GREEN GRIDS

The benefits of cross-border renewable energy trading in South Asia

Large-scale, cross-border 'green grids' have the potential to meet growing energy demand and improve energy access and energy security across South Asia. *Simon Trace* looks at the particular advantages and challenges of linking resources between India, Bangladesh, Bhutan and Nepal.

Clean, renewable energy resources are abundant across South Asia. There is solar power in the Thar desert and wind power in Tamil Nadu, for example. Meanwhile, the Himalayan region has huge hydropower potential, especially in Nepal and Bhutan (80 GW and 26 GW, respectively). From this, less than 3 GW is utilised due to low domestic demand in mountainous areas.

Harnessing these natural resources to meet growing energy demands, expand electricity access, improve the quality of services, and strengthen energy security is an increasingly attractive proposition.

There is a huge opportunity to optimise South Asia's renewable energy resources by constructing large-scale, cross-border regional and international 'green grids' to enable renewable energy trading between countries. As a simplified illustration – when solar power plants located in the Thar desert of the Indian subcontinent stop generating electricity after sunset, the Indian grid could then draw power from the wind farms of China or hydroelectric plants in Nepal and Bhutan.

The success of hydropower trade between India and Bhutan has helped to foster strong regional cooperation in many other matters

Photo: iStock

Long-distance, high-voltage direct current (HVDC) cross-border transmission lines (now a mature technology) can carry energy over long distances with little loss and make green grids technically feasible. Digitised power management systems can help to remotely manage the variety of inputs and outputs.

Linking resources together in this way offers better utilisation of regional generation capacity and potential, and can create a reliable supply of affordable, clean, secure energy across large areas.

Importantly, tapping into a wider pool of different renewable resources helps to address some of the variability of supply and grid stability issues associated with renewable energy. Weather-dependent renewable sources, especially wind and solar, are inherently intermittent and uncertain.

A high rate of renewable generation therefore places additional demands on the grid in terms of ensuring a constant, reliable supply. Connecting areas that are rich in renewable energy resources and that have high renewable energy generating capacity with areas of high demand helps to balance supply and demand.

The complementarity of solar and wind energy often eliminates or reduces the need for back-up power generation, and trading the cheapest source of electricity at any particular time with the centres of greatest demand provides an economic case for interconnected grids.

India has already started to implement its ambitious Green Energy Corridors (GEC) programme, which entails domestic transmission lines that exclusively connect areas of high renewable energy generating capacity to areas of high demand. It envisages high-capacity connections to Bangladesh, Bhutan, Nepal, Myanmar and Sri Lanka. India has been making advancements in regional power trade more generally too, including its arrangements with Bangladesh, Bhutan and Nepal.

Regional power trade

India, a power surplus country, has been trading with neighbouring countries through medium to long-term bilateral contracts – importing from Bhutan and exporting to both Nepal and Bangladesh. There is currently no power trade agreement between India and Pakistan.

India-Bangladesh and India-Nepal power trade has helped to eliminate power shortages in Bangladesh and Nepal respectively and, during the COVID-19 pandemic, interconnected grids between Bangladesh, Bhutan, Nepal and India (the BBIN countries) benefitted each other in terms of grid security. A recent EEG-funded Energy Insight demonstrated that all cross-border links continued to

operate without any interruption or restriction, and all countries were able to achieve a load/generation balance.

India – with the largest power system – was able to increase resilience by importing more power, despite a decline in the country's energy demand, and support the systems of Nepal and Bhutan. In the absence of links, the countries would have had to reduce/spill the generation at their plants, or they may have had to impose load restrictions in the absence of adequate generation in real time.

While regional power trade in South Asia has traditionally been limited to bilateral government-to-government negotiations (which is a slow process), April 2021 marked a shift from bilateral agreements of power trading to market transition, and towards the creation of a robust, regional power grid.

In April, the Indian Energy Exchange (IEX), India's largest power trading platform, announced commencement of the Cross Border Electricity Trade (CBET) on its platform. It followed the notification of CBET Regulations by the Central Electricity Regulatory Commission in 2019 and the notification of CBET Rules in March 2021 by the Central Electricity Authority. Nepal is the first country to start cross-border electricity trade in India's day-ahead electricity market.

Integrated Research and Action for Development (IRADe), based in New Delhi, expects that in the future, the power trade between BBIN countries will increase to 40 BU by 2022 and 70 BU to 2027.

The challenge of international cooperation

In all parts of Asia, governments are committed in principle to increasing grid interconnections, but there are some major issues to address. In particular, while a number of international bilateral electricity trade agreements are currently operational, the expansion of renewables at scale will require cooperation on a much larger scale – posing geopolitical challenges.

Indeed, participating in regional power trade is a political as well as a technical decision. The most debated and cited barrier to regional electricity cooperation is political will – which often comes down to differing views of energy security.

For example, while the wind may not be blowing in country X, at the same time, country Y could have an excess of wind generation, with surplus to export. In this scenario, a regionally connected grid should be able to provide the same guaranteed level of power availability with less installed generating capacity than a series of independent grids, thus providing cheaper electricity.

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However, country X may not have good relationships with country Y, or even if it does, things may change in the future. Volatile diplomatic relationships between countries can create risk, and smaller countries may be more wary of more dominant trading partners. Viewed from this perspective, questions can arise about the security of supply, which can impact political decision making.

Internally, some developing countries may also have concerns over the political advisability of being seen to sell electricity to other countries while their domestic populations still lack access to energy, even if that meant access could be extended more cheaply to all in the long term.

The South Asian region has attempted to initiate cooperation on the regional energy supply through the South Asian Association for Regional Cooperation. Similarly, the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation has initiated discussions on planning for grid interconnections around the Bay of Bengal. It has been suggested that the European electricity market could potentially serve as an example for regional grids in terms of intergovernmental cooperation.

Regional power trade does also offer political benefits. It is thought that it can help to strengthen mutual confidence and cooperation among countries – for instance, the success of hydropower trade between India and Bhutan has helped to foster strong regional cooperation in many other matters.

Harmonisation and finance

Other challenges that need to be addressed include inadequate cross-border transmission capacities and domestic infrastructure issues, which will hinder large-scale electricity trade. Furthermore, the harmonisation of technical specifications (known as grid codes), operating procedures and standards, and legal and regulatory frameworks are key requirements for the safe and reliable operation of grids in cross-border power trade. But these steps will involve different countries and will take time.

Another significant challenge can be mobilising affordable financing for projects of this scale, which will in some cases be perceived as a high-risk investment. Installed capacity must also be scaled up, though this will require substantial financial resources.

Information and research

Although organisations like the Global Energy Interconnection Development and Cooperation Organization (GEIDCO) are trying to put more information into the public domain on the potential of intercontinental ultra high voltage interconnections, there is still unfortunately a lack of in-depth research evaluating the benefits and costs of regional power trade, and a serious lack of champion projects or examples of electricity cooperation.

More studies by reputed and neutral organisations could help to attract the attention of policymakers (and investors), and more frequent dialogues and knowledge exchanges between researchers, industry and policy experts are required to keep policymakers abreast of the latest techno-economic developments.

With this in mind, EEG has been supporting roundtable events that focus on ways to overcome barriers and increase opportunities for cross-border electricity interconnections and the trading of renewable energy. We are also funding a research project on the implications of the declining costs of solar, wind and storage technologies on regional power trade in South Asia – a particularly significant research gap. The project is being carried out by IRADe and the findings will be useful on a global scale.

From standalone models of Bhutan and Nepal, IRADe has already observed that trade will help these countries to utilise their hydro potential. For example, in a no-trade case, the installed capacity of Nepal will reach only 15 GW compared to a high-trade case, where it reaches 44 GW by 2045. Similarly, for Bhutan, under a no-trade case and a high-trade case, the installed capacity reaches 5 GW and 16 GW, respectively.

Cross-border grids and electricity trading can support the transition to clean, renewable energy, helping to address climate change, electricity access challenges and energy security issues. There is widespread agreement that regional power trade presents great opportunities – but there is an acute need for research, evidence and discussions to build further consensus and cooperation, and to advance ideas and proposals. ●

Simon Trace is programme director of the Energy and Economic Growth (EEG) research programme, funded by the UK's Foreign, Commonwealth & Development Office (FCDO), **https://energyeconomicgrowth.org/**