INTEGRATING IRRIGATION PRACTICES IN IMPROVED WATERMILL AREAS FOR SUSTAINABLE LIVELIHOOD

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ABSTRACT

Watermill is an indigenous technology and being in operation since immemorial. Traditional watermills are directly connected to livelihood of rural communities through conversion of potential energy of water into mechanical energy and by providing agro-processing services. The improved watermill is an improvised version of traditional one in terms of increased efficiency of agro-processing services with replacement of traditional wooden runner kit by metallic ones. Besides the grain grinding services, the improved watermill is being capable to provide other services like paddy hauling, oil expelling, rice beating, saw milling and electricity generation etc. The improved watermill improves the standard of rural livelihood through providing energy services and generation of employment and income generation opportunities at local level. On the other hand the watermill is also directly connected with improvement of productivity of agricultural sector through irrigation. This is done in two ways i.e. sharing of watermill canals for irrigation purpose and improvement of existing irrigation canals for efficient utilization of water for multipurpose activities i.e. irrigation, agro-processing and electricity generation services.

KEY WORDS: TWM, IWM, Short Shaft, Long Shaft

INTRODUCTION

Nepal is a hilly and mountainous country where about 83% of land is covered by hills and mountains. The country has many challenges in development due to diverse landscapes. About 65.7% of total people are still engaged in agriculture as a main business. (*Karki, Yogendra Kumar, 2015*). Agriculture is still dependent with monsoon. Besides monsoon season, there is no any other provision of irrigation. The entire land does not have facility of irrigation. The agriculture system is dependent with traditional techniques and no any modern techniques were adopted. Although the country is rich in water resources, it is not being utilized in efficient manner and majority of farmlands have no any irrigation facility. The farmers could not get financial return from their agriculture due to lack of proper irrigation system.

Watermill is an indigenous technology and being in operation in rural areas of Nepal since immemorial. The watermill is directly associated with the livelihood of rural people by providing agro-processing services through generation of mechanical energy from water. In the areas of watermills, it was found that the canals for watermills are being utilized for irrigation purposes also. The water from the same canal is used for different purposes at different time. For electrification purpose the water is used in night time, for grinding and other agro-processing services, it is used for day time and for irrigation purpose, the use of water is seasonal. The usage of water from same canal is found efficient and productive utilization of canal and water and increment of productivity of agriculture as well.

WATERMILL TECHNOLOGY

Watermill technology is based on the conversion of potential energy into kinetic energy through a rotating wheel by dropping of water jet from a certain height. In traditional watermill (TWM), a wooden paddle is used as runner device which generates rotating energy and a grinding stone coupled at the top of rotating shaft, is used for grain grinding like maize, millet, wheat etc. The TWM has low efficiency and it needs huge volume of water (at least 25 lps) and it rotates slowly. Its efficiency is about 20- 25 percent only. From the study conducted by Alternative Energy Promotion Centre (AEPC) and Centre for Rural Technology, Nepal (CRT/N) it is estimated that the existence of traditional watermills is about 25000 throughout the country (*CRT/N, 2008*).

Figure 1 Traditional Watermill Runner

The improvised version of traditional watermill, replacement of wooden paddle and plank by a metallic runner shaft is known as improved watermill (IWM). The metallic runner has some sort of engineering design based upon the available water head and discharge. The IWM has better efficiency about 40 -50 percent even in case of low discharge of water. This means the IWM can grind more grains at shorter duration than TWM. The IWM can generate mechanical power from 1kW to 5 kW while TWM can generate the same up to 1 kW only. Out of 25000, only 10036 were improved and majority of them were short shaft (*AEPC, 2016*). IWMs also contribute in improvement of climate change by reduction of greenhouse gas emissions by replacement of existing diesel mills and by stopping of penetration of new diesel mills.

Figure 2 Improved Watermill Runner

END USE APPLICATIONS

The efficiency of IWM is more than that of TWM and it can generate power in the range from 1 kW to 5 kW. Traditional watermills are improved in two ways i.e. short shaft and long shaft. The IWM having short shaft has improved efficiency and its capacity is limited to 2 kW and it is used for grinding purpose only. While the long shaft IWM has additional capacity ranges between 3 – 5 kW. The long shaft IWM can be operated for diversified applications like grain grinding, paddy hulling, oil expelling, saw milling, spice grinding, rice beating and electricity generation with the addition of mechanical coupling devices depending upon the availability of power. The IWM plays a vital role in a rural area by providing rural energy need and it is capable to generate economic and employment opportunity at local level.

IWM ELECTRIFICATION

The extension of electricity grid over the entire area is not possible due to technical and financial conditions. In this situation, a small off-grid system covering a rural area like a pico-hydro system developed from IWM electrification can be a good solution. The IWM electrification can be developed by the utilization of water available from local river. The cost of generation electrification from IWM becomes cheaper than other technologies and ranges from NPR 500000.00 to 700000.00 only. The electricity generated is capable to provide basic need like lighting, operation of radio, television, mobile charging etc. Besides this, the

electrification provides economic opportunities at local level through establishment of small scale micro-enterprises like shops, tailoring, carpentry, poultry business etc.

With getting financial support from EnDev/GIZ and SNV, strategic support from Alternative Energy Promotion Centre (AEPC) and technical support from Centre for Rural Technology, Nepal (CRT/N), Gramin Urja Tatha Prabidhi Sewa Kendra Pvt. Ltd. is implementing IWM electrification programme "Rural Community Electrification with Watermill and Micro Enterprise Development in Nepal". The programme is being implemented in six districts of the country namely Kavre, Sindhuli, Makawanpur, Khotang, Nawalparasi and Dhading. The programme has the objective of installation of 20 IWM electrification systems having gross capacity of 60 kW. It provides basic electrification service to 900 rural households. Prior to this, the programme already developed 16 projects in Kavre, Sindhuli, Makawanpur and Dhading.

Figure 3 Powerhouse of IWM Electrification Project

INTEGRATION WITH IRRIGATION SYSTEM

Prior to the integration of irrigation systems with IWM systems, the irrigation practices were carried out by individual household. The entire activity like construction, repair and maintenance was being done in individual manner. There was no any formulation of groups or associations responsible for management of irrigation systems. Watermills were integrated with irrigation systems into two ways either by construction of new canal and utilization for both IWM and irrigation or utilization of existing irrigation canal for IWM application. After integrating with IWM systems, the activities were started to conduct in organized way by formulation of Users' Committee of IWM electrification system. Some cases on integration of irrigation system within watermill areas are presented below:

Case I

Aaldanda is located at Mahadev Danda VDC – 1, in the north-east part of Sindhuli district. The village has 32 households and the main occupation of the habitants is agriculture. However the village does not have any access to energy services like electricity and watermill etc. The people either use domestic grinder "Janto" or visit electric mill located at other village at the walking distance of more than two hour for grinding / processing of their agriculture products. Mainly, the female members are facing more drudgery for agro-processing for maintaining their daily livelihood. The electric mill is found very costly as it takes Rs. 2 per kg for processing (hauling or grinding).

Figure 4 Survey for construction of canal for powerhouse

When the villagers became to know about IWM Electrification Programme through, Ghatta Entrepreneurs' Association, Sindhuli, they lodged an application for installation of IWM Electrification project. After conducting detail survey of project, it was found that a 2.0 kW Sakhukhola IWM Electrification Project can be developed and a paddy huller system can be coupled in the same powerhouse to provide access of mechanical energy for paddy hulling.

The village has an existing irrigation canal being irrigated for a land about 20 ropanies. From the survey of powerhouse, it was found that the same canal can be used for electrification system in terms of technical and financial aspect. For this purpose, the Users' Committee of electrification project made an agreement with the owner of canal Mr. Mahabir Sunuwar for the use of canal and with Mr. Megh Bahadur Sunuwar for the use of land for construction of powerhouse. For the compensation of this contribution, the Users' Committee assured that the entire canal will be renovated as stone masonry from earthen canal. The periodic maintenance of canal will be carried out by Users' Committee itself. The necessary water will be provided to the canal owner when needed. The electrification needs water during evening and night time only. The water is further used in day time for operation of paddy huller which provides agro-processing services to local people at low cost. However the electrification system and paddy huller both is owned by Users' Committee of the village, it has been able to provide employment opportunity to a local person as operator. The application of existing canal brought an efficient and diversified utilization of water for electrification, paddy hulling and irrigation from the same canal.

Case II

Mr. Jibalal Lamichhane, resident of Mithukaram – 4, Nawalparasi who contributed his private land for construction of canal for IWM electrification project in his village. The village has 55 households where there was no any access to electricity. Some of households are being used small scale solar home system and some are still dependent kerosene wicked lamps.

Figure 5 Canal and Powerhouse of Nirandikhola IWME Project

When the villagers became to know about IWM electrification programme, the local partner organization Himalayan Community Development Forum, Kawasoti, Nawalparasi motivated the villagers for installation of IWM electrification project. After construction of 4.0 kW Nirandikhola IWM Electrification Project, the entire village got connection with electrification facility, paddy hulling service and irrigation facility for improvement of their rural livelihood.

The Users' Committee committed to provide irrigation facility in the village. The newly constructed canal can be able to irrigate about 18 ropanies of cultivated land. From such newly constructed canal, the community believed that the productivity of land will increase than earlier. The establishment of paddy huller will replaces the existing mill operated by diesel. This results the saving of cost of agro-processing and saves environment by stopping pollution emitted from diesel.

Case III

Barabise IWM Electrification Project having capacity of 3.5 kW is being in operation in Netrakali VDC – 5, Sindhuli. The project provides electrification service to 68 households of the village. After getting electrification service, the community tapped various economic and employment opportunities through

Figure 6 Powerhouse of Barabise IWME Project

establishment of poultry business, tailoring services and shops at their locality. Besides electrification service, the community established a paddy huller machine at the premises of powerhouse in order to utilize waste water during day time. The establishment of paddy huller brought a good opportunity for income and employment generation at local level. This project also saved time and money of the local people also. The community fixed a very cheap service price of paddy hulling facility, people from other village also started to visit the powerhouse for paddy hulling.

For the construction of powerhouse, a 350 m long stone masonry canal was constructed. The construction of canal became "boon" for the local people to provide irrigation facility during the season of cultivation. The canal has been able to provide irrigation facility for about 104 ropanies of land and the people realized the improvement of productivity of irrigated land through improvement of production of maize, rice and started cultivation of garlic and onion as cash crops. Besides this, the paddy huller operator tapped an attractive income generating opportunity at local level; he committed to take entire responsibility of repair and maintenance of powerhouse and canal. In overall, the community seems very happy with development of IWM electrification project and with sharing its diversified benefit.

CONCLUSION

The integration of IWM canals with irrigation system resulted in increase of productivity of agriculture by proper management of irrigation system. The irrigation system reduced dependency on monsoon season. The productivity of crops was increased and the people started to cultivate offseason vegetables as well. Besides this, the security of water was increased and, repair and maintenance cost of canal was entirely reduced. The establishment of agro-processing facility in their locality reduced drudgery of women and children by minimizing workload and time in remarkable manner. The integration of watermills brought a positive change in rural livelihood by ensuring food security and sustainability of rural community.

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