EXECUTIVE SUMMARY

This research report analyses the costs and benefits of power grid interconnection in the Northeast Asia (NEA) region – covering north and northeast of China, Japan, Mongolia, East Russia, and South Korea – using a linear programming and optimisation model. Based on such analysis, several important observations are made on the feasibility and optimal plans of power infrastructure development for power grid interconnection in the region. Policy implications are also drawn based on these observations. It is strongly believed that these findings and policy implications are complementary to the existing literature on power grid interconnection in the NEA region.

The key research questions are as follows:

- What are the costs and benefits of power grid interconnection and the corresponding trade of electricity in the region?
- What are the priority projects that are optimised and stand as economically and financially feasible?
- What are the remaining technical, economic, and institutional barriers?
- How should standards, grid codes, and regulations for both bilateral and multilateral interconnection and trade of electricity be harmonised?

During the first year of research conducted on the issue, the Economic Research Institute for ASEAN and East Asia (ERIA) focused on the quantitative assessment of the economic benefits of power grid interconnection among the NEA countries. It addressed questions such as who will benefit and how much the benefit will be.

In the future, this study can be extended to shed light on the issue of whether the interconnection projects will be economically and financially feasible. Further studies can also indicate the optimal planning of the interconnection projects among the NEA countries, especially in terms of routes and timing.

Large-scale interconnections among Mongolia, Russia, and China are identified as needed and feasible in almost all scenarios. Savings in the total system cost of all countries vary at 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 tonnes of carbon dioxide (CO_2) emissions – about 10% of the total carbon emission in the case of no interconnection – could be reduced during the same period.

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

For wind power to be competitive and developed, the cost of electricity from wind power needs to be 30 percent lower in Mongolia compared to neighbouring countries, especially China. 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 prerequisite to realising any of the vision for power grid interconnection in the region.

Considering that countries such as China, Japan, and South Korea already have 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 in the 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 which allow near-the-border type of power grid interconnection with neighbouring countries, may stand as the most beneficial way in this region.

Last but not least, power grid interconnection enhances energy supply security in the region by improving diversity of sources and means of supply to each participating country. In the future, the impact of clean coal technology should also be further studied, as it is almost sure that as the technology matures and cost decreases, it can potentially change the fuel mix of power generation in the region while contributing significantly to decreasing greenhouse gas emissions from the power sector.