



ScienceDirect

journal homepage: [www.elsevier.com/pisc](http://www.elsevier.com/pisc)

# Analyze the factors effecting the development of hydro power projects in hydro rich regions of India<sup>☆</sup>

Ameesh Kumar Sharma<sup>\*</sup>, N.S. Thakur

*Centre for Energy and Environmental Engineering, National Institute of Technology, Hamirpur, India*

Received 29 January 2016; accepted 8 April 2016

Available online 30 April 2016

## KEYWORDS

Policy;  
Small hydro projects;  
Incentives;  
Jammu and Kashmir;  
Potential

**Summary** Power is considered as the major back bone for all the nations throughout the world including India on the basis of which development of the country depends. If a country has the resources to generate the power at competitive price in that case the people of the country get the benefits in terms of improvement in their social and economical life. When we talk about India, various locations in the country where still there is no electricity people are living in dark without having the access of the modern technology. The total hydro power potential of India is 1, 50,000 MW out of this total hydro potential only 40,195 MW is exploited till 2014. More than 80% of the total hydro potential of the country is lying in the western Himalayan states (Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh). Small hydro projects are also playing a very important role in the modern world for the development of the remote areas which are not main grid connected specially in western Himalayan region of India. India has a total potential 19,749 MW of small hydro projects and of this total potential only 3990.9 MW harnessed till 2014. Ministry of new and renewable energy in India is also providing special incentives to hydro rich states of India. In this research article we are taken the case study of the small hydro projects in the western Himalayan region because these states are having vast small hydro potential which is still needed to be harnessed. So, it is very important to identify the factors which are effecting the development of these small ventures especially in western Himalayan region in India.

© 2016 Published by Elsevier GmbH. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Hydro power is considered as the renewable, environmental friendly and non polluting source of energy. The hydro power projects are having the ability to adapt according to the load variations and to help in increasing the reliability of

<sup>☆</sup> This article belongs to the special issue on Engineering and Material Sciences.

<sup>\*</sup> Corresponding author. Tel.: +91 9796011246.

E-mail address: [ameesh.amar@gmail.com](mailto:ameesh.amar@gmail.com) (A.K. Sharma).

the power grid. These kind of projects are considered as the first choice for handling the peak as well as the basic power demand of the area. Also the small hydro power projects have long life and help in conserving the local environment from the negative effect of fossil fuels. More than 80% of the total hydro potential of our country is distributed among the 4 Himalayan states that are Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh. In India hydro power projects which are having capacity up to 25 MW are known as Small Hydro Projects (SHPs) and Ministry of New & Renewable Energy are dealing with the installation work related to these projects. The total SHPs potential in India is about 19,749 MW from 6474 identified sites. Out of this total SHPs potential, about 34.8% lies in the Himalayan regions. These projects are based on the run of the river schemes (Sharma and Thakur, 2015a). Also the central government is providing special financial assistance to the hydro rich states as well as the private developers in order to boost up this sector. Central ministry is also giving support for the site survey as well as the investigation, preparation of the detailed project report of SHPs and special training are also provided by the Alternate Hydro Centre (AHEC), Indian Institute of Technology, Roorkee. SHPs are not encounter with the problems which are usually linked with large hydro projects like deforestation, large area requirement and construction of large dams. These kinds of projects are having the potential to meet the electricity requirement of remote areas where grid connectivity is not possible or not economical because the load centre is very far away from the main grid. Most of the Himalayan states are having separate hydro policies which are related to these SHPs in order to attract more private developers/parties to enter this sector.

### Financial help given by the Ministry of New & Renewable Energy (MNRE) for the development of SHPs

To set up a new SHP up to 25 MW capacity in the Private, Co-operative, joint Sector special financial assistance is given by the MNRE for Arunachal Pradesh, Jammu and Kashmir, Himachal Pradesh and Uttarakhand (special category states) is Rs.1.5 crore per MW limited to Rs 5 crore per project and

for other states the amount is Rs 1 crore per MW limited to Rs 5 crore per project. In case of the government sector special financial assistance is given by the MNRE for special category states is Rs 7.5 crore per MW limited to Rs 20 crore per project and for the remaining states this assistance is Rs 3.5 crore per MW limited to Rs 20 crore per project. Also financial support is provided by the MNRE for the renovation and repair of the old SHPs in case of government sector that is Rs 1 crore per MW limited to Rs 10 crore per project. A special scheme is also launched by the MNRE in order to install more watermill and micro hydro projects (up to 100 kW capacities) in which Rs 1.5 lakh is given to those projects having electrical output up to 5 kW (MNRE; Gol (Government of India)).

### Case study

In research article we have taken the case study of Jammu and Kashmir which located in the north western Himalayan region of India. This state is having a huge hydro potential in terms of large hydro as well as the small hydro (Gupta et al., 2013; Sharma et al., 2013). During over visit to some of small hydro power projects in the state in order to identify the factors which are responsible for the slow development these projects especially in this region. As they stand at 4 position in terms of hydro potential when compares with other states of India. The Jammu and Kashmir is having with huge hydel potential which, when exploited completely, will give a solid stimulus to the development of its economy (Figs. 1 and 2). The aggregate hydro power capability of the J&K state is 20,000 MW, of which around 16,475 MW have been recognized (Sharma and Thakur, 2015b).

This involves 11,283 MW in Chenab basin, 3084 MW in Jhelum basin, 500 MW in Ravi basin and 1608 MW in Indus basin. Out of the recognized potential, just 2813.46 MW i.e. 17% (of recognized potential) has been harnessed till date, comprising of 761.96 MW in State Segment from 21 power ventures, 2009 MW in central segment from 7 ventures and 42.5 MW in private segment from 4 ventures. Because of resource restrictions, exploitation of the potential economic rejuvenator like hydro energy has been very steady. Besides, due to the restrictions imposed by the Indus Water



Figures 1 and 2 Outside and inside view of the power house of fully commissioned SHP in Jammu and Kashmir.

Treaty that took place in 1960 between India and Pakistan which preventing J&K state government from water storage on its major rivers like Jhelum, Chenab and Indus rivers, these projects have been constructed on the basis run of the rivers and because of which the total generation capacity has reduced to less than 1/3rd of installed capacity. During winter when the discharge in these snow fed rivers reduces results in power shortage in the state and to fulfill this gap the state government has to rely on power purchase from Northern Grid to meet its energy requirement specially in winter, when its own power generation is minimum from the hydro projects and the power demand is maximum due to harsh winters. In spite of all these issues, the State has not found out any proper solution to ensure electrification of all its villages/hamlets. The 18th all India power survey has depicted an increase in maximum power demand of Jammu and Kashmir from 1706 MW i.e. 9640 MUs during 2004–05 to 4217 MW i.e. 21,887 MUs during 2021–22. Centre government is giving special incentives to the Himalayan states though installation of these SHPs in J&K is very slow. Lack of the private sector in the state results in the slow installation rate of these projects. Special incentives are also given by the state government to the private parties for the installation of projects up to 25 MW in J&K (GoJK (Government of J&K)). The state government also establishes separate departments which will handle the installation of mini/micro and small hydro power projects within the state. Some of incentives given by the state government for the installation of micro, mini and small hydro projects in J&K are as follows (JKEDA and GoJK, 2011; JKPDD and GoJK, 2011). [a] No entry tax will be charge by the state government on the equipments used for the installation of SHPs. Also the state government provide land if required, for power projects shall be allotted for fix period that is 40 years at the rate premium of Rs. 1 per sq.m. [b]Mortgage deed for the financing establishments required to be marked by the promoters should be exempted from installment of stamp obligation. The State Government has as of now empowered evenhanded home loan in the state. [c] The state government is also providing 10% subsidy on capital investment subject to the ceiling of Rs.60 lakhs in addition to the central subsidy for the power projects from 1 MW to 2 MW when these projects start generating the power. [d] For micro and mini hydro projects the royalty at the rate of 12% per annum shall be charged after the period of 10 years from the date of full installation of the projects up to 2 MW capacity. Independent power producers will be eligible for central financial assistance as per the standing guidelines of MNRE, Government of India. [e] The “Water user charges” for micro, mini and small hydro projects are exempted for a period of 10 years from the day these projects are fully commissioned.

## Conclusion

As per the above discussion it is very much clear that J&K has drafted very good policies to attract private player to enter in this field so that more investment, new technology and opportunities like employment can be created. During the visit to some of the SHPs meetings are conducted with the local people and power developers to see their feedbacks and mind set towards these kinds of projects. The local people are very much excited to have these kinds of projects in their nearby areas because they feel that these projects are going to help them in improving their life as job opportunities are going to create if these projects are installed as well as the power cuts will reduce specially during the winter season. As per the discussion with the power developers they feel that the these projects are in remote location and there are some securities issue as the skilled labors and technical persons are refusing to work in these remote areas resulting in high construction cost, they need safety as well as the state government to help them by at least constructing road to these areas so that the transportation and the communication can be established as most of these locations are not connected with the public transport and do not have any communication facilities. So, in the end it's very much clear that in order to have the development in these remote locations these projects can play a very vital role.

## References

- Economic Survey Report 2014–15; GoJK (Government of J&K). Statistical supplement vol. 1.
- Gupta, A., Sharma, A.K., Sharma, U., 2013. [Future potential of small hydro power project in India](#). *Int. J. Electr. Eng. Technol.* 4 (2), 427–442.
- JKEDA (Jammu & Kashmir Energy Development Agency), GoJK (Government of Jammu & Kashmir), 2011. [Policy for Development of Micro/Mini Hydro Power Projects](#).
- JKPDD (Jammu and Kashmir Power Development Department), GoJK (Government of Jammu & Kashmir), 2011. [State Hydro Electric Projects Development Policy](#).
- MNRE; Gol (Government of India). Annual Report 2014–15.
- Sharma, A.K., Thakur, N.S., 2015a. [Resource potential and development of small hydro power projects in Jammu and Kashmir in the western Himalayan region: India](#). *Renew. Sustain. Energy Rev.* 52, 1354–1368.
- Sharma, A.K., Thakur, N.S., 2015b. [Hydro power energy for sustainable development in Jammu & Kashmir](#). In: *Proceedings of International Conference on Hydropower for Sustainable Development*, 5–7 February, Dehradun, India.
- Sharma, A.K., Gupta, A., Sharma, U., 2013. [Electricity forecasting of J&K: a methodological comparison](#). *Int. J. Electr. Eng. Technol.* 4 (2), 416–426.