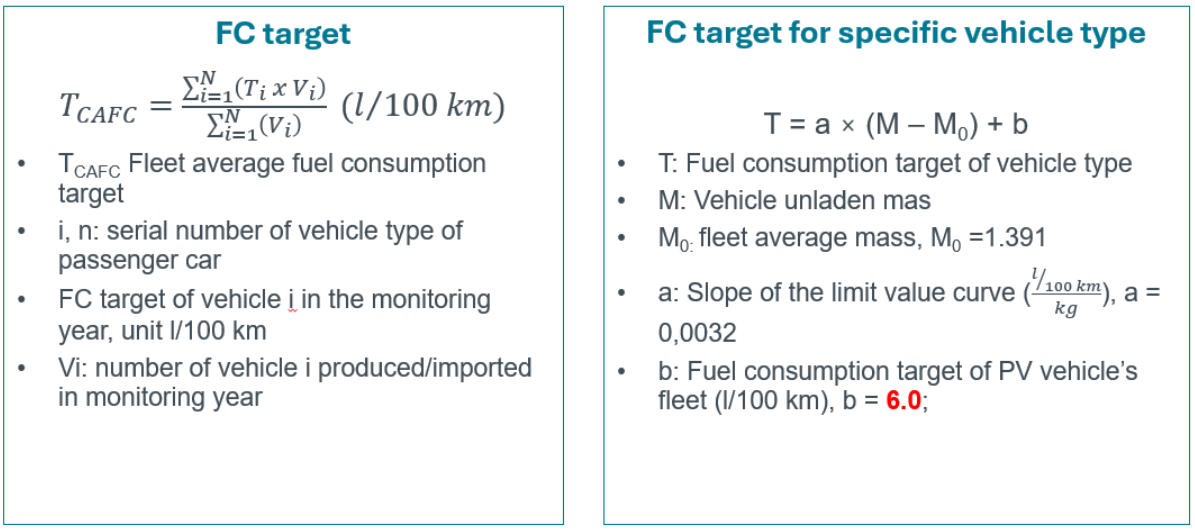
Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs	Professor, Faculty of Engineering

Meeting Commenced at: 02.00 PM

Summary of Key Points

- Vietnam Car Market:
  - Vietnam's vehicle market is growing rapidly, led by the passenger vehicle segment, which expanded by 22% from 2023 to 2024 and is projected to grow at 14–16% annually through 2030. The country also remains a major two-wheeler market, with the highest motorcycle ownership rate globally and the second-largest market in ASEAN.
  - EV adoption is accelerating, with penetration in light-duty vehicles rising from 11% in 2023 to 22% in 2024, while electric two-wheelers have maintained a stable share of around 10% since 2021. Supported by incentives, EVs are approaching cost parity, with some electric passenger cars competitive in upfront price and others on a total cost of ownership basis. Vietnam also benefits from a high EV localization rate of around 60%, strengthening domestic production and supply chains.
- Vietnam is currently developing a Corporate Average Fuel Consumption (CAFC) standard for passenger vehicles and motorcycles, with the Vietnam Register under the Ministry of Transport (now part of the Ministry of Construction) responsible for the draft. The standard aims to set average fuel consumption limits that vehicles must meet as part of Vietnam's broader efforts to improve fuel efficiency and reduce emissions.



- The figure illustrates the method for setting Corporate Average Fuel Consumption (CAFC) targets and vehicle-specific fuel consumption targets.On the left, the CAFC target is defined as a production- or import-weighted average fuel consumption of all passenger car models in a given year, expressed in liters per 100 km. It weights each vehicle type's fuel consumption target by the number of vehicles produced or imported. On the right, the fuel consumption target for a specific vehicle type is calculated as a linear function of vehicle mass, where the target increases with unladen mass relative to the fleet average mass. The parameters include a fixed slope of the limit curve and a base fuel consumption target for the passenger vehicle fleet.
- The test cycle for fuel consumption is NEDC but Vietnam has plan to switch to WLTP as the Euro 6 standard is enforced, which is plannedunder new national roadmap for vehicle emission regulations to be March 1, 2026.
- The fleet fuel consumption target is set by comparing a manufacturer's actual Corporate Average Fuel Consumption (CAFC) with the calculated target CAFC (TCAFC), following a phased tightening approach. In the first year of implementation, manufacturers are allowed a CAFC up to 116% of the target level. This tolerance is gradually reduced to 112% in the second year, 108% in the third year, and 104% in the fourth year. From the fifth year onward, manufacturers are required to fully comply, with actual CAFC equal to or below 100% of the TCAFC.
- Credit Trading: The CAFC standard also allow flexibility measures; Self-credits: OMEs committed to over compliance to offset their deficits and Credit Trading from other OEMs that over compliance with standards.

- The ICCT assessment of CAFC standard (Porposal)
  - The ICCT indicates that the Vietnam Register (VR) proposed fuel consumption standard would not be sufficient for Vietnam to achieve its NDC target. Compared with the business-as-usual scenario, the VR proposal reduces cumulative CO_2 emissions by about 6.77 million tons during 2021–2030, equivalent to only 73% of the NDC target. In contrast, the more stringent ICCT proposal would reduce emissions by 9.42 million tons, or 102% of the NDC target, meaning it would fully meet—and slightly exceed—Vietnam's NDC commitment.
  - ICCT also forecasts that the credit trading mechanism under the VR proposal would financially benefit VinFast. According to the analysis, VinFast could earn approximately USD 1,200–2,000 per vehicle from selling excess compliance credits

between 2026 and 2030, equivalent to about 5–8% of the vehicle price. At the fleet level, this translates into annual revenues of roughly USD 220–300 million, depending on the assumed rate of fuel-consumption improvement by internal combustion engine (ICE) vehicles. Overall, ICCT highlights that credit trading could create a significant revenue stream for VinFast while supporting compliance with fleet fuel-consumption standards.

- Vietnam is also developing a CAFC standard for motorcycles, following a similar approach to passenger vehicles. However, the target-setting parameters differ: engine displacement is used for internal combustion engine motorcycles, while motor power is applied for electric motorcycles. In addition, the framework allows for credit trading among manufacturers.
- ICCT assesses that the Vietnam Register (VR) proposed fuel-consumption standard is too lenient. Using 2021 as the baseline year, the analysis shows that manufacturers' existing Corporate Average Fuel Consumption (CAFE) levels already meet—or are well below—the proposed target (TCAFE) throughout the early compliance period. As a result, the standard would not require additional efficiency improvements and would deliver little to no reduction in fuel consumption, particularly in the initial years of implementation.

FC targets for ICE-2Ws

Engine displacement (cm3)	FC target (l/100 km)
To 50	1.47
(50 - 100]	1.7
(100 - 125]	1.87
(125 - 150]	2.0
(150 - 250]	2.3
(250 - 400]	3,4
(400 - 650]	4.1
(650 - 1000]	5.2
(1000 - 1250]	5.9
> 1250	6.4

FC targets for E2Ws

Motor power (Kw)	FC target (l/100 km)
To 3.73	1.64
(3.73 - 5.22]	1.91
(5.22 -14.91]	2.07
(14.91 - 29.83]	2.93
(29.83 - 37.29]	3.56
(37.29 -52.20]	5.05
(52.20 - 67.11]	5.21
(67.11 - 89.48]	5.99
(89.48 - 111.86]	5.41
(111.86 - 134.23]	5.71
(134.23 - 156.60]	5.99
> 156.60	7.25

Note: E2Ws stands for electric 2-wheelers

Meeting adjourned at: 3.30 PM

Illustrative Photos from the Visit / Meeting






As of 21 August 2025

9.3.3.6. EV Charging Station

The field survey of electric vehicle charging infrastructure focused on two sites representing distinct operational models. The first assessment was conducted at an official VinFast-operated station located within a shopping mall parking facility in Hanoi's city center, offering a primary look at the proprietary network's urban integration. The second site involved a third-party, non-VinFast charging station, providing a comparative perspective on independent infrastructure. Collectively, these visits yielded empirical insights into the practicalities of the NEV ecosystem and the actual charging behaviors of Vietnamese users.

Host Organization

1.	Mr. Nguyen Dang Quang	Deputy GD of Sale Divisions, OMODA & JAECOO Vietnam

Participants

The Office of Industrial Economics (OIE)

1.	Mr. Passakorn Chairat	Director General

Thailand Automotive Institute

1. Mr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Mr. Sunthorn Tunmuntong	Senior Specialist
4. Ms. Smitha Suttabustya	Specialist
5. Ms. Lalida Nuikhong	Staff
6. Mr. Akanit Thongklung	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyaku	Professor, Faculty of Economics

Chulalongkorn University

1. Asst. Prof. Dr. Nuksit Noomwongs	Professor, Faculty of Engineering

Meeting Commenced at: 09.00 AM

Summary of Key Points

The delegation visited two electric vehicle (EV) charging locations in Hanoi to observe the current infrastructure, operational models, and user experience.

1. First Charging Location – VinFast-Operated Station (Shopping Mall Parking, Hanoi City Center)

- Located inside the parking area of a city-center shopping mall.
- Operated exclusively by VinFast.
- Provides free charging for VinFast vehicle users until May 2027.
- Used by both private EV owners and professional drivers of electric vehicles.
- All chargers installed are DC fast-charging units, enabling quick charging.
- This model is designed to promote adoption of VinFast vehicles through strong infrastructure support.

2. Second Charging Location – Non-VinFast Provider

- Operated by a different charging service provider.
- Limited infrastructure with only two charging units installed.
- Compatible with multiple EV brands, unlike the first location which is VinFast-only.
- Highlights the early stage of non-VinFast charging network expansion.

3. Charging Station Usage & Application System

- In Vietnam, EV users can locate charging points and make payments via mobile applications.
- However, users currently face challenges downloading and managing multiple applications for each charging provider.
- Charging infrastructure is highly concentrated in major cities, with limited availability in provincial or rural areas.

4. Overview of Vehicle Taxation in Vietnam

Tax Component	Battery Electric Vehicle (BEV)	Internal Combustion Engine (ICE)	Notes
Import Duty (CBU from China)	Up to 55%	–	From China; from ASEAN = 0%
Import Duty (CKD parts)	15%	–	For imported parts for local assembly
Special Consumption Tax (SCT)	3%	35%	Based on powertrain type
Vehicle Registration Fee	0%	12%	Incentivizes EV adoption

- Overall, vehicles imported from China are approximately 2.5 times more expensive than locally assembled vehicles due to high taxation.

5. Charging Tariff (Non-VinFast Provider – Pilot Station)

Charging Time	Tariff
Free Time (09:00 PM – 04:00 AM)	5,000 VND/kWh
Normal Time (04:00 AM – 07:00 AM)	6,000 VND/kWh
Peak Hours (07:00 AM – 09:00 PM)	7,000 VND/kWh

Key Observations

- VinFast dominates EV charging infrastructure and offers strong incentives via free fast charging, likely to influencing customer preferences.
- Other charging providers remain at a small scale, and interoperability is still limited.
- Application fragmentation is a pain point for EV users, suggesting the need for an integrated charging network platform.
- High taxation for foreign-made vehicles and strong incentives for EVs underline Vietnam's drive toward localization and electric mobility adoption.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting







As of 22 August 2025

9.3.4. Fieldwork Observations in Vietnam (Activity 1)

The field visit in Vietnam provided comprehensive insights into the country's technological capabilities, industrial transformation, and policy development landscape.

At the Hanoi University of Science and Technology (HUST), the delegation observed Vietnam's strong foundation in engineering and applied research, highlighting opportunities for collaboration in smart systems, automotive technology, and digital innovation. HUST also provided an overview of national industrial policies and the competitive landscape in Vietnam's automotive market, including notable insights into VinFast's business strategy. VinFast is actively shaping its own user ecosystem—leveraging preferential purchasing privileges through its real estate networks and attempting to secure long-term customer loyalty through vertically integrated services and infrastructure.

The visit to OMODA & JAECOO Vietnam showcased the rapid emergence of new-energy vehicle manufacturers in the Vietnamese market, emphasizing their strengths in intelligent vehicle design, safety technologies, and the development of an integrated NEV service ecosystem. The company also shared its vision for competing in Vietnam's EV market, noting both the substantial growth potential and the structural challenges associated with charging infrastructure. Moreover, OMODA and JAECOO highlighted the competitive pressures faced by new entrants, who must compete with VinFast's dominant position and extensive EV-related infrastructure.

Engagements with the Academy of Construction Strategy and Cadres Training (ACST) further illustrated Vietnam's strategic direction in urban development and infrastructure planning, particularly policy frameworks that support sustainable growth and smart-city initiatives. ACST provided insights into efforts to promote EV use within Hanoi's Old Quarter to reduce pollution and encourage clean mobility. However, they noted several challenges: concerns over the high cost of purchasing new vehicles, modest income levels among government officials who tend to prefer electric motorcycles over cars, and the limited availability of parking spaces. These constraints collectively impede efforts to promote EV adoption in dense, historic urban areas.

The final visit to FPT Software Company Limited demonstrated Vietnam's growing prominence in the global digital economy, with advanced capabilities in AI, cloud computing, Big Data analytics, and mobility-related digital solutions. Discussions highlighted the company's investment in human-capital development through its internal education institutes, which cultivate a digitally skilled workforce and strengthen its software engineering capacity. FPT also outlined its strategic vision to expand technology solutions into a wider range of industrial and commercial sectors.

Observations from Hanoi's urban mobility environment further contextualize the country's EV and smart-mobility trajectory. The capital city is characterized by narrow roads, high traffic density, and the overwhelming dominance of motorcycles as the primary mode of transport. Most residential homes lack private parking, and public parking facilities remain limited. Large vehicles—including full-size electric cars—are often impractical in many districts due to space constraints. As a result, small EVs or electric motorcycles are far better suited to Hanoi's urban form. Additionally, smart-mobility systems face readiness challenges: warning sensors in intelligent vehicles activate continuously due to the proximity of motorcycles, causing inconvenience for users, while automatic braking systems tend to intervene frequently in dense traffic conditions.

During the field trip, the delegation also rented an electric vehicle and visited two different charging stations, providing firsthand experience with user behavior and charging-service conditions. Location proved to be a critical determinant of charging demand. The first station, located in the basement of a shopping mall, attracted a steady flow of private EV users and electric taxis. The second station, with only two chargers and situated in a less accessible location, saw significantly lower usage. EV users also reported challenges related to service fragmentation—multiple charging applications are required, forcing users to download several apps to access different networks.

Overall, the field trip highlighted Vietnam's evolving innovation ecosystem and identified multiple avenues for cooperation in technology, policy development, and industrial upgrading. The visit also provided important insights into opportunities and constraints for EV and smart-mobility adoption in Vietnam. While the country demonstrates strong momentum, substantial upgrades in transportation infrastructure and residential planning will be necessary to support broader EV usage. However, this field visit did not include opportunities to observe domestic automotive manufacturing facilities, which would have provided deeper context on Vietnam's vehicle-production development.

9.4 Vietnam (Activity 2)

9.4.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	KPMG Limited	June 2nd, 2026
2.	Thai Chamber of Commerce and Industry in Vietnam	June 3rd, 2026
3.	Institute of Smart City and Management (ISCM)-University of Economics Ho Chi Minh City (UEH)	June 3rd, 2026
4.	Independent Expert	June 3rd, 2026
5.	AQUILA	June 3rd, 2026
6.	SAIC Motor Vietnam	June 4th, 2026
7.	BYD Oway Sài Gòn	June 4th, 2026

9.4.2. Lists of Participants (Thailand)

No.	Name	Position	Organization
1.	Mr. Supakit Boonsiri	Director General	OIE
2.	Mr. Chalee Khansiri	Director, Division of International Industrial Economics	OIE
3.	Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level	OIE
4.	Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level	OIE
5.	Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level	OIE
6.	Dr. Kriengsak Wongpromrat	President	TAI
7.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI
8.	Dr. Tanawan Sutantaviboon	Specialist, Entrepreneur and Industry Development Division	TAI
9.	Ms. Nalada Sanpimolkul	Specialist, Automotive Human Resources Management Division	TAI
10.	Mr. Phasin Chomsomboon	Staff, Entrepreneur and Industry Development Division	TAI
11.	Mr. Suroj Sangsnit	President	EVAT
12.	Mr. Chaiyaphruek Narongkool	Secretary	EVAT

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute
EVAT: Electric Vehicle Association of Thailand

9.4.3. Summary of Key Points from the Trip

9.4.3.1. KPMG Limited

KPMG Limited is a leading global "Big Four" professional services firm offering audit, tax, and advisory services. Operating in Vietnam since 1994, it has established itself as one of the country's largest professional services firms, employing over 1,700 professionals across offices in Ho Chi Minh City, Hanoi, and Da Nang. The Ho Chi Minh City office is located on the 10th Floor of Sun Wah Tower, a Grade A landmark building in District 1.

KPMG Vietnam serves diverse international and local clients across sectors like financial services, energy, manufacturing, infrastructure, and consumer markets. Its consulting division delivers practical insights using advanced analytics and artificial intelligence for strategy formulation, operational transformation, market feasibility, and commercial due diligence.

Relevant to smart mobility, KPMG possesses deep expertise in Vietnam's electric vehicle (EV) sector. In 2024, alongside partner Cho Tot Xe, KPMG published a landmark market research study titled *"Driven by Voltage: Navigating the EV Landscape in Vietnam,"* which surveyed more than 1,100 participants and interviewed dealerships nationwide. The study revealed high consumer readiness, noting that nearly 70% of Vietnamese consumers lean toward purchasing an EV or hybrid, with over 85% motivated by environmental and health concerns. Additionally, KPMG publishes the Annual Global Automotive Executive Survey to track international investment and automotive industry sentiment, cementing its role as a premier market intelligence partner for Vietnam's EV transition.

Host Organization

1. Mr. Tran Thanh Tam	Head of Markets
2. Mrs. Phakkhanit Ua-amornwanit	Head of Thai Desks
3. Mrs. Punnika Kaewsri-on	Thai desk Senior Manager

Participants

The Office of Industrial Economics

1. Mr. Supakit Boonsiri	Director General
2. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
3. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
4. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
5. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit — President
2. Mr. Chaiyaphruek Narongkool — Secretary

Meeting Commenced at: 01.30 PM

Summary of Key Points

1. Economic and Policy Environment

KPMG noted that Vietnam is targeting 10% GDP growth and is actively promoting private-sector-led economic development through investment incentives and support measures, including Resolution 68. Rising fuel prices driven by geopolitical tensions and energy security concerns are strengthening the economic rationale for energy transition and EV adoption. Vietnam remains committed to its COP26 and net-zero targets, with EVs positioned as a key decarbonization solution. The government continues to support EV uptake through fiscal incentives, public procurement programs, and potential restrictions on ICE vehicle access in major city centers. However, challenges remain, including stringent fire safety regulations affecting charger deployment, concerns over electricity grid reliability, and the absence of a comprehensive framework for end-of-life EV battery management and recycling.

2. Current EV Market Conditions

Vietnam's EV market is currently dominated by VinFast, whose market position is reinforced by its integrated ecosystem and affiliated businesses. Nevertheless, KPMG highlighted that headline EV sales figures may not fully reflect underlying consumer demand, as a substantial share of vehicle sales is linked to affiliated fleet operations and promotional activities within the VinGroup ecosystem. Market adoption continues to face several barriers, including high total cost of ownership, insufficient and unreliable charging infrastructure, concerns regarding battery durability and software performance, limited independent maintenance services, and consumer apprehension about long-distance travel. Foreign EV manufacturers also face challenges in gaining market share due to the dominance of VinFast and the current market structure. Meanwhile, Vietnam's large motorcycle fleet presents a significant opportunity for future electrification.

3. Market Outlook and Industry Development

Looking ahead, KPMG expects EV adoption in Vietnam to continue growing, supported by government policies, environmental commitments, and increasing fuel costs. Hybrid vehicles are gaining popularity as a practical transitional technology due to their reduced dependence on charging infrastructure and lower range anxiety. The market is also expected to evolve toward more interoperable charging networks, expanded third-party maintenance services, improved battery lifecycle management, and more open EV ecosystems. In addition, motorcycle electrification is viewed as one of the most effective pathways for reducing transport-sector emissions, while regional cooperation among Lancang–Mekong countries is expected to support the development of EV supply chains, standards, and market readiness.

4. VinFast Business Model and Competitiveness

KPMG described VinFast's business model as highly vertically integrated, encompassing vehicle manufacturing, charging infrastructure, fleet operations, and after-sales services. The company benefits from strong alignment with national EV objectives, extensive charging network investments, public procurement opportunities, and strong brand recognition as Vietnam's national EV champion. However, VinFast continues to face challenges related to profitability, while consumers remain concerned about long-term after-sales support, battery durability, software reliability, and service coverage outside major cities. Furthermore, although vehicle assembly is conducted domestically, a significant proportion of components are sourced from China, highlighting continued dependence on international supply chains.

Meeting adjourned at: 3:30 p.m.

Illustrative Photos from the Visit / Meeting



As of 2 June 2026

9.4.3.2. Thai Chamber of Commerce and Industry in Vietnam (ThaiCham)

The Thai Chamber of Commerce and Industry in Vietnam (ThaiCham) is a non-governmental, non-profit organization representing Thai enterprises in Vietnam. Established as the Thai Business Association (TBA) in 1999, it officially rebranded as ThaiCham in December 2021, and is headquartered at Empire Tower, District 1, Ho Chi Minh City. ThaiCham represents over 100 Thai companies across diverse industries, collaborating closely with the Thai Embassy, the Royal Thai Consulate-General in Ho Chi Minh City, and the Thai Chamber of Commerce. As a Consortium Associate Member of the Vietnam Business Forum (VBF), ThaiCham provides a structured channel for Thai businesses to engage with Vietnamese government policy processes.

Thailand is currently Vietnam's largest trading partner within ASEAN, with cumulative investments in over 650 projects exceeding USD 13 billion. According to ThaiCham's "Thai Business Sight in Vietnam 2025" survey, 62% of Thai businesses are optimistic about Vietnam's macroeconomic outlook,

and 36% plan to expand operations in the short to medium term. The elevated "Comprehensive Strategic Partnership" between Thailand and Vietnam strengthens interlinked supply chains and joint market interest, especially in the EV and smart mobility sectors where both nations are undergoing simultaneous industrial transformations.

Host Organization

1. Mr. Tran Thanh Tam	Head of Markets
2. Mrs. Phakkhanit Ua-amornwanit	Head of Thai Desks
3. Mrs. Punnika Kaewsri-on	Thai desk Senior Manager

Participants

The Office of Industrial Economics

1. Mr. Supakit Boonsiri	Director General
2. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
3. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
4. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
5. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Meeting Commenced at: 10.00 AM

Summary of Key Points

EV Development Strategy in Vietnam

The Vietnamese Government is accelerating the implementation of its Net Zero policy, with the goal of achieving carbon neutrality by 2050, while actively promoting the adoption of electric vehicles (EVs). Vietnam's middle-class population is projected to exceed 50 million by 2035, providing a strong foundation for the continued expansion of the domestic automotive market.

In terms of national competitiveness, Vietnam possesses significant strengths in software engineering and information technology talent. Supported by proactive government policies, the country is investing heavily in the development of a highly skilled workforce in artificial intelligence (AI) and semiconductor technologies, which have been identified as strategic industries for future economic growth.

Despite these favorable conditions, the expansion of the EV industry continues to face several challenges. These include addressing air pollution, developing interoperable charging infrastructure shared among different vehicle manufacturers, and strengthening safety standards to support the industry's long-term growth.

VinFast, Vietnam's leading electric vehicle manufacturer, has experienced rapid growth with strong financial and strategic support from Vingroup. Although the company continues to incur substantial accumulated losses due to significant research and development investments and intense global market competition, VinFast has adopted an innovative market development strategy by leveraging GSM, its affiliated electric taxi operator, to accelerate EV adoption and increase consumer familiarity with electric vehicles. At the same time, the company is expanding its international presence in key overseas markets, including the United States, India, and the Philippines.

Meeting adjourned at: 12:00 PM

Illustrative Photos from the Visit / Meeting



As of 3 June 2026

9.4.3.3. Institute of Smart City and Management (ISCM)-University of Economics Ho Chi Minh City (UEH)

The University of Economics Ho Chi Minh City (UEH), established in 1976, is a multidisciplinary National Key University and ranks among the Best 1,000 Business Schools globally, supporting over 30,000 students and 767 academic staff. Located at Campus N (District 3), UEH established the Institute of Smart City and Management (ISCM) in May 2020 as a multidisciplinary Center of Excellence. ISCM focuses on five strategic pillars: Smart Planning, Smart Design, Smart Transport, Smart Management, and Integrated Application. Its international team consists of 19 members from four countries and collaborates with 27 partners across nine countries, 11 universities, and three government sectors.

ISCM performs advanced simulations, data-driven research, and policy-applied work concerning urban mobility and EV integration. Its Smart Transport program targets road safety, user behavior, congestion management, public transport planning, and infrastructure development. ISCM partners with international institutions in Belgium, Australia, Thailand, and South Korea on smart mobility and sustainable transport systems aligned with net-zero goals. This research is vital to the ASEAN context, specifically exploring the decarbonization of transit and the electrification of two-wheelers (E2W) and public transit—supporting Vietnam's national mandates to electrify all urban buses by 2025 and taxis by 2030.

Host Organization

1. Prof. Trinh Tu Anh	Director of ISCM
2. Dr. Quang Tran Vuong	Lecturer
3. Mr. An Truong Phan Le	Thai desk Senior Manager
4. Mr. Vu Anh Thai	Researcher

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
4. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Meeting Commenced at: 01.30 PM

Summary of Key Points

Background: Institute of Smart City and Management (ISCM)

The Institute of Smart City and Management (ISCM) is a multidisciplinary Centre of Excellence established in May 2020 within the University of Economics Ho Chi Minh City (UEH) — one of Vietnam's National Key Universities, ranked among the Best 1,000 Business Schools globally. ISCM operates through five strategic pillars: Smart Planning, Smart Design, Smart Transport, Smart Management, and Integrated Application. Its international team of 19 members from four countries collaborates with 27 partners across nine countries, 11 universities, and three government agencies.

ISCM's work focuses on providing evidence-based, actionable insights to local authorities through integrated technology platforms. The institute conducts advanced simulations, data-driven research, and policy-oriented work across urban mobility, EV integration, road safety, and sustainable transport, with particular relevance to the ASEAN context.

Integrated Urban Decision-Support Platforms

ISCM's core mission is to assist local authorities in making smarter, data-informed decisions about urban management. This is achieved through integrated technology platforms that consolidate information from multiple sources, providing actionable outputs for city planners and policymakers. ISCM highlighted that effective technology implementation is not purely a technical challenge — it is also dependent, to a significant extent, on the demographics and prevailing values of the local population. Vietnam, with its distinct urban culture and rapidly evolving mobility landscape, represents a particularly dynamic and complex environment for deploying smart city solutions.

Three-Pillar Research Framework

ISCM structures its research and applied work across three interconnected pillars:

Behaviour and Road Safety: This pillar focuses on understanding and improving how road users respond to traffic situations. A standout initiative is ISCM's VR motorcycle simulation, which places individuals in realistic traffic scenarios to assess how they react to hazards. This approach helps researchers and policymakers understand behavioural risk patterns and identify opportunities for targeted interventions. ISCM also operates "living labs" designed to enhance traffic rule knowledge and improve risk detection in real-world environments.

Operational Management: This pillar covers the practical management of urban mobility systems. ISCM's Smart Mobility Lab focuses on intelligent routing and optimising urban platform structures that influence mobility demand. The goal is to develop smarter, more efficient movement patterns across cities through data-driven analysis.

Environmental Impact: The third pillar addresses the sustainability dimensions of urban transport. A guiding principle across ISCM's work is accessibility — developing technologies that are not only cost-effective but also environmentally responsible, ensuring that smart mobility solutions remain viable for a broad range of cities and communities.

Smart Mobility Lab and Living Labs

The ISCM Smart Mobility Lab serves as the applied research hub for intelligent routing and urban structure optimisation. The lab analyses how physical and digital urban environments shape mobility demand, providing models that can be used to redesign city layouts or transport networks for greater efficiency.

Complementing the lab is ISCM's "living lab" concept, which embeds research activity directly into real urban environments. These living labs are used to test interventions, gather behavioural data, and observe how road users respond to changes in infrastructure, signage, or traffic management. The objective is to bridge the gap between simulated environments and the complexity of actual city conditions.

Research Rankings and International Collaboration

ISCM acknowledged that the diversity of university ranking systems reflects a broader diversity in research approaches to smart mobility. Different ranking criteria capture different dimensions of institutional strength, and no single framework fully represents the breadth of applied, interdisciplinary work that institutions like ISCM pursue. This point was raised in the context of how smart mobility research is evaluated globally and how academic-industry-government partnerships are assessed.

ISCM collaborates with international partners including Hasselt University (Belgium), the University of Melbourne (Australia), Thammasat University (Thailand), and the University of Seoul (South Korea), reflecting a strong commitment to cross-border knowledge exchange.

Key Observations and Implications

ISCM's three-pillar approach (behaviour → operations → environment) provides a structured and replicable framework that could be relevant for other Mekong-region cities assessing their readiness for smart mobility transitions.

The VR motorcycle simulation is a particularly innovative tool with potential applications in road safety education and policy design across ASEAN markets where two-wheelers dominate.

The emphasis on cost-effective, accessible technology is well aligned with the economic realities of lower-middle-income urban contexts in the region, including cities in Laos, Cambodia, and parts of Vietnam.

ISCM's observation that technology effectiveness depends on local demographics and values reinforces the importance of context-specific approaches when assessing NEV and smart mobility readiness across the Lancang-Mekong region.

The Smart Mobility Lab's work on intelligent routing and urban structure optimisation may offer practical insights for Ho Chi Minh City's ongoing transport planning efforts, particularly as the city pursues targets for electrifying buses and taxis.

Meeting adjourned at: 03:00 PM

Illustrative Photos from the Visit / Meeting







As of 3 June 2026

9.4.3.4. Independent Expert

Host Organization

1. Mr. Abhishek Sinha	Electric Mobility Expert (Freelance)

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
4. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Meeting Commenced at: 03.00 PM

Summary of Key Points

Speaker Background

Mr. Abhishek Sinha is an independent electric mobility expert with a professional background spanning start-ups, e-commerce, and e-mobility. He hosts The EV Equation, a podcast exploring the dynamics of electric vehicle adoption across emerging markets. His presentation focused on the structural and financial barriers to electric two-wheeler (E2W) adoption in Southeast Asia, with particular attention to ride-hailing drivers as a key transition target group, and the role of financing, government signalling, and cross-country policy benchmarking in accelerating the shift.

Electric Two-Wheeler Market Overview in Southeast Asia

Southeast Asia is characterised by exceptionally high motorcycle density, making the electric two-wheeler (E2W) segment a critical lever for decarbonising urban transport. Despite this, E2W penetration across most of the region remains low. The two markets with the highest E2W penetration are Vietnam and China, where adoption has been driven by a combination of regulatory push and ecosystem development.

In the four-wheel EV segment, Thailand is currently the fastest-growing market in Southeast Asia, with Indonesia in second place. However, this growth dynamic does not yet translate to equivalent momentum in the two-wheeler segment, where structural barriers remain significant.

A key illustrative challenge is the ride-hailing sector. A large proportion of motorcycle taxi and delivery drivers in the region — such as Grab drivers — use personal two-wheelers for their livelihood. Converting this segment to electric represents both a significant decarbonisation opportunity and a particularly complex transition challenge, as the decision to switch is shaped not only by vehicle cost but by financing structures, income stability, and risk tolerance.

Policy Drivers and the Low Emission Zone (LEZ) Concept

Vietnam and China's higher E2W penetration rates are attributable in large part to direct policy interventions. A primary mechanism under discussion in Vietnam is the Low Emission Zone (LEZ) model, which begins by restricting or banning internal combustion engine (ICE) motorcycles from defined city-centre zones. Hanoi has announced plans to enforce such restrictions in inner urban areas from 2026, signalling a concrete regulatory shift. Historically, similar measures in Chinese cities proved highly effective in rapidly growing E2W market share.

However, the discussion acknowledged a meaningful conflict of interest between government-led electrification pushes and legitimate infrastructure concerns — specifically grid capacity and fire safety.

As E2W and EV adoption accelerates, grid stress becomes a material risk, and battery fire incidents (particularly associated with lower-quality products and informal charging behaviour) represent a genuine public safety challenge. These concerns can create friction between the pace of policy ambition and the readiness of underlying infrastructure.

Mr. Sinha referenced Pakistan's PAVE (Pakistan Accelerated Vehicle Electrification) policy as an example of an approach that combines targeted incentives with regulatory clarity for the E2W segment. The broader principle advocated was the importance of combining the most effective policy mechanisms from different country contexts and adapting them to local conditions, rather than transplanting any single national model wholesale.

Financing Barriers to E2W Transition

Financing structures were identified as the single most consequential structural barrier to E2W adoption across Southeast Asia. Consumer purchase behaviour for two-wheelers is heavily finance-dependent in most markets. Thailand's consumer behaviour in this respect closely mirrors patterns observed in Colombia and Brazil, where financing is the predominant route to two-wheeler ownership. Indonesia exhibits an even higher reliance on installment-based financing for motorcycle purchases.

The core problem is that financial institutions set interest rates partly based on their assessment of residual vehicle value at the end of the loan period. For electric two-wheelers — a relatively new and rapidly evolving product category — lenders face significant uncertainty about future resale values, which leads them to price in risk through higher interest rates. This dynamic adds materially to the total transition cost for the consumer.

A cross-country comparison of financing rates for middle-income consumers purchasing two-wheelers illustrates the divergence:

- Vietnam: approximately 9.43% interest rate for middle-income borrowers
- Thailand: approximately 13% interest rate for middle-income borrowers
- Indonesia: approximately 25% interest rate for middle-income borrowers

The compounding effect is most acute for low-income households, who are paradoxically both the group most dependent on financing to purchase vehicles and the group facing the highest interest rates in most markets. Vietnam is a notable exception: its interest rate for low-income borrowers is reported at approximately 8.3%, markedly lower than comparable rates in Thailand and Indonesia. This divergence may partially explain Vietnam's stronger adoption baseline.

When these financing costs are incorporated into the total cost of ownership (TCO) calculation, the economic case for switching to E2W weakens considerably. Mr. Sinha noted that a TCO differential of only 2–5% between electric and conventional two-wheelers is insufficient to shift consumer behaviour at scale. The gap needs to be meaningfully wider — or the transition costs need to be structurally reduced — before financing-dependent consumers will elect to switch.

Government Signalling and Financial Institution Engagement

The most effective intervention mechanism identified is government signalling to financial institutions: communicating clearly that electrification is the policy direction and that the government stands behind the transition, creating a basis for profitable participation by lenders. This can take the form of interest rate caps or floors, subsidised lending facilities, or loan guarantee schemes targeting E2W purchases.

When government sends credible directional signals, financial institutions respond by entering into contracts and structured agreements with vehicle manufacturers, creating a more predictable ecosystem for both lenders and buyers. These manufacturer-financier agreements can incorporate discounted rates,

standardised residual value assessments, and battery performance guarantees — all of which reduce the risk premium embedded in current E2W loan pricing.

The sequence described is: government signals direction → financial institutions gain confidence → institutions form agreements with manufacturers → rates reduce → consumer TCO improves → adoption accelerates. High penetration rates, as observed in Vietnam and China, are indicators of a well-functioning ecosystem push rather than purely organic consumer preference.

Key Observations and Implications

- The E2W segment is critical to Southeast Asia's decarbonisation pathway given the region's overwhelming reliance on motorcycles for daily mobility, yet it remains structurally underserved by current policy and financing frameworks in most markets.
- Vietnam's relatively low-interest rate environment for two-wheeler financing — particularly for lower-income borrowers — may be an underappreciated factor in its stronger-than-regional E2W adoption. This structural advantage warrants further examination.
- Thailand's strong four-wheel EV growth does not automatically translate to E2W momentum; the financing and consumer behaviour dynamics for the two segments are structurally distinct.
- The ride-hailing driver cohort (e.g., Grab drivers) represents a high-priority and commercially attractive target for E2W transition programmes, given their high vehicle utilisation rates and income dependence on fuel costs.
- Policy benchmarking across markets — drawing on Vietnam, China, Pakistan, and others — offers a practical path toward designing a context-appropriate E2W transition framework for the Lancang-Mekong region.
- A TCO advantage of 2–5% is insufficient to drive consumer switching behaviour at scale. Effective policy must close this gap more decisively, either through direct subsidies, financing rate interventions, or reduced upfront vehicle costs.
- Note: Details of the Pakistan PAVE policy [Pakistan Accelerated Vehicle Electrification] referenced by Mr. Sinha could not be confirmed from available materials and should be verified for accuracy before inclusion in formal reports.

Meeting adjourned at: 04:30 PM

Illustrative Photos from the Visit / Meeting



As of 3 June 2026

9.4.3.5. AQUILA

Host Organization

1. Mr. Lorenzo Fabbiano	Aquila EV Financing Manager

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
4. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit — President
2. Mr. Chaiyaphruek Narongkool — Secretary

Meeting Commenced at: 04.30 PM

Summary of Key Points

Background: AQUILA

AQUILA is a fintech start-up whose mission is to channel missing financing into climate technology and decarbonisation efforts across Southeast Asia. The company applies capital specifically to EV infrastructure development, operating on a business-to-business (B2B) lending model rather than targeting individual consumers. Its current geographic focus spans three key markets: Indonesia, Vietnam, and Thailand — each selected for their scale, EV adoption trajectory, and the significance of their financing gaps.

Note: AQUILA does not appear in the original trip booklet. This session was arranged separately and ran immediately following the discussion with Mr. Abhishek Sinha on the same day, Wednesday 3 June 2026.

Business Model and Strategic Approach

AQUILA's core activity is lending capital to businesses — rather than individuals — to support the development of EV infrastructure, including charging networks and related logistics. This B2B focus is deliberate: by targeting companies that have already set internal fleet electrification targets or are seeking to build out EV infrastructure, AQUILA can deploy capital more efficiently and achieve larger-scale impact than through retail lending.

A key element of AQUILA's strategy is the identification and engagement of key market players within each country. Rather than spreading capital broadly, the company targets a defined set of high-impact companies — typically around six key players per market — whose scale and market position mean that financing their EV transition generates significant downstream effects across the broader ecosystem.

Market-Specific Focus Areas

Indonesia

Indonesia represents a large-scale priority market for AQUILA. The company's focus here is on battery swapping infrastructure — a model well-suited to the Indonesian market given the high density of two-wheeler usage, the practicality constraints around home charging in densely populated urban areas, and the growing interest from fleet operators in reducing downtime. Battery swapping allows riders to exchange depleted batteries for charged ones rapidly, avoiding the charging wait-time barrier that constrains adoption in markets without accessible home or workplace charging.

Vietnam

Vietnam is identified as a high-potential market given its already elevated E2W penetration rate, estimated at approximately 15% — among the highest in the region. AQUILA is focused on approximately six key players in the Vietnamese market. The country's relatively supportive financing environment and active policy direction toward electrification (including proposed LEZ measures) make it a receptive context for EV infrastructure capital deployment.

Thailand

Thailand is characterised as a flexible market with multiple cities showing receptivity to EV infrastructure investment. AQUILA identifies approximately six key players in Thailand as well. Thailand's government has set an ambitious EV transition target which provides a clear policy anchor for AQUILA's infrastructure lending activity.

Ecosystem Fragmentation: The Interoperability Problem

A central concern raised during the session was the risk of ecosystem fragmentation within the EV sector. A growing number of businesses — particularly in the E2W and charging infrastructure space — are developing proprietary battery systems and chargers that are not compatible with those of other manufacturers or networks. This results in a fragmented landscape where consumers and fleet operators are locked into specific ecosystems, limiting competition, increasing costs, and slowing overall adoption.

Mr. Fabbiano drew an analogy to the consumer electronics industry: just as the proliferation of incompatible charging standards for mobile devices created inefficiency and consumer frustration before the industry converged on universal solutions such as USB Type-C, the EV sector risks repeating this pattern at greater scale and cost if interoperability is not addressed proactively.

From a capital deployment perspective, this fragmentation creates a further problem: investment is being duplicated across proprietary, non-interoperable technologies. Capital that could be building a shared, scalable infrastructure backbone is instead being spent on competing proprietary systems that do not compound in value. AQUILA's position is that doubling down on shared, interoperable technology standards is essential to driving efficient regional electrification — and that financing decisions should actively favour businesses whose infrastructure is designed for interoperability rather than lock-in.

Key Observations and Implications

- AQUILA's B2B, infrastructure-focused lending model represents a distinct and complementary approach to the consumer-side financing barriers discussed earlier with Mr. Sinha. Together, the two sessions paint a picture of EV transition financing challenges operating at both the individual and institutional level.
- The battery swapping focus in Indonesia reflects a market-specific insight: in high-density urban environments with limited home-charging access, swapping infrastructure may be a more viable adoption pathway than conventional charging networks.
- Vietnam's 15% E2W penetration rate, cited as among the highest in Southeast Asia, reinforces findings from earlier sessions on the country's relatively favourable financing environment and active policy direction.
- The interoperability warning carries significant policy implications. If governments in the Lancang-Mekong region do not establish shared technical standards for EV charging and battery systems early in the ecosystem development phase, market fragmentation may become entrenched and costly to reverse.
- The Type-C analogy is a useful communication frame for policymakers: universal standards accelerate adoption, reduce consumer friction, and increase the return on infrastructure investment. The EV sector would benefit from analogous regional or national standardisation efforts.

- AQUILA's targeting methodology — identifying and concentrating on a small number of high-impact market players per country — offers a practical model for government agencies seeking to maximise the leverage of limited EV transition support budgets.

Meeting adjourned at: 05:30 p.m.

Illustrative Photos from the Visit / Meeting




As of 3 June 2026

9.4.3.6. SAIC Motor Vietnam

SAIC Motor Corporation Limited is one of China's largest automotive conglomerates, ranked on the Fortune Global 500 and recognized as China's top automotive exporter for eight consecutive years. SAIC has diverse strengths spanning passenger and commercial vehicles, new energy vehicles (NEVs), and intelligent connected technology, operating through brands like MG, Roewe, and IM Motors, alongside joint ventures with Volkswagen and GM. In 2023, it established SAIC Motor Vietnam (SMV) as a wholly-owned subsidiary to directly manage and exclusively distribute the MG brand, with headquarters located on the 16th Floor of Vincom Center Dong Khoi, District 1, Ho Chi Minh City, taking full control of brand positioning and service standards.

MG, acquired by SAIC in 2007, is its primary international brand, ranking as the top-selling Chinese automotive brand outside China for five consecutive years. In Vietnam, MG offers a product lineup of ICE, hybrid, and battery electric vehicles, with the MG4 EV as its flagship fully electric offering. SAIC's "Glocal 3.0" corporate strategy focuses on localized innovation paired with global operational standards. In H1 2025, SAIC's NEV sales surged 40.2% year-on-year, accounting for 63.5% of its total volume. With plans to launch 17 new overseas models over the next three years—incorporating solid-state batteries and autonomous driving assistance—Vietnam remains a core strategic focus for SAIC's global expansion.

Host Organization

1. Nguyen Duy Binh	Marketing Manager
2. Zheng jie	Finance Manager

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
4. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Meeting Commenced at: 09.30 AM

Summary of Key Points

1. Vietnam EV Market and Policy Environment

The discussion highlighted that Vietnam is actively promoting EV adoption as part of its net-zero and energy transition commitments through supportive policies, tax incentives, and public procurement programs. The automotive market is expected to continue growing, supported by economic development objectives and rising fuel prices. However, challenges remain, including electricity grid reliability, restrictive fire safety regulations affecting charger deployment, and the absence of a comprehensive framework for battery recycling and end-of-life management. While government support is strong, the operating environment for EVs remains less mature than in some neighboring markets.

2. Market Dynamics and Consumer Behavior

The current structure of Vietnam's automotive market, noting that VinFast dominates the EV segment while overall consumer demand for EVs remains constrained by concerns over charging availability, battery durability, software reliability, resale value, and after-sales services. Vietnamese consumers generally view vehicles as long-term assets and favor practical vehicle types such as SUVs and crossovers that can accommodate local road and flooding conditions. Hybrid vehicles are increasingly attracting consumer interest as they offer a compromise between conventional vehicles and fully electric vehicles, reducing dependence on charging infrastructure.

3. Charging Infrastructure and Energy Readiness

Charging infrastructure was identified as one of the most critical factors affecting EV adoption. VinFast currently operates the country's most extensive charging network, while non-VinFast brands face challenges due to limited infrastructure coverage and a lack of interoperability among charging providers. Concerns were also raised regarding the profitability of charging station investments, high operating costs, and the potential impact of large-scale EV adoption on Vietnam's electricity grid. Participants noted the need for more integrated charging networks, unified payment systems, and long-term planning to ensure adequate electricity supply and grid stability.

4. Smart Mobility Development

Vietnam has made notable progress in smart mobility initiatives, including the deployment of Intelligent Operation Centers (IOCs) in multiple provinces and the use of AI-based traffic management systems. The rapid growth of ride-hailing and electric taxi services, particularly Green SM, has increased public exposure to EV technology and contributed to broader market awareness. However, adaptation of advanced vehicle technologies such as ADAS remains challenging due to Vietnam's dense urban traffic conditions and the high volume of motorcycles on the roads.

5. Industry Competition and Business Strategies

VinFast's highly integrated business model, which combines vehicle manufacturing, charging infrastructure, fleet operations, and after-sales services, providing significant competitive advantages within the domestic market. At the same time, foreign automakers face challenges related to infrastructure access, market penetration, and regulatory requirements. MG Vietnam indicated its intention to expand its portfolio beyond conventional vehicles by introducing hybrid and electrified models while exploring local assembly opportunities to improve competitiveness and reduce costs

6. Regional Cooperation and Future Opportunities

The discussion emphasized the importance of regional cooperation in supporting the development of EV ecosystems across ASEAN and the Lancang–Mekong region. Opportunities were identified in supply chain integration, battery manufacturing, technology sharing, charging network connectivity, and regulatory harmonization. The concept of cross-border charging infrastructure and EV roaming systems was discussed as a potential pathway to facilitate regional mobility and accelerate EV adoption across neighboring countries.

Meeting adjourned at: 11:30 a.m.

Illustrative Photos from the Visit / Meeting



As of 4 June 2026

9.4.3.7. BYD Oway Sài Gòn

BYD (Build Your Dreams), headquartered in Shenzhen, China, is the world's leading New Energy Vehicle (NEV) manufacturer. After halting pure internal combustion engine production in March 2022, BYD shifted focus completely to Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs). In 2024, BYD secured global leadership in NEVs, selling approximately 4.27 million vehicles (a 40% year-on-year increase). The company targets 50% of its sales from overseas markets by 2030, with international sales jumping over 71% in 2024. BYD Auto Vietnam, a wholly-owned subsidiary, manages distribution in Vietnam—a priority market experiencing explosive EV growth from roughly 4,040 units in 2022 to nearly 79,800 units in 2024.

In Vietnam, BYD operates through BYD Auto Vietnam, a wholly owned subsidiary of the company. Vietnam is considered one of BYD's key strategic markets in the ASEAN region due to the rapid growth of the electric vehicle (EV) industry. Located in District 10 of Ho Chi Minh City, BYD Oway Sài Gòn serves as a major flagship showroom and 3S center (Sales, Service, and Spare Parts) of the Oway Auto Group in southern Vietnam.

The 3S business model represents BYD's standard global market expansion strategy, aiming to establish a comprehensive retail and after-sales service ecosystem in order to build market confidence. As such, BYD Oway Saigon acts as an important window into BYD's retail and service strategies in Vietnam, while also reflecting the challenges and competitive dynamics of the regional EV market, where global EV giants are expanding their infrastructure in a market already dominated by a strong domestic player such as VinFast.

One of the key strengths of this facility is its location on Sư Vạn Hạnh Street, a prime commercial area in the city center, unlike conventional showrooms that are often located in suburban areas. This strategic location enhances brand visibility and accessibility. The facility has been developed as a "Flagship Benchmark" to deliver a premium customer experience, integrating sales, after-sales service, and EV charging infrastructure in one location, with the aim of addressing major concerns among EV users in Vietnam.

Host Organization

1. Mr. Scofield (Mr. Tao Zhou)	Network Director, BYD Vietnam; Hon. CEO, OWAY AUTO
2. Mr. Tran Quang Vinh	General Manager, BYD Oway Saigon

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Rachaneekorn Imaram	General Administration Officer, Professional Level
4. Ms. Phimnipar Ruengsri	General Administration Officer, Professional Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Dr. Tanawan Sutantaviboon	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Mr. Phasin Chomsomboon	Staff

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Secretary

Meeting Commenced at: 01.30 PM

Summary of Key Points

Background: BYD Oway Sài Gòn

BYD (Build Your Dreams), headquartered in Shenzhen, China, is the world's leading New Energy Vehicle (NEV) manufacturer. Having ceased all internal combustion engine production in March 2022, BYD now focuses exclusively on Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs). In 2024, the company recorded global NEV sales of approximately 4.27 million units, representing 40% year-on-year growth, and is targeting 50% of sales from overseas markets by 2030.

BYD Oway Sài Gòn, located in District 10 of Ho Chi Minh City, serves as the flagship 3S centre (Sales, Service, Spare Parts) for the Oway Auto Group in southern Vietnam. Positioned on Su Van Hanh Street in a prime commercial area rather than the suburban locations typical of conventional showrooms, the

facility has been developed as a benchmark for BYD's retail and after-sales service model in the Vietnamese market.

BYD's Entry into the Vietnamese Market

BYD officially entered the Vietnamese passenger vehicle market in July 2024, making it a relatively recent entrant. Despite this, the company sold more than 2,000 vehicles in 2025 — a notable early result in a market still developing its EV consumer base. Initial offerings were limited to fully electric vehicles; however, in 2026, BYD introduced plug-in hybrid (PHEV) models to its Vietnamese lineup, broadening its appeal to consumers who may not yet be ready for a full EV transition.

BYD's market entry was meaningfully assisted by the groundwork laid by VinFast, the dominant domestic EV brand. VinFast's extensive investment in public charging infrastructure and its large taxi fleet presence — with Xanh SM taxis accounting for an estimated 45% of EV taxi usage, though possibly as high as 70% given the absence of formal tracking mechanisms — has cultivated a level of public familiarity and comfort with EVs that benefits all market entrants. Vietnamese consumers in major urban centres have, in effect, been introduced to electric vehicles as a practical daily-use option through VinFast's ecosystem building, creating a more receptive environment for BYD's commercial push.

Vietnam's overall EV penetration rate currently stands at over 30%, reflecting a market that has progressed rapidly. The primary EV markets within the country are Ho Chi Minh City, Hanoi, and Bac Ninh, which together account for the largest concentrations of EV ownership and usage.

Vietnamese Automotive Market Structure and Consumer Preferences

The Vietnamese passenger vehicle market is strongly oriented toward SUVs, which account for approximately 56% of total sales. Consumer preference ordering runs: SUV → MPV → Hatchback/Sedan → Mini Car → Pickup. Two primary factors drive SUV dominance: road conditions, which favour vehicles with stronger chassis and higher ground clearance, and family-centred purchasing decisions. Large households, common across Vietnam, frequently opt for seven-seater configurations to accommodate multi-generational travel needs.

Within the SUV category, the B-segment (smaller SUVs, by vehicle size classification) represents the largest sub-segment. This aligns with broader ASEAN market patterns where affordability and urban manoeuvrability balance against the preference for larger body styles.

Beyond VinFast, German brands continue to hold a significant presence in the fleet and corporate vehicle market. The market therefore exhibits a two-tier dynamic: VinFast leads in the EV and taxi segments, while European brands retain strength in premium and fleet categories.

The decision-making process for switching from ICE to EV is notably influenced by household composition. Single drivers tend to make the transition more readily, facing fewer stakeholder considerations in their purchase decision. Families, by contrast, apply more conservative criteria — weighing charging convenience, range, seating capacity, and total ownership cost — making the family purchase cycle a longer and more complex one for EV brands to navigate.

BYD's Commercial Strategy in Vietnam

Ride-Hailing Segment Conversion

A core pillar of BYD's near-term growth strategy is converting ride-hailing drivers — particularly Grab drivers — from ICE to electric vehicles. BYD's sales approach for this segment is explicitly financial: presenting prospective buyers with detailed, itemised calculations showing the long-term cost savings from operating an EV versus a combustion engine vehicle, including fuel, maintenance, and servicing differentials. Currently, BYD's vehicles account for approximately 23% of the EV taxi segment — a meaningfully lower share than VinFast, which reflects both VinFast's earlier market presence and its tightly integrated charging ecosystem.

On electricity pricing, this is the cost concern that weighs most heavily on taxi and ride-hailing drivers, given that their income is directly tied to vehicle operating costs. BYD's pitch to this segment therefore centres on demonstrating a favourable and predictable long-term cost profile compared to fuel-price-volatile ICE alternatives.

Competitive Positioning Relative to VinFast

Despite VinFast's dominant position in terms of volume and infrastructure, BYD does not view the competitive dynamic as a direct head-to-head contest. A meaningful price gap exists between the two brands, and their target customer profiles are sufficiently differentiated that direct competitive pressure is limited. BYD positions itself toward consumers seeking a globally recognised brand with a broader international service and technology footprint, while VinFast serves the volume and value segments with its domestically rooted charging ecosystem and price point.

Charging Infrastructure and Addressing Anxiety

Charging anxiety — consumer concern about access to charging, particularly for longer journeys or in areas with sparse infrastructure — remains one of the most frequently cited barriers to EV adoption in Vietnam. BYD is actively developing its own fast-charging network to address this directly. The company acknowledges that this is a medium-term buildout, with fast-charging capability described as forthcoming rather than fully deployed at the time of the session.

Brand Trust and Word-of-Mouth Growth

As a relatively new entrant in the Vietnamese market, BYD is investing in building consumer trust over time. The company's current approach centres on a domino effect: starting with individual satisfied customers whose positive direct experience — particularly on battery performance, running costs, and service quality — generates organic word-of-mouth referrals. This incremental trust-building is viewed as a necessary phase before broader market penetration can accelerate.

Battery Reliability and Historical Validation

A recurring consumer concern across EV markets is the long-term degradation of battery performance. BYD addresses this in its sales and after-sales communications by drawing on historical usage data from Chinese customers dating back to 2014–2015 — approximately a decade of real-world performance data — to substantiate claims about normal versus abnormal battery degradation patterns. This longitudinal dataset is presented as evidence of product durability that prospective buyers in Vietnam cannot yet draw from the local market's shorter EV history.

Regional Supply Chain: BYD's Rayong Factory

BYD operates a manufacturing facility in Rayong, Thailand, which serves as a regional production hub for Southeast Asia. The Rayong factory's current production capacity exceeds Thailand's domestic demand, and the surplus output is exported to multiple international markets including Vietnam, Europe, and Australia. This means that BYD vehicles sold in Vietnam are, in effect, produced regionally in Thailand rather than imported directly from China, with implications for supply chain resilience, lead times, and the potential future deepening of Thailand-Vietnam automotive trade flows.

Key Observations and Implications

- VinFast's ecosystem-building role — particularly its charging infrastructure investment and large taxi fleet — has functioned as a market-priming mechanism that benefits subsequent EV market entrants including BYD. This dynamic illustrates how a dominant domestic player can accelerate the overall market transition even while competing commercially with foreign brands.
- Vietnam's 30%+ EV penetration rate, combined with BYD's strong initial sales performance, suggests the market has crossed an early adoption threshold and is entering a growth phase where brand differentiation, infrastructure coverage, and product breadth will become more decisive competitive factors.
- The SUV dominance in Vietnam's passenger vehicle market — driven by road conditions and family-use preferences — carries direct implications for EV product strategy. Brands that cannot offer credible, well-priced EV SUVs, particularly in the B-segment and seven-seater configurations, will be structurally disadvantaged in this market.
- The ride-hailing conversion strategy, anchored in TCO demonstrations, reflects a pragmatic approach to a high-utilisation segment where the financial case for EVs is most compelling. However, BYD's 23% share of the EV taxi segment — versus VinFast's estimated 45–70% — highlights the competitive challenge posed by an integrated domestic ecosystem.
- Charging anxiety remains a material barrier to mainstream consumer adoption. BYD's planned fast-charging expansion will be a critical variable in its medium-term market performance, particularly outside Ho Chi Minh City and Hanoi.
- The use of a decade of Chinese battery performance data to validate durability claims is a differentiated credibility asset. As Vietnamese consumers become more informed EV buyers, this type of longitudinal evidence is likely to become increasingly valued.
- The Rayong factory's export surplus to Vietnam reinforces the strategic interdependence of Thailand and Vietnam within BYD's regional production network, and underscores the relevance of Thailand's EV manufacturing capacity to the broader Lancang-Mekong regional supply chain conversation.

Meeting adjourned at: 04:00 p.m.

Illustrative Photos from the Visit / Meeting



As of 4 June 2026

9.4.4. Fieldwork Observations in Vietnam (Activity 2)

The qualitative fieldwork and study visit indicate that Vietnam is undergoing a clear and dynamic transition toward electric vehicles (EVs), aligned with its national commitment to achieve Net Zero emissions by 2050. Government support includes tax incentives, public procurement measures, and plans for Low Emission Zones (LEZs). In particular, Hanoi is expected to begin restricting internal-combustion motorcycles in central areas from 2026. These measures demonstrate Vietnam's effort to reduce urban air pollution and encourage changes in travel behavior.

Vietnam's EV market has achieved an adoption rate of over 30 percent. VinFast is the leading domestic player, supported by an integrated ecosystem covering EV and electric motorcycle production, charging infrastructure, and Green SM electric taxi services. This integrated approach has helped increase consumer familiarity with EVs in daily life. At the same time, international manufacturers such as BYD and MG are expanding their presence in Vietnam, with a focus on SUV models and comprehensive 3S services—sales, service, and spare parts—to strengthen consumer confidence.

Consumer preferences are strongly influenced by practical vehicle use. SUVs account for approximately 56 percent of the market, reflecting their suitability for local road conditions, family travel, and multi-purpose use. However, consumers continue to express concerns about driving range, charging accessibility, and battery durability. As a result, hybrid electric vehicles, including HEVs and

PHEVs, are increasingly viewed as transitional options before full-scale adoption of battery electric vehicles.

Charging infrastructure and technical standards remain key challenges. Different manufacturers continue to operate proprietary charging and battery systems, resulting in limited interoperability across brands. This fragmentation may lead to duplicated infrastructure investment, higher costs, and inconvenience for EV users. Establishing common standards for charging connectors, battery systems, and data exchange among service providers would therefore improve investment efficiency, user experience, and market competition.

Safety and environmental management also require further attention. Key issues include fire-safety standards for charging stations, electricity-grid stability, and end-of-life battery management. A comprehensive regulatory framework for battery collection, reuse, and recycling will be essential to ensure the long-term environmental sustainability of Vietnam's EV industry.

Several noteworthy practices were also observed. EV manufacturers, such as BYD, use long-term battery performance data from the Chinese market to demonstrate battery durability and reduce consumer concerns. In addition, academic institutions in Vietnam are applying virtual reality (VR) simulation to examine motorcycle rider behavior and develop road-safety measures that better reflect Vietnam's local transport context.

At the regional level, Vietnam and Thailand have significant potential for cooperation. Thailand serves as a manufacturing and export base for some EV brands supplying the Vietnamese market. This highlights opportunities to strengthen regional EV supply chains, harmonize charging and battery standards, and support cross-border electric mobility within the Greater Mekong Subregion.

9.5 Lao PDR (Activity 1)

9.5.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	New Chip Xeng Co., Ltd.	September 9th, 2025
2.	Discover Laos Today Co., Ltd.	September 10th, 2025
3.	National University of Laos	September 11th, 2025
4.	LOCA Company Limited	September 11th, 2025
5.	Department of Transport, Ministry of Public Works and Transport	September 12th, 2025

9.5.2. Lists of Participants (Thailand)

No.	Name	Position	Organization
1.	Mr. Passakorn Chairat	Director General	OIE
2.	Mr. Chalee Khansiri	Director, Division of International Industrial Economics	OIE
3.	Ms. Potcharawan Rattanavaraha	Plan and Policy Analyst, Professional Level	OIE

No.	Name	Position	Organization
4.	Mr. Theerapon Bunnak	Plan and Policy Analyst, Practitioner Level	OIE
5.	Mr. Threepol Boonyamarn	Executive Vice President	TAI
6.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI
7.	Ms. Kanamas Wongsawas	Manager of Marketing and Customer Relationship Division	TAI
8.	Mr. Sedtawud Larbwisuthisaroj	Specialist, Entrepreneur and Industry Development Division	TAI
9.	Ms. Lalida Nuikhong	Staff, Entrepreneur and Industry Development Division	TAI
10.	Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor, Faculty of Economics	TU
11.	Dr. Phimsupha Kohchang	Researcher, Energy Research Institute	CU

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute
TU: Thammasat University
CU: Chulalongkorn University

9.5.3. Summary of Key Points from the Trip

9.5.3.1. New Chip Xeng Co., Ltd.

New Chip Xeng Co., Ltd., also known as NCX, was established in 1991 with its head office located in Vientiane Capital, Lao PDR. The company serves as the official sole distributor of Honda in Laos, covering a wide range of products including motorcycles, automobiles, power generators, and spare parts. NCX operates a network of showrooms and service centers across the country, with its main facility situated at Wattay (Honda Show Room Wattay), in order to meet the growing demand of Lao consumers.

With over 30 years of experience, New Chip Xeng Co., Ltd. has developed strong management capabilities and provides comprehensive services ranging from the distribution of high-quality Honda products and standardized after-sales services to customer care through nationwide service centers. The company also places great emphasis on human resource development and building consumer confidence, which has led NCX to become one of the leading private enterprises in Laos, well recognized and respected in the automotive business sector.

Host Organization

1. Mr. Somsack Chaleunphon — General Manager Exim & Legal Affair
2. Mr. Chaiyut Ruchanaporn — General Manager Motorcycle Business
3. Mr. Insee Suriyachay — Senior Manager Motorcycle Business
4. Mr. Surachart Phooraya — General Manager Automobile Business
5. Mr. Tienchai Buranakosol — Manager Automobile Business
6. Mr. Apichai Boonyoo — Executive Coordinator

Participants

Thailand Automotive Institute

1.	Mr. Threepol Boonyamarn	Executive Vice President
2.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3.	Ms. Kanamas Wongsawas	Manager, Marketing and Customer Relationship Division
4.	Mr. Sedtawud Larbwisuthisaroj	Specialist
5.	Ms. Lalida Nuikhong	Staff

Thammasat University

1.	Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor

Energy Research Institute, Chulalongkorn University

1.	Dr. Phimsupha Kohchang	Researcher

Meeting Commenced at: 03.00 PM

Summary of Key Points:

1. EV Promotion Policies in Laos

The Lao government actively promotes EV adoption to reduce dependency on imported oil, given the country has no domestic petroleum supply and has previously faced fuel shortages.
EV targets:

- 1% of vehicle usage by 2025→ 30% by 2030

Tax incentives:

- Excise tax of 3% on EVs and electric motorcycles (vs. 30–40% on ICE vehicles)
- Hybrids are taxed at 50% of equivalent ICE tax rates (approx. 20.5%)

Policy timeline:

- Initial concept emerged in 2012, clearer direction from 2019
- Major policy breakthrough in 2021 amid global oil price hikes
- Early import liberalization caused currency depreciation → government-imposed import restrictions (vehicle import value capped at USD 50,000, reviewed every 6 months)
- Currently, more control over grey-market imports, requiring Certificate of Origin from the manufacturer

2. Market Growth of EVs and Motorcycles

Passenger vehicles:

- EVs represent 36% of current market share, ICE 55%, Hybrids 9%
- EV pickup trucks are highly popular due to local road conditions and transport behavior → 183% year-on-year sales growth

Motorcycles:

- EV motorcycles may account for ~20% of the market (unofficial estimate)
- Most are illegally imported from China and Vietnam, priced at only THB 4,000–5,000, compared to THB 40,000 for ICE models
- They cannot be registered due to improper import procedures, leading to safety and legal issues
- A new business model offering EV motorbike rentals via mobile apps is emerging in tourist areas like Luang Prabang

3. Consumer Adaptation and Usage Behavior

Charging habits:

- Most users charge at home, but poor electrical infrastructure and unsafe cable extensions occasionally lead to fire incidents

Maintenance concerns:

- Vehicles from grey-market imports lack after-sales services and warranties
- Repairs often rely on full part replacement purchased online, at high cost

Main consumer segment: Individuals aged around 40 and above

Technology perception: Users are attracted to modern EV technologies and features, even if rarely used in practice

4. Factors Influencing EV Purchase Decisions

Motivations to buy:

- Modern lifestyle and social status (key emotional factor)
- Energy cost reduction (economic justification), e.g., reducing spending from 5 million kip/month on fuel to 500,000 kip/month on electricity

Barriers to purchase:

- Concerns over after-sales service, resale value, and vehicle performance

Payment behavior:

- Approximately 60% of EV purchases are made in cash

5. Grey Market Dynamics

Market size:

- Grey-market imports account for an estimated 50% of EV sales, rivaling official dealers

Growth drivers:

- Policy loopholes allowing early EV imports not offered by official dealers
- Product gap: Japanese brands (e.g., Toyota, Honda) do not export EV models from Thailand/Japan, whereas models manufactured in China are imported via independent traders
- Significantly lower prices, especially for motorcycles brought in as "electronic appliances" or parts

Impacts:

- No qualified service centers, unavailable spare parts, and no warranty
- Customers often complain to official dealers, negatively affecting brand image
- Non-repairable vehicles become electronic waste
- EV motorcycles cannot be registered → road safety issues and no insurance coverage
- Lack of battery disposal planning → potential future environmental risks

Government control measures:

- Import value limit at USD 50,000, reviewed every 6 months
- Mandatory Certificate of Origin directly from the manufacturer (not local Chamber of Commerce), making grey-market imports more difficult and protecting official distributors

Meeting adjourned at: 5.00 PM

Illustrative Photos from the Visit / Meeting







As of 9 September 2025

9.5.3.2. DiscoverLaos. Today

Discover Laos Today Co., Ltd. is a tourism company of the Lao People's Democratic Republic operating in key tourist destinations, including Luang Prabang, Vang Vieng, and Vientiane. The company provides travel, tourism, and vehicle rental services to facilitate mobility for both domestic and international tourists, with a strong emphasis on sustainable tourism, environmental conservation, and the reduction of transportation-related impacts on tourist areas, particularly in World Heritage cities such as Luang Prabang.

In 2020, the company began offering electric vehicle rental services in Luang Prabang, marking a significant transition toward renewable energy and electric mobility (EV). This shift was driven by the need to reduce environmental impacts, promote innovation, and address high fuel costs and domestic fuel supply uncertainties. The company provides both electric motorcycles and electric cars, supporting the practical use of EVs in daily travel and integrating EV technology into the tourism and service sectors, while contributing to reduced emissions, lower noise levels, and decreased reliance on fossil fuels in major tourist areas of the country.

Host Organization

1. Mr. Kong Chong Gee	Business Development Manager
2. Mr. Danou Samnang	Chief Technology Officer
3. Mr. Tony Wu	CEO, Switch Laos Co, Ltd
4. Ms. Buntarika Wong-on	Sales & Marketing Manager

Participants

The Office of Industrial Economics

1. Mr. Passakorn Chairat	Director General
2. Mr. Chalee Khansiri	Director
3. Ms. Potcharawan Rattanavaraha	Plan and Policy Analyst, Professional Level
4. Mr. Theerapon Bunnak	Plan and Policy analyst, Practitioner level

Thailand Automotive Institute

1. Mr. Threepol Boonyamarn	Executive Vice President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Kanamas Wongsawas	Manager, Marketing and Customer Relationship Division
4. Mr. Sedtawud Larbwisuthisaroj	Specialist
5. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher

Meeting Commenced at: 01.30 PM

Summary of Key Points

DiscoverLaos, founded by a Singaporean entrepreneur, began as a hospitality and tourism business and has since expanded into sustainable transport through EV rentals. Its fleet now includes e-motorbikes with battery swapping, golf carts, vintage electric cars, and compact passenger EVs such as the Panda Mini EV and Wuling Bingo. Most vehicles are imported from China under a 0% import tax scheme, making them affordable for both tourists and local users, with daily rental rates ranging from USD 16 for e-bikes to USD 45 for EV cars. The company has grown its fleet from around 20 EVs in 2020 to more than 160 by 2024. Electricity for charging is priced at about 5,000 kip/kWh (with station operators paying around 60% less). While most fast-charging stations remain concentrated in Vientiane, DiscoverLaos is expanding infrastructure and battery swapping systems (costing ~300,000 THB per unit) and has also integrated solar at its MyBanLao hotel. Supported by government incentives and flexible payment systems (Kip, USD, Yuan), the company is positioning Luang Prabang as a hub for sustainable transport and has been recognized by the "Lasting Laos" eco-label for its contribution to green tourism.

Key Messages

- DiscoverLaos is pioneering green tourism in Laos, expanding from hospitality into EV rentals with a diverse fleet of e-motorbikes, golf carts, vintage EVs, and compact cars.
- Affordable EV adoption is enabled by 0% import tax, flexible payment options, and battery-swapping systems, though infrastructure remains concentrated in Vientiane.
- The company is positioning Luang Prabang as a model city for sustainable transport, integrating charging, solar power, and eco-certification to strengthen Laos's transition toward green mobility.

Summary of Key Points from the Meeting

Subsection 1.1: Market Development and Business Model

DiscoverLaos, founded by a Singaporean entrepreneur, began as a hospitality and tour services business before expanding into sustainable transport through its subsidiary Switch Laos. The company now operates an EV rental service that includes passenger cars, electric motorbikes, golf carts, and buggies—most of which are imported from China under a 0% EV import tax. Vehicles typically cost around USD 10,000 in bulk and are retailed at about USD 16,000, with rental rates ranging from USD 16 per day for e-motorbikes to USD 45 per day for EV cars. The fleet has expanded rapidly, growing from around 20 EVs in 2020 to more than 160 by 2024, covering both tourism and local mobility needs. By combining its roots in tourism with EV adoption, DiscoverLaos has positioned itself as both a tour operator and a pioneer in eco-mobility, with a particular focus on making Luang Prabang a showcase city for sustainable transport and green tourism.

Subsection 1.2: Infrastructure, Technology, and Cost Structure

DiscoverLaos currently operates around six AC charging stations imported from China, mostly two-phase, though reliable scaling will require three-phase electricity. The cost of electricity averages ~5,000 kip/kWh, with station operators paying about 60% less. Fast-charging infrastructure remains concentrated in Vientiane, leaving secondary cities underserved, though DiscoverLaos is working to expand coverage in tourist hubs like Luang Prabang and Vang Vieng. To support its growing e-motorbike rental fleet, the company is investing in battery-swapping systems at a cost of around 300,000 THB per unit. This model is inspired by Switch ZEV (Thailand), which has launched IoT-enabled swap stations for two-wheelers. Switch ZEV motorcycles (rated ~3,000W, ~80 km/h speed, ~150 km range) are designed for commuters and delivery fleets, supported by mobile apps for locating and swapping batteries. In addition, DiscoverLaos has integrated renewable energy into its ecosystem: the MyBanLao hotel in Luang Prabang has installed 120 solar panels and a 193-kWh battery storage system to provide resilience during outages and peak demand, while the company is also exploring options for second-life battery reuse.

Subsection 1.3: Policy, Market Trends, and Future Direction

Laos currently lacks comprehensive supporting policies for EV development, with the only incentive being a 0% import duty on EVs from China, and vehicles typically must be routed through official dealer networks. While this provides a cost advantage, there are no broader measures such as infrastructure subsidies, tax breaks, or insurance support. Payment flexibility (in Lao kip, USD, or Chinese yuan) makes rentals more accessible to both domestic and international users, but challenges remain: EV insurance is still priced high, often benchmarked against 2,000–3,000 cc engine categories; charging infrastructure is underdeveloped, with most fast-charging concentrated in Vientiane; and grey-market imports undermine after-sales service and market stability. Despite these barriers, DiscoverLaos has been recognized under the "Lasting Laos" eco-label and continues to position Luang Prabang as a flagship city for sustainable transport. By integrating EV rentals, charging, battery swapping, and renewable energy, the company is developing a green tourism ecosystem that aligns with regional trends in EV adoption and infrastructure innovation, particularly those emerging in Thailand.

Meeting adjourned at: 15.30 PM

Illustrative Photos from the Visit / Meeting



As of 10 September 2025

9.5.3.3. National University of Laos

The National University of Laos (NUOL) was established on November 5,1996, through the consolidation of several higher education institutions, including the Pedagogical University of Vientiane, the Polytechnic University, and the Medical Science University. Initially comprising seven faculties and a School of Foundation Studies, NUOL has expanded to thirteen faculties, two institutes, a central library, and several centers. As the country's first comprehensive university, NUOL plays a key role in Laos' socio-economic development by providing higher education, conducting research in both natural and social sciences, preserving the nation's multi-ethnic culture, and offering academic services to society.

Host Organization

1. Mr. Khamphanh Phommachanh	Vice Dean
2. Assoc. Prof. Dr. Viriyasack Sisouphanthong	Professor
3. Assoc. Prof. Dr. Bouasone Sengsourivong	Professor
4. Assoc. Prof. Dr. Bounmy Inthakesone	Professor

Participants

The Office of Industrial Economics

1. Mr. Passakorn Chairat	Director General
2. Mr. Chalee Khansiri	Director
3. Ms. Potcharawan Rattanavaraha	Plan and Policy Analyst, Professional Level
4. Mr. Theerapon Bunnak	Plan and Policy analyst, Practitioner level

Thailand Automotive Institute

1. Mr. Threepol Boonyamarn	Executive Vice President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Kanamas Wongsawas	Manager, Marketing and Customer Relationship Division
4. Mr. Sedtawud Larbwisuthisaroj	Specialist
5. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher

Meeting Commenced at: 09.00 AM

Summary of Key Points:

1. Government Policies and Targets

The Government of Lao PDR is gradually promoting electric vehicles (EVs), prioritizing environmental sustainability and reducing dependence on imported petroleum rather than focusing on industrial development or technological competitiveness.

- Under the National G androwth Strategy, the government emphasizes carbon emission reduction, efficient resource management (including waste and wastewater), and enhancing climate resilience. EVs are considered one of the key instruments for reducing reliance on fossil fuels and mitigating greenhouse gas emissions.
- The government has set an EV target of 30% of all vehicle sales by 2030.
- EV adoption gained significant traction during the COVID-19 pandemic, as restrictions on fuel purchases encouraged the public to seek alternative options.
- To date, the only support measure available is the reduction of import duties, with no purchase subsidies, unlike in neighboring countries such as Thailand.

- The government is currently revising the EV regulatory framework to incorporate the EV Battery Passport system, which is an ongoing initiative at the ASEAN level.
- Currently, the Lao EV market is at an "early adoption" phase, with growing momentum, particularly in major urban areas.

2. Market Situation and Consumer Behavior

- EV imports increased significantly between 2020 and 2024, with the Ministry of Public Works and Transport responsible for overseeing import approvals.
- Electric two-wheelers are the most common and widely used, especially in urban areas and university settings.
- Popular EV brands include BYD (which operates its own service center), VinFast, ICA 03, Deepal, Toyota, and ride-hailing providers such as Kokkok MOVE and LOCA.
- The market also benefits from low-priced second-hand vehicles, making EVs financially accessible for consumers.
- Due to intense price competition in the domestic market, certain EV models are cheaper than internal combustion engine (ICE) vehicles. Over a usage period of more than seven years, operating costs of EVs are reported to be lower than those of models such as the Toyota Vios.

3. Charging Infrastructure

There are currently 49 charging stations nationwide, predominantly concentrated in Vientiane Capital.

- Infrastructure development overview:
    - Investment is primarily led by private sector operators.
    - Financing often comes from low-interest loans provided by organizations such as ADB and USAID.
    - There is no direct financial support from the government.
    - Charging stations have been installed in major hotels and PTT fuel stations selected.
- Many EV purchases include a Wall Charger installation package.
- Home charging is the primary charging method, with users installing "cutters" to prevent power fluctuations, due to frequent voltage instability in Laos.
- There are ongoing plans to develop EV Bus and BRT routes in urban areas.

4. Energy System and EV Operating Costs

Electricité du Laos (EDL) is the sole national electricity provider. The utility is experiencing financial losses and is expected to increase electricity prices.

Estimated cost comparison:

- Full EV charge: approximately THB 400
- Weekly cost of petrol vehicle usage: approximately THB 1,000
- During the post-COVID period, fuel prices increased and purchases were restricted, making gasoline vehicles more costly to operate than EVs.

Diesel prices currently range between USD 0.8–0.9 per liter.

5. Key Challenges in the Lao EV Market

Challenge	Details / Implications
Unstable electricity supply	Requires installation of "cutters" to prevent power fluctuations.
Rising electricity prices	Driven by financial losses at EDL.
Currency exchange volatility	Affects import costs and investment decisions.
Absence of purchase subsidies	Unlike Thailand, which limits user adoption and domestic experience-building.
Charging infrastructure concentration	Stations are mostly located in Vientiane, creating barriers for inter-provincial EV travel.

Meeting adjourned at: 11.00 AM

Illustrative Photos from the Visit / Meeting









As of 11 September 2025

9.5.3.4. LOCA Company Limited

LOCA Company Limited is a leading Lao technology company that operates the LOCA super-app, integrating transportation and payment services in one platform. Its core service, LOCA Taxi, is the largest ride-hailing network in Laos, available 24/7 and widely trusted by tourists and expatriates. A key highlight is LOCA's operation of the country's largest EV fleet since 2018, reflecting its strong commitment to low-carbon and sustainable mobility. Beyond ride-hailing, the company also provides LOCA Pay, LOCA Wallet, and Laos QR code payments, while supporting major international credit cards such as VISA, MasterCard, JCB, and UnionPay. LOCA ensures transparent pricing, real-time trip tracking, and comprehensive insurance coverage of up to 500 million LAK per trip, offering both safety

and reliability. The company also runs the LOCA Rewards program, enabling users to earn points redeemable for exclusive perks and benefits. Its headquarters are located on the 7th floor of the Vientiane Plaza Hotel, Saylom Road, Vientiane.

Host Organization

1. Mr. Souliyo Vongdala	Board of Director

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director
2. Mr. Theerapon Bunnak	Plan and Policy analyst, Practitioner level

Thailand Automotive Institute

1. Mr. Threepol Boonyamarn	Executive Vice President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Kanamas Wongsawas	Manager, Marketing and Customer Relationship Division
4. Mr. Sedtawud Larbwisuthisaroj	Specialist
5. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher

Meeting Commenced at: 01.30 PM

Summary of Key Points

LOCA, founded in 2018 as a ride-hailing platform, has become a leading player in Laos's EV ecosystem. The shift accelerated during COVID, when rising fuel costs highlighted the benefits of EVs, supported by the country's cheap hydropower and compact geography. From only 40 EVs in 2019, the market grew rapidly to about 15,000 vehicles by 2025.

LOCA drives this growth by offering driver financing, enabling fuel savings to cover loan repayments, and working with banks that now accept EVs as collateral. It currently operates 51 charging stations with ~180 DC fast chargers and plans to reach 100. Yet challenges remain: charging costs are 2.5 times higher than household rates, household grid connections are unstable, and CCS2 chargers are often mismatched with imported Chinese EVs using GB/T.

Government support, including a 3% excise tax, ICE import restrictions, and mandated charging expansion, has been vital. Still, competition from grey imports, high EV insurance premiums, and rising urban land costs hinder adoption. Despite this, affordable Chinese second-hand EVs and growing suburban demand continue to fuel market growth, while LOCA's telecom-style expansion strategy aims to embed charging into daily life through malls, cafés, and suburban hubs.

Key Messages

- LOCA is driving Laos's EV ecosystem by integrating ride-hailing, driver financing, and charging infrastructure into a single platform.
- Government support and cheap hydropower provide strong structural advantages, but challenges remain with cost, insurance, standards, and grey market competition.
- LOCA's strategy is to scale to 100 charging stations and expand like a telecom network, embedding EV charging into daily life while targeting suburban growth.

Summary of Key Points from the Meeting

Subsection 1.1: Market Development and Business Model

LOCA was founded in 2018 as a ride-hailing platform, similar to Grab, and shifted toward EV development during the COVID period, when fuel costs sharply increased. Laos's structural advantages—abundant hydropower, the region's lowest electricity prices, and a geography of under 1,000 km from border to border—made EV adoption strategically viable. The country had only 40 EVs in 2019, but imports grew rapidly to 5,000 units in 2024 and 8,000 units in 2025, with the total passenger car fleet reaching 15,000, most of which are EVs. LOCA's ecosystem approach goes beyond ride-hailing: it created financing mechanisms that allow drivers to redirect former fuel expenditures toward loan repayments, with some drivers able to finance more than one vehicle. Local banks increasingly accept EVs as collateral, a shift that legitimizes the asset class. LOCA also recognizes the importance of building driver income stability as a foundation for wider EV adoption, ensuring that fuel savings are translated into long-term ownership benefits.

Subsection 1.2: Infrastructure, Technical Specifications, and Cost Structure

LOCA has invested significantly in charging infrastructure, operating 51 stations with approximately 180 DC charging heads, with individual sites hosting up to eight connectors. The company's near-term goal is to scale to 100 stations. The charging model is first-come-first-serve, without reservations, reflecting both demand uncertainty and the cost of software systems. Tariffs are set at about 6 THB/kWh, which is 2.5 times higher than household rates, making home charging the most significant competitor. Installation and land acquisition are costly, particularly in urban centers where property values are high, and ongoing maintenance of imported equipment further raises the cost structure. Technically, the national 22 kV distribution grid is extensive and reliable, ensuring access to public charging even in rural areas, though household networks remain fragile, often compared to powering three air conditioners simultaneously. A key challenge is standardization: LOCA deploys CCS2 chargers, but the majority of imported Chinese EVs still rely on GB/T, forcing LOCA to invest in multi-standard charging heads at significant additional expense.

Subsection 1.3: Policy, Financing, and Market Trends

The government has created a supportive environment for EV adoption, fixing the excise tax for EVs at 3%, restricting imports of ICE vehicles, and mandating the development of 24 additional charging stations in 2025, each with at least eight charging heads. No additional duties are applied to charging equipment, lowering project costs by about 10%. Despite these measures, challenges remain. Grey market imports are highly competitive, undermining official distributors and complicating after-sales service and data tracking. The EV Association is actively fighting against grey imports and employs Power BI to analyze market data and improve transparency. EV insurance premiums remain nearly three times higher than ICE, discouraging uptake, especially for full coverage. Inflationary pressures also create risks, as electricity costs are pegged to USD while consumer charging payments are in Lao Kip, creating revenue volatility. At the same time, the market is buoyed by second-hand EVs imported

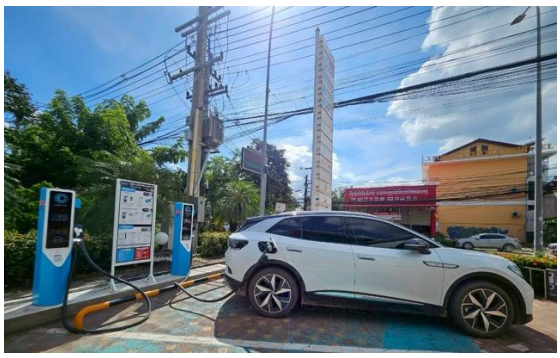
from China in the $25,000–35,000 range, which are considered affordable by middle-class consumers. As urban land prices rise, households increasingly relocate to suburban areas, shifting charging demand to cafés, shopping malls, and community hubs. LOCA's strategy mirrors telecom network expansion: building widespread low-voltage charging solutions embedded in daily life, ensuring accessibility and integration into local consumer habits.

Meeting adjourned at: 3.30 PM

Illustrative Photos from the Visit / Meeting





As of 11 September 2025

9.5.3.5. Department of Transport at Ministry of Public Works and Transport of Lao PDR

The Ministry of Public Works and Transport (MPWT), also known in French as Ministère des Travaux Publics et des Transports (MTPT), is a principal ministry of the Lao Government. It is responsible for public works, transport, housing, urban planning, water supply, and sanitation nationwide. Its purpose is to develop sustainable infrastructure and transport systems.

The Department of Transport is an agency under the Ministry of Public Works and Transport (MPWT). It serves as the Secretariat to the Minister of Public Works and Transport in conducting research, planning, and overseeing the land transport sector nationwide.

Host Organization

1. Mr. Khamathideth MANIKHAM	Director of Freight and Logistic Division
2. Mrs. Davanh LADTHANASACK	Deputy Director of Division, Motor Vehicle Division
3. Mrs. Khonevilay PHETSOMPHOU	Deputy Director of Division, Motor Vehicle Division
4. Mr. Daniel SILAVONG	Technical Officer, Motor Vehicle Division

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director
2. Mr. Theerapon Bunnak	Plan and Policy analyst, Practitioner level

Thailand Automotive Institute

1. Mr. Threepol Boonyamarn	Executive Vice President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Kanamas Wongsawas	Manager, Marketing and Customer Relationship Division
4. Mr. Sedtawud Larbwisuthisaroj	Specialist
5. Ms. Lalida Nuikhong	Staff

Thammasat University

1. Asst. Prof. Dr. Alongkorn Tanasritunyakul	Professor

Energy Research Institute, Chulalongkorn University

1. Dr. Phimsupha Kohchang	Researcher

Meeting Commenced at: 09.30 AM

Summary of Key Points

1) There are 2 ministries that have main responsibility regarding EV policy in Laos, Ministry of the Ministry of Public Works and Transport (PWT) and the Ministry of Industry and Commerce (MOIC). the Ministry of Public Works and Transport (PWT) responsible for promoting EV labeling, Registration, and vehicle inspection. And the Ministry of Industry and Commerce (MOIC)

oversees the authorization of dealers, import restrictions, and the planning of public charging stations.

2) Laos has established targets for EV adoption and charging infrastructure. The government has set an EV registration target of 1% of all vehicle types by 2025, increasing to 30% by 2030. For charging infrastructure, Laos aims to install 50 public EV charging stations by 2025 and 100 stations by 2030. To qualify as a public station, each facility must be equipped with at least 8 charging ports.
3) Since 2022, EV adoption in Laos has grown as currency depreciation and fuel purchase restrictions pushed consumers toward EVs. Unauthorized dealers import mainly low-cost but obsolete BEVs from China, benefiting from favorable taxes. However, limited after-sales service and spare parts force consumers to bear risks, though many still choose EVs due to cheaper fuel and vehicle prices.
4) Currently, the Department of Transport is facing several issues related to EV management:
    a. Annual Vehicle Inspection – EVs differ from ICE vehicles in both components and operation, requiring specialized expertise and dedicated tools for inspection.
    b. Identification Numbers – The position of VIN numbers, motor numbers, and other identifiers in EVs differs from ICE vehicles, creating challenges in locating reference numbers for registration.
    c. Registration Criteria – Existing registration requirements, especially for motorcycles, are based on engine displacement. Since electric motorcycles do not have engines, they cannot be registered under the current system.

key message

- **Insights from the Interview**
    - Currently, Laos has not yet established any regulations related to EVs and ADAS. However, a draft homologation law for EVs is being prepared to ensure consumer safety and to prevent the importation of vehicles through unauthorized dealers.
    - The Ministry of Industry and Commerce (MOIC) plans to implement measures to prevent the importation of EVs by unauthorized dealers. Importers will be required to submit safety test results, and vehicles that already have an authorized dealer in the country will not be permitted for import.
    - The budget for road maintenance is currently funded through road tax and fuel tax revenues. In addition, there are plans to draft a regulation that would allocate a portion of the electricity fees used for charging EVs to support road maintenance funding.

Subpoint 1.1: Unauthorized EV Dealer

EVs have gained popularity in Laos after 2022. This trend was driven by the depreciation of the Lao currency, which led the government to restrict citizens' fuel purchases. As a result, consumers increasingly turned to EVs. In addition, Laos shares a border with China and uses left-hand-drive vehicles, making it convenient for unauthorized dealers to import BEVs from China. However, many of these imported vehicles were obsolete models. Despite this, their prices were relatively low and benefited from favorable consumption tax policies, further boosting demand. However, unauthorized dealers lack after-sales services, including skilled technicians for maintenance and the reliable supply of spare parts. This situation forces consumers to bear the risks themselves. Nevertheless, many people still choose to use these vehicles due to the relatively low fuel costs and affordable vehicle prices.

Subpoint 1.2: Challenge of PWT to EV

The Department of Transport is currently facing several challenges in managing electric vehicles (EVs). First, annual vehicle inspections for EVs present difficulties because these vehicles differ significantly from internal combustion engine (ICE) vehicles in both structure and operation. EVs rely on high-

voltage batteries, electric motors, and energy management systems that require specialized diagnostic tools and safety procedures. As a result, inspectors need additional training and equipment to properly assess the safety and performance of EVs, since traditional methods designed for ICE vehicles are not sufficient.

Second, issues arise with identification numbers used for registration. Unlike ICE vehicles, where the positions of the vehicle identification number (VIN), engine number, and other key identifiers are standardized and well known, EVs often have different or additional identifiers, such as motor or battery serial numbers. These identifiers may not be located in easily accessible or familiar positions, creating delays and uncertainty during the inspection and registration process.

Third, the current registration criteria, particularly for motorcycles, are based on engine displacement. Since electric motorcycles do not have engines, they cannot be classified or registered under the existing system. This gap highlights the need for updated regulations that consider the characteristics of EVs, such as using motor power (kW) or battery capacity (kWh) as alternative criteria. Without these regulatory adjustments, EVs, especially electric two-wheelers, cannot be properly registered or integrated into the formal vehicle management framework.

Meeting adjourned at: 11.00 AM

Illustrative Photos from the Visit / Meeting









As of 12 September 2025

9.5.4. Fieldwork Observations in Lao PDR (Activity 1)

The research field trip to Laos offered valuable insights into the country's evolving transport ecosystem and its readiness to adopt electric vehicles (EVs), smart mobility solutions, and digital platforms. Interactions with private companies, academic institutions, and government ministries highlighted both the opportunities and structural challenges associated with Laos' transport transition.

New Chip Xeng, one of Laos' leading automotive distributors, provided an overview of the domestic vehicle market and the emerging interest in EV products. Their experience reflects a market still in the early stages of electrification, constrained by limited purchasing power. The discussions also revealed the persistent challenges of the gray market in Laos, as parallel importers continue to operate with minimal consequences. Due to consumer behavior—where buyers tend not to file complaints or demand corrective action from sellers or government agencies when defects arise—the gray market faces little pressure to improve quality or accountability, allowing the problem to persist.

Discover Laos Today illustrated the rapid digitalization of Laos' tourism sector and the potential to integrate transportation services with tourism-planning platforms to improve mobility for visitors. Many hotels are now promoting clean-energy mobility by offering electric motorcycles and EV rental services to tourists. However, these business models are highly dependent on tourism flows and face operational risks when visitor numbers decline.

The National University of Laos underscored the essential role of academic institutions in human-resource development and research. The delegation received an overview of national EV-promotion policies and the factors driving rapid EV uptake over the past three years. The primary drivers include rising fuel prices and concerns about fuel shortages, prompting relatively high-income households to purchase EVs as secondary vehicles to complement their gasoline cars.

LOCA Company Limited demonstrated significant progress in smart-mobility innovation, including ride-hailing services and pilot EV-taxi programs, highlighting the feasibility of electrifying commercial fleets. The company also shared valuable insights into opportunities for expanding Laos' national EV-charging network and the long-term business potential of the country's mobility market.

Discussions with the Department of Transport at the Ministry of Public Works and Transport provided strategic perspectives on national mobility policies, regulatory challenges, and future directions for EV adoption. While the government recognizes the importance of modernizing the transport sector, regulatory frameworks, infrastructure readiness, and institutional capacity require substantial strengthening. Laos' EV-promotion direction and policy objectives resemble those of Thailand, and Thai policy roadmaps have influenced Laos' own policy design. However, unlike Thailand, Laos does not provide EV purchase subsidies due to severe budget constraints. The country also faces significant financial limitations in road maintenance. As observed during the field visit, certain roads—such as those connecting the high-speed rail station to central Luang Prabang—contain potholes and uneven surfaces, posing risks of damage to EV batteries from repeated vehicle impacts. These conditions represent a major barrier to widespread EV adoption.

The gray-market issue is particularly pronounced in Vientiane, where numerous small luxury-car dealerships sell both gasoline and electric models without providing after-sales services. Buyers must seek repair and maintenance services independently. Vehicle dealerships are heavily concentrated in major urban centers, prompting consumers from other provinces to travel to Vientiane to purchase vehicles.

Smart mobility also faces significant limitations in Laos due to the underdeveloped road network, poor road conditions, and incomplete high-speed internet coverage. For example, even the high-speed

railway experiences intermittent internet connectivity across several segments, highlighting the uneven digital infrastructure that affects smart-mobility implementation.

Overall, the field visit revealed that Laos is at a pivotal stage in its transport-modernization journey. The country holds strong potential to accelerate EV adoption, expand digital mobility platforms, and link tourism with sustainable transport. However, achieving these goals will require coordinated policy support, strategic investment in charging infrastructure, improvements in road quality, and strengthened human-capital development to support long-term implementation. Moreover, the trip highlighted limitations in accessing reliable statistical data—much of the needed information is not systematically organized and must be obtained directly from government agencies or private enterprises. The lack of structured, year-by-year data remains a major obstacle for research and policy analysis.

9.6 Lao PDR (Activity 2)

9.6.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	The Ubon Ratchathani Provincial Land Transport Office	May 5th, 2026
2.	Tri Petch Isuzu Sales Laos Sole Co., Ltd.	May 6th, 2026
3.	BlueDot	May 7th, 2026

9.6.2. Lists of Participants (Thailand)

No.	Name	Position	Organization
1.	Mr. Chalee Khansiri	Director, Division of International Industrial Economics	OIE
2.	Mr. Matee Laipradith	Plan and Policy Analyst, Professional Level	OIE
3.	Ms. Ubonwan Lordngern	Plan and Policy Analyst, Professional Level	OIE
4.	Mrs. Neitnapha Techapanyasarn	General Service Officer, Experienced Level	OIE
5.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI
6.	Ms. Nalada Sanpimolkul	Specialist, Automotive Human Resources Management Division	TAI
7.	Mr. Ekachai Phanmetharit	Specialist, Automotive Human Resources Management Division	TAI
8.	Mr. Phasin Chomsomboon	Staff, Entrepreneur and Industry Development Division	TAI

No.	Name	Position	Organization
9.	Ms. Kantarat Pakdeebanchasak	Staff, Marketing and Customer Relations Division	TAI
10.	Mr. Akanit Thongklueng	Staff, Standard and Conformity Assessment Division	TAI

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute

9.6.3. Summary of Key Points from the Trip

9.6.3.1. Ubon Ratchathani Provincial Land Transport Office

The Ubon Ratchathani Provincial Land Transport Office is an agency under the Department of Land Transport, responsible for overseeing all matters related to road vehicles and land transportation within Ubon Ratchathani Province. Its scope of responsibility covers automobiles, motorcycles, drivers, and various transport-related businesses. The office's primary role is to provide public services, including the issuance and renewal of driver's licenses, vehicle registration, ownership transfer, and annual vehicle tax renewal. In addition, it conducts vehicle inspections to ensure that all vehicles operating on public roads comply with established safety standards.

With regard to drivers, the office is also responsible for administering both theoretical and practical driving tests, as well as providing training on traffic regulations and road safety in order to help reduce road accidents.

Beyond general public services, the Ubon Ratchathani Provincial Land Transport Office also supervises transport operators, such as passenger transport services, freight vehicles, and logistics businesses. Its responsibilities include licensing, setting and enforcing standards, and ensuring compliance with relevant laws and regulations.

Host Organization

1. Mr. Jakkrit Tangjaitrong — Ubon Ratchathani Provincial Land Transport Officer
2. Acting Sub Lt. Apisak Somma — Transport Officer, Senior Professional Level
3. Mr. Surasi Brikshavan — Transport Technical Officer, Professional Level
4. Miss Chidchanok Kullaporn — Transport Technical Officer, Professional Level
5. Mrs. Acharaporn Srimontree — Transport Technical Officer, Professional Level

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri — Director, Division of International Industrial Economics
2. Mr. Matee Laipradith — Plan and Policy Analyst, Professional Level
3. Ms. Ubonwan Lordngern — Plan and Policy Analyst, Professional Level

4. Mrs. Neitnapha Techapanyasarn	General Service Officer, Experienced Level

Thailand Automotive Institute

1. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2. Ms. Nalada Sanpimolkul	Specialist
3. Mr. Ekachai Phanmetharit	Specialist
4. Mr. Phasin Chomsomboon	Staff
5. Ms. Kantarat Pakdeebanchasak	Staff
6. Mr. Akanit Thongklueng	Staff

Meeting Commenced at: 02.00 PM

Summary of Key Points

1. Situation of Cross-Border Vehicles between Thailand and the Lao PDR

According to statistical data from 2025 to April 2026, vehicles crossing the border through Chong Mek Checkpoint can be categorized into four main types:

1. Trucks
2. Private passenger vehicles
3. Passenger buses
4. Motorcycles

The data indicated that trucks accounted for the highest number of cross-border vehicles, totaling 216,603 vehicles, followed by private passenger vehicles at 150,855 vehicles. Passenger buses and motorcycles represented only a small proportion of the total traffic.

Cross-border trucks are divided into trucks carrying goods and empty trucks. Imported goods transported from the Lao PDR mainly consist of agricultural products, with the highest volume occurring during the early months of the year, particularly from January to March. Exported goods transported from Thailand mainly consist of consumer products, with relatively stable volumes throughout each month.

For private passenger vehicles and motorcycles crossing the border, most originate from the Lao PDR rather than Thailand. The primary purposes of travel include access to healthcare services, shopping, and tourism activities. Cross-border vehicle operations require permits; however, no fees are currently imposed for such permits.

2. Vehicle Usage Situation in Ubon Ratchathani Province

Vehicle usage in Ubon Ratchathani Province has shown continuous growth in 2026. Newly registered vehicles categorized by fuel type are as follows:

- Electric vehicles (EVs): 69 units (2.4%)
- Diesel vehicles: 188 units (6.5%)
- Gasoline vehicles: 160 units (5.5%)
- Electric motorcycles: 3 units (0.2%)
- Gasoline motorcycles: 2,464 units (85.4%)

Demand for electric vehicles in Ubon Ratchathani Province has continued to increase since 2025. Chinese electric vehicle brands are currently the most popular among consumers in the province.

3. Supporting Factors for Electric Vehicles in Ubon Ratchathani Province

The growth of electric vehicles in Ubon Ratchathani Province has mainly been driven by continuously rising fuel prices, prompting consumers to consider EVs as a more economical and cost-effective long-term transportation option.

In addition, government support measures, particularly EV purchase subsidies, have become an important factor influencing purchasing decisions. At the same time, the expansion of EV charging stations throughout urban areas has improved accessibility and convenience for EV users.

Furthermore, various EV manufacturers have increasingly established showrooms and service centers within the province, helping to strengthen consumer confidence in after-sales services and vehicle maintenance. These factors have collectively contributed to the increasing adoption of electric vehicles in the province.

4. Recommendations

Relevant agencies should expedite the establishment of clear guidelines for the management of end-of-life electric vehicle batteries in order to accommodate the future expansion of EV usage while minimizing environmental impacts.

In addition, cooperation on new energy vehicles under the Lancang–Mekong Cooperation Framework should be further strengthened and implemented more concretely, particularly in the areas of infrastructure development, operational standards, and the joint development of the electric vehicle industry ecosystem within the region.

Meeting adjourned at: 3:30 PM

Illustrative Photos from the Visit / Meeting







As of 5 May 2026

9.6.3.2. Tri Petch Isuzu Sales Laos Sole Co., Ltd.

Tri Petch Isuzu Sales Laos Sole Co., Ltd. is a company under the Tri Petch Group, engaged in the distribution and brand development of Isuzu vehicles in the Lao People's Democratic Republic (Lao PDR). The company began its operations in Lao PDR in 2016 as part of the Tri Petch Group's expansion into international markets. It applies its extensive experience in the automotive business, marketing, and vehicle distribution to meet the specific requirements of the Lao market. The company has also developed a network of dealers and service channels to strengthen consumer awareness, confidence, and recognition of the Isuzu brand in Lao PDR. Currently, the company plays an important role in the distribution and promotion of Isuzu vehicles, with a particular focus on light commercial vehicles (LCVs) in the Lao market.

The company's core business activities involve the distribution of Isuzu vehicles and brand development in Lao PDR, with a primary focus on light commercial vehicles. Its operations are conducted through a network of dealers located in various areas across the country. Its business activities cover marketing planning and implementation, public relations, sales promotion, dealer network management, after-sales service support, and customer care. In addition, the company places strong emphasis on understanding market demand and consumer behavior. These insights are used to refine its marketing strategies and improve its operations in order to effectively respond to customer needs and enhance its competitiveness in the Lao automotive market.

Host Organization

1. Ms. Jutharak Chitrojanarak	President of Tri Petch Isuzu Sales Laos
2. Ms. On Raktiprakorn	Deputy General Manager of Tri Petch Isuzu

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Mr. Matee Laipradith	Plan and Policy Analyst, Professional Level
3. Ms. Ubonwan Lordngern	Plan and Policy Analyst, Professional Level
4. Mrs. Neitnapha Techapanyasarn	General Service Officer, Experienced Level

Thailand Automotive Institute

1. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2. Ms. Nalada Sanpimolkul	Specialist
3. Mr. Ekachai Phanmetharit	Specialist
4. Mr. Phasin Chomsomboon	Staff
5. Ms. Kantarat Pakdeebanchasak	Staff
6. Mr. Akanit Thongklueng	Staff

Meeting Commenced at: 02.00 PM

Summary of Key Points

1. Background: Tri Petch Isuzu in Laos

Tri Petch Isuzu currently operates two active showrooms in southern Laos, serving a region that functions as the country's primary commercial corridor. The dealership traces its origins to 1974, when a joint venture was established between Mitsubishi Corporation and Isuzu. The founding rationale was practical: the selection of Isuzu vehicles was driven by the need for robust, durable workhorses capable of withstanding the poor and rough road conditions prevalent throughout Laos at the time. This focus on rugged utility has continued to define the brand's positioning in the Lao market.

The dealership's current strategy emphasizes a multi-pathway approach to fuel types — offering diesel, petrol, and increasingly electric vehicle (EV) options — in recognition that the market cannot be served by a single powertrain solution. This flexibility is seen as essential given the evolving regulatory environment and shifting consumer sentiment in Laos.

2. Laos Economic Context and the 2022 Financial Crisis

The Lao economy is characterized by a narrow production base, relying predominantly on four key drivers:

- Project-based revenue from government-linked infrastructure bids and development funding
- Tourism receipts
- Electricity exports (primarily hydropower)
- Rail-related commerce (following the completion of the China-Laos high-speed rail link)

Laos is not a significant manufacturing economy and depends heavily on imports for consumer goods, including vehicles.

The 2022 Financial Crisis

Laos entered a severe economic crisis beginning in 2022, triggered by a confluence of factors:

- **COVID-19 aftermath:** Tourism, a significant foreign-currency earner, collapsed during the pandemic period, yet sovereign debt obligations continued to accumulate.
- **High debt burden:** Substantial debt tied to infrastructure projects, including the China-Laos railway, required ongoing repayment regardless of revenue performance.
- **Currency crisis:** Popular demand for USD over the Lao Kip (Geeb) grew rapidly, as USD was seen as a stable store of value and was quickly deployed to service foreign debts. Common retail shops began operating as informal currency exchange points, triggering competitive bidding between operators that destabilized the exchange rate.
- **Hyperinflation:** Monthly inflation reached approximately 30% at its peak, severely affecting purchasing power and consumer confidence.

The resulting financial instability deeply affected consumer behavior. The broader population, who traditionally save in gold rather than cash deposits, had built up significant latent demand prior to the crisis. Once economic conditions began to stabilize, pent-up demand created a notable surge in purchases, including in the automotive sector. IMIT, the government-linked entity managing export-related commercial activity, plays a role in regulating part of this commercial ecosystem.

3. Geographic and Demographic Factors Shaping the Market

Laos presents a unique geographic and demographic profile that directly shapes vehicle demand:

- **Terrain:** Approximately 70% of the country is mountainous, leaving very limited flat arable or navigable land. This terrain strongly favors pickup trucks (PU) over other vehicle segments.
- **Strategic geography:** Laos is landlocked, and the southern region — where Pakse is located — represents the most direct overland route to Vietnam and access to the sea. This makes the southern corridor commercially significant for logistics and trade.
- **Demographics:** The national population remains relatively low, partly due to emigration to neighboring countries in search of higher wages. Concurrently, Chinese migrants have been settling in Laos, particularly following the expansion of the rail and commercial network, contributing to changing commercial activity patterns.
- **Chinese commercial influence:** The China-Laos train project has accelerated the influx of Chinese businesses and products into the Lao market, reshaping the competitive landscape across multiple sectors.

4. Government Policies Affecting the Automotive Sector

The Lao government has implemented a series of tax and import policies that materially influence vehicle purchasing decisions:

- **Engine-size-based taxation:** Vehicles with larger engines attract higher tax rates. The policy rationale is to reduce oil import volumes, as Laos must import the vast majority of its fuel. This creates an inherent price premium on conventional internal combustion engine (ICE) vehicles with larger displacement engines.
- **EV import incentives:** Electric vehicles currently benefit from a zero-import tax policy and are exempt from road tax, creating a significant price advantage over ICE counterparts.
- **Grey market liberalization:** The favorable EV tax regime has effectively opened the door to a relatively free grey-market channel for EV imports, particularly from Chinese manufacturers. This is noted as both an opportunity and a compliance challenge for established dealers.

A key observation from the discussion is that Lao consumers are primarily price-sensitive rather than specification-driven, meaning that policy-driven price differentials have an outsized influence on purchasing behavior relative to technical or performance attributes.

5. Automotive Market Structure and Competitive Landscape

Market Segmentation

The Lao automotive market broadly segments along the following lines, consistent with patterns observed in other lower-middle-income developing economies:

- **Pickup trucks (PU):** The dominant segment. Driven by terrain requirements and dual utility as both a working vehicle and a status symbol. Single-cab configurations record stronger sales than double-cab variants.
- **SUVs:** Positioned as aspirational purchases for higher-income consumers; a symbol of social status rather than a utility vehicle.
- **Sedans:** Demand is largely confined to the capital, Vientiane, where road conditions and urban use-cases are more conducive.

- **Electric Vehicles (EV):** An emerging segment. EV adoption for taxis in Vientiane began gaining traction from 2023. However, EV infrastructure (charging networks and showrooms) remains heavily concentrated in Vientiane, limiting uptake in regional cities such as Pakse.

Competitive Dynamics

The competitive landscape is characterized by the following dynamics:

- **Established competitors:** Toyota holds strong brand recognition in the PU segment and carries additional weight as a status symbol. Hyundai has been identified as a notable competitor in the PU segment.
- **Chinese vehicle brands:** The influx of Chinese goods following the rail connection has been significant across many sectors; however, Chinese PU brands have not yet emerged as a major force in the Lao vehicle market. This is viewed as a potential future competitive risk rather than an immediate threat.
- **Consumer sentiment and market recovery:** The sharp economic shock of 2022–2023 suppressed demand and disrupted purchasing cycles. As conditions stabilize, there is evidence of pent-up demand converting into purchases. Consumer sentiment is noted as a key variable — the market is open to structural shifts (including toward EVs) when economic circumstances and consumer readiness align.

6. Modification of Right-Hand Drive Vehicles

Unofficial dealerships revealed a high proportion of converted Right-Hand Drive (RHD) vehicles being sold alongside authentic Left-Hand Drive (LHD) models. These conversions are highly superficial; mechanics swap the steering wheel, foot pedals, and dashboard console inside the cabin, but leave the engine compartment completely in its original RHD layout to save costs.

Because the engine bay is left unmodified, these converted vehicles can be easily identified by several unique key features:

- Brake Booster Piping: The brake booster remains mounted on the original right-hand side. Mechanics are forced to run a crude, extra hydraulic pipeline across the entire width of the engine bay to connect it to the relocated left-side foot pedals.
- Windshield Wipers: The wipers still rest and sweep in the original RHD pattern, which is reversed compared to authentic LHD cars.
- Door Keyhole: The physical keyhole remains on the right exterior door handle—what has now become the passenger side.

7. Key Observations and Implications

- The Lao automotive market is at an inflection point: post-crisis stabilization is releasing pent-up demand while regulatory tailwinds favor EV adoption, yet infrastructure gaps and income sensitivity constrain the pace of transition.
- The southern Laos corridor (Pakse and surrounding areas) is of particular commercial significance due to its geographic position as the gateway to Vietnam and the sea.
- Policy decisions — particularly engine-size taxes and EV exemptions — are functioning as effective demand-shaping tools, even if their primary intent is energy import reduction.
- Chinese commercial presence, driven largely by the rail project, is reshaping the broader Lao economy and will likely influence the automotive market in ways that are not yet fully visible.

- Tri Petch Isuzu's multi-fuel-pathway strategy and focus on vehicle durability appear well-suited to the current Lao market conditions, though the long-term competitive position will depend on how quickly EV infrastructure expands beyond Vientiane.
- Field observations show that Left-Hand Drive (LHD) vehicle conversions are confined to the interior cabin (steering, console, and pedals) while leaving the original Right-Hand Drive (RHD) engine layout intact. This shortcut relies on un-mirrored exterior components—such as RHD windshield wipers and passenger-side keyholes—and requires a cross-engine brake booster pipeline.

Meeting adjourned at: 4:00 PM

Illustrative Photos from the Visit / Meeting







As of 6 May 2026

9.6.3.3. BlueDot

BlueDot Charger was developed and launched in 2022 by Laothani Tractor Co., Ltd., one of the leading companies in Lao PDR specializing in the import and distribution of vehicles, heavy machinery, and commercial trucks. Recognizing the transition toward clean energy and the rapid growth of electric vehicles (EVs) in Laos, the company expanded its investment into EV charging infrastructure**.** The initiative aims to make EV travel in Laos more seamless, safe, and accessible across major routes throughout the country. In 2023, BlueDot entered into a significant Memorandum of Understanding (MoU) with PTT Lao Co., Ltd., part of Thailand's OR Group, to jointly develop and expand EV charging stations at PTT fuel stations throughout Lao PDR. The partnership aims to support both local EV users and international travelers crossing the Lao border, while contributing to the development of a nationwide EV charging network.

BlueDot has become one of the rapidly expanding EV charging networks in Laos, with charging stations strategically located along major north–south transportation routes, at key tourist destinations, and at leading hotels, such as Lao Plaza Hotel in Vientiane and locations in Savannakhet.

Number of Charging Stations

- 50 stations
- 178 charging connectors nationwide

Charging Services

- AC Chargers: Standard-speed chargers suitable for installation at residential properties, offices, commercial buildings, and other facilities.
- DC Fast Chargers: High-speed chargers with power outputs ranging from 40 kW to 180 kW, supporting internationally recognized charging standards, including CCS2 and GB/T.

Ultra-Fast Truck Hub: High-power charging infrastructure with outputs of up to 400 kW, such as the charging facility in Pak Kading, Bolikhamxay Province, specifically designed to support electric trucks and heavy-duty commercial vehicles.

Host Organization

1. Ms. Jutharak Chitrojanarak	President of Tri Petch Isuzu Sales Laos
2. Ms. On Raktiprakorn	Deputy General Manager of Tri Petch Isuzu

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Mr. Matee Laipradith	Plan and Policy Analyst, Professional Level
3. Ms. Ubonwan Lordngern	Plan and Policy Analyst, Professional Level
4. Mrs. Neitnapha Techapanyasarn	General Service Officer, Experienced Level

Thailand Automotive Institute

1. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
2. Ms. Nalada Sanpimolkul	Specialist
3. Mr. Ekachai Phanmetharit	Specialist
4. Mr. Phasin Chomsomboon	Staff
5. Ms. Kantarat Pakdeebanchasak	Staff
6. Mr. Akanit Thongklueng	Staff

Meeting Commenced at: 01.00 PM

Summary of Key Points

1. Overview of BlueDot Charging Station

Laothani Group is one of the major automobile distributors in the Lao PDR and operates electric vehicle charging stations under the brand "BlueDot EV Station PluZ" in collaboration with OR Thailand (PTT Oil and Retail Business Public Company Limited). The company aims to expand its charging station network to cover major transportation routes throughout the Lao PDR, from the northern to the southern regions of the country.



2. Types of EV Chargers and Charging Connectors in the Lao PDR

Electric vehicle charging stations in the Lao PDR are generally categorized into two main types:

1. AC Chargers for normal charging, with charging capacities ranging from approximately 7–22 kW.
2. DC Fast Chargers for rapid charging, with charging capacities ranging from approximately 40–400 kW.

The EV charging connectors commonly used in the Lao PDR are based on two major standards, namely CCS2 and GB/T, in order to support electric vehicles imported from various countries.

1. CCS2 supports modern electric vehicle models, including EVs imported from Thailand.
2. GB/T is the charging connector standard of China and is compatible with Chinese EV brands, which are widely popular in the Lao market.



3. BlueDot Service Operation

Electric vehicle users who wish to use BlueDot charging stations are required to download the "EV Station PluZ BlueDot" application in order to access the charging system. The application enables users to locate charging stations, monitor charger availability, and review charging history.
Prior to using the service, users are required to top up their account balance in advance. Payment can be made via BCEL ONE or Credit/Debit Card.



4. Other EV Charging Service Providers in the Lao PDR

In addition to BlueDot, there are currently several other electric vehicle charging service providers operating in the Lao PDR. One notable example is LOCA EV, which is considered one of the country's major EV charging network operators.

Meeting adjourned at: 2:00 PM

Illustrative Photos from the Visit / Meeting





As of 7 May 2026

9.6.4. Fieldwork Observations in Lao PDR (Activity 2)

Based on the qualitative data collection and field study visits conducted in Lao PDR, several key observations were identified regarding the country's automotive market, electric vehicle (EV) development, infrastructure, regulatory environment, and opportunities for smart mobility and regional cooperation. The automotive market in Lao PDR remains highly dependent on imported vehicles and is sensitive to economic conditions and consumer purchasing power. Pickup trucks continue to represent an important segment of the market due to the country's geographical characteristics and road conditions, while SUVs are also increasingly popular among consumers. Although EV adoption remains at an early stage, demand has gradually increased, particularly in urban areas, supported by the growing availability of Chinese EV brands, expanding charging infrastructure, and government measures aimed at promoting EV use.

Government policies and tax measures play an important role in shaping the EV market in Lao PDR. Measures such as exemptions or reductions in import taxes and road taxes for EVs provide EVs with a price advantage compared with conventional internal combustion engine vehicles. However, the government's fiscal constraints limit the implementation of direct financial incentives for consumers. The increasing presence of Chinese automotive manufacturers and businesses has also contributed to the development of the EV market and related infrastructure. Nevertheless, EV adoption remains concentrated primarily in Vientiane, where vehicle dealerships, after-sales services, and charging stations are more readily available. The expansion of charging infrastructure to other provinces and major transport corridors will therefore be important for supporting wider EV adoption and facilitating long-distance travel.

The development of EV charging infrastructure has progressed through both public and private-sector initiatives, with charging networks offering a range of AC and DC charging capacities, including high-power charging facilities for commercial vehicles. However, the distribution of charging stations remains uneven, with infrastructure concentrated in major urban areas. In addition, road conditions, maintenance limitations, and differences in infrastructure quality across regions may constrain the wider adoption of EVs and the development of smart mobility services. The field visits also highlighted the importance of strengthening regulatory oversight of the automotive market, particularly in relation to grey-market vehicles and parallel imports. The presence of unofficial vehicle conversions, including the conversion of right-hand-drive vehicles to left-hand-drive vehicles without comprehensive modification, raises concerns regarding vehicle standards, safety, after-sales services, and consumer protection.

In terms of smart mobility, digital mobility platforms and EV-based commercial transportation services present opportunities for further development, particularly in urban areas such as Vientiane. However, the development of smart mobility remains constrained by limitations in road infrastructure, digital connectivity, human resources, and the availability of reliable and systematic statistical data. Strengthening data collection and information-sharing mechanisms would therefore support more effective policy planning and market assessment. Overall, Lao PDR is at an emerging stage of EV and smart mobility development, with considerable potential arising from government policy support, increasing private-sector participation, and growing regional connectivity. Continued cooperation among Lancang–Mekong countries, particularly in areas such as EV infrastructure, technical standards, regulatory frameworks, information exchange, and the development of an integrated EV ecosystem, could contribute significantly to the sustainable development of the NEV and smart mobility market in the region.

Chapter 10 Workshop Training

10.1 Workshop Training in Thailand

10.1.1. Lists of Participants

No.	Name	Position	Organization	Country
1.	Mr. Chayangkul Chinda	Standard officer	TISI	Thailand
2.	Miss Pinpart Poonpakdee	Mechanical Engineer	DLT	Thailand
3.	Mr. Chaiyaphruek Narongkool	Assistant to president	EVAT	Thailand
4.	Mr. Sirichai Jariyasettapong	Staff	TAI	Thailand
5.	Mr. Daniel Silavong	Technical officer	DOT, MPWT	Laos
6.	Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit	NUOL	Laos
7.	Dr. Bounlert Vanhnalat	Director General of Commerce Department	NUOL	Laos
8.	Mr. Chanthavivanh Keovilayvong	EV Charger Officer	LOCA	Laos
9.	Mr. Tran Dinh Son	Researcher	ICCT	Vietnam
10.	Mr. Duong Duc Thien	Researcher	ACST	Vietnam
11.	Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group	HUST	Vietnam
12.	Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group	HUST	Vietnam

Note: TISI: Thai Industrial Standards Institute
DLT: Department of Land Transport
EVAT: Electric Vehicle Association of Thailand
TAI: Thailand Automotive Institute
DOT, MPWT: Department of Transport Ministry of Public Works and Transport
NUOL: National University of Laos
LOCA: LOCA Company Limited
ICCT: The International Council on Clean Transportation
ACST: Academy of Construction Strategy and Cadres Training
HUST: Hanoi University of Science and Technology

10.1.2. Training Course Topics

No.	Topic	Date
1.	Thailand's NEV Market Situation and Trend	Nov 25th, 2025
2.	Smart Mobility/Vehicle Visit & Hand-on Experience in Autonomous Shuttle Service	Nov 26th, 2025
3.	Electric Vehicle Rescue & EV Inspection	Nov 26th, 2025
4.	New Energy Vehicle Market Readiness in the Lancang-Mekong Region: Comparative Country Assessment	Nov 26th, 2025

No.	Topic	Date
5.	Visit Automotive and Tyre Testing, Research and Innovation Center (ATTRIC)	Nov 27th, 2025

10.1.3. Summary of the Training in Thailand

1. Thailand's NEV Market Situation and Trend

Thailand remains one of the world's major automotive manufacturing bases. However, domestic vehicle sales fell by 26.2% in 2024 to approximately 572,000 units, mainly due to stricter credit conditions, high household debt, and intense price competition. In contrast, the xEV market continued to grow rapidly. Thailand became ASEAN's largest BEV importer, with more than 90% of imports originating from China. By the end of October 2025, cumulative BEV registrations exceeded 257,000 units, up 72% year-on-year, with 34 EV brands and more than 100 models available in the market.

This growth has been supported by the government's "30@30" policy, attracting major manufacturers such as BYD, MG, CHANGAN, and GWM. Investment in domestic EV production exceeded EUR 3.748 billion, with a combined production capacity of approximately 549,000 vehicles per year. Public charging infrastructure has also expanded, exceeding 7,100 DC fast-charging plugs nationwide, although more than 60% are concentrated in Bangkok and surrounding areas. Thailand therefore needs to accelerate advanced technology development and domestic R&D capabilities to maintain its long-term competitiveness.



2. Smart Mobility

Automotive technology is rapidly transitioning from Advanced Driver Assistance Systems (ADAS) toward Autonomous Driving Systems (ADS). ADAS functions such as ACC, AEB, and LCA integrate data from cameras, radar, LiDAR, and ultrasonic sensors. Under SAE J3016, driving automation is classified into six levels, from Level 0 to Level 5. Major markets such as the United States, Europe, and China are seeing rapid growth in Level 2+ and Level 3 systems, together with the early commercial deployment of Level 4 robotaxis.

Autonomous vehicle technology is built around four key functions: perception, localization, path planning, and vehicle control. The industry is also moving toward end-to-end AI and Software-Defined Vehicles (SDVs), supported by C-V2X connectivity and 5G networks. In Thailand, Chulalongkorn University has advanced research in connected and autonomous vehicles, including 5G, C-V2X, teleoperation, and a Level 3 autonomous shuttle using 3D HD Maps, LiDAR, Autoware, and Drive-by-Wire technology.



3. Electric Vehicle Rescue

The rapid growth of HEVs, PHEVs, and BEVs has increased the need for EV rescue preparedness. Emergency response is based on three key principles: "Identify, Immobilize, and De-energize." First responders should assume the presence of a high-voltage system until verified otherwise, secure the vehicle against movement, and follow the appropriate de-energization procedure. Orange high-voltage cables and components must not be cut, punctured, or tampered with.

In the event of a battery fire, responders require appropriate PPE and SCBA, while continuous water cooling and thermal imaging are important for controlling thermal runaway and monitoring re-ignition risks. Damaged EVs should be recovered using suitable towing methods, and rescue personnel should always refer to the vehicle manufacturer's model-specific Emergency Response Guide (ERG) when performing extrication or high-voltage isolation procedures.

4. EV inspection in Thailand

Thailand's EV inspection system is evolving under the Department of Land Transport (DLT). Private electric passenger vehicles are currently required to undergo inspection after seven years of age and annually thereafter. However, current inspections remain focused mainly on general conditions and visual checks of components such as the battery enclosure, charging port, and high-voltage cables. Standardized battery State of Health (SOH) assessment, specialized diagnostic equipment, and certified personnel are still limited.

Thailand can strengthen this system by developing standardized battery health assessment criteria, training qualified inspection technicians, and introducing advanced diagnostic and AI-based systems. Meanwhile, the EV conversion market is also expanding, particularly for pickup trucks, compact passenger cars, and classic vehicles. Conversion projects must comply with DLT Notification B.E. 2565, including requirements for high-voltage wiring, crash disconnect systems, insulation monitoring, and AVAS before legal registration as electric vehicles.



5. New Energy Vehicle Market Readiness

The NEV and Smart Mobility readiness assessment in the Lancang-Mekong subregion covered five dimensions: Market Status, Policy Readiness, Energy Infrastructure Readiness, Road and Digital Infrastructure Readiness, and Vehicle Technology Readiness. China achieved the highest overall readiness score at 4.2 out of 5.0, supported by strong policies, advanced energy infrastructure, unified GB/T charging standards, and a favorable vehicle-to-charger ratio.

Among the CLTV countries—Cambodia, Lao PDR, Thailand, and Vietnam—Thailand ranked highest with a score of 2.8, followed by Vietnam at 2.5, Cambodia at 2.1, and Lao PDR at 1.8. Common challenges include vehicle price competitiveness, fragmented charging networks, and limited digital and intelligent transport infrastructure. Sustainable NEV growth therefore requires not only vehicle incentives, but also better charging interoperability, stronger digital infrastructure, and greater consumer awareness.



6. Visit Automotive and Tyre Testing, Research and Innovation Center (ATTRIC)

The Automotive and Tyre Testing, Research and Innovation Center (ATTRIC) is a key infrastructure facility for Thailand's automotive industry, operated by the Thailand Automotive Institute (TAI). It has been assigned by the Thai Industrial Standards Institute (TISI), Ministry of Industry, to support manufacturers in research and development, as well as automotive product testing, standards compliance, and quality management.

The key findings from the study visit are as follows:

1. Automotive and Automotive Parts Testing: ATTRIC provides laboratory facilities for testing tyres and automotive parts, as well as test tracks designed to evaluate vehicle performance and safety. These include brake performance testing, road grip testing, hill driving tests, and noise testing.

2. Electric Vehicle Battery Safety Testing: The battery testing center supports testing in accordance with UN Regulations No. 100 (UN R100) and No. 136 (UN R136). Safety tests cover vibration, mechanical shock, fire resistance, protection against overcharging, over-temperature protection, and protection against external short circuits.



10.1.4. Results of the Workshop Training in Thailand

1. Lao People's Democratic Republic

1.1 Knowledge Gained from the Training

The Lao PDR delegation gained a wide range of knowledge and practical insights that can be applied to their work. The key areas of knowledge gained from the training included:

- **Electric Vehicle Safety:** Knowledge of safety measures and guidelines for the use and operation of electric vehicles.
- **Stages of Automation:** An understanding of the levels and development stages of automated driving technologies.
- **Vehicle Conversion:** Knowledge of approaches, techniques, and procedures for converting conventional internal combustion engine vehicles into electrically powered vehicles, particularly in relation to modifications to the vehicle powertrain and other relevant components.
- **Information and Knowledge Sources:** Guidance on accessing relevant information and knowledge sources related to electric vehicles for further study, development, and continuous monitoring of technological advancements.

1.2 National Preparedness and Application

The knowledge gained from the training can support the Lao PDR's preparation for the transition toward electric mobility. Key areas of application include:

- **Future Planning and Preparedness:** Applying the knowledge gained to develop systematic plans for the future adoption of electric vehicles, including the study and monitoring of technologies that are expected to play an important role in the future.
- **Policy Gap Analysis:** The training enabled the delegation to identify policy gaps and areas requiring further development in their country, thereby supporting the improvement of relevant measures to facilitate the energy and mobility transition.
- **Development of Supporting Policies:** The knowledge gained can serve as an input for developing and improving policies and measures to promote the adoption of electric vehicles (EVs) and New Energy Vehicles (NEVs) in the Lao PDR.

Overall, the knowledge gained from the training provides an important foundation for the Lao PDR delegation to support planning, policy development, and national preparedness for the systematic and sustainable development and promotion of electric mobility.

2. Vietnam

2.1 Knowledge Gained from the Training

The Viet Nam delegation gained knowledge and practical insights related to electric vehicle development and emerging technologies. Key areas included:

- **Electric Vehicles and Technology:** Knowledge of electric vehicle technologies, research and development approaches, and the structure and components of emerging automotive technologies.
- **Smart Technology:** Knowledge of the concepts of Smart Devices and Smart Mobility, which are important components in the development of modern mobility and automotive systems.
- **Policies and Social and Cultural Context:** Information and insights into policies and contextual factors related to electric vehicle development, as well as the operations of research and development centers in Thailand. These experiences can be further studied and adapted to suit the context of Viet Nam.

2.2 National Preparedness and Application

The knowledge and experience gained from the training can contribute to Viet Nam's preparedness for future technological developments, particularly in electric vehicles and related technologies. It can also support the development and preparation of the domestic electric vehicle market to effectively accommodate technological expansion and increased adoption in a sustainable manner.

2.3 Other Recommendations and Relevant Issues

International Cooperation and Future Preparedness

- **International Cooperation:** The training provided an opportunity to strengthen international relations and facilitate the exchange of knowledge, experience, and technologies in various areas. These experiences can be considered and adapted to support the development of Viet Nam in accordance with its national context and needs.

- **Future Development Trends:** The delegation gained knowledge and perspectives on future developments and trends in electric mobility. These insights can serve as useful inputs for long-term planning and the formulation of future development directions.

3. Thailand

3.1 Knowledge Gained from the Training

The Thai delegation gained knowledge and experience related to New Energy Vehicle technologies and development. Key areas included:

- **Technology and Development Trends:** Knowledge of emerging technologies and development trends related to electric vehicles (EVs).
- **New Energy Vehicle (NEV) Market Trends:** Information and insights into the direction and trends of the New Energy Vehicle market, which are important inputs for future policy planning and development.
- **Policy Gap Analysis:** Increased awareness of policy gaps, particularly in relation to the **assessment** and **implementation** of EV-related measures, as well as the development of the **EV ecosystem**.

3.2 National Preparedness and Application

The knowledge gained from the training can be applied to support national preparedness and improve domestic implementation. Key areas include:

- **Future Policy Planning:** Using information on market and technology trends as inputs for policy planning and the formulation of development directions to support an effective transition toward electric mobility.
- **Addressing Policy Gaps:** Applying the findings and understanding of identified policy gaps to support the improvement and development of relevant regulations, measures, and supporting mechanisms, particularly the development of an **EV ecosystem** conducive to the production, adoption, and development of electric vehicles in Thailand.

3.3 Other Recommendations and Relevant Issues

Challenges in Policy Implementation

The Thai delegation highlighted the importance of challenges associated with translating policies into practice, particularly the possibility of delays in implementing policy measures, even after new measures have been formulated or announced. Therefore, the knowledge and experience gained from the training can be applied to support the development of mechanisms and implementation approaches that facilitate the effective implementation of EV-related measures and ensure tangible outcomes.





THAILAND AUTOMOTIVE INSTITUTE

10.2 Workshop Training in China

10.2.1. List of visited companies and organization

No.	Company/Organization	Visit/Date
1.	SAIC Motor R&D Innovation Headquarters	May 9th, 2026
2.	Qingtao (Kunshan) Energy Development Co., Ltd.	May 9th, 2026
3.	Tsinghua University Suzhou Automotive Research Institute (TSARI)	May 10th, 2026
4.	IM Motors Technology Co., Ltd.	May 11th, 2026
5.	China Automotive Technology and Research Center (CATARC)	May 11th, 2026
6.	Shanghai Weixiang Zhongyi New Energy Technology Co., Ltd. (Z-Cycle)	May 12th, 2026
7.	Shanghai Administration Institute (SAI)	May 12th, 2026

10.2.2. Lists of Participants

No.	Name	Position	Organization	Country
1.	Mr. Supakit Boonsiri	Director General	OIE	Thailand
2.	Mr. Chalee Khansiri	Director, Division of International Industrial Economics	OIE	Thailand
3.	Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level	OIE	Thailand
4.	Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level	OIE	Thailand
5.	Dr. Kriengsak Wongpromrat	President	TAI	Thailand
6.	Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division	TAI	Thailand
7.	Ms. Smitha Suttabustya	Specialist, Division of Marketing and customer relations	TAI	Thailand
8.	Ms.Nalada Sanpimolkul	Specialist, Division of Automotive Human Resources Management	TAI	Thailand
9.	Ms. Lalida Nuikhong	Staff, Division of Entrepreneur and Industry Development	TAI	Thailand
10.	Mr. Chayangkul Chinda	Standard officer	TISI	Thailand
11.	Mr. Kraisak Surawattanawong	Mechanical Engineer	DLT	Thailand
12.	Mr. Suroj Sangsnit	President	EVAT	Thailand

No.	Name	Position	Organization	Country
13.	Mr. Chaiyaphruek Narongkool	Assistant to president	EVAT	Thailand
14.	Ms. Jitpraphat Suddhibark	General Business Coordinator	CASIC	Thailand
15.	Mr. Intha Kongkhammanivong	Technical officer	DOT, MPWT	Laos
16.	Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit	NUOL	Laos
17.	Dr. Bounlert Vanhnalat	Director General of Commerce Department	NUOL	Laos
18.	Mr. Chanthavivanh Keovilayvong	EV Charger Officer	LOCA	Laos
19.	Mr. Tran Dinh Son	Researcher	ICCT	Vietnam
20.	Mr. Duong Duc Thien	Researcher	ACST	Vietnam
21.	Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group	HUST	Vietnam
22.	Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group	HUST	Vietnam
23.	Assoc.Prof. Dam Hoang Phuc	Automotive Engineering Program Director	HUST	Vietnam

Note: OIE: Office of Industrial Economic, Ministry of Industry
TAI: Thailand Automotive Institute
TISI: Thai Industrial Standards Institute
DLT: Department of Land Transport
EVAT: Electric Vehicle Association of Thailand
CASIC: China Automobile Standards Internationalization Center (Bangkok)
DOT, MPWT: Department of Transport Ministry of Public Works and Transport
NUOL: National University of Laos
LOCA: LOCA Company Limited
ICCT: The International Council on Clean Transportation
ACST: Academy of Construction Strategy and Cadres Training
HUST: Hanoi University of Science and Technology

10.2.3. Summary of Key Points from the Trip

10.2.3.1. SAIC Motor R&D Innovation Headquarters

SAIC Motor R&D Innovation Headquarters is the central research and development (R&D) hub of SAIC Motor, one of the largest automotive manufacturers in the People's Republic of China with strategic partnerships with several global automakers. The center plays a critical role in driving advanced automotive innovation, covering the development of next-generation vehicle platforms, electric powertrains (EV powertrain), battery technologies, intelligent cockpit systems, and autonomous driving technologies.

The R&D center serves as an integrated innovation base, encompassing engineering design, testing and validation, and certification processes, as well as the development of digital technologies such as connected vehicle systems and advanced vehicle control software. It also supports product development across SAIC's core brands and contributes to the transformation of the automotive industry toward New Energy Vehicles (NEVs) and a comprehensive smart mobility ecosystem.

Host Organization

1. Zhang Liang	Compliance & General Management
2. WuYun	Compliance & General Management
3. Dai Hui	Compliance & General Management
4. Chen Jiawu	Compliance & General Management
5. Jiang Jihua	R&D Department
6. Wang Min	R&D Department
7. Li Yang	R&D Department
8. Yan Jun	SAIC-Huawei Partnership Business Department
9. Zhong Heng	SAIC-Huawei Partnership Business Department
10 Lu Feng	Quality Assurance Department

Participants

The Office of Industrial Economics

1. Mr. Supakit Boonsiri	Director General
2. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
3. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
4. Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Smitha Suttabustya	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

Thai Industrial Standards Institute

1. Mr. Chayangkul Chinda	Standard officer

Department of Land Transport

1. Mr. Kraisak Surawattanawong	Mechanical Engineer

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Assistant to president

China Automobile Standards Internationalization Center (Bangkok)

1. Ms. Jitpraphat Suddhibark	General Business Coordinator

Meeting Commenced at: 09.30 AM

Summary of Key Points

The study visit to the SAIC Motor R&D Innovation Headquarters provided an overview of the company's primary research and development centre, which plays a significant role in driving automotive innovation in China. SAIC Motor's vision focuses on developing environmentally friendly vehicle technologies while simultaneously enhancing the driving experience. This includes improving cabin quietness at low speeds and ensuring responsive driving performance at medium to high speeds. The company has continuously prioritised the development of electric and hybrid powertrain technologies to support the automotive industry's transition toward the new energy era, covering Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicles (PHEV), and Extended Range Electric Vehicles (EREV) to meet diverse market demands.

From an engineering perspective, SAIC Motor demonstrated strong capabilities in developing a dedicated hybrid engine (Dedicated Hybrid Engine) with a 1.5-litre displacement, achieving a thermal efficiency of up to 41%. The engine operates in combination with a three-speed hybrid transmission system that delivers a mechanical transmission efficiency of up to 97%. The system is designed with a compact architecture while maintaining high torque capacity and incorporates a next-generation hydraulic control system that enables smooth gear shifting and efficient power delivery. These developments reflect the company's advancement in automotive engineering and powertrain innovation.

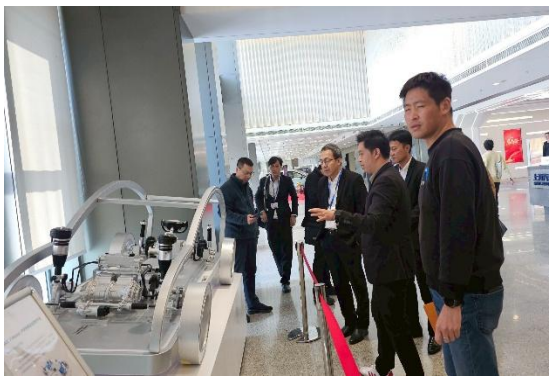
Regarding safety standards, SAIC Motor places strong emphasis on high-voltage battery system development. The company adopts a Cell-to-Pack (CTP) battery structure to increase energy density while reducing overall battery size. The battery pack cover utilises Glass Mat Thermoplastic (GMT) composite material, which offers lightweight characteristics and high thermal resistance. Safety testing results indicate that the battery system can withstand temperatures exceeding 1,200°C without ignition and can effectively delay thermal propagation for an extended period. Additionally, the battery system incorporates an Omega-shape cooling duct design to enhance thermal management efficiency.

Technologies developed by SAIC Motor have already been applied in several MG vehicle models. The HEV system is implemented in the MG3 and MG ZS models, focusing on energy efficiency and urban driving agility. The PHEV system is applied in the MG HS to optimise energy utilisation between the internal combustion engine and electric propulsion. Meanwhile, the EREV system is utilised in the IM6 model, which emphasises electric-dominant driving while extending driving range. Overall, the visit highlighted the automotive industry's development direction toward integrating performance, safety, and environmental sustainability through SAIC Motor's continuous advancement in innovative automotive technologies.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting






As of 9 March 2026

10.2.3.2. Qingtao (Kunshan) Energy Development Co., Ltd.

Qingtao (Kunshan) Energy Development Group Co.,Ltd. was founded in 2016, headquartered in Kunshan, Suzhou. It is a high-tech enterprise led by the team of Nan Cewen, an academician of the Chinese Academy of Sciences and a professor at Tsinghua University. It has taken the lead in the industrialization of solid-state batteries and established a large-scale production line for solid-state lithium batteries. Qingtao Energy has applied for more than 1300 national patents, half of which are invention patents, and more than 800 have been authorized. Qingtao Energy has successively received strategic investments from institutions such as SAIC, BAIC, GAC, Bank Of China Investment and Shanghai Sci-Tech Innovation, with a current valuation of over 20 billion yuan. Qingtao Energy has been listed for the Forbes China High Growth Gazelle List and has developed into "Global Unicorn Enterprise". Several subsidiaries have been awarded "National High-tech Enterprises", "Jiangsu Province's Innovation and Entrepreneurship Teams" and other honorary titles.

Host Organization

SAIC QingTao Energy Systems Co., Ltd.

1. Yuan Mengteng	Project Leader

Suzhou QingTao Power Technology Co., Ltd.

1. Wang Baohui	Process Director
2. Hu Zhongyun	Production Director

Participants

The Office of Industrial Economics

1. Mr. Supakit Boonsiri	Director General
2. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
3. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
4. Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Smitha Suttabustya	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

Thai Industrial Standards Institute

1. Mr. Chayangkul Chinda	Standard officer

Department of Land Transport

1. Mr. Kraisak Surawattanawong	Mechanical Engineer

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Assistant to president

China Automobile Standards Internationalization Center (Bangkok)

1. Ms. Jitpraphat Suddhibark	General Business Coordinator

Meeting Commenced at: 02.00 PM

Summary of Key Points

Qingtao (Kunshan) Energy Development Group Co., Ltd. is a technology company specializing in the development of solid-state lithium battery technology. Established in 2016 and headquartered in Kunshan, Jiangsu Province, the company operates under the leadership of Professor Nan Cewen from Tsinghua University, a member of the Chinese Academy of Sciences. The company aims to advance next-generation battery technologies with enhanced safety performance and cost efficiency to support the transition toward new energy mobility and sustainable energy systems.

Qingtao has developed an integrated industrial structure covering the entire battery value chain, including core material development, specialized equipment manufacturing, battery production, and battery management system solutions. The company reports a market valuation exceeding RMB 23 billion, with total assets of over RMB 5 billion. Its workforce consists of more than 1,500 employees, including approximately 450 research and development personnel, many of whom possess advanced academic qualifications and extensive industry experience. Qingtao currently holds over 1,000 patents related to materials, manufacturing processes, equipment technologies, and system integration. The company also maintains strategic collaboration with Huayu Automotive Systems Co., Ltd. (HASCO) to accelerate commercialization and industrial deployment of solid-state battery technologies.

Technology Development Strategy

The company presented its three-step technology roadmap toward full commercialization of solid-state batteries:

- Generation 1: Semi-solid Battery: Containing approximately 10% liquid electrolyte, this battery technology has already been applied in commercial vehicles, including the IM L6 model launched in 2024, demonstrating a driving range exceeding 1,000 kilometers per charge.
- Generation 2: Quasi-solid Battery: The liquid electrolyte content has been reduced to below 5%. The technology was officially introduced together with the MG4 model in August 2025 and is expected to enter large-scale delivery within the current production cycle.
- Generation 3: All-solid Battery: Representing the company's long-term objective, this technology eliminates liquid electrolyte entirely. Qingtao aims to achieve initial commercial deployment of approximately 1,000 vehicles by 2027, followed by expansion to more than 10,000 vehicles across multiple automotive brands starting in 2028.

Production Capacity and Infrastructure Development

The company operates its headquarters and research center in Jiading District, Shanghai, alongside a major manufacturing facility in Kunshan with a current solid-state battery production capacity of approximately 3 GWh. Qingtao is also expanding a new production base in Taizhou, expected to add an additional 10 GWh of capacity by the end of 2027. According to the company's development plan, total production capacity is projected to exceed 30 GWh, supporting large-scale commercialization and reinforcing its position in the global solid-state battery industry.

Meeting adjourned at: 04.30 PM

Illustrative Photos from the Visit / Meeting



As of 9 March 2026

10.2.3.3. Tsinghua University Suzhou Automotive Research Institute

Tsinghua University Suzhou Automotive Research Institute (TSARI) is an automotive research and development institute established by Tsinghua University in collaboration with local authorities in Suzhou, Jiangsu Province, People's Republic of China. The institute aims to bridge academic knowledge with industry applications and accelerate the commercialization of advanced automotive innovations. It focuses on next-generation vehicle technologies, particularly New Energy Vehicles (NEVs), electric powertrains, battery systems, automotive electronics, autonomous driving, connected vehicles, and intelligent infrastructure technologies related to modern transportation systems.

In addition, TSARI serves as a platform for testing, standardization, and technology transfer. It collaborates with automotive manufacturers, suppliers, and technology companies both domestically and internationally to enhance the global competitiveness of the automotive industry. The institute also supports policy development and the establishment of a comprehensive ecosystem for intelligent and electric vehicles. It is regarded as one of China's key research institutions driving advanced automotive technologies and serves as a bridge between university-level research and practical industrial applications.

Host Organization

Tsinghua University Suzhou Automotive Research Institute

1. Dr. Yifan DAI — Chief Engineer
2. Mr. Hui DUAN — Director of Industry Research
3. Dr. Mingqing TIAN — Industry and Technology Analyst
4. Mr. Jie WANG — Marketing Manager

Linktron Group – Apex Intelligent Technology (Suzhou) Co., Ltd.

1. Mr. Jiong RUAN	General Manager
2. Mr. Jieyuan WEI	Deputy General Manager

Jiangsu Intelligent and Connected Vehicles Innovation Center

1. Mr. Yao SHEN	Business Development Director

Participants

The Office of Industrial Economics

1. Mr. Supakit Boonsiri	Director General
2. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
3. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
4. Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Smitha Suttabustya	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

Thai Industrial Standards Institute

1. Mr. Chayangkul Chinda	Standard officer

Department of Land Transport

1. Mr. Kraisak Surawattanawong	Mechanical Engineer

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Assistant to president

China Automobile Standards Internationalization Center (Bangkok)

1. Ms. Jitpraphat Suddhibark	General Business Coordinator

Department of Transport Ministry of Public Works and Transport

1. Mr. Intha Kongkhammanivong	Technical officer

National University of Laos

1. Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit
2. Dr. Bounlert Vanhnalat	Director General of Commerce Department

LOCA Company Limited

1. Mr. Chanthavivanh Keovilayvong	EV Charger Officer

The International Council on Clean Transportation

1. Mr. Tran Dinh Son	Researcher

Academy of Construction Strategy and Cadres Training

1. Mr. Duong Duc Thien	Researcher

Hanoi University of Science and Technology

1. Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group
2. Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group
3. Assoc.Prof. Dam Hoang Phuc	Automotive Engineering Program Director

Meeting Commenced at: 10.00 AM

Summary of Key Points

Overview of China's New Energy Vehicle (NEV) Industry

China's New Energy Vehicle (NEV) industry is experiencing rapid and transformative growth. In 2025, total NEV sales exceeded 13 million units, with the market penetration rate reaching 50.1%. This milestone represents a significant turning point, as NEVs have begun to substantially replace internal combustion engine (ICE) vehicles. By vehicle type, battery electric vehicles (BEVs) accounted for the largest market share at 61.5%, followed by plug-in hybrid electric vehicles (PHEVs) at 28.9% and extended-range electric vehicles (EREVs) at 9.6%. Market competition is also shifting from a "price war" toward competition driven by value creation and intelligent features. New entrants from the technology sector, such as Xiaomi and Huawei, are playing increasingly influential roles in shaping market dynamics.

Historical Development of China's NEV Market

The development of China's NEV market can be categorized into four major phases. The first phase, Incubation and Start-up (2013–2018), was primarily driven by government subsidies and incentive policies. The second phase, Accelerated Growth (2019–2022), marked a transition toward growth supported by product quality and technological advancement. This was followed by the Explosion and Disruption phase (2023–2024), during which NEVs began to replace ICE vehicles on a broad scale. Currently, the industry is entering the Global Dominance and Export phase (from 2025 onward), characterized by the international expansion of Chinese technologies and industrial standards. Government policies remain a key driving force, particularly the Purchase Tax Exemption extended through 2027 and the Dual-Credit Policy, which requires manufacturers to meet mandated NEV production targets.

Future Direction and Technology Trends

Looking ahead, regulatory requirements are expected to become more stringent. The NEV credit requirement is planned to increase to 48% in 2026 and 58% in 2027. Technological development will focus on four main pillars:

1. Mass production of solid-state batteries targeted for 2027–2030
2. Advancement of autonomous driving systems from Level 2 toward Levels 3 and 4
3. Integration and miniaturization of electric drive systems to achieve lighter and more compact architectures; and

4. Deployment of artificial intelligence technologies to enable highly intelligent vehicle systems by 2030.

In addition, intelligent infrastructure development is expected to expand through Vehicle-to-Grid (V2G) technology, transforming electric vehicles into mobile energy storage units capable of supporting national power grid stability.

China is also accelerating its global expansion strategy. Chinese automakers are transitioning from "Globalization 1.0," which focused primarily on vehicle exports, to "Globalization 2.0," emphasizing overseas assembly plants and localized production bases. This strategy includes expanding entire supply chains—including components manufacturing and charging infrastructure—to mitigate tariff risks and foster sustainable local partnerships. Market projections indicate that annual sales growth will stabilize at approximately 8% - 10%, while NEV market penetration is expected to reach 70% - 80% by 2030, reflecting a shift from policy-driven growth toward fully market-driven expansion.

Role of TSARI Auto Insights

TSARI Auto Insights, an automotive think tank under Tsinghua University, plays a significant role in providing technical consultancy, industrial planning, and market research. At the national level, the institute has contributed to the development of key strategic frameworks, including the National Strategy for Intelligent Vehicle Innovation and Development and the Technology Roadmap for Energy-Saving and New Energy Vehicles of China. As such, the institute is positioned as an important driving force supporting the advancement of the global automotive industry.

Meeting adjourned at: 02.00 PM

Illustrative Photos from the Visit / Meeting











As of 10 March 2026

10.2.3.4. IM Motors Technology Co., Ltd.

IM Motors Technology Co., Ltd. is a premium smart electric vehicle (Smart EV) developer and manufacturer in the People's Republic of China. The company was established through a strategic partnership among SAIC Motor, one of the largest automotive manufacturers in the People's Republic of China; Alibaba Group, a leading global technology company; and Zhangjiang Hi-Tech, a developer of high-technology industrial zones in Shanghai. Its headquarters is located in Shanghai, the People's Republic of China.

The company focuses on developing next-generation automotive technologies by integrating expertise in vehicle manufacturing, digital technology, and intelligent systems. Its objective is to produce high-performance, safe, and comfortable electric vehicles. IM Motors places strong emphasis on Advanced Driver Assistance Systems (ADAS), artificial intelligence (AI), smart cockpit technologies, connected vehicle systems, and over-the-air (OTA) software updates to continuously enhance vehicle performance, safety, and user experience.

Currently, IM Motors is recognised as one of the emerging New Energy Vehicle (NEV) manufacturers playing a significant role in the electric vehicle industry of the People's Republic of China. The company targets the premium EV market both domestically and internationally and represents a model of integration between the automotive sector and the digital technology industry of the People's Republic of China in the era of the intelligent economy.

Host Organization

1. Ms. Zhou Neng	IM Brand Director

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
2. Ms. Surintorn Yodtasa	Plan and Policy Analyst, Professional Level
3. Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level

Thailand Automotive Institute

1. Dr. Kriengsak Wongpromrat	President
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3. Ms. Smitha Suttabustya	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

Thai Industrial Standards Institute

1. Mr. Chayangkul Chinda	Standard officer

Department of Land Transport

1. Mr. Kraisak Surawattanawong	Mechanical Engineer

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Assistant to president

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1. Ms. Jitpraphat Suddhibark	General Business Coordinator

Department of Transport Ministry of Public Works and Transport

1. Mr. Intha Kongkhammanivong	Technical officer

National University of Laos

1. Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit
2. Dr. Bounlert Vanhnalat	Director General of Commerce Department

LOCA Company Limited

1. Mr. Chanthavivanh Keovilayvong	EV Charger Officer

The International Council on Clean Transportation

1. Mr. Tran Dinh Son	Researcher

Academy of Construction Strategy and Cadres Training

1. Mr. Duong Duc Thien	Researcher

Hanoi University of Science and Technology

1. Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group
2. Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group
3. Assoc.Prof. Dam Hoang Phuc	Automotive Engineering Program Director

Meeting Commenced at: 09.30 AM

Summary of Key Points

IM Motors Technology Co., Ltd. is a premium electric vehicle manufacturer established in 2020 through a strategic partnership among SAIC Motor, Alibaba Group, and Zhangjiang Hi-Tech. The company focuses on integrating driving experience with advanced intelligent technologies, positioning itself as a technology-driven electric vehicle brand targeting global markets.

During the visit, company representatives introduced IM Motors' technological development strategy, emphasizing the integration of intelligent systems and software capabilities as core elements of next-generation vehicle development.

A key highlight of the presentation was the company's Four-Wheel Steering Technology. The system enables the rear wheels to adjust their steering angle in coordination with the front wheels, significantly reducing the turning radius while improving maneuverability in confined spaces. This technology enhances driving stability at high speeds and improves cornering precision, particularly for larger vehicle platforms.

The steering system is integrated with the Intelligent Driving System to support proactive safety functions. Coordinated control of all four wheels allows the vehicle to respond effectively to emergency situations, such as obstacle avoidance or sudden braking scenarios, thereby improving vehicle stability and active safety performance.

As part of the study visit, participants conducted performance testing at the company's proving ground. The delegation experienced prototype vehicle demonstrations, including acceleration performance, vehicle stability, and responsiveness of the intelligent chassis control system. Participants also observed real-road driving demonstrations, showcasing the operation of navigation systems and automated driving functions under complex traffic conditions.

The visit provided insights into emerging trends in the electric vehicle industry, highlighting the transition from electrification alone toward the development of Software-Defined Vehicles, where software architecture and intelligent systems increasingly determine vehicle functionality and competitiveness. The experience underscored the importance of preparing industrial ecosystems for this transition, including specialized workforce development, intelligent infrastructure readiness, and supply chain adaptation. Such developments are critical for maintaining regional competitiveness amid rapid technological transformation in the global automotive industry.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting



As of 11 March 2026

10.2.3.5. China Automotive Technology and Research Center (CATARC)

The China Automotive Technology & Research Center (CATARC) is a prominent research institution in China, established in 1985 under state administration. It plays a crucial role in advancing the Chinese automotive industry by providing services in areas such as product testing, certification, technical consulting, and research and development. CATARC supports automotive manufacturers and suppliers with essential services to meet regulatory requirements for the Chinese market, especially regarding safety, environmental standards, and innovation.

CATARC is involved in various business lines, including vehicle testing, digital transformation, R&D services, and the development of new technologies like electric vehicles (EVs) and energy-efficient automotive solutions. It has a significant presence in China, with branches in major regions, and extends its influence internationally through subsidiaries in countries like Germany and Japan.

The center is pivotal in shaping policies around vehicle standards and environmental goals, such as the "China Automobile Low Carbon Action Plan" aimed at reducing greenhouse gas emissions in line with national climate targets.

Host Organization

1. Xie Dongming	Manager, Internationalization Office, Business Management Department
2. Chen Chao	Deputy General Manager, CATARC Automotive Technology (Shanghai) Co.,Ltd
3. Chi Hejin	Director, International Market Division, Internationalization Center, CATARC Automotive Test Center (Tianjin) Co., Ltd.
4. Zhang Xiyue	Deputy Director, Technical Service Department, CATARC Automotive Technology (Shanghai) Co., Ltd.
5. Liu Yanfeng	Engineer, Internationalization Office, Business Management Department
6. Shi Chenyu	Researcher, Internationalization Center, CATARC Automotive Test Center (Tianjin) Co., Ltd.
7. Tian Fangqing	Researcher, Industrial Policy and Internationalization Research Department,China Automotive Strategy and Policy Research Center
8. Li Yi	Marketing Officer, Market Management Department, CATARC Automotive Components
9. Deng Chuheng	International Business Office, General Business Department,CATARC Automotive Test Center (Guangzhou) Co., Ltd.
10. Liu Yuhao	Standards, Regulations and Technological Innovation Office, Special Vehicle Research Department,CATARC Automotive Test Center (Wuhan) Co., Ltd.
11. Xiong Zuichen	Standards, Regulations and Technological Innovation Office, Special Vehicle Research Department,CATARC Automotive Test Center (Wuhan) Co., Ltd.
12. Zhao Shuge	Standards, Regulations and Technological Innovation Office, Special Vehicle Research Department,CATARC Automotive Test Center (Wuhan) Co., Ltd.
13. Wang Xin	Consulting Director Researcher, Recycling & Reuse Section, Sustainable Development Business Department, Automotive Data Of China Co.,Ltd.
14. Zhang Qi'an	Consulting Researcher, Recycling & Reuse Section, Sustainable Development Business Department, Automotive Data Of China Co.,Ltd.

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4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

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1. Mr. Kraisak Surawattanawong	Mechanical Engineer

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1. Ms. Jitpraphat Suddhibark	General Business Coordinator

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National University of Laos

1. Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit
2. Dr. Bounlert Vanhnalat	Director General of Commerce Department

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1. Mr. Duong Duc Thien	Researcher

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1. Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group
2. Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group

3. Assoc.Prof. Dam Hoang Phuc Automotive Engineering Program Director

Meeting Commenced at: 03.00 PM

Summary of Key Points

At the beginning of the session, a representative of the organizing institution delivered opening remarks, introducing the background of the Lancang–Mekong Cooperation (LMC) project and outlining the overall training program. The host also warmly welcomed participants from Thailand, Laos, and Vietnam who joined the exchange activities.

Following the opening session, representatives from China Automotive Technology and Research Center Co., Ltd. (CATARC) presented an overview of the organization together with the China Automotive Industry Alliance (CAIA). The presentation introduced CATARC's development and its strategic role in supporting China's automotive industry. CATARC serves as a leading technical research and service institution, engaging in automotive policy research, technology development, standards formulation, testing and certification, and industrial consulting services. The center functions as a key technical support platform for the Chinese automotive sector and has long provided policy research and technical advisory services to government authorities, contributing to the formulation of national automotive policies and technical standards.

During the introduction of CAIA, experts explained that the alliance aims to promote the internationalization of China's automotive industry. Through strengthened international cooperation and exchange, CAIA supports Chinese automotive enterprises in expanding into overseas markets while facilitating collaboration in automotive technical standards, testing and certification systems, and industrial partnerships.

Representatives from CATARC Automotive Technology (Shanghai) Co., Ltd. subsequently introduced the development and operational scope of CATARC's Shanghai branch. The Shanghai center serves as an important technical service platform within the Yangtze River Delta region. Its core activities include automotive technology research and development, testing and evaluation, technical consulting, and industrial service support. Through the establishment of automotive technology service platforms and industrial innovation platforms, the center provides vehicle and component testing, technical verification, and consulting services for automotive enterprises. Research activities also cover new energy vehicle technologies, intelligent connected vehicles, and automotive safety technologies.

During the discussion session, representatives from Thailand, Vietnam, and Laos exchanged views on automotive standards systems, testing and certification practices, and policy approaches supporting new energy vehicle development. Participants raised questions regarding the application of China's automotive testing standards within the international regulatory framework, as well as cooperation models between Chinese testing institutions and international certification systems. Chinese experts explained that China's automotive standards and testing systems generally align with the United Nations WP.29 regulatory framework and relevant ISO technical standards, while actively promoting international collaboration to enhance global compatibility of China's testing capabilities.

Discussions also addressed intelligent driving safety testing, active safety systems, and child safety seat evaluation. Experts noted that China's vehicle safety assessment framework has evolved from traditional passive safety testing toward a comprehensive evaluation system incorporating active safety technologies and Advanced Driver Assistance Systems (ADAS). Continuous improvement of testing methodologies aims to further strengthen overall vehicle safety performance.

Following the exchange session, the delegation visited the CATARC East China Sub-center Exhibition Hall, the Equipment Exhibition Hall, and the Education Exhibition Hall. The exhibitions showcased

China's achievements in new energy vehicles, automotive safety technologies, and intelligent connected vehicle development, while highlighting CATARC's contributions in automotive testing technologies, policy research, and technical services. The visit enhanced participants' understanding of China's automotive technical service ecosystem and demonstrated the role of technological innovation platforms in supporting industry advancement and regional cooperation.

Meeting adjourned at: 04.30 PM

Illustrative Photos from the Visit / Meeting



As of 11 March 2026

10.2.3.6. Shanghai Weixiang Zhongyi New Energy Technology Co., Ltd. (Z-Cycle)

Shanghai Weixiang Zhongyi New Energy Technology Co., Ltd. (Z-Cycle) is a new energy technology company operating in the battery circular economy sector. The company focuses on recycling, reuse, and cascade utilization of lithium-ion batteries, particularly electric vehicle (EV) batteries, throughout their entire life cycle. It provides integrated services covering battery inspection and evaluation, dismantling, material recovery, processing, and the development of energy storage solutions using end-of-life batteries.

The company possesses advanced technological capabilities, including rapid battery testing using AI and big data, automated battery dismantling, safe crushing and recycling processes, and environmentally friendly metal recovery technologies. These processes enable the efficient recovery of critical materials such as nickel, cobalt, manganese, and lithium. In addition, the company has developed technologies to repurpose used batteries for Energy Storage Systems (ESS) in both industrial and commercial applications.

Z-Cycle collaborates with several major automotive and battery manufacturers and has been recognized by Chinese government authorities as a high-tech enterprise. It is also regarded as one of Shanghai's key companies in the power battery recycling sector. The company operates multiple production facilities and operational centers, with plans to further expand its recycling capacity and energy infrastructure development in the future.

Host Organization

1. TAN BING	President
2. PARK NAM IL	Oversea General Manager
3. Joanna Feng	Oversea Busniess Development Director
4. James Wang	Oversea Busniess Director
5. Yanwei Yin	Technical Director
6. Jianlin Zhu	BD Director

Participants

The Office of Industrial Economics

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3. Ms. Aphissada Boonklin	Plan and Policy Analyst, Practitioner Level

Thailand Automotive Institute

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5. Ms. Lalida Nuikhong	Staff

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1. Mr. Duong Duc Thien	Researcher

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1. Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group
2. Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group
3. Assoc.Prof. Dam Hoang Phuc	Automotive Engineering Program Director

Meeting Commenced at: 09.30 AM

Summary of Key Points

The visit to Z-Cycle provided an overview of the company's role as a leading enterprise specializing in electric vehicle (EV) battery management and recycling services under the concept of "Optimize Energy, Regenerate the Future." The company has received strong recognition from the Chinese government, including certification as a Dual Whitelist Enterprise by the Ministry of Industry and Information Technology (MIIT) and designation as Shanghai's first government-approved comprehensive battery recycling demonstration base. Z-Cycle's business operations are supported by major shareholders with strong technological expertise, including TES, a global leader in electronic waste recycling, Zhongyi Industrial, and OPPLE. The company has also established strategic partnerships across the EV ecosystem, collaborating with leading automotive manufacturers such as Tesla, Volvo, SAIC, FAW, and Dongfeng, as well as battery manufacturers and national insurance companies.

During the presentation, Z-Cycle introduced its comprehensive closed-loop battery management model, which provides end-to-end lifecycle services designed to return battery materials back into the production cycle and reduce dependence on new mineral extraction. The operational framework covers the entire battery lifecycle, beginning with reverse logistics systems that collect and transport end-of-life batteries from users to authorised facilities. The company also provides after-sales services, including battery condition diagnostics, testing, and maintenance.

A key component of the business model involves battery repurposing. Batteries with a reduced State of Health (SOH) of approximately 80% are refurbished and redeployed as Energy Storage Systems (ESS). These systems support clean energy utilisation, peak-valley electricity management, and energy security enhancement. The ESS solutions have already been implemented at partner facilities, including SAIC headquarters, FAW Group sites, and the Volvo APAC Park. Once batteries reach the end of their usable life, they enter mechanical and chemical recycling processes to recover valuable materials, commonly referred to as black mass, for reuse in battery production.

Z-Cycle also presented its current operational capacity and future expansion strategy. The company operates a demonstration recycling plant in Shanghai with a processing capacity of approximately 10,000 tons per year, supported by preparation centres in Yancheng and Changzhou, as well as ESS assembly bases. Future expansion plans include establishing additional operational centres in cities such as Xuzhou, Wuhan, and Guangzhou, with a targeted total processing capacity of 60,000–80,000 tons annually. Through the global network of its parent company SKTES, Z-Cycle aims to extend operations beyond China into Europe (EMEA), Australia, and the Asia-Pacific region.

In terms of technology and regulatory compliance, Z-Cycle emphasised that its recycling processes are designed to meet stringent international standards. The company applies AI-based simulation systems to analyse battery operating conditions throughout the lifecycle. Its recycling performance complies

with China's official White List requirements, achieving mineral recovery rates exceeding 90% for lithium and over 98% for nickel, cobalt, and manganese. Operations also comply with China's latest black mass import regulations and align with European Union recycling requirements, reflecting the company's commitment to supporting sustainable development within the future energy and mobility industry.

Meeting adjourned at: 12.00 PM

Illustrative Photos from the Visit / Meeting



As of 12 March 2026

10.2.3.7. Shanghai Administration Institute (SAI)

Shanghai Administration Institute (SAI) is a higher education institution specializing in public administration under the Shanghai Municipal Government. Its primary mission is to develop knowledge, provide training, and enhance the capacity of civil servants, government leaders, and public-sector personnel. The institute focuses on improving government effectiveness, public policy formulation, and modern urban governance. It plays a significant role in supporting China's public-sector reforms, particularly at the municipal level in Shanghai, one of the country's leading economic and innovation hubs.

SAI conducts both short-term and long-term training programs, policy research, and international knowledge exchange. It also organizes seminars and academic forums on topics such as public administration, smart city development, digital economy governance, and modern public management. In addition, the institute serves as a platform for international cooperation, regularly hosting foreign delegations for study visits and exchanges on public governance and urban development.

Host Organization

1. WANG Yongjie	Vice President, Professor
2. JIN Hui	Director of Foreign Affairs Office
3. ZHOU Jing	Deputy Director and Associate Researcher

Participants

The Office of Industrial Economics

1. Mr. Chalee Khansiri	Director, Division of International Industrial Economics
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Thailand Automotive Institute

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2. Ms. Thitipat Dokmaithet	Acting Manager, Entrepreneur and Industry Development Division
3. Ms. Smitha Suttabustya	Specialist
4. Ms. Nalada Sanpimolkul	Specialist
5. Ms. Lalida Nuikhong	Staff

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1. Mr. Chayangkul Chinda	Standard officer

Department of Land Transport

1. Mr. Kraisak Surawattanawong	Mechanical Engineer

Electric Vehicle Association of Thailand

1. Mr. Suroj Sangsnit	President
2. Mr. Chaiyaphruek Narongkool	Assistant to president

China Automobile Standards Internationalization Center (Bangkok)

1. Ms. Jitpraphat Suddhibark	General Business Coordinator

Department of Transport Ministry of Public Works and Transport

1. Mr. Intha Kongkhammanivong	Technical officer

National University of Laos

1. Assoc.Prof.Dr. Viriyasack Sisouphanthong	Head of Applied economics unit
2. Dr. Bounlert Vanhnalat	Director General of Commerce Department

LOCA Company Limited

1. Mr. Chanthavivanh Keovilayvong	EV Charger Officer

The International Council on Clean Transportation

1. Mr. Tran Dinh Son	Researcher

Academy of Construction Strategy and Cadres Training

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1. Dr. Le Van Nghia	Lecturer/Researcher of Automotive Engineering Group
2. Dr. Nguyen Thanh Tung	Lecturer at Automotive Engineering Group
3. Assoc.Prof. Dam Hoang Phuc	Automotive Engineering Program Director

Meeting Commenced at: 02.00 PM

Summary of Key Points

New Quality Productive Forces

China's future economic and automotive industry development is being driven under the concept of New Quality Productive Forces, which serves as a key strategy for promoting high-quality economic growth. This approach emphasizes science, technology, and innovation as the primary drivers of development, replacing the traditional reliance on production factors such as labor, land, and capital. The concept focuses on upgrading three key elements of the production system: developing talent with expertise in digital technologies and artificial intelligence (AI); advancing new production tools such as semiconductors, high-performance computing systems, and large AI models; and utilizing data as a strategic resource for production and decision-making. These efforts are expected to drive structural transformation across both the economy and industry.

Development of Intelligent Vehicles and Smart Mobility in China

Intelligent Connected Vehicles (ICVs) are regarded as a representative application of New Quality Productive Forces, as they integrate digital technologies, semiconductors, algorithms, artificial intelligence, and big data. This integration enables vehicles to interact effectively with transportation infrastructure and smart mobility systems while supporting the transition toward autonomous driving technologies.

China is currently the world's largest smart mobility market. In 2025, production and sales of New Energy Vehicles (NEVs) exceeded 16 million units, accounting for 54 percent of domestic passenger vehicle sales. The country has also achieved significant technological advancements, including the development of advanced battery technologies, ultra-fast charging systems, and the issuance of the first permits for Level 3 (L3) autonomous vehicles.

Shanghai has emerged as a leading pilot city in this field, with NEV market penetration reaching 72.9 percent. The city has established a strong industrial ecosystem, opened more than 5,200 kilometers of roads for intelligent vehicle testing, connected traffic signal data from over 7,600 intersections to support Vehicle-to-Everything (V2X) applications, and developed China's first Digital Twin testing environment for autonomous driving. In addition, Shanghai has set a clear target for Level 4 (L4) autonomous vehicles to enter commercial production by 2027.

Future Development of Intelligent Transportation Systems

Under China's 15th Five-Year Plan, the country aims to establish an Intelligent Three-Dimensional Transportation Network by 2030. The plan seeks to deeply integrate AI technologies into transportation systems and promote practical commercial applications, including the expansion of Robotaxi services and the deployment of autonomous trucks in the logistics sector to improve efficiency and reduce costs.

The future development strategy also places strong emphasis on technological self-reliance and security. Efforts are being made to strengthen domestic capabilities in key technologies such as semiconductors and operating systems, while improving legal and regulatory frameworks to address

liability issues related to L3 autonomous vehicles. At the same time, new insurance mechanisms are being developed to support the autonomous driving era.

Cooperation Between China and Thailand

The presentation highlighted the potential for enhanced cooperation between China and Thailand. China possesses strengths in market scale, technological innovation, and advanced mobility development, while Thailand offers a well-established automotive manufacturing base and plays an important role within the ASEAN supply chain. These complementary advantages provide opportunities for further collaboration in new energy vehicles, intelligent mobility technologies, and future transportation systems.

Meeting adjourned at: 04.00 PM

Illustrative Photos from the Visit / Meeting



As of 12 March 2026

10.2.4. Results of the Workshop Training in China

Under the project entitled **"The State of Preparedness of the Lancang-Mekong Region's Market Adoption for New Energy Vehicles (NEVs) and Smart Mobility"** a Workshop Training programme was organized in the People's Republic of China. The programme aimed to enhance knowledge, facilitate the exchange of experiences, and provide study visits on the development of New Energy Vehicles (NEVs), Intelligent Connected Vehicles (ICVs), battery technologies, charging systems, and the management of related industrial ecosystems.

The Workshop Training provided participants from countries in the Lancang-Mekong region, namely the Lao People's Democratic Republic (Lao PDR), Thailand, and Vietnam, with an opportunity to study China's policies, standards, technologies, and best practices. China has demonstrated significant advancement in the development of the NEV industry. The key outcomes of the Workshop Training are summarized as follows.

1. Lao People's Democratic Republic

1.1 Key Learning Outcomes

- **Establishment of EV standards:** Participants studied approaches to the classification and standardization of electric vehicle charging systems, including Level 1 (L1), Level 2 (L2), and Level 3 (L3). Such standards are essential for ensuring that charging infrastructure is safe, interoperable, and capable of accommodating the future growth of electric vehicles.
- **Progress of the NEV market in China:** Participants learned about China's approach to advancing the NEV industry, which emphasizes long-term policy planning, investment support, and the development of a comprehensive industrial ecosystem. This ecosystem covers vehicle manufacturing, batteries, components, charging stations, and end-of-life management.
- **Testing standards and safety:** Participants examined testing standards covering battery safety, equipment, powertrain systems, information and communication technology (ICT), and cybersecurity. These standards are crucial for building public confidence in electric vehicles and ensuring the safety and reliability of connected vehicle systems.
- **Testing of intelligent vehicles:** Participants had the opportunity to experience vehicles equipped with Level 3 (L3) and Level 4 (L4) automated driving functions. This provided practical insights into the potential of intelligent driving technologies to improve convenience, road safety, and the efficiency of transport systems.
- **Policy research and standard development:** Participants studied approaches to product testing and certification, intelligent connectivity technologies, and market and industry research. These areas provide important evidence and supporting information for the formulation of NEV policies and promotion measures.
- **Battery recycling and reuse:** Participants studied standards and practices for repurposing used batteries before they enter the recycling process. Such practices can increase economic value, reduce electronic waste, and promote the efficient use of resources.
- **Policy implementation:** Participants recognized the importance of integrated cooperation among the public sector, private sector, and academic institutions in order to translate policies, standards, technology development, and human resource development into practical and measurable outcomes.

1.2 Lessons Learned

- **Policy formulation, standards, and EV classification:** Clear definitions, classifications, and technical standards for electric vehicles should be established to support regulation, investment, infrastructure development, and consumer protection.
- **Battery reuse:** The promotion of second-life battery applications should be considered prior to recycling. This requires appropriate systems for battery condition assessment, collection and return mechanisms, and safety standards.
- **Market and target user analysis:** NEV promotion policies should take into account the needs and limitations of different user groups, including private passenger vehicles, motorcycles, public transport vehicles, and freight vehicles. This will enable policies and infrastructure to be designed in accordance with actual patterns of use.
- **Institutional policy development:** Clear and consistent institutional policies should be established, covering investment, standards, human resource development, research and development, environmental protection, and data management.

2. Thailand

Participants from Thailand learned that China's success in the NEV industry has not resulted solely from the promotion of electric vehicle use. Rather, it has been driven by a clear and consistent national strategy that encompasses the entire value chain, including vehicle manufacturing, technological development, infrastructure provision, software development, data protection, vehicle deployment, and end-of-life management.

Key areas for Thailand to consider applying are as follows:

2.1 Ensuring Policy Continuity and Clear Long-Term Signals

Thailand should continue to implement policies supporting the transition towards electric and intelligent vehicles in order to build confidence among manufacturers, investors, businesses, and consumers. Preparations should also be made to strengthen data security and support the deployment of Vehicle-to-Everything (V2X) and ICT technologies, which are key components of future smart mobility systems.

2.2 Developing a Comprehensive Industrial Ecosystem

The development of the NEV industry should encompass the entire ecosystem rather than focusing solely on vehicle manufacturers. It should connect Tier 1 and Tier 2 component suppliers, small and medium-sized enterprises (SMEs), software developers, infrastructure service providers, academic institutions, and technology start-ups. Support should also be provided for innovation incubators and start-ups in order to strengthen the competitiveness of Thailand's automotive industry.

2.3 Accelerating the Development of Standards and Regulations for Next-Generation Vehicles

Standards and regulations should be upgraded to keep pace with modern automotive technologies. Priority should be given to standards related to vehicle and battery safety, data connectivity, intelligent systems, charging stations, and emerging technologies. These measures will enhance safety, strengthen stakeholder confidence, and facilitate industrial development.

2.4 Promoting Intelligent Vehicle Development and Software Capabilities

Thailand should support the development of software, connectivity systems, intelligent vehicle technologies, V2X systems, ICT infrastructure, and data management capabilities. Such support will help accommodate new mobility patterns and enhance the capacity of Thai enterprises to develop high-value technologies and services.

2.5 Promoting Battery Recycling and the Circular Economy

Appropriate systems should be established for managing used batteries and electronic components. These systems should promote battery reuse, recycling, recovery of valuable minerals, and the efficient use of resources. Such measures will help accommodate the expected increase in end-of-life batteries and reduce environmental impacts.

3. Vietnam

3.1 Overview of NEV Market Readiness in the Region

A comparison of NEV market readiness in the region indicates that Thailand has a higher level of preparedness in terms of policy development and market growth than other countries in the group. Viet Nam has strong growth potential, supported by the continued development of policies and infrastructure. Meanwhile, Lao PDR remains at an early stage of NEV development and would benefit from further support in knowledge development, standards, investment, and infrastructure suited to its national context.

3.2 Key Issues and Lessons Learned

- **Comprehensive policy framework:** The Government should work closely with relevant stakeholders, industry, research institutions, and enterprises in order to drive development throughout the entire value chain, from upstream to downstream activities.
- **Advanced and market-responsive technologies:** China has demonstrated the ability to develop technologies that correspond to market demand and to facilitate their rapid deployment. This includes vehicle technologies, batteries, charging systems, software, and related services.

3.3 Recommendations for Regional Cooperation

- **Development of common standards for NEVs and ICVs:** Countries in the region should study and adapt lessons from China in developing common standards for electric vehicles, intelligent connected vehicles, batteries, charging systems, safety, connectivity technologies, and product testing and certification. Common standards would help reduce technical barriers and facilitate trade, investment, and cross-border mobility.
- **Development of interoperable payment systems at the ASEAN level:** Common payment standards should be developed for NEV-related services, particularly electric vehicle charging services. Such systems should enable convenient, secure, and interoperable payments across countries, thereby supporting tourism, trade, and transportation within the region.

Chapter 11 Public Relations Activities

The project disseminated news and public relations content under the headline "OIE Reveals Findings on NEV and Smart Mobility Readiness in the Lancang–Mekong Region, Highlighting Opportunities for Thailand to Strengthen Regional Market Connectivity and Upgrade Supply Chains for Future Mobility."

Publication Date: 10 July 2026

Media Channels: Online Media, Print Media, and Television

1. Online Media

The news was published through the following online media outlets:

1. Matichon: https://www.matichon.co.th/economy/news_5802494
2. Thansettakij: https://www.thansettakij.com/economy/663761
3. Bangkok Biz News: https://www.bangkokbiznews.com/economics/1242684
4. Matichon (Coffee Break): https://www.matichon.co.th/economy/coffee-break/news_5802581
5. Naewna: https://www.naewna.com/business/976702
6. Thai Post: https://www.thaipost.net/columnist-people/1031572/
7. Daily News: https://www.dailynews.co.th/news/6027187/

2. Print Media

The news was published in the following newspapers:

- Naewna
- Khaosod (Afternoon Edition)
- Thairath (Afternoon Edition)
- Matichon (Afternoon Edition)
- Thai Post

3. Television News

The news was broadcast on **Thai PBS** during the *Evening News* programme (18:00–20:30 hrs.).

Broadcast Segment: 36:37–41:23

Video Link: https://youtu.be/pl0IsumOpOg?t=2196

Illustrative Photos from Public Relations Activities



มติชน กรอบบ่าย
Matichon (Mid-day)
Circulation: 950,000
Ad Rate: 1,200

Section: ข่าวหน้า 1
วันที่: วันอังคารที่ 14 กรกฎาคม พ.ศ. 2569
ปีที่: 49 ฉบับที่: 17,656 หน้า: 1 (กลาง), 7, 16
Col.Inch: 260.17 Ad Value: 312,204 PR Value (x3): 936,612 คลิป: ขาว-ดำ
หัวข้อข่าว: ลุ้นฉลุยล้านพื้นศก. เอกชนชี้รบ.ใช้คู่มค่า-ปลุกลงทุน

สศอ.ชี้มติประเมินอีวีจีนผู้นำ

แนะไทยเชื่อมตลาดภูมิภาค

ตั้งงานเดินรถนิยายส่วน

รฟท.ขอเพิ่มโซนปีหน้า461ล.

บริษัท โกลบอล คลิปปิ้ง จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523

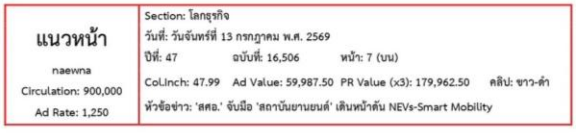


แนวหน้า
naewna
Circulation: 900,000
Ad Rate: 1,250

Section: โลกธุรกิจ
วันที่: วันจันทร์ที่ 13 กรกฎาคม พ.ศ. 2569
ปีที่: 47 ฉบับที่: 16,506 หน้า: 7 (บน)
Col.Inch: 47.99 Ad Value: 59,987.50 PR Value (x3): 179,962.50 คลิป: ขาว-ดำ
หัวข้อข่าว: 'สศอ.' จับมือ 'สถาบันยานยนต์' เดินหน้าดัน NEVs-Smart Mobility

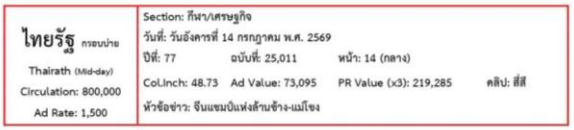
'สศอ.'จับมือ'สถาบันยานยนต์' เดินหน้าดันNEVs-Smart Mobility

บริษัท โกลบอล คลิปปิ้ง จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523



แนวหน้า
naewna
Circulation: 900,000
Ad Rate: 1,250

Section: โลกธุรกิจ
วันที่: วันจันทร์ที่ 13 กรกฎาคม พ.ศ. 2569
ปีที่: 47 ฉบับที่: 16,506 หน้า: 7 (บน)
Col.Inch: 47.99 Ad Value: 59,987.50 PR Value (x3): 179,962.50 คลิป: ขาว-ดำ
หัวข้อข่าว: 'สศอ.' จับมือ 'สถาบันยานยนต์' เดินหน้าดัน NEVs-Smart Mobility



ไทยรัฐ กรอบบ่าย
Thairath (Mid-day)
Circulation: 800,000
Ad Rate: 1,500

Section: กีฬา/เศรษฐกิจ
วันที่: วันอังคารที่ 14 กรกฎาคม พ.ศ. 2569
ปีที่: 77 ฉบับที่: 25,011 หน้า: 14 (กลาง)
Col.Inch: 48.73 Ad Value: 73,095 PR Value (x3): 219,285 คลิป: สีสี
หัวข้อข่าว: จีนแชมป์แห่งล้านช้าง-แม่โขง



จีนแชมป์แห่งล้านช้าง-แม่โขง

"ไทย-เวียดนาม" เกาะติดขบวนยานยนต์ไฟฟ้า

บริษัท โกลบอล คลิปปิ้ง จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523

บริษัท โกลบอล คลิปปิ้ง จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523

ข่าวสด กรอบบ่าย
Khaosod (Mid-day)
Circulation: 950,000
Ad Rate: 1,200

Section: เศรษฐกิจ/ต่างประเทศ
วันที่: วันอังคารที่ 14 กรกฎาคม พ.ศ. 2569
ปีที่: 36 ฉบับที่: 13,012 หน้า: 5 (ขวา)
Col.Inch: 22.92 Ad Value: 27,504 PR Value (x3): 82,512 คลิป: ขาว - ดำ
หัวข้อข่าว: จีนนำโด่งอีวี-สศอ.จี้เร่งอัพเกรดแบตเตอรี่

จีนนำโด่งอีวี-สศอ.จี้เร่งอัพเกรดแบตเตอรี่

นายสุกฤช บุญศิริ ผู้อำนวยการสำนักงานเศรษฐกิจอุตสาหกรรม (สศอ.) เปิดเผยผลโครงการประเมินความพร้อมของตลาดยานยนต์พลังงานใหม่ (NEVs) และระบบการคมนาคมอัจฉริยะ (Smart Mobility) ในอนุภูมิภาคล้านช้าง-แม่โขง ซึ่ง สศอ.ร่วมกับสถาบันยานยนต์ดำเนินการ ภายใต้การสนับสนุนของกองทุนพัฒนาความร่วมมือล้านช้าง สาธารณรัฐประชาชนจีน ครอบคลุม 5 ประเทศ ได้แก่ จีน ไทย เวียดนาม กัมพูชา และ สปป.ลาว

การศึกษาประเมินจาก 5 มิติสำคัญ ได้แก่ สถานะตลาด นโยบายภาครัฐ โครงสร้างพื้นฐานด้านพลังงาน โครงสร้างพื้นฐานด้านยานยนต์และเทคโนโลยีสารสนเทศ และการมีระบบนิเวศอุตสาหกรรม EV ที่ครบวงจร ทั้งด้านการผลิต เทคโนโลยี สถานีชาร์จ และมาตรการสนับสนุนจากภาครัฐ

ขณะที่ไทยและเวียดนามอยู่ในกลุ่มประเทศที่มีความพร้อมระดับปานกลาง โดยตลาด EV เติบโตค่อนข้างเร็ว จากนโยบายภาครัฐและการลงทุนจากภาคเอกชน แต่ยังมีข้อจำกัดด้านการเชื่อมโยงโครงสร้างพื้นฐานและการพัฒนาเทคโนโลยีขั้นสูง ส่วนกัมพูชาและ สปป.ลาว อยู่ในช่วงเริ่มต้นของการพัฒนาตลาดและต้องการการสนับสนุนเพิ่มเติมทั้งด้านนโยบายการลงทุน และโครงสร้างพื้นฐาน

ทั้งนี้ สศอ.เห็นว่าไทยควรก่อปรับบทบาทจากฐานการผลิตยานยนต์แบบดั้งเดิม สู่การเป็นศูนย์กลางการผลิตและเชื่อมโยงห่วงโซ่อุปทานยานยนต์พลังงานใหม่ของอนุภูมิภาค ผ่านการพัฒนาอุตสาหกรรมคมนาคมอัจฉริยะ ซอฟต์แวร์ ระบบราชอัจฉริยะ และมาตรฐานของรับมหกในไทย V2G ควบคู่กับการสร้างความร่วมมือระหว่างประเทศ เพื่อเชื่อมโยงระบบคมนาคมและพลังงานข้ามพรมแดน รองรับการเติบโตของอุตสาหกรรมยานยนต์แห่งอนาคตอย่างยั่งยืน

บริษัท โกลบ์เบิล ครีเอชั่น จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523

มติชน กรอบบ่าย
Matichon (Mid-day)
Circulation: 950,000
Ad Rate: 1,650

Section: เศรษฐกิจ
วันที่: วันอังคารที่ 14 กรกฎาคม พ.ศ. 2569
ปีที่: 49 ฉบับที่: 17,656 หน้า: 4 (ล่างซ้าย)
Col.Inch: 23.18 Ad Value: 38,247 PR Value (x3): 114,741 คลิป: สีสี
หัวข้อข่าว: คอฟฟี่เบรก: ทั้งใจ

คอฟฟี่เบรก
ทั้งใจ



สุโรจน์ แสงสนิท

มีโอกาสร่วมหารือ สำนักงานเศรษฐกิจอุตสาหกรรม (สศอ.) กระทรวงอุตสาหกรรม เยี่ยมชมโรงงานผลิตรถยนต์ MG ของบริษัท เอสเอไอซี มอเตอร์-ซีพี จำกัด อ.บ้านบึง จ.ชลบุรี งานนี้ **พี่ต้อม สุโรจน์ แสงสนิท รองประธานกรรมการบริหาร บริษัท เอสเอไอซี มอเตอร์-ซีพี จำกัด** ให้การต้อนรับคณะพาชมโรงงาน พร้อมให้ข้อมูลอย่างเป็นกันเอง

หลังกิจกรรมดูงานเสร็จสรรพ ตกเย็นรับประทานอาหารร่วมกับ กระซิบข่าวแอบสังเกตนำสีกาข้อมือ เคลมือถือ ตลอดจนอุปกรณ์ทำงานต่างๆ ของพี่ต้อม **"ยี่เหล่ง"** และอุดตา *"เอ้ยพี่ชายซีพี หรู ต้องยี่เหล่สั่งไหหริบ"* (ลิ้น) **ยินยันรถยนต์ยังเป็นเครื่องยนต์สันดาปเครื่องเล็กแรงม้าน้อย เข้าประเด็นต่อไปเลยพร้าน (ฮาๆ)**

บริษัท โกลบ์เบิล ครีเอชั่น จำกัด : 1124/281 ซอยพหลโยธิน 32 แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทร 02-005-1523

ไทยโพสต์
That Post
Circulation: 650,000
Ad Rate: 1,200

Section: First Section/เศรษฐกิจ-สังคม-สตรี
วันที่: อังคาร 14 กรกฎาคม 2569
ปีที่: 30 ฉบับที่: 10831 หน้า: 7(ซ้าย)
Col.Inch: 38.83 Ad Value: 46,596 PRValue (x3): 139,788 คลิป: ขาว-ดำ
คอลัมน์: กระจกโรงงาน: ต้นยานยนต์พลังงานสู่ล้านช้าง-แม่โขง

ต้นยานยนต์พลังงานสู่ล้านช้าง-แม่โขง

ณัฐวัฒน์ หาญกล้า

เมื่อพูดถึงกรอบความร่วมมืออนุภูมิภาคล้านช้าง-แม่โขง (Lancang-Mekong Cooperation: LMC) ที่มีจุดกำเนิดมาจากความร่วมมือของ 6 ประเทศ ได้แก่ จีน ไทย ลาว กัมพูชา เมียนมา และเวียดนาม ร่วมกันสร้างความโดดเด่นด้านการผลิตรถยนต์ไฟฟ้า ตั้งแต่การผลิตชิ้นส่วน แบตเตอรี่ ยานยนต์พลังงานสะอาด ระบบอัจฉริยะ (Smart Mobility) การรีไซเคิลแบตเตอรี่ เป้าหมายคือ ผลการพึ่งพาทรัพยากรจากนอกภูมิภาค และเพิ่มขีดความสามารถการแข่งขันของอุตสาหกรรมยานยนต์ร่วมกัน

ที่ผ่านมาประเทศไทยมีการเชื่อมโยงกับประเทศเพื่อนบ้านเพื่อขยายตลาด การลงทุน และการผลิตร่วมกัน

โดยล่าสุด **สำนักงานเศรษฐกิจอุตสาหกรรม (สศอ.)** ได้ดำเนินการศึกษา โครงการประเมินความพร้อมของตลาดยานยนต์พลังงานใหม่ (New Energy Vehicles: NEVs) และระบบการเดินทางอัจฉริยะ (Smart Mobility) ในอนุภูมิภาคล้านช้าง-แม่โขง สนับสนุนโดยกองทุนพัฒนาความร่วมมือล้านช้าง สาธารณรัฐประชาชนจีน โดยมีเป้าประสงค์เพื่อประเมินความพร้อมและศักยภาพในการพัฒนาอุตสาหกรรมยานยนต์ไฟฟ้าในแต่ละประเทศ โดยประเมินจาก 5 มิติสำคัญ ได้แก่ สถานะตลาด นโยบายภาครัฐ โครงสร้างพื้นฐานด้านพลังงาน โครงสร้างพื้นฐานด้านยานยนต์และดิจิทัล และเทคโนโลยีการยานยนต์

ผลการศึกษาพบว่าจีนมีความพร้อมสูงสุดในภูมิภาค เนื่องจากมีระบบนิเวศอุตสาหกรรมที่ครบวงจร ทั้งด้านการผลิตเทคโนโลยี โครงสร้างพื้นฐานการชาร์จ และการออกนโยบายที่สนับสนุนการพัฒนาอย่างต่อเนื่อง ขณะที่ประเทศไทยและเวียดนามอยู่ในระดับความพร้อมปานกลาง โดยมีการเติบโตของตลาดยานยนต์ไฟฟ้าอย่างรวดเร็ว และได้รับแรงสนับสนุนจากนโยบายภาครัฐและการลงทุนจากภาคเอกชน แต่ยังมีข้อจำกัดด้านการบูรณาการโครงสร้างพื้นฐานและการพัฒนาเทคโนโลยีขั้นสูง ส่วนกัมพูชาและ สปป.ลาว อยู่ในช่วงเริ่มต้นของการพัฒนาตลาดและต้องการการสนับสนุนเพิ่มเติมทั้งด้านนโยบายการลงทุน และโครงสร้างพื้นฐานที่จำเป็น

จึงเป็นโอกาสสำคัญที่จะกำหนดแนวทางยกระดับอุตสาหกรรมยานยนต์ไทยให้เชื่อมโยงกับภูมิภาค และห่วงโซ่อุปทานยานยนต์พลังงานใหม่ของอนุภูมิภาค ซึ่งจากผลการศึกษาของ สศอ. ระบุว่าไทยควรเร่งยกระดับบทบาทจากฐานการผลิตยานยนต์เดิมไปสู่การเป็นฐานผลิตและเชื่อมโยงห่วงโซ่อุปทานยานยนต์พลังงานใหม่ของอนุภูมิภาค โดยเฉพาะการพัฒนาทางโซ่อุปทานยานยนต์ของประเทศ อุตสาหกรรมแบตเตอรี่และซอฟต์แวร์ โดยเร่งสร้างพื้นฐานการชาร์จ มาตรฐานของรับมหกในไทย Vehicle-to-Grid และระบบการเดินทาง

โดย **นายสุกฤช บุญศิริ ผู้อำนวยการสำนักงานเศรษฐกิจอุตสาหกรรม (สศอ.)** เปิดเผยว่า ล่าสุดได้ลงพื้นที่ศึกษาดูงานกระบวนการผลิตรถยนต์ รีเทลลิ่งรถยนต์ ณ บริษัท เอสเอไอซี มอเตอร์-ซีพี จำกัด อ.บ้านบึง จ.ชลบุรี โรงงานผลิตรถยนต์ MG สามารถยกระดับอุตสาหกรรมเปลี่ยนผ่านพื้นที่เกิดขึ้นจริงในกระการผลิต ทั้งด้านเทคโนโลยีการลงทุน และกระบวนการผลิต ของอุตสาหกรรมยานยนต์ไทย เพื่อจะเป็นข้อมูลประกอบการจัดทำข้อเสนอเชิงนโยบายให้สอดคล้องกับทิศทางตลาดและข้อจำกัดของแต่ละประเทศในภูมิภาค

นายสุกฤชกล่าวว่า ผลการศึกษาจะเป็นข้อมูลสำคัญในการพัฒนาอย่างยุทธการ เพื่อจะเปลี่ยนผ่านสู่ยานยนต์พลังงานใหม่ และระบบการเดินทางอัจฉริยะในอนุภูมิภาคล้านช้าง-แม่โขง ทั้งด้านนโยบายเทคโนโลยี พลังงาน และโครงสร้างพื้นฐานดิจิทัล ควบคู่ไปความร่วมมือระหว่างประเทศในภูมิภาค เพื่อสร้างมาตรฐานร่วมส่งเสริมการแลกเปลี่ยนองค์ความรู้ และเชื่อมโยงระบบคมนาคมและพลังงานข้ามพรมแดน อีกทางนำไปสู่การพัฒนาระบบการเดินทางที่มีประสิทธิภาพ เป็นมิตรต่อสิ่งแวดล้อม และสนับสนุนการเติบโตทางเศรษฐกิจอย่างยั่งยืนในระยะยาว

ด้วยเหตุนี้ของประเทศในภูมิภาคที่ยังเผชิญความท้าทายร่วมกันหลายด้าน จึงต้องเร่งพัฒนาการยกระดับนโยบายและกฎระเบียบด้านระบบการเดินทางอัจฉริยะและยานยนต์ดิจิทัล ความพร้อมด้านความมั่นคงปลอดภัยทางไซเบอร์และการบริหารจัดการข้อมูล เพื่อให้การพัฒนาระบบนิเวศของยานยนต์พลังงานใหม่และการเดินทางอัจฉริยะในภูมิภาคสามารถเดินหน้าได้อย่างยั่งยืนสำเร็จ

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