Executive Summary

Demand for automobiles to transport passengers and freight has been rapidly increasing in members of the Association of Southeast Asian Nations (ASEAN), giving rise to traffic congestion and air pollution. As demand for petroleum increases, the region's oil self-sufficiency has declined greatly whilst CO_2 emissions have increased. Automobile penetration is expected to rise as the economy grows, further increasing energy security and environmental concerns.

To tackle these issues, ASEAN countries have announced policies to promote electric vehicles (xEVs),[1] which reduce oil consumption and air pollution but increase demand for electricity. Depending on its power generation sector, a country might not achieve energy self-sufficiency or solve its environmental problems.

The study analyses xEV deployment's effects and side effects on the economy, energy, and environment (3Es) – the basic principle of energy policy. The study analyses qualitative and quantitative information on energy supply and demand structure, impacts on CO_2 emissions, and the macroeconomy to contribute to ASEAN members' automobile and energy policy planning. The study delivers the following outcomes.

1. Indonesia, Malaysia, Thailand, and Viet Nam may face challenges in the 3Es in the reference scenario, which assumes continued historical trends without strengthening policy measures.

    - ✓ Cars increase 2.5 times by 2040 due to high economic growth. Motorbikes, which are over three times more numerous than cars, increase 1.7 times.
    - ✓ Total primary energy demand increases by 3.2% annually in Indonesia, 4.3% in Viet Nam, 1.8% in Thailand, and 2.3% in Malaysia. Coal demand grows at higher rates in each country to meet rapidly increasing electricity demand.
    - ✓ High fossil-fuel dependency leads to increasing CO_2 emissions. CO_2 emissions increase annually by 3.5% in Indonesia and 5.2% in Viet Nam – rates that are higher than energy-demand growth, meaning that their energy mix becomes more carbon intensive. In Thailand and Malaysia, CO_2 emissions grow at almost the same rate as energy demand.

- ✓ Rapidly increasing fossil-fuel demand results in lower energy self-sufficiency. One of the largest coal exporters, Indonesia keeps its energy self-sufficiency rate (ratio of domestic output to domestic consumption in a given year) over 100% but it drops significantly from today's level. Malaysia is a net export country today but becomes a net energy importer within 10 years.

[1] Including hybrid, plug-in hybrid, and battery electric vehicles.

- ✓ Net import bills dramatically increase in the four countries as oil self-sufficiency declines, even though Indonesia and Malaysia export coal and gas. Higher import bills might damage their economies.

2. The hybrid electric vehicle (HEV) bridge scenario and battery electric vehicle (BEV) ambitious scenario have the same effect on energy security and CO_2 emissions. The BEV scenario, however, needs investment funds and subsidies several times larger than in the HEV scenario.

   - ✓ BEV penetration's effect of reducing CO_2 emissions is limited unless the power generation sector is decarbonised. ASEAN countries largely depend on coal-fired power generation.
   - ✓ The energy self-sufficiency ratio does not vary much between each scenario because imports of petroleum products for vehicles decrease whilst imports of coal and natural gas for power generation increase. BEVs, however, improve the trade balance more than HEVs do.
   - ✓ BEVs require several times the investment that HEVs do, and large investments in low-carbon power supply are required to make clean BEVs based on well to wheel.
   - ✓ xEV penetration may need large subsidies to realise the scenarios. The total subsidy for the BEV scenario is several times that for the HEV scenario and puts pressure on government finances.

3. Charging infrastructure is a key requirement, but not the only one, for plug-in electric vehicles (PEVs), which include BEVs and plug-in hybrid electric vehicles (PHEVs).

   - ✓ PEV charging infrastructure is more complex in technology, interoperability, standardisation, and impacts on electric power grid than the well-established ICEV refuelling infrastructure.
   - ✓ The cost of rolling out public PEV charging facilities is high. National governments need to invest significantly at least at the beginning of PEV penetration whilst partnering with private business until markets reach a certain maturity.
   - ✓ Central governments can implement measures to develop charging infrastructure, such as by providing rebates, tax breaks, low interest loans, and subsidies to private business to build infrastructure; building make-ready facilities for private business; partnering with private business to develop and operate stations; amongst others.
   - ✓ Local or regional (urban) circumstances such as manufacturing maturity, business characteristics, and electricity supply profile need to be considered early to define a proper partnership approach and to discourage excessive intercity competition.

- ✓ A charging scheme strategy needs to be planned as early as possible to ensure that PEV penetration achieves its main objectives: reducing greenhouse gases by reducing the use of fossil-fuel–based power generation whilst ensuring that additional electricity demand does not further burden the electricity grid.

4. Introducing xEVs into ASEAN countries would fulfil various policy purposes, but their massive deployment might have negative economic side effects. xEV penetration needs realistic and affordable policies. We recommend the following:

I. Harmonise automobile and energy policies

Countering climate change by promoting xEVs is important, but the overall effects of well to wheel must be considered to make the most of vehicle electrification's environmental mitigation effects. It is critically important to coordinate policy goals.

II. Take a 'bridging' pathway to mitigate negative side effects

xEVs are more expensive than IECVs, and the amount of investments and subsidies needed to promote them might be enormous. Vehicle electrification must be affordable for consumers, businesses, and governments. Vehicles must be electrified at a speed that fully anticipates cost reduction.

III. Encourage support by local governments

Local as well as central governments can promote xEVs. Local measures are less cost intensive and include public procurement of xEVs, provision of free parking spaces and free charging at public stations, use of lanes reserved for public transport, and road toll exemptions or discounts.

IV. Develop charging infrastructure to facilitate PEV deployment

- ✓ Set targets for building charging infrastructure.
- ✓ Facilitate infrastructure investment, especially involving stakeholders in a transparent process whilst creating an open and competitive market for EV charging.
- ✓ Price electricity fairly and improve interoperability by standardising charging equipment and payment and communication systems.

V. Develop measures to ensure that PEV penetration objectives are achieved

- ✓ Prepare a strategy to implement charging schemes. In the early phase of PEV penetration, PEV charging has negligible impacts on the grid and power generation. At a certain PEV penetration level, additional electricity demand affects the grid. The

strategy will relieve the pressure on the grid and maximise low-carbon power generation.

- ✓ Educate users on optimal PEV use and charging. Driving EVs requires behaviour change to optimise vehicle use and minimise costs.
- ✓ Construct an open data platform to gather information on public charging stations: their locations, types, modes, real-time occupation, and operators.

VI. Create a clear long-term vision for xEV deployment

Such a vision will encourage private investment. Concrete and reasonable policies are important to create a safe investment environment.

VII. Consider appropriate country-specific paths to vehicle electrification

- ✓ In Indonesia, vehicles are so numerous that electrification will be enormously expensive. Cost control is critical. The power generation mix must be decarbonised to make the most of the environmental mitigation effects of vehicle electrification.
- ✓ In Malaysia, gasoline is much cheaper than electricity, resulting in a longer payback period for BEV introduction and higher total subsidies. Reviewing energy prices can be a policy tool to diffuse BEVs.
- ✓ In Thailand, a car manufacturing base, overly rapid vehicle electrification might damage existing production systems. It is necessary to proceed with caution.
- ✓ Viet Nam has about 20 times more motorbikes than cars, and motorbikes consume as much oil as cars. If Viet Nam promotes bike electrification, air pollution and oil consumption could be reduced and costs kept down.