

RENEWABLE ENERGY SCENARIO, POLICIES AND DEVELOPMENT BARRIERS IN THE 27TH STATE OF INDIA: UTTARAKHAND

Abhishek Pandey¹, Madhu Sharma², Mayank Kumar³

^{1,2,3}University of Petroleum and Energy Studies, Bidholi, Dehradun 248007, India

ABSTRACT- *Uttarakhand was formed in 2000 as 27th state of India; previously it was part of Uttar Pradesh. Uttarakhand has micro climatic zones, it have 84% hilly area and 16% plains, Kashipur, Rudarpur, Haridwar, Haldwani, Dehradun are major cities of plain Uttarakhand. Uttarakhand divide in two parts Kumaun and garhwal. Uttarakhand is rich in renewable source of energy like Biomass, Solar, and some Geo Thermal. Government is making good effort to generate power from renewable sources of energies, and notified many policies to achieve them. In Uttarakhand UREDA (Uttarakhand Renewable Energy Development Agencies) is taking care of all the matter related to new and renewable energy. UREDA has deployed many renewable energy based power projects through the involvement of private sectors and even some government sectors too. Apart of this, they conduct public awareness program in the state related to renewable energy technologies and policies of the state and conduct time to time conferences with experts and take their suggestions. Government has made so many efforts to promote renewable but still they are unable to achieve the target, a lot of barriers are in between government expectations and outcomes arriving in ground level. This research has been done to highlight barriers arriving in the deployment of energy from renewable sources with the suggestions/recommendation to restrict these barriers.*

1. INTRODUCTION

Uttarakhand was formed on 9th November 2000 as the 27th State of India, when it was carved out of northern Uttar Pradesh. Uttarakhand is richly endowed with natural renewable resources for generating electricity. Uttarakhand has multiple micro-climatic zones. The hilly areas are close to 'cold and sunny' and 'cold and cloudy' climatic zones, while some locations like Dehradun lie under semi-moderate climate. In addition, the plains of the state like Haridwar, Roorkee, Kashipur and Rudrapur lies in the composite climatic zone. The entire state receives good amount of solar insolation, about 4.5–5.5 kWh/m².

Uttarakhand, a state richly endowed with perennial rivers and water streams, has a large potential of generating power using hydro power projects. Uttarakhand has an estimated potential of about 3000 MW of hydro power, in the small, mini and micro hydro segment. This potential, if harnessed efficiently, can help to meet Uttarakhand government's goals of rural development, viz-a-viz, electrification, revenue generation and livelihood development. Uttarakhand is highly rich in availability of pine litter as bio-mass. Out of the total forest area in the State, 16.36 percent (399329 Hectare) is covered by Chir Pine forests. As per the estimates over 15 Lakh MT Pine litter is generated annually in Reserve and Van Panchayat forests (excluding wild life area). Therefore, even if about 40 percent of the estimated quantity is taken as collectible quantity after making sufficient provisions for traditional uses; about 6 Lakh MT is available for industrial use. Apart from Pine Litter, about 8 Lakh MT of other Biomass (Agricultural Crop Residues, Lantana, etc.) is also available for industrial purposes. Based on this, the state has the potential of producing over 150 MW of energy annually. This untapped potential of generating energy from bio-mass based projects of capacities up to 250 KW and the briquetting units of capacities up to 2000 MT per annum can help to meet not only the local energy needs but also could be an effective means for livelihood/revenue generation.

2. RENEWABLE ENERGY POTENTIAL

S.N.	RE Sources	Approx Potential
1	Small, Mini & Micro hydel segment	: 3000 MW
2	Biomass (Pine needles, Lantana, other biomass) including Cogeneration	: 262 MW
4	Wind	: Not having much windy areas in Uttarakhand
5	Solar Power Project	: 4077 MW <i>Available Solar radiation on horizontal plane is 5.32 kwh/m²/day. The average annual solar radiation is 1300 Kwh/Sq.m. 10% of total geographical area can be used for solar energy. This is equivalent to solar power potential of about 4077 MW</i>
6	Geo Thermal	: 20 MW As per the preliminary survey done by NTPC, two no's of sites namely Tapovan (Chamoli), Dharma (Pithoragarh) are identified having geothermal potential of approx. 20 MW
7	Waste to Energy	: 100 MW About 2500 MT per day of MSW is generated throughout the state, which is equivalent to power generation capacity of about 100 MW

3. RENEWABLE ENERGY INSTALLATION IN UTTARAKHAND TILL MAR, 2018

The state has made the remarkable achievement in the field of renewable energy till from the date of formation of state i.e. Nov, 2000. Total cumulative 576.38 MW capacity (grid connected and decentralized generation) of renewable energy has been deployed in the State with the solar having the maximum share of 45.46% (262 MW) followed by small hydro energy and bio energy with 34.31 % (197.78 MW) & 20.23% (116.60 MW) respectively. Apart from this around 4356 nos. of family size biogas plant and 50500 cubic meter waste to energy project have been installed in the State. Around 4477 nos. of dish type solar cooker have been distributed to the govt. primary schools under mid day meal program and to the calamity disaster affected family. The renewable energy sources by installation in the state have been elaborated below:

3.1 SOLAR ENERGY

Policy: GoUK vide its notification no. 1044 / I / 2013- 5/14/ 2009 dated 27/06/13 has issued Uttarakhand Solar Power Policy-2013 with target to install 500 MW SPP by 2018. Uttarakhand Renewable Energy Development Agency (UREDA) has been designated as Nodal Agency for implementation of Solar Policy.

The Solar power projects to be setup under this policy are categorized in 4 (four) types. The first type is reserved for UPCL for meeting their Renewable Purchase Obligation and the projects will be selected through the tariff based competitive bidding process. The second type is for projects to be set up on private land for captive/3rd party sale/under REC mode. The third type is similar to the second type with a difference that under the third type Govt. land will be used and will be given to developer who will provides maximum free power per MW to GoUK. Solar projects under Jawaharlal Nehru National Solar Mission, GoI will be setup under type four of solar policy.

The total cumulative solar capacity installation in the state is 262 MW till 2018. The Out of which 226 MW is grid connected and remaining equivalent capacity of 36 MW is off-grid. The measure installation of grid connected solar projects comes under the Type-1 category of the policy i.e. 211 MW. The details of grid connected solar power project installed till 2018 are:

S.N.	Category under the policy	Nos. of solar plants	Cumulative installation	CoD	Procurer	Tariff (Rs/Kwh)
1	Installed before the notification of the policy	3	5	2013	UPCL (Distribution Licensee)	17.60
2	Type-1 (Phase-I)	12	30	2016	UPCL (Distribution Licensee)	6.85-7.99
3	Type-1 (Phase-II)	23	181.04	2017	UPCL (Distribution Licensee)	5.57-5.99
4	Type-4 (under net-metering scheme)	30	9.978	2015-17	UPCL (Distribution Licensee)	4.35-9.20
Total			226.018			

The off-grid decentralized solar systems in the State were mainly installed before the notification of Uttarakhand Solar Power Policy. These included Solar PV Power Plant, Solar home light system, solar lantern etc. The cumulative total off-grid decentralized solar systems installation till Mar 2018 in the state is 36 MW as per following details:

S.N.	Name of the off-grid decentralized solar systems	Nos. of installation	Equivalent capacity in watt	Capacity installed (in KW)
1	Solar PV power project	38	Same as per installation	2540.80
2	Solar home light systems	19678	37 W/system	728
3	Solar Photovoltaic Street light	19123	72 W/System	1415
4	Solar Lanterns	170900	10 W/System	1709
5	Solar Water heating Systems	29.58 Lakh Liter Per Day	10 W/ LPD System	29580
Total				Say 36 MW

3.2 BIO ENERGY

Uttarakhand has an about 220 MW of bio & 100 MW of W2E potential. The forest is annually generating 15 Lakh Metric Tons of residue especially pine-needle and about 1000 Metric Tons of Municipal, Urban and Industrial solid/liquid waste is being produced every day in the State. Out of this total potential State has harnessed only 116.60 MW including off grid projects. The major portion i.e. 72.60 MW comes from the grid connected bagasse based cogeneration plant installed at the Sugar mill. The remaining 87.73 MW capacity of bio energy project are off-grid viz-a-viz rice husk based captive power plant, biogas based

power generation plant etc. Beside these, over 4356 no's of family size biogas plant and 50500 cum/day capacity waste to energy biogas plant have been installed so far in the state. The details of bio-energy project installed in the state are:

S.N.	Bio-Projects	No's of projects	Cumulative Capacity (in MW)	Grid Connected/Off-grid
1	Baggase & non-baggase based Co-generation Power Plant	3	72.60	Grid Connected
2	Rice Husk & biomass based Captive Power Plant	6	39.62	Off-grid
3	Biomass Gasifier	5	2.35	Off-grid
4	Biogas based power generation	11	1.954	Off-grid
Total			116.6	

At present, State doesn't have any bio-energy policy. However draft policy for "Energy Generation from Pine Litter and Other Biomass" has been drafted out and proposed to government for its approval and notification.

3.3 SMALL HYDRO ENERGY:-

The state has made remarkable well achievement in the field of small hydro. State has installed capacity of 190 MW grid connected small hydro power project. Beside this, around 42 no's of cumulative capacity 3.195 MW off-grid Micro Hydro power have been installed so far which are providing electricity to 187 numbers of remotely and hilly villages and hamlets. About 1512 no's of Watermill (Gharat) have been upgraded in the State which are used for grinding grains, oil extraction and supply of electricity to nearby households. Watermill owners are generating income by operating welding machine, small workshop, cyber cafe, fruit processing unit etc through watermill.

The state has 2 small hydro power policies categorized according to the capacity of projects i.e. for projects up to 2 MW and projects above 2 MW. Uttarakhand Renewable Energy Development Agency (UREDA) has been made nodal agency for implementation of "Policy for harnessing Micro & Mini Hydro Power Project (up to 2 MW)-2015" and Jal Vidyut Nigam Limited (UJVNL) has been made nodal agency for "Policy for harnessing Small Hydro Power Project (above 2 MW and up to 25 MW)-2015. Till Mar 2018, total 190 MW small hydro power projects are installed by Uttarakhand Jal Vidyut Nigam Limited (UJVNL), Uttarakhand Renewable Energy Development Agency (UREDA) and several Independent Power Producers (IPP). The details are:

S.N.	Name of Players	Nos. of SHP	Capacity in MW
1	Independent Power Producers (IPP)	16	151.70
2	Uttarakhand Jal Vidyut Nigam Limited (UJVNL)	3	32.70
3	Uttarakhand Renewable Energy Development Agency (UREDA)	5	5.60
Total		24	190.01

3.4 WIND ENERGY:-

The Uttarakhand doesn't have good wind power potential in MW scale; however some hilly sites have small KW potential. Seeing this, policy for small solar wind hybrid system up to 5 KW capacities has been drafted out and would be notified by the end of this year. The State with financial from MNRE has installed 3 numbers of Solar Wind Hybrid Systems of cumulative capacity 24 KW in district Pithoragarh. The details are:

Sl. No.	Particulars	Solar Wind Hybrid Systems at		
		Vill. Garbiyang Dist. Pithoragarh	Vill. Reilkot Dist. Pithoragarh	Vill. Milam Dist. Pithoragarh (under Installation)
1	Detailed list of installation of windmills /aero generators /hybrid systems	10.16 KWp (6 KW AG + 4.16 KWp SPV)	4.00 KWp (1.80 KW AG + 2.24 KWp SPV)	10.16 KWp (6 KW AG + 4.16 KWp SPV)
2	Name of Beneficiaries	Villagers	ITBP	Villagers and ITBP
3	Site Addresses	Vill. Garbiyang Dist. Pithoragarh	Vill. Reilkot Dist. Pithoragarh	Vill. Milam Dist. Pithoragarh
5	System application	Power supply to the villagers for the Domestic and Street light load	Power supply for the Domestic to the ITBP and Street light load	Power supply to the villagers and ITBP for the Domestic and Street light load

4. FINDINGS

4.1 Solar Energy

Expensive Land: The state has 65% of its area covered with forest and also 86% of its total area is hilly areas. There is limited land available in the State and if it is available than it is very expensive. The average cost of land available for solar power generation is comes to around Rs 1.25 cr per MW. The same has been accepted by Hon'ble Uttarakhand Electricity Regulatory Commission.

Unavailability of big land patches: The expensive land if available for the solar power project is available in small patches. The big patches of land could not be found in the state for solar power generation. The biggest capacity of solar power project installed in the state is of capacity 20 MW by Emami Power at district US Nagar. The per unit cost of generation of smaller project is more as compared to bigger Ultra megawatt project because of economies of scale.

Non availability of evacuation system: The average sunny hours available in the state is around 7 hours. If evacuation system will not available even for an hour during the day time than most of the generation would be lost. The interruptions/outages in the evacuation system are very common in the State of Uttarakhand. Hon'ble UERC has allowed the deemed generation for ground mounted solar power project but at the floor of non availability of evacuation system for more than 60 hours in a month. Indirectly it means the outage for non availability of evacuation system for up to 2 hours during the sunny hours in each day is allowed in the State.

High voltage problem in hilly region: In Uttarakhand, there is problem of high grid voltage during the day time as most of the family members of the hilly houses go for their daily work at the day time and comeback to their home at evening. The load is minimum on the grid in the hilly regions during day time and that result the high voltages during the day time. The grid

connected rooftop power plant installed at these places stops generating power due to high grid voltage i.e. beyond 270 V for single phase. The inverter of plant is designed with minimum voltage rating of 165 V and maximum voltage rating of 270 V.

No deemed generation for rooftop solar power plant: UERC (Tariff and Other Terms for Supply of Electricity from Non-conventional and Renewable Energy Sources) Regulations, 2013 has allowed deemed generation for big solar PV power project. Deemed generation for rooftop solar power plant has not been allowed by Hon'ble UERC

Lack of developer interest in Type-2 and Type-3 category of Solar Policy: The Government of Uttarakhand had notified Uttarakhand Solar Power Policy in year 2013 with target to install 500 MW solar projects by 2018. However 226 MW solar power project is only installed by 2018. This is due to lack of solar developer under Type-2 and Type-3 category of Solar Policy. These categories were formulated under the policy by seeing the scope of Renewable Energy Certificate (REC). The market of REC has not been developed yet in the State due to lack of enforcement of Renewable Purchase Obligation (RPO).

4.2 Bio Energy

Seasonal availability: The yearly availability of bio waste is the measure challenge. The bio waste is available during their season like pine needle in forest is available for 3 months i.e. from April to June. The biowaste is needed continuously to run the bio waste power project through the year and to maintain the capacity utilizing factor up to 80%.

Storage of biowaste: The Mega Watt scale biowaste based power plant required bigger storage area. It is estimate that around 12300 Metric tons of pine needle is needed annually for 1 MW biowaste based power project. Around 2 acre of land with proper shed would be needed for storage of biowaste. Further also there is continuous risk of fire in the storage places because pine needle catches fire due to friction even when they strike to each other by air.

Collection: The biowaste are mainly available in the forest during the season. The manpower deployed for collection of pine needles in the forest is risked to wild animals. The bigger project requires acres of forest land for collection of pine needles which further increases the transportation cost.

4.3 Small Hydro Energy

Requirement of consents from the locals for the land use: Developers of hydro power projects have to obtained consent from the locals for the use of land for hydro power development. Forest Rights Act 2006 (FRA 2006) requires an immediate review and amendment particularly for the forest area. Except tribal areas, all other areas should not need the consent of the locals for the land use. Areas where rights have been already settled should not be covered under the FRA act.

Construction of transmission line in the forest: The construction of forest line in the forest requires clearance of 15 m wide corridor even for small hydro power projects. For transmission line, the mandatory 15 m wide corridor should be reviewed as such width is required for specific higher line voltage and cannot be generalized for voltages up to 132 kV.

Environmental flow should² be put in law rather than in agreements or contracts which ask for recommendation of making "environment" a concurrent subject.

References:

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6. Uttarakhand Electricity Regulatory Commission (Tariff and Other Terms for Supply of Electricity from Renewable Energy Sources and non-fossil fuel based Co-generating Stations) Regulations, 2013.