

# Integrating Electric 2&3 Wheelers into Existing Urban Transport Modes in Developing and Transitional Countries

August 2023

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# THAILAND

## INTRODUCTION

### MARKET OVERVIEW

Thailand's electric two-wheeler market, though still in its infancy, is gaining momentum. Current data from the Land Transport Department reveals that out of over 22 million registered motorcycles, only 8,783 are electric<sup>1</sup>. However, projections from the National Energy Technology Center ENTEC (ENTECC)'s S-Curve development model, aligned with the 2035 electric vehicle (EV) targets, suggest a surge to about 600,000 electric two and three-wheelers by 2025 and 8.75 million by 2035. The projected uptick is partly attributable to government incentives for EV purchases, including for example a subsidy for e-motorcycle purchases, and the implementation of strategic measures to bolster EV manufacturers' presence in Thailand.

In terms of product segmentation, e-scooters dominate the market, followed by pedal-assisted e-bikes, e-motorcycles, and other variants such as e-three-wheelers. To date, sealed lead acid batteries are still predominant, owing to their cost-effectiveness and the predominance of low voltage 36V and 48V electric two-wheelers in the market. More advanced electric two and three-wheelers use Li-ion and NiMH batteries. Non-removable batteries for fixed charging are the standard choice. However, the battery-swapping station business models are attracting more and more interest in Thailand<sup>2</sup>, and work is ongoing to develop a battery-swapping standard.

Government initiatives promoting electrification such as "30@30" policy<sup>3</sup>, coupled with bike manufacturers' general commitment to stringent standards, bode well for the industry's future. The ambition of both emerging and developed countries to introduce a new era of

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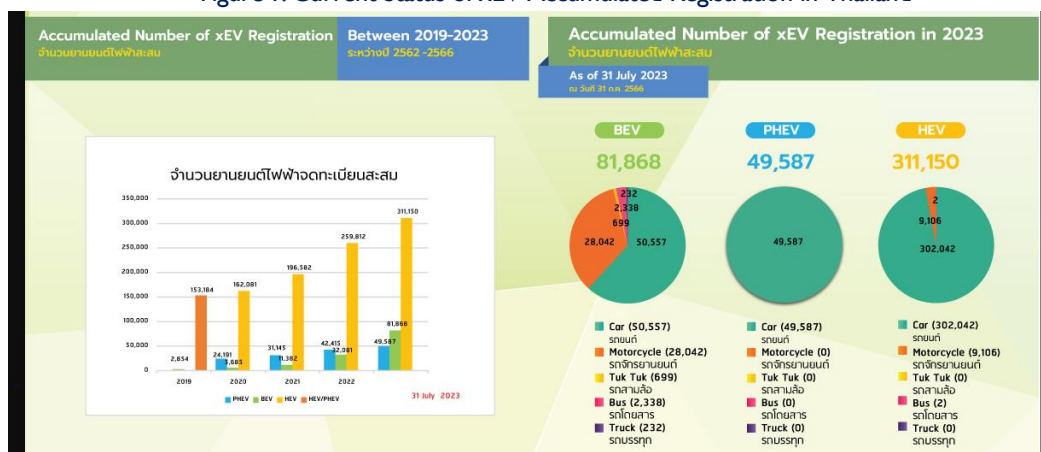
<sup>1</sup> link:<https://www.bangkokpost.com/business/2465205/h-sem-motor-sees-ev-bike-sales-rising>.

<sup>2</sup> <https://www.vynzresearch.com/automotive-transportation/thailand-electric-two-wheeler-market>

<sup>3</sup> Thailand 30@30 policy states that by the year 2030 Thailand's production of EVs must constitute 30% of all vehicles produced in the country, including 2&3 wheelers.

two-wheelers for daily commuting stands to amplify product demand.

Figure I: Current Status of xEV Accumulated Registration in Thailand



Source: Electric Vehicle Association of Thailand – data was sourced from the Department of Land Transport

The investment research firm “Tracxn” highlighted that as of March 2022, Thailand was home to 33 startups in the EV sector. These spanned a spectrum of services from electric rental platforms and EV manufacturing to charging and swapping infrastructure. A notable share of these startups including Edison Motors, Deco Green Energy, and i-Motor have ventured into the electric two-wheeler manufacturing domain. Other key players shaping the electric two-wheeler landscape in Thailand encompass STAR 8 (THAILAND), UDA Motor, Honda, E-Revolution, and MYWAY Intelligent Technology. Their presence underscores the nation’s burgeoning commitment to sustainable transportation solutions.



## E 2&3 WHEELERS TARGET AND POLICY

Thailand’s journey towards electric vehicle adoption began in 2015 when the first EV roadmap was approved by the Thailand National Innovation System Development Committee. The nation’s ambitions are clear: By 2030, 30% of automobiles manufactured in the country should be electric, aligning with the “30by30 policy”. The overarching vision is for Thailand to emerge as a regional epicentre for EV production. Several government-backed initiatives have been rolled out to bolster this vision:

- The launch of the 100 EV charging station promotion project.
- Incentives to transition from traditional to electric Tuk-Tuks.
- Establishment of national industrial standards for EV charging stations and batteries.

In a bold move, Thailand has set its sights on selling zero-emission vehicles by 2035. To achieve this, targets have been delineated to steadily increase the EV share in vehicle registrations: 4% in 2022, 30% in 2025, 50% in 2030, and culminating at 100% in 2035. This ambitious EV target encompasses a range of vehicles, from passenger cars, pickup trucks, and motorcycles to heavy-duty buses, trucks, Tuk-Tuks, watercraft, and trains.

Figure 2: ZEV Target of vehicles’ new registration and production

Target	Vehicle type	Annual vehicles		
		2025	2030	2035
 New registration	Car / Pickup truck	225,000 (30%)	440,000 (50%)	1,154,000 (100%)
	Motorcycle	360,000 (20%)	650,000 (40%)	1,800,000 (100%)
	Bus / Truck (HDV)	18,000 (20%)	33,000 (35%)	83,000 (100%)
	Tuk-Tuk	500 (85%)	2,200 (100%)	2,800 (100%)
	Passenger Ship	130 (12%)	480 (35%)	1,800 (100%)
	Rail train	620 (70%)	850 (85%)	1,170 (100%)
 Production	Car / Pickup truck	225,000 (10%)	725,000 (30%)	1,350,000 (50%)
	Motorcycle	360,000 (20%)	675,000 (30%)	1,850,000 (70%)
	Bus / Truck (HDV)	18,000 (35%)	34,000 (50%)	84,000 (85%)
	Tuk-Tuk	500 (85%)	2,200 (100%)	2,800 (100%)
	Passenger Ship	130 (12%)	480 (35%)	1,800 (100%)
	Rail train	620 (100%)	850 (100%)	1,170 (100%)

Source: Ministry of Energy, 2021

To further incentivize the shift to EVs, measures such as a CO<sub>2</sub>-based excise tax and eco-sticker labeling have been introduced, both of which align with the broader goal of CO<sub>2</sub> mitigation. From 2022 to 2025, the cabinet has greenlit incentives to stimulate domestic EV production. These benefits are extended to local EV manufacturers participating in the EV support program. Specifically, for EV motorcycles priced up to 150,000 baht (approximately EUR 3,800), there's an 18,000-baht (approximately EUR 460) subsidy available for both Completely Knocked Down (CKD) and Completely Built-Up (CBU) models. Additionally, the Board of Investment (BOI) offers corporate income tax incentives for manufacturers of battery electric motorcycles and tricycles, alongside other EV types<sup>4</sup>.

Table I: BOI corporate income tax incentives for manufacturers for battery electric motorcycle and tricycle

Type of Activities	Incentives
<b>Battery Electric Motorcycle</b>	3-year CIT exemption <ul style="list-style-type: none"> <li>+1-year exemption if the manufacture starts in 2022</li> <li>+1-year exemption if the battery manufacture starts from the module production process within 3 years as from the promotion certificate issuance date</li> <li>+1-year exemption per part in case other key part (BMS, Motor, or DCU) is additionally manufactured within 3 years as from the promotion certificate issuance date.</li> <li>+1 to 3-year exemption in case of R&amp;D</li> </ul> <i>*No additional exemption in case situated in the industrial area or estate</i>
<b>Battery Electric Tricycle</b>	3-year CIT Exemption <ul style="list-style-type: none"> <li>+1-year exemption if battery manufacture starts from the module production process within 3 years from the promotion certificate issuance date.</li> <li>+1-year exemption per part in case other key part (BMS, Motor, or DCU) is additionally manufactured within 3 years as from the promotion certificate issuance date.</li> <li>+1 to 3-year exemption in case of R&amp;D</li> </ul> <i>*No additional exemption in case situated in the industrial area or estate</i>

Source: Office of the Board of Investment, June 2023

<sup>4</sup> [https://www.boi.go.th/upload/content/20230706%20EN%20BOI\\_.pdf](https://www.boi.go.th/upload/content/20230706%20EN%20BOI_.pdf)

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# COUNTRY PROJECT - THAILAND

## PROJECT SUMMARY

### **The standards for electric 2 & 3 wheelers**

The demonstration project in Thailand is composed of two phases. In Phase 1 of the project, a comprehensive review of the standards for Electric Two and Three Wheelers both in Thailand and internationally was undertaken. This phase aimed at assessing the performance of these EVs, to promote awareness of electric mobility, and at establishing a standard for battery swapping in electric motorcycles within Thailand. Currently in Phase 2, 50 electric motorbikes, donated by TailG, have been assembled locally by Stallions and were provided to motorbike taxi drivers. Throughout this experimental phase, several key indicators including the daily operations of electric motorcycle taxis for a Total Cost of Ownership (TCO) analysis, CO2 emissions reduction, income comparisons between traditional ICE and battery-swapping e-motorcycle taxis will be monitored and user feedback through surveys will be gathered.

**City/Country:** Bangkok, Thailand

**Timeframe:** Ongoing

**Partners:** National Energy Technology Center (ENTEC), Electricity Generating Authority of Thailand (EGAT), Dongguan Tailing Electric Vehicle Co., Ltd. (TAILG), The Stallions Co., Ltd. (Stallions)

## INTERVENTIONS

Under Phase 1, comprehensive evaluations and assessments were conducted on the prevailing standards for electric two-wheelers in Thailand and internationally to see where they match up and where they can be improved. Furthermore, through the piloting of 11 electric EGAT bikes with installed tracking devices, their performance was measured and evaluated. Initial regulation to set a battery swapping standard for electric two-wheelers in Thailand, was initiated.

### Phase 1 Activities

- Standards Assessment: Evaluated Thailand's Electric Two and Three Wheelers standards against global benchmarks.
- Advanced Tracking: Developed state-of-the-art vehicle tracking equipment for real-time signal generation, GPS tracking, and data storage.
- Odometer Validation: Conducted both preliminary and on-road tests
- Performance Testing: Measured primary electric energy, compared vehicle torque and power outputs, and utilized thermal imaging for detailed energy analysis.
- Battery Swapping Standard: Collaborated with the Thai Industrial Standards Institute and a dedicated working group to establish a battery swapping standard, drawing insights from models in Taiwan, Japan, and China.
- Demonstration project –Electric 2-wheelers were piloted by the existing motorcycle taxi drivers in Nonthaburi and Bangkok with the EGAT vehicles



*Building and installation photos with 11 EGAT E-Bike; Electric motorcycle on chassis dynamometer; Captured screen of the dynamometer monitoring program*

Under Phase 2 (still ongoing), in a partnership with the Electricity Generating Authority of Thailand (EGAT) of Thailand, 50 electric scooters donated by TailG were equipped with energy consumption tracking devices as well as battery swapping systems compliant with the standards developed based on Phase 1 efforts. These pilot vehicles are integrated into electric motorcycle taxi fleets in Nonthaburi and Bangkok, under the cooperation of a local motorcycle taxi drivers' association. This hands-on approach not only generates valuable real-world data but also provides insights into the practicality and advantages of the swapping technology.

The electric scooters were deployed in Bangkruai, Nonthaburi, and Bangphlat, Bangkok, where two battery swap stations were set up to facilitate their recharge with the installation of another swapping station underway. TailG's model assumes Each e-motorcycle operated by EGAT in combination with the automated swapping stations is envisaged to pave the way for scaling up the e-two-wheeler segment in the demonstration area.

## Phase 2 Activities:

- Shipment and assembling of 50 motorcycles and battery packages: TAILG shipped 50 electric motorcycles from China to Thailand. Upon the delivery of 50 TailG motorcycles and battery packages, Stallions assembled the package of parts and components.
- Battery-Swapping Stations: EGAT has set up two battery-swapping stations with another underway.
- Driver Recruitment: Contracted 50 drivers overseen by the ENTEC legal office.
- Rider Training: ENTEC organized two events for riders, focusing on contract details and safe riding practices.
- Motorcycle Handover: 50 electric motorcycle taxis were provided to riders in the condition of granting full ownership after a successful one-year demonstration period.
- Handover Ceremony: A high-level ceremony was held with the presence of the Nonthaburi Governor, the Deputy Permanent Secretary of Bangkok Metropolitan Administration, the German Ambassador to Thailand and the UN Resident Coordinator for Thailand.
- Monitoring: ENTEC prepared tracking kits for tracking trip length and energy consumption on all motorcycles. ENTEC trained Stallions technicians to install the tracking kits.
- Demonstration project – 50 electric 2-wheelers were piloted by the existing motorcycle taxi drivers Bangkok with the TailG vehicles



## IMPACTS AND RESULTS

The first phase of the project focused on scenario modelling and impact analysis by analyzing the effect of the ambitious EV market adoption scenario on energy use and greenhouse gas emission stemming from the transport sector. In the absence of an alternative strategy, energy demand and GHG emissions could potentially double by 2035 and even triple by 2040. Under the EV roadmap scenario, the analysis suggests that the EV adoption target could lead to a significant reduction in energy consumption and GHG emissions of 6.3 million tons of oil equivalent and 19.6 million tons of CO2 equivalent by 2035, respectively. If Thailand successfully implements its ambitious EV promotion plan targeting 15.58 million units by 2035, energy demand from road transport could be reduced by 12.46% and GHG emissions by 4.29% by 2035 compared to the baseline scenario. To better understand the calculated figures, it is important to remember that the Thai EV adoption targets apply to new registrations, and not to the vehicle fleet in use. While new registrations achieve a complete shift to EVs by 2035, fleet shares of EVs are expected to be around 30% depending on the vehicle mode and the respective new registration share targets for EVs in 2025 and 2030.

Furthermore, the study confirmed that the surge in electricity demand due to EV adoption would comfortably fit within the nation's planned electric generation capacity, investigating projections up to 2040.

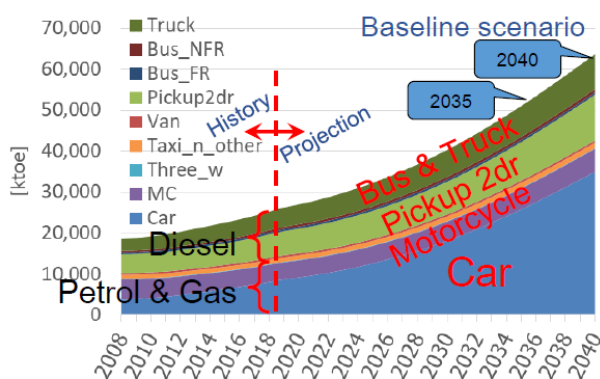


Figure 45: Energy consumption by vehicle type

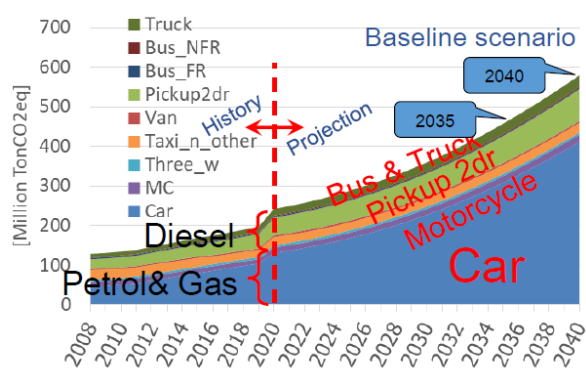


Figure 46: Tank-to-Wheel (TTW) road transport GHG emission

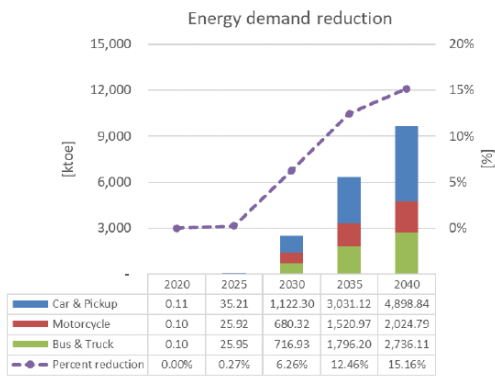


Figure 47: Impacts of 15.58 Million EV roadmap on energy demand reduction

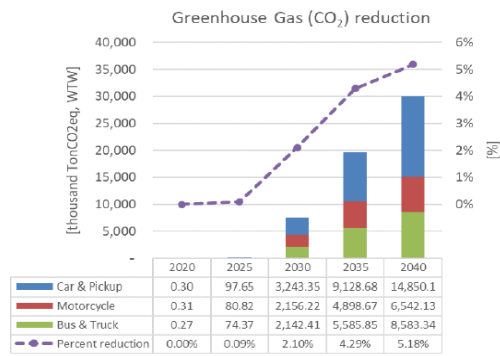


Figure 48: 15.58 Million EV road impacts on GHG emission reduction

Regarding battery swapping standardization, several methodologies for battery standards have been finalized. These include a single battery standard that covers socket types, dimensions, and voltages; standards that allow for multiple voltage levels but with specific dimensions for each, such as 48V, 60V, and 72V; standards that maintain a single size across different voltage levels; and a universal battery base size across all voltage levels. The socket design is particularly noteworthy. It's recommended to have a communication pin, a feature currently absent in international standards. This socket standard would focus on specifying only the pin number and essential information for the charging station. For the battery pack's dimension, a standardized width and length are proposed, but with a flexible height to fit various vehicles. Lastly, for voltage, the focus is on the commonly used levels of 48V, 60V, and 72V, suggesting that standards could be divided to cater to these distinct levels.

In the second phase, 50 drivers from a local motorcycle taxi drivers' association are now operating with electric motorbikes. Building upon the insights and successes of Phase 1, and the ongoing activities in Phase 2, there's a plan to expand the electric motorcycle taxi service into Bangkok's city centre: Chulalongkorn University area. This expansion is supported by the SolutionsPlus replication project. For battery swapping, the project will cooperate with a local start-up company, SwapAndGo. Unlike the initial phase where motorcycles were donated, this expansion will procure its own pilot vehicles and will work with the private sector partner for the provision of battery swap stations. This aims to examine financial sustainability, building a financially viable model for the wider adoption of electric motorcycle taxis.

## LESSONS LEARNED

According to the consultations of different stakeholders conducted as part of the project, Thailand's manufacturing sector demonstrates numerous strengths, such as diverse technological capabilities, a skilled workforce, infrastructure advantages, and abundant raw materials and resources. These strengths put Thailand in a leading position in the region and globally.

However, Thailand's road to electrification is not without challenges. As a key manufacturer, the country is faced with the reliance on imported raw materials for the batteries. It also needs to urgently to synchronize the country's power generation strategies with clean energy solutions. This synchronization is vital to ensure that Thailand's transition to electric mobility achieves its maximum emissions potential for reducing GHG and air pollutant emissions.

It's worthwhile to take note of the specific local considerations when it comes to 2 and 3-wheelers in Thailand. Drivers and riders in Thailand tend to use these vehicles more heavily than in other countries. Consequently, electric vehicle specifications should be tailored specifically for Thailand, considering their unique patterns of use. Thailand's electric vehicle standards, particularly for 2 and 3-wheelers, cannot simply rely on international standards. To address this issue, it is essential that the primary responsible department or organization provides clear and customized qualification guidelines for Thailand's electric vehicles.

The ongoing Phase 2 motorcycle taxi demonstration exemplifies Thailand's dynamic innovation landscape and robust public-private collaboration. This partnership provided an opportunity for field testing swappable battery platforms for electric motorcycles in Nonthaburi and Bangkok and collecting evidence for their application for a real-life use case in the motorcycle taxi sector. A push for a unified battery pack standard across various motorcycle types and charging stations is underway. Such a standard will guide manufacturers and service providers, facilitating a battery-swapping platform that addresses challenges like extended charging times and high ownership costs.

## RECOMMENDATIONS

Drawing from extensive consultations and project analysis, several recommendations have emerged to provide guidance for future initiatives and potential scaling efforts:

- **Standardized EV Procurement:** Establish a consistent mid-range price for government agencies' electric vehicle procurement.
- **Tailored Import Support:** Provide customized support durations for importing essential raw materials or parts, aligning with the local industry's adaptation timeline.
- **Advanced Charging Billing:** Implement advanced billing systems for electric vehicle charging, incorporating tools such as smart meters for both home and public charging stations.
- **Global Market Promotion:** Support exhibitions that showcase domestic industrial innovations on international platforms to expand the market reach of Thailand's industrial sector.
- **Accessible Carbon Credits:** Improve the accessibility and recognition of carbon credits, making them more widely available for businesses.
- **Technology Transfer Facilitation:** Facilitate the transfer of technology from international sources, including innovative resources, to make them readily available to the private sector. This can assist businesses in reducing R&D costs and refining their product offerings.
- **Skills Development Investment:** Increase funding dedicated to enhancing personnel skills and capabilities in the industrial sector.
- **Efficient Approval Processes:** Streamline the review and approval of industrial proposals, reducing processing time for greater efficiency.
- **Enhanced Research Dissemination:** Ensure that successful research findings are made publicly accessible to promote knowledge sharing and broader awareness.
- These recommendations are aimed at bolstering government operations and fostering growth within Thailand's industrial landscape.

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