

Executive Summary

Indonesia became a net oil importer in 2003 due to the rise in transport-related oil consumption and dwindling domestic production. The Institute of Energy Economics, Japan projects that, under the reference scenario, 75 percent of Indonesia's demand for oil products will be met by imports by 2040.

To reduce the expected potential increase in oil imports and to nurture the domestic automobile manufacturing industry, Indonesia has set a target to abandon sales of internal combustion engine vehicles (ICEVs) by 2040. Indonesia also intends for alternative vehicles to account for 20 percent of total vehicle production by 2025. If these targets are reached, their expected impacts are likely to transform the energy industry as a whole, with significant repercussions for electricity generation, transmission, and distribution, as well as refineries, oil product retailers, and gas stations.

This study analyses the potential impacts (through 2040) of using alternative vehicles such as electric vehicles (EVs) – including hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and battery-powered EVs – as motorcycles, passenger vehicles, trucks, and buses in Indonesia. The study also considers the implications of such changes for energy policy and energy supply industries. As many East Asia Summit countries* are expected to rely increasingly on imported oil products in the future (mostly driven by the growing demand for energy in the transport sector), the conclusions of this study examining the targeted shift away from ICEVs will provide important perspectives for the countries in this region.

The study delivered the following outcomes:

1. Alternative vehicles' potential to contribute to oil savings and reduce carbon dioxide (CO₂) emissions was ascertained by developing three scenarios: a reference scenario, a moderate EV scenario, and an advanced EV scenario.
2. In the moderate EV scenario, oil demand in the road sector continued to increase but remained 20 percent lower by 2040 than in the reference scenario. On the other hand, in the advanced EV scenario, oil demand peaked around 2025 and declined rapidly to almost half of the current level.
3. In the reference scenario, the demand for electricity more than tripled from 200 terawatt-hours (TWh) to 680 TWh, led by the industry and the building sectors. In the advanced EV scenario, rapid EV penetration increased the electricity demand further to around 900 TWh, more than four times the current level.

* These are the 10 countries in the Association of Southeast Asian Nations (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam); as well as Australia, China, India, Japan, New Zealand, the Republic of Korea, the United States, and Russia.

4. EVs could be an effective tool for reducing CO₂ emissions when decarbonisation of the electricity generation mix takes effect. Assuming that Indonesia will remain dependent on fossil fuels for power generation through 2040 (these fuels currently account for 90% of the total generation mix), this analysis found that massive deployment of EVs (in the advanced EV scenario) would only reduce CO₂ emissions by 2 percent compared with the reference scenario. In contrast, based on the assumption of the National Energy Council (*Dewan Energi Nasional*) that renewables would account for 23 percent of the primary energy mix by 2040, EVs could contribute to a 17 percent reduction of CO₂ emissions by 2040.
5. Estimating the cost of the lithium-ion battery module is critically important to estimate the future cost of HEVs, PHEVs, and EVs. By using the learning curve analysis method and applying the IEEJ's assumptions as to the global penetration of EVs, this study estimated that the cost of the lithium-ion battery module will decline from \$209 per kilowatt-hour (kWh) in 2017 to \$72/kWh by 2030 and \$51/kWh by 2040.
6. An analysis of the annualised cost of ICEVs and EVs, including payments for energy (gasoline, diesel, or electricity) and maintenance, revealed that a shift to EVs would benefit drivers of different modes of transport at different times. For example, the cost of driving an electric motorcycle would be lower than that of a conventional motorcycle sometime after 2020, suggesting that the benefits of shifting to electric motorcycles would outweigh those of using conventional motorcycles by that date. This shift happens much earlier for motorcycles than for trucks (2025), passenger vehicles (2025), and buses (2035) due to faster upfront cost reduction.
7. Assuming an annual driving distance of 19,000 kilometres (km), bus drivers will be able to enjoy the benefits of the shift to electric buses after 2035. Based on upfront costs in 2017, it is estimated that electric buses will become cost-competitive at a travel distance of more than 90,000 km. In contrast, based on estimated upfront costs in 2040 (which are 41 percent lower than in 2017), the total cost of electric buses will be lower than that of conventional buses when the travel distance exceeds 10,000 km. These findings suggest that, given the current cost gap, EV buses should be used on routes with long travel distances to ensure drivers' benefits. Also, until upfront costs are reduced, supporting measures (such as the provision of subsidies or battery leasing) should be instituted to realise the full benefits from the introduction of EV buses.
8. The use of EVs in Indonesia can be an effective tool for various policy purposes, including energy security enhancement, climate change mitigation, air quality improvement, and manufacturing industry development. The analysis results show that a shift towards EVs would benefit drivers in Indonesia, as well as society as a whole by boosting oil savings, reducing CO₂ emissions, and improving air quality. The cumulative monetary benefits of these developments would reach \$79.6 billion by 2040. Meanwhile, the additional cumulative costs of developing electricity generation (including the increased deployment of renewables) will amount to \$187 billion by 2040. To realise the full benefits of EVs in Indonesia, it is important to consider the specific characteristics of locations where the existing electricity supply infrastructure can accommodate the massive introduction of EVs.

9. The upfront costs are currently the biggest hurdle for the introduction of EVs, and it is important for the Government of Indonesia to provide necessary incentives to help drivers and other consumers realise the potential benefits of EVs. Mechanisms should be put in place to secure necessary funds for the provision of incentives. A good lesson in this regard can be found in India, where the state of Delhi charges an additional fee on diesel consumption and uses this fee as the basis for incentive funds.
10. Another important lesson can be found in Malaysia, where the introduction of energy-efficient vehicles (including HEVs and EVs) is considered an important strategic area and effective tool for developing the manufacturing industry. To this end, the country is providing incentives to the industry, specifically to assembly and manufacturing companies that produce parts, including electric motors, HEV and EV batteries, battery management systems, inverters, air conditioning units, and air compressors. This case offers some important insights for the stepwise development of the manufacturing industry in Indonesia.