

# PERSPECTIVE

RESEARCHERS AT ISEAS – YUSOF ISHAK INSTITUTE ANALYSE CURRENT EVENTS

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## Mapping the Surge in EV Production in Southeast Asia

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*This photo taken on 26 August 2022 shows EVs (electric vehicles) at the VinFast electric automobile plant in Haiphong, Vietnam. Photo: Nhac NGUYEN/AFP.*

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## EXECUTIVE SUMMARY

- Automobile producing countries in SEA are rushing to promote the use and production of EVs to reduce carbon emissions and to attract more investments and employment opportunities, with the use of fiscal and non-fiscal incentives.
- Assessment of the development of EVs along the seven main modes in the EV supply chain shows that Thailand leads the shift towards EV production, closely followed by Indonesia, Malaysia, and Vietnam.
- Existing Japanese producers in Thailand are tapping on government incentives to expand and increase their production of especially hybrids, as in Malaysia. Indonesia uses its natural resource advantage to enter the BEV production market. VinFast, a private automobile producer in Vietnam, is leading that country's entry into the EV market.
- The greening of the automobile sector will reap greater benefits if it is accompanied by the increasing use of renewables in the national grid. But each country also needs to explore and use decarbonisation technologies and think ahead on how to manage their existing fossil fuel-producing assets from becoming stranded assets in the transition to renewable energy.
- Policy measures have yet to address sustainability concerns in the use of lithium-ion batteries, including sustainable sourcing of minerals and the safe disposal, repurposing, and recycling when these batteries reach the end of their shelf-life, as well as the search for better and more sustainable EV battery options.

## **INTRODUCTION**

The transportation sector is a major source of Greenhouse Gas Emissions (GHG). It has been estimated that approximately 89% of the total transport-related emissions in Southeast Asia (SEA) are from road transportation.<sup>1</sup> Rapid growth in the demand for automobiles, due largely to poor public transportation in most SEA countries, has contributed to increasing air pollution. The use of motorcycles, the primary mode of transportation for the lower-income group, is led by Indonesia, Thailand, and Vietnam.

SEA is also an important production base for automobiles. The region is the seventh largest automotive manufacturing hub worldwide and produced a total of 3.5 million vehicles in 2021.<sup>2</sup> Within the region, Thailand is the largest car producer, producing over 1.6 million motor vehicles in 2021.<sup>3</sup> It is followed by Indonesia (1.1 million), Malaysia (0.48 million) and Vietnam (0.16 million).

The potential for growth in the region is expected to fuel further increases in demand since the motorisation ratio (or registered motor vehicles, including two-wheelers, per 1,000 people) is still relatively low for most countries in this region. Of the four largest automobile-producing countries, Malaysia, and Thailand, respectively had 993.7 vehicles and 608.7 per 1,000 persons in 2020.<sup>4</sup> Indonesia had an ownership ratio of 485 vehicles per 1,000 persons, while Vietnam had a mere 44.6 registered vehicles per 1,000 as of 2020.

Growing interest in electric vehicles (EVs) in SEA is part of the global trend and is motivated by the need to control CO<sub>2</sub> emissions as well as the rush to capture the emerging EV market as a new source of growth. Accelerating EV adoption is expected to help decarbonise the transport sector as well as attract new foreign direct investments, provided the power sector is also decarbonised at the same time. SEA is thus emerging as a potential market and manufacturing hub for EVs; the EV market was estimated at USD500 million in 2021 and is forecasted to grow to USD2.7 billion by 2027.<sup>5</sup> This essay seeks to explain key policies used to foster EV development in SEA and to map their current production in the region and the challenges encountered in this shift towards EVs.

## **KEY POLICIES FOR FOSTERING EV DEVELOPMENT IN SEA**

McKinsey estimated that EV adoption as a percentage of total new passenger vehicles was 0.7%, 0.3% and 0.1% respectively for Thailand, Malaysia and Indonesia in 2021.<sup>6</sup> There is therefore plenty of room to grow the EV market. Policy makers in the region are using numerous incentives to drive EV adoption. The main policy levers address common demand and supply issues in EV adoption. To increase demand, policies need to address affordability as it is one of the key factors hindering EV adoption. Cutting taxes is a common incentive used to lower the costs of owning EVs in these countries, which includes hybrid electric vehicles in

Indonesia and Thailand (Table 1). Despite lowering costs, these incentives have not necessarily made it affordable as EVs are still expensive and remains a niche market.

Given-range anxiety is another demand deterrent, there are also specific policies addressing the development of charging facilities in each country. The approach may differ though. Indonesia, Malaysia and Thailand have targeted the number of charging stations to be developed under their respective national plans. Vietnam's development is led by the private sector, spearheaded by VinFast, the domestic enterprise that is leading EV development in the country, as well as MNCs that are importing EV models into the country.

All countries have set certain targets of EVs to be used by a given date, with Malaysia focussing on public procurement, which is the fleet of vehicles used by the government, while the other three countries have included motorcycles in their planned targets.

All the countries have also used fiscal incentives to attract multinational companies (MNCs) to produce EVs in their respective countries,<sup>7</sup> although Vietnam is slower to tap on this, possibly because it has a domestic champion, VinFast, with global ambitions.

## **MAPPING EV PRODUCTION IN SEA**

EV production covers the production of e-motorbikes, Hybrid Electric Vehicle (HEVs), where a small electric motor assists the internal combustion engine (ICE) such as Toyota Prius, Plug-in Hybrid Electric Vehicle (PHEVs) which are powered by both gasoline and electricity and Battery Electric Vehicles (BEVs), which typically do not have an ICE, fuel tank or exhaust pipe and rely only on electricity for propulsion. EV production, including planned production, is mapped in Figure 2 for the main nodes in the EV supply chain, which comprises mineral resources mining for EV battery production, battery production, battery swapping, semiconductors for battery production, EV production, battery recycling, as well as EV research and development (R&D).

**Table 1. Key EV Policies in Four SEA countries**

| <b>EV Policies</b>                    | <b>Indonesia</b>   | <b>Malaysia</b>   | <b>Thailand</b>  | <b>Vietnam</b>   |
|---------------------------------------|--|---|--|--|
| Increase domestic demand <sup>8</sup> | Exemption from luxury sales tax; reduction or exemption from regional or central government taxes (e.g. motor vehicle tax); lowered parking tariffs (determined by the local government) | EV owners are exempted from road tax and can claim a personal tax exemption of up to 2,500 ringgit (US\$571) for costs relating to EV charging hardware and services, including the purchase, installation, rental, and subscription fees of EV charging facilities, until the end of 2023. | In February 2022, the government announced that it would cut excise taxes on imported EVs from 8% to 2%, and reduce import duties by 20 to 40 % for completely built-up (CBU) EVs. | Exemption from registration fees for three years:<br>Battery electric cars are exempt from registration fees for 3 years from March 1, 2022. The first registration fee shall be paid at a rate equal to 50% of the fee for petrol and diesel cars with the same number of seats over the next two years;<br>Lower consumption taxes:<br>From March 1, 2022 to the end of February 28, 2027, battery-powered electric cars with 9 seats or fewer will be subject to tax rate of 3%;<br>From March 1, 2027, the tax rate will be 11%. The type that carries people from 10 to under 16 seats is 2%; from March 1, 2027 is 7%.<br>Electric cars carrying people from 16 seats to less than 24 seats will be subject to tax |

|                                |  |  |   |   |
|--------------------------------|--|--|---|---|
|                                |  |  |   | rate of 1%, from March 1, 2027, the tax rate is 4%.; The type that carries both people and goods has the special consumption tax rate of 2% and from March 1, 2027, the tax rate will be 7%.  |
| Charging stations <sup>9</sup> | The state-owned electricity enterprise (Perusahaan Listrik Negara or PLN) plans to build 31,000 charging stations by 2030. | To set up 10,000 charging stations for electric vehicles in Malaysia by 2025 under the country's Low Carbon Mobility Blueprint (LCMB 2021-2030). | EV Roadmap: 12000 DC quick chargers by 2030, 36500 by 2035. | Private sector-led, with the first quick EV charging system opened in Da Nang in December 2017. This pilot project was funded by the Central Power Corporation in cooperation with Mitsubishi. By July 2021, VinFast had installed 500 EV charging stations and plans to have 2,000 charging stations set up nationwide with over 40,000 charging ports by end of 2022. Besides VinFast, Porsche has built fast-charging stations in Hanoi and Ho Chi Minh City for its Taycan models while Mitsubishi or Audi are also setting up charging stations for its distribution of EVs. |

|  |   |  |  |  |
|--|---|--|--|--|
| EV Targets <sup>10</sup>                               | <p>2025: Minimum of 20% of its vehicles to be electric</p> <p>2035: Ban sales of ICEVs for passenger and motorcycles</p> <p>2050: EV/PHEV to account for 5% of market share</p>   | <p>Adoption of BEVs for use in government and GLC fleets as a means to encourage wider adoption;</p> <p>10% of new additions to the fleet being BEVs by next year, with the percentage increasing to 20% from 2023 to 2025.</p> <p>From 2026 to 2030, 50% of the new additions to government and GLC fleets are targeted to be locally-manufactured BEVs</p> | <p>2025: EV hub for ASEAN; 250,000 EVs, 3,000 electric public buses, 5,300 electric motorcycles</p> <p>2030: 30% of local production to be EVs; 750,000 units.</p> | VinFast targeting 500,000 vehicles and 1,000,000 e-scooters annually by 2025 |
| Incentives for production and investment <sup>11</sup> | <p>Producers: 1. Exemption from customs duty on SKD and CKD kits during the initial stage of the project 2. Exemption of customs duty on production-related capital goods 3. Incentives for charging station production (including equipment)</p> | MIDA incentives for FDI in EVs include incentives which are pioneer status to produce original goods, investment tax allowance, and the exemption of import and excise duties.   | Producers: 1. Corporate tax exemption (duration depends on electric vehicle type) 2. Import tariff exemption for production machinery                              | Under consideration  |

Note: BEV- battery electric vehicles

Source: See endnotes for all sources

Minerals used for battery production include lithium, aluminium, cobalt, copper, nickel, manganese, graphite and iron. In SEA, Indonesia and Vietnam have nickel as well as other minerals. Nickel is the most important metal by mass in the lithium-ion battery cathodes used by EV manufacturers.<sup>12</sup> Although Malaysia and Thailand have some nickel, it is not significant. Indonesia utilised its vast nickel resources for fostering industrial development, including battery production, by banning its export.<sup>13</sup> Some metal smelters are already in operation and under construction to supply these materials for industries. Notably, the most significant investment is from China, since China was also Indonesia’s largest nickel importer before the nickel ore ban was introduced. Nickel is also mined for supporting stainless steel production in Indonesia.

All four countries have plans for EV battery production, be it with state-owned enterprises, local private companies or with foreign partners (Table 2). These are reportedly coming on board by year end or the next year. Honda in Malaysia is already producing HEV batteries for its hybrid vehicles manufactured there. Likewise, Mercedes Benz is already producing plug-in hybrid batteries in Thailand.

**Table 2. EV battery production in Four SEA countries**

| <b>Country</b> | <b>Production and Plans</b>  |
|----------------|--|
| Indonesia      | EV battery production in Indonesia is slated to start in 2023, based on a collaboration between Hyundai Consortium and the Ministry of Investment/Indonesia Investment Coordinating Board (BKPM), which was signed in 2021, and another planned project between Indonesia Battery Corp (IBC) — a holding company consisting of four state-owned enterprises, and a consortium led by South Korea’s LG Group with a reported initial investment worth US\$1.2 billion <sup>14</sup> |
| Malaysia       | Honda started producing hybrid vehicle batteries in Malaysia in 2020, to support its production of hybrid vehicles there. <sup>15</sup> There is also an MOU signed between Malaysia’s Hong Seng Consolidated and EoCell in June 2022 to establish an EV battery manufacturing hub in the country. <sup>16</sup> There are also plans for Samsung to develop EV batteries in the country. <sup>17</sup>  |
| Thailand       | In 2019, Mercedes-Benz opened a factory for plug-in hybrid batteries in the Bangkok region in Thailand. <sup>18</sup><br>Thailand’s SET-listed Energy Absolute announced it had completed construction of a THB6bn (US\$180m) lithium-ion battery and energy storage plant in Chachoengsao, east of Bangkok, in December 2021 for powering public buses and later other public transportation like river boats. <sup>19</sup>  |
| Vietnam        | In December 2021, VinFast started building a \$174 million VinES Battery Manufacturing Factory in Ha Tinh, Vietnam, which is expected to produce up to 1 million battery packs per year. <sup>20</sup>   |

Source: See endnotes



Since charging batteries can be time-consuming, battery swapping is used to shorten the down time by exchanging an empty battery for a fully charged one. In Indonesia, Swap, a city-based infrastructure of battery swapping stations is available for e-motorcycle riders.<sup>21</sup> There are also plans to strengthen the swapping system through collaborations between Indonesia's national energy company, Pertamina, and Grab.<sup>22</sup> Malaysia and Thailand also have similar plans to initiate and expand a battery-swapping network for e-bikes.<sup>23</sup> Vinfast is moving into battery rentals.<sup>24</sup>

Semiconductor chips are also needed for battery production. The production of these third-generation chips is in the hands of a few MNCs such as Fujitsu Semiconductor, Infineon, NXP, Renesas and Texas Instruments.<sup>25</sup> Contract manufacturing of power modules used for these chips are found in Malaysia and Thailand.<sup>26</sup> In July 2022, Infineon announced the construction of its third wafer fabrication (fab) plant in Kulim Technology Park, Malaysia, that will be producing these chips.<sup>27</sup>

EV production for electric motorcycles are found in all four countries. . Toyota is planning to produce hybrids and PHEVs in Indonesia while Honda is producing locally assembled hybrid electric vehicle (HEV) in Malaysia and Thailand. . Mercedes-Benz is producing PHEVs in Malaysia and Thailand. There is no media announcement of the production of hybrids and PHEVs in Vietnam.

Battery electric vehicles (BEVs) have reportedly started in Indonesia, under Hyundai and in Vietnam, under Vinfast. Plans to produce BEVs in Malaysia reportedly include Fieldman Group's joint venture production with China's Changan Automobile.<sup>28</sup> In 2022, Thailand's investment agency approved a joint venture between Taiwan's Foxconn and PTT BK to produce BEVs in Thailand.<sup>29</sup>

Battery recycling is important as the mining of metals used in EV batteries is an energy-intensive process. Recycling will help to lower the environmental harm from mining as well as offset some of the demand of raw materials from the ground, thereby contributing towards more sustainable use of the raw materials. Battery recycling is at its infancy in SEA, since EVs are just emerging, and countries have not yet reached the stage of having to handle battery disposal. Toyota Motors of Japan is reportedly shifting its battery recycling operations from Europe to Thailand to be more cost-effective and sustainable as the company increases its commitment to eco-friendly cars.<sup>30</sup> Interestingly, Singapore, an insignificant automobile producer, has opened a new battery recycling facility capable of recycling 14 tonnes of lithium-ion batteries, to support the drive towards EV utilisation.<sup>31</sup>

Finally, EV battery testing centres are reported in Thailand as collaborations between Thailand Automotive Institute and foreign testing companies/laboratories as well as some car companies such as FOMM (Japan) and Mercedes-Benz.<sup>32</sup> VinFast has also reportedly invested in R&D in Melbourne to develop its EVs.<sup>33</sup>

**Figure 1. Mapping of EV production in SEA, October 2022**

| Nodes in EV supply chain                       | Indonesia | Malaysia | Thailand | Vietnam |
|--|-----------|----------|----------|---------|
| Mineral Resources                              |           |          |          |         |
| EV battery production                          |           |          |          |         |
| Battery Swapping                               |           |          |          |         |
| Semiconductor chips                            |           |          |          |         |
| EV production by types of vehicles: Motorbikes |           |          |          |         |
| HEVs   |           |          |          |         |
| PHEVs  |           |          |          |         |
| BEVs   |           |          |          |         |
| Battery Recycling                              |           |          |          |         |
| R&D activities                                 |           |          |          |         |

Notes:

|  |                           |
|--|---------------------------|
|  | In production             |
|  | Planned                   |
|  | No announced plans as yet |

Source: Author

Figure 1 indicates Thailand is facing competitive challenges in EV production. It has ventured into four of the seven nodes in the EV value chain. It is manufacturing electric motorcycles, HEVs and PHEVs and shifting into BEVs as well. Nevertheless, it is unclear whether the shift towards BEV cars in Thailand can duplicate its export success in pickup trucks. Malaysia, Indonesia, and Vietnam have each ventured into three of these nodes and are manufacturing different types of EVs as shown in Figure 1. Indonesia is seizing on battery production, its large domestic market, and high usage of e-bikes to carve out a presence in the EV value chain, while Vietnam is riding on VinFast’s global ambitions.

## CHALLENGES

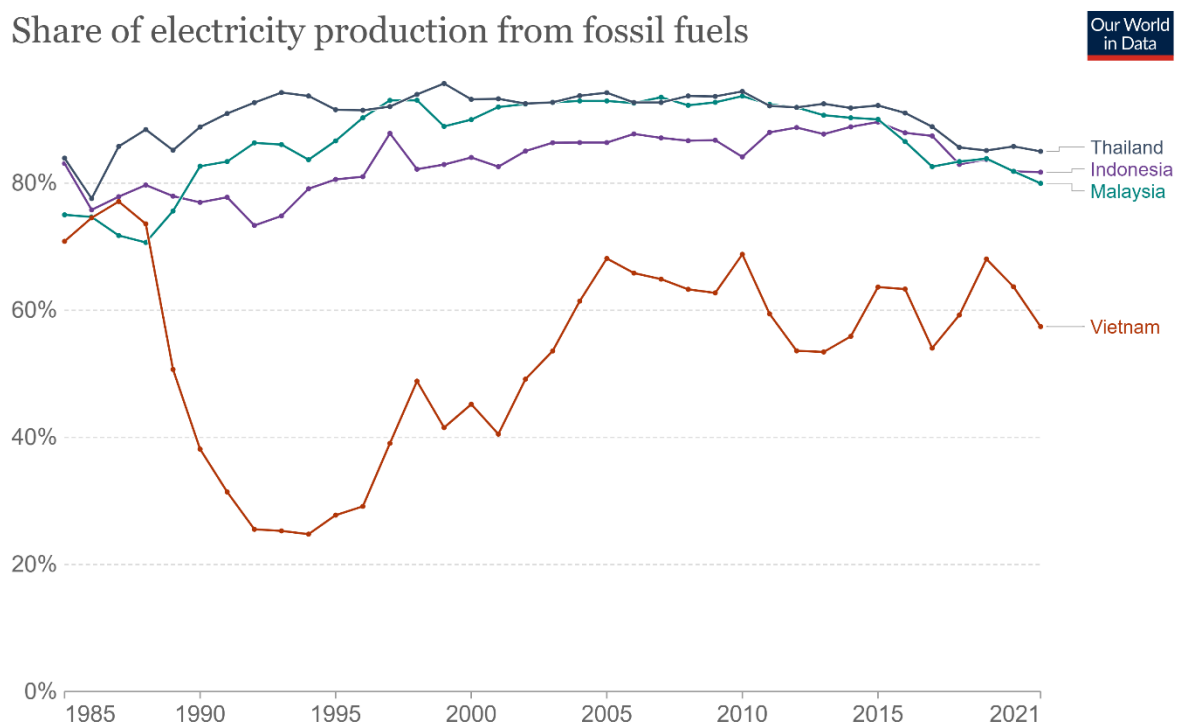
### *Greening the Grid*

The sources of power in the national grid that is used to power EVs will determine the extent to which the full benefits of EVs will be realised. For the four countries, fossil fuels (coal, oil, and gas), which are a major source of air pollution, are the major sources of electricity production. They account for at least 80% of the electricity production, respectively for Thailand, Indonesia, and Malaysia, in 2021 (Figure 2). Vietnam uses slightly under 60% of its electricity production from fossil fuels. Renewables account for around 10% or less for

Indonesia (10.39%), Malaysia (8.06%) and Thailand (7.11%).<sup>34</sup> Vietnam is the most advanced in using renewables, at 22.73%.

The demand for coal was partly driven by the fuel’s relative abundance and its low cost, which includes subsidies compared with oil, gas, and renewable energy. Indonesia is the world’s fifth-largest coal producer and its second-largest net exporter, while Malaysia and Thailand are the eighth- and ninth-largest net importers. Vietnam’s coal-power capacity under active development is reported to be the third largest in the world after China’s and India’s.<sup>35</sup>

**Figure 2. Share of electricity production from fossil fuels, 1985 to 2021**



Source: Our World in Data based on BP Statistical Review of World Energy (2022) ; Our World in Data based on Ember's Global Electricity Review (2022) ; Our World in Data based on Ember's European Electricity Review (2022).  
OurWorldInData.org/energy • CC BY

All four countries have plans to increase the share of renewable energy in a grid in the bid to decarbonise their respective economies, as shown in Table 3. Indonesia, Malaysia, and Vietnam also plan to curb the production of new coal-fired plants.

**Table 3. Increase in share of renewables in national grids in four SEA countries**

| Country   | Plans   |
|-----------|---|
| Indonesia | 2021-2030 Electricity Procurement Plan (RUPTL) of state utility PLN, provides for a bigger share of new, renewable energy power plants. The renewables target set in the National Electricity Master Plan (RUKN) is 23% by 2025. <sup>36</sup> The new RUPTL does not contain any plans for new coal-fired power plants except those that have already reached financial close or under construction.               |
| Malaysia  | Malaysia targets 31% Renewable Energy (RE) in its installed capacity in 2025 and 40% in 2035. <sup>37</sup> The government has also announced that it will not develop any new coal power plants.   |
| Thailand  | The long-term Alternative Energy Development Plan 2015–2036 (AEDP2015) of Thailand sets the target of RE electricity up to 20 percent in 2036. <sup>38</sup>  |
| Vietnam   | Power Development Master Plan for 2021-2030 with a vision to 2045 (PDP 8) shows that expansion will be driven primarily by new solar and wind energy projects and gas-fired power plants. These sources combined will make up 47% of the system in 2030, rising to 60% in 2040. PDP 8 also cancels and postpones until after 2030, up to 17GW of coal-fired capacity, or nearly half of the pipeline. <sup>39</sup> |

Source: See endnotes

There are therefore plans in each country to green the grid, but implementation is the key for the realisation of the stated targets. Lack of careful implementation action plans has reportedly led to unanticipated problems in Vietnam with the power grids not being able to manage intermittencies in the use of its solar power.<sup>40</sup>

Each country also needs to explore and use decarbonisation technologies that have high impact and high readiness for individual countries, including the use of carbon capture and storage (CCS) technologies to decarbonise fossil and industrial plants.<sup>41</sup> Countries also need to think ahead on how to manage their existing fossil fuel-producing assets from becoming stranded assets in the transition to renewable energy.<sup>42</sup>

#### *Ensuring sustainability in the usage of EV batteries*

EVs are attractive due to their lower or zero tailpipe emissions, but the manufacturing of EVs is not carbon neutral. Most EV components are much the same as those of conventional cars, but the major difference is in the battery. Although traditional lead-acid batteries are widely recycled, the same cannot be said for the lithium-ion versions used in electric cars (or lithium-ion batteries (LIBs)). EV batteries are larger and heavier than those in regular cars and are

made up of several hundred individual lithium-ion cells, all of which need careful dismantling as they may possibly explode if disassembled incorrectly.<sup>43</sup>

The use of minerals in battery manufacturing needs to consider mining practices when assessing the ESG compliance for these batteries as there are environmental and humanitarian risks in the extraction and production process.<sup>44</sup> For example, the mining and refining of nickel in Indonesia are deemed to be carbon intensive.<sup>45</sup> While SEA rushes to produce EV batteries, there is not enough attention paid to the use of sustainable practices in the mining of these minerals.

As EVs reach the end of their life in coming years, the new challenge is how to manage the increasing number of old LIBs.<sup>46</sup> The lifetime of a LIB is typically between 5 and 20 years. There is urgent need to include in policy planning, the regulation and management of the disposal and repurposing for second life use as well as recycling of EV batteries, as countries in SEA start to use BEVs. Developed countries like the UK are currently facing environmental, economic, and regulatory challenges confronting the management of obsolete (or end-of-life) LIBs (or OLIBs) as its stockpile of end-of-life BEVs increases.<sup>47</sup> Therefore, this gap in policy measures in SEA needs to be addressed to ensure the sustainability of an EV industry beyond the reduction of tailpipe carbon emissions.

Policies should also support the use of more sustainable EV batteries for the EVs approved for use in a country. This includes the use of fewer critical mineral resources such as cobalt and nickel, ability to store more energy while using less material, and material circularity, which promotes substitutability in the use of material resources.<sup>48</sup>

## **CONCLUSION**

Automobile producing countries in SEA are rushing to promote the use and production of EVs to reduce carbon emission and to create more investments and employment opportunities. Fiscal and non-fiscal incentives are used to encourage EV adoption by reducing the price of EVs and improve the charging infrastructure in each country. Likewise, incentives are also given to attract EV production.

Assessing the development of EVs along the seven main modes in the EV supply chain shows that Thailand leads the shift towards EV production, closely followed by Indonesia, Malaysia and Vietnam. Existing Japanese producers in Thailand are tapping on government incentives to expand and increase their production of hybrids and PHEVs, as in the case in Malaysia. Indonesia uses its natural resource advantage to enter the BEV production market, while VinFast, a private automobile producer in Vietnam, is leading Vietnam's entry into the EV market.

The greening of the automobile sector will reap greater benefits if it is accompanied by increasing use of renewables in the national grid. Many targets are set but ultimately, careful

implementation is needed to realise the different goals. Each country also needs to explore and use decarbonisation technologies and think ahead on how to avoid their existing fossil fuel producing assets from becoming stranded assets in the transition to renewable energy. Policy measures have yet to address sustainability concerns in the use of LIBs, including sustainable sources of minerals used and the safe disposal, repurposing, and recycling when these batteries reach the end of their shelf-life, as well as the search for better and more sustainable EV battery options.

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