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editor@ijeast.com



COMPARING HYDROPOWER LEADERS: ORGANIZATIONAL PRACTICES, CHALLENGES, AND OPPORTUNITIES AT BC HYDRO AND NHPC

Kaushal Meena
MBA Student, Department Of Commerce And Management,
Nirwan University Jaipur

Shivpal Meena
Research Scholar,
Nirwan University Jaipur

Dr.Kapil Meena
Assistant Professor
Department Of Management And Commerce,
Nirwan University Jaipur

Abstract-This paper offers a detailed comparison between two major players in the hydropower industry: BC Hydro of Canada and NHPC (National Hydroelectric Power Corporation) of India. The study examines their organizational structures, operational practices, sustainability efforts, and business models. Additionally, the paper explores the challenges both companies face in their respective regions and the opportunities they can leverage in the rapidly evolving energy sector. The comparison highlights how BC Hydro and NHPC navigate their unique political, economic, and environmental landscapes to remain leaders in the global hydropower sector.

Keywords: Hydropower, Environmental, Protection, Sustainability, Renewable energy, Organizational practices, NHPC, BC HYDRO.

I. INTRODUCTION

Hydropower plays a significant role in global energy production, contributing to the **renewable energy** sector's efforts to reduce carbon emissions and combat climate change. Among the leading companies in this field are **BC Hydro** and **NHPC**, both of which have established themselves as significant players in their respective countries. BC Hydro, based in British Columbia, Canada, and NHPC, based in India, operate in distinct markets with unique challenges and opportunities. While BC Hydro focuses on **providing sustainable energy** to the province of

British Columbia, NHPC plays a crucial role in India's energy infrastructure development, with a broader focus on both **hydropower and renewable energy**.

This paper compares the two organizations by examining their **organizational practices**, identifying the **challenges** they face in their respective regions, and analyzing the **opportunities** for growth in an increasingly competitive and environmentally-conscious energy market.

II. LITERATURE REVIEW

2.1 The Role of Hydropower in Global Energy Production

Hydropower has long been a cornerstone of renewable energy production worldwide. According to the **International Energy Agency (IEA)** (2021), hydropower currently accounts for nearly **16% of global electricity production**, with more than **1,300 GW** of installed capacity. It plays a crucial role in reducing greenhouse gas emissions, as hydroelectric plants do not burn fossil fuels and therefore have minimal direct emissions. As the world seeks cleaner energy solutions to mitigate climate change, hydropower continues to be a **vital part of the energy mix**, especially for countries with abundant water resources (IEA, 2021).

Hydropower is often lauded for its **reliability** and **efficiency** in producing large amounts of electricity. However, its role is evolving with the increasing integration of other **renewable energy sources** like solar and wind. These technologies, unlike hydropower, have intermittency



challenges, while hydropower offers a form of **baseload generation** that can stabilize the grid. In this context, organizations like **BC Hydro** and **NHPC** are at the forefront of hydropower's expansion and adaptation to contemporary energy needs.

2.2 BC Hydro: Organizational Practices and Sustainability Efforts

BC Hydro operates in British Columbia, a region known for its abundant freshwater resources. As one of the largest public utilities in Canada, BC Hydro's operations primarily focus on the generation, transmission, and distribution of electricity. Approximately **90%** of BC Hydro's electricity comes from **hydropower**, making it one of the largest renewable energy producers in Canada (BC Hydro, 2022). The company plays a central role in **reducing carbon emissions** within the province and contributes to the **carbon-neutral goals** set by the government of British Columbia.

Research by **MacDonald & Beck (2020)** highlights BC Hydro's organizational practices, which emphasize **sustainability** and **innovation**. The utility has made significant investments in smart grid technology, demand-side management, and energy efficiency initiatives to optimize resource utilization and minimize environmental impact. Moreover, BC Hydro's commitment to sustainable energy practices aligns with its obligation to meet **government mandates on carbon reduction**. The company has also focused on reducing its environmental footprint by investing in programs for **wildlife conservation**, **fish habitat restoration**, and **environmental mitigation** (BC Hydro, 2022).

In addition to environmental concerns, **indigenous land rights** have emerged as a significant issue for BC Hydro. As **Indigenous communities** hold legal claims to large parts of the land used for hydroelectric development, BC Hydro has been forced to engage in lengthy negotiations with these communities, often causing delays in project timelines (McCulloch, 2019). This situation highlights the tension between economic development and **social sustainability** within the hydropower industry in Canada.

2.3 NHPC: Organizational Practices and Challenges in India

NHPC, as India's premier public hydropower entity, plays an essential role in the country's energy infrastructure development. With an installed capacity of over **7,000 MW**, NHPC operates a variety of hydroelectric projects across India and is increasingly expanding into other renewable energy sectors, such as **solar** and **wind energy**. Research on NHPC's operations reveals that the company's core focus has shifted towards **sustainable development**, ensuring that energy generation contributes to both **economic growth** and **environmental protection** (Singh, 2020).

One of the major challenges for NHPC, however, is the complexity of **bureaucratic processes** and **government regulations** in India, which often result in delays and cost overruns for major projects (Kumar & Bansal, 2020). **Land acquisition** and **environmental clearances** have also been a significant source of conflict. Large hydropower projects in India often displace **local communities**, raising concerns over **social justice** and **equitable development**. In response to these challenges, NHPC has been increasingly focused on **community engagement** and **social welfare programs** in the areas where it operates, such as providing education and healthcare services to affected populations (Singh, 2020).

Additionally, NHPC has diversified its operations to meet India's growing energy demand and reduce its reliance on **fossil fuels**. India's **renewable energy targets**, such as achieving **500 GW** of non-fossil fuel energy capacity by 2030, are a key opportunity for NHPC to expand into the solar and wind sectors. As part of this strategy, NHPC has launched various **joint ventures** and **public-private partnerships** to explore clean energy alternatives (Kumar & Bansal, 2020).

2.4. Comparative Organizational Practices: BC Hydro vs NHPC

When comparing the organizational practices of BC Hydro and NHPC, it is clear that both entities operate under different environmental and political frameworks. While BC Hydro is part of a developed and highly regulated market, NHPC operates in a rapidly growing emerging economy with a broader range of energy needs.

BC Hydro's focus is on maintaining **grid reliability** and enhancing its **smart grid infrastructure**, which allows for the integration of **renewable energy sources** such as **wind** and **solar** into the existing grid. As **public trust** and **environmental stewardship** are crucial for BC Hydro, its practices reflect the need to balance **economic efficiency** with **sustainable development goals** (MacDonald & Beck, 2020).

In contrast, NHPC's primary goal is to contribute to **energy security** for a large and growing population, particularly in rural and underserved areas. The **Indian government's renewable energy policy** offers significant support to NHPC's initiatives in both hydropower and **other renewable energy technologies**. However, NHPC must contend with **bureaucratic inefficiencies**, **community displacement issues**, and **socio-political challenges** that often impede progress (Kumar & Bansal, 2020).

2.5. Challenges in the Hydropower Sector

Both BC Hydro and NHPC face significant challenges in the hydropower sector, albeit of a different nature. BC Hydro is dealing with the **uncertainty of climate change** and its effects on water availability for hydropower generation (BC Hydro, 2022). In particular, **droughts** and **flooding** could



reduce the efficiency of hydroelectric plants, while increasing the likelihood of environmental disputes with **indigenous communities** (McCulloch, 2019).

For NHPC, challenges primarily revolve around **social and environmental concerns**. The construction of hydropower projects in India often leads to the **displacement of communities**, especially in tribal areas. These projects also face opposition from **environmental groups** due to concerns over the **destruction of ecosystems** (Singh, 2020). The complex and often delayed **environmental clearance process** adds to the difficulty of executing large-scale hydropower projects in India.

2.6. Opportunities for Growth

Despite these challenges, both companies face significant **growth opportunities**. BC Hydro can capitalize on the growing demand for **clean energy** by expanding its **renewable energy portfolio** through **wind and solar power** and by leveraging advancements in **battery storage** technologies (MacDonald & Beck, 2020). Furthermore, BC Hydro has the opportunity to expand its role in **electric vehicle infrastructure**, an area that aligns with its long-term sustainability goals.

NHPC, on the other hand, has vast potential for growth in India's **renewable energy sector**. With the Indian government's ambitious goals for **clean energy**, NHPC can diversify into **solar and wind energy** markets, potentially

expanding its reach into neighboring countries like **Nepal and Bhutan** through cross-border hydropower initiatives (Kumar & Bansal, 2020). The demand for **grid stabilization** in India, due to the integration of intermittent renewable sources, also offers NHPC opportunities to focus on **hydropower as a baseload generation**.

III. COMPANY OVERVIEW

3.1 BC Hydro: A Snapshot

BC Hydro is a **government-owned utility** in British Columbia, Canada. It serves over **4.5 million people** and generates around **90% of its electricity from hydroelectric power**. Established as the **British Columbia Hydro and Power Authority** in 1961, BC Hydro is responsible for both the generation and distribution of electricity across the province. The company operates a vast network of **hydroelectric plants**, transmission lines, and other infrastructure essential for power delivery.

- **Annual Revenue (2023):** Approx. **CAD 6.5 billion**
- **Installed Generation Capacity:** Approximately **12,000 MW**
- **Primary Energy Source:** Hydropower (90% of its energy)
- **Customer Base:** Residential, industrial, and commercial customers across British Columbia

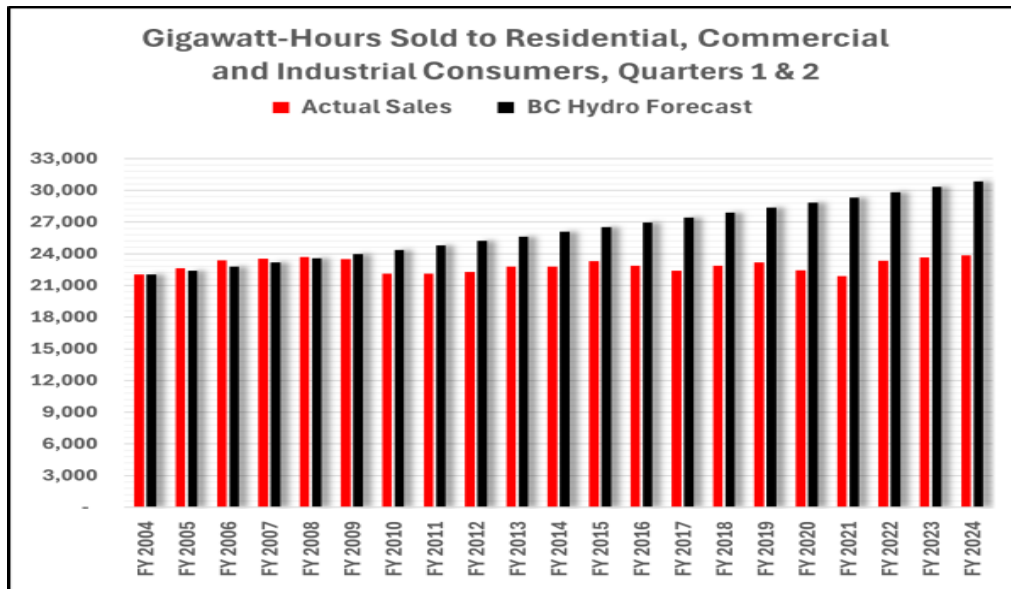


Fig: BC Hydro

3.2 NHPC: A Snapshot

NHPC, founded in 1975, is a **public sector undertaking** owned by the **Government of India**. It is India's leading hydropower development company, with a focus on

renewable energy. NHPC is responsible for developing, operating, and maintaining a significant number of **hydroelectric plants** in India. While it is primarily focused on hydropower, NHPC is expanding into **solar and wind**



energy to align with India’s ambitious renewable energy goals.

- **Annual Revenue (2023-2024):** Approx. **INR 10,000 crore** (~USD 1.2 billion)
- **Installed Generation Capacity:** Approx. **7,071 MW**

- **Primary Energy Source:** Hydropower (though also expanding into solar and wind)
- **Customer Base:** Indian government entities, state utilities, and other regional power distribution companies

NHPC DATA :

Authorised Capital	15000 Crore
Value of Assets	₹ 85486.44 Crore as on 31st December 2024
Paid Up Capital	₹ 10045.03 Crore as on 31st December 2024

Power Stations	Total: 28Nos. 7232.90 MW Hydro (Incl- 2 in JV): 22 Nos. (6971.20 MW) Wind:01 No. (50 MW) Solar (Incl- 4 in JV):05 No. (211.70 MW)
Projects Under Construction	Total 16 Nos. 10804.00 MW Hydro (Incl. JV) 9 Nos. 9314.00 MW Solar 07 Nos. 1490.00 MW
Projects Awaiting Clearances	Total 09 Nos. 4291 MW Hydro (Incl.1 in JV) 5 Nos. 4046 MW Solar (Incl. 3 in JV) 4 Nos. 245 MW
Projects Under Survey and Investigation Stage	Total : 10 Nos. 9715 MW Hydro : 6 Nos.(5475 MW) Pump Storage : 04 No. (4240 MW)
Projects Under New Initiative	Total : 16 Nos. 27214 MW Hydro : 3 Nos.(13900 MW) Pump Storage : 13 No. (12690 MW)
Projects on Turnkey / Deposit Basis (Completed)	Total : 5 Nos. 89.35 MW

In	2023-2024
Income from Sale of Power	7957Crore
Net Profit	3744 Crore
In 2022-2023	
Energy Generated	24907 MU
PAF	88.75%
Income from Sale of Power	9125 Crore
Net Profit	3834 Crore
In 2021-2022	
Energy Generated	24855 MU



PAF	88.19%
Income from Sale of Power	8181 Crore
Net Profit	3538 Crore
In 2020-2021	
Energy Generated	24471 MU
PAF	85.76%
Income from Sale of Power	8094 Crore
Net Profit	3233 Crore
In 2019-2020	
Energy Generated	26121 MU
PAF	85.45%
Income from Sale of Power	8301 crore
Net Profit	3007 crore
In 2018-2019	
Energy Generated	24193 MU
PAF	84.97%
Income from Sale of Power	8095 Crore
Net Profit	2631 Crore
In 2017-2018	
Energy Generated	22625 MU
PAF	85.32%
Income from Sale of Power	6869 crore
Net Profit	2759 Crore
In 2016-2017	
Energy Generated	22948 MU
PAF	83.41%
Income from Sale of Power	7139 Crore
Net Profit	2796 Crore
In 2015-2016	
Energy Generated	23683 MU
PAF	81.60%
Income from Sale of Power	7347 Crore
Net Profit	2440 Crore
In 2014-2015	
Energy Generated	22038 MU
PAF	77.3%
Income from Sale of Power	6737 Crore
Net Profit	2124 Crore
In 2013-2014	
Energy Generated	18386 MU
PAF	77.7%
Income from Sale of Power	5335 Crore



Net Profit In 2012-2013	979 Crore
Energy Generated PAF Income from Sale of Power Net Profit In 2011-2012	18923 MU 85.3% 5049 Crore 2348 Crore
Energy Generated PAF Income from Sale of Power Net Profit In 2010-2011	18683 MU 83.3% 5510 Crore 2772 Crore
Energy Generated PAF Income from Sale of Power Net Profit In 2009-2010	18606 MU 85.2% 4047 Crore 2167 Crore
Energy Generated PAF Income from Sale of Power Net Profit In 2008-2009	16960.45 MU 84.1% 4219 Crore 2090 Crore
Energy Generated Capacity Index Income from Sale of Power Net Profit In 2007-2008	16689.59 MU 93.61% 2672 Crore 1075 Crore
Energy Generated Capacity Index Income from Sale of Power Net Profit In 2006-2007	14813.16 MU 96.12% 2244 Crore 1004 Crore
Energy Generated PAF Income from Sale of Power Net Profit In 2005-2006	13048.76 MU 94.13% 1754 Crore 925 Crore
Energy Generated Capacity Index Income from Sale of Power Net Profit	12567.15 MU 98.15% 1614 Crore 743 Crore

IV. ORGANIZATIONAL PRACTICES

4.1. BC Hydro's Organizational Practices

BC Hydro's organizational practices are heavily shaped by its status as a **government-owned utility** operating in a

highly regulated environment. The company's operations focus on three main pillars: **sustainability**, **innovation**, and **customer satisfaction**.

- **Sustainability:** BC Hydro is committed to reducing its environmental footprint and supporting British Columbia's transition to a **low-carbon economy**. The company invests in **environmental protection**, energy conservation programs, and **green technologies** like smart grids and electric vehicle charging infrastructure.
- **Innovation:** BC Hydro has adopted advanced **smart grid technologies** to enhance grid reliability and efficiency. Through initiatives such as **demand-side management**, BC Hydro encourages customers to use energy more efficiently, balancing supply and demand effectively.
- **Customer-Centricity:** Customer service is a central focus for BC Hydro, which strives to provide **reliable power** at competitive rates. The company has been recognized for its commitment to customer service excellence, with a focus on **transparency** and **stakeholder engagement**.

4.2. NHPC's Organizational Practices

As a state-owned entity, NHPC's organizational practices are aligned with the Indian government's focus on achieving **energy security** and **sustainable development**. NHPC's practices are influenced by a combination of **government mandates**, **regional priorities**, and its role in serving India's large population.

- **Diversification into Renewables:** NHPC has progressively shifted from being a solely hydropower-focused organization to one that is also active in **solar** and **wind energy** projects. This diversification aligns with India's target to achieve **175 GW of renewable energy** capacity by 2022, and **500 GW** by 2030.
- **Collaborations and Partnerships:** NHPC engages in joint ventures with state governments, international partners, and private players for energy development. Notably, it has entered into ventures for **cross-border energy exchange** with neighboring countries such as **Nepal** and **Bhutan**.
- **Community Development:** NHPC is deeply involved in the **social development** of the regions where it operates. It invests in **community welfare programs**, including health, education, and infrastructure, and works closely with local communities affected by its projects.

V. CHALLENGES FACED BY BC HYDRO AND NHPC

5.1. BC Hydro's Challenges

- **Regulatory Constraints:** As a publicly owned company, BC Hydro is subject to **price regulation** by the **British Columbia Utilities Commission (BCUC)**.

Regulatory pressures limit the company's ability to adjust prices in response to fluctuating operational costs, especially in the face of increasing environmental compliance costs.

- **Environmental Challenges:** BC Hydro's hydroelectric operations rely on water availability, which is affected by **climate change**. Shifting weather patterns, droughts, and flooding can impact hydroelectric generation, potentially leading to supply disruptions.
- **Indigenous Land Rights:** BC Hydro's expansion plans have been frequently delayed due to legal disputes with **Indigenous communities**. Many of its hydroelectric projects are situated on Indigenous lands, requiring extensive consultations and agreements.

5.2. NHPC's Challenges

- **Environmental and Social Concerns:** NHPC faces significant **environmental** and **social challenges** due to the scale of its hydropower projects. These include **displacement of communities**, **loss of biodiversity**, and concerns over the environmental impact of dam construction. Opposition from local populations and environmental groups often leads to project delays.
- **Bureaucratic Hurdles:** NHPC, as a public-sector enterprise, is often affected by **bureaucratic inefficiencies** and delays in obtaining **government clearances** and **environmental approvals**. These delays can slow down project timelines and escalate costs.
- **Competition in Renewables:** With India's growing emphasis on renewable energy, NHPC faces **intense competition** from private sector companies entering the solar and wind energy markets. Despite its established position in hydropower, NHPC must continually adapt to a rapidly changing energy landscape.

VI. OPPORTUNITIES FOR GROWTH

6.1. Opportunities for BC Hydro

- **Renewable Energy Integration:** BC Hydro has the opportunity to increase its focus on **wind and solar energy** to complement its hydropower generation. This diversification will allow BC Hydro to contribute to Canada's **carbon-neutral** goals and become a leader in **clean energy** solutions.
- **Electric Grid Modernization:** The adoption of **smart grid technologies**, **battery storage solutions**, and **demand-response systems** presents significant opportunities for BC Hydro to enhance the resilience of its energy infrastructure and provide **grid flexibility** for future energy demands.
- **Export of Clean Energy:** BC Hydro could explore the possibility of **exporting electricity** to neighboring



regions like the **United States**, where demand for **renewable energy** is growing.

6.2. Opportunities for NHPC

- **Expansion in Solar and Wind:** NHPC's continued expansion into **solar** and **wind** energy presents significant growth opportunities, especially as India works toward meeting its renewable energy targets. NHPC's established track record in hydropower gives it a strong foundation to diversify further into these sectors.
- **Cross-Border Hydropower Projects:** NHPC has opportunities to expand its **hydropower operations** beyond India, particularly in neighboring countries like **Nepal** and **Bhutan**, which have vast untapped hydropower potential. These cross-border projects could help NHPC strengthen its position as a regional leader in energy development.
- **Government Support for Clean Energy:** India's government policies favoring **renewable energy development** offer NHPC a conducive environment for growth. The company can leverage incentives, subsidies, and green energy targets to expand its footprint.

VII. INVESTMENTS AND JOINT VENTURES

7.(a) BC Hydro

1.1. Smart Grid Investments

BC Hydro has made substantial investments in **smart grid technologies** aimed at improving the efficiency and reliability of its electrical grid. Smart grids help integrate renewable energy, optimize energy distribution, and enhance real-time monitoring and control of power systems. This includes investments in:

- **Advanced Metering Infrastructure (AMI):** BC Hydro is expanding its deployment of **smart meters** to provide customers with better visibility into their energy usage and to enable dynamic pricing models.
- **Demand Response Programs:** BC Hydro is investing in **demand-side management** programs that help control energy consumption during peak times and reduce stress on the grid.

These investments support BC Hydro's long-term goals of grid modernization, flexibility, and responsiveness to evolving energy demands.

1.2 Electric Vehicle (EV) Charging Infrastructure

As part of its commitment to supporting **clean energy solutions** and reducing carbon emissions, BC Hydro has been actively involved in the expansion of its **electric vehicle (EV) charging infrastructure**. The company has invested in the installation of **fast-charging stations** across British Columbia to meet the increasing demand for **EVs**. The company has also partnered with various stakeholders

to further accelerate the **transition to sustainable transportation**.

- **Partnerships with Municipalities:** BC Hydro collaborates with **municipalities** and **private companies** to expand the charging network across urban and rural areas.
- **Support for EV Adoption:** BC Hydro offers incentives and rebates to encourage the adoption of **electric vehicles**, including rebates for home **EV chargers** and discounts on public charging stations.

1.3 Joint Ventures and Partnerships

While BC Hydro does not heavily engage in joint ventures outside of Canada, it does engage in **strategic partnerships** with private companies, research institutions, and municipalities within its region:

- **Clean Energy Partnerships:** BC Hydro has engaged in various **partnerships** with local and international companies to develop and implement **clean energy solutions**, particularly in the areas of **wind** and **solar power**. These collaborations support the utility's efforts to diversify its renewable energy portfolio.
- **Indigenous Partnerships:** A significant aspect of BC Hydro's business involves **collaborations with Indigenous communities** in British Columbia. The company partners with Indigenous groups for the development of energy projects, while also ensuring that it respects Indigenous land rights and integrates **traditional knowledge** into project planning.

1.4 International Clean Energy Collaboration

Although BC Hydro focuses primarily on the domestic market, the company has expressed interest in exploring **energy exports** and collaborations beyond Canada's borders, particularly with **U.S. energy providers**:

- **U.S. Clean Energy Collaboration:** BC Hydro is exploring opportunities for **electricity export** to the United States, where there is growing demand for **renewable energy** sources. The utility is investigating the feasibility of using its vast hydroelectric resources to supply power to nearby U.S. states, particularly those in the Pacific Northwest.

7.(b) NHPC

1.1 Renewable Energy Investments

NHPC is progressively diversifying its portfolio beyond hydropower, with significant investments in **solar** and **wind energy**. These investments are aligned with India's **renewable energy goals** under the **National Action Plan on Climate Change (NAPCC)** and India's target of achieving **500 GW of renewable energy capacity** by 2030.

- **Solar Power Investments:** NHPC has established a strong presence in **solar power** generation through investments in **large-scale solar farms** and **solar**



rooftop projects. The company is expanding its solar capacity by developing new projects across India, including in states such as **Rajasthan, Gujarat, and Madhya Pradesh.**

- **Wind Power Projects:** NHPC has also invested in **wind energy** generation in regions with high wind potential, such as **Tamil Nadu and Gujarat.** By developing these projects, NHPC aims to contribute to India's renewable energy capacity and reduce the country's dependence on fossil fuels.

1.2 Joint Ventures for Energy Development

NHPC has formed **strategic joint ventures (JVs)** to support its growth and expansion into both domestic and international renewable energy markets.

- **Joint Ventures in Solar and Wind Energy:** NHPC has entered into joint ventures with **private sector companies and state utilities** to develop solar and wind energy projects. These ventures typically involve shared capital investment, expertise in project development, and resource mobilization.
- **Cross-Border Hydropower Projects:** NHPC has been actively involved in **cross-border hydropower projects**, particularly with **Nepal and Bhutan.** These joint ventures focus on harnessing the vast hydropower potential in these neighboring countries and exporting electricity to India. NHPC has partnered with **Nepal Electricity Authority (NEA) and Bhutan Power Corporation (BPC)** for various hydropower ventures.
- **Nepal:** NHPC has several **joint ventures** with Nepal to develop **hydropower plants and electricity transmission lines.** These collaborations help facilitate the export of electricity from Nepal to India.
- **Bhutan:** NHPC has partnered with Bhutan's state-owned hydropower company to develop large-scale **hydroelectric plants** that supply power to India.

1.3 International Collaborations

- **Regional Power Exchange:** NHPC is exploring collaborations with other South Asian nations as part of the **South Asian Association for Regional Cooperation (SAARC)** initiative to promote **cross-border energy trade.** NHPC is actively pursuing projects in **Bangladesh, Myanmar, and Sri Lanka,** enhancing regional energy integration.
- **Technology Partnerships:** NHPC collaborates with international technology providers to adopt advanced turbine technology, **environmentally friendly solutions,** and **green hydropower innovations** for its projects. It also partners with academic institutions and research bodies to develop new hydropower technologies.

1.4 Corporate Social Responsibility (CSR) and Sustainable Development

NHPC has committed to investing in **community development** in the areas where it operates. Through its **CSR initiatives,** NHPC focuses on:

- **Education:** Investments in local schools and skill development centers to support **education and vocational training** for communities affected by hydropower projects.
- **Healthcare and Infrastructure:** NHPC invests in building essential **healthcare facilities, roads, and water supply systems** in remote areas where its projects are located.

1.5 Expansion into Non-Hydropower Projects

In addition to renewable energy, NHPC has also expressed interest in investing in **thermal power and energy storage** technologies to enhance its generation capabilities:

- **Thermal Power:** NHPC has entered into thermal power generation projects to complement its **hydropower** and renewable energy ventures, ensuring a diversified portfolio for **grid stability.**
- **Energy Storage:** NHPC has begun exploring investments in **energy storage** technologies, including **pumped storage** solutions, to balance intermittent renewable energy sources like solar and wind.

VIII. FINDINGS

NHPC Limited (India):

- **Net Worth:** ₹38,701.03 crore (₹387.01 billion) as of March 31, 2024.

nhpcindia.com

BC Hydro (Canada):

- **Total Assets:** Approximately CAD 12 billion for the fiscal year ending March 31, 2024.

Government of British Columbia

Projected Growth to 2047:

To estimate how NHPC could reach a net worth of ₹6 trillion and BC Hydro could achieve total assets of CAD 15 billion by 2047, we can calculate the annual growth rates required over the 23-year period (from 2024 to 2047).

NHPC's Growth to ₹6 Trillion:

1. **Current Net Worth:** ₹387,010 crore
2. **Target Net Worth:** ₹600,000 crore
3. **Growth Factor:** ₹600,000 crore / ₹387,010 crore ≈ 1.550
4. **Annual Growth Rate (CAGR):** Using the Compound Annual Growth Rate (CAGR) formula:

$$\text{CAGR} = \left\{ \left(\frac{\text{Target Value}}{\text{Starting Value}} \right)^{\frac{1}{n}} - 1 \right\}$$
$$\text{CAGR} = \left\{ \left(\frac{600,000}{387,010} \right)^{\frac{1}{23}} - 1 \right\} \approx 0.0238 \text{ or } 2.38\%$$



This means NHPC would need to achieve an annual growth rate of approximately 2.38% in its net worth to reach ₹6 trillion by 2047.

BC Hydro's Growth to CAD 15 Billion:

1. **Current Total Assets:** CAD 12 billion
2. **Target Total Assets:** CAD 15 billion
3. **Growth Factor:** CAD 15 billion / CAD 12 billion = 1.25
4. **Annual Growth Rate (CAGR):** Using the CAGR formula:

$CAGR = \{(Target\ Value / Starting\ Value)^{(1 / n)} - 1\}$
 $CAGR = \{(15,000 / 12,000)^{(1 / 23)} - 1\} \approx 0.0098$ or 0.98%
This indicates BC Hydro would need to achieve an annual growth rate of approximately 0.98% in its total assets to reach CAD 15 billion by 2047.

NOTE - To achieve the projected financial targets by 2047, NHPC would need to maintain an annual growth rate of about 2.38% in its net worth, while BC Hydro would need to sustain a growth rate of approximately 0.98% in its total assets. Achieving these growth rates would depend on various factors, including strategic investments, operational efficiencies, market conditions, and regulatory environments in their respective countries.

IX. CONCLUSION

BC Hydro and NHPC, while both giants in the hydropower industry, face unique challenges shaped by their operational environments. BC Hydro benefits from its status as a regulated utility in a developed country with stable energy demand, whereas NHPC navigates the complexities of rapid growth in India's energy sector, including dealing with bureaucratic hurdles and social challenges. Both companies have vast opportunities to diversify and grow by focusing on **renewable energy** integration, grid modernization, and cross-border projects.

Ultimately, the ability of BC Hydro and NHPC to adapt to changing market dynamics, innovate, and leverage government support will determine their future success. Their roles in **sustainable energy** development are crucial not only in their respective countries but also on a global scale.

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