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India-Nepal Energy Cooperation

Mohak Gambhir is a Research Assistant at CLAWS. He holds a Master's Degree in International and Area Studies from Jamia Millia Islamia and a Bachelor's Degree in Commerce (H) from University of Delhi. He has previously worked as an analyst at PricewaterhouseCoopers India (PwC). His areas of focus include China-South Asia Relations, India's Foreign & Strategic Policies towards Smaller South-Asian States (SSAs) of Bangladesh Bhutan and Nepal, and Non-Traditional Security in South Asia.

Key Points

- Energy remains a cornerstone in the broader India-Nepal relation.
- Lately, cross-border electricity trade (CBET) has garnered much momentum with several agreements being signed and infrastructure established in the last few years alone.
- There are some emerging shifts in the existing CBET pattern, mainly due to demand and price factors in both India (particularly Uttar Pradesh and Bihar) and Nepal.
- Future growth in CBET lies in transmission infrastructure development within Nepal and harmonising regulations and procedures between both countries that facilitate more efficient trade.
- As far as cooperation in electricity generation is concerned, the way forward should be a combination of small hydro plants and solar power.

Introduction

India and Nepal have remained steadfast development partners for decades, encompassing vital sectors that are important for the growth and security of both countries. Amongst the many areas of cooperation, the power sector features prominently. As the two developing countries continue to grow economically, the demand for electricity is also growing at a rapid pace.. This requires timebound infrastructural planning and execution along with efficient ways of ensuring cross-border electricity trade (CBET) to maximise socio-economic gains.

The Power sector in Nepal has seen a steady growth over the last decade, with the electricity demand rising to 8960 Gigawatt hours (Gwh) in FY 2020-21.[1] Almost all of its electricity comes from hydro power.[2] The Nepal Electricity Authority (NEA) generation rose from 2305

GWh in 2016-17[3] to 3021GWh in 2019-20[4] before dropping down to 2810 GWh in 2020-21[5], due to factors like dry lean season and monsoon floods which led to several plants being shut down and longer duration of plant shutdowns for maintenance. Independent Power Producers (IPPs) are now major electricity generators in the country, with their contribution rising from just 1777GWh in 2016-17 to 3241GWh in 2020-21. Despite the increasing generation capacity from both the NEAs and the IPPs, imports from India continue to witness a steady rise (from 2175GWh to 2826GWh) as a measure to bridge the gap between domestic supply and demand, as Nepal continues to expand electricity access in the country with consumers increasing from 3.26 million in 2016-17[6] to 4.53 million in 2020-21.[7]

This paper aims to understand the current status of energy cooperation between India and Nepal, and highlight some of the key hurdles and recommend the possible way forward for enhancing cooperation.

Cross-Border Electricity Trade (CBET)

CBET forms the bedrock of India-Nepal Energy Cooperation. Efficiently implemented, CBET leads to electric system diversification. Benefits also include lower cost of scheduling and dispatch, reduced area control error, greater operational flexibility and lower cost of renewable energy integration.

In the post-2015 Nepal earthquake, the main driver of CBET between the two countries was extensive load shedding, which often reached 16 hours a day during the lean season in some parts of the country. There are more than 20 transmission interconnections between the two countries, most of them being there for power exchange at local levels. For enhanced transmission of electricity, the first highcapacity 400 kV Muzaffarpur (India) to Dhalkebar (Nepal) cross-border power transmission line was completed in 2016 with financial support from the Indian Government. [8] Two additional 132 kV cross-border transmission lines between Kataiya (India) & Kusaha (Nepal) and Raxaul (India) to Parwanipur (Nepal) were completed in 2017. Nepal is currently importing around 600 MW of power from India. [9]

An Agreement on 'Electric Power Trade, Cross-border Transmission Interconnection and Grid Connectivity' was signed between India and Nepal on 21 October 2014. [10] The

agreement was aimed at facilitating and further strengthening cross-border electricity transmission, grid connectivity and power trade between Nepal and India. The agreement provides a framework for power trade between the two countries, import by Nepal from India until it becomes power surplus and subsequent import by India from Nepal, on mutually acceptable terms and conditions. A Joint Working Group (JWG) and a Joint Steering Committee (JSC) have also been established under the agreement.

Possible Shifts in Current CBET Pattern

The CBET routes can be divided into two broad areas of western and eastern Terai regions. Internal east-west flows are limited within both countries. Therefore, each north-south CBET zone could have its own economic pattern, making it justifiable to treat them separately. Traditionally, the majority of bilateral CBET happens through the eastern Terai region, which accounts for 90% of Nepal's electricity imports from India.

Two main factors that could drive a shift in the existing CBET pattern includes price factors and demand patterns.

Price Factor

NEA pays domestic power producers more for energy delivered during the dry season than for energy delivered during the rainy season. According to a study,[11] power producers generally received $81.75 per MWh for energy delivered during the dry season and $46.72 for energy delivered during the rest of the year in 2017. The domestic payment rates guide CBET because they set the economic benchmark for future power exports to India. For example, if market prices in Bihar, during the dry season, are less than $46.72, IPPs will export little or no energy from Nepal if they can sell energy to the NEA. Day-ahead, prices in Bihar averaged to $36/MWh for 12 months ending 12 April 2017, about 36% lower than the power purchasing agreement price governing most exchanges across the Eastern Terai region. By comparison, Indian Energy Exchange (IEX) prices for Uttar Pradesh averaged to $40/MWh for the year ending 12 April 2017. Wholesale market energy prices can run higher in Uttar Pradesh than in Bihar. This is in congruence with the fact that the Northern Regional Load Dispatch Centre (RLDC) region was a net importer and the Eastern RLDC region a net exporter during this time.

Demand Factor

- **Eastern Terai Area.** Bihar, West Bengal and Odisha have significant amount of demand spike for 3 hours before evening peak during monsoon. As demand throughout the Eastern RLDC increases, the additional burden could require operational flexibility that mainly coal-based plants in the region might not be able to provide as efficiently as Nepal's hydropower plants running at full capacity during the monsoon can provide. Therefore, seasonal power exports from Nepal to Eastern RLDC are potentially viable whenever Nepal's new hydropower capacity comes online.
- **Western Terai Region.** Higher penetration of renewable energy in the northern RLDC, as compared to ERLDC, would require flexible resources due to the lack of round the clock availability of renewable power, which could also increase the value of power transmission from Nepal to India. This power trade would be more consistent in nature as compared to ERLDC's seasonal requirements.

Ways to Improve CBET

The western Terai region offers significant potential for mutually beneficial power exchanges. However, its actual utilisation depends a lot on Nepal's domestic energy transmission development. This must go beyond the recent expansion of Butwal flowgate in 2016. Effective utilisation of any new transmission could be directly affected by bilateral tariff reforms and greater operation coordination between India and Nepal. Efficient real-time price formations are needed, which in turn depends on the level of integration of grid operations and energy markets.

A free market between India, Nepal and Bangladesh could increase regional CBET in a more economically efficient way. Several studies indicate the value of deeper integration over a larger geography. For instance, a regional, multi-jurisdiction market for CBET has saved utilities in the western region (US $400 million) since its introduction in 2014. That market comprises one large operator that accounts for about 60% of the group's total demand and five smaller players. Of the US$71 million (Indian Rupees 458 crores) in benefits seen in the second quarter of 2018, more than half was accrued to the smaller operators. [12]

High Points in Recent Times

- ***Butwal-Gorakhpur Transmission Line.*** The two countries signed an agreement in September 2021 to establish a 400 kV Butwal-Gorakhpur transmission line with a capacity of 3500MW power transmission.[13] The construction of this transmission line is very important for Nepal as many power projects are expected to be completed in the next few years, and Nepal needs to export power to India. While a joint venture will construct the line on the Indian side, Nepal will construct its side of the line on its own. It is important to highlight the positive outcome of India-Nepal development cooperation which has enabled the transfer of technical skills and know-how from India to Nepal. This is in addition to the upgradation of the 132kV Muzaffarpur-Dhalkebar line to 400kV, which was completed in 2016. Two additional 132kV lines between Kataiya & Kusaha and Raxaul to Parwanipur, built with Government of India's, assistance were completed in 2017.
- ***Energy Exchange Trade.*** In February 2021, India introduced the procedure for approval and facilitation of cross- border trade of electricity. In a major step towards a potential sub-regional power grid, the Indo-Nepal cross- border power trade began in April 2021 through the IEX. This is a step towards an integrated power market that will enhance energy access and security, competitive prices and resource optimisation.

Key Challenges

While hydropower remains the key resource for Nepal's power generation, how it is utilised is equally important. In last two decades, the construction of big dams has slowed down throughout the world. They are highly expensive, and have a great social impact in terms of people displaced; there is also immense environmental impact as vast lands of forests are often submerged, land acquisition hurdles, projects are plagued with time delays, and the oftencited major benefit of flood control is increasingly being questioned by scientists, especially amid climate change when extreme weather events like unprecedented rains are becoming increasingly routine.

While there are other delayed projects like Arun 3 and Upper Karnali, to understand this argument, one can look at the Pancheshwar Multipurpose Project. The original

conceptualisation goes back to the 1960s, while it came to the forefront after the signing of the Mahakali Treaty in 1996. The project essentially remained dormant till 2014, when the Pancheshwar Development Authority was created to expedite the project.

Several detailed project reports (DPRs) and studies have been undertaken so far. There was an initial study by Water and Power Consultancy Services Limited in 1971. This was followed by a DPR prepared by Nepal in 1995 and then one by India in 2003.[14] The latest DPR was prepared by WAPCOS Ltd. under the Pancheshwar Dam Authority in 2018. The report highlights key issues pertaining to the vulnerability of the project site and is situated in a "hyperactive seismic environment". The rehabilitation packages for the people, who will be displaced, are yet to be agreed upon by the locals, and the project continues to face resistance from environmental activists who argues that the dam would irreversibly damage the ecological balance around the project site. A preliminary ecosystems study by scientists Mark Everard and Gaurav Kataria, carried out in 2010 for the international organisation, Institution of Environmental Sciences (IES), had concluded that the project was neither ecologically nor economically viable.[15] The study assessed the project against World Commission on Dams' seven strategic priorities and concluded that it failed on all counts. Project costs estimated to have been ranging between INR 330bn to 400bn. The project is expected to generate 9,116 million units of power at 90 per cent dependability.[16] This would increase the cost of every unit of power from the Pancheshwar project from around Rs. 6 to Rs. 8. The average market price for solar energy at the IEX usually hovers around Rs. 3. Since, most of the power generated through the project is expected to be sold to India, the question remains as to whether such expensive power will find any buyers in India.

Way Forward

There is a need to shift focus towards other renewable sources of energy while hydropower should mainly be harnessed via the run-off river projects, which have a relatively less socio-economic and environmental impact. According to Sunil Prasad Lohani from Kathmandu University and Andrew Blakers from Australian National University, a combination of solar power and pumped hydropower can meet the entire power demand in Nepal.[17] Solar energy in Nepal is abundant and cheap, which could be exploited to meet the energy needs of the

country, which would benefit not only domestic consumers but commercial and industrial entities, thus extending the country's economic progress.

The solar potential in Nepal is 50,000 terawatt-hours per year, which is significantly larger than its hydropower potential and its current electricity consumption. Growth in the solar power sector, however, would require help, both technical and financial. India, with its tremendous success in solar capacity expansion, which also led to the world's lowest solar tariffs, can help Nepal in harnessing its solar-hydro potential by sharing its expertise in the same. India could begin by providing a dedicated line of credit to Nepal for expanding solar energy. Both countries should work together for moving towards a completely dutyfree market space for renewable energy equipment especially solar.

The energy sector will continue to remain a strong point and area of common focus for India and Nepal. In contrast, it is understood that the potential for mutual benefits in the energy domain is immense, but this potential remains greatly underutilised. A sustainable approach is required to reverse this situation wherein more practical and attainable projects should be taken up at priority which has a positive impact on local communities in shorter frames of time as compared to large projects, which often face resistance on account of legal, social and environmental grounds.

End Notes

[1] "Annual Report 2020/2021", *National Electricity Authority*, 18 August 2021. Accessible at https://www.nea.org.np/annual_report. Accessed on 16 November 2021.

[2] "Nepal-Countries and Region", *IEA*. Accessible at https://www.iea.org/countries/nepal. Aaccessed on 16 November 2021.

[3] "Annual Report 2016/2017", *National Electricity Authority*, 23 August 2017. Accessible athttps://www.nea.org.np/annual_report. Accessed on 16 November 2021.

[4] "Annual Report 2019/20", *National Electricity Authority*, 18 August 2020. Accessible at https://www.nea.org.np/annual_report. Accessed on 17 November 2021.

[5] N.1.

[6] N.3.

[7] N.1.

[8] "India-Nepal Bilateral Relations", *Ministry of External Affairs*, February 2020. Accessible at https://mea.gov.in/Portal/ForeignRelation/India-Nepal_Bilateral_Brief_Feb_2020.pdf. Accessed on 18 November 2021.

[9] Ibid.

[10] "Agreement on Electric Power Trade, Cross-Border Transmission Interconnection and Grid Connectivity with Nepal", *Business Standard*, 25 September 2014. Accessible at https://www.business-standard.com/article/government-press-release/agreement-on-electric-power-trade-cross-border-transmission-interconnection-and-grid-114092401438_1.html. Accessed on 20 November 2021.

[11] David J Hurlbut, "Cross-Border Energy Trade Between Nepal and India: Trends in Supply and Demand", *National Renewable Energy Laboratory*, April 2019. Accessible at https://www.nrel.gov/docs/fy19osti/72345.pdf. Accessed on 18 November 2021.

[12] Ibid.

[13] Prithvi Man Shrestha, "Nepal, India sign deal to build 400 kv power line", *The Kathmandu Post*, 10 September 2021. Accessible at https://kathmandupost.com/money/2021/09/10/nepal-india-sign-deal-to-build-butwal-gorakhpur-power-line. Accessed on 19 November 2021.

[14] "Pancheshwar Multipurpose Project Detailed Project Report", *Pancheshwar Development Authority*, 2017. Accessible at https://savemahakali.files.wordpress.com/2017/10/section-1-executive-summary-final.pdf. Accessed on 19 November 2021.

[15] Mark Everard and Gaurav Kataria, "The proposed Pancheshwar Dam, India/Nepal: a preliminary ecosystem services assessment of likely outcomes", *Institution of Environmental Sciences*. Accessible at https://www.the-ies.org/sites/default/files/reports/pancheshwar_dam.pdf. Accessed on 19 November 2021.

[16] Manshi Asher, "What Lies Behind the Resistance to India's Highest Dam?", *The Wire*, 19 February 2018. Accessible at https://thewire.in/environment/uttarakhand-lies-behind-resistance-building-countrys-highest-dam. Accessed on 20 November 2021.

[17] Andrew Blakers and Sunil Prasad Lohani, "Solar energy: Nepal's most sustainable resource", *The Himalayan Times*, 01 December, 2020. Accessible athttps://thehimalayantimes.com/opinion/solar-energy-nepals-most-sustainable-resource . Accessed on 20 November 2021.