

Executive Summary

This report examines quantitatively the possibility and risks of realising high shares of renewable energies through the planned extension of power grid interconnection, focusing on Southeast Asia, specifically, Cambodia, the Lao PDR, Myanmar, Peninsular Malaysia, Singapore, Sumatra, Thailand, and Viet Nam, using a mathematical model that calculates the cost optimal diffusion of various types of power-generating technologies, setting a long-term target year of 2040.

Main argument

Considering the recent cost declines in solar photovoltaic and wind power generation, the primary aim of this study is to investigate whether variable renewable energies (VRE) and other renewable energies would be diffused in the targeted region without strong policy measures, such as feed-in tariffs, in the cost optimal power generation mix.

Another issue to investigate is whether the international grid interconnection would contribute to higher VRE and renewables diffusion, lower costs in the power sector, and energy security.

The study also sets additional cases with higher fossil fuel prices, with explicit consideration of the health externalities of fossil fuels and with strong policy measures reflecting the different levels of economic development. Moreover, the effects of introducing other low-carbon technologies, such as nuclear power, are investigated.

Through these case studies, this report illustrates the preferable energy mix for each region in 2040, estimating the cost increases related to possible changes in the energy mix, as well as the battery requirements for coping with the risks of supply disruption associated with the intermittency of VRE. This study also investigates the effects of grid interconnection expansion to reduce such costs and risks.

Conclusions

- VRE will be diffused in the Association of Southeast Asian Nations only if people accept strong policy measures to combat climate change, such as feed-in tariff systems, even though the costs of VRE will decline significantly through 2040. Given the challenges associated with the intermittency of VRE, the maximum exploitation of other renewables, such as hydro and geothermal, is also important for achieving low-carbon power systems.
- The currently planned grid interconnection expansion would increase power trade in the region and work as massive regional batteries that can ensure further deployment of VRE. It would also help maximise the use of unevenly distributed hydropower resources, resulting in further carbon dioxide (CO₂) emission reductions and cost minimisation. This can reduce fossil fuel imports and enhance regional energy security.

- The optimal energy mix may change with explicit consideration of higher fossil fuel prices, the health effects of fossil fuels, and economic development levels, which may also be considered when designing future energy policies. In addition, nuclear can also be a viable option as a proven low-carbon technology.

Policy recommendations

- Given the projected low fuel prices, the governments will need strong policy measures to promote renewable energies. Without such measures, high dependence on fossil-fuel fired thermal power generation will remain and may not be changed by and large.
- The governments should promote power grid interconnection expansion at least to the planned scale as this would help in realising CO₂ emissions reductions, cost minimisation, and energy security at the same time.
- Not only strong policy measures but also other factors, including the costs of VRE, international energy prices, externalities, and the utilisation of nuclear may affect the optimal energy mix that governments should seek.
- As achieving very high shares of renewable energies may induce significant cost increases, governments should also consider other decarbonising options, such as the use of fossil fuels with carbon capture and storage, hydrogen, ammonia, and nuclear power.
- 100% decarbonisation of the power sector may be very challenging with considerable cost increases. At the same time, we should also note the inevitable need to decarbonise energy systems, given the growing global concerns about climate change.