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The Price of Power

The political economy of electricity trade and hydropower in eastern South Asia

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By
The Asia Foundation
114 Jor Bagh, First Floor
New Delhi – 110003
E-mail: india.general@asiafoundation.org
Website: http://asiafoundation.org/

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Overview

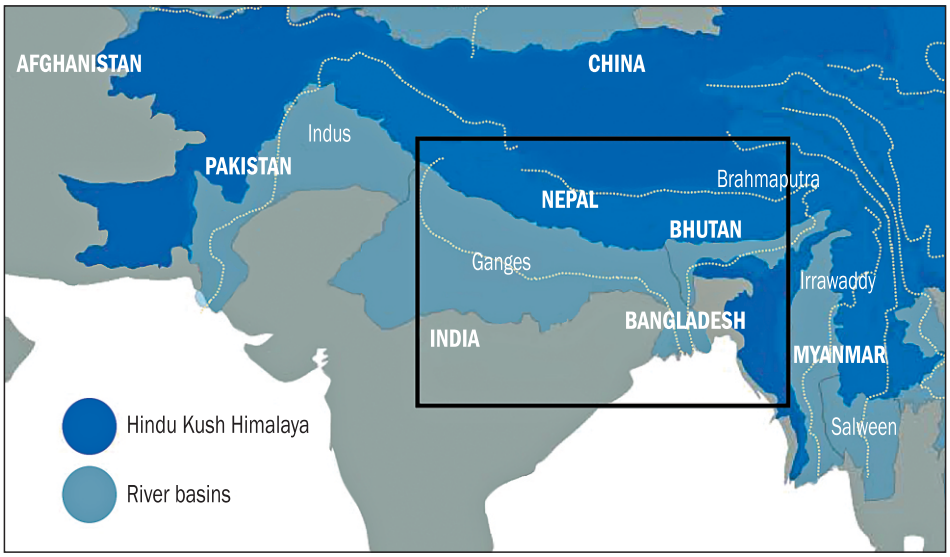
In the winter of 2016, India's ministry of power issued guidelines that defined the limits of electricity trade with South Asian neighbors. In a phraseological departure from earlier documents on regional power cooperation, it called electricity a 'strategic' commodity. This is with reason. Electricity's central role in economic growth makes it a focal point for contestations in democratic politics across the world, and it is no different in South Asia. The interdependencies created by regional electricity markets can diversify the generation pool and reduce the cost of electricity, but, like all forms of regional cooperation, they are also a vulnerability. The process of their creation must, therefore, first pass the test of politics. A failure of trust in South Asia has led to the creation of a sub-regional bloc called BBIN (an abbreviation for Bangladesh-Bhutan-India-Nepal), which today serves as the functional core of the South Asian regional project. One of the bright spots of BBIN has been the growth of cross-border electricity trade between the four countries. The complementarity of supply and demand in the four countries creates a firm economic logic for the growth of power trade, which is buttressed by largely stable diplomatic relations. This could serve as the nucleus of a broader South Asian electricity market when geopolitics permits. At present, however, cooperation in the sub-region is nascent; it emphasizes the joint creation of regional power assets, such as power plants and transmission lines, but is far from creating shared, independent institutions to govern a full-fledged electricity market.

Shifts in the global balance of power have been a hinderance. China has recently been more assertive in exercising economic and diplomatic power in South Asia. India's objectives for electricity trade in the BBIN sub-region, crystallized in the guidelines mentioned above, are shaped by China's recent overtures to its neighbors. They are designed as a response that asserts its geographic and economic centrality in the region. This marks a shift from earlier attempts to lay the foundations for a liberal and open power trading environment. Indian policy serves the purpose of ring-fencing Chinese influence in the energy sectors of its neighbors by imposing conditions on access to India's vast demand base.

Parallel developments in the operating environment of India's domestic power sector have changed the economic logic of BBIN electricity trade for the coming decade. India's distribution companies, historically plagued by large operating losses, high debt burdens and incorrect demand estimations have shown a degree of price sensitivity in their power procurements. A freefall in renewable prices in the last twenty-four months and the availability of cheap, surplus thermal power has made relatively expensive hydropower, both domestic and imported, an unattractive commodity. Hydropower generators in Bhutan and Nepal will find it difficult to locate profitable sources of demand in the Indian market. Bangladesh, on the other hand, will continue to pursue Himalayan

hydropower. Faced with an impending energy crisis due to the depletion of its gas reserves, it seeks to diversify its fuel base. It has shown a willingness to invest in hydropower in Bhutan and Nepal and import power through the Indian grid. Power imports are projected to play a significant role in its long-run energy planning.

This survey of the political economy of electricity trade reveals two broad lessons for the future. First, forging a regional compact on electricity markets is an incremental process that takes years, if not decades. As geopolitical calculations change, particularly in unpredictable regions such as South Asia, new countries might join the trading arrangement while others leave. That the center of gravity has shifted from SAARC to the BBIN construct is an illustration from the recent past; India's ambition of trading electricity with southeast Asia might be a glimpse of the future. The economics of supply and demand might change as well. As economies grow, countries that were once net consumers could become net suppliers. Conversations about regional power markets must be grounded in these political economy realties, moving beyond abstract ideas of 'political will'. Second, the disruption caused by India's once-in-a-century transition to renewables could permanently alter the economics of energy. Hydropower from the Himalayas might become a necessary complement to solar and wind power in the long run, called into action when the sun stops shining and the wind blowing. This could have a lasting impact on the management of rivers, the response to climate change and the water-food-energy nexus in the region.



Map from International Centre for Integrated Mountain Development (ICIMOD), Kathmandu

Introduction

Lower electricity prices make goods across most sectors of the economy cheaper, thereby stimulating consumption and contributing to national prosperity. Ignoring national borders allows the region's energy planners to consider larger geographies for the exploitation of natural resources and investments in power generation. A country in the mountains with abundant hydropower potential or one by the sea floating on a pocket of natural gas could generate power for others in the region. Economies of scale are, in these instances, smartly harnessed by building larger power plants than would have otherwise been built. Less money is invested in replicating costly power plants across countries. Beyond economic considerations, regional interdependencies make regions more stable. Power trading agreements create long-term interdependencies; countries are more likely to avoid conflict in the neighborhood to safeguard their own economic interests. Over time, cooperation on essential resources, such as electricity and water, builds trust and stimulates cooperation in other areas of bilateral and regional interest.

South Asia, generally described as 'the least integrated region in the world', has made remarkable progress in this direction over the last two decades. The idea for a South Asian 'energy ring' was first fielded in the declaration that accompanied the 12th summit of the South Asian Association for Regional Cooperation (SAARC), South Asia's regional grouping, held in Islamabad in 2004. Brief and limited in ambition, the declaration merely called for a 'study' on the issue.[1] A year later, a SAARC Energy Center was created in Islamabad to drive the creation of the energy ring, as its website still notes. The idea of the energy ring went beyond the trade of electricity to include the trade of fuels such as oil and gas, the exchange of technology and improvements in energy conservation in the region. Through the early 2000s in India, regional cooperation began to be seen as a potentially useful tool in tackling what was mounting to an energy crisis. A decade and a half after liberalizing its economy in the early 1990s, growth rates had begun to surge while power supply lagged. In response, the policy base for an ambitious expansion of power generation was laid. This included, among other things, a focus on commissioning large multi-gigawatt capacity coal-fired power plants and governance reform through the landmark Electricity Act of 2003, which sought to introduce competition in generation, private sector involvement in the power supply chain, and corporatize ossified state electricity boards.

Nepal and Bhutan put their collective political weight behind South Asian power trade. Their interest was in attracting investment to harness vast untapped hydropower reserves and generate revenue through its sale after satisfying relatively meagre domestic demand. Bangladesh and Pakistan, both experiencing deficits in their power sectors through the early 2010s, would act as sources of demand alongside India. The economic logic was strong, and a moment of geopolitical opportunity in 2014 led to the apotheosis of the idea, a SAARC Framework Agreement for Energy

1. South Asian Association for Regional Cooperation, "Islamabad Declaration," January 6, 2004, http://saarc-sec.org/uploads/digital_library_document/12_-_Islamabad_-12th_SAARC_Summit,_4-6_January_2004.pdf.

Cooperation on electricity signed by eight constituent governments. A new government in India, elected with a historic majority that year, had made clear within a few months of coming to power that its foreign policy placed a high priority on economic diplomacy in its immediate neighborhood. In 20 articles and five pages, the framework agreement painted a broad and economically liberal vision of the future of South Asian power cooperation. Among its notable features was an agreement to work towards reducing duties and taxes on electricity trade and the adoption of a broad definition of buying and selling entities that included private sector players, a meaningful signal of intent to the private sector in a region of state-backed power generators.[2] In a moment of exuberance at the 5th meeting of SAARC energy ministers in New Delhi a few months after the change of government, India's then minister for power, coal and renewable energy laid out a tangible vision: "Rivers can flow only in one direction, but power can flow in the direction of our choice! I dream of a seamless SAARC power grid within the next few years. For example: hydroelectric power generated in North East India could be transported via Bangladesh, India and Pakistan, on to Afghanistan or offshore wind projects could be set up in Sri Lanka's coastal borders to power Pakistan or Nepal. The possibilities are limitless!".[3] Only a month before signing the South Asia-wide agreement, India had concluded a power trade agreement with Nepal that adopted a similarly liberal stance. Towards the end of 2014, private investors, regional analysts and power sector officials from the four countries began to feel that the long-term trajectory was locked onto the vision of a common electricity market for the region. In one telling press release from India's ministry of power, the framework agreement was called 'a crucial step towards developing a SAARC Market for Electricity (SAME) on a regional basis'.[4] An evolved common market is the purest distillation of regional power sector cooperation, leaving independent regulators and grid operators autonomy to manage the regional grid and creating conditions for the transparent discovery of electricity prices by matching supply and demand.

The SAARC moment was not to last, however. A widening diplomatic rift between India and Pakistan has taken the momentum out of the SAARC process, which operates on consensus between member countries. While the framework agreement could serve as the guiderails for future SAARC cooperation on electricity, the locus of regional cooperation has in recent years shifted to a sub-regional grouping of four SAARC countries called BBIN (an abbreviation for Bangladesh, Bhutan, India and Nepal). These countries are geographically contiguous and unburdened by the geopolitical contentions that undergird the relationship between India and Pakistan. The grouping has relatively low levels of institutionalization (it does not have a permanent secretariat, for example, and operates through working groups) but benefits from strong political backing from the highest

2. South Asian Association for Regional Cooperation, "SAARC Framework Agreement for Energy Cooperation (Electricity)," November 2014, http://www.moen.gov.np/pdf_files/SAARC-Framework-Agreement.pdf.

3. Press Information Bureau, Government of India, "Shri Piyush Goyal Calls for Building SAARC Power Grid," October 17, 2014, http://pib.nic.in/newsite/PrintRelease.aspx?relid=110632.

4. Press Information Bureau, Government of India, "Saarc Countries Finalized Framework Agreement for Energy Cooperation," October 17, 2014, http://pib.nic.in/newsite/PrintRelease.aspx?relid=110645.

levels of the four governments. Early success with a four-way pact to allow free motor vehicle movement between the countries has led to excitement about an agenda that spans infrastructure and transport, telecommunications, inland waterways and power trade. At the core of the group lies the Bangladesh-India bilateral relationship, driven by a high degree of complementarity in interests and friendly relations between the governments.

The origins of power trade in South Asia can be traced back to small border-town exchanges between India and its northern neighbors Bhutan and Nepal in the 1960s and 70s. The first major demonstration of the potential of power trade was the 336 MW Chhukha hydropower project in Bhutan, commissioned in 1986. The hydropower plant was built with Indian assistance, and surplus power after Bhutanese consumption was sold to the Indian grid. This early success made a compelling case for Indian financing of over 1.6 GW of Bhutanese hydropower (almost its entire capacity), most of which is exported to eastern and northern India.[5, 6] Indian financing has had a significant impact on the Bhutan's macroeconomic indicators. The Bhutanese Royal Monetary Authority's Annual Report for 2016-2017 shows that revenue from the hydropower sector constitutes around 20 percent of the country's revenue and 40 percent of the country's exports to India, its largest trading partner. Loans to build hydropower have, however, left the country heavily indebted to India with total hydropower sector debt at 80 percent of GDP.[7]

The Bhutanese experience was the prototype for power sector collaboration in the BBIN sub-region. In theory, Nepal is similarly positioned. It has abundant hydropower potential and its economy could benefit from additional power that satisfies long suppressed demand. Yet the construction of hydropower plants financed by Indian entities has met with little success. In fact, despite attempts, Indian state-owned and private hydropower companies have failed to finance or build any significant hydropower plants in that country since the mid-1980s, when a 14 MW plant was commissioned. Two projects, the 900 MW Upper Karnali (to be built by a private Indian company, GMR) and the 900 MW Arun III (to be built by Indian public utility Satluj Jal Vidyut Nigam Limited) have been delayed for years for a variety of reasons, from political instability and local opposition to a failure to receive clearances. These projects could take the better part of the next decade to reach completion.

Bangladesh has expressed interest in buying 500 MW of the Upper Karnali's capacity of 900 MW, introducing an important trilateral dynamic to power trade in the region. Bangladesh, which is fast

5. The Chhukha plant was followed a 1,020 MW plant at Tala, a 60 MW plant at Kuricchu and a 126 MW plant at Dagachhu. Three more plants totaling around 3 GW, Punatsangchhu 1 and 2 and Mangdechhu, should be completed in the coming five years.

6. Cecilia Tortajada and Udisha Saklani, "Hydropower-Based Collaboration in South Asia: The Case of India and Bhutan," *Energy Policy* 117 (June 2018): 316-25.

7. Royal Monetary Authority of Bhutan, "Annual Report 2016/17," 2018, 51-52, https://www.rma.org.bt/RMA%20Publication/Annual%20Report/annual%20report%20%202016-2017.pdf.

running out of the natural gas that fuels its economy, faces a future of reliance on expensive imported coal and gas. Over the past year, Bangladesh has made diplomatic efforts to source power from hydropower projects in Bhutan and Nepal that is to be imported through Indian territory.[8] With the power deficits of the mid-2000s a distant memory, India today must grapple with the twin problems of excess capacity and distribution companies that are unable to stomach expensive hydropower due to perennial losses. The presence of an alternate source of demand for Himalayan power in Bangladesh, with an economy of over 160 million people growing at around 6 percent a year, is a crucial element in the medium-term future of power trade in South Asia. India currently exports 660 MW of thermal power to Bangladesh through two cross-border transmission lines that are being expanded to a total capacity of 1.6 GW. A private Indian company, Adani Power, will add around 1.5 GW to that total through exports from an ultra-supercritical coal plant in the eastern Indian state of Jharkhand.

Regional power cooperation has come a long way from exchanges of power between small border towns and early ideas for an energy ring. By 2025, trade could be powered by ten power plants with installed capacities of around 9 GW and half a dozen high capacity transmission lines.[9] This comes at a critical moment. The region has entered the age of renewables just as this vision of an inter-connected sub-region takes shape. India is rapidly adding renewable energy capacity to its grid as it scales back construction of thermal power till 2027. It aims to install 175 GW of renewable energy capacity by 2022 and source 40 percent of its installed capacity from non-fossil fuel sources by 2030 in order to meet its mitigation pledges under the Paris climate accord. As this transition takes place, meeting peak power demand will become a challenge when the sun stops shining or the wind blowing. This is a challenge that hydropower, domestic or imported, is well-suited to solve since it can generate power at short notice. As this report illustrates, however, the rapid development of hydropower in the region remains uncertain for a variety of reasons. For energy planners, keeping demand and supply in lockstep through this period of transition, ensuring that costs are kept low and that the energy-mix continues to meet climate commitments is a daunting task. In the sections that follow, we describe the geopolitical, institutional and economic factors that could impede the energy security of the region.

This report begins with a description of the general evolution of regional electricity markets and the BBIN market's current place in that trajectory. The second section frames the geopolitical context in which this market is evolving. The third section surveys demand signals for Himalayan hydropower over the next decade, with a focus on India's power market and Bangladesh's energy crisis. The final section concludes.

8. Bangladesh could invest USD 1 billion in a 1.1 GW hydropower project in Bhutan.

9. Seven plants from Bhutan with a capacity of 4.5 GW, two plants in Nepal of 1.8 GW, a coal-plant in India of 1.5 GW and additional power exports from India to neighbors totaling 1 GW.

The evolution of regional electricity markets

Each regional electricity market is unique. In South Asia, power traders and generators sometimes describe a complete regional market as the end goal of cooperation. This vision holds that generators across the region compete in a pool to offer the lowest prices to consumers that are free to choose their source of supply. This pool would ideally be governed by an independent regulator and transmission system operator. Prices are discovered through the transparent matching of demand and supply. The emergence of thriving power exchanges in India provides grounds to argue that this vision is attainable. There are, however, several hurdles to be crossed before regional power pools across sovereign boundaries can be made fully functional. This section describes the broad stages in the evolution of regional electricity markets and locates present-day BBIN in that trajectory. It also points out that the construction of cross-border transmission infrastructure between BBIN countries should not be mistaken for a decisive move towards a regional energy market but seen as an incremental extension of the Indian national grid through bilateral connections with Bhutan, Nepal and Bangladesh, done project by project, through short-term, small-batch pricing and supply agreements.

Recent comparative analyses of global experiences in creating electricity markets and regional trading arrangements reveal a pattern in their evolution.[10] In their infancy, regional trading projects typically involve power generators that export power to a neighbor through cross-border transmission lines built specifically to evacuate power from that power plant. The infrastructure, such as the power plant and the transmission line, could be jointly funded by the governments or private companies of the two countries. In the second stage, if the logic of demand and supply permits, a third country might enter the equation to make trading arrangements tripartite. Cross-border transmission lines might begin to be seen as regional goods that move power over a country's territory without being consumed there. This is a critical step towards a regional network. The third stage cements trading arrangements in multilateral institutions. This could involve the creation of an independent system operator that operates the regional grid, or an independent regulator that worries about emerging monopolies, pricing and the construction of sufficient transmission capacity to keep the grid from choking. If there is adequate political commitment, countries might agree to an open market that allows generators to compete through transparent pricing mechanisms. This stage might, in parallel, witness an expansion in the number of countries participating as new entrants tap into the benefits of stable, transparent institutions that usually produce lower electricity prices. The three stages broadly follow this sequence but may not always be neatly separated.

10. Musiliu M. Oseni and Michael G. Pollitt, "Institutional Arrangements for the Promotion of Regional Integration of Electricity Markets," Working Paper, Policy Research Working Paper (World Bank Development Research Group, June 2014), http://documents.worldbank.org/curated/en/707091468183843171/pdf/WPS6947.pdf; Niru Yadav et al., "Regional Power Cooperation and Trade: Lessons for South Asia" (Hydropower-based collaboration in South Asia: Socio-economic development and electricity trade, Kathmandu, 2017).

The BBIN sub-region is nascent, situated between the first and second stages. The total volume of cross-border trade is approximately 2.2 GW out of a total installed capacity of over 340 GW in these four countries. There are seven transmission lines that shoulder this trade, though both the volume and number of transmission lines will increase in coming years. A significant portion of investment in transmission and generation assets comes from Indian government or the country's private sector. The rules of trade, as the next section will show, are decided by India and their implementation governed by its national institutions in the absence of independent regional institutions.

Third-country access to existing transmission infrastructure between two countries is a bridge to more complex multi-country arrangements. The Southern African Power Pool (SAPP) is built on several bilateral agreements that laid the foundation for tripartite agreements and third-country access. A series of tripartite agreements between Botswana, Democratic Republic of Congo, Mozambique, South Africa, Swaziland, Zambia and Zimbabwe in the 1990s served as the foundations for the Southern African market.[11] South Asia is moving in this direction. In 2017, Bangladesh, Bhutan and India signed a trilateral Memorandum of Understanding (MoU) that laid the groundwork for Bangladesh to invest in a 1,125 MW hydropower project in Bhutan with electricity to be exported to Bangladesh via India.[12] Similarly, Bangladesh has expressed interest in signing a power purchase agreement (PPA) for the 900 MW Upper Karnali project in Nepal, with power wheeled through India.[13]

Progress towards the third stage, that of a fully formed regional power pool characterized by competition between generators and independent supra-national governance mechanisms, is contingent on broader political commitment to the free flow of goods and services in the region. The stamina to re-define notions of sovereignty and overcome domestic lobbying efforts are more likely to exist in these cases, paving a smoother path to a power pool. Oseni and Pollitt point out that agreements on the trade of goods and services generate the necessary trust between countries for a regional power pool.[14] By this metric, the BBIN grouping exhibits some of the characteristics required for grid integration. It has received political support from the highest levels of the four governments and the agenda for cooperation covers transport, connectivity and water resources management apart from electricity trade. Overall, however, BBIN cooperation is presently issue focused, driven by a determination to harness the benefits of low-hanging fruit rather than by a broader vision for the free flow of goods and services.

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11. Niru Yadav et al., "Regional Power Cooperation and Trade: Lessons for South Asia."
12. "Bhutan to Supply Hydropower to Bangladesh through India Soon," *ETEnergyworld.Com*, July 2017, http://energy.economictimes.indiatimes.com/news/power/bhutan-to-supply-hydropower-to-bangladesh-through-india-soon/59434785.
13. Bibek Subedi, "GMR, B'desh to Sign Deal to Evacuate Power," *Kathmandu Post*, July 7, 2017, http://kathmandupost.ekantipur.com/news/2017-07-06/gmr-bdesh-to-sign-deal-to-evacuate-power.html.
14. Musiliu M. Oseni and Michael G. Pollitt, "Institutional Arrangements for the Promotion of Regional Integration of Electricity Markets."

An important juncture in the evolution of a regional market is the creation of an independent grid operator and regulator. The evolution of such institutions generally takes several years, if not decades, as seen in the cases of the Central American (SIEPAC) and Nordic power markets (Nordpool). Such power pools typically prioritize the principles of the market, foster competition between generators to reduce prices and improve reliability, build in dispute resolution mechanisms and undertake joint planning and investment for expansion of the grid. These conditions allow spot markets to grow, allowing utilities to balance short-term fluctuations in supply and demand. Commitment to designing sophisticated electricity markets are often also reflected in national legislation that entrenches policies and regulatory frameworks.[15] Geopolitics must permit the creation of such institutions, which are essentially a product of high trust levels between participating countries. These markets also require large amounts of pre-existing transmission capacity that can meet demand at short notice without risking grid congestion. Neither the trust nor the infrastructure needed for the markets described here exist in South Asia or the BBIN sub-region at present.

Instead, electricity trade in the BBIN sub-region is better understood as the incremental extension of India's national grid. The seven-decade process of creating a unified national grid across thirty political entities (29 states and the central government) forms the core of India's technical imagination for electricity trade in the region. The Indian grid is seen as the nucleus from which branches extend radially to leverage demand and supply in neighboring countries through state-controlled power traders or private exchanges; in this construction, its value as the core is derived from the fact that the grid has independent regulators and system operators at multiple scales, spot markets, power traders and several, interlocking layers of policy and regulation built on a half-century of trial and error.

India's Central Electricity Authority (CEA) describes the gradual development of a synchronous national grid as the necessary groundwork needed for India to harness the benefits of SAARC interconnections. Indian grid formation began in the 1950s with the creation of state grids cobbled together from fragmented local distribution networks. These efforts were implemented by newly formed State Electricity Boards that were, at the time, vertically integrated utilities responsible for generation, transmission and distribution within their jurisdictions. State grids were connected to form five regional grids through the 1970s and 80s. A national grid was created in 2014 when the power-starved southern grid was connected to the 'NEW' (North, East, West) grid to create 'one of the largest electricity grids operating at a single frequency in the world'.[16] The CEA's approach to integration with South Asian neighbors mirrors the incrementality seen in national grid expansion. The CEA stresses that cross-border interconnections must be 'integrated step-wise' through 'need

15. Niru Yadav et al., "Regional Power Cooperation and Trade: Lessons for South Asia."

16. Central Electricity Authority, "Indian Power Sector" (Roundtable Discussion on Connecting North-East India to South East Asia for Power Trading, India Habitat Center, New Delhi, May 18, 2017).

based planning', and that 'quantum jumps' were 'undesirable'. The guidelines on cross-border trade in electricity issued by the Indian ministry of power explicitly states that "grid security is paramount, therefore, cross border electricity trade would be undertaken in a manner that does not jeopardize grid security at any point" (sic).[17]

While a technical imagination rooted in incrementalism and caution is bound to play a role in the pace and depth of progress, the strategic calculus that underpins India's attempts to create a uniform framework for South Asian electricity trade is, perhaps, the most crucial element of its political economy, as the next section demonstrates.

17. Ministry of Power, Government of India, "Guidelines on Cross Border Trade of Electricity," December 5, 2016, http://powermin.nic.in/sites/default/files/webform/notices/Guidelines%20for%20Cross%20Boarder%20Trade.pdf.

Guidelines and geopolitics

The contest for influence between China and India is rapidly intensifying in South Asia. Since 2014, China has been less reticent in the exertion of its growing economic, diplomatic and military strength beyond its borders. The friction of a changing balance of power can be seen in several geopolitical contests across the world, of which South Asia is one. This section describes how a part of the South Asian contest has played out in the realm of energy. India's objectives for electricity trade in the BBIN sub-region are shaped by China's recent overtures to neighbors in South Asia; Indian policy on regional electricity trade serves the purpose of ring-fencing Chinese influence in the energy sectors of South Asian neighbors by imposing conditions on access to India's vast demand base. This section begins with an overview of China's recent energy initiatives in South Asia. It concludes by describing the transformation of India's regional electricity trade strategy from one that prioritized relatively unencumbered open-border trading schemes to one designed to assert its geographic and economic centrality in the region.

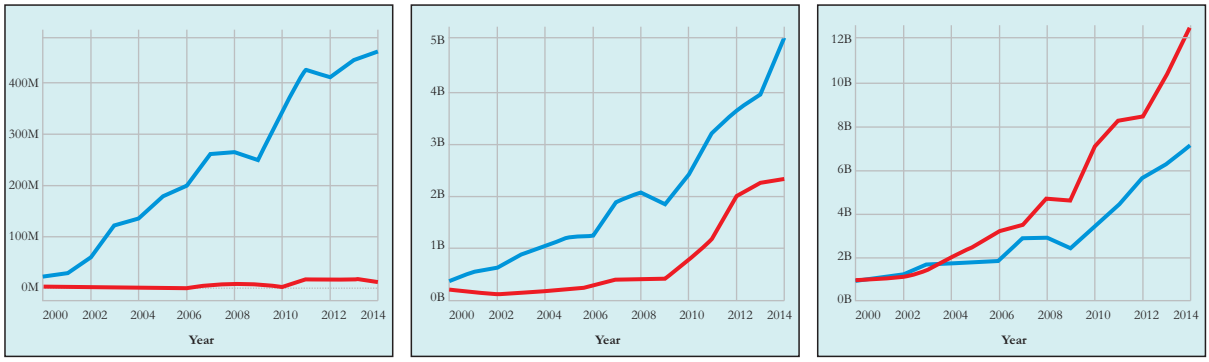
China in the neighborhood

China has been more assertive in global affairs. It has, in the last half-decade, adopted a more active voice in agenda-setting for climate change and global trade. It has been more open about projecting force in the Pacific and the Indian Ocean region, and has built alliances in the two regions by providing countries access to cheap capital, exports and technical expertise. Its Belt and Road Initiative (BRI) seeks to deploy unprecedented amounts of foreign aid and development loans, estimated to total USD 1 trillion, on infrastructure, connectivity and energy programs across Europe and Asia to build its export markets, deepen diplomatic ties and expand influence in areas where China has traditionally not played a major role.[18] This has had implications for the balance of power in South Asia, with India's neighbors increasingly engaging with China on large infrastructure projects. China's traditional toehold of influence in South Asia has expanded from Pakistan to include closer ties with Sri Lanka, Nepal and the Maldives in the last decade while significant overtures have been made to Bangladesh, Afghanistan and, reportedly, Bhutan. India opposes the BRI in South Asia though BRI investments are likely in all South Asian countries except Bhutan and India. Indian foreign policy has long held South Asia to be its sphere of influence; shifts in the regional order have prompted it to balance growing Chinese influence. Observers of the region note: "As China steps up its engagement with the region and promotes Asian connectivity, largely through its Silk Road "belt and road" vision, it can marshal extensive resources on initiatives such as the Asian Infrastructure Investment Bank that will likely outpace other financial sources. With an eye on India's own regional position, Prime Minister Narendra Modi has doubled down on his outreach across South Asia, stressing infrastructure development, people-to-people connectivity,

18. Jane Perlez and Yufan Huang, "Behind China's $1 Trillion Plan to Shake Up the Economic Order," *The New York Times*, May 13, 2017, sec. Business Day, https://www.nytimes.com/2017/05/13/ business/china-railway-one-belt-one-road-1-trillion-plan.html.

and a "lift all boats" approach to help India's neighbors gain from its own rise".[19] The BBIN initiative is set against this backdrop of geopolitical competition and rooted in India's need to spread the benefits of regional cooperation in the absence of a functional SAARC process. India has, therefore, pushed the thrust of South Asian cooperation away from its fraught relationship with Pakistan to the relatively less contentious eastern half of South Asia under the BBIN banner.

Fig 1: The three charts compare Chinese and Indian trade volumes in Bhutan, Nepal and Bangladesh, from left to right. Indian trade volumes are in blue, Chinese trade volumes in red. Chinese trade with Nepal has increased sharply since 2008; China has been Bangladesh's top trading partner since 2004. From Ashlyn Anderson & Alyssa Ayres, 2015.



Nepal's historic election in 2017 under a new Constitution led to the victory of a leftist coalition between the Communist Party of Nepal (Maoist) and Communist Party of Nepal (Unified Marxist-Leninist) and prompted alarm in India's strategic community over the possibility of further drift into China's orbit.[20] The new government has signaled that it will attempt to balance India and China to ensure the flow of capital and technology to meet its development needs. Within days of taking office, there were assertions from the new prime minister to this effect.[21] Closer ties between China and Nepal have been particularly worrying for New Delhi. China is already the largest source of foreign direct investment in the country. At a recently concluded investment summit held in Kathmandu, China was the largest potential contributor with pledges of USD 8.3 billion.[22] It has already made its first moves in hydropower investment. In late 2016 and early 2017, two Chinese

19. Ashlyn Anderson and Alyssa Ayres, "Economics of Influence: China and India in South Asia," Council on Foreign Relations, August 3, 2015, https://www.cfr.org/expert-brief/economics-influence-china-and-india-south-asia.

20. The Government of India has historically had strained relations with the communist parties in Nepal; these were weakened further by India's alleged support for a six-month blockade of the country sparked by perceived discrimination in the country's new constitution against people living in the southern plains who are largely of Indian descent. Current and then Prime Minister K.P. Oli turned to China immediately after the blockade in 2015 to decrease reliance on Indian fuel; prior to taking office again in February 2018, the Prime Minister made a symbolic trip to inspect the country's only functioning international border crossing with China in the district of Rasuwagadi.

21. K.P. Oli, the new prime minister explained this shift in the country's foreign policy to the South China Morning Post: "We have great connectivity with India and an open border. All that's fine and we'll increase connectivity even further, but we can't forget that we have two neighbours (…) We don't want to depend on one country or have one option".

22. Ministry of Foreign Affairs Nepal, "Nepal-China Relations," accessed February 19, 2018, http://mofa.gov.np/nepal-china-relations/.

supported hydropower projects began generating power; the Upper Marsyangdi A and Upper Madi projects have a combined capacity of 75 MW. The former was constructed by a company in which Sino Hydro Resources Ltd., owned by the Government of China, owns 90 percent of shares while the latter was developed by China International Water and Electric Co., a subsidiary of China Three Gorges Corporation.[23] Reservoir projects are seen by Nepal's government and hydropower experts as critical to the country's energy security, particularly in dry winter months when output from numerous small run-of-the-river hydropower projects falls. China's other highly-publicized foray into large reservoir hydropower has met with controversy. The 1,200 MW Budhi Gandaki hydropower project was scrapped in a joint meeting of the Nepal Parliament's Agriculture and Water Resources Committee and Finance Committee ostensibly due to irregularities in the award of the contract to China Gezhouba Group Corporation.[24] The NEA will now develop the project, likely with domestic funds.[25]

Not since 1984, when the 14 MW Devighat hydropower project on the Trisuli river was commissioned on an Indian grant, has India substantially contributed to new hydropower in Nepal. The Devighat plant came almost two decades after India's first demonstration of hydropower aid in 1967. The two projects have a combined capacity of approximately 40 MW. Indian involvement in Nepal's hydropower sector currently takes the form of the Arun III hydropower project, which is being built by the state-backed Satluj Jal Vidyut Nigam Ltd. in the Kosi basin, and the Upper Karnali project being built by a private Indian company, GMR. Both projects have encountered significant delays.

Chinese overtures to Bangladesh have evoked less concern in India, given its currently warm ties with Bangladesh and Bangladesh's energy crisis (described in greater detail in the next section of the report). China's efforts have, nonetheless, had the collective effect of establishing it as a significant external player in Bangladesh's power sector alongside India, Japan and Russia. President Xi Jingping's visit to Bangladesh in 2016, the first by a Chinese President in 30 years, concluded with the extension of lines of credit worth USD 24 billion, the largest in Bangladesh's history, and an upgrade of the bilateral relationship to a strategic partnership.[26, 27] China's intention of playing a

23. Rudra Pangeni, "Two China-Built Projects Starting Generation This Year," *My Republica*, July 23, 2016, http://www.myrepublica.com/news/2534/.

24. Sanjeev Giri, "Govt Asked to Scrap Budhi Gandaki Deal with Chinese Firm," *Kathmandu Post*, September 26, 2017, http://kathmandupost.ekantipur.com/news/2017-09-26/govt-asked-to-scrap-budhi-gandaki-deal-with-chinese-firm.html.

25. Sanjeev Giri.

26. Ruma Paul, "China Signs Deals Worth Billions with Bangladesh as Xi Visits," *Reuters*, October 14, 2016, https://www.reuters.com/article/us-bangladesh-china/china-to-sign-some-24-billion-in-loans-to-bangladesh-as-xi-visits-idUSKCN12D34M.

27. Some of the 27 deals signed on that visit related to energy, including agreements to construct two 1,320 MW thermal plants in Patuakhali and Chittagong, a USD 1.6 billion deal with TBEA, a state-backed Chinese transmission company and a USD 1.1 billion agreement with a Chinese company on strengthening the country's power grid.

more central role in Bangladesh's energy sector was reiterated a few months later, in the summer of 2017, when a Chinese consortium comprised of state-backed China ZhenHua Oil and a government investment firm, CNIC Corp., came close to acquiring gas fields in Bangladesh's northeast that account for more than half of the country's total output. The deal fell through when Chevron, the current owners, decided not to sell their assets.[28]

China has also offered Bangladesh 3,000 MW of power for a 15-year period from Kunming in China's southern Yunnan province, routed through Myanmar. The offer has evoked interest in Bangladesh's Ministry of Power, Energy and Mineral Resources, with early thinking underway for a transmission line between Bangladesh and Myanmar. A report on Bangladesh's perspective on BBIN electricity trade that interviewed officials from the country's energy and foreign affairs bureaucracies found that Bangladesh was 'strategically neutral' on electricity trade and would accept energy from any source, its primary concerns being diversification away from shrinking natural gas reserves and containing electricity prices.[29] The offer comes against the backdrop of warming ties between China and Myanmar and a recent surplus of electricity in Yunnan.[30] The concept of linking Yunnan, Myanmar and Bangladesh is nearly two decades old. First floated in 1999, the Kunming Initiative was a regional connectivity proposal that envisioned the revival of road links between Kunming, Mandalay, Dhaka and Kolkata. Subsequent iterations of the idea expanded its scope to include trade, transport and energy.[31] The proposal was initially approached with some reluctance by New Delhi, with concerns over the dumping of Chinese goods and border security in India's restive northeast. The idea underwent a short-lived revival in 2013 after a car rally from Kolkata to Kunming and a high-level endorsement by the Chinese Premier during a visit to New Delhi. Energy cooperation excluding India - between Bangladesh, China and Myanmar – could now find fresh impetus due to a favorable configuration of supply and demand in the three countries and China's foreign infrastructure push through the BRI.

The offer for trilateral cooperation was put forth by Chinese Global Energy Interconnection Development and Cooperation Organization (GEIDCO), an organization formed in 2016 to promote the connection of transregional energy grids. GEIDCO has positioned itself as a key

28. Aminur Rahman Rasel, "Chevron Officially Announces to Stay in Bangladesh," *Dhaka Tribune*, October 29, 2017, http://www.dhakatribune.com/bangladesh/power-energy/2017/10/29/ chevron-announces-stay-bangladesh/; Krishna Das and Serajul Quadir, "Chevron to Sell Bangladesh Gas Fields to Chinese Consortium," *Reuters*, April 24, 2017, https://www.reuters.com/ article/us-china-bangladesh-chevron/chevron-to-sell-bangladesh-gas-fields-to-chinese-co-idUSKBN17Q0WS.

29. Ijaz Hossain et al., "BBIN Electricity Trade in Bangladesh: A Survey of Prospects and Challenges," January 2018, 37.

30. Yimou Lee and Shoon Naing, "China in Talks to Sell Electricity to Myanmar amid Warming Ties," *Reuters*, August 4, 2017, https://www.reuters.com/article/us-myanmar-china-energy/exclusive-china-in-talks-to-sell-electricity-to-myanmar-amid-warming-ties-idUSKBN1AK011.

31. K. Yhome, "The BCIM Economic Corridor: Prospects and Challenges," Observer Research Foundation, February 10, 2017, http://www.orfonline.org/research/the-bcim-economic-corridor-prospects-and-challenges/.

institution in the constellation of Chinese organizations implementing BRI. A speech by the Chairman of GEIDCO at the Belt and Road Forum in Beijing in 2017 illustrated a vision for global energy integration (a concept referred to as GEI in GEIDCO's phraseology) by leveraging 'mature' transmission technology and creating a cleaner global energy mix.[32] The offer to Bangladesh was initially made during a series of visits to Bangladesh, Myanmar and Lao PDR in July 2017, during which GEIDCO's vision was laid out in terms of a practical regional objective for South and Southeast Asia. A report on GEIDCO's website, quoting its Chairman's comments in these meetings, states, 'IndoChina Peninsula and neighboring regions have a large population, small fossil energy reserves, abundant hydropower resource reserves, but small per capita power consumption with huge development potential, which needs time to build an integrated synchronous grid that connects with China on the North and with South Asia on the West, thus realizing optimized power resource allocation on a larger scale (sic)'.[33]

Why are India and China focused on the energy sectors of South Asian countries? Infrastructure development in the energy sector often comes with financing packages in the form of concessional loans, better outcomes in key development parameters such as electrification and business productivity and allows the aid donor political leverage on issues that affect its national interests. It is, therefore, an expected location for geopolitical competition between powers. This forms the context to India's shifting perception on electricity trade, which is no longer seen purely as a development input or commodity import but increasingly as a strategic commodity that could enmesh and secure the South Asian interdependencies it fears it is losing. The topography of decision making in India's regional power trade policy reflects this, with the Indian Ministry of External Affairs (MEA) attaching foreign policy concerns to some of the provisions of India's cross-border power trade guidelines.[34] Grand development designs have long been subverted by the exigencies of geopolitics, the next section details an instance of this phenomenon in South Asia.

Guidelines on cross-border trade of electricity

On December 5, 2016, India's power ministry unveiled a set of guidelines on the cross-border trade of electricity with the intention of harmonizing existing bilateral power trade agreements and memoranda of understanding with Bangladesh, Bhutan and Nepal. The headline message was that India intended to 'facilitate and promote cross-border trade of electricity with greater transparency,

32. "Liu Zhenya Participated in the Belt and Road Forum for International Cooperation and Gave a Speech at the High-Level Meeting," Global Energy Interconnection Development and Cooperation Organization, August 15, 2017, http://www.geidco.org/html/qqnycoen/col2015100728/2017-08/15/20170815192345392895803_1.html.

33. "Promoting Grid Interconnection to Drive Regional Sustainable Development," Global Energy Interconnection Development and Cooperation Organization, August 15, 2017, http://www.geidco.org/html/qqnycoen/col2015100728/2017-08/15/ 20170815193736109419084_1.html.

34. From interviews with officials in the power ministries of India, Bhutan and Nepal and academics in India's strategic community.

consistency and predictability in regulatory approaches across jurisdictions and minimize perception of regulatory risks'.[35] At a power sector meeting in the summer of 2017, a senior official in India's ministry of external affairs asserted that the political objective of the guidelines was 'cooperation and shared prosperity', with energy cooperation seen as a subset of India's regional connectivity push. On the technical front, the document hints at the existence of conditions for a natural electricity market in the region, noting that the 'exchange of electricity across the South Asia region will (…) balance the diversity of primary energy sources and differences in seasonal patterns of supply and demand'.

Certain provisions of the guidelines were almost immediately opposed by Nepal and Bhutan. At the heart of the disagreement sits sub-clause 5.2.1, which views electricity as a strategic commodity rather than a development input. Indeed, it begins with the observation that electricity trade involves 'issues of strategic, national and economic importance'. This order of priorities leads to the prescription of several restrictions on foreign generators that can participate in power trade with India. It declares that one-time approval for trade with India will be accorded to generators located outside India that are 'owned or funded by the Government of India or by Indian Public Sector Units or by private companies with 51% or more Indian entity (or entities) ownership'. It also allows generators owned or controlled by the government of the neighboring country to avail of one-time approval, stating that entities 'having 100% equity by Indian entity and/or the Government/ Government owned or controlled company(ies) of neighbouring country' (sic) are eligible for participation in cross-border trade of electricity. Read together, the two sub-clauses quoted above dissuade both non-Indian private generators and generators owned by governments of third countries (i.e. governments other than India and that of the country in which the generator is located) from trading with India.

The official Indian response to concerns raised by Nepal and Bhutan was to point to the flexibility offered by sub-clause 5.2.2. This states that 'any other participating entity shall be eligible to participate in cross border trade of electricity after obtaining approval (…) on case to case basis' (sic). While 'case to case' approval does not preclude the import of electricity from generators owned by non-Indian private companies or the governments of third countries, it introduces an intermediate procedural step that creates uncertainty in such generators' long-term access to the Indian market. Since policy statements are also investment signals, the intention, and probable effect, of the guidelines is to deter investment from such sources. This significantly alters the long-term hydropower investment landscape in Nepal and Bhutan by favoring Indian private sector companies and developers owned by the governments of India, Nepal and Bhutan. With the Indian market closed off, Chinese hydropower investments are unlikely to be financially viable since domestic demand in Bhutan and Nepal is relatively small.

35. Ministry of Power, Government of India, "Guidelines on Cross Border Trade of Electricity."

During the research for this report, Indian officials pointed out that the guidelines were easily amendable and could evolve in consultation with its neighbors. There have been conflicting reports on the possibility of amendments from current and former officials in the Indian ministry of power since the promulgation of the guidelines, yet none were passed as this report went to press despite at least two formal high-level delegations and several informal representations to India's ministries of power and external affairs. This is indicative of the internal tensions between an open-trade bloc and a strategic-containment bloc within the Indian establishment.

Representatives of Nepal's private hydropower producers and energy bureaucracy point out that the guidelines shift the goal posts for bilateral energy cooperation and run against the spirit of the landmark Power Trade Agreement (PTA) signed between the two countries in 2014. A comparison of two clauses of the agreement against the guidelines quoted above illustrates this. Article 2 (a) of the PTA called for 'non-discriminatory access to the cross-border interconnection(s) for all authorized/licensed participants in the common electricity market' and article 4 (b) declared that the two countries 'shall allow the authorized/licensed electricity producers/buyers/traders of each country to engage in cross-border electricity trading, including that through Power Exchanges, and to seek cross-border transmission access as per the laws of the respective country'. There are no restrictions, then, on who can produce and export power. The preamble of the agreement suggests a vision for liberalizing electricity trade in the region as a whole: 'Recognizing that the cooperation in cross-border power exchange and trading through enhanced transmission interconnections and grid connectivity would mutually benefit both the countries by moving towards a *common electricity market that could extended to sub-regional and regional levels*'.[36] Since the release of the guidelines, bureaucrats in Nepal's energy ministry have continued to argue for staying the course set by the PTA of 2014. They have called for revisions to the guidelines that would prioritize a free market where traders, consumers and generators are given autonomy in transactions and can rely on government-supported supplementary institutions for critical ease-of-doing-business issues such as payment mechanisms, dispute resolution and contract exit among others.[37] Reflecting unease in Nepal's hydropower sector, Shailendra Gurgain, president of Independent Power Producers Association of Nepal (IPPAN) – an umbrella body to represent the interests of Nepal's vibrant indigenous hydropower development sector - publicly called for South Asian countries to lobby together for "easy access to the South Asian giant".[38]

One representative of a Bhutanese hydropower developer pointed out that India sees influence in the sub-region as a strategic imperative but 'Bhutan turning north' (i.e. to China) was a misplaced

36. "Agreement between the Government of Nepal and the Government of the Republic of India on Electricity Power Trade, Cross-Border Transmission Interconnection and Grid Connectivity," October 21, 2014, https://policy.asiapacificenergy.org/sites/default/files/PTA-English-21-Oct-2014.pdf. Emphasis added.

37. "Opportunities and Challenges for Electricity Trade in the BBIN Sub-Region" (Confederation of Indian Industry, February 2018), 14.

38. "Indian Regulations a Jolt for Would-Be Electricity Exporters from Nepal," The Himalayan Times, July 6, 2017, https://thehimalayantimes.com/business/indian-regulations-jolt-electricity-exporters-nepal/.

worry as there was 'no market to the north'. In this line of argument, India's 7.5 percent average annual growth rate made it the only real destination for Bhutanese hydropower and concerns about Chinese investment buying influence in the country were unfounded. Bhutan did see the guidelines, however, as a missed opportunity in ensuring higher returns in the long-run for its hydropower plants; access to the day ahead market of India's energy exchanges and a transparent mechanism for bidding on tariffs rather than using rates determined in inter-governmental negotiations were considered necessary steps to maintain long-run revenue. The economic viability of these propositions in maintaining, if not boosting, Bhutanese revenue is uncertain and can only be assessed through further study. The long-term trajectory of prices in India's spot market is uncertain and exposure to revenue volatility is undesirable in an economy heavily dependent on hydropower remittances from India. In 2015-16, around a fifth of the country's revenue was derived from the hydropower sector.[39]

One of Bhutan's main concerns, however, relates to the uncertainty created by the guidelines around relatively new hydropower plants that have been built through joint ventures or public private partnerships between Indian and Bhutanese entities. These companies are not majority (51 percent) owned by Indian entities or owned by the Government of India or India public sector companies as clause 5.2.1 (a) of the guidelines recommends. Nor do they have 100 percent of their equity controlled by the government of Bhutan or a company owned by that government. A recent media report indicated that the concession agreement for the 600 MW Kholongchu hydropower project (whose ownership is evenly split between Bhutan's Druk Green Power Corporation Limited and India's Satluj Jal Vidyut Nigam Limited) and Indian market access for the first hydropower project built as a public-private partnership, Dagachhu (owned 59 percent by Druk Green, 26 percent by India's Tata Power Company and 15 percent by Bhutan's National Pension and Provident Fund), have been stalled since the guidelines were issued.[40, 41] Bhutanese officials have reacted with perturbation at a perceived nudge towards 'giving up control of hydropower projects and trading companies to the tune of 51 percent to Indian entities'. They stress that what is fundamentally 'a political issue must not be addressed through an electricity trade guideline'. The Indian government, for its part, has reportedly formed a committee to resolve issues created by the guidelines and assured its Bhutanese counterparts of stability in power transactions between the two countries.

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39. Ministry of Finance, Government of Bhutan, "National Revenue Report 2015-16" (Department of Revenue and Customs, 2016), 23, http://www.mof.gov.bt/wp-content/uploads/2014/07/ NRR2015-2016.pdf.

40. Tshering Dorji, "Cross Border Electricity Trade Issues under Review," *Kuensel Online*, March 3, 2018, http://www.kuenselonline.com/cross-border-electricity-trade-issues-under-review/.

41. Druk Green is the largest hydropower developer in the country and wholly owned by the commercial arm of the Bhutanese government, Druk Holding and Investments; Satluj Jal Vidyut Nigam Limited is a joint venture between the Government of India and the Government of Himachal Pradesh and Tata Power is a private Indian company. For more on the structure of the corporate structure of Bhutan's public companies, see: "Druk Green Power Corporation Limited: Private Company Information - Bloomberg," accessed March 11, 2018, https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=111969365; "Corporate Profile," Druk Holdings and Investments Ltd., accessed March 11, 2018, http://www.dhi.bt/company-profile1.

Bangladesh's primary interest in electricity trade has been in developing Nepal and Bhutan as sources of energy over the coming decade. Officials interviewed suggested that the guidelines acted as an impediment to free negotiation with Bhutan and Nepal as they entrench India in the role of permanent intermediary in such deals.[42] This is the case with Bangladesh's potential purchase of power from the 900 MW Upper Karnali power plant being built by Indian company GMR; the terms of trade are to be laid out in a trilateral MoU under which Bangladesh will import power through an Indian trading company. On the process of policy formulation, Bangladeshi respondents saw the formulation of the guidelines as a process that lacked the consultative elements required for shared ownership of the policy. This did not detract from the broader sentiment among Bangladeshi respondents that the initiative was beneficial for all parties involved and specific issues could be resolved through discussions with India.

42. Ijaz Hossain et al., "BBIN Electricity Trade in Bangladesh: A Survey of Prospects and Challenges."

A survey of demand for Himalayan hydropower

Beyond geopolitics, the rate of growth of cross-border electricity trade between BBIN countries will depend on the strength of demand signals sent by Bangladesh and India, and how quickly Himalayan hydropower plants can be built to satisfy it. This section analyses three key demand variables for hydropower that will impact electricity trade over the next decade. First, India's distribution companies will be picky about the price of power they purchase, keen on keeping losses in check in a new reform environment and cognizant of the falling prices of domestic energy, particularly renewables. Second, India would have satisfied domestic demand after a decade of feverish thermal power addition. As Nepal becomes ready to export after attaining power self-sufficiency and Bhutan completes ongoing projects in the next four years, they will find that Indian demand for expensive hydropower is low. Third, Bangladesh will serve as an interim source of demand, keenly interested in meeting demand projections with relatively inexpensive energy. It has experienced a bitter price shock over the past decade and reckons with the impending depletion of its gas reserves.

Price sensitive distribution companies in India

India's power distribution companies play three important roles in the country's power sector. First, they perform a logistical function as an intermediary between suppliers of power, such as generators and power traders, and its consumers such as farms, industries and households. Second, they are an important force in shaping the country's energy markets. Their core mandate is to extend the distribution network to places that have no power and to provide reliable, inexpensive electricity to all their consumers, thereby fulfilling a critical function in the pursuit of economic growth. The magnitude of this task is captured by the frequently cited estimation that around a fifth of India's population lacks access to the grid. Finally, they are a site of politics in their role as an instrument for the delivery of state subsidy. The compulsions of democratic politics have shaped who accesses electricity and at what price, leaving a deep imprint on the financial health and public reputation of distribution companies. Their function of supplying electricity to over half of South Asia's population of 1.7 billion gives India's distribution system a weight felt beyond its borders. Their ability to send convincing demand signals to investors in Himalayan hydropower will play a significant part in determining the pace at which electricity trade grows in the region. There is, at present, little indication they will serve as a fulcrum for demand in the medium-term due to a preference for sources of power cheaper than newly built Himalayan hydropower. Internally, this price sensitivity arises from the effects of persistently loss-making tariffs and consequent indebtedness, the strictures of a new government bailout and the availability of markedly cheaper sources of thermal and renewable power for procurement.

Distribution companies take on large debts to cover for revenue shortfalls. The shortfalls are a product of subsidized prices for some customer segments (particularly agricultural customers, as explained at the end of this section) and aggregate technical and commercial losses (AT&C), which

is revenue lost due to pilferage or outdated grid infrastructure. The magnitude and ubiquity of this indebtedness among distribution companies curtails the Indian market's ability to purchase relatively expensive forms of power and diversify its basket of energies. In the early 2010s, for example, solar and wind power were considered too expensive and ignored in procurement despite regulation that compelled distribution companies to buy them. As of March 2015, distribution companies had accumulated losses of USD 60 billion, largely financed through debt that totaled a little over USD 68 billion.[43] The central government has launched multiple bailouts to clean up their finances over the last two decades, only to have debts reappear on balance sheets.

Table 1. Distribution companies procure power at rates much higher than those at which it sells power, leading to persistent losses. They must contend with the exigencies of politics manifest in subsidies to crucial vote blocs and the unpopularity of tariff increases. A large amount of revenue is also lost through technical losses and pilferage.[44]

Year	Average cost of power supply (Rupees/kWh)	Average tariff realized (Rupees\kWh)	Loss per kWh procured
2007-08	4.04	3.05	25%
2008-09	4.62	3.25	30%
2009-10	4.78	3.33	30%
2010-11	4.84	3.57	26%
2011-12	4.87	3.80	21%

Table 2. Three large bailouts sponsored by the Indian central government since 2000 failed to address the root causes of losses in distribution companies. Debt transferred to other entities, such as state governments, reappears on balance sheets in time leaving distribution companies financially vulnerable.[46]

Period	Name of distribution company bailout	Scheme magnitude	Comparable to
2001	2001 Scheme for repayment of SEB (state electricity board) dues	USD 6.2 billion (INR 41,473 crores)	Central and state planned expenditure on social services in 2001-02
2012	Financial Restructuring Plan	USD 17.9 billion (about INR 1.19 lakh crores)	Cumulative expenditure on wages in the MNREGA scheme[45] 2006-14
2015	Ujwal Discom Assurance Yojana (UDAY)	USD 30.2 billion (about INR 2.01 lakh crores as on July 2016)	Over half of India's defense spending for 2015-2016

43. Press Information Bureau, Government of India, "UDAY (Ujwal DISCOM Assurance Yojana) for Financial Turnaround of Power Distribution Companies," November 5, 2015, http://pib.nic.in/newsite/PrintRelease.aspx?relid=130261.

44. Planning Commission, Government of India, "Annual Report on the Working of State Power Utilities and Electricity Departments (2011-12)," October 2011, 115, http://planningcommission.gov.in/reports/genrep/arep_seb11_12.pdf.

45. MNREGA, the Mahatma Gandhi National Rural Employment Guarantee Act, is a scheme instituted to guarantee employment to individuals below India's poverty line and is one of the country's largest social security measures.

46. Ashwin Chitnis et al., *Many Sparks but Little Light: The Practice and Rhetoric of Electricity Sector Reforms in India* (Pune: Prayas Energy Group, 2017), 206, http://www.prayaspune.org/ peg/publications/item/332-many-sparks-but-little-light-the-rhetoric-and-practice-of-electricity-sector-reforms-in-india.html.

The latest effort, launched in 2015, at rectifying the operations and finances of distribution companies, called the Ujwal Discom Assurance Yojana or UDAY for short, is the largest and most sophisticated yet.[47] States that sign up for the scheme take over 75 percent of their distribution companies' debt by raising bonds whose proceeds are used to repay existing lenders. The debt remaining with discoms after this transfer, totaling 25 percent, are repaid through funds raised from distribution company bonds backed by the state government, or through new loans at lower interest rates. In return for the bailout, distribution companies agreed to improve operational efficiency by cutting down AT&C losses and reducing the gap between the average cost of power supply and average tariff realized *to zero* by increasing tariffs. The UDAY scheme also puts the onus of reducing the cost of power purchase on states through competitive bidding for new purchase agreements by distribution companies.[48] Since the launch of the scheme, 27 states and 5 Union Territories have signed up through memoranda of understanding with ministry of power. It is too early to evaluate the scheme or predict its final results, but a written statement to Parliament by the power minister revealed minor early reductions in operational losses and the gap between cost of power supply and tariff realized.[49]

The scheme attempts to change the operating environment for the governance of the power sector as a whole, and distribution companies in particular, in three ways: in shifting the financial burden of populist policy to the states, it hopes to create a feedback loop that deters electoral profligacy; it forces state governments and regulators to pay closer attention to the operations and procurements of distribution companies in an attempt to improve accountability; and it pushes already price-sensitive distribution companies to be more discerning of the price of power they purchase. The unit cost of hydropower in countries across the region are higher than those of thermal power and renewables (seen in Table 3), making unsubsidized hydropower tariffs unattractive. A recent report by the Parliamentary standing committee on energy noted that short loan repayment periods drove the price per unit for newly built hydropower as high as USD cents 8-9, preventing states from signing power purchase agreements as the price was too high.[50]

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47. For a comprehensive assessment of the many frailties distribution companies in India face, please read chapter 5 of 'Many Sparks but Little Light: The Rhetoric and Practice of Electricity Sector Reforms in India' by Prayas Energy Group, Pune (p. 167-249).

48. Ministry of Power, Government of India, "UDAY (Ujwal Discom Assurance Yojana) Scheme for Operational and Financial Turnaround of Power Distribution Companies (DISCOMs)," November 20, 2015, https://powermin.nic.in/pdf/Uday_Ujjawal_Scheme_for_Operational_and_financial_Turnaround_of_power_distribution_companies.pdf.

49. Ministry of Power, Government of India, "Lok Sabha Unstarred Question No. 2271," March 3, 2018, https://powermin.nic.in/sites/default/files/uploads/LS08032018_Eng.pdf.

50. Parliamentary Standing Committee on Energy, "Hydropower: A Sustainable, Clean and Green Alternative," Standing Committee Report, May 2016, 23.

Table 3. The unit prices from new hydropower plants in Bhutan, India and Nepal are higher than the unit prices of Indian coal and solar power. These sector-wide prices were constructed from newspaper articles, reports and inputs from industry experts and should be seen as an estimation of prices from several plants for the purposes of comparison. Unit prices of individual projects will be different from those represented here.

Energy Source	Estimated cost per unit in India	Estimated cost per unit in Nepal	Estimated cost per unit in Bangladesh	Estimated cost per unit in Bhutan
Hydropower	USD cents 9 or above for under construction plants (INR 6)	USD cents 7.3 (NPR 7.52)	-	USD cents 6 or above for under construction plants (Nu 4), USD cents 3-4 for existing plants (Nu 2.25 to 2.9)
Coal	USD cents 4.6 or above (INR 3)	-	Domestic coal @ USD cents 6-8 Imported coal @ USD cents 8-10	-
Solar	USD cents 4.6 (INR 3)	USD cents 7 (NPR 7.3)	USD cents 17	-

The inefficiencies of distribution companies have their roots in the country's political history. The solutions to their frailties lie as much in the realm of politics as technical improvements in operations. Dubash and Rajan (2001) note that two parallel developments in agriculture and politics in the 1970s and 80s led to institutional 'lock-ins' that continue to determine the state of the power sector. In agriculture, a concerted policy effort for better farm productivity and national food security, commonly called the Green Revolution, led to greater demand for groundwater tapped through electric or diesel pumps. This came as national politics witnessed profound change. India began its transformation from a democracy dominated by a single party, the Congress, to one with genuine multiparty contestation, particularly at the state level. Electricity subsidies became a widely used political tool to enlist the support of poor and middle-class farmers, who were a crucial vote bloc for upstart state-level parties wishing to assert themselves and for a Congress weakened by internal divisions and lacklustre regional appeal, particularly in South India. The result was the introduction of flat-rate tariffs for agricultural consumers in many states and the removal of existing electricity meters.[51]

Surplus in the Indian grid

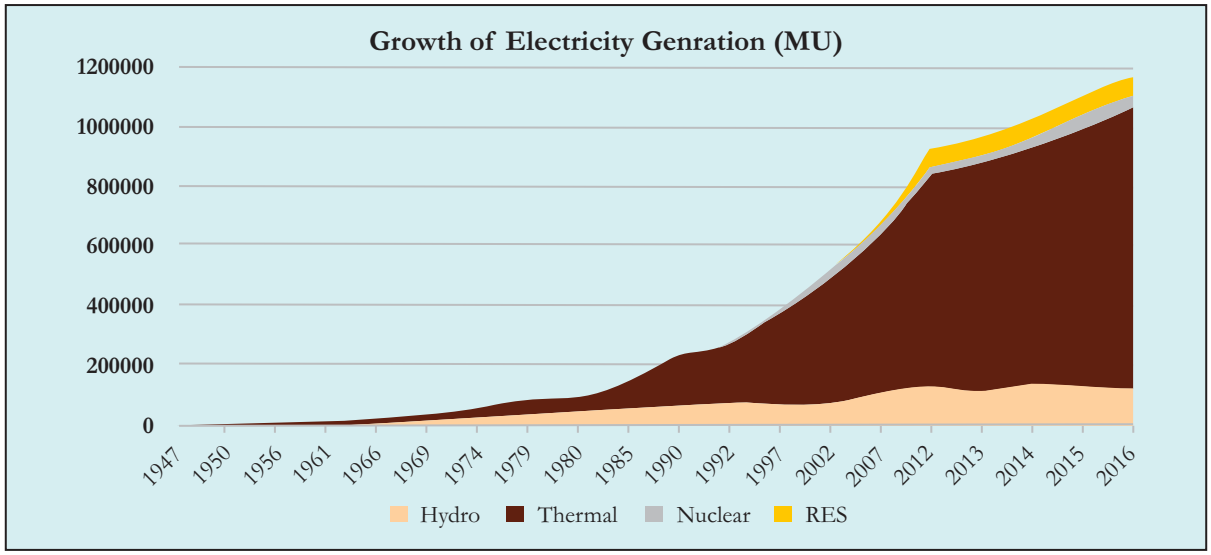
The Central Electricity Authority's 'Load Generation Balance Report' for 2016-17 declared that 'the country was likely to experience an energy surplus of 1.1 percent and a peak surplus of 2.6 percent'.[52] This comes on the back of a decade of breakneck capacity addition, particularly in thermal energy.

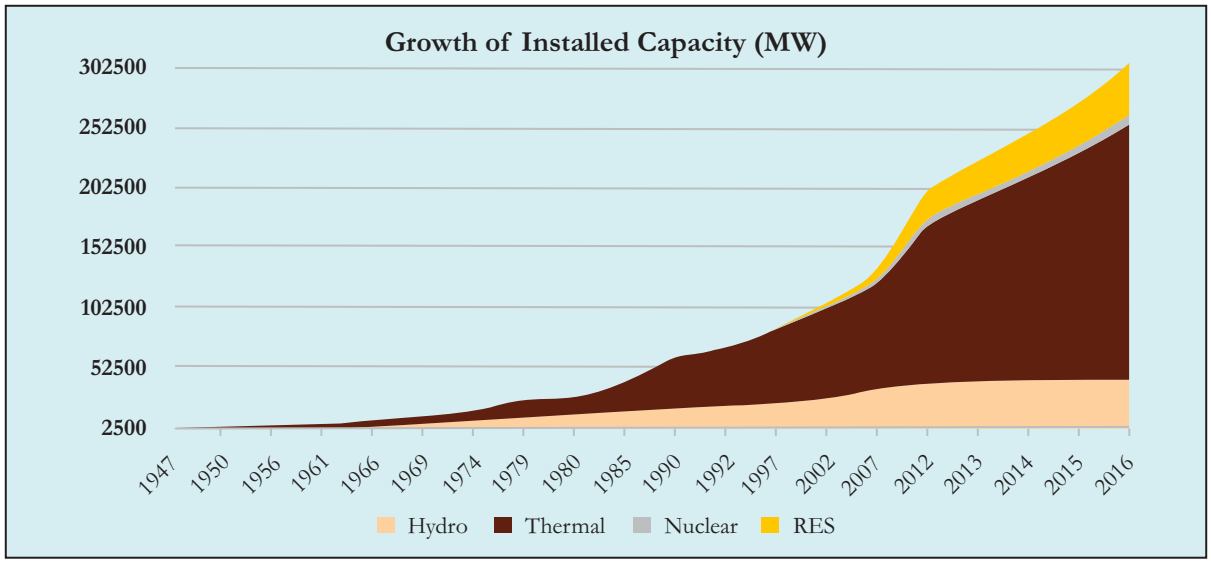
51. Navroz K. Dubash and Sudhir C. Rajan, "Power Politics: Process of Power Sector Reform in India," *Economic and Political Weekly* 36, no. 35 (September 1, 2001): 3369-70.

52. Central Electricity Authority, "Load Generation Balance Report 2016-17" (Ministry of Power, Government of India, May 2016), http://www.cea.nic.in/reports/annual/lgbr/lgbr-2016.pdf.; the report notes that around half of India's states are currently power deficit, which creates conditions ripe for domestic trading as India's inter-state transmission capacity grows and power exchanges mature. On pricing, power from Indian surplus states is likely to be cheaper than newly constructed Himalayan hydropower.

In the decade between 2005-06 and 2015-16, installed capacity in India increased by over 240 percent. In the half decade between 2012 and 2017, the country added around 87 GW of thermal capacity, which was roughly 14 percent more than its target.[53] This half-decade spurt constitutes a quarter of India's current installed capacity of just over 340 GW.[54]

Figures 1 and 2. Thermal capacity addition has been central to achieving a generation surplus. Renewable energy sources (RES in chart) have begun registering prominence in installed capacity over the past five years.[55]





53. Central Electricity Authority, "Monthly Report on Broad Status of Thermal Power Projects in the Country" (Ministry of Power, Government of India, December 2016), http://www.cea.nic.in/reports/monthly/broadstatus/2016/broad_status-12.pdf.

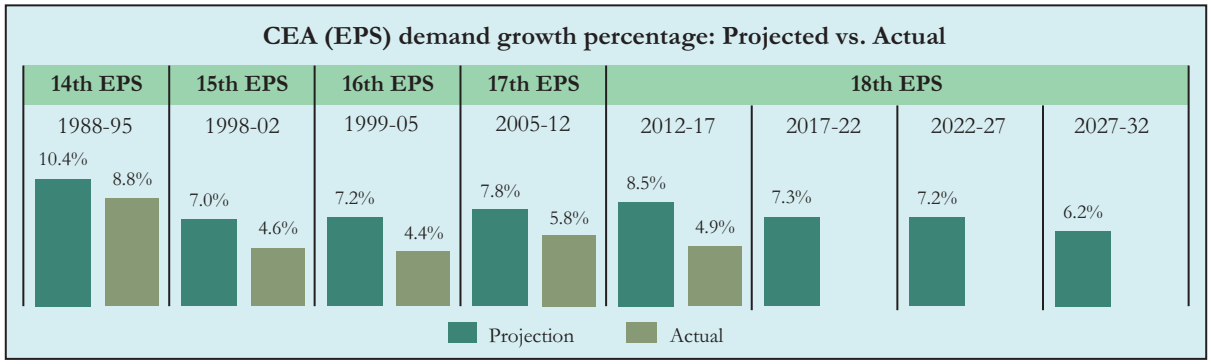
54. Central Electricity Authority, "Monthly Report on Installed Capacity" (Ministry of Power, Government of India, March 2018), http://www.cea.nic.in/reports/monthly/installedcapacity/ 2018/installed_capacity-03.pdf.

55. Central Electricity Authority, "Draft National Electricity Plan" (Ministry of Power, Government of India, December 2016), 1.6, http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf.

After decades of grappling with generation deficits and forfeited economic growth, the emergence of surplus capacity has presented a new set of pathologies in the power sector. Principle among these is the rise of the phenomenon of 'backing down' powerplants, which is to leave them idle because distribution companies do not need their power. The magnitude of the problem is large enough to threaten the entire power supply chain. According to the CEA, around 15 percent of the country's total capacity was backed down in 2014-15. Large states like Punjab and Gujarat were forced to back down around 30 percent of their contracted capacity in 2015-16, while Maharashtra, Madhya Pradesh and Rajasthan backed down between 14 and 20 percent of their capacity that year.[56] This threatens the revenue streams of generators that are forced to idle, and the financial position of distribution companies that must continue to pay annual fixed costs to such generators.

An analysis published in 2017 by Prayas (Energy Group) finds that at least three-fourths of the capacity backed down is due to consistent overestimation of demand in projections put forward by the Central Electricity Authority. These central estimates are used by state regulators and distribution companies to project demand and plan power procurement to meet projected demand. Actual demand growth has been consistently lower than projected, while capacity addition and distribution company procurement surged ahead based on inflated projections. Since India's requirements have been fulfilled, the draft National Electricity Plan prepared by the CEA proposed to halt thermal capacity addition till 2027. It maintained, however, that around 50 GW of thermal capacity currently in the pipeline will still come online between 2017-22. A recent report prepared by a power ministry committee tasked with understanding the optimal energy mix in power generation found that 'there is not much scope in optimizing the generation mix by the year 2021-22' due to the thermal capacity in the pipeline. It warns that coal plants will remain under-utilized.[57] This could add to the complexity of managing the surplus.

Figure 3. Electricity demand forecasts have been consistently overestimated by between 30 and 40 percent over the past two decades. Taken from an analysis by Prayas (Energy Group) of the backing down problem in the Indian power sector.[58]



56. Ann Josey, Manabika Mandal, and Shantanu Dixit, "The Price of Plenty: Insights from 'Surplus' Power in Indian States" (Prayas (Energy Group), March 2017), 1, http://www.prayaspune.org/ peg/publications/item/335-the-price-of-plenty-insights-from-surplus-power-in-indian-states.html.

57. Ministry of Power, Government of India, "Report of Committee on Optimal Energy Mix in Power Generation on Medium and Long Term Basis," January 1, 2018, 1.

58. Ann Josey, Manabika Mandal, and Shantanu Dixit, "The Price of Plenty: Insights from 'Surplus' Power in Indian States," 21.

India has also been rapidly adding renewable power to the grid, whose prices were, till 2017, in virtual freefall. In the summer of that year, a bid for solar capacity addition in Rajasthan discovered a price of USD cents 3.6 (INR 2.44 per unit), which was 40 percent less than prices discovered the previous year.[59] This represents a fall of over 80 percent in prices from 2010, when solar tariffs were over USD 19 cents (INR 12.76 per unit).[60] India added around 10 GW of solar capacity in 2017, taking its total solar capacity to just under 20 GW in March 2018. India's wind sector has been similarly competitive, with an auction in 2017 discovering a price of USD cents 3.7 (INR 2.64 per unit), and a total 33 GW of installed capacity by March 2018.[61] Overall, this makes solar and wind as cheap as, and in some instances slightly cheaper than, thermal power. Capacity addition in renewables is likely to continue to be robust over the coming years given the Indian government's aim of installing 175 GW of renewables by 2022. Regardless of whether this target will be met, there is significant foreign investment and growing competition among a large pool of renewable energy generators indicating the emergence of a mature market ecosystem to drive future growth.[62]

Reports indicate that distribution companies are actively seeking better deals in this new environment. A combination of three factors – the freefall in the prices of renewable energy, slow demand growth and an effort to mend balance sheets – has prompted some distribution companies to renege on signed power purchase agreements, renegotiate rates, refuse renewal of existing power purchase agreements or sign new deals for much shorter durations.[63] This is symptomatic of new dynamics emerging in India's power market, fueled by increased competition in the generation

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59. Michael Safi, "Indian Solar Power Prices Hit Record Low, Undercutting Fossil Fuels," *The Guardian*, May 10, 2017, http://www.theguardian.com/environment/2017/may/10/indian-solar-power-prices-hit-record-low-undercutting-fossil-fuels.

60. Shreya Jai, "Solar Power Tariff Falls 80% in 6 Years to Rs 2.44 a Unit," *Business Standard India*, June 9, 2017, http://www.business-standard.com/article/economy-policy/solar-power-tariff-falls-80-in-6-years-to-rs-2-44-a-unit-117051200408_1.html; B. Sivakumari, "Solar Power Tariff Falls by 80% in Seven Years," *Times of India*, August 4, 2017, https://timesofindia.indiatimes.com/city/ chennai/solar-power-tariff-falls-by-80-in-seven-years/articleshow/59906190.cms.

61. Mayank Aggarwal, "India to Add 9.4GW Solar Power Capacity This Year: Bridge to India Report," *Mint*, August 15, 2017, https://www.livemint.com/Industry/YldFbSr6nmeYvJUzqdTnVN/ India-to-add-94GW-solar-power-capacity-this-year-Bridge-to.html; Rishi Kumar, "India Achieves 20 GW of Installed Solar Capacity within Eight Years," *Hindu Business Line*, January 30, 2018, https://www.thehindubusinessline.com/economy/india-achieves-20-gw-of-installed-solar-capacity-within-eight-years/article22591953.ece; Press Information Bureau, Government of India, "Year End Review 2017 - MNRE," December 27, 2017, http://pib.nic.in/newsite/ PrintRelease.aspx?relid=174832; Central Electricity Authority, "Monthly Report on Installed Capacity."

62. It must be noted that enthusiasm from solar developers in recent months has waned due to policy uncertainty, confusion over a new tax regime and the prospect of import tariffs on solar panels.

63. Utpal Bhaskar, "Will Low Tariffs Eclipse India's Solar Run?," *Mint*, August 17, 2017, https://www.livemint.com/Industry/YP4O4FOY598j9CqmRaRfOM/Will-low-tariffs-eclipse-Indias-solar-run.html; Kaavya Chandrasekaran, "PPA Rejig: Centre Takes Wind out of State Discom Bullies," Economic Times, August 17, 2017, https://economictimes.indiatimes.com/ industry/energy/power/centre-rejigs-ppa-takes-the-wind-out-of-state-discom-bullies/articleshow/60094101.cms; Anindya Upadhyay, "Wind Projects in Peril as Indian States Rethink Purchases," *Bloomberg News*, July 28, 2017, https://www.bloomberg.com/news/articles/2017-07-27/wind-projects-in-peril-as-indian-states-rethink-purchase-pacts.

sector. This has had the cumulative effect of prompting doubts about India's position as a viable market for Himalayan hydropower among policymakers, investors and the media in Kathmandu and Thimpu.

Since hydropower is being outcompeted in Indian power markets at present, it is worth speculating on its prospects for the coming decade. Of interest is India's wholesale addition of renewable capacity and the effect this will have on hydropower investor sentiment. A sudden increase in renewable energy penetration brings the country's grid stability in question. A key management problem in India's transition is how peak power demand (created when the lights are turned on at dusk, for example) is to be managed in a grid dependent on a mixture of thermal and renewable sources. Neither of these sources can increase output fast enough to keep pace with demand during peak periods. Hydropower and natural gas, on the other hand, are considered well suited to the task for their ability to ramp up output in very little time. As India adds renewable capacity, it stands to reason that the price of peak power will increase over the years, presenting an opportunity for hydropower.

Hydropower's suitability in meeting peak demand been a central part of its discourse for decades. One of the opening sentences of the India's first hydropower policy in 1998 notes that hydropower is the 'best choice for meeting peak demand' since it possesses the 'inherent ability for instantaneous starting, stopping, load variation etc.'[64] Subsequent hydropower policies and reports on India's power sector have maintained the importance of this aspect of hydropower, which attains particular relevance today since more than a third of installed capacity within the next five to seven years could be renewable. Will more hydropower plants be needed to complement this shift? An influential modelling exercise recently carried out by the National Renewable Energy Laboratory, the Lawrence Berkeley National Laboratory and India's power ministry found that the grid integration of current renewable capacity addition targets (100 GW of solar and 60 GW of wind power by 2022) could be achieved without the construction of new fast-ramping infrastructure. It relies instead on 'all generating stations exploiting their inherent ramping capability', where coal plants operating at low minimum plant loads ramp up output in concert with existing hydropower plants. Hydropower 'is dispatched during the periods of highest value, which occur during the net demand peaks. The adaptability of hydro helps the power system to absorb the variability that RE adds to the system, complementing the flexibility from the thermal fleet'.[65] A recent power ministry report on the optimal energy mix for the country endorsed these findings.[66]

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64. Ministry of Power, Government of India, "Policy on Hydro Power Development," August 1998, http://hperc.org/wp-content/uploads/2016/03/hydro_power_policy_developmemt.pdf.

65. David Palchak et al., "Greening the Grid: Pathways to Integrate 175 Gigawatts of Renewable Energy into India's Electric Grid, Vol. I -- National Study," June 28, 2017, 6-10, https://doi.org/10.2172/ 1369138.

66. Ministry of Power, Government of India, "Report of Committee on Optimal Energy Mix in Power Generation on Medium and Long Term Basis."

It seems certain that the first wave of Indian renewable capacity additions after the country's commitment to the Paris climate accord will not prompt a building spree in the hydropower sector. Further additions beyond the current 175 GW target, such as the ambition of installing 275 GW of renewable capacity by 2027, might change the economics of hydropower. Private investors, Indian government entities and neighboring states will, however, closely watch developments on three fronts. First, the contracts and regulations that allow hydropower released during periods of peak demand to be priced at a premium could make hydropower more lucrative if put in place. Distribution companies must be able to pay a high enough unit cost for hydropower generated by plants that might operate only a few hours a day. Second, new dams must be less expensive than grid-scale solar installations that are linked to large batteries. While standalone solar power is currently cheaper than hydropower and gas, solar power with battery storage that allows power output to be maintained at night is not. The emergence of cheap grid-scale storage solutions, largely dependent on advances in battery technology, could dampen the market for large, expensive and risky investments in hydropower. Third, the quantum of electricity consumption during peak hours will depend on advancements in efficiency. Time-of-day pricing that dissuades users from high consumption during peak hours, less leaky grids and more efficient appliances (such as air conditioners) could significantly reduce peak demand, making this an important space to watch for South Asia's hydropower sector.[67]

Demand from Bangladesh

Bangladesh's energy present and future are very different from India's. Approximately three-fourths of the country's fuel supply currently comes from gas, around 20 percent from oil and most of the remainder from coal. The country's domestic natural gas reserves, once considered plentiful, have proven to be less substantial than originally hoped. It is estimated that natural gas supply will peak between 2016 and 2020 while energy demand grows. By 2030, gas will satisfy only a third of demand if exploration activities continue to bear insufficient returns, which has been the trend in the recent past. The country's substantial coal reserves, long held to be the primary fallback option, cannot be mined due to local opposition. Energy planners and politicians are, therefore, faced with the prospect of increased reliance on imported fuels, particularly coal and natural gas, both of which are likely to drive up the price of electricity since cheap indigenous natural gas is currently used to generate around 60 percent of the country's electricity.[68]

The cost of electricity generation almost tripled between 2008 and 2014 as demand outpaced supply. To meet the shortfall, policy turned to small, expensive oil and diesel generators that drastically increased the Bangladesh Power Development Board's losses (BPDB), apart from being

67. India has laid the groundwork for improved efficiency in the past decade, illustrated in part through an efficiency certification regime for appliances, a successful transition to CFL and LED bulbs and policy tweaks to reduce transmission and distribution losses (such as the UDAY scheme).

68. Ijaz Hossain et al., "BBIN Electricity Trade in Bangladesh: A Survey of Prospects and Challenges," 11-15.

more polluting. The BPDB is the sole purchaser of electricity in the country's power sector, buying from its own plants and several independent generators. It then sells power to distribution companies at a price determined by regulators, and the shortfall between purchase and selling prices is borne by the exchequer as a subsidy. During the spike of 2008-15, losses per customer increased from around USD 50 per customer to USD 300 per customer. In absolute terms, the losses totaled close to USD 1 billion.[69]

Against this backdrop of increased energy insecurity and rising prices, electricity imports have begun to play a significant role in energy planning. These plans are driven by the option of relatively inexpensive thermal power imports from India and, latterly, hydropower imports from both Bhutan and Nepal. This could serve as the fulcrum of BBIN electricity trade in the coming decade, increasing the likelihood of Bangladeshi investment in Himalayan hydropower and cross-border transmission capacity. A comparison of estimated tariffs for different sources of generation reveals that imported hydropower could compete with electricity generated by imported coal and liquified natural gas (LNG) if its unit cost can be limited to USD 10 cents. Thermal power from India is likely to remain cheaper than both imported coal and gas at USD 6-10 cents. A recent news report indicates that the Indian construction company GMR, which is constructing a 900 MW hydropower project in the Karnali basin in Nepal, is in negotiations to sell power 500 MW to Bangladesh at USD 10 cents, which could be brought down to USD 9 cents during negotiations.

Table 4. Thermal power imports from India are likely to stay cheaper than imported gas and coal fired electricity. Potential hydropower imports from the Indian northeast, Bhutan and Nepal should ideally stay in the USD 9-10 cent range to stay competitive.[70]

Options	Tariff (USD cents/kWh)	Planned capacity (in MW)	Challenges
LNG based electricity	10-14	Over 5,000	Location of regasification units and construction; tariff will fluctuate with LNG prices
Coal (domestic)	6-8	2000-3000	The government has put a moratorium on open-pit mining
Coal (imported)	8-10	More than 10,000	Country lacks a deep-sea port, challenges in location and investment for plants
Nuclear	8-10	2,400 by 2024	Investment and trained manpower
Solar	11-12	2000+	Land availability
Power import (thermal)	6-10	3000+	Contingent on Indian government policy and surplus capacity in India
Hydropower imports	N.A.	3000+	Dependent on several factors including final tariff at Bangladesh border after wheeling through India

69. Tim Buckley, Simon Nicholas, and Sara Jane Ahmed, "Bangladesh Electricity Transition: A Diverse, Secure and Deflationary Way Forward" (Institute for Energy Economics and Financial Analysis, November 2016), 11-12, http://ieefa.org/wp-content/uploads/2016/11/Bangladesh-Electricity-Transition_-NOVEMBER-2016.pdf.

70. Ijaz Hossain et al., "BBIN Electricity Trade in Bangladesh: A Survey of Prospects and Challenges," 21.

The master plan for Bangladesh's power sector, developed in collaboration with the Japanese International Cooperation Agency (JICA), demonstrates that power imports could play an influential role in meeting power demand projections till 2041. Like all long-run projections, there are several assumptions in the model that cannot realistically be predicted, but the predicted composition of fuels is instructive. Estimating a total capacity requirement of around 55 GW in 2041 (from 13.8 GW at present), it projects that close to 40 GW could come gas and coal. A little short of 10 GW is predicted to be derived from power imports through India, and the rest from oil plants and nuclear power. This strategy exposes Bangladesh to the vicissitudes of global coal and gas price fluctuations since nearly all the coal and over four-fifths of the gas used at that time will have to be imported.[71] Two factors become critical in this scenario: Bangladesh's ability to secure cheap long-term fuel contracts and its capacity to finance and build the considerable infrastructure needed to induct imported coal and gas, from regasification plants to ports, into its power sector supply chain at the magnitudes predicted. Unfavorable global prices or an inability to construct the infrastructure required to meet electricity demands could lead to periods of increased reliance on imported power. The weight of power imports in the energy mix will, therefore, wax and wane over the next two decades, largely based on the status of these external variables.

A limiting factor on power imports through India is the threat to energy security that the imports themselves pose. First among the four challenges that arise from imports through India described in the master plan is the "risk of supply interruption caused by adverse relationships between the two countries". The document stresses that "the capacity of imported power from one country should be within (…) 10% of all supply capacity in order to continue the supply in the event of supply interruption. In the case of Bangladesh, imported power from Bhutan and Nepal has to be transmitted through India. Therefore, imported power from Bhutan and Nepal should be within 10% of all supply capacity".[72] Though this pronouncement is a statement of guidance and has no binding force, it represents an important long-term concern in Bangladeshi politics. At present, however, there is bipartisan convergence on the need for power imports. Representatives from the ruling Awami League and the opposition Bangladesh Nationalist Party both acknowledged the domestic and regional benefits of cross-border power trade and their party's support for it.[73]

Cooperation has expanded at a steady clip since 2010, when India and Bangladesh signed a power agreement for the supply of 500 MW of power and the construction of cross-border transmission lines. The transmission capacity being planned, built and renovated is far more than the 660 MW currently traded and is evidence of the central role energy plays in the bilateral relationship. Two

71. Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, "Power System Master Plan 2016," September 2016, 1-44, http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/(E)_FR_PSMP2016_Summary_revised.pdf.

72. Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, 1-63.

73. Ijaz Hossain et al., "BBIN Electricity Trade in Bangladesh: A Survey of Prospects and Challenges." Representatives from both parties were interviewed as a part of this study.

transmission lines reach into Bangladesh from the east and west, which will together be capable of supplying over a gigawatt of energy after the current round of upgrades are complete. A third, highly ambitious transmission line could connect the hydropower of India's northeast to its plains through Bangladesh. This plan is contingent on India's ability to stimulate investment and complete construction in the northeast, where hydropower potential is largely untapped and ongoing projects have been delayed by years. For the foreseeable future, however, thermal power will continue to be the lynchpin for energy cooperation. The Adani group, a major Indian conglomerate, will supply Bangladesh with 1.5 GW for 25 years from a coal plant in the eastern coal-rich Indian state of Jharkhand.[74] Indian thermal generator NTPC, a state-run utility, is working with the Bangladesh Power Development Board to build a 1.3 GW coal-fired plant in the southern Bangladeshi town of Rampal, and the two counties recently signed a memorandum of understanding to build a 130 km oil pipeline between Bangladesh and its northern neighbor Assam that could lead to as many as a million tons of Indian oil flowing across the border each year.[75]

Bangladesh's quest for stable sources of power has led it to turn to the hydropower of Nepal and Bhutan. As mentioned above, it is in negotiations with an Indian company on buying hydropower from a 900 MW plant in Nepal and the Bhutanese government on co-investing in a hydropower project along with India. The power will be routed through India, creating the first real example of trilateral trade. As noted in a previous section, trilateral trade is a building block for more complex multilateral trading arrangements and the eventual creation of a regional electricity market, where supply and demand are met regardless of borders. Though premature, these negotiations could be seen as a step in that direction. Bangladesh also sees hydropower imports from these countries as a central element in its emission mitigation strategy. A section on power imports in the country's Power System Master Plan notes that there is 'abundant water power resource potential in the countries that surround Bangladesh, namely Bhutan, Nepal, Myanmar, and the Indian states of the North East and West Bengal' that can be harnessed for 'stable base load supply, energy fuel diversification, and climate change mitigation'. In fact, power imports and the use of renewable energy are listed as the only two practical steps towards achieving the 'advance use of green technology', which is one of five pillars upon which the master plan was designed.[76]

The country's true demand for imported power will depend on a variety of factors: global prices of oil and gas; the actual pace of Himalayan hydropower development; the status of relations with India and, most of all, the country's actual growth rate. The government of Bangladesh has set itself

74. Press Trust of India, "Adani Power Inks Power Purchase Agreement with Bangladesh Power Development Board," *Hindu Business Line*, November 8, 2017, https://www.thehindubusinessline.com/companies/adani-power-inks-power-purchase-agreement-with-bangladesh-power-development-board/article9949195.ece.

75. "About Company," Bangladesh-India Friendship Power Company, accessed April 13, 2018, https://bifpcl.com/; IANS, "Bangladesh, India Sign 130km Oil Pipeline Deal," *Times of India*, April 10, 2018, https://timesofindia.indiatimes.com/world/south-asia/bangladesh-india-sign-130km-oil-pipeline-deal/articleshow/63688802.cms.

76. Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, "Power System Master Plan 2016," 1-8, 1-63.

an ambitious target of achieving developed country status by 2041, yet the pathway to that goal is unclear. At present, there are few sectors that seem likely to replace the textile industry as the new engine of industrial growth. The previous demand forecast, calculated in 2010, marginally overestimated GDP growth through the boom years that followed.[77] There is a possibility that Bangladesh will not grow fast enough or large enough to consume the 55 GW of power estimated to be needed by 2041, and power imports will remain significantly below the 10 GW predicted. It is clear, however, that the country is actively utilizing its financial and diplomatic resources to push for greater regional cooperation on power and will continue to act as a source of demand in the coming decade.

77. The estimated average growth rate was 7.3 percent whereas the average growth rate achieved was 6.9 percent.

Conclusion

We have emphasized four factors that will determine the eventual prospects for grid integration in eastern South Asia and, consequently, hydropower development in the Himalayas. First, the current logic of grid integration is not market-oriented. It is operationally too fragmentary to emit reliable long-term supply signals to hydropower investors in the Himalayas. In a noodle-bowl of bilateral and tri-lateral power purchase agreements between India-Bhutan, India-Nepal, India-Bangladesh, India-Bhutan-Bangladesh and, most likely, India-Nepal-Bangladesh, the logic of an integrated market is almost completely lost.

Second, geopolitical competition between the two Asian giants - India and China - will continue to loom over any imagination of a fully-integrated South Asian power pool that includes a sizable hydropower component. The Himalayas mark the boundary of India's geopolitical sphere of influence and the source of hydropower for the region. Any geopolitical competition in this sensitive geography is bound to distort the operating environment and impede hydropower development. This could, consequently, limit the development of renewables in the region in the long run.

Third, because of its disproportionately large domestic demand and geographic centrality, the distribution-end dynamics of India's domestic market is what matters most when it comes to pricing and supply signals for hydropower development in the region. In the absence of successful reforms, most distribution companies will find that they are financially incapable delivering a climate-compliant mix of electricity or purchasing significant amounts of hydropower to displace addictively cheaper thermals.

Fourth, while India remains power surplus in the short-run, Bangladesh is the key interim market for hydropower in the Himalayas. The role Bangladesh plays in the development of hydropower depends, in turn, on two factors: (1) whether India takes decisive steps to create a stable policy foundation for Bangladeshi investments in Bhutan and Nepal and (2) whether Bangladesh remains resolute in pushing for a greener energy mix in the face of readily available and cheap thermal imports from India. The underlying political economy factors are complicated enough to block any decisive movement on both fronts for the time being.

These four issues will remain relevant for the next three to five years, if not more. In the same period, close to 23 GW of hydropower currently in the pipeline in India, Nepal and Bhutan will have to find a market. An assured regional market for the pipeline is not readily visible, given the absence of a regional power pool that can efficiently match demand and supply and the presence of cheaper thermal alternatives. Even if a large part of this capacity is absorbed domestically, barring perhaps in Bhutan, the risk exposure is high for private sector projects that are built on take-and-pay power

purchase agreements and commercial bank loans. Nepal is a bellwether because close to 60 percent of its current hydropower projects fall into this category. Such a crisis would sour the long-term investment climate for hydropower in the rest of the region as well.

Seen through the lens of sustainability, India's attempt to transform its energy mix will change how water is used in the production of electricity. A reliance on coal plants to meet both peak power demand and the country's baseload requirements will heap further stress upon already scarce freshwater resources in central and south India just as Himalayan hydropower built to compliment solar capacity will change river ecologies and lead to competition with other users of that water, from Nepal's whitewater rafting operators to marginalized downstream agriculturalists. Local challenges to energy pathways set in national capitals will arise in part due to the diversion, consumption or pollution of water by power plants, thermal or otherwise. As the water stresses induced by demography combine with the unpredictability of climate change, water will begin to occupy a more central role in deciding the region's power sector trajectory. Ecological and social solidarities arising from contestations for water will form in response to power sector investments, political fortunes will be made and lost.

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114 Jor Bagh, First Floor
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