Small Hydro Power Project- a tool of Sustainable Economic development in Himachal Pradesh

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Abstract: Himalaya, the youngest mountain range on the Blue Planet, Earth. It is spread across like a sword from Jammu & Kashmir to Arunachal Pradesh up to 2500 kms. Himachal Pradesh is a part of this mighty Himalayan range which is blessed with many fast flowing perennial rivers, forming many narrow gorges. This mountainous region is having great potential for hydro power generation. Small Hydro Electric Power (SHP) is one of the earliest known renewable energy resources being used in India and elsewhere in the world in various forms like water wheels for grinding, water lifting wheels etc. In India Small Hydro electric power has installation capacity up to 25 MW. 15000 MW potential has been estimated all India through 503 sites. In Himachal Pradesh a potential of approximately 2268MW is estimated to be Small Hydro electric power sector. Present study is based on the issues related with the sustainable economic development of society at micro level by developing small hydro power projects in Himachal Pradesh.

Keyword: Small Hydro power project, Sustainable Economic Development, Himachal.

Introduction

The Himalayas, or Himalaya literally, "abode of the snow" is a mountain range in Asia separating the plains of the Indian subcontinent from the Tibetan Plateau.The Himalayan range is home to the planet's highest peaks, including the highest, Mount Everest. The Himalayas include over a hundred mountains exceeding 7,200 metres (23,600 ft) in elevation. The Himalayas have profoundly shaped the cultures of South Asia. Many Himalayan peaks are sacred in both Buddhism and Hinduism. Besides the *Greater Himalayas* of these high peaks there are parallel lower ranges. The first foothills, reaching about a thousand meters along the northern edge of the plains, are called the Sivalik Hills or Sub-Himalayan Range. Further north is a higher range reaching two to three thousand meters known as the Lower Himalayan or Mahabharat Range.

Himalaya cross six countries: Bhutan, India, Nepal, China, Afghanistan and Pakistan, with the first three countries having sovereignty over most of the range. The Himalayas are bordered on the northwest by the Karakoram and Hindu Kush ranges, on the north by the Tibetan Plateau, and on the south by the Indo-Gangetic Plain. Three of the world's major rivers, the Indus, the Ganges and the Tsangpo-Brahmaputra, all rises near Mount Kailash and cross and encircle the Himalayas. Their combined drainage basin is home to some 600 million people.

The western rivers combine into the *Indus Basin*, of which the Indus River is the largest. The Indus begins in Tibet at the confluence of Sengge and Gar rivers and flows southwest through India and then through Pakistan to the Arabian Sea. It is fed by the Jhelum, the Chenab, the Ravi, the Beas, and the Sutlej rivers, among others. Most of the other Himalayan Rivers drain the *Ganges-Brahmaputra Basin*. Its main rivers are the Ganges, the Brahmaputra and the Yamuna, as well as other tributaries. The Brahmaputra originates as the YarlungTsangpo River in western Tibet, and flows east through Tibet and west through the plains of Assam. The Ganges and the Brahmaputra meet in Bangladesh, and drain into the Bay of Bengal through the world's largest delta, the Sunderbans. The easternmost Himalayan Rivers feed the Ayeyarwady River, which originates in eastern Tibet and flows south through Myanmar to drain into the Andaman Sea.

The Himalayas have a profound effect on the climate of the Indian subcontinent and the Tibetan plateau. They prevent frigid, dry Arctic winds blowing south into the subcontinent, which keeps South Asia much warmer than corresponding temperate regions in the other continents. It also forms a barrier for the monsoon winds, keeping them from travelling northwards, and causing heavy rainfall in the Terai region. The Himalayas are also believed to play an important part in the formation of Central Asian deserts, such as the Taklimakan and Gobi.

In India Longitudinally, the Himalaya is divided into Greater Himalaya, the Himadri and Central Himalaya. The western Himalaya is further subdivided into four regions: North Kashmir Himalaya, South Kashmir Himalaya, Himachal Himalaya, Kumaun Himalaya from west to east.

The western part of eastern Himalaya includes Sikkim Himalaya, Darjeeling Himalaya and Bhutan Himalaya. The Assam Himalaya embraces remaining portion of the Eastern Himalaya.

Hydroelectricity in Himachal

Himachal Pradesh is extremely rich in its hydel resources. The state is having about twenty five percent of the national potential in this aspect. It has been estimated that about 21,244 MW of hydel power can be generated in the state by the construction of various hydel projects on the five perennial river basins no matter they are major, medium or small. Himachal is the home to many Himalayan rivers which have huge potential for the production of Hydroelectricity. The capacity of Sutlej has been estimated as 9443.5 MW, Beas 4586 MW, Ravi 2319 MW, Chenab 3032.30 MW and Yamuna with 603.52 MW. There is also 750 MW of Small Hydro Projects. Out of total hydel potential of the state, 6037 MW (approximately) is harnessed so far, out of which only 7.6% is under the control of Himachal Pradesh Government while the rest is exploited by the Central Government.

Small Hydro Electric Power (SHP)

Small Hydro Electric Power (SHP) is one of the earliest known renewable energy resources being used in India and elsewhere in the world in various forms like water wheels for grinding, water lifting wheels etc. Prior to independence whatever development

took place was governed by Electricity Act, 1910 and was mainly set up by princely states, the first 130 kW Small Hydro project set up at Darjeeling in 1897. At the time of independence there was already a capacity of 1362 MW including 508 MW of SHP. In India Small Hydro electric power has installation capacity up to 25 MW. It is future classified as under

(a) Micro Hydro - Station installed capacity up to 100 KW.

(b) Mini Hydro - Station installed capacity from 101 KW to 2000 KW.

(c) Small Hydro - Station installed capacity from 2001 KWto 25000 KW.

15000 MW potential has been estimated all India through 503 sites. In Himachal Pradesh a potential of approximately 2268MW is estimated to be Small Hydro electric power sector.

Need of Small Hydro power

1. Reliable, eco friendly, mature and prove technology.
2. More suitable for the sensitive mountain ecology.
3. Can be exploited wherever sufficient water flows along small streams, small rivers.
4. Does not involve setting up of large dams or problems of deforestation, submergence or rehabilitation.
5. Non- polluting, entails no wastage or production of toxic gases.
6. Small capital investment and short gestation period.
7. Minimal transmission losses.

Theoretical Context

It has been developed as a unique mechanism for increasing financial flows to developing countries for promoting clean technologies that not only reduce GHG emissions but also contribute towards the sustainable development of the country (Diakoulaki et al., 2007; Muller, 2007; Resnier et al., 2007). Consequently, new and renewable sources of energy have emerged as a viable option to achieve the goal of sustainable development (Dincer, 2000; Silveira, 2005; Lund, 2007). Many countries across the world have begun taking the necessary steps to move towards an ecologically sustainable development path (Dunn, 2002; Robinson, 2004)). As per the updates of Renewable Global Status Report 2006 (REN21) the overall, renewable power capacity expanded to 182 GW, up from 160 GW in 2004, excluding large hydro power. The renewable power capacity in developing countries grew from 70 to 80 GW, with China (small hydro) and India (wind) leading the increase (Jagadeesh, 2001; Li, 2002; Hicks, 2004). India's renewable power capacity exceeded Japan's for the first time. The developing-country share thus remained constant compared with 2004, at 44%. Including large hydro power, renewable power capacity reached 930 GW in 2005. Large hydro power increased by an estimated 12–14 GW in 2005, led by China (7 GW added), Brazil (2.4 GW added), and India (over 1.3 GW added). Small hydro increased by 5 GW to total 66 GW worldwide, with 38.5 GW existing in China alone as the boom in small hydro investment there continued. Small hydro power (SHP) projects could be of interest under the CDM because they directly displace green house gas emissions while contributing to sustainable rural development, if developed correctly. An attempt has been made to estimate the CDM potential of SHP projects in India. The preliminary estimates indicate that, there is a vast theoretical potential of CO_2 mitigation by the use of SHP projects in India. On the basis of available literature, the gross potential of SHP projects is more than 15 GW. CDM could help to achieve the maximum utilization potential of SHP projects more rapidly as compared with the current diffusion trend if supportive policies are introduced.Water flow is a “master variable” (sensu Power et al. 1995) that governs the fundamental nature of streams and rivers (Poff et al. 1997,Hart and Finelli 1999), so it should come as no surprise that the modification of flow caused by dams alters the structure and function of river ecosystems. Some useful insights regarding the sequence and rate of these responses can potentially be gained from Petts (1984), who examined various time scales at which different physical, chemical, and biological characteristics responded to the construction of dams. Most studies have focused on the ecological effects of large storage dams, which clearly have major impacts on rivers (Ward and Stanford 1979, Petts 1984, Collier et al. 1996). In India, MNRE is responsible for small and mini hydro projects up to 3 MW station capacities since 1989 whereas Ministry of Power (MOP, 2007) is responsible for the development of large hydro power projects. The subject of small hydro between 3 and 25 MW has been assigned to MNRE w.e.f. 29 November 1999. MOP has announced a policy for accelerated development of hydro power in the country in which development of SHP at an accelerated pace is one of the important tasks (MNRE, 2007). The potential of SHP projects (up to 25 MW) is estimated at 15,000 MW, not all of which might be technically feasible and economically viable. Technically feasible potential of identified sites, which are around 5403 in number, is placed at around 15000 MW SHP in India.

Findings

Small, mini and micro hydro power projects are environmentally most benign, operationally flexible, technically proven and commercially viable option for generation of electricity among the renewable resources of energy. Apart from carbon - dioxide abatement, small hydro electricity projects is known for its advantage like short gestation period, limited investment affordable by the private sector and accepted as socially and friendly, thereby providing quicker electricity generation and economic return.

State wise details of SHP projects are as:-

Sr. No	State	Total sites	Identified	Project Set Up		Project Under Implementation	
		No.	Capacity MW	No.	Capacity MW	No.	Capacity MW
1	Andhra Pradesh	489	552.29	58	179.10	17.50	
2	Arunachal Pradesh	566	1333.04	68	45.24	56	41.82
3	Assam	60	213.84	3	2.11	4	15.00
4	Bihar	94	213.75	7	50.40	9	7.60
5	Chhattisgarh	164	706.62	5	18.050	1	1.0

6	Goa	9	9.10	1	0.5	-	-
7	Gujarat	292	196.97	2	7.00	-	-
8	**Himachal Pradesh**	**547**	**2268.41**	**61**	**141.615**	**13**	**64.00**
9	Haryana	33	110.5	5	62.70	1	6.00
10	J&K	246	1411.72	32	111.830	5	5.91
11	Jharkhand	103	208.95	6	4.05	8	34.85
12	Karnataka	128	643.16	70	441.250	16	78.75
13	Kerala	247	708.10	16	98.12	5	39.55
14	Madhya Pradesh	99	400.58	9	52.16	5	30.90
15	Maharashtra	253	762.58	29	209.33	3	13.50
16	Manipur	113	109.10	8	5.45	3	2.75
17	Meghalaya	102	229.81	4	31.03	3	1.70
18	Mizoram	75	166.94	16	17.47	3	15.50
19	Nagaland	99	196.98	10	28.67	4	4.20
20	Orissa	222	295.47	6	7.30	8	60.93
21	Punjab	234	390.02	29	123.90	-	-
22	Rajasthan	67	63.17	10	23.85	-	-
23	Sikkim	91	265.54	14	39.11	4	13.20
24	Tamil Nadu	176	499.32	14	89.70	4	13.00
25	Tripura	13	46.86	3	16.01	-	-
26	Utter Pradesh	220	292.16	9	25.10	-	-
27	Uttrakhand	458	1609.25	88	80.67	34	56.25
28	West Bangal	203	393.79	23	89.40	16	79.25
29	A&N Island	12	7.91	1	5.25	-	-
	Total	**5403**	**14292.24**	**607**	**2013.915**	**216**	**612.16**

Source : IASH Journal Vol 11 No. 1, 2009

The table above shows that India has an estimated small hydro power potential of about 15000 MW in different 5403 sites. As far as Himachal Pradesh in concerned, it has vast power potential up to 21000 MW in five river basins and 6040 MW (approx) has been harnessed. Out of this approximately 2268 MW is estimated to be in Small Hydro power sector. Himachal Pradesh government is according top priority to speedy exploitation of Small hydro power potential in the state and has emerged as a leader among all hydro states in the nation. Small hydro power projects up to 2 MW capacity shall be exclusively reserved for the bonafied residents of Himachal Pradesh and cooperative societies comprising of bonafied Himachali. While allotting such projects up to 5 MW capacity preferences will be given to bonafied Himachali. If there are more than one applicant then preference will be the given to the person of that area/ district. Till 30th November, 2011, 468 small hydro power Project with an aggregate capacity of 1176 MW have been allotted. Out of these 45 projects with an aggregate capacity 177.55 MW have been commissioned. A goal of 500 MW through SHP by the end of 2014 has been fixed.

Conclusion

Small Hydro Project installations are financially attractive and an environmental friendly solution, able to contribute remarkable to the solution of the energy demand problem in India. Hydropower is a natural endowment that is environmentally, friendly and perennial source of electricity. Its development has been to enhance the sustainable development process both in rural electrification. The establishment of small industries and the provision of life irrigation and rope- ways in the remote areas are some features that will certainly stimulate the local economy by way of providing opportunities and challenges in diversifying the agriculture in one hand and earning economy on the other. Small perennial rivulets in Himcahal Pradesh are the vital source of essential water for electricity generation. It can be the source of earning in the tribal and rural areas by installing there Small hydro projects at village level or at Panchyat level. Tremendous employment opportunities will also be emerge in the rural areas of the state but for speedy development requires strong commitments from all stake holders including the Himachal Pradesh Government and the people of the state.

References

1. Jagadeesh (2001) Indian wind power: wind as a supplementary energy source in India. *Refocus, 2 (4)*, pp. 16–18
2. Muller (2007) How to make the clean development mechanism sustainable—*the potential of rent extraction Energy Policy, 35 (6)*, pp. 3203–3212
3. Hicks (2004) Small hydropower in China: a new record in world hydropower development. *Refocus, 5 (6)*, pp. 36–40
4. Collier M, Webb RH, Schmidt JC (1996) Dams and Rivers: A Primer on the Downstream Effects of Dams. Menlo Park (CA): *US Geological Survey*. Circular no. 1126.
5. Diakoulaki, P. Georgiou, C. Tourkolias, E. Georgopoulou, D. Lalas, S. Mirasgedis, Y. Sarafidis (2007) A multicriteria approach to identify investment opportunities for the exploitation of the clean development mechanis Energy Policy, 35 (2), pp. 1088–1099
6. F. Li (2002) Hydropower in China. *Energy Policy, 30 (14)*, pp. 1241–1249
7. Hart DD, Finelli CM (1999) Physical-biological coupling in streams: The pervasive effects of flow on benthic organisms. *Annual Review of Ecology and Systematic. 30*: 363-395.
8. H. Lund (2007) Renewable energy strategies for sustainable development. *Energy, 32* (6), pp. 912–919

9. Dincer (2000) Renewable energy and sustainable development: a crucial review Renewable and Sustainable Energy Reviews, 4 (2), pp. 157–175
10. J. Robinson (2004) Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics, 48 (4)*, pp. 369–384
11. MNRE (2007) Annual Report: 2006–0 7. Ministry of New and Renewable Energy (MNRE), Government of India, New Delhi
12. MOP (2007) Power Statistics. Ministry of Power (MOP), Government of India, New Delhi. see: powermin.nic.in
13. M. Resnier, C. Wang, P. Du, J. Chen (2007)The promotion of sustainable development in China through the optimization of a tax/subsidy plan among HFC and power generation CDM projectsEnergy Policy, 35 (9), pp. 4529–4544
14. REN 21, (2006). Renewables Global Status Report 2006, Paris.
15. OECD/IEA (2003)Technology Innovation, Development and Diffusion. OECD and IEA Information Paper, Paris
16. Power ME, Sun A, Parker G, Dietrich WE, Wootton JT (1995) Hydraulic food-chain models. *Bio Science. 45*, pp. 159-167.
17. S. Dunn (2002) Hydrogen futures: toward a sustainable energy system. *International Journal of Hydrogen Energy, 27 (3)*, pp. 235–264
18. S. Silveira (2005) Promoting bioenergy through the clean development mechanism Biomass and Bioenergy, 28 (2), pp. 107–117
19. IASH Journal Vol 11 No. 1, 2009, p. 35.
20. http://www.hpseb.com/hydro_potential.htm)Annexure-2: Memorandum submitted to the Governor of Himachal Pradesh, Retrieved on 23/08/2022.