Chapter 4

Key Findings and Policy Implications

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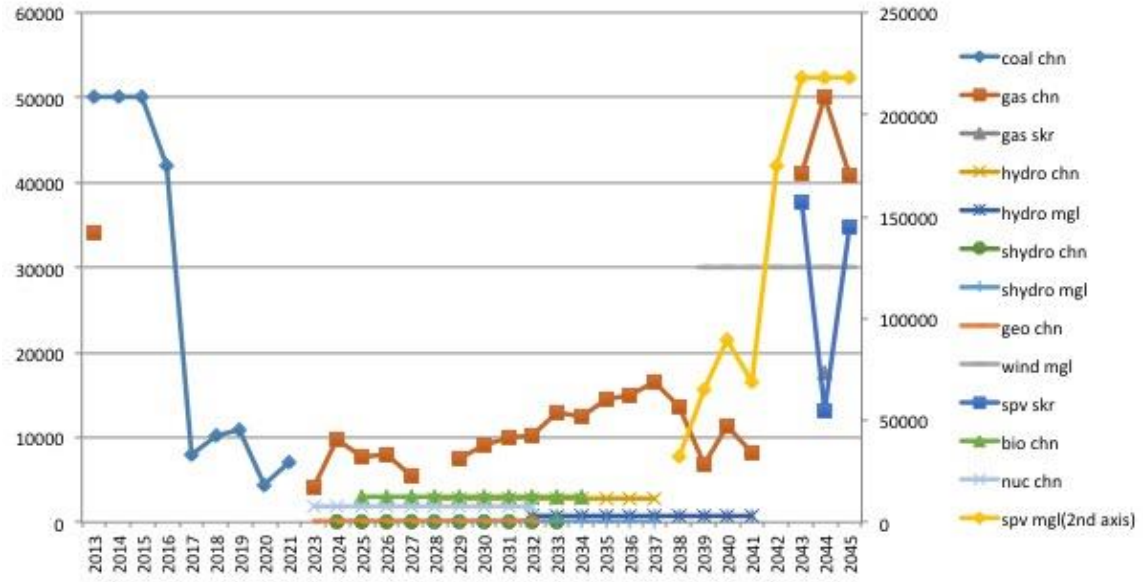
Chapter 4

Key Findings and Policy Implications

4.1 Key Findings

A linear programming model was used with the objective function of minimising the system cost of supplying power and electricity demand of all countries covered in the model. As explained in Section 3, the model achieves this by duly reflecting the cost of generation capacity, the cost of operation, and the costs and losses of transmission. By integrating the daily and monthly demand patterns for power and the supply of wind, solar, and hydropower in the countries involved, the model also works to optimise the dispatch of loads to various generation and transmission capacities in the region. Based on such considerations, the optimal plan for developing generation and cross-border transmission capacities is developed for the region. These are the key results of this model and could be used as reference in formulating relevant policies to encourage the development of power grid interconnection and even electricity market integration in the region. The following scenario is built on the assumption that the financial cost (or the required rate of return to investment) of cross-border transmission lines is heavily subsidised, and is as low as 3 percent only, and that the cost of wind power generation from Mongolia is 30 percent lower than that of China.

Figure 17: Power Generation Capacity Development with Power Grid Interconnection
(MW)



bio = biomass, chn = China, coal = coal, gas = natural gas, geo = geothermal, hydro = large hydropower, mgl = Mongolia, MW = megawatt, nuc = nuclear, shydro = small hydropower, skr = South Korea, spv = solar PV, wind = wind.
Source: Economic Research Institute for ASEAN and East Asia.

Figure 17 presents the optimal development plan of various new power generation assets in NEA countries. Some interesting observations include the following:

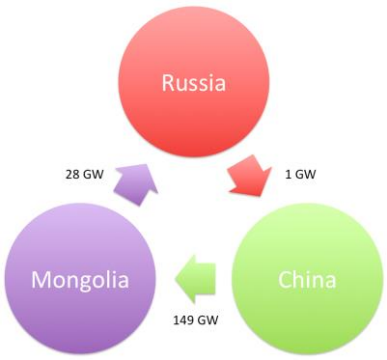
(i) Coal-fired power plants will continue to be developed in northern and northeast China until 2021.

(ii) Natural gas and hydropower dominates the development between 2023 and 2038.

(iii) After 2038, solar PV and wind will be developed on a massive scale.

The development of new cross-border power transmission capacities is mainly driven by the development of new renewables, namely, solar PV and wind, after 2038. As indicated by Figure 18, the new capacities will be concentrated in the China–Mongolia and Russia–Mongolia routes. Unfortunately, due to the high cost and high loss of power transmission to South Korea and Japan, no cross-border interconnection is envisioned to be developed to connect to these two countries during the model period 2013–2045. Such is also partly due to the saturated demand for power in Japan.

Figure 18: Cross-Border Power Grid Interconnection Capacities required by 2045[a]



[a] Arrows do not indicate the direction of trade flow. This figure indicates the capacity of interconnections only.
GW = gigawatts.
Source: Economic Research Institute for ASEAN and East Asia.

The above results are derived from one scenario; yet many possibilities exist for future scenarios. The uncertainties about the future comes from nuclear energy policies, environment and carbon emission policies, technological progress in new renewables, energy storage, high-efficiency power transmission, and changes in the demographic

and economic structure of NEA countries (such as urbanisation, adoption of electric transport systems, and automation of production and application of robotics). Thus, further studies in this regard may deliver more optimistic and more aggressive results on how power grid interconnection, together with new renewable energy potentials, should be developed in this region.

4.2 Policy Implications

Large-scale interconnections among China, Mongolia, and Russia are identified as needed and feasible in almost all scenarios. Savings in the total system cost of all countries vary at around US$500 billion in total in about 30 years as a net present value, compared to the case of no power grid interconnection and, thus, no trade of electricity. This is equivalent to about 10 percent of total system cost for all countries involved. On the environment side, some 4 billion total tonnes of carbon dioxide emissions could be reduced during the same period.

Solar PV, which has a better match with peak power demand, appears to be more competitive than wind power and to be developed on a large scale in Mongolia starting 2033 or 2038, depending on the scenario.

According to the scenario results with varying assumptions, the cost of electricity from wind power needs to be 30 percent lower in Mongolia compared to neighbouring countries, especially China, for wind power to be competitive and developed after 2039. The complementary development of pump storage, battery storage, and smart grid may help improve the competitiveness of wind power.

Considering the massive scale of investment required for both renewable generation capacities and cross-border power transmission lines among NEA countries, collaborative, open, and transparent foreign investment policies – especially for the power sector – are a prerequisite to realise power grid interconnection in the region.

Considering that China, Japan, and South Korea have already set domestic targets for renewable power generation capacity and share in total electricity generation, the demand for renewable power (both solar and wind) generated from Mongolia may come even later than currently estimated. NEA countries, thus, may need to coordinate policies on renewable energy to avoid restricting the source of renewables from domestic only; that is, the environmental benefits of imported electricity from renewable sources should be counted in setting relevant domestic policies among importing countries.

Considering the high costs of building dedicated cross-border power transmission lines among the NEA countries, policies that encourage developing robust domestic power transmission network and allowing near-the-border type of power grid interconnection with neighbouring countries may be the most beneficial way in this region.

Last but not least, power grid interconnection enhances the energy supply security in the region, as it improves diversity of sources and means of supply to each participating country.