Scenario of Small Hydro Power Plant (SHP) in India and Effects on Climate Change: An Eco-friendly Approach Towards Sustainability

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Abstract. Water is the crucial asset to help all shape life on earth. Tragically it isn't uniformly conveyed over the world via season or area. Hydroelectricity is the term alluding to power created by hydropower, the creation of electrical force using the gravitational power of falling and streaming water. It is most broadly utilized type of sustainable power source. Once the hydro electric complex is developed, the item delivers no immediate waste. Hydroelectricity produces 16.6% of the word electricity, and accounted for about 70% of electricity from renewable source in 2015 and was expected to increase by about 3.1% each year for the next 25 years [1]. The annual hydroelectric production of India is 122.31 TWh while installed capacity is 43.8 GW. The national electric grid in India has an installed capacity of 368.79 GW as of 31 December 2019. The hydropower contributes 25%. [2]. In India, hydropower ventures with a station limit of up to 25 MW each fall under the class of little hydropower (SHP). India has an expected SHP capability of around 16000 MW, of which about 18.5% has been tapped so far for example 2960 MW. Service of MNRE has made a database of potential locales of little hydro and 5,718 potential destinations with a total limit of 15384.15 MW for ventures up to 25 MW limit have been distinguished as on 2019. Environmental change has suggestions for both human and characteristic frameworks and could prompt critical changes in asset use creation and monetary action. Because of the effect and potential effects of environmental change universal, local, national and neighbourhood activities are being created and executed to constrain and moderate GHGs fixation in the Earth's climate. The worldwide worry for reasonable improvement and environmental change has brought grouping of vitality strategy creators towards the sustainable power sources since these give vitality, without emanations of ozone depleting substances (GHGs) and are additionally plentiful asset accessible for future. In the present paper an endeavour has been made to depict the potential and use of little hydropower in India for the practical advancement of the nation.

Keywords: Renewable Energy, SHP, Climate Change, Sustainability, Greenhouse gas

1. Introduction

The expansion in oil costs and consequent overall vitality emergency provoked numerous nations to look and create sustainable wellsprings of vitality. Since every year costs increment and supply of petroleum derivatives reducing, non-ordinary vitality sources establishment, improvement is taken as
prime thought [17-22]. A great part of the little hydro potential is in the bumpy and remote, difficult to reach zones of India, where age from different sources or transmission of control over long separation would not be plausible. Advancement of this neighbourhood potential meets a since quite a while ago felt need [3]. Vitality Production has become profoundly costly overall and its deficiency has prompted increased research reads for creating exchange wellsprings of vitality. India aggregate introduced power limit as on 31st Dec 2018 is appeared in figure 1. Little Hydro Power is a portion of the elective sources whose appropriate use can improve the general vitality image of the world [4].

Hydropower is a sustainable, non-contaminating and naturally benevolent wellspring of vitality. It is maybe the most seasoned sustainable power source strategy known to the humankind for mechanical vitality transformation just as power age. The assessed capability of sustainable force in India as on 31st March 2018 is appeared in figure 2. Hydropower speaks to utilization of water assets towards expansion free vitality because of nonattendance of fuel cost with develop innovation described by most elevated prime moving productivity and astounding operational adaptability [5].

Hydro power ventures are commonly classified in two fragments for example little and huge hydro. In India, hydro extends up to 25 MW station limits have been ordered as Small Hydro Power (SHP) ventures. While Ministry of Power, Government of India is answerable for huge hydro ventures, the command for the subject little hydro power (up to 25 MW) is given to Ministry of New and Renewable Energy. Grouping of little hydro power is given in table 1.

Table 1 Classification of Small Hydro power
(Source: MNRE 2018)

| Class       | Station Capacity in kW |
|-------------|------------------------|
| Micro Hydro | Up to 100              |
| Mini Hydro  | 101 to 2000            |
| Small Hydro | 2001 to 25000          |

Small hydro is the improvement of hydroelectric force on a scale serving a little network or modern plant. SHP is considered as a dependable alternative for advancement of provincial zones and is one of the push zones of intensity age from sustainable in the MNRE. It has been perceived that little hydro
power ventures can assume a basic job in improving the general vitality situation of the nation and specifically for remote and out of reach regions.

![Estimated potential of renewable power in India as on 31st March 2018](image)

**Figure 2** Estimated potential of renewable power in India as on 31st March 2018 [13]

### 2. Hydro Power towards Sustainability

Economical improvement requires a harmony between the nature and humankind; through this parity, it programs for the life and advancement of both present and people in the future without draining common assets. Feasible improvement requires the reconciliation of three parts – financial advancement, natural alert and social equity – as related, commonly fortifying columns. Feasible improvement is troublesome idea to characterize. One of the first depictions of practical advancement is credited to the Brundtland Commission: "Maintainable improvement is the advancement that addresses the issues of present without bargaining the capacity of group of people yet to come to address their own issues [6-7].

The term 'sustainable energy' alludes to vitality gave and utilized in manners that help in maintainable advancement in the entirety of its monetary, social and natural measurements. It doesn't mean basically an extended stock of vitality, however a dynamic move to vitality assets and innovations that help human well – being and biological soundness over the long haul [8].

Hydropower is an inexhaustible wellspring of vitality, which emits no dirtying gases. Hydropower is viewed as a productive, cost – powerful, and clean vitality hotspot for creating power. Hydropower is versatile and adaptable. Contingent upon the capacity limit included, a significant bit of leeway of hydropower is that age can be booked. Run – off stream plan can be executed to give ceaseless base burden age. Along these lines, hydropower can economically improve effectiveness, diminishing outflow from non-renewable energy sources and sponsorship up irregular source, for example, and wind power [9].

### 3. Global Scenario of Hydro Power

Hydroelectricity produces 16.6% of the word power, and represented about 70% of electricity from inexhaustible source. Brazil, Canada, New Zealand, Norway, Paraguay, Switzerland, and Venezuela are the main nations on the planet where most of the interior electric vitality creation is from hydroelectric force. Paraguay produces 100% of its power from hydroelectric dams, and fares 90% of its creation to Brazil and to Argentina. Norway produces 98–99% of its power from hydroelectric
sources. The best ten hydroelectric produces nation are given in table 2 and furthermore appeared in figure 3.

Table 2 Top Ten Hydroelectric Producer Country by 2014 [10]

| Country   | Annual Hydroelectric Production (TWh) | Installed Capacity (GW) |
|-----------|---------------------------------------|-------------------------|
| China     | 1064                                  | 311                     |
| Canada    | 383                                   | 76                      |
| Brazil    | 373                                   | 89                      |
| United States | 282                                | 102                     |
| Russia    | 177                                   | 51                      |
| India     | 132                                   | 40                      |
| Norway    | 129                                   | 31                      |
| Japan     | 87                                    | 50                      |
| Venezuela | 87                                    | 15                      |
| France    | 69                                    | 25                      |

Figure 3 Top ten hydroelectric producer countries by 2014 [10]

4. Potential of Small Hydropower (SHP) in India

In India, hydropower ventures with a station limit of up to 25 MW each fall under the class of little hydropower (SHP). India has an expected SHP capability of around 19750 MW, of which about 19.25% has been tapped so far for example 3803 MW. Service of MNRE has made a database of potential destinations of little hydro and 6,474 potential locales with a total limit of 19750 MW for ventures up to 25 MW limit have been distinguished. State insightful SHP potential and introduced limit as on 2014 is appeared in figure 4.
Environmental change has suggestions for both human and regular frameworks and could prompt critical changes in asset use creation and monetary movement. In light of the effect and potential effects of environmental change universal, local, national and nearby activities are being created and executed to restrain and moderate GHGs focus in the Earth's air. The conduct of green house gas outflow with different natural framework is appeared in figure 5. The worldwide worry for practical advancement and environmental change has brought centralization of vitality strategy creators towards the sustainable power sources since these give vitality, without outflows of ozone harming substances (GHGs) and are likewise plenteous asset accessible for future [11, 14].
Since hydroelectric dams don't consume petroleum derivatives, they don't legitimately create CO₂. While some carbon dioxide (CO₂) is created during assembling and development of the undertaking, this is a modest division of the working emanations of comparable petroleum product power age. Hydroelectricity delivers minimal measure of ozone harming substances and externality of any vitality sources. Coming in runner up was twist, third was atomic vitality, and fourth was sun based photovoltaic [15-16].

Lower positive effects are found in the tropical districts, as it has been noticed that the stores of intensity plants in tropical locales may deliver significant measures of methane. This is because of plant material in overflowed territories rotting in an anaerobic situation, and framing methane, a strong ozone harming substance. As per the World Commission on Dams report, where the repository is enormous contrasted with the creating limit (under 100 watts for each square meter of surface zone) and no freeing from the backwoods in the region was embraced before impoundment of the supply, ozone depleting substance discharges from the store might be higher than those of a regular oil-terminated warm age plant. The emanation of green house gas from different sources is appeared in figure 6.
6. Barriers in Development of SHP

The boundaries saw being developed of the little hydro portion are specialized, procedural and cost-related in nature. The specialized obstructions incorporate factors, for example, openness to the locales and dangers associated with shipping overwhelming supplies to the destinations. The procedural issues essentially identify with the quantity of clearances required before taking the undertaking. Ordinarily, an engineer is required to get a task apportioning from the state nodal organization, get freedom from MOEF where forestland is associated with (ventures costing more than Rs100 crores), leeway from the Irrigation/Water Resources Department, freedom from the state government ashore accessibility, and so forth. Without any arrangement for a solitary window freedom, the way toward acquiring these clearances/endorsements may take quite a while. In certain territories security issues are additionally experienced because of rebellion. On the cost front, it involves some worry that gear costs are not going down because of the set number of players.

7. Conclusions

Legitimate usage of little hydro force can improve the general vitality image of the world and can assume a significant job in building up the provincial and uneven territories. Then again SHP favours the improvement of both present and people in the future without exhausting the common assets. With the advancement, restoration, remodel of new and previous SHPs, critical extra perfect and sustainable power source limit can be accomplished.

“To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy.” This was cited by American president Mr. Obama and it is altogether valid as environmental change isn’t just a monstrous danger to the worldwide condition, it is likewise maybe the best monetary test confronting us in the twenty-first century. It requests a dire and radical reaction over the created and creating world. Little Hydropower is called upon to play a solid, multidimensional job in manageable advancement and destitution mitigation. It isn't only a method for skirmishing GHG discharges; water stockpiling additionally bolsters adjustment to environmental change. There is a basic need to grow new, increasingly feasible natural arranging and arrangement moves toward that coordinate social and biological worries in SHP extends in the nation.

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