Electric Vehicle Adoption in ASEAN; Prospect and Challenges

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Energy demand in transportation sector is increasing and the transportation sector currently emits high amount of greenhouse gases. Electric vehicles (EVs) were introduced to mitigate these emission of greenhouse gases. EVs are well-deployed at leading countries such as China, Europe, and United States due to EV-friendly policies and well-planned EV charging infrastructure. Association of Southeast Asian Nations (ASEAN) is following these leading countries and aims to become the next EV hub. Effective deployment of EVs not only require involvement from governments but also willing consumers that push EVs into communities. A survey was carried out among policy makers, manufacturers, and academia to determine suitable policies and financial incentives to increase deployment of EV in the market. The survey also included the hurdles and issues faced by the community to adopt EVs, and identifies that high purchase cost and charging issues are hampering the deployment of EV in ASEAN. EV-friendly policies and financial incentives were suggested in the survey and will be a good reference material for EV manufacturers and policy makers in ASEAN.

1. Introduction

One of the main factors that leads to the adoption of pure electric vehicles (EVs) is the energy crisis caused by the depletion of fossil resources that has become an urgent issue. According to Li et al. (2019), the greenhouse gasses (GHGs) emission can be reduced by about 99.2 % by introducing EVs to replace gasoline Internal combustion engine vehicles (ICEVs). Many countries have announced various policies to increase the use of EVs within their countries to meet global reductions in greenhouse gas (GHG) emission targets and improve air quality in urban centres (Capuder et al., 2020). Europe, China, and United States are known as the leading countries in EV penetration while Association of Southeast Asian Nations (ASEAN) countries are lagging in terms of EVs sales for multiple reasons (Walton et al., 2020). Therefore, with the goals to enhance the production of EVs in ASEAN and to shift the country to a marketing hub for EVs in the future, policies for EVs have been introduced in each ASEAN countries. However, these government interventions in the form of pro-environment policies and their subsequent lukewarm response from manufacturers to these policies have been insufficient to bring about a shift from ICEVs to EVs (Chhabra, 2020). It is positive consumer perception that will influence the rate of EV uptake and ensure the transformation to full electrification will take place (Xiuhong et al., 2018). Consumers already have many variables to assess when it comes to making a purchasing decision on regular cars, and EVs compounds that problem. A survey has been conducted to evaluate the potential of EV adoption in ASEAN countries and found that in order to promote acceptance of EV technology, knowledge and awareness is essential. This survey was carried out in August 2021 from the convenience sampling of respondents from 8 ASEAN countries. This survey was distributed via google forms and 28 respondents from different countries were received. This study, performed in collaboration with ASEAN Centre of Energy (ACE) which is responsible for development of Electric Vehicle (EV) Integration in South East Asia Region, was designed to collect feedback and opinion from representatives of stakeholders of EV adoption in ASEAN. Figure 1 highlights the composition of the survey demographic; the respondents can be classified to those from policy making background

(government, ministry, agency), followed by industry background (manufacturer, technical services), and lastly from academia background (college, university and etc.). The respondents are from Brunei, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, and Thailand. They hold various positions in their background such as director, analyst, engineer, technical officer, researcher, lecturer, education officer, and etc.
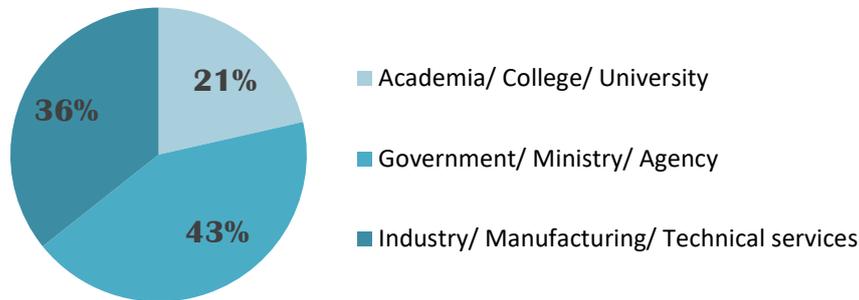

Figure 1: Respondents Affiliation

As shown in Figure 2, Malaysia and Indonesia had the highest number of respondents (32.14%), followed by Thailand (14.3%), Cambodia (7.14%), Myanmar, The Philippines and Singapore (3.57%).
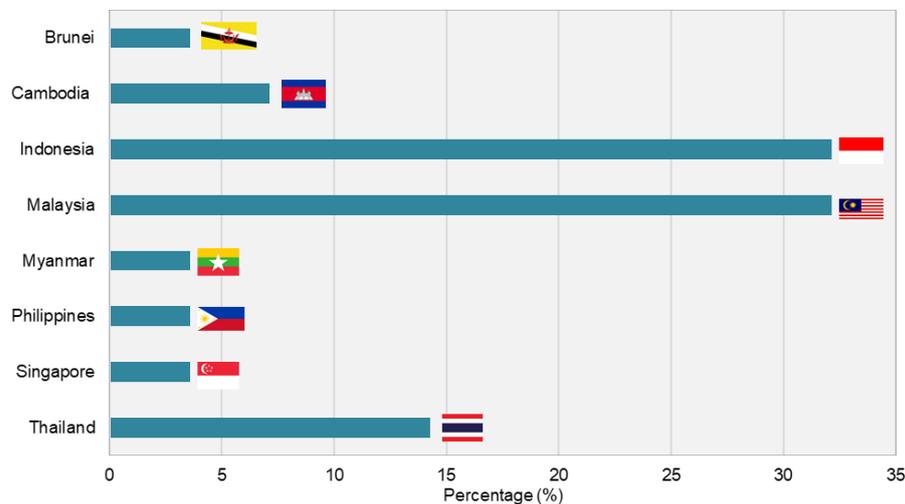

Figure 2: Respondents nationality

2. Survey Design

The survey consists of three sections: Section I whereby the participants were to assess their knowledge and preferences to purchase EV, as well as their country's state of implementation and promotion of EVs via multiple choice question or a rating scale of 1-5. 1 means "strongly disagree", 2 means "disagree", 3 means "partially agree", 4 means "agree" and 5 means "strongly agree". In section II, the participants had to evaluate their country's policies promoting EV adoption and identify factors restricting EV adoption at a national level via the rating scale of 1-5 as mentioned above. In section III, they had to assess technological factors leading to EV adoption and implementation required to boost EV technology. In all three sections, participants have the provisions to suggest or provide extra information that is relevant to their respective section. The survey was created using google forms to be completed by participants prior to the 2021 Workshop on vRE Smart Microgrid in ASEAN region sessions. The analysis of the survey will be discussed in the next section.

3. EV in ASEAN – Prospect and Challenges

In this section, a deeper analysis into each of the survey response to evaluate the level of maturity of eight EV markets in Southeast Asia – Malaysia, Thailand, Indonesia, Cambodia, Brunei, Philippines, Singapore, Myanmar – will be discussing. Based on survey response shown in Figure 3, most of the countries in ASEAN are still at the early stage of adopting EV. Hence, the result shows that they are still in policy implementation stage and in the process of EV charging network (infrastructure) deployment. This survey intends to discover

the consumer challenges, perspectives, and preferences in order for EV adoption. The survey also includes some comparison with successful countries with high EV penetration as benchmarks.
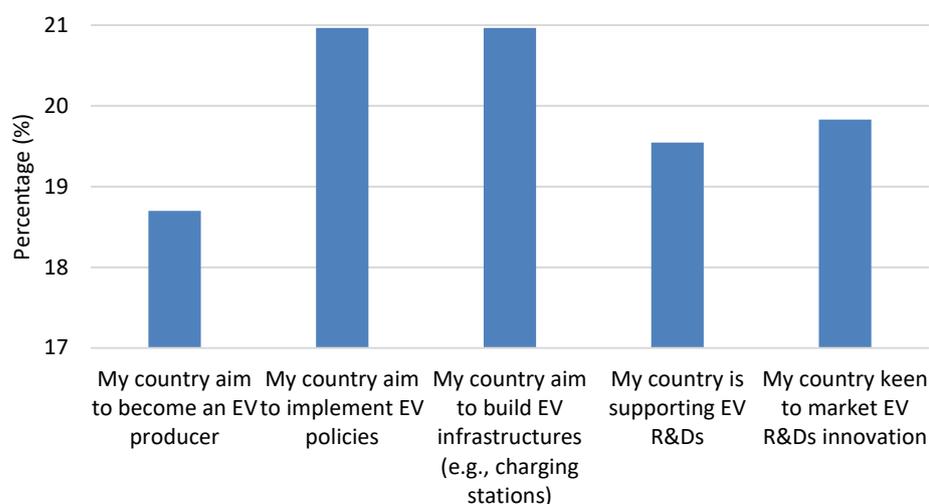
Figure 3: Readiness level of EV implementation of ASEAN countries

3.1 Consumer perspectives

From Table 1, it can be seen there were some noticeable changes in consumer attitudes toward EVs from 2018 to 2020 for France, Germany, Italy, UK, and China. The number one concern in France shifted to driving range from cost price, while driving range remained the greatest concern in Germany. However, the statistics also show a reduction in driving range as a concern in those two markets. In Italy, the lack of charging infrastructure has become the main challenge for consumers since 2018, while in 2020 UK had started reflecting on the possibility of EVs as a realistic option and are considering the practicalities of ownership. In China, the consumers' concern also shifted from driving range to safety of battery in EVs which shows the maturity of the consumers' knowledge on EVs. However, in ASEAN countries, it shown that the cost price is the biggest concern for owning an EV. This is common in new adopter countries as the switch to EVs is often perceived to be expensive due to the higher costs in batteries contributing to the higher purchase price of the vehicle. Apart from the price factor, infrastructure, charging time, and driving range are also factors that discourage consumers to purchase an EV.

Table 1: Comparison of consumer priorities global and ASEAN level

Main factors that you would consider before buying an EV	France[a]		Germany[a]		Italy[a]		UK[a]		China[a]		ASEAN[b]
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2021
Driving Range	31 %	28 %*	35 %*	33 %*	4 %	27 %	26 %*	22 %	25 %*	22 %	14 %
Cost price	32 %*	22 %	22 %	15 %	19 %	13 %	24 %	16 %	9 %	12 %	32 %*
Charging time	11 %	15 %	11 %	14 %	18 %	16 %	13 %	16 %	12 %	15 %	23 %
EV Charging infrastructure	16 %	22 %	20 %	25 %	44 %*	32 %*	22 %	33 %*	18 %	20 %	22 %
Safety of battery tech	4 %	11 %	5 %	10 %	7 %	10 %	6 %	12 %	22 %	31 %*	9 %
Others	6 %	2 %	7 %	3 %	8 %	2 %	9 %	1 %	14 %	0 %	0 %

*greater concerns

Source: a) 2020 Deloitte Global Automotive Consumer Study, b) Survey response from this study

3.2 Factors to enable EV adoption in ASEAN

Based on the survey, in order for ASEAN to accelerate the rate of EV adoption, there are three different factors that should be addressed to increase the feasibility and attractiveness of EVs. They are the total cost of ownership, charging time, charging infrastructure, and driving range.

3.2.1 EV cost

The average price of the EV in ASEAN is around USD 50,000 to USD 100,000 based on Figure 4. From the survey result in Table 1, this range of prices is considered the biggest deterrent to ASEAN consumers in purchasing EV. According to McKinsey (2019) report consumers are considering EVs, but not as many are buying. Insights from the McKinsey's EV consumer survey show higher costs compared to conventional vehicles is found to be a barrier to adoption of EV. To address this issue, it may be worthwhile to consider the total cost of ownership which includes all costs incurred during a vehicle's lifecycle in the comparison between EVs and ICEVs. Up-front purchase price is only part of the cost consumers pay to own their EV. Savings can be made from the daily operation and maintenance of EVs when factoring in savings from gas, unscheduled repairs, and resale value of gas-powered vehicles. In addition, Seba (2020) forecasted that a 200-mile range EV purchase price will be competitive to a conventional ICE vehicle by 2022.
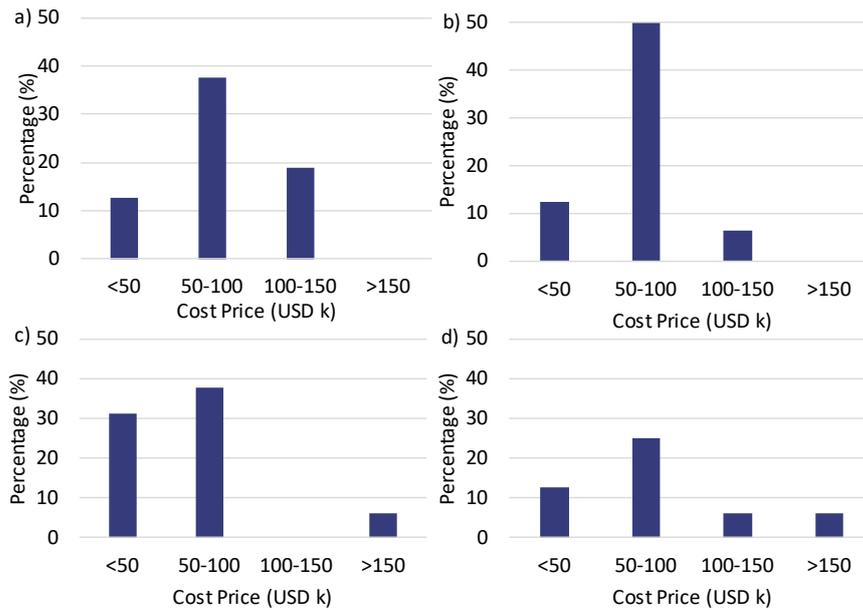

Figure 4: Average current cost of (a) BEV, (b) PHEV, (c) HEV, (d) FCEV in ASEAN country

However, it is undeniable that incentives and rebates from policies or government initiatives will boost up the EV industry. From the survey, most of respondents agree that financial related assistance will help in promoting EV in their country as shown in Figure 5. This includes measures such as tax exemption for EV users, tax exemption on EVs, tax benefits for EV manufacturers, and special tariff for EV charging.
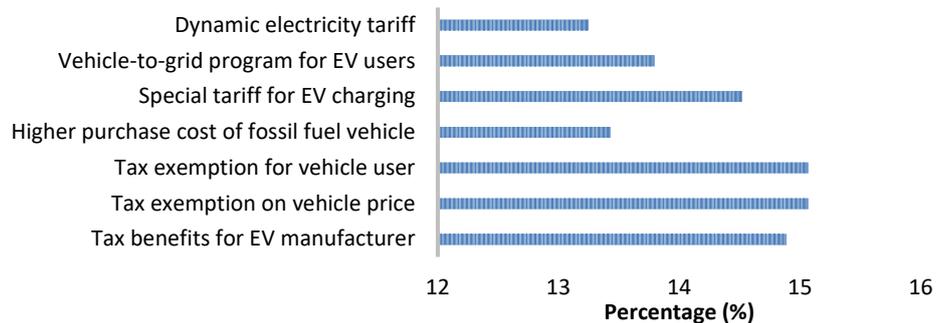

Figure 5: Implementation of financial mechanisms to promote use of EVs in ASEAN countries

3.2.2 Charging time and charging infrastructure readiness

Charging time is seen as another big challenge for consumers. Respondents in the survey are expecting electric vehicles to recharge its battery in a convenient way, and without wasting their time. By looking at Figure 6, it can be seen that most of the ASEAN consumers prefer the charging facilities be provided at their workplace

first, followed by home, public charging station, and shopping mall parking area. From this pattern, it can be inferred that they mostly choose the area they spend their time most. The longer time spent in a single area will allow for longer uninterrupted charging. The accessibility and interoperability of charging infrastructure is a major source of concern not only for EV consumers, but also governments and public utilities. To increase the return on investment (ROI), ASEAN economies should consider the implementation of demand-optimised location prioritisation of charging facilities, and introduce digital solutions (e.g., apps to monitor charging percentage while consumers is away from their car) for consumer's convenience. This initiative has been introduced by General Motors through their Ultium Charge 360 apps that will allow drivers to access information of EV's battery (Edelstein, 2021), locate available charging stations along a route and provide plug in and pay features (Korosec, 2021). According to Ramer (2021), CEO of EV Connect these digital transitions can increase data transparency, grow the profitability of the EV charging business (better ROI), improve strategy and in same time maintain driver satisfaction.
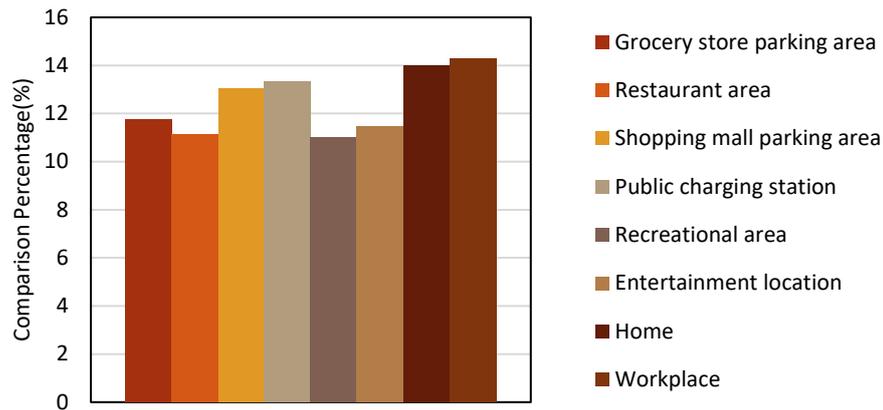

Figure 6: Consumer response on preferable area to charge EV

3.2.3 Driving range

Another finding in this survey highlights driving range to be one of the top concerns hindering EV adoption in ASEAN countries. Commonly known as range anxiety among EV owners, it is when an EV driver finds that the battery charge is low and the usual sources of electricity are unavailable. It sparks a fear of getting stranded which adds time, inconvenience, and stress to a journey. This can also be related back to a lack of charging infrastructure and completes the EV charging conundrum: low EV adoption leading to inadequate charging infrastructure which hinders further EV adoption. Apart from convenient and well-established charging stations, consumer education and ownership experience will be key to addressing range anxiety. Based on survey response in Figure 7, governments and manufacturers can aim to promote awareness by promoting EVs on online media platforms, organize EVs events and showcases, and conduct educational events on EVs to educate the public. All the actions described below help to address and overcome key consumer barriers related to awareness and understanding of electric vehicle technology.
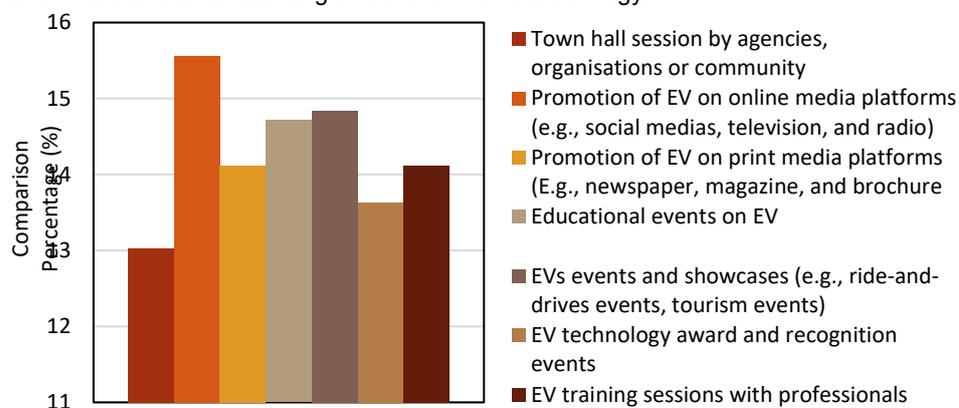

Figure 7: Initiatives to increases awareness of EV adoption

4. Conclusions

From the survey response, it is clearly shown that ASEAN countries are receptive to the idea of transitioning towards electric vehicles. This survey focused on how actions to address awareness and understanding might influence electric vehicle uptake. Education and incentives are also key to expanding the EV market; policy makers and manufacturers can focus on educating the consumers first by promoting the EV benefits to overcome any misconceptions among the public and, at same time, construct strategies to entice EV transition such as deployment of infrastructure, financial, and non-financial incentives. EV is the future, and the technology is quickly maturing. ASEAN countries will need to adequately prepare for the EV transition, or stand to lose valuable time, energy, and resources to catch up. However, this result does not represent the overall population in its entirely since it is only based on 28 respondents. Hence, to obtain more reliable and accurate data in the future, a larger sample size is required so that all subgroups in ASEAN are represented.

Acknowledgments

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