

## Executive Summary

Transition towards a carbon neutral society is currently a top energy topic in the Association of Southeast Asian Nations (ASEAN). Regarding CO<sub>2</sub> emissions, the power sector is the biggest emitting sector in ASEAN, followed by the transport sector, especially the road transport sub-sector. In the Lao People's Democratic Republic (Lao PDR), the road sub-sector was the biggest regarding CO<sub>2</sub> emissions, but after 2013 when the Hongsa coal-fired power plant started operation to export electricity to Thailand, the power sector has been the biggest CO<sub>2</sub> emitting sector.

For the power sector, the Lao PDR has significant potential of hydropower, so that the country still has the possibility to shift from coal-fired power generation to hydropower generation in the future. Thus, a remaining sector regarding significant CO<sub>2</sub> emissions will be the road transport sub-sector, in other words, vehicles.

There are several ways in ASEAN to decarbonise the road transport sub-sector: (i) increase biofuel consumption, (ii) shift from internal combustion engines (ICE) to battery electric vehicles (EV), and (iii) shift to hydrogen vehicles such as fuel cell vehicles. Paying attention to the energy supply situation in the Lao PDR, EVs will be an option to achieve zero emissions in the road transport sub-sector. Consequently, this report analyses the positive and negative impacts to be brought by shifting to EVs from ICE vehicles in the Lao PDR.

First, a positive impact is the energy saving effect to be brought by EVs. If we assume that EVs will reach at least half of the vehicle stock in 2040, oil demand (gasoline and transport diesel oil) will decrease to 1,460 kilotons of oil equivalent (ktoe) in 2040, and on the other hand, the increase in electricity demand will be 551 ktoe in 2040. Therefore, the total final energy consumption (TFEC) will decrease to 909 ktoe in 2040 compared to the business-as-usual (BAU) scenario. The second positive impact will be to improve the energy supply security situation when the Lao PDR will penetrate EVs. Because the additional power needed from the penetration of EVs will come from hydro or coal-fired power generation, both hydro and coal will be classified as domestic energy. In addition, gasoline and diesel oil for transport will be imported from Thailand. Thus, import dependency defined as  $\text{import} / (\text{domestic production} + \text{import})$  will decline. The third positive impact of EVs is to increase the GDP (gross domestic product) due to a decrease in the imports of gasoline and diesel oil.

CO<sub>2</sub> emissions will reduce due to the decrease in gasoline and diesel consumption, but we need to consider whether the Lao PDR will generate the additional electricity demand from hydropower or coal-fired power plants. According to our analysis result, the maximum rate of coal-fired power generation should be lower than 50%. If we apply 50% of EV penetration ratio, the total CO<sub>2</sub> emissions will be 9.2 million tons of carbon (Mt-C) under 50% of coal-fired power generation to BAU 9.4 Mt-C in 2040.

Next, we analyse how EV penetration will impact the oil industry and power sector. Firstly, we analyse negative impacts to the oil industry due to a decrease in gasoline and diesel oil demand: (i) revenue of the oil companies will decrease compared to the BAU scenario; and (ii) in the case of the EV 50% scenario, gasoline and diesel oil demand will saturate at around the 2018 level up to 2040, thus an expansion of the transport fuel market in the Lao PDR will not be expected. In other words, existing oil companies will be able to survive because the current market volume will be continued to 2040. But they will face severe competition due to the limited oil market volume in the future.

EV penetration in the Lao PDR will bring several positive impacts to the electricity sector due to an increase in electricity demand: (i) investment in additional power plants by Electricité du Laos and independent power producers will be around \$2,000 million in the case of EV 50%, (ii) investment in transmission and distribution lines will be around \$1,300 million in the case of EV 50%, (iii) as a result, a total of \$3,300 million will be necessary to support the increase in electricity demand in the case of EV 50%, and (iv) EV penetration will also expect 2,600–3,600 additional employees to engage in the electricity sector that includes power plants, and the transmission and distribution networks.

The penetration of EVs will need EV charging stations and a small number of charging stations does not contribute to the penetration of EVs, the so-called chicken-and-egg dilemma. Finally, following are policy recommendations to penetrate EVs in the Lao PDR: (i) necessary government support for penetration of EVs with the assistance of the international community that has much EV experience; (ii) penetration of EV charging stations with numerical targets, (iii) define positive expectations such as energy saving, CO<sub>2</sub> reduction, improvement of energy supply security, and increase of GDP; (iv) huge investment in the power sector (\$3,300 million); and (v) application of foreign investment because of the huge investment needed for EV penetration, but applies only to power plants like independent power producers. For the transmission and distribution networks, Electricité du Laos and the Ministry of Energy and Mines should also make investments in order to maintain national security on power supply.