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BENEFITS OF HYDRO POWER PROJECTS: SCENARIO IN HIMACHAL PRADESH

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Abstract

Power is one of the most important inputs for economic development. In addition to its widely recognized role as a catalyst to economic activity in different sectors of the economy, the power sector makes a direct and significant contribution to the economy in terms of revenue generation, employment opportunities and enhancing the quality of life. The increasing global demand for energy combined with the ongoing quest for clean, renewable energy has been a topic of perceived interest amongst countries of developed and developing status worldwide. With a population of well over a billion people a fast-growing economy, India electricity demand is expected to double over the next decade. Unlike other sources of energy, hydropower generation provides an abundance of unique benefits which can be those emanating from the generation of electricity itself or from side benefits associated with hydropower reservoirs along with sustainable development.

***Keywords**: Power, economy, energy, electricity, development*

Introduction

Energy is the most fundamental sector for the progress of a nation. It is inevitable for survival and indispensable for developmental activities to promote education, health, transportation and infrastructure for attaining a reasonable standard of living and is also a critical factor for economic development and employment.

Renewable electricity generation in 2017 was 24.5 percent and non-renewable electricity generation was 75.5 percent in the world. India currently has 5th rank in the world.

Power is one of the most important inputs for economic development. In addition to its widely recognized role as a catalyst to economic activity in different sectors of the economy, the power sector makes a direct and significant contribution to the economy in terms of revenue generation, employment opportunities and enhancing the quality of life. The increasing global demand for energy combined with the ongoing quest for clean, renewable energy has been a topic of perceived interest amongst countries of developed and developing status worldwide. Several renewable energy sources like hydroelectric, wind, solar and

biomass can be used for generation of electricity and for meeting our daily energy demands. The increasing global demand for energy combined with the ongoing quest for clean, renewable energy has been a topic of perceived interest amongst countries of developed and developing status worldwide. Hydropower is a renewable, economic, non-polluting and environmentally friendly source of energy. It has been one of the sources of energy harnessed for centuries in different parts of the world. India has achieved remarkable progress in the field of power development since independence in 1947. The rate of growth of installed capacity, though impressive has not been able to keep pace with the increase in power demand and as a result, the country is presently facing peak power shortages of varying degree in various regions of the country.

RESEARCH METHODOLOGY:

The present study is an empirical study just to examine the benefits of Hydro Power Projects in Himachal Pradesh. The study will be conducted on the basis of Secondary data. A secondary data is one where data is collected from the publications. The present study will be based on the relevant information from the secondary data. This type of data will be collected from the publications, office records, newspapers, magazines, existing literature, internet, and other scholarly work.

Himachal Pradesh and Hydro power

HP is a small state by both size (55,670 km2) and population (6.8 million), 90% of whom live in rural areas and depend primarily on agriculture. It has some of India's best development indicators and is on track to meet most of its MDGs. From its inception in 1971 it has had a higher income per head and better social indicators than much of the country. Supportive policies have facilitated investment in infrastructure and achieved per capita social expenditures of approximately double the Indian state average. Much of HP is inaccessible and uninhabitable. Its elevation ranges from 400m to 6,600m above sea level, with rugged terrain and a high level of forest cover. Its net sown area is only 15% of the total area and it is estimated that over 40% of cultivated land is prone to very high erosion (Department of Environment, Science and Technology, 2009). HP is classified as a "special category" jurisdiction, which gives it access to special central government grants and other incentives.

Himachal being a hilly State has natural strength in harnessing of hydro electric power. Hydro power development is the key engine to the economic growth of the State of Himachal

Pradesh, as it makes a direct and significant contribution to economy in terms of revenue generation, employment opportunities and enhancing the quality of life. The Hydro Power Sector in Himachal Pradesh strongly emphasizes the economic dimensions by way of environmentally and socially sustainable Hydropower Development in the State in line with the objective of Government of Himachal Pradesh to promote inclusive green growth and sustainable development of the State through climate change related with transformative actions across the key engines of economic growth of the State.

Present Status of Hydro Power in H.P.

Himachal Pradesh is in a unique position regionally, and contrasts with India as a whole, in terms of its high reliance on hydropower and high access to grid electricity . Hydropower exploitation in Himachal Pradesh began even before it was a full-fledged state with the commissioning of a 0.45 MW HEP by the Raja of Chamba in 1908. There were couple of other small projects that were executed like the 110 MW Shanan HEP in mandi district and the 60 MW HEPs each of Bassi and Giri (Department of Environment, Science and Technology, Government of Himachal Pradesh, 2005). In the late 50's and early 60's, the ersthwhile Punjab government started the construction of Shansha and Billing HEPs in Lahaul and Spiti.

Himachal Pradesh has large hydropower potential 25% of India's total 84,000MW (Himachal Pradesh State Electricity Board (HPSEB), 2014; National Institute of Hydrology, 2014) and extensive experience of hydropower development at various scales. Its hydropower potential, together with its large forested area, give it a crucial role in India's Green Economy and low-carbon development ambitions.

The State of Himachal Pradesh has an estimated Hydro Potential of 27,436 MW out of which 24,000 MW has been assessed as harnessable while the Government of Himachal Pradesh has decided to forgo balance potential in lieu of safe guarding the environment and to maintain ecological as well as protect various social concerns.

Out of the total harness able potential of about 24,000 MW, a potential to the tune of 20,912 MW already stands allotted under various sectors. The State has been accelerating the pace of Hydropower development through the active involvement of both the public and private sectors. A potential of about 10,547.17 MW has already been harnessed so far under various sectors.

Table: Power harnessed under various sectors

SECTOR	Capacity (MW)
HPSEBL	487.55
HPPCL	170.00
CENTRAL/JOINT	7,457.73
HIMURJA (STATE)	2.37
HIMURJA (PRIVATE)	310.45
PRIVATE above 5 MW	1,964.90
HP SHARE	159.17
Total	10,547.17

Source: Economic Survey 2018-19 H.P.

The largest potential for electricity generation lies on the river Satluj (13,332 MW), followed by Beas (5,995 MW), Chenab (4,032 MW) and Ravi (3,237 MW).

Through preliminary hydrological, topographical and geological investigations, it has been estimated that about 27,436 MW of hydroelectric potential can be exploited in the state by constructing various major, medium, small and mini/micro hydroelectric projects on these five river basins.

Himachal Pradesh is one of the few states in India where power delivered to consumers is entirely metered.

Hydropower Policy

HP formulated its first Hydropower Policy in 2006

This statement, and subsequent additions and modifications, have set out:

• Policies towards environmental management.

• A bidding process for the allotment of new hydro projects.

• The promulgation of river-basin planning and implementation.

• Principles for dealing with community risks and benefit sharing. The current set of policies seek to promote Integrated Watershed Management in this nationally-sensitive catchment. HP's Himalayan ecosystem forms the catchment of major Indian Rivers such as the Sutlej, Beas, Ravi and Yamuna. Their waters support 200 million people in Punjab, Haryana and Uttar Pradesh, "these rivers are crucial in sustaining livelihoods and assuring food and water security for irrigation and domestic use across much of North India...Hence consideration of downstream impacts is critical to the State's development strategy." (World Bank, 2012).

Himachal Pradesh has been blessed with vast hydroelectric potential in its five river basins, namely Yamuna, Satluj, Beas, Ravi and Chenab. Through preliminary hydrological,

topographical and geological investigations, it has been estimated that about 23,000 MW of hydel potential can be exploited in the state by constructing various major, medium, small and mini/micro hydel projects on these five river basins.

Table The basin wise capacities of Himachal Pradesh

Name of Projects	Assessed Potential Capacity (MW)	Capacity (MW)
Yamuna	840	794
Satluj	13,332	10,226
Beas	5,995	5,721
Ravi	3,237	2,912
Chenab	4,032	3,037
Self-Identified/ New Identified	Depends on explorations	310
Total	27,436	23,000

Source: (Economics and Statistics Department, Government of Himachal Pradesh, 2014)

Table : Total Identified Hydro Power Potential (H.P.)

TOTAL IDENTIFIED HYDRO POWER POTENTIAL (MW)						
Sr. No	**PARTICULARS**	**State Sector HPSEBL/ HPPCL/ HIMURJA in (MW)**	**Central/ Joint Sector/HP Share (MW)**	**Private Sector**		**Total in (MW)**
				Above 5MW	**Upto 5 MW (through HIMURJA)**	
	Projects Commissioned	490	6,835	1,862	246	9,433
	Under Execution/ Construction	956	1,600	781	153	3,490
	Under Implementation/ Obtaining Clearances	13,00	66	829	428	2,623
	Under Investigation	1,049	588	3,090	394	5,121
	Under Litigation/ dispute	-	-	20	-	20
	Abandoned schemes in view of environmental & social concerns	20	-	735	-	755
	To be allotted	-	-	2,090	-	2,090
	TOTAL	3,815	9,089	9,407	1,221	23,532
Balance Potential under consideration						3,904

Source: (Economics and Statistics Department, Government of Himachal Pradesh, 2014)

Nothing is perfect on Earth, and that includes the production of electricity using flowing water. Hydroelectric-production facilities are indeed not perfect (a dam costs a lot to build and also can have negative effects on the environment and local ecology), but there are a

number of advantages of hydroelectric-power production as opposed to fossil-fuel power production.

Review of Literature:

The World Bank Report (2015), " Himachal Pradesh Towards Green & Inclusive Development": Over a seven –year period, the World Bank has helped Himachal Pradesh move forward on its green and inclusive development agenda. The two DPLs that followed – for $100 million each, between 2011 and 2014-helped the state promote environmentally and socially sustainable development in hydropower, tourism, and industry, as well a in the development of watersheds. This is the first time the World Bank has provided support of this nature to a state in India. It is also the first time that India has accessed a loan from the Clean Technology Fund-a global fund that finances clean technologies to reduce greenhouse gas emissions. The two loans have helped the state establish the institutions and policies needed to bring long-lasting change in the manner in which these key sectors grow and develop.

CRGGS (2015). Climate Resilient Green Growth Strategy for Himachal Pradesh (Summary for Policymakers). Implemented by The Energy and Resources Institute (TERI) in collaboration with Global Green Growth Institute (GGGI): The study provides an assessment of long-term sustainability challenges in the state using a range of analytical tools and field case studies. Implementation of climate resilient green growth strategies requires concerted policy action and interventions. This document synthesizes five analytical components1 for understanding aspects to inform decision-making for: ™ Climate Variability, Soil and Water, Power Generation, Sector-wise Opportunities, Field Case Studies. The analytical framework included three models (climate modelling, Soil and Water Assessment Tool, and energy modelling), case studies from field visits, and a comprehensive review of sector-wise interventions in Himachal Pradesh. The case studies component examines socio-economic aspects at hydroelectric project sites in the State for further understanding the concerns of the local people with respect to hydro power projects. This understanding aims to assist policymakers in evolving procedures with respect to project planning and implementation of hydroelectric projects.

Rampur Hydropower Project In Himachal Pradesh, India, "Environmental Assessment & Management Plan": The project has engaged stakeholders including the project-affected people in discussing different aspects of the project over the last 3 years. SJVN has organized

community meetings, meetings with village elders and elected leaders of the villages. During the preparation of EA and social assessments, a number of informal, but significant, meetings were organized. As part of the regulatory clearance process, a formal public hearing was organized. At village Bael, a public information centre (PIC) had been set up since December 2005, where the local community and any other stakeholders have full access, and this public information centre has been helpful for the local public in recording their views about the project. Additionally, SJVN has sponsored and participated in the traditional village fairs, special events such as the Republic Day celebrations, and sports events in all the villages in the project area.

Himachal Pradesh, India case study: Harnessing hydropower (2014), "This case study draws on a literature review and in-country stakeholder consultations to understand the issues surrounding hydropower performance and development in HP and includes sections on the case study context, systematic mapping of water-energy-food systems, hydropower performance and its influencing factors, and identifies interventions for increasing the positive impacts of hydropower schemes on water, energy and food security. The case study found that a more integrated approach to planning and operation of the state's hydropower potential, including an improved climate change strategy and action plan could help HP to stay at the forefront of efforts to harness hydropower sustainably, in developing countries. Increasing river flows owing to glacier melt, which are likely over the next century, present an opportunity to employ HP's hydropower potential to maximise growth and development in the state. It is important that development of the state's hydropower potential does not compromise the ability of its natural environment to support sustainable development however.

Local Area Development through Hydropower Project: A Case Study of Parbati Hydro-Electric Project Stage-III (520MW) in Kullu district of Himachal Pradesh (India)" The result of study shows that there is substantial increase in developmental activities in and around the project area due to the construction of Parbati HE Project-III. Particularly, infrastructural development (road-bridge) led to improvement in communication and accessibility of villages (Manham, Banau, Sapangini,Talara) in Sainj valley, better transport facility for horticulture products of farmers in Sainj valley to nearby market located on NH-21. The prospects of job opportunities in Project construction works, ancillary

activities and in petty contract works also improved. Implementation of community development Schemes of NHPC led to availability of additional medical facilities, educational facility in Govt. Schools and development of socio-cultural aspects (Crematorium, melaground, toilets,watersupply etc) in Sainj valley are attributed to the construction of Parbati HEP-III. During construction phase of the project, in compliance to Govt. policy for LADF @ 1.5% of project cost allocated for execution of developmental works resulted in source of specific fund for development opportunity in Project affected area(PAA) in the valley and nearby areas. Out of total LADF for PAA, 60% was shared equally among three project affected gram-panchayats and remaining 40% among 04 gram-panchayats for taking-up developmental works by resolution of Gram-Shaba and local area development Committee(LADC). Also, during operational phase of Project, the provision of LADF @ 1% share of free power and revenue equivalent to 12% share of free power to State Govt. Of Himachal Pradesh from Parbati HEP-III on annual basis through-out the life span of project are continuous source of financial gain from Parbati HEP-III which will act as a stimulus for development.

Review of the concerned literature provides an overview of following advantages of hydropower in Himachal Pradesh.

ADVANTAGES OF HYDROPOWER:

1. Hydroelectricity is a renewable energy source.

Hydroelectricity uses the energy of running water, without reducing its quantity, to produce electricity. Therefore, all hydroelectric developments, of small or large size, whether run of the river or of accumulated storage, fit the concept of renewable energy.

2. Hydroelectricity makes it feasible to utilize other renewable sources.

Hydroelectric power plants with accumulation reservoirs offer incomparable operational flexibility, since they can immediately respond to fluctuations in the demand for electricity. The flexibility and storage capacity of hydroelectric power plants make them more efficient and economical in supporting the use of intermittent sources of renewable energy, such as solar energy or Aeolian energy.

3. Reliable and affordable source of energy.

The energy generated through hydropower relies on the water cycle, which is driven by the sun, making it a renewable power source, making it a more reliable and affordable source than fossil fuels that are rapidly being depleted.

4. Long life and low maintenance cost.

Hydropower projects are known to have much longer life and provide cheaper electricity as there is no fuel cost and the recurring cost involved in generation, operation and maintenance is lower than that in case of other sources of energy. The first hydro project completed in 1897 is still in operation at Darjeeling is still in operation.

5. Hydroelectricity promotes guaranteed energy and price stability.

River water is a domestic resource which, contrary to fuel or natural gas, is not subject to market fluctuations. In addition to this, it is the only large renewable source of electricity and its cost-benefit ratio, efficiency, flexibility and reliability assist in optimizing the use of thermal power plants.

6. Hydroelectricity contributes to the storage of drinking water.

Hydroelectric power plant reservoirs collect rainwater, which can then be used for consumption or for irrigation. In storing water, they protect the water tables against depletion and reduce our vulnerability to floods and droughts.

7. Hydroelectricity increases the stability and reliability of electricity systems.

The operation of electricity systems depends on rapid and flexible generation sources to meet peak demands, maintain the system voltage levels, and quickly re-establish supply after a blackout. Energy generated by hydroelectric installations can be injected into the electricity system faster than that of any other energy source. The capacity of hydroelectric systems to reach maximum production from zero in a rapid and foreseeable manner makes them exceptionally appropriate for addressing alterations in the consumption and providing ancillary services to the electricity system, thus maintaining the balance between the electricity supply and demand. Ability to start and stop quickly and instantaneous load acceptance/rejection makes it suitable to meet peak demand and for enhancing system reliability and stability.

Some hydropower facilities can quickly go from zero power to maximum output. Because hydropower plants can generate power to the grid immediately, they provide essential back-up power during major electricity outages or disruptions.

8. Hydroelectricity helps fight climate changes.

The hydroelectric life cycle produces very small amounts of greenhouse gases (GHG). In emitting less GHG than power plants driven by gas, coal or oil, hydroelectricity can help retard global warming. Although only 33% of the available hydroelectric potential has been developed, today hydroelectricity prevents the emission of GHG corresponding to the burning of 4.4 million barrels of petroleum per day worldwide. Has higher efficiency (over 90%) compared to thermal (35%) and gas (around 50%).

9. Hydroelectricity improves the air we breathe.

Hydropower is fuelled by water, so it's a clean fuel source, meaning it won't pollute the air like power plants that burn fossil fuels, such as coal or natural gas.

Hydroelectric power plants don't release pollutants into the air. They very frequently substitute the generation from fossil fuels, thus reducing acid rain and smog. In addition to this, hydroelectric developments don't generate toxic by-products.

10. Hydroelectricity offers a significant contribution to development.

Hydroelectric installations bring electricity, highways, industry and commerce to communities, thus developing the economy, expanding access to health and education, and improving the quality of life. Hydroelectricity is a technology that has been known and proven for more than a century. Its impacts are well understood and manageable through measures for mitigating and compensating the damages. It offers a vast potential and is available where development is most necessary.

11. Hydroelectricity means clean and cheap energy for today and for tomorrow.

With an average lifetime of 50 to 100 years, hydroelectric developments are long-term investments that can benefit various generations. They can be easily upgraded to incorporate more recent technologies and have very low operating and maintenance costs.

12. Hydroelectricity is a fundamental instrument for sustainable development.

Hydroelectric enterprises that are developed and operated in a manner that is economically viable, environmentally sensible and socially responsible represent the best concept of sustainable development. That means, "development that today addresses people's needs without compromising the capacity of future generations for addressing their own needs" (World Commission on the Environment and Development, 1987). A renewable source of energy - saves scarce fuel reserves.

13.Water Management.

In addition to a sustainable fuel source, hydropower efforts produce a number of benefits, such as flood control, irrigation, and water supply.

14. Domestic Source of energy.

Hydroelectric power is a domestic source of energy, allowing each state to produce their own energy without being reliant on international fuel sources.

15. Recreational Opportunities.

Impoundment hydropower creates reservoirs that offer a variety of recreational opportunities, notably fishing, swimming, and boating. Most water power installations are required to provide some public access to the reservoir to allow the public to take advantage of these opportunities.

16. Planned Development of Project Area

Involve large scale afforestation activities under various schemes like Compensatory Afforestation, Catchment Area Treatment, Green Belt Development, Voluntary Afforestation etc. which ultimately improve the environmental quality of the project area.

17. Social Benefits

Hydro projects are a boon to the society and the population in and around the projects. With enhanced employment opportunities, increased earnings, enriched life style and improved standard of living, the people in these localities experience an economic and social upliftment. Reservoir area is an ideal place for recreation and source of eco-tourism promotion in the area. The reservoirs are also used for promoting pisciculture. There are other direct benefits accruing from hydro projects and dams such as increased water for improved irrigation, and drinking water to villages and people living in and around the project area

Being located in remote regions leads to development of interior backward areas (education, medical, road communication, telecommunication etc.)

Conclusion

One of the oldest technologies for electricity production is hydro generation. It has many advantages as compared to the other technologies and only 17% of the world energy is supplied by hydroelectric plants. Himachal Pradesh has some specific characteristics that set it apart from other Indian states. It faces development challenge arising from its high elevation, topography, resource dependence, and ecological vulnerability- as well as from a

changing and more competitive international environment. The hydro power potential of the state is estimated to be twenty five percent of the national hydropower potential. The state government has been according hydropower the highest priority for its development, since hydropower can meet the growing needs of power for industry, agriculture and rural electrification etc. the abundance of perennial rivers enables Himachal Pradesh to sell hydropower to other neighbouring states such as Delhi, Punjab, and Rajasthan ,etc. It is also the largest source of income of the state. Climate change is affecting and will continue to affect hydropower development. The potential for hydropower development has to be judiciously and prudently managed to support the desired fiscal outturns and to invest in the future of the state. At the same time, the downside effects of hydropower development on the environment, especially reduced water for downstream uses, will require much improved attention to ensure that society as a whole benefits, and that development is sustainable.

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