

## Hydro Power Potential in Uttarakhand

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### 1 INTRODUCTION

The development of small hydropower around the world is on the increase. Much of the world has huge potential to further develop this resource. Small hydropower offers a wide range of benefits-especially for rural areas and developing countries. The resource is environmentally responsible and has substantial economic advantages. Efforts also being made to improve the exchange of ideas and technology related to small hydropower.

In India, small hydropower up to capacity of 25 MW also includes the mini-and-micro hydropower projects which are usually confined strictly to local use. A potential of over 15,000 MW has been identified from small hydropower and Government of India has been according top priority to SHP development as thrust area.

Uttarakhand has a large network of rivers and canals which provides an immense scope for hydro-power energy. In India, the development of Micro, Mini, and Small Hydro Power Projects started in the year 1897. One of the first hydro-power stations in India was commissioned at Galogi in 1907. More power stations were subsequently developed over a period of time. In Uttarakhand, the estimated capacity of Small hydro power projects is about 1500 MW out of total estimated capacity of 20,363 MW.

State Uttarakhand has geographically 8 districts are completely in the hilly region of this Himalayan Region with the remaining 4 districts are partly hilly and partly plain areas with tarai and Bhabar characteristics while one district Haridwar is completely in the plain area. This province is also having the origin of some of the ice-fed rivers like the Ganges, Yamuna, Bhagirathi, Alaknanda, Sarju, Tons, Kali and Gori. In the foothills the medium and large dams for collecting the water of rain fed rivers for irrigation and flood protection purposes have been built. Thus the availability of ice fed and rain fed rivers along with the natural incline make this province a State having a good hydro power potential and a future Energy State.

There is an urgent need to develop this promising sector of renewable energy in all developing countries as only a fraction of available potential has been harnessed so far. At present all the electric power being generated (except the captive power plants and diesel generators in the factories and commercial places) is only hydro power with some power from thermal and nuclear plants allocated from power stations situated outside the State.

The table 1 shows the present status of hydro power potential in the State of Uttarakhand:-

Table 1 the present status of hydro power potential in the State of Uttarakhand

1.	Identified potential	about 20,000 (plus) MW
2.	Harnessed potential	1400 MW
3.	Under Commissioning/Final Stage of Completion	1704 MW
4.	Allocated (at various stages of development)	12784 MW

The table 2, 3 and 4 shows the developer wise position of the developed/under developed and allocated hydro power potential in the State of Uttarakhand:-

### Developed Potential

1.	State sector under UJVNL-Uttarakhand Jal Vidyut Nigam Ltd.	1000 MW
2.	Central sector under National Hydroelectric Power Corp. Ltd.	400 MW
3.	Private sector	-Nil-
<b>Total</b>		<b>1400 MW</b>

Table 2 Developed Potential in the State of Uttarakhand

### Under Commissioning/Final Stage Of Completion

1.	State sector under UJVNL-Uttarakhand Jal Vidyut Nigam Ltd.	304 MW
2.	Central sector under THDC-Tehri Hydroelectric Dev. Corpn. Ltd.	1000 MW (Tehri Dam Stage-I)
3.	Private sector (Vishnuprayag Project)	400 MW

Table 3 Under Commissioning/Final Stage Potential in the State of Uttarakhand

### Allocated Projects

S.N.	Developer	Allotment Procedure	Capacity
1.	Central Sector (various CPSUs)	Through MOU (21)	8091 MW
2.	State Sector (UJVNL)	Direct Allotment (13)	2444 MW
3.	Private Sector	Through Bidding (07)	1245.50 MW

Table 4 Allocated Projects in the State of Uttarakhand

In Uttarakhand about 65% land is under forests out of which about 15% forest areas are either under National Parks or Sanctuaries/Biospheres. Some of the hydro power project sites are situated in these protected areas, thereby getting environmental clearances is one of the major issues in addition to the issues raised by local people with regard to employment, rights with regard to the use of water and land etc. Some of the projects are multipurpose dam based projects which attract R&R (Rehabilitation and Resettlement) issues. Some projects especially the Padeshwar Dam (5000 MW) is to be situated in Indo-Nepal Border. Some time ago the Govt. of Uttarakhand has decided to give preference to run-of-the-river projects by even changing the nature of dam based projects to run-of-the-river type by having cascade of projects rather than one dam based project. One good example in this regard is the Kotli Bhel Project (1000 MW) which was earlier dam based and now three cascade based run-of-the-river projects with total estimated capacity of 1045 MW has been prepared through NHPC.

At the time of creation of Uttarakhand the following 04 projects were languishing at construction stage due to various reasons, mainly paucity of funds/failure of private sector to yield. However, after creation of new State these projects have now been showing good progress, one being at commissioning stage. The table 5 shows the status of these projects:-

Sl.	Name	Developer	Status
<u>1.</u>	Vishnu Prayag (400 MW)	M/s JP Power Ventures Ltd.	3 units already commissioned.
<u>2.</u>	Srinagar (330 MW)	M/s Alaknanda Hydro Power Co.	Construction work restarted after about 14 yrs.
<u>3.</u>	Lakhwar Vyasi Multipurpose Projects (420 MW)	Allocated to NHPC for further implementation in 2003.	Cost sharing issue between beneficiary States for water component is to be settled.
<u>4.</u>	Maneri Bhali-II (304 MW)	State sector under UJVNL. Work restarted after a period of about 10 years.	Under final stage of completion.

## 2 SMALL HYDRO POWER POTENTIAL/PROJECTS

In addition to the large & medium identified hydro potential of about 20,000 MW. Uttarakhand State is also having about 1500 MW potential in the segment of Small Hydro projects upto 25 MW capacity, ranging even upto 1 MW also.

The table 6 shows the status of SHPs developed so far is being given here below :-

Sl.	Developers	No. of Projects	Total Capacity (in MW)
1.	State undertaking (UJVNL)	31	54.405
2.	State Agency (UREDA)	32	2.8875 (For Village Electrification)
3.	Private	02	6.60

Table 6 Status of Developed SHPs

While most of the SHP projects developed so far under state undertaking UJVNL and all under private sector are being fed to grid, the projects under UREDA (Uttarakhand Renewable Energy Development Agency) are mostly stand alone projects with electrification of remotest villages as its primary goal. Such stand alone projects are being managed by the local community for day to day operation and maintenance through a registered society with elected representatives among the consumers. Such stand alone projects were planned and constructed by the State's agency with 100 percent funding through Govt. grant.

The table 7 shows the status of SHP projects allotted to/under construction by various developers is being given below :-

Developer	Allotment Procedure	Nos.	Capacity (MW)
Central Sector	-	Nil	Nil
State Undertaking (UJVNL)	Allotment Order	16	82.30
State's Agency (UREDA)	Allotment Order	18	1.82
Private Sector	1. Earlier MOU route; 2. Now transparent bidding process.	32 8	218.55 100.10

Table 7 Status of SHPs Allocated/Under Construction

## 3 ALLOTMENT PROCEDURE

The allotment of hydro project sites, whether large, medium or small to private parties was being done earlier during the time of erstwhile Uttar Pradesh through MOU route only. In case of SHPs such sites were even identified through self identification by the parties themselves. This process had its own merits and demerits. In such a case deciding for optimum size and site of projects and optimum utilization of streams may have raised some criticism. Now Uttarakhand Govt. has decided and put in place a mechanism and policy of transparent bidding process for allotment of identified projects to private sector. As DPRs are not ready and cost surprises even after having a good DPR may be there, hence tariff based bidding process has not so far been adopted by Govt. of Uttarakhand.

## 4 EVACUATION OF POWER

Evacuation of power from large, medium and small hydro power projects is also a major issue especially with regard to forest, environmental, rehabilitation and availability of space point of views as these constraints have to be dealt with effectively along with minimizing the cost. Govt. of Uttarakhand has prepared such integrated evacuation project to evacuate power from all new hydro power projects. A

project of \$300 million has been sanctioned by Asian Development Bank for which final agreements have to be signed after approval from Govt. of India.

## **5 GENERAL EXPERIENCE**

The pace of developing the allocated hydro power projects whether large, medium or small has not been encouraging so far. Various reasons may be quoted for delay in developing the projects ranging from preparing the DPR and getting clearance to actual implementation. In the Govt. Sector the paucity of funds and less attention to hydro power projects led to delays of some of the projects while Tehri Hydro Power Project faced a lot of issues ranging from lack of funds to R&R issues and R&R policy and even to religious/social and environmental issues. Now Tehri Stage-I (1000 MW) project is under commissioning stage. In case of private sector as well as central sector projects there were delays due to various reasons. In case of SHPs under state's undertaking as well as private sector the situation is the same and one can observe delays due to various reasons. At the time of erstwhile state of Uttar Pradesh as many as 22 SHPs under less than 5 MW category (upto 3 MW) and 12 SHPs between 5-25 MW have been allocated to private developers or parties through MOU route by allocating them a particular river or stream and asking them to identify upto 3 projects and prepare DPRs and then construct those projects. These allotments were made prior to 1997 and Agreement (MOU) for implementation with a time bound time schedule of commissioning were signed but only 2 projects under upto 3 MW category have so far completed while for others the new state of Uttarakhand has further given extended time schedule by signing a new Implementation Agreement.

## **6 CHALLENGES**

The Operation of Small Hydro Power Projects poses unique challenges:

- i. The power stations are located in remote hilly areas where even road linkages are not available.
- ii. The small hydro power stations are prone to natural calamities such as flash floods due to cloud bursting, land sliding, avalanche's causing heavy damages & long shut downs. Road blockages & severe climatic conditions causing difficulty in construction, operation & maintenance.
- iii. Small Hydro Power Stations are normally connected through service lines or weak grid connections, therefore incidence of disruptions are mainly, causing low generation.
- iv. The specific cost (Cost/kW) of a small hydro projects generally tends to be higher because of the intrinsic reasons associated with them comparatively small power output. The specialized nature of the generating plant and equipment especially in case of very small heads, leads to comparatively higher cost of generation.
- v. Due to their locations in far off & inaccessible locations of the state, it is difficult to provide necessary technical skill & spares in case of breakdown, necessitating long shut down requiring heavy expenditure & loss of revenue.
- vi. The load factor of SHP's tend to lower and there is considerable variability in quantum of generation across different SHP's in different years. An important reason for these variations in output is the lack of critical size in case of SHP & also varying hydrological and climatic conditions for year to year.
- vii. The plants have to be shut down for app. 30- days during monsoons due to high silt contents & debris in the flowing water which can not be handled by D-silting tanks. This happens normally every year.
- viii. Some of the commissioned plants have highly sophisticated machines and without the availability of skilled labour in remote areas, there is lot of difficulty in operating & maintaining them. As a result the machines are degenerating and their efficiencies are declining.
- ix. Many a times the telephone lines remain interrupted that create lack of communication, especially during monsoon.
- x. Long transmission lines are prone to frequent damages.