Electric Vehicle Readiness in Southeast Asia: A PEST Policy Review

Muhammad Rizki Kresnawan¹, Zulfikar Yurnaidi¹, Amira Bilqis¹, Tabita Natasha Wijaya¹, Beni Suryadi¹

¹ASEAN Centre for Energy, Soemantri Brodjonegoro II Building, 6th fl., Directorate General of Electricity, Jl. HR. Rasuna Said Blok X-2, Kav. 07-08, Jakarta 12950, Indonesia

Corresponding author: mkresnawan@aseanenergy.org

Abstract. Transportation sector in Southeast Asia is highly dependent on petroleum products, making it one of the most carbon-intensive energy sectors in the region. The 6th ASEAN Energy Outlook (AEO6) projected the sector’s oil consumption to rapidly grow to 330 million ton of oil equivalent (Mtoe) by 2040 or about 97% from total energy consumed in the sector. Mostly imported, the ever-increasing oil demand poses risk to economic and energy security. The growing concern of climate change also brings another issue to the sector. Cleaner mobility alternatives include electric vehicle. This study aims to assess the readiness of electric mobility roll-out in Southeast Asia, especially from supporting policy perspective. It critically reviews the related policies from each ASEAN member states. Further, the PEST (Political, Economic, Social, Technological) framework is utilised to assess the readiness of such policies. Based on such analysis and identification of critical factors of electric mobility implementation, the study proposes policy recommendations.

1. Background
Transportation sector has long been become one of the most carbon-intensive energy sectors in Southeast Asia. The 6th ASEAN Energy Outlook (AEO6) [1] reported that transportation sector represented the second largest energy consuming sector after industry, with around 30% of total final energy consumption (TFEC) in the region. Largely dependent on petroleum products, the sector accounted for around 125 million ton of oil equivalent (Mtoe) oil consumption in 2017 and is projected to rapidly grow to 330 Mtoe by 2040 or about 97% from total energy consumed in the sector—huge energy security and economic risk due to import dependence, as well as environmental risk due to pollution.

Therefore, the shift towards cleaner and more sustainable mobility is inevitable. Options such as electric vehicle and biofuel blending are currently pursued by countries in the region. AOE6 findings showed the potential greenhouse gases (GHGs) emission reduction impacts of such transition, due to the avoided consumption of petroleum products. Biofuel shift has been mandated by several countries such as Indonesia and Thailand. As for electric mobility, some of the ASEAN Member States (AMS) already have national target of the electric vehicle deployment, such as Brunei Darussalam, Indonesia, Singapore, and Thailand. Meanwhile, Cambodia, Lao PDR, Malaysia, Myanmar, Philippines,
and Vietnam are still at the development phase of setting its national target as well as the supported regulations.

The push towards electric mobility has met some challenges. The high capital requirement, the lack of supporting infrastructure, risk aversion can be some of the critical factors inhibiting electric vehicles penetration. Another constrain of electric vehicles is due to the argument that the electricity generation in many of Southeast Asian countries is still dominated by fossil fuels. Thus, overall emission reduction might end up negligible. Such argument, though, could be tackled with the decarbonization trend currently happening in the power system.

Considering the facts that electrifying the road transport sector will not only tackling the environmental issues in the urban areas, but also help the countries to less import in oil, the readiness of EV deployment in AMS is become one of the crucial topics to be analysed in Southeast Asia. Understanding such policy readiness would lead to proper recommendation of policy actions.

2. Literature Review

Electrifying the transportation sector have been widely known as one of the options to reduce the environmental risk and health impact such as emissions and air pollution. The analysis from Choma et al. [2] lie down the implication of EV adoption could gain the public health benefits in urban areas in United States. In another research by Horton et al. [3] mentioned that adoption of EV could moderate the public health benefit while emission reduction from power generation should also be accelerated as well to derive greater positive impacts. However, the gap between the front-runner country such as US with ASEAN Member States (AMS) is quite substantial.

Several analyses have been conducted to assess the EV policy in AMS using various methodology. Bakker et al. [4] examined a comparative analysis of the approach and status of sustainable, low-carbon transport policy in selected ASEAN countries and identifies differences and similarities through Taxonomy of policy components. Results has shown, despite several commitment on climate change mitigation, acceleration of the road transport transition to be aligned with the climate-goal would require further effort.

Li and Chang [5] studied the policy implications as well as the quantitative analysis on how road transport sector electrification has giving impacts to the energy security throughout a 4A framework: availability, applicability, acceptability, and affordability of energy. The results of this study discovered the intensive interaction of electrification of road transport with the introduction of higher fuel economy standards and higher integration of renewable energy into the power sector can decrease road transport's primary energy consumption much more effectively than introducing EVs only.

From the previous analysis, we could conclude that EV development could not be stand-alone effort to mitigate the climate-issues as well as the health issues. However, EV alone is also need extra attention to be developed in Southeast Asia. Different characteristics from each AMS would need to be streamlined in order to boost EV together in the region. Pricing, infrastructure development, and perceived social utility are the most determining factors for increasing willingness to adopt EV. Innovation and education aspects also emphasize a specific role in catalyzing a higher adoption rate, according to Natalia et al. [6].

Several mentioned factors are considerably related to the regulated policy from the government; hence it is argumentatively become crucial to be investigated to mapped out what is being placed in AMS policy and regulation on EV development. This analysis could be carried out using PEST framework. PEST analysis is commonly used in EV-related energy sector to assess the readiness of implemented policies.

Various research on using PEST as a framework of the research methodology has been outlined. Oussama has used PEST as a tool to identify strategic analysis as well as the influencing factors of EV’s electrical energy storage adoption. [7] The results have shown that PEST could draw the evaluation regarding to the maturity of this technology and its various advantages such as cost, charging facilities, efficiency, etc.
PEST has also been used by Yılmaz and Ustaoğlu [8] to run the analysis of the EV production in Turkey. PEST analysis has been run for the incentive program and projects implemented by the manufacturing firms, central and local administrations. The result of this study is in response of those issues, the producers have developed new marketing and sale strategies for Turkey, trying to expand their market share abroad, and draft their new policies to reduce their costs. [8] to run the analysis of the EV production in Turkey. PEST analysis has been run for the incentive program and projects implemented by the manufacturing firms, central and local administrations. The result of this study is in response of those issues, the producers have developed new marketing and sale strategies for Turkey, trying to expand their market share abroad, and draft their new policies to reduce their costs.

Noting the importance of transition to electric mobility, this study aims to assess the readiness of electric vehicle roll-out in the Southeast Asia, especially from the perspective of supporting policy. Such policy is critical as signal to key stakeholders, including academes, industries, and society, to jointly push the adoption of electric mobility. Policy recommendations should be built upon critical assessment of such policies.

3. Methodology
The main methodology employed in this paper is policy review, which is conducted extensively on all of 10 ASEAN member states. Specific insights are extracted for each country. This, in turn, shows the differing status and level of readiness for wide adoption of electric vehicle as clean transportation option. The study employed PEST (Political, Economic, Social, Technological) framework to assess the policy readiness of ASEAN countries. The study also identifies critical factors for promotion of electric mobility. Connecting the two, policy recommendations are outlined, which are designed to address the critical factors. Although focusing on policy review, some cases of electric mobility progress in the region is presented as well.

4. Result and Discussion
Summary policy review of ASEAN Member states has been drawn into table 1. Several countries have been stated its target related to the EV deployment while others are still focus on the cleaner public transportation vehicle. The table 1 also examined on the status of economical incentives that being regulated various member states while the technological advancement among countries is also vary. Lastly, the social impact has been an underlying perspective on why EV development being put in place for the states.

Table 1. Summary of Policy Review

| Country            | Summary of Critical Policies                                           |
|--------------------|------------------------------------------------------------------------|
| Brunei Darussalam  | • Brunei Darussalam National Climate Change Policy (BNCCP) sets a target to have at least 60% of total annual vehicle sales in the country will be electric vehicle by 2035.[9]  
• Ministry of Transportation and Infocommunications (MTIC) strategic plan sets the target of an increase in Hybrid and EV proportion to 50% by 2025.[10] |
| Cambodia           | • Cambodia Climate Change Strategic Plan 2014-2023 (CCCS) by National Climate Change Committee (NCCC) served as a guide to supporting policy instrument towards low-carbon and climate-resilient economy.[11]  
• Greater Area of Phnom Penh Urban Transport Master Plan (PPUTMP) has a target on the use of public transport over 30% of the modal share by 2035.[12] |
| Indonesia          | • Indonesia’s Ministry of Industry has set the production target of 400,000 units of four-wheeler and 1.76 million units of two-wheeler by 2025.[13] |
| Country       | Key Points                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------|
| Lao PDR      | - Nationally Determined Contribution (NDC) noted focus on road network and public transportation systems. [16] |
| Malaysia     | - Third National Automotive Policy (NAP) provided regulatory framework on energy-efficient vehicles since 2014. [17]  
- National Electric Mobility Blueprint set 2020 target of 100,000 units each for electric cars and motorcycles, 2,000 electric buses, and 125,000 EVCS. [18]  
- Low Carbon Mobility Blueprint 2021-2030 is being finalized by the Ministry of Environment and Water. [19] |
| Myanmar      | - Non-regulation support for EV manufacturers, pilot projects, and EV’s charging stations. [20] |
| Philippines  | - EV manufacturing roadmap by Department of Trade and Industry (DTI) is equipped with incentives to encourage EV investment such as the removal of tariffs, excise duty exemptions, and VAT exemptions. [21]  
- E-Trike Project by Department of Energy (DOE) plans to roll out 100,000 e-trikes nationwide to replace traditional gasoline-fed tricycles. [21]  
- Philippines National Standards for EV are available for 7 components. [22] |
| Singapore    | - Land Transport Master Plan (LMP) 2040 by the Land Transport Authority (LTA) has a long-term plan to build a convenient, well-connected, inclusive and fast land transport system—aiming to phase out all fossil-fueled vehicles by 2040. [23]  
- Installation of 60,000 charging points by 2030 and removal of the $5,000 minimum additional registration fee for EVs starting from January 2022. [24] |
| Thailand     | - An EV roadmap by National Electric Vehicle Policy Committee (NEVPC) aims to make the country a hub of electrified vehicles in ASEAN region in five years—targeting 250,000 EVs, 3,000 electric public buses, and 53,000 electric motorcycles by 2025, and 750,000 units (30% of production) by 2030. [25]  
- Board of Investment (BOI) issued tax incentives for the EVs industry. [26] |
| Vietnam      | - At the current status, Vietnam still do not have any policy to support EV development.  
- Although the government has not prioritised electromobility, private companies have attempted to foster EVs.  
- VinFast, the national prestige project, aims to become the leading automobile and motorcycle manufacturer in Southeast Asia—targeting 500,000 vehicles and 1,000,000 e-scooters annually by 2025. [27] |
After assessing the summary of the EV policies in AMS, PEST framework of Political, Economic, Social, and Technological analysis is discussed and summarized as below.

1. **Political**
   Several AMS has set its own target of EV deployment through the official policies and regulations, but in different level. For example, Brunei Darussalam stated will have a target in number of annual EV sales within country. Indonesia, Malaysia, and Thailand are having their target on the number of EV production, while Cambodia, Philippines, and Singapore are having a target in the number of EV being rolled out down the road. This target has shown majority AMS’ political will to move to cleaner transport.

2. **Economic**
   In terms of economic-wise, five countries are stated to give the incentives in order to accelerate the EV roll out namely Cambodia, Indonesia, Malaysia, Philippines, and Singapore. All the said countries have been stated to give several kinds of incentives such as tax exemption, tax reduction etc., to boost the penetration and attract investment of EV in its respective country. Indonesia even also provides the incentive for local manufacturer as well, in order to increase the number of charging station within the country.

3. **Social**
   Electric vehicle is oftentimes claimed as one of the solutions to reduce the greenhouse gases (GHG) emission in the road transport sector since it is emitting zero emission during its operational. Furthermore, the more EV on the road will lead to the more reduction in Oil consumption, which most likely leading to the less import as well for the country that have limited proven oil reserves. Several countries such as Brunei Darussalam, Cambodia, Malaysia, Myanmar, and Singapore, has stated in its policies to significantly increasing EV share to reduce the GHG emission in transport sector. More penetration of EV down the road will help the country to reduce more of the emission which later could also contribute to fulfill its commitment under the Paris Agreement.

4. **Technological**
   The deployment of EV is sometimes seeming not favorable due to its price. Hence some countries such as Indonesia, Philippines, Thailand has stated in its regulation to establish an EV automaker locally. With more local content in assembling the EV part, it hoped could draw down the price to be more competitive compared to the conventional vehicle. The government has specified to give the incentives to the local manufacture to be able to scale up their current production rate. A success story of Vietnam’s EV manufacturer, VinFast, could be a good benchmark for the other three AMS to learn from.

It has been shown that countries have differing level of policy readiness in term of Political, Economical, Social, and Technological. To support the PEST Analysis of electric vehicle policy framework in ASEAN above, we have identified several critical factors of EV roll-out, which are the charging infrastructure, operation and maintenance support, incentive policies, public appetite, and electricity generation. Effective policy designs should then consider these factors.
(a) **Charging infrastructure**

Charging infrastructure become one of the critical components of the enabling environment for electric mobility. Providing incentive to the private sector could building a climate investment to be more friendly to the investor. Moreover, the incentives could also be given to the local manufacturer, so they are able to produce a supported component with low price.

(b) **Operation and maintenance support**

Albeit relatively simpler than conventional vehicle, the supporting industries should also be ready. With the growing market of EV, it is indeed will also require the operation and maintenance support for several parts, such as battery, tires, brakes etc. Current ability of the conventional car service providers is basically able to cope with the growing EV market, however, since EV still relatively new technology, the provider should be able to adapt immediately.

(c) **Incentive policies**

Fiscal and non-fiscal policies should move away from conventional mobility incentives. The incentive could mobilise and attract more investment to the EV market. This kind of support will provide a better climate of EV itself from supply to demand, from upstream to downstream.

(d) **Public appetite**

As other new technologies, adoption needs to start with primary movers. The tipping point of EV penetration is still far. Hence, promoting the use of EV to the public is barely needed. The public could be educated through the campaign that relate to the health issues due the emitted pollutant from the conventional vehicle. Also, the public will could be a decider, whether the government could attain its stated target in their current policies and regulations or not, indirectly.

(e) **Electricity generation**

With the majority of the electricity supply in the region is still dependent on fossil fuels for power generation, the issues on how clean EV will always be there. But since the region is having the target to have more renewable energy shares in its total primary energy supply (TPES) and in its installed power capacity, EV could also simultaneously be promoted. Other issues might also rise from grid reliability for now, but along the time grid will always be improved by the utility provider since more emerging technologies and methods could help them to be operated in more efficient way.

5. **Conclusion**

Upon close review of EV supporting policies in the region, the readiness in term of accelerating policy differs among countries. In regional level, policies are more focused on pursuance of energy efficiency and improvement of fuel economy. The study structurally analysed the policies into Political, Economic, Social, and Technological perspectives. The study also noted the critical factors of electric vehicle promotion: charging infrastructure, operation and maintenance, incentive policies, public appetite, and electricity generation. The policy recommendations are categorized based such critical factors and PEST framework. As the Southeast Asia continues to grow, the transportation demand would need to be satisfied sustainably; thus, supporting policies need to be well-designed, nationally and regionally.

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