Himalayan Small Hydropower Summit
(October 12-13, 2006), Dehradun

SMALL HYDRO POWER (SHP) DEVELOPMENT IN THE HIMALAYAN REGION A BRIEF HISTORY AND A FEW CASE REMEMBRANCES

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Himalayan region is endowed with one of the world's largest water resources mostly rain and snow fed rivers, rivulets and streams with perennial flows. The mountainous hilly regions in the Himalayan belt suffer from the general impediments of difficult terrain, poor accessibility, poor transportation and poor communication facilities. The villages are predominantly tribal and are scattered over large mountainous hilly areas. A lot of work has already been done by Rural Electrification Corporation (REC) to electrify these tribal villages. We have made substantial progress. But, are we near to the target? A recent study has shown that nearly 42000 of the 1,47,000 tribal villages are yet to be electrified in the Himalayan region. A great deal of work thus remains to be done at a rapid pace to achieve the goal.

The problem of rural electrification is a peculiar one especially in the mountainous regions of Himalayas. The laying of transmission lines across these regions poses a stupendous problem because of the long distances to be covered and the existence of hills and valleys, mountains, ridges, etc. As such, the process of laying transmission lines from the existing grid network becomes an extra-ordinarily costly proposition. What is more, the problem is not entirely solved by laying of these lines. Up keep of the lines is also an equally tough job in view of the frequent occurrences of storms, snow falls, land slides, ice formation, avalanches, etc. For such hilly regions diesel generating sets are also no answer, as the transportation cost of the fuel is prohibitive. Thus for such mountainous areas there is no other choice than to depend on Decentralized. Renewable Sources of energy of which SHP is the first option because of its higher energy intensity and availability in the region. Obviously therefore, most of the SHP development in the beginning has taken place in the Himalayan region.

The first SHP station in India was a 130 KW plant installed at Sidrapong, Darjeeling in 1897. The progress of development was very slow until Independence (1947) and even there after the situation was no different for about 12 to 15 years. In and around 1959 the situation underwent a change not because of any conscious planning but mainly because of a few dedicated people. Although it is said that personalities do not count, the history of SHP development in the Himalayan Region will be meaningless without acknowledging the contribution of these great personalities. The topmost among them, is Mr.Allen Mankhouse - a New Zealander- who came to India under "Colombo Plan" of the United Nations in 1952. Under the Colombo Plan the services of some of the world energy experts were rendered to

Under-Developed Countries for a Period of 5 years for helping the done countries to chalk out appropriate development plans for implementation. “Micro-hydel” was the expertise of Mr. Mankhouse who was put in the office of the chairman of the then Central Water Power Commission (CWPC) New Delhi. Mr. Mankhouse travelled all over the Himalayan region many times and prepared numerous proposals for the electrification of some of these regions through development of Decentralized SHP. Unfortunately, what ever Mr. Mankhouse proposed were quickly disposed off by the then Chairman of CWPC saying that small is not that beautiful. Undeterred, Mr.Mankhouse fabricated a portable 5KW micro hydel set using his hard earned salary and installed this demonstration set in this very beautiful city of Dehradun in 1958. He had used 100 tube lights as load to prove his point. His audience, mainly officials from Delhi and locals, readily agreed on the spot but this was short lived. Thoroughly dejected and frustrated, Mr. Allen Mankhouse was returning back to his country in 1958 when a chance meeting happened with Dr. Nanubhai Amin, the then Chairman and Managing Director of Jyoti Limited, Baroda, later the quint essential doyen of Renewable Sources of Energy in India. Dr.Amin told Mr. Mankhouse “Although energy is a State subject, I am willing to under- write a few projects if only you are willing to execute the same from concept to commissioning.” Mr. Mankhouse was delighted and readily agreed to this proposal. Mr. Mankhouse traveled the Himalayan region right from Jammu and Kashmir upto Arakkan range many many times and prepared more than 500 Feasibility Reports for SHP projects. A good number of projects (about 30) were implemented by he himself like Lahaul and Spiti, Gendhichera, Utterkashi, Guptakashi, Chamoli, Rudraprayag, Pangi, Keranath, Bageswher, Bijanbari, Kharding, Rongli, Rangpo, Jorthang, Dharchula, Passighat, Pandukeshwar etc. under the patronage of Dr.Nanubhai Amin of Jyoti Ltd. before his departure in1970 due to failing eye sight. A large number of projects were subsequently implemented after his departure. Mr. Mankhouse died as a blindman in 1974 in London. The author had the proud privilege of spending a few days with him in 1973 when he visited Baroda as a totally blindman as the gust of Dr. Nanubhai Amin. Surely, the father of SHP in India his not an Indian but a New Zealander.

In the horizon of SHP development in the Himalayan region yet another dedicated doyen arrived in 1970 Dr. Raj Nath Kar and his company Flovel. Both these companies, Jyoti and Flovel together did pioneering work in the development of SHP in the Himalayan region for the next three decades.

Under suggestion from Mr.Mankhouse Jyoti also made 5KW and 10 KW vertical portable hydel sets with shaft governing using springs for heads from 10M to 30M using Francis turbines. This did not catch up in the market mainly because the power generation was not privatized in India at that time. About 12 to 15 units were only found place in the Himalayan region through UPSEB and CPWD Arunachal Pradhesh. The scheme failed only because you needed licence to install and operate hydel stations however small they are and licences were not issued to individual entrepreneurs.

Some time in the end of Eighties the author was in Nepal as a guest of Mr.Akkalman Nakarmi the Rolex Award winner of 1982 for his MPPU (Multi Purpose Power Unit). Mr. Nakarmi took the author to an interior town where there was a 5KW MPPU installed by a family. It was a single phase generator coupled to a MPPU through belt. The Unit was operated from 6pm to 10pm every day by one of the family members by turn. There were 80 bulbs of 60W each supplied by the family, one bulb to each shop and two bulb to each house. The houses were very few and all the shops in the road junction were covered. In the evening before start of the Unit the family members go around the shops and collect Rs.One per bulb per day from the shop owners as the rent. If any body does not pay the rent the collecting member would remove the bulb. There were no separate switches provided in the wiring. The member after collecting the rent comes to the power house and starts the unit. On the author's query he was told that no license is needed in Nepal for generation up to 100 KW even at that time. The author asked the good lady of the family if there were any defaulters. She promptly replied that defaulters are very rare, as per their rules if any body failed to pay the daily rent the bulb would be removed and the bulb would be given to a new connection from the waiting list and the defaulter goes to down end of the waiting list. Therefore, even if the customers starve they would not dare to make any default of the light rent. She was planning to put one more MPPU but she was not getting the 5KW generator for which the author was too pleased to help.

DEVELOPMENT APPROACH

The development approach followed in those days was very simple. First, assess the energy requirement of a cluster of villages and then locate a most suitable water source having power generation potential with in the region. Keeping in mind the future load development which is bound to take place, decide on the installed capacity. Usually, this installed capacity so decided will be much less than the power potential of the site contrary to the rule followed in the planes. After all, excess installed capacity in a Decentralized (stand alone) Generation and Distribution system (DGDS) has no meaning. Nevertheless, provision is invariably made for add -on-units to take care of further load development in the foreseeable future while designing the water conductor system.

Load Restricted Part Load operation (LRPL) is ideal for a successful DGDS rather than Flow Restricted Part Load operation (FRPL). With the development of more and more loads LRPL will tend to become FRPL with consequent load shedding and other inconveniences to the villagers. It is still fresh in the authors' mind an incidence occurred in 1985 in the Anini Power house (2X50KW) in Arunachal Pradesh when a black out occurred due to technical reason was misunderstood by the tribals as a deliberate cutting-off of electricity and some of the them rushed to the power house with arrows and spears in their hands to attack the engineers. Fortunately for us, there were a few tribals around whom we could convince the technical reason for the blackout who saved our lives by telling the crowd the truth in their vernacular. The crowd dispersed only after restarting of the unit and lights were put on. We realized that electricity once given cannot be taken back in a tribal area.

TRANSPORT RESTRICTION

Transport restriction was yet another important aspect to be taken in to account while planning for SHP in the interior villages of the Himalayas. Manual and mule's back are the main means of transport in those days. Further, river crossing need to be done by temporary rope ways. Helicopter services were not that frequent in those days. 300 Kg was considered as a limit for a single piece. Generators were always transported stator and rotor separately and in some sites for example, Pandukeshwar, even roter was dismantled into shaft with spider and poles separately. Turbine used to be transported in several parts like runner, casing, bearning etc. separately and assembled at site. The last 800 meters to Pandukeswar site the consignments were transported on 8 inch pipe rollers. In one of the projects in Uttaranchal (then U.P) one turbine casing fell from a ridge down to 700 meters deep which could not be retrieved and finally abanded.

For Lahaul and Spiti the then Punjab State Electricity Board (Himachal Predesh was part of Punjab in 1961) asked for 2 units of 100 KW which was finally changed to 4 Units of 50 KW only due to transport constraints.

L/H RATIO FOR DGDS SHP

L/H ratio (length of penstock devided by gross head) is an important aspect to be considered in selecting the type of turbine for DGDS. For Francis or any other reaction turbine this ratio should be ideally less than 3. But in any case it should not exceed 6 for a reaction turbine, to avoid governing problems even with a heavy flywheel. For example, Charju SHP 2 X 200 KW in Arunachal Pradesh was originally planned with Francis turbine at a net head of 58m. The length of penstock was 700m. (L/H ratio> 12). Calculations showed that even a huge flywheel was also not giving a stable operation. The turbine type was therefore changed from Francis to Turgo impulse type and a gearbox was used to increase the turbine speed to 1000 RPM and solved the governing problem.

DE-SILTING

Himalayan water contains a great amount of silt and desilting arrangement should be an integral part of the water conductor system. In many SHP projects in the Himalayan region this was not done initially which caused premature runner damages. The situation was later corrected by installing suitable desilting arrangements in the power channels.

LAND SLIDE

In a few projects landslides washed away power channels. In Jorthang (Sikkim) the power channel was changed to fabricated channel for the sliding zone and in another project low pressure pipes of larger dia were used.

CASCADING

Ultra high head (> 600m) SHP sites are not uncommon in the Himalayas. Instead of resorting to high technology runners for such projects, which are prohibitively costly for low generation, the site can be cascaded with tail race of the first section forming as the head race of the second, so on so forth to get an economic installation.

CONCLUSION

Decentralized Generation and Distribution System (DGDS) using SHP is the most effective answer to electrify the unelectrified tribal villages of the Himalayan Region. Both Ministry of Non – conventional Energy Sources of Govt. of India and the respective State Government should extend all facilities and existing subsidies to the Himalayan Region and also to the Hilly Regions of all other States. Under the new Electricity Act 2003 the State Electricity Regulatory Commission have to play a positive role in fixing up tariff and giving prompt clearances for setting up of SHP.

ACKNOWLEDGEMENT

The author is grateful to Alternate Hydro Energy Centre of IIT Roorkee particularly its enthusiastic Head Mr. Arun Kumar and the Govt. of Uttaranchal for giving him an opportunity to present this paper.