Opportunities and Critical Success Factors for Economic Development of Uttarakhand due to Implementation of Hydro Projects

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Abstract—Throughout the history man has harnessed the natural water resource to his aid and has devised and empowered hydro power to cater needs such as irrigation, power generation, flood control etc. Development of hydro power has given sources of economic development of the local area and alongside development of the national economy. Hydro power has become a backbone of sustainable development with its renewable attributes. It gives energy security and chances additional income. The low or zero affluent emission with reduced greenhouse gas emission has given hydropower its essence of green energy. The main focus of any developing country is reduction of carbon footprint and carbon emission along with harnessing its natural resources for sustainable development, hydropower caters to all this and more enabling it to become the major indicator of economic development.

1. Introduction:

UN conference on Environment and Development (UNCED) was held in Rio de Janeiro in the year 1992, which focused on sustainable development on the base of natural resources. Natural resources are those resources which are direct derivative of nature such as hydro resource, solar resource, wind resource etc. In a country like India economic development can center around this hydropower because it is blessed with this resource. Thus, hydropower has become the back bone of sustainable development. Since ancient times water resource has been used for agricultural and urban usage by manipulating flow of rivers. First man made dam came into picture around 2950-2750 B.C. in ancient Egypt. This dam was 11.3 meters high, had a crest length of 106 meters and had a foundation of 80.7 meters. From there on throughout history we could see that hydropower has been a medium for development and sustainability. The Hoover Dam was built in 1936 on the Colorado river with a purpose of flood control, power generation, water storage, regulation and recreation site. This dam created lake mead and has a significant role in power distribution in different states such as Nevada, Arizona, Los Angeles and California in United States of America. The Three Gorges Dam in China is one of the biggest dam in the world and has the largest power generation capacity in the world from a single Dam approximately 22500 MW. China accounts for nearly 20 percent of its electricity from hydro power. As per the world commission on dams China has a share of 45 percent of dams in the world followed by USA in 14 percent and India with 9 percent. Completion of this dam changed the economic development scenario of China. India’s first ever hydro plant or hydel power project, Sidrapong hydel power station was established in
Darjeeling district of West Bengal in the year 1897. Presently India is the 7th largest producer of hydroelectric power in the world. India has an installed capacity of 44963.42 MW of hydro power as on 31.01.2018. India’s total economically exploitable hydro electric potential is estimated to be 148701 Mega Watts along with various small hydro. Hence the main focus for sustainable future is investment in hydro project. [1][2][3]

2. Factors depicting Economic aspects:

Development of hydropower symbolizes making of dams and it will lead the way for economic development of the country and state.

a) Power Generation: The first and foremost point is it will lead to power generation. Power generation from hydro resources is one of the cheapest and greenest form of energy available. Hydropower does not need any kind of fuel to generate power, it is totally dependent upon natural resources. Hydro generated 6.62 billion units of electricity in January 2018 as per CEA report. It accounts for 6.54% of total electricity pan India. Uttarakhand has a huge network of rivers and canals which gives it a huge bank of hydro resource at its disposal. Uttarakhand has an estimated hydro power potential of 20363 MW out of which approximately 3594 MW has been harnessed till now. Approximately 3574 million unit of power was generated in the year of 2014 by hydropower in the state of Uttarakhand as per state government report in the year 2014. This shows that a major chunk of power is generated by hydro power. This generated power can be sold for economic benefits as IPPs and for captive use for new industrial users. Power generated from small hydro stations comes under renewable sources and this power can be encashed as RECs (Renewable Energy Certificates). [3][4][5]

b) Recreation and Tourism: Hydro power facilities and dams are being used as recreational area all over the world, this fetches a huge amount of remunerations for the state and country. Tourism is boosted through these sites in a huge manner. The classic example is the Hoover dam in United States of America. The authorities are charging USD 15 as entry fees per person in the dam area. They are arranging special events, educational trips, private tour etc. to increase the earning from the dam. These earnings are extra earnings which supports the dam expenditure for operations and enables less investment from the government authorities. The same scenario is reflected in Uttarakhand through various sites. There are 15 dams in the state of Uttarakhand as per government report. Amongst these Tehri dam is a very popular tourist destination in the state of Uttarakhand. Local areas have flourished due to tourism which centers around the dam, various avenues of employment and earnings have opened due to large number of tourists visiting this area. The government should focus more on developing the other dams and promoting them as tourist spots to enable and encash the opportunity of extra earnings and local socio-cultural development. [5][6][10][30][31]

c) Sustainable Development: After the COP21 the major focus of government is in sustainable development and harnessing its natural resources. All hydroelectric projects use the energy of run of water whether it is a run off river type or accumulated water type, hence small or large every hydro project fits the description of renewable
sources. The main advantage of hydro power is that it is a green source of energy. There is no pollution or emissions in hydro power generation, it is basically harnessing the force of nature and using it in a manner which helps and empowers mankind. The second factor is there is no requirement of fuel in generation of fuel. This scenario has two aspects, first of all there is no pollution and Greenhouse gas emission from the generation, second of all the energy security is increased for the nation. In other type of power generation such as thermal power the main component the coal is imported from other nation, hence it is dependent on the other nation and its policies. But in case of hydro power there is no fuel requirement hence there is no dependencies on other countries. This increase the energy security of the country. This gives hydropower the title of sustainable development because it addresses the needs of today without compromising the needs of the future. Moreover, multipurpose hydroelectric project will help in flood control, irrigation purposes, navigation issue and drinking requirement.\[7\][8]

d) **Cheap and Clean energy:** Hydroelectricity means clean and cheap electricity. A hydro project has a life span of 50 to 100 years. Whereas the recovery period of hydro project is almost around 20 years. After that the cost per unit electricity generation becomes very less. This enables to produce cheap electricity and gives a good avenue of income. Hydro is also clean electricity, in other power plants there is usage of hydrocarbon-based fuels which when burned produces greenhouse gasses. In order to reduce emission lots of measures are to be taken which becomes very costly and adds to the cost of per unit electricity generation.\[9\][10][11][30].

e) **Integration with other renewable sources:** The main advantage or plus point of hydro project is that is can be used in amalgamation with other renewable sources to produce electricity. Sources like wind and solar are intermittent in nature that is 24X7 availability of these sources is not possible. Due to the incomparable flexibility of hydro power it can be coupled with renewable sources like wind and solar. Hydro power can immediately respond to the fluctuations caused by the hydroelectric generations. Coupled with reservoirs which acts as storage the reliability of this type of power sources increases more compared to run off river type. For larger integration other renewables can be used as main source of energy which feeds the grid and hydro power can be used as the component which stabilizes the fluctuations caused by other renewables.\[11\][12][13][25][26][27][28][29]

f) **Stability and reliability of electric system:** The operation of the electrical grid depends upon the flexibility and rapidity of the generation sources which meets the peak demands, maintains the system voltage, and which quickly heals itself and reestablish supply after a blackout scenario. The electricity generated from a hydroelectric source can be injected into grid faster than any other sources of energy. The time taken by a hydroelectric station to fully integrate and start generating is very less compare to other power plants. 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. [12][14][15][16][17][19][24][25]

\( g \) Climate change and air quality: The amount of greenhouse gas produced by hydroelectric life cycle is very less. It emits less greenhouse gas than coal or gas fired power plants thus it reduces the global warming caused by these kinds of emissions. Hydroelectricity prevents emission of greenhouse gas corresponding to burning of 4.4 million barrels of petroleum per day worldwide. It helps immensely in bringing down carbon emission and carbon footprint. In addition to this it does not produce pollutants and increases the air quality, it frequently substitutes the generation from fossil fuels and reduces acid rain and smog in the local area. [18][20][21][22][23]

3. Summary:
Hydroelectricity always has been one of the indicator of development of the modern society. Implementation of hydro power can lead to various aspects that can aid in economic development and growth of society and local sociology and ecology. Throughout history we have seen man harnessing the raw potential of nature to his aid, hydropower is one of the shining example of this. By using the natural resource to its maximum potential, we can ensure that proper growth and evolution of society. Hydro power ensures sustainable development and a manageable future for our next generation.

Hydro power can be a main source of power which can be produced, in states like Uttarakhand, Himachal and Arunachal hydro potential is huge and if harnessed properly it can lead to power generation so huge that it can cater to the entire countries power demand. Dams can be a source of recreation and can boost tourism of the local area and this tourism can be an avenue of income and economic development of the local area as well as the state in which it is being harnessed.

Hydropower is a marker of sustainable development and it can lead to reduced emission of greenhouse gasses which can and will reserve the ecosystem for future, by harnessing the natural resources and focusing on improving the efficiency sustainable development can be ensured. Hydroelectricity requiring no fuel can be termed as cheap and clean source of energy. Increasing the energy security of the country it has a potential to make a country self-sufficient and secure.

This kind of power can be coupled with other renewable sources and can be used. Renewable sources like solar and wind are intermittent in nature and can cause huge fluctuations in the grid along with destabilizing it. Due to quick startup and heavy reliability hydro can be coupled with these kinds of renewable sources and can be used as efficient and reliable system, it can take care of the peak demands and fluctuation of the grid. This improves the stability of the system many folds.

Due to its nature as nonpolluting source of energy the air quality improves reducing chances of phenomenon like acid rain and smog. With reduced greenhouse gas emission global warming also reduces many folds.

Conclusion:
Due to the various reasons explained before hydropower is an indicator of economic development and a gate way of healthy and sustainable future. Investing in hydro projects will ensure good returns and will flourish and
enrich economic development of the local area which in turn will benefit the national economy.

Reference:


3. "Executive Summary." Feb, 2018


7. CEA, 2014 Region wise list of Hydro Electric Stations, as on 31.03.2014, with capacity above 25 MW

8. Sustainable Hydropower–Issues and Approaches, Helen Locher and Andrew Scanlon, Hydro Tasmania, Australia


12. CEA, 2016. Hydro potential in India, accessed on 2/7/2016


17. Mr. Sonam Tshering, Mr. Bharat Tamang. "Hydropower - Key to sustainable, socioeconomic development of Bhutan."


19. All India Installed Capacity (in MW) of Power Stations (As on 30.09.2016) (UTILITIES) CEA, New Delhi


21. MNRE, Ministry of New and Renewable Energy (MNRE), Government of India, New Delhi

22. INDIA BRIEFING Posted on August 22, 2014 by India Briefing


27. Development of Small Hydro, G. Baidya, Chief Engineer (CDM –R&D), NHPC Faridabad submitted at Himalayan Small Hydropower Summit (October 12-13, 2006), Dehradun


