

CHAPTER - I

INTRODUCTION

1.1 Background of the Study

Situated in the lap of Himalaya, Nepal is located between the latitude 26⁰22' N to 30⁰27' North and longitude 80⁰4 East to 88⁰12' East and elevation ranges from 90 to 8848 meters. The average length being 885 km. east to west and average breadth is about 193 km. north to south. The country is bordering between the two most popular countries of the world, India in the east, south, west and China in the north. Nepal is land locked country and home place of natural beauty with traces of artifacts. The northern range (Himalaya) is covered with snow over the year where the highest peak of the world, the Mount Everest stands. The middle range (hills) is captured by gorgeous mountains, high peaks, hills, valleys and lakes. The southern range (Terai) is the gangaitic plain of alluvial soil and consist of dense forest area. National park, wildlife reserves and conservation area. The temperature and rainfall differ from place to place. In the geographic diversity and varied climatic conditions. National census 2011 enumerated more than 103 caste/ethnic groups. Population projected for the year 2011 is 26.8 million. Nepal presents an example of being united in diversity are the history and has maintained its pride to be an independent and sovereign state.

Geographically the country is divided in three regions, mountain, hill and tarai accommodating 7.3, 44.3 and 48.4 percent of the population respectively in 2011. Based on areas of districts there regions comprise 35, 42 and 23 percent respectively of the total land area of the kingdom. There are 5 development regions Eastern Development Region, Central Development Region, Western Development Region, Mid-Western Development Region and Far-Western Development Region. There are 75 administrative districts. Districts are further divided into smaller units, called Village Development Committee (VDC) and municipality. Economic growth of the country has not improved substantially over time to overtake population growth.

Nepal is an agricultural country. About 80 percent of the population depends on agriculture. Agricultural economic holding is an important element of rural life. Only limited commercial product are counted due to lack of infrastructure and globalization.

1.1.1 Introduction to Micro hydro

Water wheels and vertical-shaft Norse wheels or bucket turbines had been in use in many parts of Europe and Asia for some centuries mostly for milling grain. Two distinct types of watermill were developed: the small, vertical-shaft Norse Mill evolved out of Scandinavia, while the horizontal shaft waterwheels originated in the Mediterranean civilizations. Subsequently, improved engineering and metallurgical skills, during the Eighteenth century, combined with the need to develop smaller and higher-speed devices to be able to generate electricity without the need for large gear trains, led to the development of turbines which were first used to generate electricity for practical purposes.

Micro hydropower is an indigenous and renewable source of energy for which the potential exists in almost the whole Hindu-Kush Himalayan Region, which includes Afghanistan, Bhutan, China, India, Myanmar, Nepal and Pakistan. Micro Hydro (MH) is generally defined as decentralized small-scale water power plant less than 100 kW. Micro hydro can provide electricity to rural communities which otherwise might take years to be served by national electricity services.

1.1.2 The History of Micro hydro in World and Nepalese Context

Until the 1930s small turbines were increasingly used in Europe and North America. With the development of centralized electricity grids and the economies of scale achieved by large hydro plants, (and with the increasing penetration of subsidized electricity into remote rural areas) there was a steady trend away from small hydro from the 1930s until the 1970s. In fact micro-hydro installations that functioned earlier in the century were allowed to run down as grid connections, often linked to fossil-fuel power stations brought into remote regions.

Manufacturers who had produced small hydro-turbines for decades either went out of business or switched their main production capacity to pump manufacturing or other such allied products, for which there was a steady market. Early micro-hydro was often with DC (Direct Current) because of the crude level of speed control on the turbine-generator set, compared with more modern AC (Alternating Current) generation. Thus another reason for the decline of micro-hydro was the increasing standardization towards AC 50Hz (sometimes 60Hz) of mains electricity. Most readily available electrical appliances began to need good quality AC power with only small variations in voltage and frequency. The cost (and power) overheads associated with good quality control systems proved very high for small systems. A control system for a 10KW installation costs much the same as for a 100KW plant and often uses as much as 1KW to sustain itself; this is trivial for a 100KW system but is 10% of a 10KW output. As a result, the control system for micro-hydro of less than around 15-20 KW might cost more than the whole or the rest of the system.

A lot of work has been done to standardize and to develop modular construction like building blocks for small low-head turbines, so that low-head installations can be packaged by manufacturers in a way that reduces the complexity of designing and constructing the civil works. Low-head sites tend to be demanding in terms of design skills because no two sites can ever quite use the same arrangements for impounding the water and controlling the flow to the turbine. Numerous novel turbine types have appeared commercially in recent years, such as reversed pumps (an attempt at a cheap turbine by reversing the direction of a standard pump) and various 'bulb' turbines in which the generator is packaged into the turbine hub and submerged in the flow so that the need for a powerhouse can be eliminated.

1.1.3 Potential of Micro Hydro in Nepal

Nepal, located on the lap of Himalayas range, has about six thousand rivers and rivulets hurling towards India with huge potential of hydropower generation. Being a small but rich in hydropower resources, Nepal, boasted its first hydro plant way back in 1911. Considering the geographical situation, small and medium sized hydropower projects

seem more suitable in Nepal. Despite 83000 MW of economically feasible hydropower potential, less than 2% of these potentials have been exploited so far. Hydropower plants have capacity between 100KW and 10 MW are considered as small Hydro. Government of Nepal (GoN) is trying hard in fulfilling the ever-increasing demand of electricity in the country-particularly in rural areas. After the promulgation of Hydropower Development policy 1992 and revised Hydropower Development Policy 2001, apart from the traditional public sector, private investors and local communities/co-operatives also have shown keen interest in generation and distribution of electricity in the country.

In 1974, Small Hydro Development Board (SHDB) was established. The main objective of the establishment of SHDB was to implement small scale-isolated type hydropower plants up to 5000 KW as supply electric energy to the surrounding areas of the plant. To date, forty six small hydropower plants are in operation in Nepal with total capacity reaching nearly 50 MW. Also, there is about 1500 mini-micro hydro power plants-including portable type Pelton sets

1.2 Statement of the Problem

Due to the population growth the demand for energy is increasing day by day in the country. Nepal government is not capable of supplying electricity in the rural and targeted people. People are becoming aware day by day and wants the different kinds of facilities i.e. solar Pv, radio, TV, biogas, win energy, improved stove cooking, biomass, improved water mill so on. Majority of people share energy consumption is met through traditional source like fuel wood, animal dung and agriculture wastages. Due to this reason living standard of rural people has decreased i.e. health condition, education status, communication and awareness level has increased or constant. Micro hydro energy will cut both traditional and imported commercial survey.

Micro hydro energy is comparatively advantages than other renewable energy sources like hydropower, solar and wind energy in rural areas. Micro hydro helps to improve the health condition of rural women and children due to the reduction of indoor and outdoor pollution. Thus, it will be advantages for micro hydro development for rural electrification for sustainable rural development.

1.3 Objectives of the Study

The general objective of the study is to assess the social and economic impact of the micro hydro beneficiary households and livelihood status among rural community people. The specific objective are :

1. To assess the socio-economic situations of micro hydro user households.
2. To analyze impact in sustaining rural livelihood.
3. To examine entrepreneurship development activities practising by HHs.

1.4 Significance of the Study

In Nepal, the traditional use of renewable source of energy such of solar, hydro energy, wind etc date back to centuries, Initially these source were used with crude type of technological development and invention that have taken place worldwide, more efficient technologies and end use devices were adopted to exploit the renewal energy sources. The dissemination of renewal energy technology had started only a few decades ago in Nepal. But it was in early pieties during the oil crises, the government of Nepal took initiative for the development of a renewal energy resources as a substitution for limited supply of fossil fuels and depleting forest resources. Subsequently the government realized the head of fulfilling institutional gas that existed in the renewal energy sector for the promotion and development of renewal energy technology and created on institution known a Alternative Energy Promotion Centre (AEPC) under the ministry of science and Technology (MST) in 1996, (AEPC 2007) . It objectives are to develop and promote different sources of renewal energy considering the fact that the maximum utilization of these renewal energy source could contribute to sustainable rural development and environmental conservation.

Micro hydro technology has a high potentiality and is more feasible in comparison to the installation of costly Mega Hydro power plant, solar and wind energies. Micro hydro rural electrification technology is a rural based technology and the propose achieving in encouraging. But except some part of Nepal most of the micro hydro users are using electricity only for lighting.

Many studies has done on impact of micro hydro have drawn the positive impacts on children education micro enterprise operation, women health and their socio-economic activities. The outcomes of the study will be of great importance to plan appropriately for further development of the technology, sustainable operation and its will be helpful to solve the problem of existing energy crisis scenario.

1.5 Limitation of the Study

This study attempts to limit itself only in Chainpur Municipality 1, Nundhaki of Sankhuwasabha district. So the generalization of this study may or may not be applicable to other parts of the nation. All economic variables have been calculated in terms of local price, if necessary. This study considers only with the socio-economic and livelihood aspects of micro hydro technology, it does not considered with the technology but it can reference for further studies. The samples size of 24 household(HHs) used for the particular study gets the 20 percent in total households in the study area and it is assumed that the study provides the representative figures of socio-economic impact of micro hydro plants. There are some limitatiions of the study such as:

- This study is confined only to Niduwakhola Micro-hidro Program of Chainpur Municipality 1, Nundhaki, Sankhuwashaba.
- The findings of the study may not be generalized to other such organization.
- The study has been conducted within given time frame and financial limitations.
- Different types of statistical tools make the research study more accurate and reliable but limited statistical tools are used for the purpose of the study.
- Economic impact carries the different aspects of life of the respondents but limited economic aspects are tried to explore incorporating impact of Micro hidro on Rural Livelihoods.

1.6 Organization of the study

Before selecting topic, a brief review of the literature related to the impact study of micro hydro on users has been studied. Primary as well as secondary data have been used in this study. The main objective of this study is to evaluate the role of micro hydro plant in energy contribution, mostly in terms of quality of life, rural livelihood and

entrepreneurship, impact on economic activities through the sociological prospective in five chapters as below.

In this chapter one brief introduction and general background of study topic and basic database of overall scenario has given like status of micro hydro in Nepal, objectives of the study limitation of the study and significance of the study.

The existing definitions that are given diversified views in several issues and sometimes conflicting appraisals are explicating some vagueness because of their too normative criteria or statements. This research paper studied the impact of electricity from micro hydropower plants, an Appropriate Technology, on the daily life habits of households and on entrepreneurship. Chapter II looked at aspects of changes through the lens of the livelihoods frameworks and how electricity has made an impact on the five capitals and on diversification of livelihoods. Chapter II also mentioned that the past study as literature review.

Chapter III discusses on the methods, which are employed to conduct the research. The whole study is carried out on the basis of primary as well as secondary data. Reliable and relevant study can be made possible only by applying scientific method. Hence the primary purpose of this chapter is to discuss and design the framework for the research. Different procedures have been followed.

Chapter IV deals with the introduction of study area and socio-economic condition of the micro hydro beneficiary households, hydrology geology, potential endues opportunities, existing infrastructure etc. It deals with the introduction of study area and socio-economic condition of the micro hydro beneficiary households in Chainpur Municipality 1, Nundhaki of Sankhuwasabha district. Caste/ethnicity, occupation, family size, education status, land holding pattern, livestock holding and population are the main variables considered in this study.

Chapter V describe main findings and conclusion of the research paper studied the impact of electricity from micro hydropower plants, an Appropriate Technology, on the daily life habits of households and on entrepreneurship. The research looked at aspects of changes through the lens of the livelihoods frameworks and how electricity has made an impact on the five capitals and on diversification of livelihoods.

CHAPTER - II

LITERATURE REVIEW

Review of literature is an essential part of all research works. A critical review of the literature helps the researcher to develop a thorough understanding and insight into previous research works that relates to the present study. It is also a way to avoid investigate problems that have already been definitely answered.

2.1 General Review

According to Carney (1998) livelihoods comprises ‘the capabilities, assets (material social resources), and activities needed for a means of living’ (de Vries, 2011, p.35). However, this theoretical framework will show that except for climate change related influences, also multiple social and ecological influences shape the vulnerability of livelihoods. To be able to define and link vulnerability, livelihoods and their stressors, in this chapter a selection is made of the literature chosen as most applicable in guiding this study.

‘A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base’.

The focus of this research is on socio economic impact of micro hydro for livelihoods recovery process, which means it is directed towards a livelihood approach. The main purpose of a livelihood strategy is to try to understand the strategies used by people to sustain an existence and thereby determine the factors that make people’s decisions. These chosen strategies are highly diverse between and within households and communities. Rural livelihoods, on which this research is concentrating, can derive their livelihoods from social, economical and other living standard changes of local communities household members in rural areas. The central focus of all livelihood approaches is people and their assets. The access to assets (human, social, natural,

physical, political and financial assets) determines people's livelihood and their chosen strategies

As Murray (2001) states: *“The objectives of this approach are to identify ‘household’ or family trajectories of accumulation and impoverishment and hence particular structural matrices of vulnerability”* Consequently, such an approach can discover positive and negative aspects of these chosen strategies and thereby unfold factors responsible for livelihoods recovery.

A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term.

2.2 Review on Previous Studies

Micro Hydro Projects are from the holistic perspective sustainable although from the financial perspective because of externalities and other reasons they are not always viable. Technologically, Nepal can even export MHP components in some Asian and African countries. There is the technical capability of implementing at least three MW yearly, from the manufacturers and installers perspective. Policies, regarding the empowering of the local bodies and communities are being made favorable. Overall, MHP with friendly policies and good implementation strategies, as a community energy enterprise can be implemented in Nepal in large scale. This sector will contribute significantly to the rural energy sector and alleviates the poverty noticeable in the hilly and mountain regions of the country thereby promoting the sustainability in Nepal.

Since the backbone of the study is its ethnographic methodology, living in and with the community was crucial to gain access to the community members. The first day or so was spent mostly walking around the villages getting to know a few people. There was a great level of curiosity among the residents because they were not used to seeing an outsider walking around in hiking boots toting a notebook. During the meeting with community

people, I had been told that informing the locals about my research objectives was key to gaining access because they would not be honest with me unless I was honest with them. I was able to gain access to meet roughly ten percent of the households. All the households approached for interviews were welcoming and interviews and observations regarding change in life habits were conducted in informal settings like during the morning meal together, or in the kitchen during the preparation of a meal, and in one case during a ceremony to celebrate the birth of a new born child in the family. The respondents were always willing to have their names used, however since most respondents in site share one of two family names, this research paper will only use first names and also a middle name if two people have the same first name. A community mobilizer who worked on behalf of the DDC/RERL before the setup of the micro hydropower plants was also interviewed to understand the process of building a new power plant. Two school teachers were also interviewed to understand any effect electricity may have had on school children. Literature on similar studies done in Nepal and abroad on micro hydropower plants also helped to understand the situation in the research site better.

Broadly, a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and contributes net benefits to other livelihoods at the local and global levels and in the long and short term. In a narrow economic sense, the word livelihood is used for (the way someone earns) the money people need to pay for food, a place to live, and clothing. To avoid confusion we will only use the broader definition.

Firstly, formulation of livelihood impact of micro hydro is the main approach, namely holistic approach based on complete livelihood strategy is the major thrust of this dissertation as a part of theoretical underpinnings. The holistic determinism has tried to incorporate issues left out by other approaches and tried to illustrate how this approach

can be brought into the operational level of projects and program for further impact replication.

Secondly, as one of the major empirical analysis in the context of district, it has also been tried to calculate the externalities of energy uses in rural Nepal considering few sectors and sub-sectors. This is new to the Nepalese context, especially for renewable energy technology like MHP. This endeavor of finding approximate data could be the beginning but it lays the basis and guidelines for the further studies in this aspect, which will ultimately instigate the policy formulation to support renewal energies technologies in Nepal based on the facts.

Thirdly, this dissertation has tried to analyze the MHP cycle (from operation and management) from the economic perspective both at micro and macro level. Finding the job or employment creation scenario by the MHP sector could be the pioneer work in Nepal that has been done in this dissertation. This work will help to develop input output economic model of hydropower development in Nepal and understand the backward and forward linkages of renewable energy enterprise like MHP.

Fourthly, based on the existing data and analysis, future financing modalities with new approaches have been suggested which will help to reframe the existing MHP extension approaches and will promote the sustainable MHP development activities in the future. This dissertation has explicitly tried to explain that the development promoted by renewable energy enterprises like MHP is a social process based on both qualitative as well as quantitative indicators. Creation of enterprise does not mean establishing only private entrepreneurs, which are installing energy systems, but also development of social institutions that will empower local societies to share the benefits as well as costs of those entities and run such enterprises sustainably. Development of MHP enterprises in rural Nepal should also be seen from that perspective for the promotion of sustainable development.

2.3 Theoretical Linkage

2.3.1 "People Participation Theory"

People participation is a process which provides private individuals an opportunity to influence public decisions and has long been a component of the democratic decision-making process. The roots of citizen participation can be traced to ancient Greece and Colonial New England. Before the 1960s, governmental processes and procedures were designed to facilitate "external" participation. Citizen participation was institutionalized in the mid-1960. Public involvement is means to ensure that citizens have a direct voice in public decisions. The terms "citizen" and "public," and "involvement" and "participation" are often used interchangeably. While both are generally used to indicate a process through which citizens have a voice in public policy decisions, both have distinctively different meanings and convey little insight into the process they seek to describe. Mize reveals that the term "citizen participation" and its relationship to public decision-making has evolved without a general consensus regarding either its meaning nor its consequences.

Public participation is a process in which people can influence projects and decision making on issues that are relevant to their lives and the environment they live in. By providing the public with necessary information and allowing their voices to be heard, the quality of plans is expected to improve with the citizen's ideas, opinions and knowledge. It also gives the power holder a chance to assist them in understanding the problem, the alternatives and possible opportunities.

Many agencies or individuals choose to exclude or minimize public participation in planning efforts claiming citizen participation is too expensive and time consuming. Yet, many citizen participation programs are initiated in response to public reaction to a proposed project or action. However, there are tangible benefits that can be derived from an effective citizen involvement program. Cogan and Sharpe (1986, p. 284) identify five benefits of citizen participation to the planning process:

- Information and ideas on public issues;
- Public Support for planning decisions;

- Avoidance of protracted conflicts and costly delays;
- Reservoir of good will which can carry over to future decisions; and
- Spirit of co-operation and trust between the agency and the public.

All of these benefits are important to the Forest Service in its planning efforts, particularly the last three. Recent forest management decisions have led to prolonged court cases and a general lack of trust among many people with respect to the Forest Service. In discussing the theory of public participation, it is useful to review broad theories of decision-making structures. DeSario and Langton, in their book *Citizen Participation in Public Decision Making* explore the role of technology in public policy decisions (DeSario and Langton, 1987). They conclude that public decisions are increasingly being influenced by technology. Two broad decision-making structures are defined and analyzed: the technocratic approach; and the democratic approach.

This research paper studied the impact of electricity from micro hydropower plants, an Appropriate Technology, on the daily life habits of households and on entrepreneurship. This chapter looked at aspects of changes through the lens of the livelihoods frameworks and how electricity has made an impact on the five capitals and on diversification of livelihoods. In this chapter, the following theoretical concepts are described as below.

2.3.1(a) Livelihood strategies

Livelihoods strategies are the various activities taken by livelihoods to generate a living. The specific geographical position, the history and culture, the possibilities of cultivation are amongst others determinants influencing livelihood strategies. Over time, livelihood strategies can be dynamic as they respond to specific constraints and opportunities. For example, migration can be seen as a mean to secure a livelihood as people move somewhere else when they can no longer secure a livelihood in their living area. Besides, seasonal migration can be a mean to secure food security in winter season when there is not sufficient agricultural harvest (Thieme, 2008).

Rural livelihoods can consist of a range of diverse livelihood strategies like agricultural and livestock activities and non agricultural activities like migration activities. Which strategies are chosen to generate an income and a living depend on the specific context and the possibilities of the livelihood groups. Not all groups in a community will be equal in participating in different livelihood strategies depending on factors like access to land and business skills.

Chambers and Conway (1992) say: “a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the long and short term”. Ellis and Freeman (2005). note that in the ‘approach’ “resources are referred to as ‘assets’ or ‘capitals” They name human capital, physical capital, financial capital, natural capital, and social capital as those that are parts of the framework (ibid.). Livelihoods approach is less top down development intervention in the sense that it seeks ways to achieve survival with what ‘assets’ families and the poor have.

According to Ellis (2000b:10): “(a) livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household.” For poor households one way to increase stability and improve life quality is through livelihood diversification, which Ellis (2000b:15) describes as the process to diversify the number of activities and assets.

Farming versus non-farming diversification will also be discussed in this research paper. It is discussed much in literature and conclusions from the developing world provide some answers as to why the rural poor diversify the way they do (Barrett et al., 2001; Rahut and Scharf, 2014). The kind of nonfarm activities that households are involved in depends on the asset base of the household as the poor invest in low-return non-farming

activities while the relatively better-off tend work in higher return activities (Rahut and Scharf, 2014). Also, Barrett et al. found in their review of literature from Africa that diversification in non-farm activities led to an increase in earnings (2001).

2.3.1(b) Entrepreneurship

Berner et al.'s (2008: 1) "anthropological slum walk" reveals two distinctive types of entrepreneurs in the developing world. 'Survivalist' entrepreneurs who undertake a small business venture of their choosing that requires very little capital to begin, meaning low entry barriers, usually have minimal or no skills to seek regular employment (Rogerson in Berner et al., 2008: 5). Survivalists tend to be primarily women who seek to supplement the steady incomes of other family members, and these entrepreneurs usually deal in goods or products that can be easily bartered or consumed in the case of a shock or stress to their income (ibid.). 'Growth-oriented entrepreneurs' usually tend to be family enterprises that are more of a risk-taking variety and for them it is more difficult to get started because access to finance can act as one of the barriers to entry (Berner et al., 2008:7). They are often male and tend to specialize in terms of what goods and services they sell. Their ability to micro-accumulate is probably the most important distinction between them and survivalist entrepreneurs (ibid.).

The concept of entrepreneurship and typology of entrepreneurs is crucial because this research paper will aim to find out how availability to electricity affects entrepreneurs. Whether access and availability of electricity to the villagers gave the entrepreneurs in the communities a more stable environment to begin a new enterprise or to take greater risks will be something that needs closer attention. This analysis of kinds of entrepreneurs is important to this research because this study would like to find out if the communities under investigation are headed down a slippery slope or are becoming part of a 'virtuous circle.'

Berner at al. (2014:389) argue that survivalist entrepreneurs lack the motivation to expand their business and in contrast to growth-oriented entrepreneurs they tend to have low or no income to support their business, and much of the responsibility of running a

survivalist enterprise in the household is delegated to female members who also have to participate more than men in household work. Another distinction made by Berner et al. (ibid.) is that smaller firms have a harder time getting access to finance because and even when finance is available they tend to get micro-finance which is not well suited for growth oriented entrepreneurs.

Growth of MSEs in developing countries had been the issue of debate in both the academic and development circles. Whether development organizations should continue to support enterprises that have low rates of graduation from the informal to the formal sector is another issue that is a frequent topic of debates. Nichter and Goldmark (2009) suggest that firms in developing countries “lack both profitable business opportunities and capabilities such as skills, resources, and technology.” Rather than being forward-looking and looking for opportunities to grow, MSEs in developing countries are more focused on survival (Nichter and Goldmark, 2009:1460).

Ozgen and Minsky (2007: 51) postulate that opportunity recognition in rural entrepreneurship is an important factor because how local factors like human resources interact with national frameworks. According to Ozgen and Minsky (2007: 53), three capitals: human, socio-cultural and environmental, with the national framework play an important role in helping entrepreneurs find opportunities in rural areas. Already constrained by growth rates as low as 3 percent, newer MSEs in developing countries tend to be one-person firms that start in vast numbers during low levels of economic activity and tend to end up working in sectors with low returns (Mead and Liedholm, 1998, Nichter and Goldmark, 2009). Education, work experience, and gender can be limiting factors for entrepreneurs; characteristics of the firm like firm age, the formality informality conundrum, and finance are factors associated with growth of firms (Nichter and Goldmark, 2009).

Nichter and Goldmark (2009: 1460) also suggest roles that development practitioners can play in helping enterprises succeed. Programs that work in enterprise development tend to focus on multiple areas to help entrepreneurs and there is no one “winning formula”

organizations should be more focused on what they would like to achieve (Nichter, 2009: 1460). Nichter's (2009) segmentation of entrepreneurs into latent-gazelle and survivalist entrepreneurs provide a good segue into Berner et al's (2008) typology of entrepreneurs in the developing world.

2.3.1(c) Promotion of Rural Energy

Nepal, over the last four decades, has made great strides in adopting decentralized forms of energy. Micro hydropower plants that rely on fast flowing streams with minimum infrastructure and small investments, compared to large power plants that require large sums of capital and have major impact on the environment, have been able to meet some of the energy needs of hundreds of rural communities throughout the mountains of Nepal. A system that generates between 1 kilo-Watt and 100 kilo-Watts is termed as a micro hydropower system (Pokharel et al. 2008). See Figure 3.1. Although water wheels have been used in the past to reduce drudgery like grinding grains and milling oil, generation of electricity for individual localities goes back to 1962 when a 5kW set was installed by the Swiss and estimates show that up to 2003, over 2500 micro hydro systems have been set up and 2065 were still in operation (Nepal Micro Hydropower Association, 2014; Pokharel et al., 2008).

The Government of Nepal established the Rural Energy Promotion Centre in 1996 with assistance from UNDP to streamline its efforts to promote new micro hydropower systems or provide assistance to existing ones (Nepal Micro Hydropower Association, 2014). Micro hydropower has been a favorite of donors and international lending institutions like the Asian Development Bank because it has greater reach to people in rural, isolated communities and has a greater involvement of the private sector. Since extending the grid is costly and not cost-effective, due to lack of market efficiency or lack of ability of users to pay, micro hydro can be set up with minimal subsidies from the government and the private sector or the community can take charge within a short period of time. The best way to deliver appropriate technology and to manage distribution of electricity from in rural areas has been discussed much in the academic literature. The

role of micro hydropower in climate change adaptation and community mobilization in Nepal has also been studied recently.

Cromwell has analyzed that transferring technology in the micro hydro-power sector works differently when handled by private firms and by the government and concluded that the private sector can be more efficient and effective than the government(1992). A micro hydropower station is one that generates electricity between 1kW and 100 kW (Chhetri et al. 2009: 571). (100 Watts of electricity is enough power to power up to five compact fluorescent light bulbs). Micro hydropower is a form of renewable energy that relies on a fast flowing stream of water that is then channeled through a pipe or inlet into an electrical generator that turns and generates electricity. Examples of micro hydropower stations in Nepal show that survival of micro hydropower projects depend on a number of factors, like the management's ability to learn and adapt from experience . Micro hydropower has also shown to reduce to some degree reliance on firewood, fossil fuels and batteries and to have improved access to communication technologies in the beneficiary communities .

Nepal has a long history with micro hydropower stations. The Swiss cooperation agency installed a 5kW plant near Kathmandu in 1962 (Nepal Micro Hydropower Development Association, 2014). Since there have been around 2500 such plants installed around the country although not all of them fit the “micro hydro” designation. Much of the electricity generated has been done to provide household electrification, agricultural hulling, and pumping water. The Intermediate Technology Group (now Practical Action) was crucial in transforming traditional water wheels into electricity generating power plants.

The failure by the government to introduce large power generation plants was added incentive to invest in micro hydro. Ambitious projects like Arun III were proposed to make Nepal electricity self-sufficient but due to various political mishaps this never materialized, which meant rural electrification became a distant reality without micro hydropower. In 1985, the government decided to deregulate the micro hydro energy

sector by deciding not to levy taxes. Projects up to 100 kW were provided subsidies and soft loans through the Agriculture Development Bank to foster the growth of the sector and to encourage private sector players to take charge. At one point the government even agreed to subsidize start up costs up to two thirds of the total costs. Experts say that this move by the government made the sector attractive to private investors who had previously been reluctant to invest in it. The Government of Nepal established the Alternative Energy Promotion Centre in 1996 and the UNDP set up, with the Ministry of Energy, the Rural Energy Development Program (REDP), which is now known as the Renewable Energy for Rural Livelihood Program. These two program have been fundamental in stimulating the setup of more micro hydropower plants in Nepal. The REDP is now active in 25 of the 75 districts (REDP, 2008). The REDP claims that 7.6 MW of electricity has been developed reaching 76,000 households throughout the country (REDP, 2008). REDP has worked in phases setting goals beginning with a pilot program in 5 districts (ibid). According to REDP, by June 2003, there were around 120 micro hydro programs.

There have been a number of major developments in Appropriate Technology that have supported the growth of micro hydropower plants in Nepal and elsewhere. Intermediate Technology Development Group, now known as Practical Action, has been a key actor in working in developing countries to develop solutions that have benefited the micro hydro sector. In the 1960, the Swiss government helped to establish Balaju Yantra Shala, a manufacturing facility, that was designed specifically to produce devices and machinery for Nepal's agricultural sector. It also produced the first micro hydro generators used in Nepal (Nepal Micro Hydropower Association, 2014).

CHAPTER - III

RESEARCH METHODOLOGY

This chapter discusses on the methods, which are employed to conduct the research. The whole study is carried out on the basis of primary as well as secondary data. Reliable and relevant study can be made possible only by applying scientific method. Hence the primary purpose of this chapter is to discuss and design the framework for the research. Different procedures have been followed.

3.1 Research Design

The research is was based on the exploratory and descriptive research design. It is exploratory because it has tried to accumulate the primary data and it is descriptive as the study describe the different causes for and against the significance of the technology. Hence it is of importance that various conditions prevailing in the respective households selected for the study after the electrification is also know to compare them with the conditions. The historical and other references are also taken for assistance of the micro level. In order to fulfill the objectives, information has been collected from the field survey, questionnaire, interview and observations which were the main techniques that has been used to obtain the information from the MH users. Only the user's families have been taken into consideration for interview.

3.2 Nature and Sources of Data

On the basis of nature, both qualitative and quantitative data has been agglomerated. The age, sex, occupation, income, belong to the quantitative nature, whereas, why and how they are dependent on micro hydro energy is collected hereby in quantitative nature. On the basis of sources both primary and secondary data has been collected during the entire research process:

3.2.1 Primary Data

To generate primary data for this study, key informant interview, field observation, sampling household survey, have been agglomerated.

3.2.2 Secondary Data

The information about micro hydro energy in Niduwakhola micro hydro power plant of Sankhuwasabha District and its interrelation between people has been gathered from hard or soft copy of scholarly journals, books, reports, library works as the secondary data needed during the study.

3.3 Universe/Population of the Study

According to Niduwakhola Micro Hydro Functional Group and District Development Committee/Renuwal Energy for Rural Livelihood Program total of 120 household were beneficiated from the Niduwakhola Micro Hydro Power Plant. From those 24 households (20 percent) were the respondent from different income level and geographical region using purposive random sampling method. However while selecting households for study the following points were considered given below:

Income Level : As far as possible different Income level house holds were selected.

Ethnicity of HHs: Possible different ethnicity of electricity users were selected.

Micro enterprises and social involvement : Operated micro-enterprises and changes on social activities were selected.

Location : As far as possible different geographical area.

3.4 Data Collection Methods and Tools

Mainly primary data were taken for the study and this study has been collected from the field survey. They are used to estimate and analyze the socio-economic impact of micro hydro on the survey. They are used to estimate and analyze the socio-economic impact of micro hydro for rural livelihood recovery process on the surveyed households. The questionnaire served as the chief source of primary data while secondary data were taken

from the concerned institutions and books. Following techniques has been used for data collection.

3.4.1 Household Survey

Detailed structured questionnaire was prepared various kinds of data such as socio economic characteristics of the micro hydro beneficiary, impacts of micro hydro on the users after its installation. The approved questionnaire served as a basic tools of data collection. Interviews were conducted among 24 households who had access to electricity to gauge and understand the kinds of life changes that had come about since the introduction of electricity from the power plants. Some households that chose not to use the electricity were also interviewed in Site to understand how not having electricity had affected them. This study also interviewed entrepreneurs at research sites in order to see how availability and access of electricity created new jobs, led to possible process upgrades, and more importantly creation of new enterprises. This study interviewed 2 staff members employed directly by the micro hydropower plants, 2 general store owners, 1 chicken farmer, 1 Hotel owner and one owner of agro processing mills in the beneficiary sites, and 1 school teacher.

Table 3.4.1: Interviewees and Interviewee Number

Interviewee	Number
Household	24
Power plant Employee	2(1 Plant Operator, 1 Plant Manager)
General Store Owner	2
Chicken Farmer	1
Hotel Owner	1
Mill Owner	1
School Teacher	1

Source: Field Survey 2016

3.4.2 Observation

Some of the beneficiary households were observed directly to have better idea about the micro hydro's benefits. Observation included following:

- Social and Sanitary Changes after electrification.
- Use of electricity for rural livelihood recovery process.
- Use of electricity for end use promotional activities.

The direct observation provided information about how the micro hydro power plant was constructed. Similarly the sanitation condition around the households and cleanliness were observed.

3.4.3 Focus Group Discussion

The concerned users in the community were consulted for focus group discussion. The number of participants in each discussion ranged from 5 to 8 numbers. Information related to the impacts of micro hydro on quality of life, environment, social life, health and sanitation and other relevant issues were collected during focus group discussion.

3.5 Data Processing Methods

The collected data were edited, coded and tabulated in the spread sheet by using excel program of computer. After doing this, the qualitative data were presented in paragraphs and quantitative data were presented in tables.

3.6 Methods of Data Analysis

The data obtained from the survey were edited and classified. Then the grouped and sub-grouped data converted into tables of averages and percentages. The analysis of impact was made through these averages and percentages. Actually the tables have been prepared according to characteristics of data such as selected beneficiaries HHs, family size, land holding, castes education etc. No analytical statistical tools, were utilized for data analysis.

CHAPTER IV

INTRODUCTION OF THE STUDY AREA

4.1 Profile of Sankhuwasabha District.

Sankhuwasabha district lies in the North and Eastern part of Nepal which is located in between the latitude 27°06' to 27°55' north and longitude 86°57' to 87°40' east and elevation ranges from 300 meters (Piluwa-arun Dovan) to 8463 meters (Mt. Makalu) and total area of the district is 3468.17 Square kilometers. The study area Khandbari Municipality situated in the central part of Sankhuwasabha district. Sankhuwasabha district has 2 election area, 5 municipality, 5 VDPs. The total no. of population of the sankhuwasabha district is 158742. According to the DDC profile 2072. The khandbari municipality is an administrative and commercial center. Sankhuwasabha district has been Biodiversity and its remote and mountain. The Project site is located at Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha district. The source of the flow is Niduwa Khola. The altitude of the area is about 1500m AMSL. The potential load centers of the project comprise ward no: 1, Yangsijung of the Chainpur Municipality. Most of the load centers lie within the range of 27 km from the Transformer station/powerhouse. It is quite difficult for transporting the goods. The nearest seasonable road head of the project site is Chainpur municipality of sankhuwasabha district. It takes about 1 days from Chainpur to the project site.

4.2 Physical Feature of Study Area

In This Chapter an attempt has been made to describe the geographical, socio-economic and demographic characteristics of the people covers by this study. As mentioned above, Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha district has been selected as a case for the present study. In veiw of this , a brief introduction of the study area and the discription of the sample characteristics have been presented.

4.2.1 Topography and Geology

Niduwa Khola MHS area consists of diverse topographical and geographical features including flat plains, steep terrains, gorges and high mountains. The average altitude of the project area is between 1500 m from the mean sea level. The topographical features of the project area were judged to be favorable for the construction of a micro-hydro scheme. All structures of the MHS are on the left bank of Niduwa Khola. The canal alignment runs through the left of Niduwa Khola. The alignment of channel seems stable and easy to construct with minimum loss of water.

4.2.2 Hydrology and Water Use

The source of the flow is Niduwa Khola. The flow available in the stream is 200 lps when measured by velocity method in March, 2007. From MIP Method, predicted mean monthly flow for Niduwa Khola at proposed intake is 160 lps in April. Which is the considered to be the driest flow.

Floods are not major design consideration for the purpose MHVP because it has not cause major problem around the intake area since a long time. For this reason, Temporary diversion weir of stone soling and wooden stop log are purposed in this scheme. Annual flood may damaged the head work once in year but this can easily repaired by the community in their self initiation.

4.2.3 Energy Potentials and Uses

The main sources of the energy in the project area are fuel wood, kerosene and agriculture residue. For lighting purpose kerosene is used and for cooking purpose fuel wood is used. The uses of fuel wood in such activity promote deforestation and activate environmental problem in the society. To reduce deforestation and preserve natural environment within the village is one of the basic principles of REDP. Similarly, to reduce the use of imported fossil fuel and use of locally available power in income generating activities is a major focus of the program. REDP has considered micro hydro as an entry point to the development of a community. Electrical energy is one of the least cost options for income generating activities in the remote rural area. Similarly, people

are highly interested in getting their village electrified. There is no possibility of extension of grid line in next 5 years also.

Based upon the household survey, carried out under the community mobilization process, the per capita fuel wood consumption is approximately 8 bhari (400kg) and kerosene is 3 liter per month. Similarly local people are using 2 pairs battery in an average per HH per month. This clearly indicates the alarming situation. It has been experienced that if effective measures are not taken in time to safeguard the forest resources, it will further deteriorate the ecological and geological conditions resulting in imbalance ecological system. Similarly, a large amount of foreign currency also goes to the third country.

In addition to household lighting there is possibility to promote different kinds of end uses by providing technical training and supporting the rural people. Such activities may be the establishment of agro-processing mills, nodules making, rural communication centre and others. If proper support is provided, community people can easily install such businesses.

At present, nearly 694 people of 120 households at the MHS area in the VDC will get electricity facility from the proposed project. The power produced by the proposed scheme is 12 kW, can meet the present demand for lighting in the evening. The power is to be distributed on an average of 100 watt per household. Similarly, the excess power in the daytime would be utilized for different end-uses activities.

4.3 Socio-Economic Profile of the Respondents

The Project site is located at Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha district. The source of the flow is Niduwa Khola. The altitude of the area is about 1500m AMSL. The potential load centers of the project comprise Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha district.. Most of the load centers lie within the range of 27 km from the Transformer station/powerhouse. It is quite difficult for transporting the goods. The nearest seasonable road head of the project site

is Chainpur municipality of sankhuwasabha district. It takes about 1 days from Chainpur to the project site.

The Reseacher couldn't take sample from all households of Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha because of time constraint. Only ward no 1, Yangsijung touch the Micro hidro project. 120 HHs. Has been benifited by micro hidro project. Among 120 HHs, 24 HHs 9 more than 20 percent) have been selected by simple random sampling in order to carry out the study and research.

4.3.1 Population Distrubution by Sex of Household.

Population is one of the socio-economic parameters that have integreted in each and every aspect of the social phenomenon. That has relation to social productivity and potential of that society. The total population of the surveyed households is given in the following table one.

Table 4.3.1: Population Distrubution by Sex of Household.

Sex	Population	Population in Percent
Male	67	47.86
Female	73	52.14
Total	140	100

Sources: Field Survey 2016

Table 4.3.1: shows that the total population of 24 households is 120 comprinsing of 73 famale populations and 67 male populations. Hence 52.14 percent of the population is occupied by famale where as the rest 47.86 percent of the population is occupied by male.

4.3.2 Population Distrubution by Age.

Out of the 140 Population of respondents below 4 years age each 5.71, 4-9 yrs. Is 7.14, and other which are presented intable mentioned.

Table 4.3.2: Population Distrubution of the area by Age.

Age Group	Population	Population in percent
0-4yrs	8	5.71
4-9 yrs	10	7.14
9-14 yrs	12	8.57
14-19 yrs	11	7.86
19-24 yrs	11	7.86
24-29 yrs	13	9.29
29-34 yrs	9	6.43
34-39 yrs	8	5.71
39-44 yrs	8	5.71
44-49 yrs	8	5.71
49-54 yrs	8	5.71
54-59 yrs	9	6.43
59-64 yrs	10	7.14
64-69 yrs	7	5
69-74 yrs	5	3.57

74-79 yrs	2	2.43
79-84 yrs	1	0.71
Total	140	100

Source : Field Survey, 2016

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

This chapter deals with the introduction of study area and socio-economic condition of the micro hydro beneficiary households in Chainpur Municipality 1, Nundhaki of Sankhuwasabha district. Caste/ethnicity, occupation, family size, education status, land holding pattern, livestock holding and population are the main variables considered in this study. Micro Hydro technology is being widely used in both the developed and developing economics. In developing countries micro hydro is valued more as source of energy for household lighting, cooking, use for the operation of household accessories and use for energy based micro enterprises. The main domestic use of micro hydro in household is for lighting. Actually, most of the households use lighting, watching TV, and for computer as well. The minimum use of electricity for lighting is found to be 12 hours average. Before the use of micro hydro majority of the people depend on kerosene for lighting purpose. The use of kerosene for lighting brought the problem of health on the one hand and on the other hand it spread many types smoke born disease like eye-illness coughing.

This chapter contains findings from fieldwork conducted on effects of micro hydropower projects on the life-habits and livelihoods assets of households in Site. The direct effects on life habits that were identified during the fieldwork will be discussed and analyzed. Changes in daily activities and reduction in use of fossil fuels, strengthening of livelihoods assets, and improvement in capitals will be described and assessed using literature on livelihoods. This chapter will also venture into what specific areas of life in the beneficiary localities have specifically changed or improved with the addition of electricity.

5.1.1 Family Type

The result of the survey reveals that the total population of the 24 sampled households are 140 and average family size is 5.8. Households with maximum number of family

members are 13 whereas the minimum number is 1. Table 5.1.1 shows the distribution of households by family size.

Table 5.1.1: Distribution of Sampled Households by Family Type.

S.N.	Family Size	Number of HHs	Percentage
1	Nuclear family	5	20.83
2	Joint family	19	79.17
Total		24	100

Source : Field Survey, 2016

Table 5.1.1 shows that among all 24 beneficiary, 19 households (79.17%) have 4-13 family members which are categorized as medium family size. Only 20.83 percent of households found consisting of 1 to 3 family members and 20.83 % of household fund in 8 and above size group.

5.1.2 Caste/Ethnicity

There are different castes and ethnic groups in Chainpur Municipality 1, Yangsijung Nundhaki of Sankhuwasabha District. The total population of Chainpur Municipality 1, Yangsijung, Nundhaki of Sankhuwasabha is 694 in which male and female composite is 328 and 366 respectively. There are 120 households having average household size is 5.8. The VDC is inhabitant by various caste and ethnic group such as Brahmin/Chhetri, Limbu, Sherpa and Tamang.

5.1.3 Religion

Out of 24 HHs, it was found that 22 HHs follow Buddhist religion where as 2 HHs follow Hindu religion.

Table 5.1.3: Households Distribution of the Respondent by Religion.

Religion	HH No.	HH in Percent
Buddhist	22	91.67

Hindu	2	8.33
Total	24	100

Source: Field survey 2016

Table 5.1.3 indicates that 91.67 percent HHs are Buddhist and 8.33 percent are Hindues Peoples are from Limbu/Shrepa/Tamang, Bramin/Ksetri.

5.1.4 Major Economic Activity

Agriculture is the main source of subistence income in the Project Area. Most of the Households have Their own cardamom farming in significantly contribute in the local economy. Cardamom farming is dominantly seen in Chainpur Municipality 1, Yangsijung Nundhaki of Sankhuwasabha and adjoining Mawadin. Generally one household sells about 20 - 300 kilogram of cardamom annually an earns about 40 thousands to 6 lakhs income (as per the prevailing rate for the year) in average. Thirty five percent of the people of the project are poor, campair to avrage standard of rural people of the country. In generall, it is observed that most of the household could afford electricity as per their required level. The mejour economic activity of the community is presented in table 5.1.4.

Table 5.1.4: Major Economic Activity of the Sample Households.

S.N.	Particular	Total HHs	%
1	Agriculture	16	66.66
2	Remittance	5	20.83
3	Business	1	4.17
4	Employment	1	4.17
5	Wages	1	4.17

Total	24	100
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Source: Field Survey 2016

5.2 Quantative Data Analysis:

5.2.1 Occupation

The main occupation of the beneficiary is agriculture. Besides agriculture, services and business are the main occupations of the plants owners. Major occupation practiced by the sample households are given in the below table.

Table 5.2.1: Occupation Distribution of Beneficiaries HHs.

S.N.	Occupation	Number of HHs	Percentage
1	Agriculture	14	58.34
2	Service in Nepal	2	8.33
3	Service in Foreign Country	5	20.83
4	Trade and Business	1	4.17
5	Other	2	8.33
Total		24	100

Source : Field Survey, 2016

Table 5.2.1 shows that the higher percent of the benificaries are engaged in agriculture sector. About 58.34 percent of the HH are involved in agriculture. Service in foreign countries 20.83 percent, Trade and business 4.17 percent, Service in Nepal 8.33 percent and remaining 8.33 percent are engaged in other. Besides agriculture, most of the households has secondary sources of income as well like cardamom farming and so on. As well as they are government service pensions, and other business. It supports them economically support to the basic requirements.

5.2.2 Family Size

The result of the survey reveals that the total population of the 24 sampled households are 140 and average family size is 5.8. Households with maximum number of family members are 13 whereas the minimum number is 1. Table 5.2.2 shows the distribution of households by family size.

Table 5.2.2: Distribution of Sampled Households by Family Size.

S.N.	Family Size	Number of HHs	Percentage
1	Small (1-4 persons)	5	20.83
2	Medium (5-7 persons)	11	45.83
3	large (8 and above persons)	8	33.34
Total		24	100

Source : Field Survey, 2016

Table 5.2.2 shows that among all 24 beneficiary, 11 households (45.83%) have 5-7 family members which are categorized as medium family size. Only 20.83 percent of households found consisting of 1 to 4 family members and 33.34 % of household fund in 8 and above size group.

5.2.3 Educational Status

Education has played the vital role in the development of people. Most of the family members of the MH electricity users are educated. They have admitted to their children to school. The literate people of the selected households are found to be in around 60 percent (table 5.2.3).

Table 5.2.3: Educational Status of Sampled Family Members.

S.N.	Literacy Level	No. of Person				Total	
		Male	%	Female	%	Number	%
1	Infant	8	11.94	11	15.07	19	13.57
2	Illiterate	6	8.96	31	42.47	37	26.43
3	Literate	40	59.70	24	32.88	64	45.72

4	1-SLC	9	13.43	6	8.21	15	10.71
5	Above SLC	4	5.97	1	1.37	5	3.57
Total		67	100	73	100	140	100

Source : Field Survey, 2016

From the table 5.2.3 shows that majority of the family members belong to Literate (45.72%) category and only 10.71, 3.57 percent people are secondary and above secondary level, 26.43 percent are in illiterate. This result shows that only 14.28 percent are Secondary and above secondary level. So the education status of this study area isn't satisfactory.

5.2.4 Land Holding

The main occupation of all plan owners is agriculture. All of them have their own land to cultivate. While calculating the land holding, only operational land holding has taken into account. It is found in most of the cases, that the land is cultivated by owners themselves. Though little, almost all the MH beneficiaries have their own land. Table 5.2.4 shows the distribution of land holding of the users HHs.

Table 5.2.4: Land Holding of Sample Beneficiaries Households

Group	Land area in Ropani	Number of HHs	Percentage
Marginal	Below 5	6	25
Small	6 to 10	11	45.83
Medium	11 to 15	4	16.67
Large	Above 16	3	12.50
Total		24	100

Source : Field Survey, 2016

Table 5.2.4 shows that maximum households have land holding below 25 percent (5 Ropani). It is found that 45.83 percent of total land falls on the small category (6 to 10 ropani), whereas 16.67 percent are of medium category (11 to 15 ropani). Similarly 12.5 percent fall under the large group.

5.2.5 Livestock

Since livestock farming is the main source of rural life and all the electricity beneficiaries have some kinds of livestock. On an average the beneficiary households own 4 heads of livestock. The number of users having more than average size of livestock. The number of MH users having more than average size of livestock is 4.

Table 5.2.5: Distribution of livestock among the households under study area.

S.N.	No. of Livestock	Number of HHs	Percentage
1	1 - 3	2	8.33
2	4 - 6	6	25
3	Above 6	16	66.67
Total		24	100

Source : Field Survey, 2016

Table 5.2.5 shows that 8.33 percent households have 1 to 3 livestock and 25 percent has 4 to 6 livestock and 66.67 percent households have above 6 livestock in their farm. Out of 24 households.

5.2.6 Economic Status

The annual income of the sampled households from the all sources ranges from Rs. 20,000 to Rs. 10,00,000. The income of beneficiary user has observed by auditing the total current market value of all agriculture production and total income from non agricultural sector. Proportion of households whose income range from Rs. 300000 to Rs. 600000 is higher in the sample. This shows that middle level of families are more interested in rural electrification in the study area.

Table 5.2.6: Economic Status of the Micro Hydro Users (Sample Beneficiaries Households)

S.N.	Income (Rs. 000)	Number of HHs	Percentage
1	Below 300	5	20.83
2	300 - 400	6	25
3	400 - 500	5	20.83

4	500 - 600	5	20.83
5	600 and above	3	12.51
Total		24	100

Source : Field Survey, 2016

Main expenditure heading of the sampled households are food, clothes, health, education interest of loan. All the sampled households live in their own house so that spending on housing is not accounted in the study. Share of expenditure on food would be greater if we count the market price if self produced goods also. Similarly, spending on education is second larger part of the total expenditure. As the expenditure in education shows, the increment of private schools in VDC area, the increasing rate of students' enrolment as well as moving of local students to Chainpur, Madi, Dhankuta, Dharan, Kathmandu and other cities of Nepal for higher education is in growth. Increasing share of education in the study are shows the growing consciousness of people towards education. Expenditure on health end clothing are also significant parts of the expenditure. However, due to the talk of accurate information the expenditure on health of the electricity users have saved are impossible to have been explained.

5.2.7 Savings Groups for micro capital development

One interesting and long-lasting impact of the setup of the micro hydropower plants has been the set-up of savings groups in the study site. Before the power plants were constructed, REDP sent community mobilization workers to both sites to establish neighborhood savings groups that would collect funds to help bear some of the initial costs. Having electricity allows people to diversify their income source to build what assets they have. Set up and successful running of savings group show that households not only have improved each community's financial capital but also improve their assets. Savings groups in both Sites represent assets that households can access in time of need as credit. Each savings group was further divided into groups for women and men. All men and women in the village contributed Rs.50 to their respective savings groups. The money was then loaned out to a member of the group and fees were levied if a member made late payments. This money was loaned out at an interest rate of 20%. During the

period of the study visit, the savings groups were in the process of merging all the groups into one savings cooperative that had been registered recently with the local government. The amount contributed by each member depended on the savings group. Men's savings groups met each month deposited Rs. 50 each month and the women's groups met every two weeks and deposited Rs. 50. Each month the money was loaned out for a period of 3 months. Men paid 20% and women paid 20% interest to the savings group for the money borrowed. Similarly, the savings group loaned out the entire amount to a member in need. By saving their money, although a small amount, in savings groups provides household members, both male and female, the ability to borrow cash reducing the need to sell other assets like jewellery or livestock. Savings groups also allow households to strengthen their portfolio of tangible stores and the interest earner, although little, can be considered a gain from their asset. Although these savings groups have allowed households to access finance during times of crisis, one counterintuitive result has been that households also access these assets when a family member needs money to go abroad as a migrant worker. Although migration is a diversification strategy on part of the household, use of savings to finance migration, which may or may not be financially beneficial has the counter effect of reducing the financial asset of a household.

The respondents have asked about the specific achievement they made by investing the money from the saving of money for kerosene and others. Following answers were obtained by the micro hydro beneficiaries.

Table 5.2.7: Specific Benefits made from Saving Sample Beneficiaries Households

S.N.	Specific Benefits	Number of HHs	Percentage
1	Educate children	2	8.33
2	Income generating activity	8	33.34
4	General expenses	6	25
5	Invest in Agriculture	6	25
6	Households work	2	8.33
Total		24	100

Source : Field Survey, 2016

The table 5.2.7 shows that micro hydro has good contribution towards the field of Income generating activity as well as invest in agriculture and general expenses. 8.33 percent and 8.33 percent of the households have invested their saving for the purpose of educating their children and households work.

5.2.8 Health and Sanitation

The study shows that micro hydro positive impacts towards health and sanitation of the respondents. Uses of toilet, reduction in diseases and change in the prevalence of flies and mosquitoes have been dealt in this section. Among the surveyed households, 80 percent of the households have built toilet and 20 percent households are devoid of toilet.

Table 5.2.8: Use of Toilet among Sample Beneficiaries Households.

S.N.	Have Latrine	Number of HHs	Percentage
1	Yes	22	91.67
2	No	2	8.33
Total		24	100

Source : Field Survey, 2016

The table 5.2.8 shows that, out of 24 households, 22 households have toilet and 2 households have no toilet. Out of 22 households having toilet, 22 households built their toilets only after the operation of electrification program. Similarly 8.33 percent of the households have no toilet and they use their agriculture field instead of toilet. This indicates that after awareness about sanitation through community mobilization process, people were encouraged to use toilet for better sanitation practice.

5.2.9 Improve in Health Condition of Women and Children

Micro hydro had a positive impact on the personal health of family members specially women and children who have electricity facility. While using the electricity for households purpose, that has played the vital role to maintain the proper health condition for them. It is known that electricity is generally used for lighting specially. Generally, the children are engaging in education. It seems that after electrification the quality of education and success rate is being increased. Headache burning cases coughing and

respiratory problems has reduced such problems. So electricity projects have positive health impact on women and children of rural community.

Table 5.2.9: Improve in Health Condition of Women and Children among Sample Beneficiaries Households.

S.N.	Diseases	Number of HHs	Percentage
1	Respiratory	7	29.16
2	Eye illness	4	16.67
3	Headache	6	25
4	Coughing	4	16.67
5	Other	3	12.50
	Total	24	100

Source : Field Survey, 2016

Table 5.2.9 shows that improvement of health condition of women and children is considerable. From this study, it has been observed that about 29.16 percent of the households respiratory problems have improved after electrification. Similarly 25 percent of the sample households headache problems, 16.67 percent of the sample households eye illness and Coughing problem and 12.5 percent of the sample households other problems have improved after electrification.

5.3 Qualitative Data Analysis:

5.3.1 Reduction on Drudgery

In the project area's households are primarily farmers. Cardamom, the main source of cash, requires only a few months of labor a year, especially during the weeding and harvesting process. The other activities revolve around growing corn, millet, and potatoes for self-consumption. Each household may also have squash, beans, and lentils because there are no markets available to purchase vegetables. Every household also keeps animals like cows, goats, sheeps, pig, buffallows, bull, oxs and chickens etc. So a lot of time, mostly for the women, goes into fetching fodder for the cows and goats. One major

change for the women, who already have a lot to do, has been the new electric powered mill in the village.

Nepali women reportedly spend 12 hours on household chores so the introduction of mills in the villages has meant women would have normally had to wake up in the early hours to grind the corn have more time to rest. This seems to concur with my personal observations. The family was staying with in Site had two women, a mother and daughter pair, who awoke well before the male members of the household and began the day's chores. Typically their mornings began at 5 AM and I never saw them sit still until they went to bed around 10 PM. Besides working in the kitchen and feeding their livestock, the two women spent much of their time working on their fields and their relative fields. During the study found that women in rural Nepal spend between two and four hours daily to process grain. If women, both adults and female children, did not spend the first few hours of the day grinding corn would mean no lunch on the table before the rest of the family headed out to school or to the fields. The arrival of the mill has meant that they can just make a weekly trip to the mill that is in the center of the village. One elderly man remarked how women in the village now wake up later, because when he was young, women would have gotten kicked out of their homes if they woke up as late as women still did.

The hardship now associated with milling was getting the grains from the home to the mill and back. Most households lived within 20 minutes of the mill so in comparison to spending 2-3 hours on a stone mill, walking that distance means a significant reduction in drudgery for women compared to spending long hours leaning over a stone mill. This reflects a significant impact on the human capital of households and specifically women. Mahat (2004: 12) notes a possibility in her gender analysis matrix that reduction in drudgery means increased possibilities for women to engage in income generating activities. However, these possibilities are still limited because both sites did not have any significant change in women's participation in productive activities. There were no women's literacy classes where adult women could study in the time saved from

drudgery. There was also little evidence to suggest that women were involved in entrepreneurial activity now that they had more time.

The ability to mill their produce in an electric-run mill rather than at home has multiple implications in terms of protecting their assets. One important effect is on the health of these women who have to spend less time doing back-breaking work on a stone mill which can be both tiring and causes physical pain. This in turn leads to an improvement in their human capital. A few extra hours of rest means they can be more productive on the farm or spend more time with their family. This also brings into focus the fact that reduction in drudgery means the metabolic energy of women is no longer unseen. The use of electric mills in a program-wide analysis by the UNDP shows that households saved on average 240 hours each year . Electricity for women has significant meaning because it means an improvement in activities that are not compensated. However, reduction in drudgery has not necessarily meant growth in other areas.

The livelihoods framework so far has been adamant about how rural livelihoods operate. The livelihoods framework has been widely adopted by development practitioners throughout the world and their credo has been a call for diversification by the rural poor. This saved time would allow women to pursue other things but this research shows otherwise. Besides being able to rest more, there has been no effort on part of the households to actually increase their sphere of diversification. This research, although it is merely a scratch on the surface, shows that it is possible that the rural poor may actually opt out of diversifying even when opportunities exist.

Since the arrival of electricity three years ago, project area has seen no actual growth in electricity use for major commercial purposes other than household consumption and related activities. The families in Site, I am just glad that they have light when they flick their switch and can eat food without having to process it for hours. There is definitely a strengthening of assets but not a diversification of livelihoods. Since households now have more free time and rest there are opportunities for individuals and households to diversify their livelihoods and to evaluate their risk strategies. But personal observation is

that since one aspect of the needs is taken care of, there is no imperative desire on their behalf to exploit wants. This leads us to the assumption that there may be unfulfilled needs but an absence of wants in this project site.

5.3.2 Extended Hours of Light and Reduction in Kerosene Use.

In the two localities studied the impact of electricity becomes visible as darkness fall. Neighboring villages are no longer visible in the dark and the areas under study come alive with the sounds of radios. Children study under light bulbs and adults gather around radios and televisions. On the way to Site I, a person walking along talked about how he could see the lights in Site I and feel a bit of envy because he and his family had to spend hours in the darkness at night. Electricity has had an impact on a number of life-habits discussed earlier and there is a sense of pride among the residents who stated that when they applied to the government for funds to build a power station their main concern was having electricity at home, they did not think about what would happen once they received it. Pasang sherpa, a resident of Chainpur Municipality 1, Yangsijung, Nundhaki remarked: *Before electricity we were in the darkness, but now we feel like we have joined the rest of the world.* Just this immeasurable sense of being not left out from the rest of the world is enough for the residents to feel a bit of satisfaction each time they flick on a light bulb switch. In addition to reduction in drudgery, a result of electricity has been change in use of kerosene by households in the two research sites. Since the power supply from the power plants is reliable and is shut down only in case of a flood in the river or a downed power line the beneficiaries have had to rely less and less on kerosene for lighting purposes. Not only did kerosene purchase deplete the villager's already low cash savings but it also had a negative effect on the health of children who studied by the light from kerosene lamps. Most families reported that they only kept kerosene at home as a reserve in the case of accidental power outage during the monsoon season when the river tends to flood and interrupt power generation. Balaram's family would purchase up to 3 liters of kerosene a month to light home before the micro hydropower plant was opened. Not only was the kerosene expensive but it had to be carried all the way from a market town an hour's walk away.

One member of the community proudly showed all his rechargeable lanterns and flashlights when asked what he used to walk around at night. An added benefit of using less kerosene has been that the risk of fires have been reduced. From this it is apparent that there is an increased sense of security to walk about at night.

Damber Shing Limbu's, a school teacher, spoke of how some students had almost burned their homes to the ground when they tipped over the kerosene lantern over while falling asleep studying late into the night. Kerosene lanterns are not the most efficient at producing light, because the wicks used are old and tend to smoke a lot so this can only be seen as a benefit to the micro hydropower users. Since a household can save from reduced kerosene use, it means that cash can be utilized to purchase rechargeable lanterns and flashlights that not only last a lot longer but are also safe and have no adverse health effects. Charging rechargeable light sources cost a lot less, so a household can save more cash in either the savings schemes or at home than spend money on kerosene. During this research, interviews with each household revealed that they owned at least one rechargeable lantern or flashlight. Saving financial capital can be used either for saving for future or for consumption, money saved from the purchasing kerosene can be significant. In this study area I found that micro hydropower beneficiary households on average use 6 liters of kerosene per year in contrast to 25 liters used by families that do not have access to electricity.

Mingma's, a resident of Nundhaki VDC-8 said:*In the past we used a liter of kerosene each week but now we can manage with that same amount for 3 to 4 months. Each time we ran out of kerosene we had to walk 1 day to Chainpur Bazaar.*

In addition to reduction in fuel consumption, there is also more sense of physical security at night from drunks. Another respondent, Fulmaya said: *Having light at night means we can walk around without fear.* Reduction in kerosene use is an important start towards a reduction in fossil fuel use. However, there has been a no effort to introduce other services that complement electricity availability to reduce fossil fuel consumption.

5.3.3 Access to Newer Technology

Site I feels as close to anywhere in the world as it is far. Television dishes are a common at the most homes and every young person in town seems to have a close attachment to their cell phone as any young person in the city areas. According to them, this was unimagined before the availability of electricity because even charging a cell phone would have required expensive solar panels that only a few could afford. The proliferation of cell phones is also very high in Site I, however televisions are still a rarity. Only families with regular cash income, like school teachers, enjoyed having a television at home. Some other families besides the teachers also owned television, where young children had compelled their parents to buy one. A young woman revealed that she often went to a friend's house and wanted to move to a big city like Kathmandu when she saw attractive young women on television shows who drove cars and did not get their clothes dirty working in the fields. This young woman was listening to music throughout the entire conversation. However, her mother had no idea what movies were and claimed she never watched the television. One villager spoke of how he felt closer to the world because he could now listen to the news on agriculture and farming issues.

Since cell phones and radios draw very little power from the power plant users in both sites were not deterred by cost of usage. Since does not have a cap on electricity use except on the amount of power drawn from the system, users often had their radios on until they went to sleep. With the advent of cell phones a benefit for farmers has been the immediate availability of market prices for their cardamom produce. Since prices fluctuate based on commodity markets in India, the same quantity may fetch different prices throughout the day. This aspect of usage of electricity is important because "access to information may be obtained by investment in a radio or in education" and now with cell phones means having greater choices in terms of where and when to sell their crop of cardamom. With increased interaction with and increased access to technology, there has also been change in terms of goods consumed in research site.

5.3.4 Impact on Education

The impact of electricity from the micro hydropower plants on education has become apparent even though the study area has only had the power plants for short period of time. I and, the principal of a lower secondary school at Nundhaki VDC-8, spoke of how his school was not attracting students from surrounding villages and there was a rise in overall attendance. Naina shing Limbu, a teacher at the Lower Secondary School at Nundhaki VDC 8 said: *In the past parents kids would not show up for school if they hadn't finished their homework. Now the attendance is much better. In the past (before electricity) parents used to prevent their kids from studying late at night because it used up kerosene and was also a safety hazard, but now with electricity kids can study late into the night, especially during examinations.*

It is found that in households who had electricity, children spent longer hours on homework and reading than in non electrified households. Households with electricity spent twice as much as non electrified households on school supplies and school expenditures. Improvement in rural lighting increases the chances of education possibilities which “would help remove the bottleneck of failure to get an urban job by raising skills and increase prospects of rural non-farm employment. This is possibly a long term effect of improved access to education because unless opportunities exist in the two villages, youth, regardless of education level, will attempt to migrate to an urban area or go abroad for employment when household income is not adequate. The school at Chainpur Municipality 1, Yangsijung, Nundhaki had received a desktop computer and a printer from a MHVEP user group, Chainpur Municipality 1, Yangsijung, Nundhaki, Sankhuwasabha and students were given regular access to it. Although they lacked internet connectivity in the school, the students and teachers made regular use of it. The principal of the school noted that they even had a photocopier in the school, so it was much easier for them to publish/print exam questions in the town rather than having to walk 2 days to District Headquarter Sankhuwasabha. The impact on school attendance and the schools ability to make use of electronic equipment to enhance their teaching capabilities is noteworthy.

5.3.5 Social Impacts

Social impacts of micro hydro electrification are mostly intangible and need to be assessed from user's percent. The outcome of the study showed that there are some positive impacts of rural electrification that influenced the social aspects of beneficiary household directly. They are :

- The household electrification has a matter of social prestige in the community.
- Access to the globe through television and mobile.
- Kerosene collection time and working load of women and children decreased (2 days per month). Due to which children got free time to study whereas women were found more active in social and political activities.
- All most of all the under study felt a rise in their social status in the village after the electrification.
- All of the beneficiary were involved in social organizations such as Mahila Bachat Sanstha, Amma Samuha, Krishi Sahakari etc.
- Engaged to social action based awareness and right based program.

There were four households around project beneficiary area, that opted not to receive electricity because they said the monthly dues were too much for them to pay each month and were also not able to contribute labor during the construction process. They all belonged to an extended family and were hesitant to speak in the beginning and later on the elderly mother of the family spoke that they did not feel like cooperating with the rest of the village because they could not go to work during the construction phase and felt left out. When I spoke to others in the village about that household, they spoke of that family as always the odd ones out because they often chose not to participate with the rest. However, this is inconsistent with what Appropriate Technology is supposed to be. One of its tenets is that it should involve the local community during the design and implementation. Although this family did sign up initially to help during the construction phase, they stopped going to help and eventually decided not to get an electricity connection because they felt they could not afford the monthly dues. It is important to note the role of agency here. The livelihoods framework's emphasis on making decisions in a group means that independent voices tend to be unheard or silenced by the majority.

Although working in groups has its benefits, the overemphasis on groups undermines the individual's agency and choices. One respondent (not a member of this family) had said that the monthly dues were the same as the price of two eggs in the store.

However, for this family it was too much. This family, which is obviously disadvantaged relative to other families. Although the majority of village has the opportunity to participate these four families have not been incorporated to take advantage of something that was meant to be for everyone. This is a major shortcoming on the management committee and local government's part because these households not only cannot have the same benefit as everyone else but they may also get left out of future development projects.

5.3.6 Gender Issues in Micro Hydro Plant

The gendered roles and relationships in the communities have shown varying levels of inequality in productive, reproductive and community concerns. In many studies, gender inequality is revealed even in those areas where cooperativism has been traditionally strong. Burdens are placed on women in both productive and reproductive spheres. In many cases, women suffer even greater burdens because of the physical and cultural difficulties inherent in mountain areas and tribal communities.

Despite the traditionally dominant role of men in water works, women contributed quite substantially to the micro-hydro project in its construction phase. Men and women shared the work; men doing the heaviest tasks and women hauling sand from the river, fetching water and preparing food for the workers. Although the women had not been present during the planning meetings, the focus group discussions revealed that the men had consulted with their wives at home and brought their views into the discussions. Three of the seven members of the project management team are women and are thus involved in making decisions regarding the micro-hydro project. In terms of operation and maintenance, men are involved in the technical troubleshooting and repairs, while the women take care of administrative matters such as book keeping and payment collection. Women have not participated in any of the related technical training program and therefore have only very limited knowledge of the technical workings of the micro-hydro project.

CHAPTER - VI

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary

Micro Hydro plants, one of the best options and appropriate technologies for meeting the growing need of fuel in the rural as well as in the urban areas, is being popular in the recent years in Nepal. Installation of Micro Hydro plants has been increasing rapidly in Nepal. Realizing the existing problem of energy, Government of Nepal, different NGOs and INGOs have been incorporating in the installation of the Micro Hydro plants.

This study on the Socio-economic impact of Micro Hydro for rural livelihood recovery process in Nundhaki VDC 8, Sankhuwasabha, is chosen as a special topic to address the problem of energy in the study area and to provide the scope for the dissemination of the micro hydro technology which seems to offer potential for future development. Providing relevant and reliable information can surface the real implementation of the program and may also make understand the deficiencies in the existing problem, in the policy level. Raising concern over ecology it might be helpful to improve the rural economy and keep clean environment as well, micro hydro is seen as the top most effective energy technology for the up liftment of the economy.

Before selecting topic, a brief review of the literature related to the impact study of micro hydro on users has been studied. Primary as well as secondary data have been used in this study. The main objective of this study is to evaluate the role of micro hydro plant in energy contribution, mostly in terms of quality of life, rural livelihood and entrepreneurship, impact on economic activities .Interview and field observation have been taken as a method of data collection and collected data has been analyzed using simple statistical tools such as average, percentage, table and diagrams.

This research paper studied the impact of electricity from micro hydropower plants, an Appropriate Technology, on the daily life habits of households and on entrepreneurship.

The research looked at aspects of changes through the lens of the livelihoods frameworks and how electricity has made an impact on the five capitals and on diversification of livelihoods. This paper also studied the impact of electricity on entrepreneurship, examining the kinds of enterprises that had emerged that utilized electricity. The impact on direct job creation, demand for new products and services, and business upgrading was also studied.

Electricity is a crucial element in fostering local development. Micro hydropower stations, a form of Appropriate Technology, have allowed poorer regions of the world to transform their lives by using a piece of technology that is suited to their needs. Appropriate Technology is an attempt to move away from replicating technology that already exists in the developed world and to adapt technology, or sometimes even build it from scratch, to meet the needs of those living in the developing world. This study argues that electricity from micro hydropower plants have had significant impact in terms of altering the life habits of households in the two research sites but the impact on entrepreneurship is minimal. This research also argues how Appropriate Technology tends to fumble when the needs of the users change over time and provides evidence in support of this argument.

6.2 Conclusion

Much of this study was conducted using semi-structured interviews in rural Sankhuwasabha district in east of Nepal. Spending the research period walking around the Nundhaki VDC ward no. 8, speaking to people to identify what had changed since the arrival of electricity, to identify changes in life-habits gave the research direction. Spending time in the homes of local families, purchasing products from shops, these were all ways to strike up conversations that later led to collecting data from the respondents.

Micro hydropower plants have had a major impact on the life-habits of households in the area but the impact on entrepreneurship is minimal at best. Households have been able to take advantage of the extended hours of lighting, women have more time to free because they no longer have to grind grain on traditional mills, and school attendance is higher now because students have more light to study in the evenings. There has also been a

reduction in use of kerosene for lighting. There is some new demand for complementary products like electronics and mobile phone top-ups.

One of the interesting findings of this study contributes to what we know about livelihood diversification strategies of the rural poor. Previous scholarship has been reinforcing diversification as the only way for the rural poor to deal with changes in their assets and risks but the findings of this paper suggest that it is not necessarily so. Just because women have more free time to relax because they do not have to manually process grain does not mean that they will invest that time to diversify their assets in other areas. A lack of markets may also be a contributing factor to slow diversification in non farming activities but evidence suggests that they were simply satisfied that they no longer had to be involved in back-breaking work. Also, households felt that electricity had satisfied a need that was unfulfilled in the past, but it wasn't necessary that they wanted to do more with this resource to diversify their livelihoods.

Another key finding challenged the existing understanding of Appropriate Technology and the notion of it being adapted to suit the needs of its users. Evidence from this research shows that Appropriate Technology becomes less appropriate when the needs of its users change. This paper challenged that simply handing over Appropriate Technology without putting in a place for a feedback system that ensures continuous development can lead to a dead-end. Also, the lack of information about complementary products like low-wattage cookers that actually use electricity needs to be wide-spread. Donors and government should make choices available to the rural poor to take advantage of tools that can supplement the needs of the rural households.

The analysis presented in this paper is qualitative in nature. It is possible that also including a quantitative approach could have led to stronger conclusions to support the findings. A stronger quantitative method combined with qualitative data collection could help to further the discussion on the link between Appropriate Technology and local development. This research opens room for discussion on how we perceive the needs of the rural poor. Development planners, donors and the government have for made some

attempts like handing over decision-making to the beneficiaries themselves but the lack of an efficient and effective system that follows up rather than gives a Band-Aid and bids goodbye is necessary. Limited capacity of government, donors' agenda-setting and the rural poor's resignation to poor accountability have meant that the rural poor are often compelled to accept what they are given.

From this research it is clear that what households present as their needs is subjective to what they think is shaped by the way they perceive development. For a rural farmer the ability to access services that reduce the space that exists between rural and urban life is what electricity addresses. By influencing changes, however small, in the daily lives of the rural poor electricity, when easily accessible, can be a long-lasting satisfier towards the fulfillment of basic needs. Other infrastructures that can complement the needs like safe water, roads, health facilities are possibly more imperative for the rural poor than industry that use electricity.

6.3 Suggetions

Following recommendation have been derived from the present study. It is recommended that the concerned organizations as well as government should take necessary steps to implement the recommendations of this study in the coming days.

- The installation of micro hydro plants has helped for recovery for rural livelihood process and quality of local life. But such leisure time is wasted idle. Some income generating program should be implemented to address such leisure time the government with the installation of the plants.
- Most of the beneficiary owners have complained about the subsidy. Equal subsidy to all the people is not reasonable. The poor and downtrodden people should be given more subsidies, so that such people can easy access of electricity.
- Most of the beneficiary have suggested that the regular monitoring of process and construction materials of the service provide company and suppliers should be specified. The government should publish the market value of such materials annually and subsidy should be given to those materials.
- Women should be encouraged for income generating activities and maintain trainings.

- Due to control mechanism and monitoring system regarding after operation of micro-hydro plants, monitoring sector should be strengthened.
- Importance and benefits for local community by micro-hydro plant should be radio, TV and moreover through FM channels (most of the people in the study area listen FM radio now a days).

Annex I

Questionnaire for Household survey

1. Name:
2. Address:
3. Name of the MH scheme: :
4. Who initiates or facilitates the maintenance and repairing of power failure/trip of the scheme?
5. What is the response of the community in context of power failure/trip of the scheme?
6. What is the role played by the management committee during Consumers Household power failure ?
7. Who is responsible for the maintenance and management of the scheme?
8. Is there any defined Procedure for maintenance? If interrupted what are the major reasons?
9. Operation modalities of MH
10. Resource Mobilization
11. What is Tariff?
12. How much do you pay for electricity per month?
13. Who fixes the tariff?
14. Who collects the tariff?
15. How the tariff is collected?
16. Education and Profession

S.N.	Male/Female	Age	Profession	Education(1-6)

Note:

- | | |
|-------------------|---|
| Illiterate | 1 |
| Literate: | 2 |
| Primary School: | 3 |
| Secondary School: | 4 |

Higher Secondary School 5
 University: 6

17. Household Landholding

Irrigated Farming :Khet	Gardening : Bari	Non Farming: Pakho	Bush Land: Khetbair	Grazing Land:Charan	Forest Land:Ban	Others:Anya
Ha	Ha	Ha	Ha	Ha	Ha	Ha

18. Agricultural Detail Income:

Crops	Unit	Annual Production	Selling Rate(Rs/Unit)	Annual Income
Paddy				
Corn				
Wheat				
Bat				
Potatoes				
Soya bean				
Mustard				
Others				

19. Non Agriculture Income Source:

S.N	Source Of Income	Person Involved	Remarks
1	Trade		
2	Enterprise		
4	Government Service		
5	Foreign Jobs		
6	Labor		
7	Others		
Total			

20. Income from Livestock

Types	No	Local Price(Rs/No)	Remarks
Buffalo			
Cow/Ox			
Sheep/Goat			
Chicken/Duck			
Pig			
Horse/Donkey			
Others			
Total			

21. Health and Sanitation

S.N	Disease	Cause(No of Person/Year	Frequency(Time/Year)
1	Skin Problem		
2	Headache		
3	Diarrhea		
4	Cold/Cough		
5	Fever		
6	Sores		
7	Eye Problem		
8	Ear Problem		
9	Jaundice		
10	Stomach Problem		
11	Pneumonia		
12	Tuberculosis		
13	Typhoid		
14	Tonsil		
15	Blood Pressure		

22. Major Health Incidents (Death)In the families (Last 10 Years)

Incidents	Year of	Major Cause of	Remarks
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	Death	Death	
Below 5 Years			
Women(Reproductive Age)			
Others			

23. Gender Division

Household work division in the family level activities

Type of Work	Girl Below(16)	Women	Boy Below16	Men	Remarks
Cooking	.....Hr	.....Hr	.....Hr	.....Hr	
Household Cleaning	.....Hr	.....Hr	.....Hr	.....Hr	
Firewood Collection	.....Hr	.....Hr	.....Hr	.....Hr	
Take Care Children	.....Hr	.....Hr	.....Hr	.....Hr	
Gro Processing	.....Hr	.....Hr	.....Hr	.....Hr	
Farming	.....Hr	.....Hr	.....Hr	.....Hr	
Animal Grazing	.....Hr	.....Hr	.....Hr	.....Hr	
Others	.....Hr	.....Hr	.....Hr	.....Hr	

24. Energy Source in the house hold level

Firewood

Biogas

Electricity

Kerosene

25. Kerosene Consumption detail in the house hold level

Yes.....No.....If yes

Use	Consumption (Liters/Month)	Local prict(Rs/Liters)	Nearest Market	Remarks
-Cooking			-Place	
-Lighting			-Hours(Two Way)	
-Others				

26. Social Impact:

Does Micro Hydro plant raise social status of the family?

a) Yes b) No

Which member of family is highly benefited by the plant?

a) Man b) Women c) Children

Thank you !!!

Annex II

Questionnaire for Focus Group Discussion.

Focus Group: Male/Female/Mixed

Project name:

Address:

1. What is the main objective of project?
2. Is there a feeling of coordination in the project or not?
3. How has the project and its members contributed for empowering the VDC activities?
4. How is the project monitored?
5. What is the condition of power failure/Monthly/ Per Annum?
6. Who takes the responsibility of the power failure or Power trip?
7. Who initiates or facilitates the maintenance and repairing of power failure/trip of the scheme?
8. What is the response of the community in context of power failure/trip of the scheme?
9. What is the role of management on maintenance?
10. How do you coordinate with the Village Development Committee?
11. Have you noticed any noticeable changes in the members of the community after intervention of Micro-hydro project ? If yes, how have those changes contributed the Micro-hydro project ?
12. How often do the project share their experiences?
13. What is the level of the participation of women and Bal club ?
14. How are people organized in the project?
15. Do the project or its members try to find out how the resources are produced, shared and mobilized or not?
16. Financially how much strong is the project?
17. What type of capacity of the members of such project has increased in your opinion?

Economic

Social

Political

How.....

Annex III

Keypoints for Observation

- 1.Name of the MH scheme:
- 2.Scheme Location:
- 3.Status of the forway tank :
4. Manage and Operate by :
5. Power Output, KW. :
6. Facilitation in community level by
 - External :
 - Internal :
7. Women status in local level.
8. Demand of electricity(KW) in community.
 - Lighting :
 - Cooking:
 - Heating :
 - Others :
- 9.Quality of the light.
10. Child education growth rate.
- 11.living standard of micro-hydro users.

Thank you !!!

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