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Political Economy of Resource Economics: Unlocking the Policy Debate on Accelerated Hydropower Future in Bhutan

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Abstract

Bhutan is endowed with abundant hydropower potential and harnessing it has assumed national strategic importance as it is the backbone of Bhutan's economy. Given the importance of hydropower, the Sustainable Hydropower Development Policy was adopted in 2008 to accelerate hydropower development and achieve economic self-reliance. However, the acceleration generated a lot of controversy undermining the confidence of the Bhutanese people from all fronts, such as anticipated lower returns to investment, unstable future markets, threats from climate change, cost overrun, and delayed completion of projects. These are the emerging policy discourses among the Bhutanese bureaucrats, politicians, policy analysts, researchers, and independent thinkers concerning the hydropower future. However, a lot of what is discussed and published often comes in the form of general commentaries, media interviews, conference presentations, and official policy documents. A limited number of research papers either publish or unpublished comes from the graduate students' thesis which are based on data and documents available in the public domain. Correspondingly, this paper engages in implementing this significant agenda with scientific enquiry on Bhutan's investment in hydropower projects and its sustainability. Employing transdisciplinary research methodology, this paper debates why Bhutan needs to continue investing in accelerated hydropower development.

Keywords: Hydropower, Investments, Natural Resources, Policy, Political Economy

Introduction

Bhutan is a tiny land-locked country whose development philosophy is based on the concept of Gross National Happiness (Gross National Happiness Commission [GNHC], 2021; Druk Green Power Corporation [DGPC], 2019; Center for Bhutan Studies [CBS], 2016; Royal Government of Bhutan [RGoB], 2008). Bhutan's population as recorded in the National Population and Housing Census of 2017 is 735,553 (National Statistics Bureau [NSB], 2018), and the projected population as of January 2021 is 756,129 spreads across the total land area of 38,394 km^2, with the forest coverage of 71% (NSB, 2021). Bhutan's nominal GDP is US$ 2,475 million, and the GDP per capita is US$ 3,411.94 (Royal Monetary Authority [RMA], 2020; World Bank, 2020). The country's topography is made up of vastly rugged terrain with swift-flowing rivers spread into three major climate zones of alpine, temperate, and subtropical climate with the altitude variance from 150 m above sea level in the south to more than 7500 m above

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Table 1: Hydropower plants developed and operational as of 2021

Hydropower plants		Capacity in MW	Total completed
Mini hydropower plants		7.7	12
Micro hydropower plants		0.42	9
Medium hydropower plants	Kurichu (60 MW)	250	1
	Basochu (64 (MW)		1
	Dagachu (126MW)		1
	Chhukha (336 MW)		1
Large Hydropower plants	Mangdechu (720 MW)	1,056.00	1
Mega hydropower plant	Tala	1,020.00	1
Total		**2,334.12**	**27**

Adopted from (DGPC, 2019; NSB, 2020; BSHD, 2021)

sea level in the north, and the glacier in northern Bhutan covers about 10% of the total land surface area which forms an important renewable source of water for Bhutan's rivers (NSB, 2020). These rivers in Bhutan are seen as an enabler to harness hydropower with minimal socio-environmental impact, which also makes Bhutan the highest per capita availability of water in South Asia with 100,645 m^3 (Hirji, Nicol, and Davis, 2017), and among the highest per capita availability of water in the world (World Bank, 2018).

Bhutan's pristine fast flowing rivers have been often referred to as the 'White Gold' given its potential contribution to achieving economic self-reliance of the nation through the hydropower development. Hydropower has been identified as one of the strategic investment areas for Bhutan as envisioned in Bhutan 2020 (RGoB, 1999). Bhutan has a

Table 2: Hydropower plants currently under construction as of 2021

Hydropower plants		Capacity in MW	start date	completion date
Medium hydropower plants (Nikachu)/ Tangsibji		118	2016	2021
Large hydropower plants (Kholongchu)		600	2015	2022
Mega hydropower plants	Punatsangchu I (1200 MW)	2,220	2008	2022
	Punatsangchu II (1020 MW)		2010	2021
Total		**2,938**		

Adopted from (DGPC, 2019; Tortajada & Saklani, 2018)

Table 3: Proposed hydropower projects to be constructed in the next five years

Hydropower plants (proposed funding Source)	Capacity of Power (MW)	Mode of funding		Estimated project cost DPR Cost in billions (Nu)
		Debt	Grant	
Sunkosh Reservoir (GoI)	2,560	70	30	129.05
Kuri-Gongri (GoI)	2,640	70	30	211.68
Amochu Reservoir (GoI)	540	70	30	43.78
Sub-total: 1	**5,740**			**384.51**
Bunakha (Joint Venture)	180	70	30	31.68
Wangchu Reservoir (Joint Venture)	570	70	30	44.7
Chamkharchu -1 (Joint Venture)	770	70	30	52.12
Sub-total: 2	**1,520**			**128.5**
TOTAL 1+2	**7,260**			**513.04**

Adopted from (National Transmission Grid Master Plan of Bhutan, DHPS, 2018)

theoretical potential of hydropower generation at 30,000 MW with techno-economically feasible to access production potential of 23,765 MW (The Power System Master Plan, Ministry of Economic Affairs [MoEA], 2010; National Transmission Grid Master Plan, Department of Hydropower and Power Systems [DHPS], 2018). The Sustainable Hydropower Development Policy (2021) revised the estimated hydropower potential to 36,900 MW with annual production capacity of 154,000 GW hours (MoEA, 2021). The current installed production capacity of hydropower in Bhutan is approximately 2,334.12 MW generating 8,856.92 million units (MU) in 2019, out of which 6,146.60 MU were exported to India (NSB, 2020). This corresponds to 9.82% of the techno-economically feasible potential of 23,765 MW. The power generation from all diesel generators and wind power constitutes only about 7 MW. In 2019, the hydropower sector generated a revenue of Nu. 16.2 billion and constituted 40.8% of the total export (RMA, 2020), which is 12.69% of the total share of the GDP (NSB, 2020).

Institutional arrangements for hydropower development

The Electricity Act of Bhutan (EAB) was enacted in 2001 to restructure electricity supply industry. The objective of EAB (2001) is to provide safe and reliable supply of electricity in the country and enhance revenue generation through export of electricity (DGPC, 2019). Following the enactment of the EAB, a major restructuring exercise of the erstwhile Department of Power under the Ministry of Economic Affairs was carried out, and the following institutions were established.

In addition to the completed (2,334.12 MW), ongoing (2,938 MW), and planned projects (7,260 MW) as in Table 1, 2 and 3 above, 11 additional projects with a total of 2,057 MW capacity are in the various stages of planning. These projects add-up to a total of 14,589.12 MW of electricity in the near future. These accelerated hydropower development statistics is overwhelming in the face of growing public criticism and controversy undermining the confidence of the Bhutanese people. While hydropower has undoubtedly spurred

Table 4: Hydropower institutions and their mandates

Institution	Operational modality	Mandate
Department of hydropower and power systems (DHPS)	DHPS is a department under the ministry of economic Affairs.	Policy formulation; Power system expansion plans; rules and codes of conduct of the power institutions
Bhutan Electricity Authority (BEA)	Autonomous agency	Regulate the electricity industry, developing regulations, standards, codes, principles and procedures, and licensing and tariff regulation
Bhutan Power Corporation (BPC)	Corporate Office: Public Utility Company	Distribution of electricity; provide transmission access to the
Druk Green Power Corporation (DGPC)	Corporate Office: State Owned Company	Manage existing hydropower plants and accelerate hydropower development, by developing new hydropower projects
Bhutan Hydropower Service Limited (BHSL)	One-stop service center	Provide Technical Services such as manufacture of Pelton runners and other services such as underwater hydro-

Adopted from (BPC, 2020; DGPC, 2019; DHPS, 2018; EAB, 2020)

Bhutan's high economic growth and continues to be the backbone to Bhutan's economic self-reliance, there are emerging issues and challenges associated with accelerated hydropower development in Bhutan (as detailed out in the Literature review section). There are critical discourse and systemic arguments *for* and *against* the accelerated hydropower development. Therefore, this paper seeks to answer the question, should Bhutan invest in hydropower projects? If so, at what rate? If not, why?

Literature review: Underpinning the discourse

The approach to harnessing the hydropower wealth of the nation till 2008 had been planned and progressive. However, the government of Bhutan has strategized to accelerate the development of hydropower projects since 2008. Between 2008 and 2018, six major (medium, large and mega hydropower) projects were being constructed, and at-least six mega projects were being proposed with completed Detailed Project Reports. Development of large hydropower plant in Bhutan are either donor funded or based on grants or loans or joint venture project. Loans are either granted by international institutions like Asian Development Bank (ADB) or are based on grant-loan arrangement with government of India (DGPC, 2019).

Arguments for accelerating the hydropower investments are that; Bhutan is naturally endowed with ideal conditions for hydropower and is the only country with surplus power generation capacity in South Asia (ADB 2010), is among the highest per capita availability of water in the world (World Bank, 2018), and has highest per capita availability of water in South Asia (Hirji, Nicol, and Davis, 2017). Electricity from hydropower contributes to lighting in 99% and cooking in 94.9% households and therefore is the main source of energy (Bhutan Living Standards Survey, 2017; as cited in NSB, 2020). The hydropower sector generated a revenue of Nu. 16.2 billion in 2019 constituting 40.8% of the total export and 12.69% of the total share of the GDP (NSB, 2020; RMA, 2020). Hydropower is the backbone of Bhutan's economy and has been the main engine of

growth since 1980s, enabling to achieve 100% rural electrification, and contributing Bhutan in establishing various electricity-intensive industries (RMA, 2020; International Monetary Fund [IMF], 2018). Hydropower is the white gold for the Bhutanese economy and is the cornerstone of Bhutan-India friendship – in neighborhood relation (Rinzin, 2017).

Arguments against accelerated hydropower investments are the emerging issues and challenges, and lessons from the current investments that include economic, social, political and environmental dimensions (Rinzin, 2017; Kuensel, 2015a; 2015b; 2015c; Vasudha Foundation [VF], 2016). Kuensel, the national newspaper ran several headlines such as, 'Of lofty dreams and ground realities' citing the outcome of the 12th Empowered Joint Group (EJG) meeting which states that the Indian government had declined to finance some mega projects; Dagachu project cost has escalated by 50% and Punatsangchu projects have encountered geological problems (Kuensel, 2015a). Some Bhutanese analysts pointed out that with all attention given to hydropower sector, some sectors are bearing the brunt of what is called, 'putting all eggs in one basket', increasing hydropower debts 'living beyond our means,' and 'making too much of a good thing' (Kuensel, 2015b) and the urgent need to diversity the economy (ADB, 2014; as cited in Kuensel, 2015c). In addition, there are also concerns over long-term sustainability of hydropower investments in the face of global warming, climate change, decreasing precipitation, future demand of electricity in India, and more importantly the localized changing environment and ecology within Bhutan's own watershed (DGPC, 2019; Nie, *et al*., 2021).

Though hydropower energy is considered as clean, renewable, and the backbone of Bhutan's economy, an inquiry into its impact and sustainability with inclusive worldview is what the government as well as the general public is searching for. The Bhutan Sustainable Hydropower Development Policy (MoEA, 2021) which is the most recent policy expected to guide the overall hydropower development in Bhutan, acknowledges the *pros* and *cons* of the hydropower development sector. The policy states that hydropower is strategic renewable energy source; an enabler of industrialization; creating employment opportunities; providing reliable, adequate, secure and affordable energy, while enhancing revenue through export (MoEA, 2021). The same policy also acknowledges the inherent problems of cost escalation and overrun of construction completion dates. It also acknowledges the emerging future challenges such as competitiveness of Bhutan's hydropower in the Indian power market and impact of global warming and climate change in the form of receding snowlines and fast melting glaciers.

While there is heightened policy discourse among the Bhutanese bureaucrats, politicians, policy analysts, researchers, and the independent thinkers concerning the hydropower future, a lot of the discussions are in the form of general commentaries, media interviews, conference presentations, and official reports and policy documents. A limited number of research papers either publish or unpublished comes from the graduate students' thesis which were based on data and documents available in the public domain. These thesis and reports are approached from a single variable, employing either qualitative or quantitative methodologies, such as investigating the impact of hydropower investments on economic growth (Tobgye, 2017); India-Bhutan energy cooperation (VF, 2016); Voltage and power systems in Bhutan (Chophel, 2019); Hydropower development finance (Ogino *et al.*, 2021); Domestic socioeconomic barriers to hydropower trading (Ogino *et al.*, 2019) etc. Therefore, this paper engages in implementing this significant agenda with scientific enquiry in collaboration with key experts and key officials that are engaged in planning and implementing hydropower projects in Bhutan in conversation with academics and researchers. This is particularly important as the extent to which the holistic and sustainable approach

to development that aims to enhance the well-being of people in relation to GNH will be determined by the extent to which independent ideas, analysis, and informed opinions influence and shape policymaking in Bhutan (Tobden, 2020. p.2). Unlike the past thesis, reports and policy documents, this paper employs transdisciplinary methodology, as justified in the methodology section.

Materials and Methods

Rittel and Webber (1973) used the term 'wicked' to imply that the policy problems cannot be definitively described, because of the very nature of these problems being wicked. The characteristics of wicked problems are difficult to define, interdependent, multi-causal, unforeseen consequences, emergent behavior, no clear solution, socially complex, cross organizational boundaries, and behavior change (Rittel and Webber, 1973). The accelerated hydropower power development discourse is transdisciplinary and multi-causal (economy, political, social, environmental), interdependent and cross organizational boundaries (Inter-governmental, Joint-ventures, Public Private Partnership, various institutions), unforeseen consequences and emergent behavior (market dynamics, climate change, receding glaciers, flash floods).

According to Jahn *et al*. (2012) an ideal transdisciplinary process involves three processes such as; *problem formulation* (frame societal problems, relate the societal problems to scientific knowledge, and transform the societal problems into a boundary object; *co-production of knowledge* (clarifying/ negotiating the roles of participants, design of an integration concept, and implementation of the integration concept; *transdisciplinary design integration and evaluation* (assessing outcomes from science and society). The transdisciplinary research is purposive, holistic, participatory, experimental, action focused, and dynamic (Camillus, 2008; Mauser *et al.*, 2013). It engages the whole system, transgresses boundaries, engages with multi-stakeholders to gather diverse perspectives beyond academia, which is fundamental to achieve progress on wicked problems. It also tests ideas through real world interventions (Tress *et al.*, 2005) and is particularly relevant for researchers and practitioners in the fields of sustainability, qualitative research, environmental impact assessments and development studies (Fam *et al.,* 2017). Therefore, this research employs transdisciplinary research methodologies, as transdisciplinary research is a tool to address the wicket problem.

Method

This study employs the transdisciplinary design where academic and non-academic participants are engaged in high integration cross-disciplinary research spectrum (Tress *et al.*, 2005), and the knowledge is co-designed and co-produced between academic and stakeholders (Mauser *et al.,* 2013). The transdisciplinary research is generally conducted by different disciplines creating conceptual, theoretical, methodological, and translational innovations to address a common problem.

Stage 1: Problem Formulation process: Since early 2012 with the emergence of rupee crises, and the increasing debt stock reaching critical point, the discourse turned its page towards hydropower borrowings, investments, and spending. Ample holdings of Indian rupee reserve are critical for Bhutan, as its trade with India accounts to more than 74%, and the annual average debt growth rate at 19.5% indicating a growth of Nu. 7 billion every year was worrying (Ura, 2015). About 64% of the debt stock was due to hydropower projects owned to the Government of India, therefore causing Indian rupee crisis/debt (Ura, 2015). The latest figure in 2019 stands as US$ 2,728.44 million external debt which accounts to 112.40% of GDP. Likewise, the Indian rupee debt stands at INR. 138,409.37 million, which accounts to 82.72% of GDP (RMA, 2020). In addition, there were growing con-

cerns about the hydropower investments in Bhutan in the face of global warming, climate change, receding glaciers, market monopoly, energy diversification, and environmental concerns (Kuensel, 2015a; 2015b; 2015c). It was on this wicked problem that this research developed a problem-formulation-process on accelerated hydropower investments and its sustainability using the future triangle, as illustrated in Figure 1.

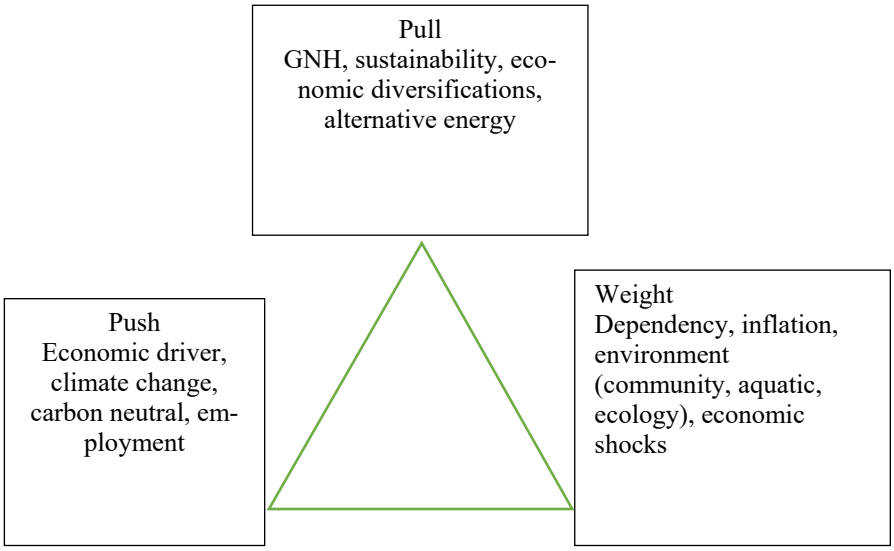

Figure 1: Future triangle

Conducting similar assessment using future triangle shows that Bhutan needs to accelerate hydropower development because it is the key economic driver, employment generator, supports hydropower associated development. However, this doesn't align so well with the GNH development approach and the contested sustainability issues from the view of environmental and ecological losses which come with the accelerated hydropower development projects. Also, the dependency created by hydropower, inflation, and low internal rate of return from hydropower provides a premise to consider rethinking on current approach to planning and development of hydropower.

Stage 2. Co-production of knowledge: Following the development of the problem-formulation-process, this research adopted transdisciplinary method to co-design and co-produce the knowledge on accelerated hydropower projects. Since this research dwells on future scenario to prompt discourse and flesh out various societal factors, STEEP analysis was conducted, as illustrated in Table 5 below. Social, Technological, Economic, Environmental, and Political (STEEP) analysis was used to evaluate external factors that may impact design decisions (UTS, 2020). The STEEP analysis was embedded within the expert participants' methodology, as experts are seen as crystallization points for practical insider expertise (Bogner *et al.*, 2009. p2), thereby ensuring crucial data was not left out.

Stage 3. Transdisciplinary design integration and evaluation: This stage involves assessing outcomes from science and society. Eighteen researchers from the Royal University of Bhutan, four Professors and researchers from the institute for Sustainable Futures, University of Technology Sydney, Australia, and 14 external stakeholders from key hydropower intuitions were involved in the integration and evaluation process. The stakeholders' workshop was held on 1st June 2018 at the conference room of the Royal University of Bhutan, Thimphu. The workshop was divided into presentations followed by group discussions and followed by presentation on key outcomes of the discussion. The stakeholders from Gross National Happiness Commission, Center for Bhutan Studies and GNH Research, Druk Green Power Corporation, Department of Power and Power Systems, Department of Renewable Energy, Bhutan Power Corporation,

Table 5: Sustainability through STEEP analysis (UTS, 2020)

Social	Technological	Economic	Environmental	Political
What is the equity, or income distribution impacts of the current energy system, electricity pricing and current hydropower development strategies?	How will the future hydropower and integrated energy system work, in terms of electricity flows, vulnerability, transmission and distribution system, security, peak demand?	What are the economic costs and benefits of current and future hydropower development strategies, in terms of: capital; ownership and loan arrangements; returns; alternative strategies; other energy supply and demand; other sectors?	What are the environmental impacts of hydropower construction and operation?	How does the monopoly buying power of India impact on the economics and return from hydropower?
What are the employment impacts of the current hydropower development strategies?	What prospects and opportunities are there to tap the human and technological resource development?	What could these benefits be with different market and policy settings?	What are the environmental benefits of hydropower operation in terms of fossil fuel displacement?	What are the opportunities and challenges in extending the export of electricity to other countries?
What are the impacts on social and cultural values arising from rapid growth in capital inflows, construction labor force?		What is the expected market demand for domestic and exported hydropower?	What is the potential for displacing liquid fossil fuels?	
What are the impacts on entrepreneurial culture and the innovation ecosystem?			What are the environmental impacts of low industrial operational efficiency due to cheap electricity?	

and the Bhutan Electricity Authority, Bhutan Trust Fund, Bhutan for Life, and National Environment Commission attended the workshop.

Data Collection

The facts and figures that emerged from the documentary analysis and the literature review were presented in the stakeholder's workshop. Stakeholders made presentations on their policy, mandates, and prospects. To co-create knowledge on sustainability of hydropower, the researchers and stakeholder engaged in the focus group discussions. The entire workshop was conducted adopting the Causal Layered Analysis (Inayatulla, 1998) to run the workshop and explore different layers of the future as illustrated in Table 6.

Table 6: Causal Layered Analysis Levels (adopted from Inayatulla, 1998)

CLA Level	Data Process
Problem Formulation process	Issues and trends: Documental analysis, articles, conference presentations
Co-production of knowledge: Systemic causes	Social, Technological, Economic, Environmental, and Political factors – analysis articulated in
Transdisciplinary Workshop	Presentation on the issues and trends, focus group discussion with the key institutions and experts, and generating the data.

Results and Discussion

Clean, Green, and Renewable Energy

The senior executives of World Wildlife Fund, UN Convention on Biological Diversity, and World Health Organization have come together to convince the world that, 'the world must embrace a recovery that involves sustainable farming and clean energy. Anything else is a false economy' (Lambertini, Mrema, and Neira, 2020. p.1). The world is looking for clean, green and renewable energy. Is hydropower clean, green, and renewable? According to UN Water (2011) hydropower contributes to the emergence of a green economy, as it offers much-needed low carbon electricity for development. The same report states that hydropower with proven best practice, if operated and maintained as per the globally applicable framework for assessing the sustainability of hydropower projects, the sustainable hydropower plays a significant and growing role in the green economy. The institutional vision of Druk Green Power Corporation which is Bhutan's electricity utility company is to promote, develop and manage renewable energy projects, particularly hydropower, and have instituted 'being green' as a part of the corporate social responsibility (DGPC, 2019). The stakeholders (Table 2) confirmed that solar and wind energy are although renewable energy, the investment and returns are not as competitive as hydropower in Bhutan.

Climate Change

The other emerging issue confronting sustainability of hydropower is the future of hydropower in the face of extreme weather, droughts, and floods triggered by climate change. Bhutan is heavily dependent on climate sensitive sectors such as Agriculture, Hydropower and Tourism. Himalayas show a consistent warming trend for the last century and a stronger warming than lowlands (Liu *et al*., 2009). Increase in temperature in the Himalayas is three times greater than the global mean average which the Intergovernmental Panel on Climate Change (IPCC) has projected at 3 °C by 2050s (Xu *et al*., 2009). To this, the UN Water (2011) shows that hydropower is clean, renewable energy which compliments with global low carbon energy goals, and therefore is a contributor to climate change mitigation. In addition, the hydropower reservoir can enhance water security and management, providing flood mitigation, storage of irrigation, stabilize downstream flow regimes, and provide recreational, and tourist facilities. The stakeholders focus group (groups from Table 1) cited how studies and forecast predict that the monsoons will be more severe and there could actually be higher hydrological discharges in our rivers in the long-term future, and Bhutan will see more reservoirs built in the future (Rinzin, 2017).

Social and Environmental concerns

There are also social and environmental concerns over proliferation of hydropower projects across the country with large influx of expatriate labourers, noise and dust pollution,

causing disruption to otherwise peaceful and tranquil environment, ecological disturbances and the loss of species habitat. The stakeholders (focus group discussion from both Table 1 and Table 2) agree to this disruption, however argued that the projects are sensitive about integrating livelihood and living environment of the local communities. Protecting forest, river systems and remaining committed to carbon neutrality is Bhutan's commitment to the world. DGPC continues to support social and environmental activities, programs and projects, and DGPC is subject to assessment of regularity requirements mainly relating to environment and disaster management conducted by ISO audit team (DGPC, 2019). The stakeholders (Table 1 focus group discussion) shared that population of displacement, resettlement and rehabilitation of people along the project sites in Bhutan is very small ranging from few households to a thousand people, and therefore it is manageable. The stakeholders also reconfirmed that Bhutan has the best environmental and social laws, and cited examples of Chhukha and Dagachu projects where the environment is well rehabilitated such that one would not be able to know if the projects exist there, except for the small townships near the powerhouses. The stakeholders (focus group discussion from both Table 1 and Table 2) also reveal that the priority in the future would be to concentrate on a smaller number of mega projects rather than on several mini and micro projects, considering the market vicinity, environmental and social impacts, and comparative advantage of cost returns per MW.

Economy and Market

The key argument surrounding the impact of hydropower on the Bhutanese economy is about how to service the massive hydropower debt, and gain access to energy markets (Rinzin, 2017). Electricity exports to India contribute a major chunk of INR earnings for Bhutan, and the highest GDP growths have been registered either on completion of a mega hydropower project or when a substantial export tariff increase came into effect. The hydropower sector generates Bhutan's highest revenue which constitutes 40.8 % of the total export, and 12.69 percent of the total share of the GDP (NSB, 2020; RMA, 2020). In the domestic front, low domestic generation tariff spurs industrial growth. Availability of power stimulates the establishment of major energy intensive industries creating jobs and value adding to the energy. Salary revision or increasing minimum wages in Bhutan happens vis-a-vis power tariff revision. Electricity from hydropower is the main source of energy in Bhutan (Bhutan Living Standards Survey, 2017; as cited in NSB, 2020). The stakeholders focus group from (Table 1 and Table 2) shared that the 2014 SAARC framework agreement for energy co-operation is expected to liberalize the electricity market beyond India. Bangladesh is likely to emerge as Bhutan's electricity export market, as the regional co-operation, and a trilateral arrangement to export electricity to Bangladesh through India is being explored (Stakeholders focus group from table1). India is one of the fastest developing countries in the world with continuously increasing demand for electricity, owing to its expanding population base and industries (Ganguly, 2018). In addition, the global manufacturers have initiated talks with the Indian firms to explore the possibility of shifting a part or whole of their supply chains from China to India following the COVID-19 outbreak, and India is already forming economic task force as well as readying pool of land to attract firms to invest and operate in India (BBC, May 2020). In this scenario, the demand for electricity in India will only escalate.

Conclusion

Hydropower is clean, green, renewable, and sustainable energy. Hydropower is the 'White Gold', and a cornerstone of Bhutan's socio-economic development policy. It is also of strategic importance to the future of Bhutan's

economy and economic diversification. In the political front, it is the cornerstone of Indo-Bhutan bilateral corporation, symbolizing the mutually beneficial and time-tested nature of Indo-Bhutan relations. Besides generating top revenue for the country, there are also other ancillary services and benefits that make economic sense in Bhutan's fast-evolving market, such as irrigation, drinking water, flood control, fisheries and tourism.

Bhutan's hydropower projects are funded through a mix of grant and debt financing. While the grant component has been declining over the years, the debt component has been increasing; the bilateral hydropower corporation is getting touted as one of the productive interdependences rather than one of an assistance. Of the various modes of investments such as Inter-governmental (IG), Joint venture (JV), and Public-private partnership (PPP), IG mode has been proven to be the preferred financing mode for its hydropower projects for Bhutan. The experts also suggest that Bhutan must strategize hydropower construction into two streams. One for *domestic consumption*, for which smaller hydropower plants could be built closer to the people, spread across the country. DGPC venturing into small hydropower projects is an initiative towards this stream. The other for *export stream*, for which it is advisable to build few mega hydropower projects in the market vicinity, which will ensure economies of scale and provide comparative advantage of per MW cost of investment. With global warming and climate change issues, there are concerted efforts being made worldwide to promote renewable energy resources. Besides hydropower, solar and wind energy are being explored. However, in the Bhutanese context, the experts have suggested that wind and solar energy are not competitive to hydropower in terms of investment and return and may be pursued as supplementary to the hydropower.

There are also issues and challenges associated in pursuing the accelerated sustainable hydropower development. This paper highlights some significant concerns; First of how it aligns with the GNH development approach and the contested sustainability issues, particularly from the view of environmental and ecological loss, and the displacement of human settlements that comes with the accelerated hydropower development projects. Second, the dependency created by hydropower, and low internal rate of return from hydropower. Third, competitiveness of Bhutan's hydropower in the Indian power market. Fourth, impact of global warming and climate change in the form of receding snowlines and fast melting glaciers. These issues provide a premise to constantly work on changing modalities in changing scenarios to reap the maximum benefit from hydropower projects. As it has been, it will be the hydropower sector that will drive Bhutan's socio-economic development in pursuit of economic self-reliance.

Despite issues, challenges and the emerging public concerns, hydropower is too important a sector for Bhutan to shy away. Indecision could be the worst enemy. By then, a lot of water could pass under the bridges down the Bhutanese Himalayas without benefitting the people of Bhutan.

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