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Exploring Productive End Uses and Capacity Development Techniques in Hydropower: A Case of Sikles Village, Madi Rural Municipality, Kaski

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Abstract
Like many developing countries, the energy consumption pattern in Nepal is characterized by the use of biomass as the main source of energy. Nepal has very little coal and no viable reserves of oil or gas. Commercial sources of energy, such as electricity and petroleum products, are inaccessible or unaffordable to the poorer sections of the society. Hence, the majority of rural people rely on the traditional fuels, wood, crop residues and animal waste. Harnessing energy from falling water has been practiced in the hilly regions of Nepal for hundreds of years. Traditionally, streams were diverted and the potential energy released by diverting water to a lower level was used to rotate a grinding stone. These agro-processing water wheel schemes are known as Ghatta and are still popular in rural areas, an example of indigenous appropriate technology. Meanwhile, micro and mini hydro has become the main source of electricity in remote areas. It has been providing promising options for off-grid electrification in many rural areas, it does not only provide modern forms of energy to the large hinder lands but also acts as a catalyst for socio-economic development. This paper seeks to study of the situation of Sikles village, in terms of the condition of hydropower and its impacts on the livelihood of the community, capacity status, end usages conditions and problems the community and current micro hydro power plant is facing. The research explores about how the productive end uses and capacity development of current hydropower electricity can be achieved.

Keywords
Hydropower, Capacity Development, Productive End uses, Renewable energy, Socio-economic development

1. Introduction

Energy growth is directly linked to well-being and prosperity across the globe. The approach of sustainable development has always been linked to the energy issues. Providing the energy needed to support development at an acceptable cost, and ensuring that it is used efficiently, while protecting the local environment, is a huge challenge. Accessing sustainable rural energy has been a critical challenge in developing countries. For the economic growth of developing countries, the electricity plays a vital role.

If we observe the energy consumption status of Nepal, only 5% (2% electricity and 3% renewable energy) of the total energy consumed constitutes of the clean energy [1]. In Nepal, the National Population Census 2011 has shown that 83% population live in rural areas. 67% of households have access to electricity. Meanwhile, RE technologies such as micro hydro (5-100kW), mini hydro (100kW -1MW), small hydro (1-10MW) are providing promising options for off-grid electrification in many rural areas, it does not only provide modern forms of energy to the large hinder lands but also acts as a catalyst for socio-economic development. Nepal has high potential for hydropower development but lags behind in harnessing it. Total installed capacity of micro hydropower of Nepal is 25MW (2500 nos, potential 100MW) [2]. But, our country is hugely dependent on both traditional fuels (e.g. fuel wood, agricultural residue and animal dung) and fossil fuels. Nepal cannot afford to continue spending its national income on imported fossil fuels that are not only expensive but are equally climate unfriendly. Hydropower development continues to provide the best alternative to developing clean energy, lowering reliance on traditional and fossil fuels in the long term. In

addition to the national grid, Nepal has a long history of off-grid electrification mainly in the rural areas where the national utility continues to lag behind in the provision of regular electricity. For many off-grids, micro hydro has been the main focus.

2. Case Area

Sikles lies in Madi Rural Municipality ward no 1 at northern east part from Pokhara, Kaski district in Gandaki zone of Nepal. It is 24 km (5 hours jeep drive from kaunkhola) from pokhara at an altitude of 1980m with annual average temperature of 15-20 °C.

It is homogeneous traditional settlement of Gurung ethnic group with few minority of Kami, Sunuwar, Damai and Pariyar castes. Sikles lies in the southern belt of Annapurna Conservation Area Project (ACAP) with 360-400 households. Tourism and Eco- Trekking is the major attraction of this community.

The main sources of energy are biomass from the nearest forest for the cooking purpose and hydro-electricity from Madi Khola Micro Hydropower Plant for lighting and other purposes. Recently, new private hydropower, Sikles Hydropower Plant Pvt. Ltd., has been introduced to the village.

Figure 1: Settlement of Sikles Village

3. Problem Statement

Nepal is well endowed with renewable energy (RE) resources that can transform its economy if well utilized. Compared to the rest of developing Asia, the country has a considerably good electrification rate albeit unreliable, and the reliance on traditional biomass use continues to be very high. While hydropower development is promoted as the best option, other renewable energy alternatives such as solar, bioenergy and a lesser extent wind is on an increase.

The capacity of micro hydro as well as policy makers is fairly robust but issues such as quality of installations and post installation support, weak management of community projects, productive use maximization and attrition rate of local technicians still remain. The AEPC estimates that 30-40% trained in rural areas may travel abroad [3]. NRREP had allocated budget to train 100 MHP operators in 2015-16 but there were no trainings held in 2015. Potentially, a longer term support for certification of skilled operators and professionals will be required. There is knowledge that the integration of productive uses is also important.

Likewise in Sikles, there is a big need for field-based trainings, incentives for managers and operators. Managerial awareness and knowledge is also reported to be low especially for productive end uses of electricity for profitable enterprise led system. From the research of the project work done in third semester module, data were collected that leads to the conclusion that the major problems in Sikles found were the limited productive end uses, weak post installation support and weak maintenance and technical skill.

4. Rationale of Research

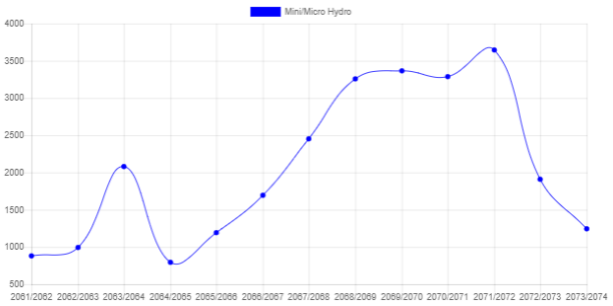

Figure 2: Installation number of mini and micro hydro in Nepal, Source: AEPC, 2018

If we observe the graph of the installation trend of mini and micro hydro power plants in Nepal in the past years, we can see the robust installation of Mhp, there were total 3646 nos of installation in 2071/72 [4]. But issues, such as less effort in post installation support, weak management of system, weaker productive use

of electricity, limitation in field base trainings and incentives for managers and operators etc are still there. Since hydropower is considered as one of the major energy solution in the rural settings like Sikles has. But no prior research conducted for such solution of these growing issues creates a research gap.

5. Research Objective

Main objective of the research is to:

- To explore different techniques for the productive uses and the capacity development of hydropower in Sikles Village.

Specific objectives of the research are:

- To explore the indigenous skills of the case area and possibilities to utilize it to maximize the productive end uses of electricity,
- To find the triple bottom line impacts of the possible productive end uses,
- To assess the capacity scenario of current hydropower and explore the strategies to enhance it in the case area.

6. Literature Review

6.1 Capacity Development

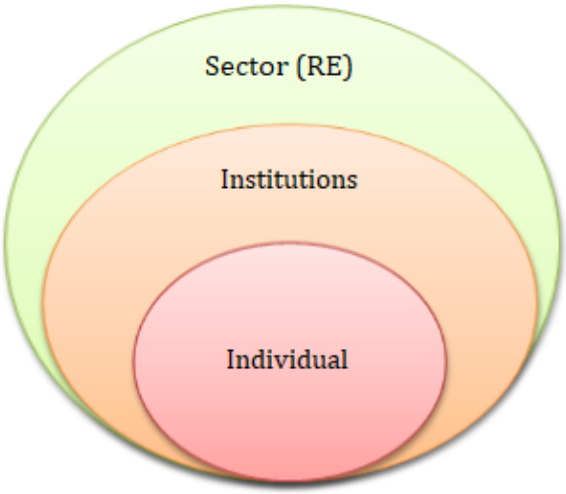

Figure 3: Capacity Development at three levels

Capacity development can be any effort to teach someone to do something, or to do it better. For others, it may be about creating new institutions or strengthening old ones. Some see capacity development as a focus on education and training, while others take a broad view of it as improving individual rights, access or freedoms [5]. For UNDP, capacity development contains elements of all of the above. UNDP sees capacity development as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. Simply put, if capacity is the means to plan and achieve, then capacity development describes the ways to those means. An essential ingredient in the UNDP capacity development approach is transformation. For an activity to meet the standard of capacity development as practiced and promoted by UNDP, it must bring about transformation that is generated and sustained over time from within.

Capacity development is the process by which individuals, groups and organisations, institutions and countries develop, enhance and organise their systems, resources and knowledge; all reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives [6].

- At the individual level, 'knowledge and skill enhancement' is sought such as in leadership, management, and technical maintenance through trainings.
- At the institutional level, capacity development is targeted on 'processes' such as the enhancement of abilities to plan, implement, and assess (monitoring) etc. through trainings, development of tools, guidelines and information systems.
- At the sector level, capacity development is often focused on 'engagement and knowledge transactions' through networks, knowledge portals etc

Capacity development is widely used recognising that it will contribute to the on-going inherent development process of countries and communities.

6.2 Productive End Uses

Productive End Use of Renewable Energy can be defined as agricultural, commercial and industrial activities, powered by renewable energy sources, which generate income. Productive use of renewable energy in Africa, AEEP states that the productive end uses has following benefits:

- Triple bottom line Sustainable business
- Stronger Local Economy
- Local impacts: Jobs and increased purchase power
- Enhanced gender equality
- Improved heath and stronger socio economic development
- Contribution to environment and climate consideration

A productive use is an activity performed in which money (or something equivalent) is exchanged for a service. It can also be defined as an activity which produces (products) that can fetch money or something equivalent. Most of those activities take place in small businesses. Eg: Saw mills, carpentry shop, lathe machines, grain grinding, etc. that use power from MHP plants. Using the energy generated with a hydro scheme in a mechanical way has some advantages over the use of electricity as intermediary.

7. Methodology

The ontological base of the study was that the exploring the techniques for productive end uses and capacity development will lead to the optimum utilization of hydropower electricity in Sikles. The people from case area and literature studies from past researches, articles, reports and papers from different organizations were the source of information (epistemology) of the research. With the community as the basis of the research, the study was qualitative and done under constructivist paradigm. As the data were collected to make a wholesome analysis of case area, the research approach was inductive. Semi-structured interviews, key informant interviews accompanied by observation were used as the methods of study. Photography, audio and video recording and field notes were used as tools. Parameters of study are next identified and stakeholders are segregated and survey is done with the questionnaire thus prepared.

7.1 Parameters of Study

7.1.1 Parameters of Capacity Development

1. **Institutional level**

   It focuses on the overall policy framework in which individuals and organizations operate and interact with the external environment.

   - Policy/Regulatory Framework
   - Trainings and programs

2. **Organizational level**

   It focuses on the overall performance and functioning capabilities as well as the ability of a body to adapt to change.

   - Mission and Strategy
   - Structure/Competencies
   - Process
   - Human Resources
   - Financial Resources
   - Information Resources
   - Infrastructure

3. **Individual level**

   It refers to the process of changing attitudes and behaviors—imparting knowledge and developing skills while maximizing the benefits of participation, knowledge exchange and ownership.

   - Job requirements and skill levels
   - Training/Retraining
   - Career Progression
   - Accountability/Ethics
   - Access to Information
   - Personal/Professional Networking
   - Performance/Conduct
   - Incentives/Security
   - Values, Integrity, and Attitudes
   - Morale and Motivation
   - Inter-relationships and Teamwork
   - Communications Skills

7.1.2 Parameters of Productive End Use of Electricity

- Local traditional skills
- Local Resources
- Climates, crops, or cultures
- Local demands
- Coordination between local institution and village
- Tariff at off-peak hours (can be reduced to promote business)
- Policy and regulation
- Community engagement
- Supply and equipment quality
- Costs and Access to Finance
- Awareness
- Access to Markets

- Pre-existing industries
- Infrastructure and Security
- Promotion of Productive uses
- Trainings for Skill development
- Current and possible end uses

8. Case Study and Data Collection

8.1 Insights from Case Study

8.1.1 Physical Aspect

The village includes six traditional neighborhoods: Ghairi-Thar, Sava-Thar, Koi-Thar, Dhaprang-Thar, Lama-Thar, and Harpu-Thar. Settlement is on the top of east facing hill overlooking the Madi Khola with stunning view of Mount Lamjung. Agriculture is the predominant in Sikles, supplemented by animal husbandry. The upper part of the village is covered by dense forests- Chare Dada, Raising Dada. The middle and lower portion are terraced slopes and categorized as Khet (irrigated land: mainly rice) and Bari (non-irrigated land: maize, millet, wheat, potato barley and seasonal vegetables). Traditional practices like alcohol fermentation, weaving various bamboo products, clothes and sacks from the wild nettle plant and wild honey hunting are still intact in this place. The main access to Sikles is the partly graveled and mostly muddy road from Kaunkhola, Pokhara, which is usually blocked during rainy season. Only jeep services are available from Kaunkhola. Inside the settlement all the houses are connected with the stone paved steps as the whole settlement is in slope. Another access is 5 to 6 hours trekking from Taprang.

8.1.2 Socio-cultural Aspect

With maximum Gurung's people, the community of Sikles mainly follows Buddhism and rest of the people are Hindu. Having festivals like Dashain, Tihar, Maghey Sankranti, Tamu Lhosar and many other traditional dances like Ghato, People of Sikles are rich in tradition and cultures. There is one group of females (Aama Samuha), village development committee and a youth club which have been active for the development of the community. There are total two numbers of community buildings, where the festivals, community programs and other programs are held.

8.1.3 Economic Aspect

Many hotels and guest houses are there which supports the tourism in Sikles. Homestays are recently initiated with 15 houses. The households are usually agro based but very few families have grocerys (only 3 no's). There are 2 processing mill, 2 small carpentry workshop and a metal work shop. Bamboo products made in households are usually sold to Pokhara. All the daily goods such as: groceries, LPG and construction materials are imported from the nearest market that is Kaunkhola.

8.1.4 Environmental Aspect

Chare Dada and Raising Dada are the main forests at the upper parts of the village, it is the main source of the fodder and firewood for cooking, heating and construction purposes. Late Dr. Chandra Pd. Gurung, who designed and implemented Nepal's first community-based integrated conservation and development project, the Annapurna Conservation Area Project. Forests in Sikles are rich in Flora and Fauna, different types of birds and butterflies and other wild animals. Likewise, Madi khola is the river flowing at the bottom of the village. Another attraction of this village is Dudh Pokhari- Glacier Lake.

8.1.5 Energy Aspect

Firewood is predominant source of energy for space heating and cooking in households. Solar water heating are seen in hotels only. However, other renewable energy sources such as small solar pv panels, Improved cooking stoves and Bayupankhi Chulo are available in few households. LPG imported from Kaunkhola is used by hotels. Likewise, three numbers of traditional 3-Water mills are still running. Electricity from Maadi khola Micro hydro power plant (Mhp) is used for lighting in all households. Very less small scale enterprises are established with this electricity.

8.2 Madi Khola Hydropower

Madi khola micro hydropower plant was installed in Sikles in 1994 with a capacity of 100 kW under the Alternative Energy Programme (AEP) established by the ACAP, with the donor support and USAID, and labour contribution from villagers.

This community owned MHP plant uses water from the nearby river, which is about 2 hour walking

distance from the village. Initially the MHP plant was installed to provide electricity for households in Parche and Sikles. Later the supply was extended to Khilang. Currently, approximately 600 households are benefited by MHP plant in three villages. There are only four staffs- 1 Manager and 3 operators working in station of the plant. There is no metering system for billing, the households are provided electricity with the watt capacity system, and when the watt limit exceeds the fuse gets down automatically. The tariff of the electricity is Rs 500 monthly for upto 500 watt and Rs 1000 for upto 1000 watt. The electricity from mhp has been used widely for lighting and other communication devices such as TV, radio. Due to the capacity of the plant, it cannot afford the use of high power consuming electrical devices at household levels. Therefore, the productive end uses of the electric energy have not been met yet. Few enterprises and workshops are run during the day time only when there is no peak hour. As the billing system is watt capacity wise, people are indifferent about the saving of energy and usually leave the electric bulbs turned on almost every time.

8.3 Sikles Hydropower Pvt. Ltd.

The new private hydropower, named Sikles Hydropower Pvt. Ltd. has been in operating phase in sikles from few months ago. It's total generating capacity is 13Mw. This private hydropower uses the water resources from the Madi khola micro hydropower, therefore an agreement has been done between two hydropowers to give the supply the 100Kw electricity (capacity of micro hydropower) to Madi khola hydropower for the areas it has been facilitating before. The further agreement is in negotiating process for increment of the capacity of the electricity provided because it is not sufficient for the increasing demand of the communities.

8.4 Capacity Development

Two hydropower plants were separately studies under the identified parameters of capacity developments are data were collected as below:

8.4.1 Madi Khola Micro hydropower

1. **Institutional level**

    - Policy/Regulatory Framework
      No governmental subsidy was taken while establishing the micro hydropower. Subsidy policy of PUE component from AEPEC for productive use of electricity is not applied in Sikles.
    - Trainings and programs
      Few training programs for women from skill development, but no staffs are participated in other capacity development programs and trainings for operator and management. Simple accounting training was given to managers.

2. **Organizational level**

Table 1: Capacity status- Organizational level

Parameters	Remarks
Mission and Strategy	Yes
Structure/Competencies	Staffs need to be added; staffs are pretty aged now and have health issues
Process	Not satisfactory
Human Resources	Not sufficiently skilled
Financial Resources	Not satisfactory
Information Resources	Yes
Infrastructure	Not satisfactory

3. **Individual level**

Table 2: Capacity status- Individual level

Parameters	Remarks
Job requirements and skill levels	Yes, but skill to be upgraded
Training/Retraining	Not satisfactory
Career Progression	Satisfactory only
Accountability/Ethics	Team work
Access to Information	Satisfactory only
Personal/Professional Networking	Yes
Performance/Conduct	As a Team work
Incentives/Security	Not satisfactory
Values, Integrity, and Attitudes	Yes
Morale and Motivation	Yes
Work Redeployment and Job Sharing	Not satisfactory
Inter-relationships and Teamwork	Yes
Communications Skills	Yes

8.4.2 Sikles Hydropower Pvt. Ltd.

1. **Institutional level**

    - Policy/Regulatory Framework
      As per NEA Policy.
      Governmental subsidy–In case of demand energy lag penalty is to be covered

2. **Organizational level**

Table 3: Capacity status- Organizational level

Parameters	Remarks
Mission and Strategy	Yes
Structure/Competencies	Yes
Process	Yes
Human Resources	Yes, under supervision upon necessary
Financial Resources	Yes
Information Resources	Yes, with supervision upon necessary
Infrastructure	Yes

3. **Individual level**

Table 4: Capacity status- Individual level

Parameters	Remarks
Job requirements and skill levels	Yes distribution is adequate
Training/Retraining	Yes under government and our seniors
Career Progression	Yes under government and our seniors
Accountability/Ethics	Team work is carried upon problem arises with close monitoring
Access to Information	Connected with all sorts of knowledge upon required
Personal/Professional Networking	Team Mentoring and work is preferred
Performance/Conduct	Yes
Incentives/Security	Yes as performance is base for increment
Values, Integrity, and Attitudes	Yes
Morale and Motivation	Yes
Work Redeployment and Job Sharing	Yes
Inter-relationships and Teamwork	Yes
Communications Skills	Yes

8.5 Productive Uses

8.5.1 Local Traditional Skills

Weaving various cloths (Bhangro, Coats etc) and carpets from sheep and nettle wool, making various products from allo, milling of agricultural grains from traditional mills (Dhiki), making of various products from bamboo (Nigalo) like Doko, Chicken coop, Fencing (Chitraa), Mandro etc, Bee heaving, traditional agriculture etc are some indigenous skills of the people of Sikles.

8.5.2 Local Resources

The followings are some local resources of sikles village:

- Allo, Bamboo, Nettle, Sheep wool
- Timber from forests
- Agriculture products: Seasonal vegetables, Wheat, millet and maize, so flour has to be imported from Pokhara

8.5.3 Pre-existing Industries

There is one metal welding workshop and one furniture workshop and two electric mills as existing industries in sikles, which usually busy with their works, therefore people have to specially hire the skill persons from pokhara to sikles for the works such as carpenters, metal welding etc.

Figure 4: Metal Work

Figure 5: Furniture in making

8.5.4 Curent Productive End Uses of Electricity

Recently the bakery has been added as the productive end use of the electricity in sikles, with one baking oven of 2000 W and refrigerator. It is currently serving the hotels and households of the village. The owner initiated the idea of bakery with his skill from the aboard (Dubai) and expects to expand his business in future.

Figure 6: Oven in Bakery

Figure 8: Co-operative Building

8.5.5 Local Demands

From the interviews during the research it was found that metal workshop, furniture, Bakery, Wool Processing, Poultry farm, Plywood factory for utis wood, electric mill and smart agro equipment are some growing demand that would contribute for the productive use of electricity in sikles. Among those, Poultry, Dairy, wool processing and Bakery as the highest demand.

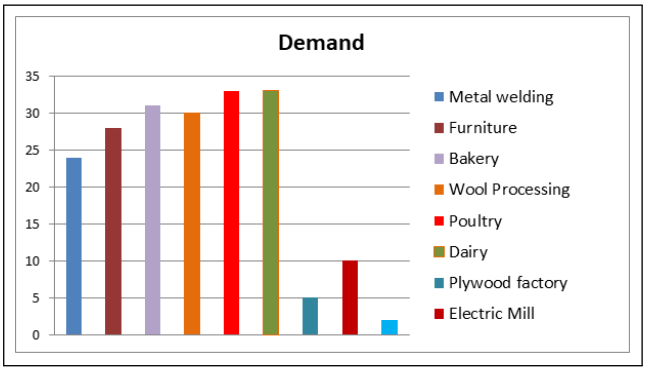

Figure 7: Local Demands

8.5.6 Coordination Between Local Institution and Village

ACAP has been a strong local body available for the promotion of skill development such as cook training, allo training, agro training, homestay training and various other trainings. But other trainings according to the growing demand of the community are still lacking.

8.5.7 Costs and Access to Finance

There are two co-operatives in sikles for the loan facility but it is not in satisfactory condition.

8.5.8 Acess to Market

The demands thus identified were the internal demands of the village, so the internal market is in demand, whereas the supporting external market for exports is nearby villages and Pokhara.

8.5.9 Awareness

Youth migration, credit and finance and geographic condition and infrastructures available were the main reasons considered by the interviewee for the lesser productive end uses.

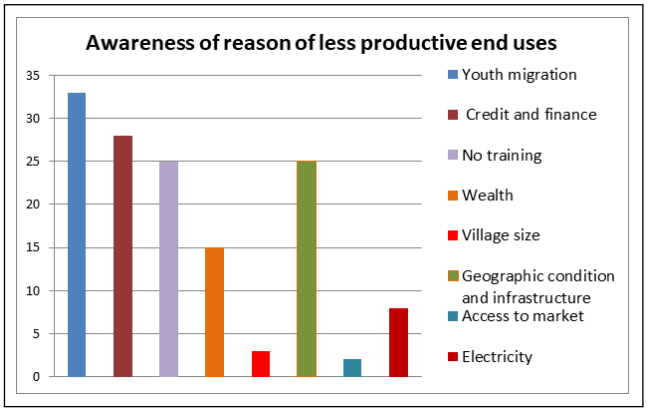

Figure 9: Awareness

9. Analysis and Discussion

9.1 Possibilities of New Uses

As per the interviews, the growing possibilities for the productive uses of electricity seem to be the demand for poultry, bakery, dairy, wool processing and furniture workshops. It can be analyzed that because of the Sikles being a tourist potential area and people

see prospects in tourism; these demands ultimately oriented to fulfill the needs of tourism i.e. hotels and homestay. Therefore, a keen eye to these demands not only promotes the productive end uses of electricity in Sikles village, it also encourages the sustainable tourism in this village.

9.2 Social, Economic, and Environmental Impacts

The possible end uses thus identified from the survey will have following triple bottom line impacts 5.

9.3 Capacity Status And Analysis

The new hydropower plant Sikles Hydropower is analyzed to have more reliable capacity status in comparison to the older micro hydro power plant because of its physical and manpower capacities. Talking about the institutional policy and subsidy provision in sikles, it doesnot seem that the community is well known about the subsidy and the promotion about it is also not in satisfactory manner. Likewise, to increase the productive use of the community in sikles, the ongoing agreement issue between two hydro powers has to be settled to increase the capacity of the electricity supply. It will definitely promote the higher use of productive uses of electricity in future.

Table 5: Triple Bottom Impacts

Social	Improved skill development trainings, Enhanced gender equality, Enhanced Livelihood, Reduce in human drudgery, Empowerment, Use of traditional skill of animal husbandry, timber works and so on
Economical	Stronger Local Economy, Income generation, Entrepreneurship, Jobs opportunity, Traditional skill development, Product price reduction, Support to current hotel and homestays
Environmental	Utilization of the resources such as animal husbandry, forest timbers and agro products, Less Emission

9.4 Challenges

The challenges in promoting the productive uses and capacity development of current electrify in Sikles can be analyzed as following:

- The out migration of young generations
- Finance and loan provisions
- Increment of electricity access
- Trainings and skill development from the local body's
- Implementation and promotion of subsidy for SME's

10. Conclusion And Recommendations

10.1 Conclusion

Hydropower sector has played very important role in improving overall sustainability of rural villages. However, these hydropower plants have been challenged by various issues such as inefficient management, post installation, trainings and low end use technology of electricity produced. Similar situation has been encountered in Sikles village; need for field-based trainings, incentives, managerial and public awareness for the promotion of productive end uses of electricity, low post installation support and weak maintenance and technical skill are some growing issues of Sikles.

The indigenous skills of Gurung people in Sikles have possibilities for the productive uses of electricity that demands poultry farm, bakery, dairy, wool processing and furniture workshops. Since, Sikles has big tourist potential, these demands ultimately encourages the sustainable tourism in this village. In addition these end uses have various triple bottom line suitability impacts. Knowledge of the benefits and possible productive uses of electricity is also a key factor in the take up of electricity access, and potential users need to be aware of how electricity and also have the skills to operate and maintain electrical machinery. These end uses also promotes the gender equality in community through shared works, the possible human drudgery is also reduced due to the various technology and availability of different access to livelihood opportunity. Mainly the empowerment issues can be resolved using the traditional skills of animal husbandry, timber works and so on. Likewise, the sustainable economy concept can be visualized through these end uses with stronger local economy/income generation. It also enables enterprise creation and jobs opportunity, traditional skill development. The sustainable tourism impacts are the most important impacts considering the tourism value of Sikles. Similarly, these possible

productive end uses utilize the resources such as forest timbers, agro products and animal husbandry.

In general, contrary to the use of electricity for lighting and domestic appliances, its adoption for production does not happen on its own or rapidly. This reality makes it important to include activities in rural electrification projects that address barriers to and encourage the adoption of electricity for income generation activities.

10.2 Recommendations

10.2.1 Policy Level

The design of programs, as well as policies from the local institutions, must give more attention to the productive use of electricity access, and ideally electricity access should be delivered as part of broader development initiatives that tackle infrastructure, skills and foster access to markets and finance. Policy support for the productive use of electricity has seemed to exist more in theory than in practice. It is seen as a major policy-related barrier to the provision of productive use of electricity access.

10.2.2 Local institution level

The trainings from the local agency should be oriented to the demand of the community. Therefore, demand side trainings and skill development initiatives are mandatory. Emphasis should be given to promote the governmental subsidy policies in communities.

10.2.3 Organizational level/ Electricity Generation Companies

Rural hydropower programs can be more effective in contributing to economic growth and social development when the promotion of productive uses of electricity is included. It can facilitate the communities' access to the full benefits of electricity. Therefore, electricity access provision and capacity should be combined with measures to tackle other barriers to enterprise development and poverty reduction such as:

- Raising awareness of potential productive uses of electricity
- Building skills and capabilities
- Improving transport and communications links
- Providing access to finance (for electricity services, wiring and appliances)

10.2.4 Individual level

Villagers should know about various businesses activities that can convert the local resources such as water, land, forests into some useful products using electricity. They should also be aware about the business opportunities by fulfilling the local demands. Thus promotion of such potential business activities can greatly increase the productive use of electricity. It is also necessary to establish coordination between local people and local institutions.

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