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MEGAWATTS OF TRUST

Navigating the 2040 Roadmap for India–Bhutan Hydropower Potential

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Abstract

This Research Article explores the evolution and contemporary dynamics of the relationship between India and Bhutan through the lens of hydropower cooperation. The paper traces the development of cooperation in the field of hydropower, highlighting the significant historical events that contributed to the development of the sector over the years. The paper argues that hydropower cooperation has been mutually beneficial, furthering Bhutans socio economic development while positively contributing to India's energy security and decarbonisation goals. However, key domestic and bilateral challenges, like project delays, cost overruns, rising debt burdens, environmental risks, and pricing tensions between the two countries, are limiting the full potential of the sector. The paper concludes by providing policy recommendations that work towards financial sustainability, institutional capacity, and environmental safeguards, intending to ensure long-term resilience and a future-oriented energy partnership.

Introduction

India's partnership with Bhutan is one of the most harmonious and structured relationships, marked by similarities and complementarities. Since the post-independence era, the two sides have anchored their ties in trust, cooperation, and strategic alignment. At the heart of this partnership lies hydropower cooperation, which began with the Jaldhaka Agreement (1961) and has since pioneered mutually beneficial collaboration. While providing clean electricity to India and generating billions in revenue for Bhutan, it is the most visible and economically consequential expression of this partnership. Additionally, as the global energy landscape pivots towards decarbonisation, Bhutan's clean energy potential in hydropower, solar power, and green hydrogen positions it as a strategic energy partner of exceptional value to New Delhi.

To contextualise, India imports around 40 per cent of its primary energy, with fossil fuels accounting for nearly 90 per cent of those needs, according to the International Energy Agency's India Energy Outlook 2021. Meanwhile, its renewable energy resources stood at 274.68 GW as of March 2026. However, India has set an ambitious target to decarbonise energy by 50 per cent and to achieve 500 GW of fossil fuel-free generating capacity by 2030. Therefore, the relationship with Bhutan, which has a hydropower potential of approximately 30,000 MW and an annual generation capability of 154,000 GWh, according to the Asian Development Bank, secures India a reliable, clean power source, aiding in energy security, grid stability, and energy portfolio diversification.

Further, this cooperation has propelled Bhutan's socio-economic development by upgrading roads and regional connectivity infrastructure, creating jobs via technical training, strengthening institutions, fostering data-sharing, and deepening hydrological cooperation. As stated above, it has also allowed Bhutan to optimise its national income through power exports to India, reinforcing its macroeconomic stability. This paper analyses the evolution of India–Bhutan relations in the hydropower sector, diagnoses the challenges it faces, and suggests policy measures to enhance mutual benefits while addressing geopolitical, climate, and economic risks.

Overview of India–Bhutan Relations

Sharing a 699-kilometre border, the India–Bhutan relationship is not merely a result of geographical proximity, but of deep civilisational, cultural, and developmental interdependence. The Treaty of Friendship and Cooperation, signed in 1949, laid the foundation for establishing diplomatic relations in 1968. Subsequently, the treaty was revised in 2007, acknowledging the sovereign equality of both nations and emphasising a shared commitment to non-interference in each other's internal affairs. The hallmark of the relationship remains a tradition of regular high-level political and official exchanges, especially since Prime Minister Narendra Modi chose Bhutan as the destination for his first overseas visit after assuming office in 2014. Similarly, His Majesty the King of Bhutan has also visited India numerous times, reflecting the depth of the friendship and the commitment of both governments to the bilateral relationship.

The development partnership with Bhutan has been most comprehensive; India has acted as a close partner in its socio-economic development, coordinating assistance under the overarching mechanism of the Bilateral Development Cooperation Talks, popularly known as 'Plan Talks'. Additionally, under a Programme Grant component, India provides direct budgetary support to Bhutan. For the 13th Five-Year Plan period, the Government of India has committed INR 10,000 crore. The scope of India's development assistance spans infrastructure, roads, digital connectivity, energy, agriculture, ICT, health, education, and urban development.

Economically, India and Bhutan share positive trade relations, with India operating as the dominant economic partner for decades. The 2016 India–

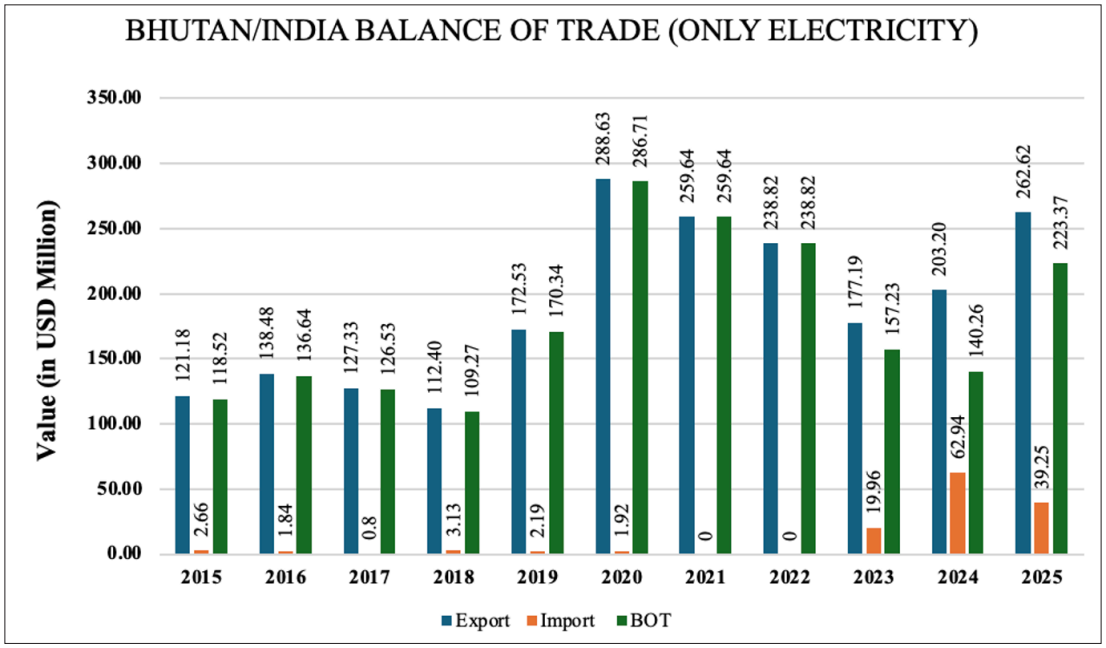
[1] *The commodity-wise imports and exports are attached in the appendix.*

Bhutan Agreement on Trade, Commerce, and Transit established a free trade regime and provided Bhutan with duty-free transit access to third countries. According to the Bhutanese Finance Ministry's 2025 trade report, India accounts for 58.8 per cent of Bhutan's imports and 78.8 per cent of Bhutan's exports, consistently serving as Bhutan's largest trading partner, both as a source of imports and as a destination for exports. The past decade has witnessed a threefold increase in trade, climbing from USD 484 million in 2014–15 to USD 1,777.44 million in 2024–25, accounting for over 80 per cent of Bhutan's overall trade.[1] This trend extends to investments; India has contributed 55 per cent of total Foreign Direct Investment (FDI) inflows into Bhutan, making it the largest source of FDI to the country as of December 2024. Indian investments focus primarily on sectors such as hydropower, banking, IT services, and infrastructure development, and for this paper, we will focus on hydropower.

The Context of Hydropower

The hydropower sector is crucial to the India–Bhutan economic relationship, contributing about 42 per cent of Bhutan's electricity export revenue over the past decade.[2] The balance of trade in the sector has consistently favoured Bhutan, with the average over the last 10 years amounting to USD 179 million. Bilateral trade in this sector operates through a variety of long-term power purchase agreements (PPAs)[3] and developer agreements.

Figure 1: Graphical Representation Explaining Bhutan's Trade Relations with India in the Electricity Sector from 2015 to 2025



Source: The Graph is made by the author. The data collected is from the Trade Statistics Reports of Department of Revenue and Customs, Ministry of Finance, Royal Government of Bhutan (2015-2025)

The institutional foundations for cooperation date back to 1961 with the signing of the Jaldhaka agreement. The 44 MW project, located on the Indian side of the India–Bhutan border in West Bengal, generated a large portion of the power exported to southern Bhutan. This laid the foundation for future cross-border energy collaboration. Bhutan, with its abundant water resources and dramatic Himalayan terrain, possesses

[2] *Calculated by taking the average of export data from the India–Bhutan Balance of Trade Data, 2025.*

[3] *Under these agreements, the excess electricity generated by hydropower projects is imported into India.*

enormous hydropower potential estimated at approximately 30,000 MW, of which only a fraction has been harnessed. Consequently, the logic of hydropower cooperation was compelling from the outset: Bhutan held the water, the gradient, and the land; India commanded the capital, the technical expertise, and the appetite for clean electricity to power its growing economy. This complementarity of resources and needs created the foundational basis for a partnership that has deepened over five decades.

The early agreements established the inter-governmental modality, whereby India finances projects through a mix of grants and concessional loans, while Bhutan earns revenue by selling surplus electricity to India. The electricity is exported to India at agreed rates, and the revenues form a significant and sometimes dominant portion of Bhutan's national revenue. This model has been credited with enabling Bhutan to finance its development without incurring unsustainable external debt, maintain fiscal stability, and invest in human development, turning Bhutan's hydropower–development nexus into a model for resource-rich small states.

In 1974, the partnership received impetus with the signing of a bilateral agreement for the construction of the Chukha Hydroelectric Project (HEP), which resulted in the commissioning of Bhutan's first mega power project, the 336 MW Chukha Hydropower Project (CHP). It generated revenue that catalysed Bhutan's development in the 1980s and 1990s. Other projects commissioned and concluded include the 60 MW Kurichhu HEP, 1,020 MW Tala HEP, 720 MW Mangdechhu HEP, and 1,020 MW Punatsangchhu-II HEP, with a combined capacity of over 3,156 MW. This has collectively enhanced Bhutan's generation capacity to approximately 3,490 MW. Recent developments within the sector indicate continued momentum. The construction of the delayed Punatsangchhu-1 Hydropower Project (PHPA-I), with a generation capacity of 1,200 MW, has resumed and entered an advanced execution stage following years of geological redesign and slope-stabilisation works.

In 2025, the Adani Group and Druk Green Power Corporation (DGPC),[4] a state-owned hydropower plant operator and developer, signed an MoU for the joint development of 5,000 MW of hydropower projects in Bhutan. They are also working towards developing the 570 MW Wangchhu hydroelectric project. In the same year, Tata Power Company Limited, India, and the DGPC signed a commercial contract for the execution of the 1,125 MW Dorjilung Hydro Power Project, expected to be Bhutan's biggest power project under the public–private partnership (PPP) model. In 2026, Patel Engineering secured a ₹230 crore deal from Bhutan-based Dorjlung Hydro Power Ltd for executing pre-construction activities in Package 1 of the project.

In a new and significant development in September 2023, India gave approval for the 64 MW Basochhu HEP to trade its energy through the Indian Energy Exchange (IEX), initiating a market-based modality for electricity export. This was extended in May 2024 when the Government of India approved both the Basochhu and Nikachhu HEPs to trade their energy on the IEX through Day-Ahead Market and Real-Time Market mechanisms. These projects highlight the sustained bilateral commitments, which significantly contribute to Bhutan's installed capacity, helping it achieve its aims under the Renewable Energy Roadmap 2040.[5] During 2025, Bhutan's total export of electricity was valued at INR/Nu. 24,298 million (approximately INR 2,430 crore), underscoring the economic significance of this trade. The table below provides a brief timeline showcasing some of the hydroelectric projects between India and Bhutan over the years.

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[4] *The organisation, a subsidiary of Druk Holding and Investments Limited, is the only generation utility in Bhutan; it was established to utilise water resources, develop water-to-wire expertise amongst the Bhutanese, and lead in accelerating hydropower development on its own or through joint ventures, in keeping with the 2021 Sustainable Hydropower Development Policy.*

[5] *Under the roadmap, Bhutan looks to add 15,000 MW of hydropower and 5,000 MW of solar generation capacity.*

Figure 2: Progress of Major, Medium, and Minor Hydropower Projects in Bhutan[6]

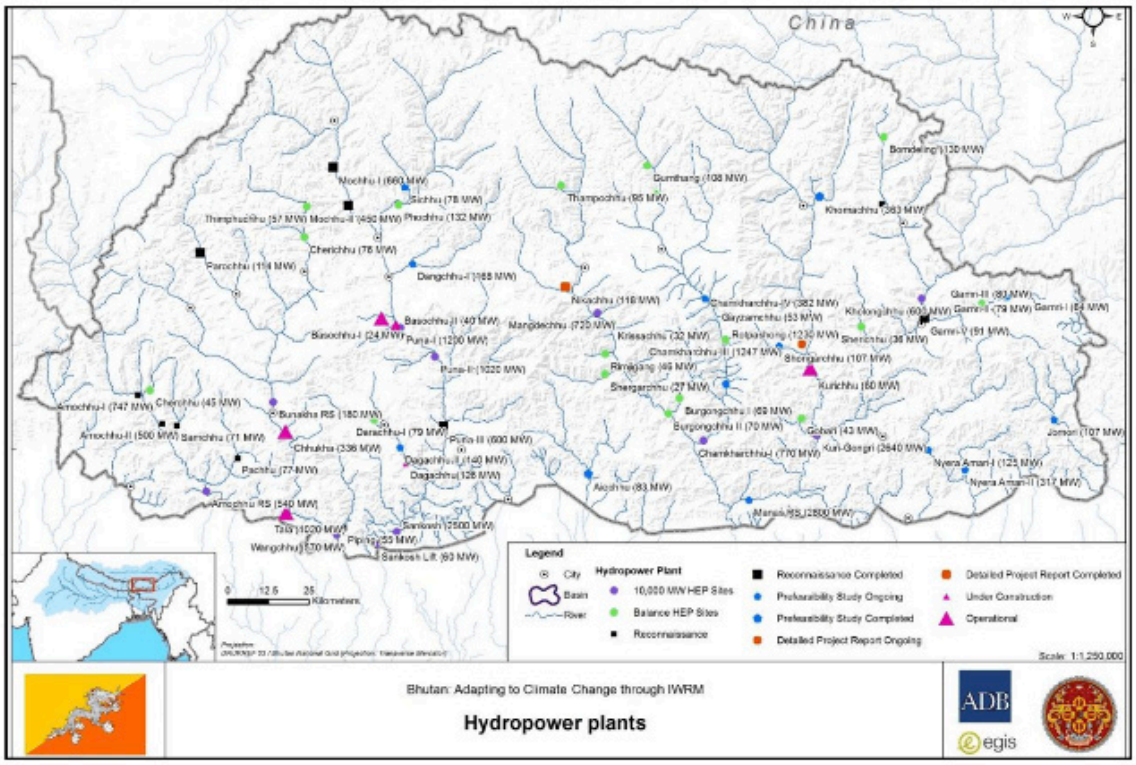


Table 1: Timeline of Hydropower Projects over the years

Name of Project	Capacity (MW)	Comissioning/Commercial Operations
Jaldhaka	44	1961–1967
Chhukha	336	1986–1988
Kurichhu	64	2001–2002
Basochhu	24	2001–2004
Tala	1020	2006–2007
Dagachhu	126	2015
Mangdechhu	720	2019
Nikachhu	118	2024
Punatsangchhu-II	1020	2025
Kholongchhu	600	2029 (expected)
Bunakha	180	2030 (expected)
Nyera Amari	404	2030 (expected)
Chamkharchhu	770	2030 (expected)
Wangchu	570	2031(expected)
Punatsangchhu-I	1,200	2031 (expected)

Source: The table is author made. The information has been compiled from websites of the Embassy of India in Thimphu, the Druk Green Power Corporation Limited (DGPC), the Asian Development Bank (ADB), Power Technology, newspaper articles and the 2016 Vasudha Foundation Report titled, "A Study of the India-Bhutan Energy Cooperation Agreements".

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[6] *This image is sourced from Dialogue Earth's 2019 article titled, 'Many questions as Bhutan plans big dam with reservoir'.*

Alongside the establishment of these projects, several institutional frameworks have deepened collaboration. The 2006 Agreement on Cooperation in the Hydropower Sector, followed by its 2008 protocol, established a long-term framework for the sustainable development of hydroelectric projects, facilitating cross-border electricity trade. The 2008 amendment also set an ambitious target to increase generating capacity to 10,000 MW by the year 2020. However, in 2023, the sector had only achieved an installed capacity of 2,326 MW, proving that progress was slower than anticipated. This gap highlights persistent project delays, financing constraints, and implementation bottlenecks.

A key parameter of the hydropower partnership has been the evolution of the financing structure from state-led concessional financing to a hybrid public–private partnership model. Initially, hydropower projects were developed under the inter-governmental model involving a 60:40 grant-to-loan ratio from India. This arrangement proved mutually beneficial, allowing Bhutan to generate substantial export revenues while aiding India's energy security goals. However, delays and cost overruns in subsequent mega-projects exposed structural weaknesses in the model. The 1020 MW Punatsangchhu-II Hydroelectric Project began construction in 2010 but was only fully commissioned in 2025, following prolonged implementation challenges.

In 2014, a 'Framework Inter-Governmental Agreement' introduced a joint venture model whereby 70 per cent of project financing flows from corporate debt and 30 per cent is sourced as equity from India. The model sought to provide Bhutan greater flexibility in ownership and risk management. The Kholongchhu Hydropower Project, a joint venture between Bhutan's Druk Green Power Corporation (DGPC) and India's Satluj Jal Vidyut Nigam Limited (SJVN), pioneered this model.[7] As of 2026, four major hydropower projects are underway within this framework. While the model was anticipated to enhance efficiency and lessen bureaucratic delays, the projects have encountered difficulties due to the 50:50 ownership structure, leading to decision-making stalemates with unresolved disputes requiring intergovernmental intervention despite the projects' 'commercial' orientation.

Eventually, Bhutan decided to deepen Indian private sector involvement, allowing up to 49 per cent private investment in hydropower initiatives to reach the 25 GW generation capacity target for 2040. This shift has encouraged firms such as Tata Power, the Adani Group, and Reliance to enter joint ventures with the DGPC. The transition showcases Bhutan's intention to reduce long-term reliance on the Indian government for technical expertise, engineering design, and project management, while strengthening domestic institutional and technical capabilities through more diversified partnerships.
In addition to power generation, both nations have been investing in further strengthening cross-border transmission infrastructure, streamlining power transmission networks for electricity trade. Initiatives such as the Joint Team for Power Transmission drive collaboration, interaction, and planning to expand transmission facilities between India and Bhutan, catering to future needs. This integrated approach ensures that hydropower cooperation remains both a driver of economic growth and a cornerstone of the strategic and energy partnership between the two nations.

Beyond hydropower, India has expanded bilateral cooperation to encompass solar energy and green hydrogen. During Prime Minister Modi's state visit to Bhutan in March 2024, the two sides signed a Joint Vision Document on the India–Bhutan Energy Partnership to develop new projects in these emerging sectors, including through Indian entities acting as strategic partners with Bhutanese enterprises like the Druk Green Power Corporation (DGPC) and Druk Holding and Investments (DHI). To operationalise this vision, the Ministry of New and Renewable Energy (Government of India), the

[7] *The Satluj Jal Vidyut Nigam Limited is a prominent Indian Navratna Central Public Sector Enterprise under the Ministry of Power, established in 1988 as a joint venture between the Government of India and the Government of Himachal Pradesh.*

Embassy of India in Thimphu, the Ministry of Energy and Natural Resources (Royal Government of Bhutan), the Confederation of Indian Industry (CII), and the DGPC jointly convened the India–Bhutan Renewable Energy Roundtable in Thimphu on 28 October 2024. This forum brought together experts from both governments and the private sector to chart the next phase of energy cooperation.

Domestic Issues and Challenges

While the hydropower-led development model has helped propel the growth of the Bhutanese economy, the country still faces a range of economic, structural, and geopolitical challenges that could potentially complicate its survival and derail its economic growth.

Geographical and environmental constraints limit Bhutan's hydropower potential. First, large hydropower projects in the Himalayas generate significant environmental concerns. Constructing dams and tunnels in seismically active zones, diverting river flows, submerging valleys and forests, and displacing communities all invite scrutiny from environmental advocates and local communities. Bhutan's own governance philosophy, enshrined in its Gross National Happiness framework, places great emphasis on environmental conservation, and the Royal Government constitutionally mandates that at least 60 per cent of the country's land area remain forested. Balancing hydropower development with these environmental imperatives has required careful environmental impact assessments and mitigation measures. Therefore, run-of-the-river projects, which do not involve large storage reservoirs, have been preferred over storage dams precisely because they minimise submergence and ecosystem disruption. Nevertheless, cumulative impacts across multiple projects on the same river system – particularly on fish migration, sediment transport, and downstream water availability – remain subjects of ongoing ecological concern.

Second, the region's rugged mountainous ecology has led to projects facing issues like slope destabilisation, tunnel mishaps, and unexpected geological conditions. Rising temperatures and erratic weather exacerbate the risks of glacial lake outburst floods (GLOFs), flash floods, and landslides, as well as biodiversity loss. These hazards significantly affect hydropower projects by increasing their overall cost, owing to the climate-related reassessments and additional reconstruction efforts, thereby contributing to further project delays.

Third, while Bhutan enjoys the highest water availability in South Asia, dispersed settlements and low population density spike per capita delivery costs. Construction, river diversion, and tunnelling for run-of-the-river projects alter the natural flow of ponds and springs, disrupting local water supply pipelines.

Fourth, electricity production within Bhutan also fluctuates because run-of-the-river hydroelectric plants force Bhutan to import costly electricity in winter. While Thimphu traditionally imported from India for only three months of the year, these imports stretched to four months in 2022 and five months during 2023–2024. This pattern stems from climate change, as erratic weather patterns and drier winters reduce the river flows needed for generation.

Finally, the improper implementation of present policies, such as the Land Act of 2007, fuels resettlement and compensation disputes. Affected communities claim that their consent was not sought for the construction of hydropower projects, while reports reveal that families whose agricultural land was seized received poor-quality or barren land as compensation. Furthermore, construction has resulted in severe dust and noise pollution.

Bilateral Issues and Challenges

The electricity trade between India and Bhutan operates on a seasonal pattern. Bhutan exports surplus hydropower to India from May to November each year, when its rivers are swollen with monsoon waters and snowmelt. During the lean season, Bhutan imports power from India to meet its domestic requirements. For the 2025 lean season, India approved Bhutan's request to import 1,250

MW of power, reflecting the collaborative spirit of the energy relationship. However, the two sides face the following issues and challenges.

The most significant challenge confronting the India–Bhutan hydropower partnership has been the severe cost and time overruns experienced in the Punatsangchhu-I and Punatsangchhu-II projects. The Punatsangchhu-I HEP, originally planned to generate 1,200 MW, was expected to be commissioned around 2016 but has faced repeated delays extending to a decade or more beyond the original schedule. The principal cause of delays at Punatsangchhu-I stems from geological instability; the valley experienced unexpected slope instability and landslides in the dam area, requiring extensive geological investigations, a redesign of the dam structure, and additional civil works. These geological surprises, not fully anticipated in initial feasibility studies, led to massive cost revisions and scheduling disruptions that eroded confidence in the project timelines, straining both governments' developmental budgets and the financial frameworks agreed upon at project inception.

Another persistent concern is the pricing of electricity exported from Bhutan to India, which has periodically sparked negotiations and, at times, friction. Bhutan's interest lies in obtaining the highest possible tariff for its clean energy exports, while India seeks to ensure affordability consistent with its broader energy procurement strategy. In the past, critics accused New Delhi of undervaluing Bhutan's tariff rates by importing hydropower far below domestic Indian market rates. Objections had also been raised about the restrictive provisions of India's Cross-Border Trade of Electricity (CBTE) Guidelines 2016.[8] While periodic tariff revisions have generally satisfied both sides, the underlying tension between Bhutan's revenue aspirations and India's tariff expectations remains a structural feature of the relationship. With the entry of private sector players and the new mechanism of trading electricity through the Indian Energy Exchange (IEX), tariff determination is increasingly subject to market dynamics rather than bilateral negotiation alone. This marketisation of electricity trade introduces both opportunity and risk: Bhutan can potentially capture higher prices during peak demand periods but stands exposed to price volatility in exchange markets.

There have also been concerns about the insufficient employment opportunities created for Bhutanese citizens from Indian hydropower projects. The sustainable management and operation of large hydropower infrastructure require deep technical expertise and institutional capacity within Bhutan. While organisations like the DGPC have developed significant competency over the years, gaps remain where capacity needs strengthening – particularly in project management, geological risk assessment, environmental monitoring, and energy trading. The large presence of Indian workers and engineers in Bhutan's hydropower sector (approximately 50,000 Indians work in Bhutan across various sectors) reflects both the scale of the partnership and the ongoing need for technical exchange. Currently, Bhutanese firms are relegated to small subcontracting roles in civil works (e.g., supplying boulders and sand), leaving the domestic private sector with only marginal participation in the hydropower sector.

Further, hydropower exports have historically contributed a major share, often 20 to 40 per cent, of Bhutan's government revenues, and the country's development model has been partly predicated on this income stream. However, the delays in commissioning Punatsangchhu-I and Punatsangchhu-II meant that anticipated revenues did not materialise on schedule, creating fiscal pressures for Bhutan. Even the 2026 Annual Macroeconomic Performance and Outlook report noted that delays or implementation challenges in ongoing projects, including PHPA-I, Dorjilung, and

[8] *Key issues included restricted market access, where eligibility was limited to projects owned or financed by Indian entities, barring Bhutan from trading with foreign investors. Furthermore, the requirement for one-time approval by an Indian designated authority raised concerns over strategic economic control, potentially restricting Thimphu's ability to diversify partnerships. The shift in financing from grants to loans also led to fears of increasing external debt, particularly as the hydropower sector constituted nearly 60 per cent of Bhutan's obligations.*

Khorlochhu, have adversely affected medium- and long-term growth, fiscal revenues, export earnings, and sustainability. Additionally, rising public debt, largely driven by hydropower financing (constituting almost 60.1 per cent of total external debt), fuels concern. As of June 2025, Bhutan's external debt stands at USD 4.021 billion, which represents 110.47 per cent of its GDP in Q2 of FY 2025–26.[9] Therefore, while the projects help maximise export revenues, the rising debt could potentially have significant impacts on the economic stability of Bhutan.

Finally, trade relations beyond the power sector reveal a trade asymmetry between India and Bhutan. The graphical representations below show the overall effect the power sector has on both exports and the balance of trade. Bhutan's overall balance of trade is heavily skewed in India's favour, with only the electric sector mitigating the imbalance somewhat.

Figure 2: Graphical Representation Explaining Bhutan's Overall Trade Relations with India from 2015 to 2025

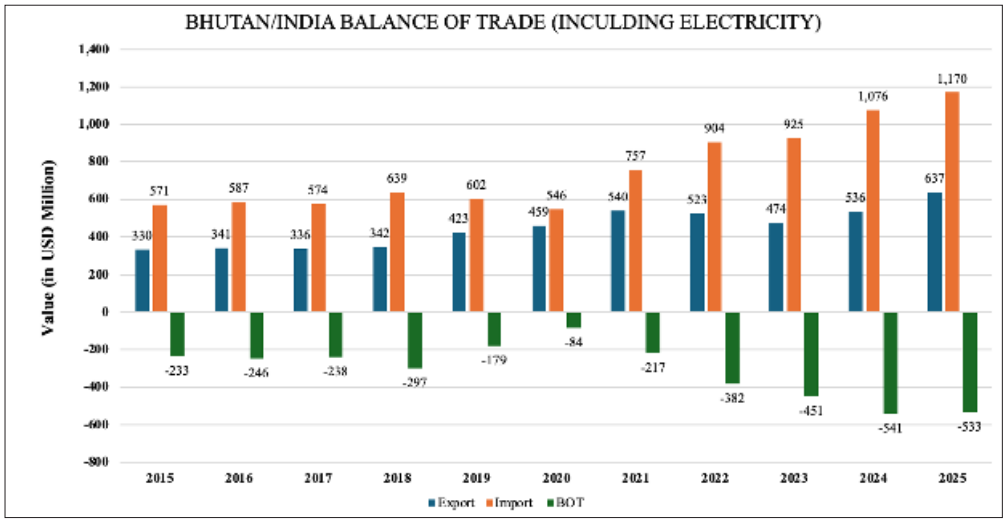
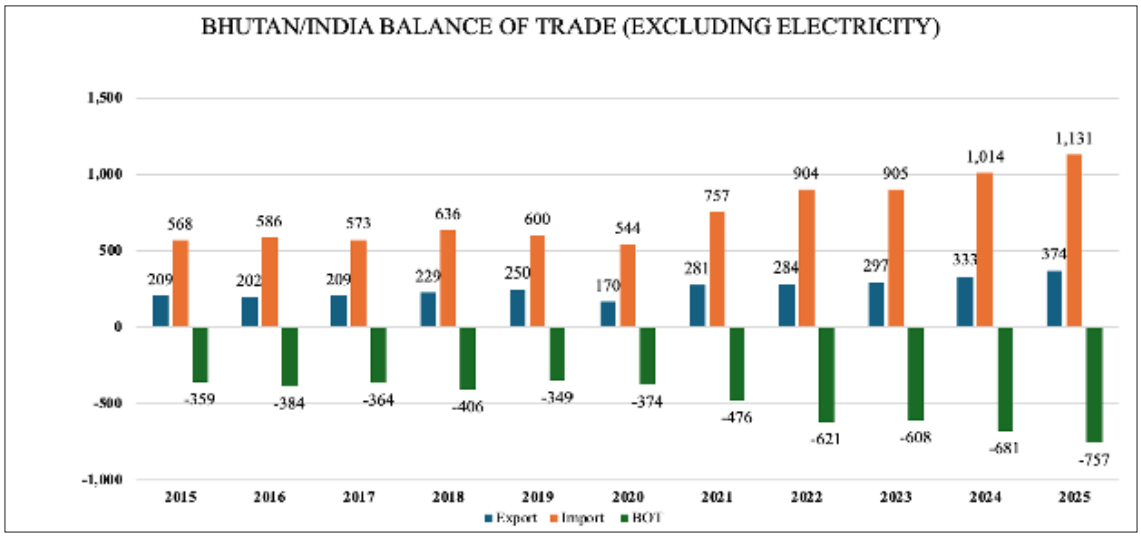


Figure 3: Graphical Representation Explaining Bhutan's Overall Trade Relations with India from 2015 to 2025 (Without Electricity)



Source: (Figure 2&3) The Graph is made by the author. The data collected is from the Trade Statistics Reports of Department of Revenue and Customs, Ministry of Finance, Royal Government of Bhutan (2015-2025)

[9] *These are statistics provided by Bhutan's Department of Macro-Fiscal and Development Finance in the Public Debt Situation Report 2025.*

According to data provided by the Indian government's Department of Commerce's Trade Intelligence and Analytics Portal, Bhutan accounts for only 0.06 per cent of India's import share and 0.30 per cent of India's export share. Over the years, India has maintained an average trade surplus of around USD 355 million from 2017 to 2026. The introduction of the Goods and Services Tax (GST) in 2017 contributed to a widening trade deficit, further reinforcing economic asymmetries.

Policy Recommendations

Despite the foregoing domestic and bilateral challenges, the hydropower sector remains a premier pillar for mutually beneficial collaboration, owing to Bhutan's massive energy-generating potential and India's capacity – through finance and technical knowledge – to help realise it. This section offers policy recommendations to resolve these doubts while strengthening the partnership to achieve its full potential.

First, the soaring cost and time overruns at the Punatsangchhu projects demand a fundamental review of the project delivery framework. Both governments should establish a Joint Hydropower Project Management Authority equipped with dedicated expertise in Himalayan geology, project risk management, environmental compliance, and financial oversight. Pre-feasibility and feasibility studies for future projects must mandatorily incorporate advanced geological investigations – including geotechnical drilling, seismic risk mapping, and slope-stability analysis – before anyone makes financial commitments. Contracts should incorporate realistic contingency provisions for geological surprises, and tariff frameworks should be indexed to actual commissioning timelines to curb financial uncertainty. Stricter environmental impact assessments, transparent resettlement frameworks, and enhanced corporate accountability for Indian firms operating in Bhutan can strengthen environmental and social safeguards, bolstering local trust and social acceptance.

Second, to address debt sustainability concerns and revenue predictability, both governments should explore creating a Bhutan Hydropower Revenue Stabilisation Fund, modelled on sovereign wealth fund principles. In years of high hydropower revenues, a portion of Bhutan's export earnings could be set aside to cushion against lean seasons, project delays, or tariff fluctuations. India could contribute to this fund's capitalisation as part of its development assistance. Additionally, the interest rates and repayment terms on India's project loans to Bhutan should undergo periodic reviews to ensure they remain aligned with Bhutan's actual revenue-generation capacity. India must also incorporate balanced financing models with improved grant components, equitable risk-sharing, and multilateral participation to mitigate Bhutan's rising debt burden.

Third, reforms also need to be made concerning pricing and trade mechanisms. The introduction of market-based electricity trading through the IEX is a welcome development that should be systematically expanded. Both governments should develop a Bilateral Electricity Trade Framework that establishes clear rules for market participation, price-stabilisation mechanisms, protocols during peak demand periods, and transparent settlement procedures. A joint regulatory body or working group on electricity trade, building on the existing Joint Team for Power Transmission, could provide the governance architecture for this framework, ensuring that market liberalisation serves the long-term interests of both countries. Additionally, there needs to be a sustained push to transition from High-Voltage Alternating Current (HVAC) lines, which are reaching their capacity limits, towards dedicated High-Voltage Direct Current (HVDC) technology. Dedicated HVDC systems will transmit electricity over longer distances more efficiently with fewer losses, securing smoother power delivery systems between Bhutan and India.

Fourth, Indian private sector companies are already collaborating with the DGPC and DHI on select hydropower projects. This private sector dimension requires systematic encouragement, provided it operates within a framework that safeguards Bhutan's national interests and ensures equitable

revenue-sharing. Clear guidelines for private sector participation – covering equity stakes, PPAs, environmental compliance, and technology transfer – should be jointly developed. Indian corporate participation must orient itself towards genuinely strategic partnerships rather than mere contract execution, building Bhutanese institutional capacity in the process. Here, India should expand financial and technical assistance to Bhutanese entrepreneurs and firms across the private and public sectors, enhancing project development, generating employment, and facilitating Bhutan's gradual transition towards greater sectoral self-sufficiency.

Fifth, to address the concerns of employment opportunities for Bhutanese citizens, India should expand its capacity-building programmes in Bhutan across energy management, geological sciences, environmental engineering, and energy trading. Beyond individual scholarships, India should establish a dedicated Centre of Excellence for Himalayan Hydropower and Renewable Energy within Bhutan, possibly in partnership with an IIT or the National Hydroelectric Power Corporation (NHPC), to train Bhutanese engineers and policymakers, pioneer site-specific research on Himalayan hydropower challenges, and serve as a technical knowledge repository for the bilateral partnership.

Furthermore, the initiative to push beyond hydropower to explore solar energy and green hydrogen as the next frontier marks a step in the right direction. Bhutan boasts significant solar potential, particularly in its southern foothills, and green hydrogen produced from its clean hydropower could serve as a premium export commodity for India's decarbonising industry. India's National Green Hydrogen Mission provides a policy and financial architecture that can incorporate Bhutan-produced hydrogen. Fast-tracking pilot projects in these sectors will diversify Bhutan's energy export base and reduce over-dependence on large hydro projects. India should also assist Bhutan's economic diversification by promoting investment in growth sectors such as tourism, agro-processing, and digital services. Space cooperation has also emerged as a significant new domain; the two sides jointly developed the India–Bhutan SAT, launched on 26 November 2022 from ISRO's Satish Dhawan Space Centre, rendering Bhutan one of the few small nations to co-develop its own satellite.

Finally, hydropower cooperation cannot be viewed in isolation from broader bilateral connectivity. The proposed cross-border rail links connecting Kokrajhar (Assam) to Gelephu and Banarhat (West Bengal) to Samtse, currently under discussion, will not only facilitate trade and people-to-people connectivity but will also reduce logistics costs for hydropower project construction and maintenance. The Gelephu Mindfulness City initiative, which India should actively support through infrastructure and institutional linkages, can become an economic complementarity hub, integrating energy trade, tourism, and commerce in a manner that deepens the bilateral economic relationship.

Conclusion

The challenges are real: geological risks have caused costly delays; financial sustainability has raised concerns; environmental imperatives need attention; and pricing and trade negotiations require periodic revision. To address these concerns, strengthen economic diversification, and ensure environmentally responsible development, the two sides must engage in sustained high-level dialogue and improved policy coordination, ensuring a partnership that is resilient, mutually beneficial, and aligned with an ever-evolving regional landscape. Already, the institutional depth, the track record of delivery, and the expanding vision articulated in the Joint Vision Document on Energy Partnership of March 2024 provide solid grounds for collaboration.

As the global energy landscape shifts towards decarbonisation, Bhutan's clean energy potential in hydropower, solar, and ultimately green hydrogen, positions it as a strategic energy partner of exceptional value for India. For Bhutan, a sustainable, diversified, and equitably structured energy partnership with India remains the surest path to financing its development aspirations while preserving the unique identity and ecological

heritage. Therefore, the bilateral relationship stands as a prime model of stability and mutual benefit within the subcontinent, with historic ties and the hydroelectric sector reinforcing this cooperation. By creating an environment of mutual trust and adaptation, the two nations can sustain their partnership, advancing their strategic and developmental interests. •

By Ethan Dmello and Dr Cchavi Vasisht

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APPENDIX

Table A1: Indian Imports from Bhutan (By Commodity)

Label	USD million
72022100: FERRO-SILICON CONTNG>55% OF SILICON	14.494954
25181000: DOLOMITE NOT CALCINED OR SINTERED	4.526535
09083110: LARGE (AMOMUM)	2.492459
72071920: MILD STEEL (M.S.) BILLETS	2.38325
72023000: FERRO-SILICO-MANGANESE	2.248857
72142090: OTHERS	2.071051
25171090: OTHR BALLAST SHINGLE AND FLNT W/N HT-TREATED	1.878262
25201010: NATURAL GYPSUM AND ANHYDRITE	1.059561
28492090: OTHER CARBIDES OF SILICON	0.891953
25232910: ORDINARY PORTLAND CEMENT, DRY	0.746389

Source: Trade Intelligence and Analytics Portal, Department of Commerce, Government of India

Table A2: Indian Exports to Bhutan (By Commodity)

Label	USD million
27101949: HIGH FLASH HIGH SPEED DIESEL FUEL CONFORMING TO STANDARD IS 16861	14.156818
27160000: ELECTRICAL ENERGY	10.345484
27101241: MOTOR GASOLINE CONFORMING TO STANDARD IS 2796	5.595047
44029000: OTHER	4.284169
27040030: HARD COKE OF COAL	3.21355
72031000: FERS PRDCT OBTND BY DRCT RDCTN OF IRON ORE	1.772913
15079010: SOYA BEAN OIL OF EDIBLE GRADE	1.638645
85371090: OTHER	1.416636
84295200: MCHNRY WTH A 360 DGR. RVLVNG SUPR-STRCTR	1.355409
10063099: OTHERS-OF-SEMI/WHOLLY MILED RICE W/N POLISHED/GLAZED	1.297023

Source: Trade Intelligence and Analytics Portal, Department of Commerce, Government of India

Table A3: Balance of Trade between India and Bhutan (Including Electricity)

TRADE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Export	330	341	336	342	423	459	540	523	474	536	637
Import	571	587	574	639	602	546	757	904	925	1,076	1,170
BOT	-233	-246	-238	-297	-179	-84	-217	-382	-451	-541	-533

Source: Bhutan Trade Statistics, 2025

Table A4: Balance of Trade between India and Bhutan (Excluding Electricity)

Trade	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Export	209	202	209	229	250	170	281	284	297	333	374
Import	568	586	573	636	600	544	757	904	905	1,014	1,131
BOT	-359	-384	-364	-406	-349	-374	-476	-621	-608	-681	-757

Source: Bhutan Trade Statistics, 2025

Table 5: Balance of Trade between India and Bhutan (Electricity Only)

Trade	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Export	121.18	138.48	127.33	112.40	172.53	288.63	259.64	238.82	177.19	203.20	262.62
Import	2.66	1.84	0.8	3.13	2.19	1.92	0	0	19.96	62.94	39.25
BOT	118.52	136.64	126.53	109.27	170.34	286.71	259.64	238.82	157.23	140.26	223.37

Source: Bhutan Trade Statistics, 2025

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