

# CHAPTER I

## INTRODUCTION

### 1.1 Background of the Study

Nepal is located at the lap of Himalayas and has about six thousand rivers and rivulets hurling towards India with huge potential of hydropower generation. It is small country but rich in water resources. Nepal first boosted its hydropower plant in 1911. Considering the geographical situation small and medium sized hydropower project seem suitable in Nepal. Nepal has great potential of 83000MW hydropower and 42000MW of the total capacity has been estimated to be economically feasible. Till this date less than 2% of the overall hydropower potential has been explored. Nepal's electricity generation is dominated by hydropower. The entire scenario of the energy use of the country the electricity is the tiny fraction. So far hydropower plants having capacity between 100KW and 10MW are considered to be small hydropower (NEA 2007). Nepal is trying to fulfill the ever increasing demand of electricity in the, particularly in rural areas.

In Nepal, Pharping Micro Hydro (500KW) was the first hydro plant established way back in 1911. After long interval approx. 25 years to 30 years, two other hydro plants namely Sundarjal-900KW and Panauti-2400 KW came in to operation. The demand of electricity is increased onwards from 60s and bigger hydropower plant increased almost 20 times (Ghimire, 2007).

The electricity demand in Nepal is increasing by about 10-12% per year. About 44% of population in Nepal has access to electricity through grid and upgrade system. Nepal's tenth Five year plan (2002-2007) aims to extend the electrifications within the country and export it to India for mutual benefit. The Hydropower policy 2001 also seeks to promote private sector investment in sector of hydropower development aims to expand the electrification within the country and export to neighboring countries. ([www.welcomenepal.com](http://www.welcomenepal.com))

Micro-hydro technology is electrical energy generation system from water resources with installed capacity respectively up to 100KW to 3MW of electric power. This

technology has been successful to expand electricity in the rural areas. It has been found that, for instance in Sri Lanka, many micro hydro plants have been initially installed primarily to improve the quality of life by providing electric light. And in Peru, the key question for many projects developers was “how long will the plan last and how quickly the capital will be back? Similarly in Nepal, after passing the era testing and assessing the technical feasibility for micro-hydropower to increase access to rural energy seems inevitable for basic lighting facilities.(Parajuli,2011)

Micro hydro is an indigenous and renewable source of energy for the potential existing in the almost all Hindu-Kush Himalayan region that includes Afghanistan, Bhutan, China, Myanmar, Nepal and Pakistan. Micro-Hydro is generally defined as decentralized small scale water power plant less than 100KW for the power generation up to 100KW. MHP(Micro-Hydro Power) has gained massive popularity in developing countries during the last four decades (koirala,2011). Micro –Hydro can provide electricity services and is a cost effective and low impact technique for power generation. It affects a potential solution for rural electrification in Nepal (Parish 2002). The study shows that Micro Hydro projects established during 1962 to 2005 generated 1300064 KW of electricity (AEPC , 2005 ), while the total of 11742 KW electricity have been generated during 2006 to 2011 (AEPC Data Book ,2011).

As Micro-Hydro has been defined as decentralized small scale water power plant that generate electricity power up to 100 KW and serves nearby households through a local grid for power generation up to 100 KW. Micro-Hydro power includes pico hydro schemes up to 5KW capacity. The Government of Nepal (AEPC 2011) fixed cut-off point of 5KW as the subsidy policy.

Level of economic development is also reflected in the level of per capita energy consumption in Nepal. The per capita energy consumption in Nepal is 15GJ.

There is great disparity in the energy consumption attitudes, aspiration and lifestyle when the energy is divided in to three parts by three sources viz. traditional, commercial and renewable. Traditional energy occupied 87.8%, commercial energy 11.5% and renewable energy 0.4% of the total energy consumption in Nepal. (MOELGON 2012). In the present condition in Nepal, energy plays vital role for the fulfillment of resources. It is the primary need for all, .Sustainable energy can be used

for diverse processes such as lighting bulbs, charging batteries, burning fuels and propelling machines and so on.

## **1.2 Statement of the Problem**

Despite of higher technological advancements in the field of energy generations, many developing countries are facing energy problems. The major problems of energy are raising price of fossil fuels, depleting forest resources, increasing environmental degradation etc. In the context of Nepal, solar, water and wind energy have not been fully explored. High consumption of fuel wood, a traditional source of energy is leading to deforestation which have resulted in to natural disasters such soil erosion, flood, landslides and deforestation etc. Firewood is the most common and traditional source of energy for Nepal. It represents about three forth of total energy consumption which is mainly consumed in rural areas.

In rural area, people are responsible for 3Cs: Cooking, Caring and Cleaning. Cooking consists of using fuel wood and it creates indoor pollution and it results into making women and children it's victims. In addition, the lighting objective is fulfilled by kerosene lamps, which also creates pollution.

Rural people especially women have to spend much of their working hours in collecting fuel woods. Student's study is affected due to lack of lighting facilities in the houses. They may suffer from the eye infections, ENT infections and so on because of the smoke of fuel wood. All these problems arise due to the lack of commercial sources of energy which would negatively impact the human capital formation in the area.

Lack of energy supply in rural area is a chronic problem. In many developing countries, less than 10 % of the rural population has access to electricity. Rural electrification through conventional means such as grid connections or diesel generators is very costly production which is available in some countries.

A couple of research questions might be relevant for our case, as given below:

- ) What are the impacts of Bagagad Microhydro-power project in income, health and sanitation and education sector of the study area?

- ) What are the sustainable measures implemented in Bagagad Micro-hydro power project?
- ) What is the impact of MHP on rural communities?

### **1.3 Objective of the Study**

The general objectives of the present study is to find out the benefit of micro hydro power for villages related to Hat VDC and to evaluate the socioeconomic and environmental impact of the MHP project in this VDC of Baitadistrict.

The specific objectives of this study are as follows;

- ) To study the socio economic and environmental impact of Baggad micro hydropower project,
- ) To find out the attitude of community people towards Baggad micro hydropower project,
- ) To study the sustainability of micro hydropower project in rural areas.

### **1.4 Significance of the Study**

Electricity is the basic pillar of economy which helps to enhance standard of living of the people by different angle .The study has been round on the pivot of impact of MHP on the socioeconomic aspect of rural people. Outcomes of the study will help assess the impact of MHP on income, and livelihood of local people of Hat VDC,BaitadiFar western Nepal.

### **1.5 Limitations of the Study**

This research has been conducted for this study is focused on socio-economic and environmental impact of the micro hydropower project in the rural development of Nepal.

This is a project work mainly for an academic purpose based on information. The budget, manpower, theoretical and methodology, limitation during has been prevailed for the thesis work carried out by student. This study has been only limited to micro hydropower, which cannot be generalized especially to other types of plant.

The research has been limited in 4 wards of Hat VDC of Baitadi district. The impact that occurs by construction of a MHP is the derivation of numerous social, economic and environmental effects. Thus the study has been limited only social, economic and environmental perspectives. The social indicators are less factual which had made some difficulties to analyze social impacts and pre-electrification information has been depended on the user groups saying and other secondary information.

## CHAPTER II

### LITERATURE REVIEW

Globally, MHP is often studied as component for the rural development and rural electrification .Since the scale of MHP is comparatively small,the effects are very often found analyzed in the socio economic dimension of a society. Some studies have linked MHP with appropriate technology as well.

Micro hydro schemes have significant less negative environment impacts than large schemes (Clancy and Reedy, 2000).MHP is also taken is also taken as a technology demonstration and its investment considered as an important social infrastructure and also has positive impact on a schools , hospitals , business, agriculture/industries and so on.

Role of hydroelectricity in economic development is of great importance which is possible due to the enormous water resources as well as favorable topographic and climatic condition. The proper utilization of electric power accelerates the motion of national development as well as the community developments it provides job opportunities to the local youths. Actually micro hydropower project is very necessary for Nepal as well as rural areas where the national projects can't cover electrification. In such a place the small project as micro hydropower plant may be very useful. The micro hydro power project conducted in district head quarter and as well as another place can't cover the whole district. So the Bagged micro hydropower is suitable and usable.

Dhital,(2003), In a conference paper presented in international conference on renewable energy technology for rural development (Returned 03 ) presents important information to the energy sector ,which combines the present states,past experiences and future plans of the energy sector with the view of national and foreign experts .The study tries to analyze the initial evaluation of investments and optimize the components to observe on total projects cost .This analysis deals with the approach for financial analyze to calculate the cost where three scenario's i.e. with subsidy , without subsidy and with net economic benefits .

## **HMG/N. (2000) .Annual Report of Rural Energy (UNDP,Supported Rural Energy Development Programme**

The fairly informative report prepared by REDP, which has included the information of rural energy sector. The principal aims of this report are to give the message to the people about rural energy related areas, to appraise the impacts of energy and its related components. It tries to demonstrate the development path of rural development sector, to review on rural energy sector policy and to raise the issues and solutions of the rural energy problem for the sustainable development.

This report mainly focuses on the information of execution of working to increase the level of energy services to poor citizens in the village of Nepal through technological development including micro-hydro, solar, biogas, improved cooking stove etc. This report connotes that the increased population increase the demand of resources that puts further pressure on the forest which is already in determine process of Nepal. Desertification, ecological instability, loss of biodiversity, drying of water springs are some of the serious environmental consequences of massive deforestation. So most of the energy needed can be fulfilled by the big hydro power projects but which is focused only on urban areas. This effort has largely ignored the rural population. This report raises the issues and focuses on the promotion of rural energy.

Hora, (1996), In her study "Role of micro hydro power in Rural Electrification of Nepal" "explains that among the alternative energies more popular and available, continuously renewable, non-polluting and based on simple as well as flexible energy source is micro hydropower in Nepal. It is technically flexible as well as economically viable and the most appropriate technology for Nepal needed, micro hydropower projects are not sufficient to meet the national demand of electricity on one hand, we have no economic resources, technology and skilled manpower to install the large scale hydro power project on the other hand, small scale hydro power projects can play very important role in such context. This technology provides access to electricity and other mechanical forms of energy for agro processing. Furthermore, it is also capable of providing rural electrification to a limited scale.

As Hat VDC of Baited district has a lot of potentiality for generating hydroelectricity because of various reasons such as lack of finance, skilled manpower etc. And also

not sufficient researches have been carried out in the sector of micro hydropower. So these are the problems involved with MHPs.

UNVN-2003- Water contains energy. The energy generated by downward movement of higher place can be converted in to dynamic energy with the help of turbine, we can run different machines directly and we can produce electricity is called micro hydropower. Generally, MHP includes the project of capacity up to 100 KW.

**ESAP. (Report-Social Mobilization for Micro-hydro scheme-2044, p. 39)**

Semi-structured interview are the separate tools to be used on their own and an important part of other, PRA tools. A part of tools the SSI is the depth discussion and probing to find out the how and why of information produced by the other tools often this comes at the end when map matrix of calendar has been produced and it is the social mobilization needs to understand the how and why without this interviewing the map and matrix or calendar will not give much insight in no way community useless energy and sees micro hydropower.

**AEPC.(2063). Rural Energy Policy, Khumaltar:Alternative Energy Promotion Center**

Micro hydropower sector in Nepal has a long history dating back to the 1960s. The private sector companies mainly the manufactures started providing services from 1970s. Electricity generation from micro hydropower started after 1980s. Around 1990s, micro hydropower started getting recognized as a means of providing electricity in rural areas. Initial micro hydropower schemes were primarily addressing the need of processing, agricultural products and subsequently rural communities installed a large number of turbine mills.

Nepal is the first richest country in water resources in Asia and second richest in the world. Nepal has about 6000 large and small rivers. The total hydro power potential of these rivers is estimated about 83000 MW and which 45000 MW and 43000 MW are technically and economically feasible. But only 563 MW hydro powers are produced. The produced electricity is mostly used in urban than the remote rural areas, because of this condition the remote rural areas are directly affected, in which,



they are not getting clean and affordable energy. Thus, in Nepal there are lots of possibilities of micro hydro power project in remote rural areas, which is very much, environment friendly and economically bearable.

### **Energy Policy of Nepal -2063**

Only the 121% are getting service of electricity from the alternative source of energy, where the national transmission line is not assessable to reach in the geographically remote area. From the MHP: 23 MW, wind energy: 20 KW, Solar energy: 12 MW, and Biogas: 11 KW all together 35.03 MW electricity is produced up to now. NPC, 2013.

Pokhrel, (2013), in his article “A Brighter Future” clean energy need to change the story of Nepal as the country with the lower energy use and the highest potential. We can't afford to wait any larger. Denmark and Nepal share a vision of sustainable energy for all, and as long time partners, we have delivered concrete results in the last twelve years, more than 1 million households have benefitted from our common engagement to accelerate access renewable energy technologies in rural Nepal. It has helped many women, children and families to better health, it has created green jobs, and it has mobilized billions of rupees of local environment in the renewable energy sector. At the same time the alternative energy promotion center has become a driver of change in developing the renewable energy sector in Nepal.

The definition of micro hydro power varies in different countries and can even include system with a capacity of a few mega wards. One of the many definitions for micro hydro power: is hydro system of till a rated capacity of approximately 300 KW capacities. The limit is set to 300 KW because this is about the maximum size for must stand alone hydro system not connected to grid and suitable for “run of the river” installation. (WimJonkerKlunne, 2013)

Micro hydro of small scale hydro is one of the most environmentally being energy conversion options available because unlike large scale hydro power it does not attempt to interfere significantly with river flows. (Fraenken, 1991)

Micro hydropower sector in Nepal has a long history dating back to the 1960s. The private sector companies mainly the manufacturers, started providing since 1970s. Electricity generation from micro hydro power started after 1980s and was added on activity at that period. Around 1990s micro hydro power started getting recognized as a means of providing electricity in rural areas. Initial micro hydro schemes were primarily addressing the need of processing agriculture product and subsequently rural communities installed a large numbers of turbine mills. (AEPC/ESCAP, 2008)

According to subsidy policy Renewable Energy, 2069 BS, around 12% population has access to electricity through renewable energy sources. Around 23 MW of electricity has been generated from micro hydro schemes, 12 MW from solar PV system, less than 20 KW from wind energy etc. till date. More than 1.5 Million households are benefitted from different renewable energy sources both for cooking, lighting and end users. But majority of the population under poverty level living in the rural remote areas are out of access to clean energy due to high initial upfront cost of the renewable energy technologies.

Between 1996 and 2012, the total cost for the REDP MHS program (3500 KW installed)- including upfront capacity development costs as well as equipment and other “hard” costs required to implement and successfully scale up the program – was in the order of \$18.3 million. This is equivalent to about \$110 per beneficiary. Reduction is per-unit programs costs, which decreased by 84 per cent between 1996 and 2012. Assuming that costs continue to decline, UNDP and AEPC estimates suggest that scaling up the program to meet its full potential of 150 MW by 2030 would cost about \$435 million. While a large part of the funding has until now been provided from public resources, it is expected that private funding will gradually account for a greater portion of the overall investments, making up to about 60 per cent of future funding needs (UNDP AEPC, 2012)

Conventional approaches to electrification through a centralized power plant and power line distribution cannot reach poor people who live in dispersed rural communities where levels of demand are low and limited and the cost of providing energy is high. The best opinion for improving access to modern, sustainable energy service in rural area is the promotion of decentralized and integrated rural energy

system that are cheaper, more environmentally friendly and easy for local people to operate and manage (Neupane, M., Sharma, 2009).

The best approach to harnessing people's potential to develop rural energy system is the provision of self-government institutional mechanisms for inclusive participation and empowerment based on a decision – making process that is transparent and building their capacity, and motivating and encouraging both men and women to participate equally in the development process. Local people have the ability to implement and manage rural energy system with appropriate guidance and capacity building. Decentralize institutional framework and operational modalities are required for wide scale promotion of rural energy system (Neupane M., Sharma B., 2006).

Nepal is among the world's poorest and least developed countries. The Human Development Index 2012 ranks Nepal 138<sup>th</sup> out of 182 countries. (UNDP, 2012). Rural – urban disparities are still large in Nepal. Urban poverty stands at around 10 per cent, compare to about 35 per cent in rural areas, where 85 per cent of the people live. Why 80 per cent of households are involved in agriculture, the sector contributes only 35 per cent of Gross Domestic Product (GDP) and has high under employment rates and low productivity. Expansion of rural electrification is one of the five key elements under the Agriculture Perspective plan to improve agricultural sector.

Micro hydropower (MHP) schemes is considered the most feasible decentralized renewable energy option for providing reliable and affordable electricity to the remote and isolated areas of Nepal. The word electricity is derived from the Greek word “electron” which means amber. According to Web sector Electricity is a term referring to the large body of physical phenomenon arising from stationary and moving charge particles.

It can be calculated that after 2003, the total growth of micro hydro power is 11742 KW (during 2006 to the first half of 2011). Especially the first half of 2011 shows twice the growth rate KW that than the last two years (2009 & 2010). According to the AEPC Report 2011, total 68 Micro hydro schemes had been established during 1962 to 1985. After this, 805 micro hydro schemes had been established during 1986 to the half of the year 2011. The number of schemes seems to be more than twice just in the first half of 2009 to 2010 from this study.

Human development Report 2013, "The rise of the south: Human progress in a diverse world" examines the profound shift in global dynamics driven by the fast rising new powers of the developing world and its long term implication for human development.

The report identifies more than 40 countries in the developing world that have done better than had been expected in human development terms in recent decades with their progress accelerating markedly over the past ten years. The report analyzes the cause and consequences of these countries achievement and the challenges that they face today and in the decade to come.

### **Energy sources and supply in Nepal (Oct, 2006) By Karki**

Nepal has vast potential hydro resources, the economic potential for hydro power is estimated at 43000 MW. Yet hydroelectricity accounts for only 1 % of total energy supplies, fire wood 65% and agricultural waste 15% are still the main sources of energy while petroleum products 8% have replaced dung 8% as the third most important source of energy supply in terms of energy content.

BPC, (2013), "Sustainability", sustainable development is at the core of BPCs businesses and value BPCs business decisions and operations invariably integrated economy, environmental social dimensions. BPC has been carrying out series of social, environmental and economic development activities in and around its project areas and plan to continue them in future in a sustainable way in collaboration with the various stakeholder organizations in the project area.

- ) Economic Dimensions: has been reporting sustained level of revenue generation, in spite of the poor performance of share market throughout the year. BPC continues to focus on bringing internal efficiencies to work processes and rationalizing its investments where possible to count the challenges it faces.
- ) Dimensions: Social impact assessment study is conducted to set the socio-economic base line before implementation of projects, which helps in identifying impacts and recommending mitigation measures in the affected area. BPC has mobilized its own and external resources to implement social

development projects in its area. Jhimruk Downstream Mitigation Projects (JDMP) is an example, where BPC has been able to mobilize resources to implement activities in the field of social, environmental and economic development. Similarly, awareness programs, capacity building training programs has also been carried out to enhance the skill and the knowledge enabling the communities to initiate new economic activities. As a result of people and improve their economy condition which will ultimately help in sustainability of the project development.

Nepal hydro and electric limited. (2013).by BPC, Nepal hydro and electric limited (NHE) was established in 2042 B.S. by Butwal power company limited Ltd, Aniston power Norway as Kvaerner energy (formally sorumsandverk stand)As Norway, Butwal technical institute and Himel Hydro and general construction Ltd, As the shareholders.NEHS capabilities include design, manufacturing and installation of hydro power equipment, mainly covering various types of hydraulic gates, stop logs. Trash racks, penstock piper, medium size turbine housing, micro/mini turbines andsubstation and repair of electro mechanical /equipment. Some of the major job completed during f/y 2069/70 are as follows:

- ) Shanibheriseel truss bridge at Rolpa district
- ) Hydro mechanical works of 10 MW .Siprin HEP at Dolakha district.
- ) Substation works of NEA good Lamahi , NEA Chameliya HEP
- ) Supply of substation equipment of NEA Butwal and Birjung sub station.

Acharya, (1983), has mentioned the contribution of hydroelectricity to Nepalese economy. According to her, hydroelectricity plays significant role by developing various fields such as agriculture, industries, transportation, social services etc. Water resources are Nepal's greatest assets. But unfortunately, very small portion has been harnessed to this date. She says that there is unequal distribution of electricity in different development region. Nepal is facing many problems in respect to hydro power development. There is lack of capital, skilled man power, technical knowledge, sufficient market and economic status of people as well as country.

Sarfoh Joseph (1990) has examined that Africa has the highest potential for hydropower development.It is also behind other regions in developing that

potential. Sarfoh argues that hydropower was not developed to the required levels in West Africa because of the initial high cost of hydropower plants. Low domestic power makes an ignorance of hydro resources and future energy needs.

The main features of the energy sector are the imbalance between energy resource endowment and its current use. There is an excessive dependence on forest to meet energy needs while hydro power, which has vast potential, has remained virtually not so utilized. Biogas is not an important energy, which are technical limitations in hills and mountains even in Terai. Nepal's hill and mountain areas occupied underdevelopment infrastructures make life hard for rural population. Women generally bear the full responsibility of household chores and share work in the farm and also fuel collection for energy requirements. This increases work load for women. This makes women's daily life more difficult. The report mainly concentrated on women who are responsible reproduction and bring up all the time spent to the next generations and care on a daily basis of all family members. Moreover they generally work hard but paid low wage and offer security low valuation of women's work, few legal rights and ,and also non wages.

Energy supply programme should also include generating activities for rural people either men or women. Women are handicapped by their skills, materials and technology and extension services. Energy supply could increase both productivity as well as decrease in hardship if men or women in such activities like shorter processing hour on agricultural sector and less physical work. It reduces time and hardship, i.e. cutting grinding; stirring as a result more time has gone for productive work. So that energy helps women to improve income generating activities. We have large amount of water resources, which could be exploited for hydropower, hydro-based energy (also all sector of energy) used in the domestic and industrial sector. It contributes development of the country as a whole.

Pandey, (2009), In Nepal, the installation of MHP has been supported by bilateral donors and banks that have not been effective in providing reliable and affordable energy to poor rural areas. In addition, due to poor planning and execution, most of the existing MHP plants were not functioning in many rural parts of the country. Also there is a lack of data regarding rural energy supply and consumption patterns since energy planners overlook enterprises as less productive members of the

economy. More-over, rural electrification follows a top down approach in Nepal. However, primarily rural energy sector has to be improved in order to improve the economic status of the country. Because more than 80% of the Nepalese people still live in rural parts of the country. Therefore more attention should be given towards rural households who are deprived of electricity specially. The objective of the current paper was to investigate the impact of decentralized small scale renewable energy technologies in a rural community, Nepal. A case study was carried in order to assess the socio economic conditions of a village impacted by the MHP plant as well as quantitative.

By considering the fact of only two percent total rural population has access to electricity, the small hydropower plays vital role in providing electricity to the rural areas and even too isolated pockets areas of the countries. The micro-hydropower is also important from the considerations of national welfare in diverse fields such as, conservation of forest, creation of self-employment opportunities and also promotion of the tourist industry. Since electrification is related to production, small and micro hydropower helps to increase the efficiency of rural power.

The gender and social inclusion concept in micro-hydro has prioritized women empowerment in this sector. Better lighting facility also increases study hours for school-going children and impact of results. Microhydro plants have been a very good work for promoting the Clean Delivery Mechanism (CDM) by reducing carbon emission. About 10 million kg of CO<sub>2</sub> is saved every year by MH households in Nepal. Selling that carbon can also be listed as income generating way from micro hydro. Studies shows that, households benefit from MH exceeds its cost by about 3 times. Nepal's micro hydro projects are already registered in the CDM. (AEPC-WB Survey, 2009).

WECS (1995), examined the needs of energy in our lives. We cannot think our survival without energy. Energy is compulsory for development purposes. After the utilization of the energy properly and apply then the status of education, condition of health, development of infrastructure, transportation facilities are gear up which lead a country on the prosperous way of development due to which living standard of people automatically sky up and it is vital for economic development and employment. It is also a critical factor for shortage of biomass fuels have forced urban households and

industries to switch from biomass fuel to imported fossil fuels and other commercial forms of energy. Deforestation and desertification are threatening our traditional energy supplies and agro based rural economy. These shortage of biomass fuel in rural sector have energy care and needed to promote rapid economic growth to meet the basic need of rural families is also plugged by the lack of other resources e.g. farmland technology and capital for investment .

Harop (1996), in her thesis, explains that it is technically feasible as well as economically viable and the most appropriate technology for Nepal. Indeed, micro hydropower projects are not sufficient to meet the national demand of electricity . On one hand, we have no economic resources, technology and skilled manpower to install large scale hydropower project while on the other hand, and small scale hydropower project can play very important role in electricity and other mechanical forms of energy for agro processing. Furthermore, it is also capable of providing rural electrification to limited scale.

Hilly topography and enough availability of water resources show the huge potential for micro hydropower in the country. Micro hydropower helps to reduce the alarming deforestation, import of petroleum products there by playing a vital role to improve the economic condition of the people. Agriculture Development Bank of Nepal (ADB/N) is not only providing loans and subsidies but also providing resources survey, feasibility studies. Promotions of manufacturers involve technical assistance and training has financed over 90 % of the private MHP in Nepal. It may not generate electricity in dry season. Likewise, the skilled manpower may not be available to get it repaired . Sufficient research has not been carried out yet . These are few problems with MHPs.

Win Rock International Nepal (2006), gives the argument on the role of energy for poverty alleviation and upliftment of the living standard of people in terms of education, health, sustainability, environment and women's empowerment. Similarly it measured quantitative efforts of different power agencies and the decade towards the national poverty reduction strategy (PRS) reviewed in detail . This study is designed to analyze PRS as well as MDH targets.



Nepal's micro hydropower system program places a strong emphasis on community mobilization. It works to ensure that MHSs are installed by community members, in close co-operation with District Development Committees and Village Development Committees. Local NGOs are engaged to act as support organizations and carry out the process of community mobilization. Within the MHS program, the process of community mobilization is guided by six basic principles (the 'MulMantras'). These principles include organizational development, skills enhancements, capital formation, technology promotion, environmental management and empowerment of vulnerable groups and communities.

The micro hydropower functional group is the key body at the village level for establishment, operation and management of MHSs. Once the community managed MHS has been running successfully for at least six months, the community groups are encouraged to convert the micro-hydropower functional group into a legal entity, such as a co-operative, to encourage long term sustainability.

All studies above are mainly related with the study of micro hydro project. Actually micro hydro project is very necessary for rural area. Most of these studies try to analyze the problem, prospects, economical evaluation and technical assistance of MHP. Some limited studies have analyzed the impact of the MHP to assess education, health, information of the people living in the rural area.

### **Energy Source of Nepal**

Commercial and traditional fuel has remained as two principal source of national energy. 90% people are living in rural areas and are consuming traditional energy source, and in urban areas people are consuming traditional energy. Commercial energy is rarely available in rural areas where they use firewood and diyalo to light in their house. Commercial energy is available in urban areas. However, Micro-Hydro projects, biogas, solar and small scale wind energy are currently being developed in rural areas.

### **Traditional Energy Source**

It is clear that sustainable energy is supplied by firewood, animal dung, agriculture residue; which over 90.5% of total energy consumption leaving 9.5% to

commercial source. Supply of fuel wood cannot be maintained from uncontrolled deforestation which is the main source of traditional energy shared 67.6%. In rural area energy is substituted by agriculture residues and cattle wastage. Human labors and animal draft power is also referred to traditional energy (MoF,2011 ).

### **Forest Resources**

Forest is the major source of traditional energy in rural areas. People are depending on this source. Various programs and projects are launched for the promotions and conservation of forest resources, which is one of the most important natural (traditional) resources of the country. Total traditional energy is shared of fuel wood by 67.6% (MOF, 2011).

### **Agricultural Residues**

Agricultural residues are also traditional source of energy used in Nepal. Such as rice husks and straw are increasingly using for in traditional stoves in houses. Present agriculture residue constitute is 15% of the energy consumption (MoF 2011).

### **Animal Dung**

Animal residue is used for cooking either in front of dung cakes or in family scale biogas digests. Dung is mostly dried and burned directly for cooking purpose. Alternatively, it is used for biogas plants in which it is used both for energy and organic fertilizer. 7.9 % of energy contributes to traditional source by animal or cattle wastage sector.

### **Commercial Energy Source**

In Nepal, Commercial energy (petroleum and coal) consumption is very low compared with other countries. It contributed only 9.5%of total energy consumption (Economic, Survey 2008). The demand of most of commercial energies e.g. coal, petroleum product or mineral oils are fulfilled through import. Commercial energy is mainly supplied in urban areas. Internal product of commercial energy is electricity, which contributed 1 percent of total energy supply. Its contribution is very low

because of high project cost and limited capital to invest in this sector. Commercial energy consumption is very low than traditional energy.

### **Petroleum Product and Coal**

Commercial energy like petroleum product and coal are another option. But they are not available in our country and are imported from India and abroad. That's why they are expensive too. A huge amount of export earning is drained to important petroleum product and coal have been increasing every year. Economic Survey 2008 shows that consumption of traditional and commercial source of energy is estimated to grow by 2.2 and 9.7 % respectively. The causes of that would be rapidly increasing urbanization, rapidly increasing number of vehicles and people using kerosene for cooking in areas, lighting in rural areas and rapid population growth.

### **Solar Energy**

The use of solar energy power in the country is at early stage of development. Solar energy is used for domestic water heating, drying agro products in urban areas; the solar energy products are not only expensive but also technically complicated. So, it is underutilized. Solar energy potential of Nepal is estimated to be equivalent of 26.6 million MW (MOF, Economic Survey, 2011).

### **Wind Energy**

Utilization of wind energy is still at the research stage in Nepal. But while considering its geographical features and wind velocity, there is possibility to develop wind energy in Nepal. Moreover the only one project that has been installed at Kagbeni of Mustang district can generate 20KW electricity from wind power (Bhattarai, 2002). It is technically too costly to develop this kind of projects.

### **Hydro-Electricity**

Hydro –Electricity is the main resource, which will ultimately become the dominant source of indigenous resource. It has been calculated that the size of theoretical hydropower potential based on average flow of six thousand rivers is 83,000MW whereas technically potential 114 major schemes are identified where the total

capacity of those schemes is 45610MW. Those are economically potential major hydropower schemes whose benefit cost ratio is more than one amount 42330MW (Mishra S.N.2000). With such capacity current utilized hydroelectricity is 549.2MW (NEA 2003). Nepal has 6000 rivers having capacity to generate electricity. So Nepal is rich energy sector if all that resources can be utilized. Hydropower development requires high initial investment and infrastructures like transportation. Electricity generated in Nepal essentially consists of both the interconnected system and remote isolated areas, which is backbone of our economic development and earning foreign currency (Thapa and Pradhan, 1995).

This study has sketched the impact of MHP on the rural livelihood in the PatanBaitadi in Nepal. Thus micro-hydro scheme provides clean, affordable and sustainable renewable energy both locally and globally. Presently energy consumption appears to be directly related to the living standard of the people. Therefore, energy is the basic requirement of development without which the peace of economy cannot be accelerated.

## **2.1 Review of Micro-Hydro Policy Issues**

### **Fifth Five year plan (1975/76-1979/80)-For the First Time Small Hydro-Power was Mentioned**

- ) Sixth Five Year Plan (1980/81 -1984/85) –ADB/N launched Rural Electrification Project (1981).
- ) HMG/N waived the licensing requirement for MHP (1984)
- ) Eighth Five Year Plan (1992/93 -1996/97) –The target for MHP development was fixed for the first time.
- ) Nine Five Year Plan (1996/97 -2001/02) –MHP target of 5MW.
- ) HMG/N established AEPC (1996).
- ) REDP was initiated (1997).
- ) NEA announced the policy of purchasing electricity from independent power producers (1998).
- ) ESAP was initiated (1999).

Policy has significant impact on the Micro-Hydro projects established, management, mobilization and utilization of resources. All the micro-hydro projects have to confirm to the legislative and policy provisions and the rules and regulations formulated the smooth running of MHP.

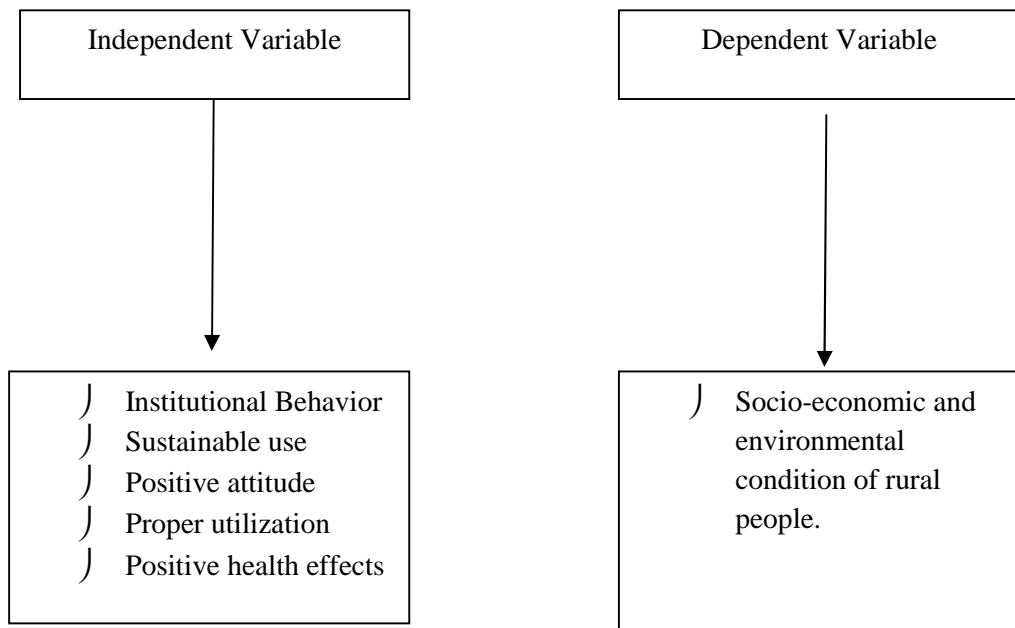
## **2.2 Conceptual Framework**

In conformity with the principle of regional balance in development activities, the growth of hill economy assumes special significances. The inaccessible terrain of the hills has made life for the inhabitants and continuous struggle. Furthermore, development cannot effect unless the entire population is encompassed in the mainstream of economic program and prosperity. These are enrolled to study. The study area has been selected in Hat VDC, which is in Baitadi district, because 131 households are willing to use electricity for domestic purpose for lighting, cooking, photo studio, computer center and so on. But people in the project site have weak economic condition. So they are willing to contribute labor force in the project setup. They are also willing to provide local materials like stone, sand, bamboo and wood. Leadership role to mobilize local community for the self-help development is lagging behind.

The local community has shown interest and willingness to construct the MHP setup. Similarly, they have shown interest in mobilizing local resources in building Micro-Hydro Power project. Much need to be done to work in self-motivates the local people in self-help approach.

Concept is the collection of facts; it depends upon the development variables or independent. These are interrelated to each other. The study aims to an institutional setup of Micro-Hydro Power connected with the objectives and verify it to get into the valid conclusion. The inter links of causes and effects are under listed below:

**Figure 2.1: Conceptual Model Showing Specific Variables and Scheme of their Relationship**



## **CHAPTER III**

### **RESEARCH METHODOLOGY**

#### **3.1 Research Design**

The types of research design adopted for this study is exploratory and descriptive in nature to get the reliability and validity of the research data. The exploratory research design is adopted to explore the new variables connected with the existing problems of micro hydro power. Similarly descriptive research design is employed to get valid conclusion from the analysis of existing phenomenon of micro hydro power concerning with the rural development. The study has investigated the socio-economic impact of micro hydropower projects in rural sectors and has found out how people are benefitted by the project. Besides the impacts of MHPs, this study also attempts to describe the benefits experienced by the households of the project affected areas after the installations of micro-hydropower project such as economic activities, income, information, education etc. Thus study is done descriptive, analytical and explanatory.

#### **3.2 Rationale of the Study Area**

Bagagad Micro-Hydropower project lies in Baitadi district; one of the mountainous districts of Mahakali Zone in Far-western region of Nepal. In Baitadi the BMHP with 20KW of capacity is installed by using the water of Bagagad, situated in the Hat VDC. This project is playing a very important role for rural electrification in Hat VDC of Baitadi. The total household of Hat VDC are 330, and the total population is 2,292 including 1,136 male and 1,156 female.

#### **3.3 Nature and Sources of Data**

Qualitative research seeks out the why and how of its topic through the analysis of unstructured information. In quantitative analysis number and what they stand for the material of analysis. By contrast, qualitative analysis deals in words and is guided by fair universal rules and standardized procedures than statistical analysis. In this study the researcher had applied both qualitative and quantitative data.

## **Primary Data**

Primary data were collected from the field visit through direct household questionnaire survey, key Informant Interview (KII).

## **Secondary Data**

Secondary data has been collected from differential source of governmental and non-governmental organization such as; AEPC/NRREP Municipality, Related bulletins, Journals, Published report, Knows and official etc.

## **3.4 Sampling Procedure**

Baggad micro-hydropower system 20 KW is the unit of analysis in this study. The universe of the study is the household of Hat VDC ward no. 3, 4, 8 and 9 of Baitadi district, out of total 131 household of these wards, 40 households are selected as the sample size by using systematic random sampling with lottery method.

## **3.5 Tools and Techniques of Data Collection**

Different Tools and Techniques of data collection were applied on the basis of research context. The structured questionnaire, semi or unstructured interviews, field observations were used to generate primary data .The information collection tools and techniques are as follows

### **3.5.1 Household Survey**

Structured Questionnaire for responded has been used for HH survey. This questionnaire will generate the realistic and accurate data from the HH survey. Mainly this questionnaire has been related with the socioeconomic characteristics of the study area.

The respondent of sampled HH has been requested to fill up the questionnaire, the questionnaire has been asked to the respondent and the answer will be filled up as the response of them.



### **3.5.2 Key Informant Interview (KII)**

Some specific data has been collected by interviewing some key informants like Mr. Anant Bohara, the principal of Nar Memorial Bording School and Mr. Govind Raj Joshi, the Secretary of Haat VDC. It is based on research context and area.

### **3.6 Methods of Data Analysis**

To analyze the collected data, categorization, ordering, ranking is done to obtain required answer of research question. Data has been presented in simple statistical tools like table, figure etc. Average, percentage, numbering etc. were used for simplifying data for comparison and analysis. According to attributes and features of data, the required tables and figures were created textually. This study declares on socio-economic and environmental impacts of BMHP on Hat VDC, Ward No. 3, 4,8 and 9 of Baitadi district.

## CHAPTER IV

### DATA ANALYSIS AND PRESENTATION

#### Description of Study Area

The study site is mainly located in ward no.3,4, 8 and 9 Hat VDC in Baitadi district last development region of the country. It takes about 5 hrs by bus and about 4 hours by walk from the district headquarter (Gothalapani)in summer and winter season but there is no transportation facility in rainy season. Hat VDC lies in the west part from the district headquarter. It is facilitate by drinking water, agriculture and forest .

The total population of Hat VDC according to CBS census 2011 was 2,292 (1,136 male and 1,156 female). The numbers of households are 330. This VDC consists of various ethnic groups but the dominating groups are Brahmin and Chhetri. Nuclear family system represents the main basis of social structure.

Agriculture represents the main source of income of Hat VDC. The average farm size is medium and fragmented. The agriculture production consists of food grains such as wheat, maize, paddy and cash crops, livestock consists of cow, buffalo and goat, literacy estimated at out of 60 percent. Health facility is also available in this village. In the case of drinking water facilities, large sector of people drinks water from piped drinking water. For irrigation facility, the VDC is surrounded by tributary of streams and farmer use such water in any time for irrigation purpose .There are some public telephone booths and Nepal Telecom and SKY phone have provided mobile services to which serves all the population of the Hat VDC .Only micro hydropower facility is available in this VDC for the purpose of electricity .In summer season the dam of hydropower is affected by the flood which came out in the streams. In ward 1 and 2 there is another small hydro power having 10 KW capacities.

Agriculture is the main source of livelihood. More than 80%people are engaged in farming activities .Livestock are friends of farmer. They use the dung of the animal in their farming land. It is the good sources of pesticides as well as energy for the plants and crops. They can able to get fresh milk and milk related product, etc. This is essential for sound health. Animal like bull are used for ploughing as well as donkeys

are useful for the rural transportation. The people having services are especially joined in army, police force and teacher etc.

The chapter four includes the analysis and interpretation of data. For this purpose data are tabulated at first and then analyzed. This chapter is divided in to three sub chapters. The first of the chapter covers the socio-economic and environmental impact of Baggad MHP. Second part covers the attitude of community people towards Baggad MHP project; and third part of the study covers the sustainability of micro hydropower project in the rural area.

## **4.1 Socio-economic and Environmental Impact**

There may be so many impacts of everything; the first part of the chapter covers the socio-economic and environmental impact of the MHP plant. This study was focused especially what types of changes occurred in social as well as economic sector. Then what kind of effects have seen in environment after the plant implemented. For detail different data are tabulated and interpreted as follow.

### **4.1.1 People's Perception about Improvement of the Village Using BMHP**

Installation of micro hydro power project definitely has some positive impacts in the society. We can take the perception of beneficiary household in order to measure how the project has made significant improvement in the society. Out of total 40 respondents, almost all mentioned that the role of the project is vital for their living standard. Life became easy and children's reading habits improve significantly. They have now access to TV and computers and other electrical goods. Besides they have felt the improvements in other sectors like health and education.

### **4.1.2 Household Information of the Project Affected Area**

#### **The Households Participation of Ward No. 3,4,8 and 9**

Micro Hydro has played the vital role for electrification in the rural area of Nepal. This Baggad Micro Hydro power has benefited total 4 wards of Hat VDC including wards 3,4,8 and 9. Out of 131 total benefited households from above wards, 40

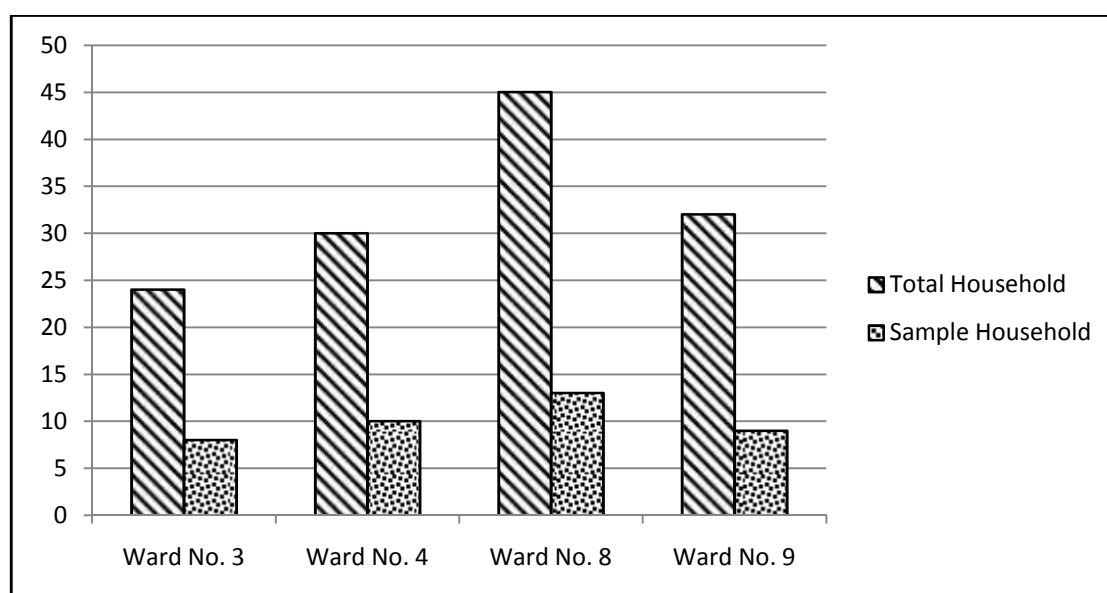
households have been taken as random sample. The ward wise distribution of respondents of this study is shown in the table below:

**Table 4.1: Ward Wise Participation of Respondents**

Wards	Total Households	Sample Households from Ward
3	24	8
4	30	10
8	45	13
9	32	9
Total	131	40

Source: Field Survey, 2016

**Figure 4.1: Ward Wise Participation of Respondents**



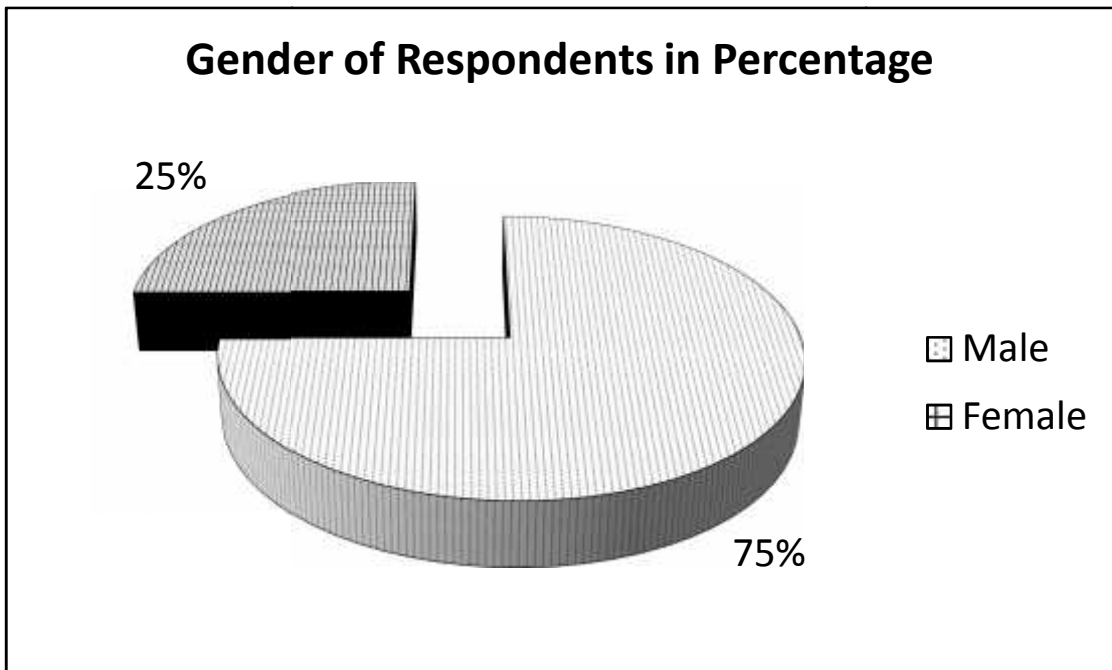
The above Table No. 4.1 depicts that out of total 40 respondents, the higher number of respondents were from ward no 8 because large number i.e. 45 households are benefited from that ward.

#### 4.1.3 Gender of the Respondents

There was a significant imbalance in the participant respondents regarding gender. The population ratio of male and female are nearly 50-50 but female respondents

were fewer in number than males in this study. It's because male were the households heads in most of the families. Out of total sample 75% (30) were male respondents where female respondents were only 25% (10). The gender wise participation percentage of respondents of study area has been presented in the pie-chart below:

**Figure 4.2: Gender Wise Distribution of Respondents**



From this chart, we conclude that female participation is still less than male. And it's obviously male dominated society of Nepal. The prime reasons behind this are lack of education and empowerment campaigns targeted to women.

#### **4.1.4 Caste of Survey Households**

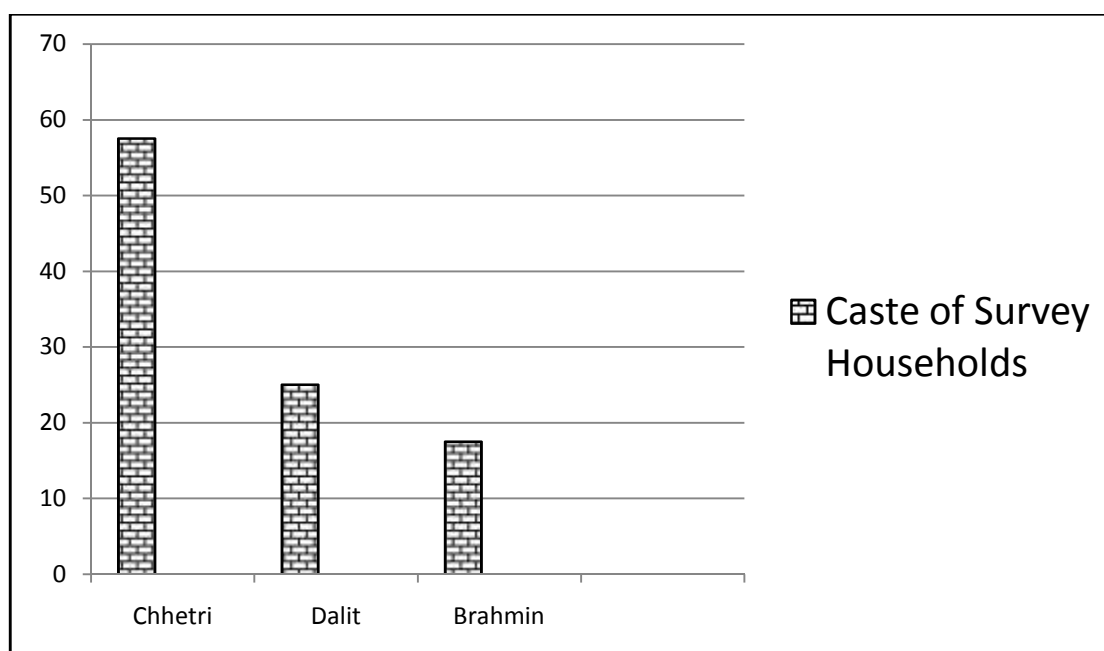
Heterogeneity and multiplicity are the figures of the study area. Various castes like Brahmin, Chhetri and Dalit are in existence in the villages. Among the total population of the study area, Chhetri is the dominant caste followed by Dalit and Brahmins with the least population. Baitadeli is the common communicative dialect of all castes. The table 4.3 shows the distribution of respondents by caste.

**Table 4.2: Caste of Survey Households**

Cast	Frequency	Percent	Cumulative Percent
Chhetri	23	57.5	57.5
Dalit	10	25	82.5
Brahmin	7	17.5	100
Total	40	100	

**Source: Field Survey, 2016**

**Figure 4.3: Caste of Survey Households**



Out of total 40 households, the highest portion, 57.5% respondents are Chhetri, Dalit and Brahmin respondents are only 25% and 17.5 respectively.

#### **4.1.5 Change in Living Standard**

The modern facilities mostly affects in human beings. After using such facilities it is expected that there most change in living standard of human. Actually living standard refers to the higher living. The table 4.1 shows that aggregate status of living standard after electrical facility.

**Table 4.3: Change in Living Standard after Electricity**

Status	Number	Percent
Changed	37	92.5
Not changed	1	2.5
Neutral	2	5

**Source: Field Survey, 2016**

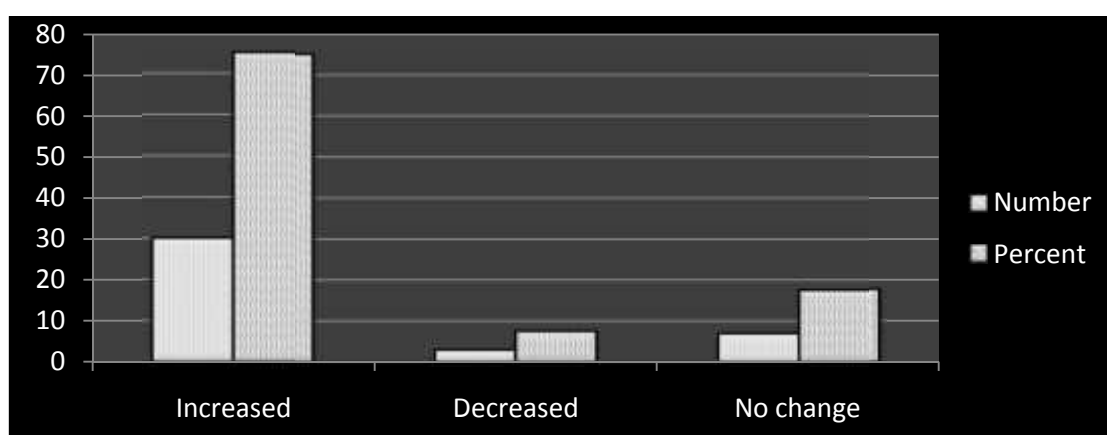
It is expected that modern facility like electricity may affect in human life style. So, this table shows the status of living standard of respondents. The question was asked to respondents that have their living standard been changed or not, after the MHP. All respondents i.e. 92% reported that living standard has been changed after the MHP. In addition, it is proved that electricity is one of the most affecting factors that help to change living standard of people.

#### **4.1.6 Status of Family income**

**Table 4.4: Status of Family Income after Having Electricity**

Status	Number	Percent
Increased	30	75
Decreased	3	7.5
No changed	7	17.5
Total	40	100

**Figure 4.4: Status of Family Income after Having Electricity**



The table shows that the status of family income of respondents, out of 40 respondents' highest portion i.e. 30 reported that their family income has increased. Among 40 respondents only 3 reported their family income decreased after using electricity and remaining 7 respondents reported that their family income is in neutral situation.

To sum up, those respondents who have able to use the electricity properly, who have sufficient knowledge and ways about electricity facilities, and they have been able to increase their family income. Those people who have credit of loan when interested in MHP, they reported that their family income decreased. Some of the respondents' income neither increased nor decreased.

#### **4.1.7 Main Income sources of Households**

Agriculture, service, foreign employment etc. are the main occupations/income sources of the survey households. Other occupations include daily wage and business. The main incomes source of households in the study area is shown in the table below:

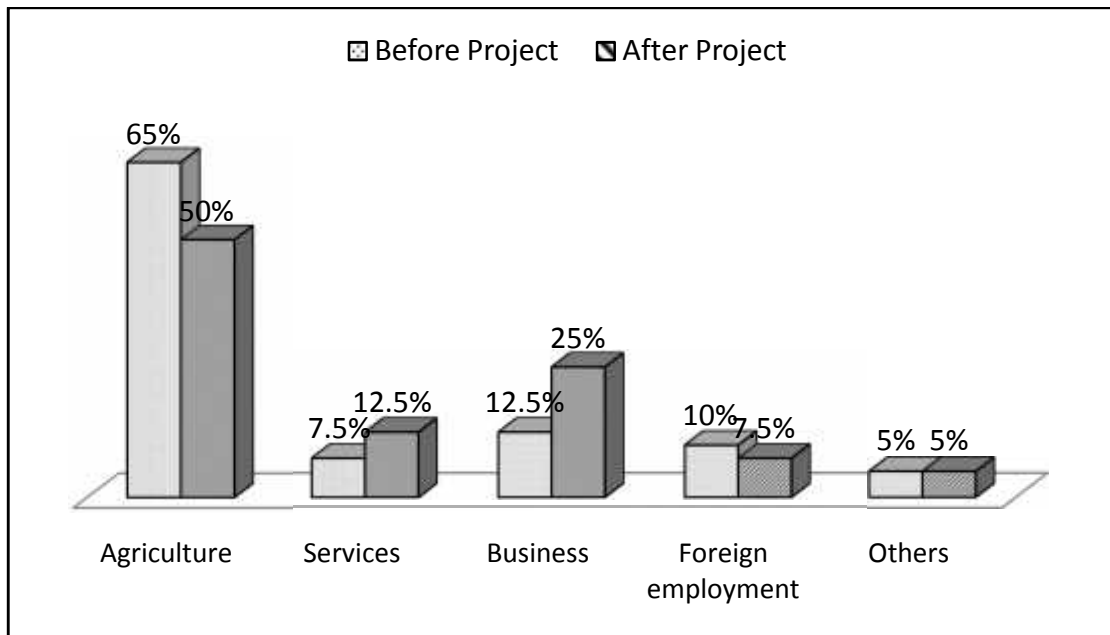
**Table 4.5: Main Income Sources of Households**

<b>Income Sources</b>	<b>Before Project</b>		<b>After Project</b>	
	<b>Frequency</b>	<b>Percentage</b>	<b>Frequency</b>	<b>Percentage</b>
Agriculture	26	65	20	50
Services	3	7.5	5	12.5
Business	5	12.5	10	25
Foreign Employment	4	10	3	7.5
Others	2	5	2	5
Total	40	100	40	100

**Source: Field Survey, 2016**



**Figure 4.5: Main Income Sources of Households**



As per the survey results, major income source of study before project seems to be agriculture(65%) while other income sources include services(7.5%), business(12.5%), foreign employment(10%) and other income sources(5%).Slight changes have been found in the income sources of project affected families after the implementing the project i.e Agriculture(50%), Services(12.5%), Business(25%), Foreign employment(7.5%) and other income sources(5%) have been found. The study before and after the project shows that their financial habits are affected by the agriculture. The community is based on agriculture.

#### **4.1.8 Change in Health**

It is said that ‘Health is Wealth’ when people are healthy then they can contribute a lot for the development of the nation. The health condition of the individual can be decreased because of various factors such as the improper use of traditional source of energy can also be harmful for the health of people. Electricity can play vital role for the improvements of the health of the people as it helps to treat the patients at the time of illness as it helps to run different machineries which are used for the treatment. So, the following table shows about health condition in the survey area.

**Table 4.6: Health Condition**

<b>Status</b>	<b>Number</b>	<b>Percent</b>
Positive	37	92.5
Negative	-	-
No change	3	7.5

**Source: Field Survey, 2016**

The above table shows the facts that 92.5% respondents reported that they have felt positive change, none of the people felt negative change and 7.5% people felt no change in health after the establishment of MHP.

#### **4.1.9 Irrigation Facility**

Irrigation is known as the important factor for farming. There is no chance of maximum production of crops in the absence of irrigation. The study area is located in a region surrounded by mountains like a valley having tributary of streams flowing within this region. It is attempted to find out that either there is facility of irrigation or not.

**Table 4.7: Situation of Irrigation Facility in Farm**

<b>Irrigation</b>	<b>Number</b>	<b>Percent</b>
Yes	35	87.5
No	5	12.5

**Source: Field Survey, 2016**

The above table shows that the availability or situation of irrigation in study area. Out of 40 respondents, maximum number i.e.87.5% respondents reported that they have irrigation facility in their farmland; remaining only 12.5% respondents are out of irrigation facility because they have no farmland only they are living there for business purpose.

To sum up, irrigation is necessary to produce sufficient crops and other agri sources but in absence of irrigation facility there is lower productivity. There is no irrigation facility in hilly regions which may also affects negatively in socio-economic status.

#### **4.1.10 Effect in Drinking Water**

Some of the construction may affects on different sectors. Electricity is nearest to water. Therefore, it may affects on drinking water on some places but not everywhere. This table 5.5 presents the situation that what is the effects of projects in drinking water supply.

**Table 4.8: Effects of Project on Drinking Water Supply**

<b>Effects</b>	<b>Number</b>	<b>Percent</b>
Yes	2	5
No	38	95
Total	40	100

**Source: Field Survey, 2016**

Out of 40 respondents, maximum portion i.e.95% reported that the project has no effect on drinking water. Similarly, 5% reported that the project has affected the drinking water supply.

#### **4.1.11 Status of Education**

Nepal is stated as the second position with reference to water resources in the world. Most of the rural areas of Nepal have been dark at the night. People have been using kerosene and burning firewood for light. By this situation schooling aged generation is mostly affected. It is attempted to find out that what the status of the student's education is after electricity. The following table shows the status of education after electricity.

**Table 4.9: Status of Students' Education after Electricity**

Status	Number	Percent
Improved	36	90
Not Improved	1	2.5
Unknown	3	7.5
Total	40	100

Out of 40 respondents 90% of them reported that educational status of their children is improved. Lowest proportion i.e. 2.5% respondents reported that their children's educational status is not improved and 7.5% respondents were unknown about the educational status of their children.

In addition, most of the guardians of schooling children found that their children have been studying at the night time using electricity by this time. It can be concluded that most of the student's education is improved after generating electricity.

#### **4.1.12 Environmental Degradation**

There are different types of pollution that degrades environment. In this study it is attempted to find out the status of environmental degradation regarding if there is any kind of pollution after MHP or not. The following table i.e. 5.7 shows the status of environment after MHP.

**Table 4.10: Environmental Degradation**

Degradation	Number	Percent
Yes	6	15
No	34	85
Total	40	100

**Source: Field Survey, 2016**

The development of different infrastructure may invite environmental degradation and pollution. In this situation a question was asked either there is environmental degradation or not in the rural area. In addition to this out of 40 respondents 85%

reported that there is no environmental degradation and remaining 15% respondents reported that there is environmental pollution due to this micro hydropower.

In conclusion, it is found that there is minor environmental degradation during the construction of this MHP as it invites different sorts of natural disaster like landslide, soil erosion etc.

## **4.2 Attitude of Community People towards MHP**

The chapter four is divided in to three sections according to objectives. In this sub chapter or section it is attempted to find out the thinking feeling and vision of the community towards MHP. What kind of mind making with respondents for MHP related data or tabulated and analyzed.

### **4.2.1 Effects in Social and Cultural Aspects**

The invention of new technology can affect directly and indirectly in different sectors. The electricity is also known as modern technology in rural area of Nepal. The table 5.8 shows the effects of MHP in social and cultural aspects in rural area.

**Table 4.11: Effects in Social and Cultural Aspects after Electricity**

<b>Effects</b>	<b>Number</b>	<b>Percent</b>
Positive	25	62.5
Negative	15	37.5
Total	40	100

**Source: Field Survey, 2016**

Among 40 respondents the highest proportion i.e.62.5% respondents reported that there is positive effects on social and cultural aspects andthe lowest proportion i.e. 37.5% respondent reported that there is negative effects on social and cultural aspects in rural areas.

In addition, modern services directly and indirectly affect traditional attitudes, eating, speaking, clothing and behavior. So MHP has also affected the social and cultural aspects negatively or positively.

#### 4.2.2 Effects in Livelihood

Rural area is inhabited by the people of different caste, culture, tradition and occupation. So, different people may have involved in different occupations and professions like farming, business, agriculture, teaching and so on for their livelihood. The invention of modern technology may affect their source of livelihood. As electricity is also known as modern technology it has also some effects on the livelihood of the people. The following table 5.9 shows the effects of electricity on livelihood of the people in rural area.

**Table 4.12: Effects on Livelihood after Electricity**

Effects	Number	Percent
Change in Business	5	12.5
Change in Agriculture	-	
Change in Health	33	82.5
No change	2	5
Total	40	100

**Source: Field survey, 2016**

Among 40 respondents highest proportion i.e. 82.5% respondents reported that there is change in their health condition after the introduction of electricity, 12.5% respondents have change in their business, but only 5% respondents have been answered that there is no change in their livelihood due to electricity. None of the respondents answered that there is change in agriculture.

In addition, it can be concluded that electricity generation has helped in the livelihood of the people if we utilized electricity properly.

### 4.2.3 Satisfaction of the Community People

All the development activities in the community are done by for the people. So, all the people have equal right to take the advantage from such activities /work. But because of the some factors people may have taken more profit and some may be marginalized from such facilities. The person who has got proper access to the project may be satisfied and who has not proper access they may be unsatisfied. The following table shows the satisfaction and dissatisfaction of the community people to this MHP.

**Table 4.13: Satisfaction of the Community People to Electricity**

<b>Opinion</b>	<b>Number</b>	<b>Percent</b>
Satisfied	33	82.5
Unsatisfied	7	17.5
Total	40	100

**Source: Field Survey, 2016**

In order to know about the opinion of the community people about their satisfaction from this MHP a question was asked to 40 respondents among which 82.5% respondents reported that they are highly satisfied with this MHP and the lowest proportion i.e. 17.5% respondents reported that they are not satisfied.

### 4.2.4 Effects in Health

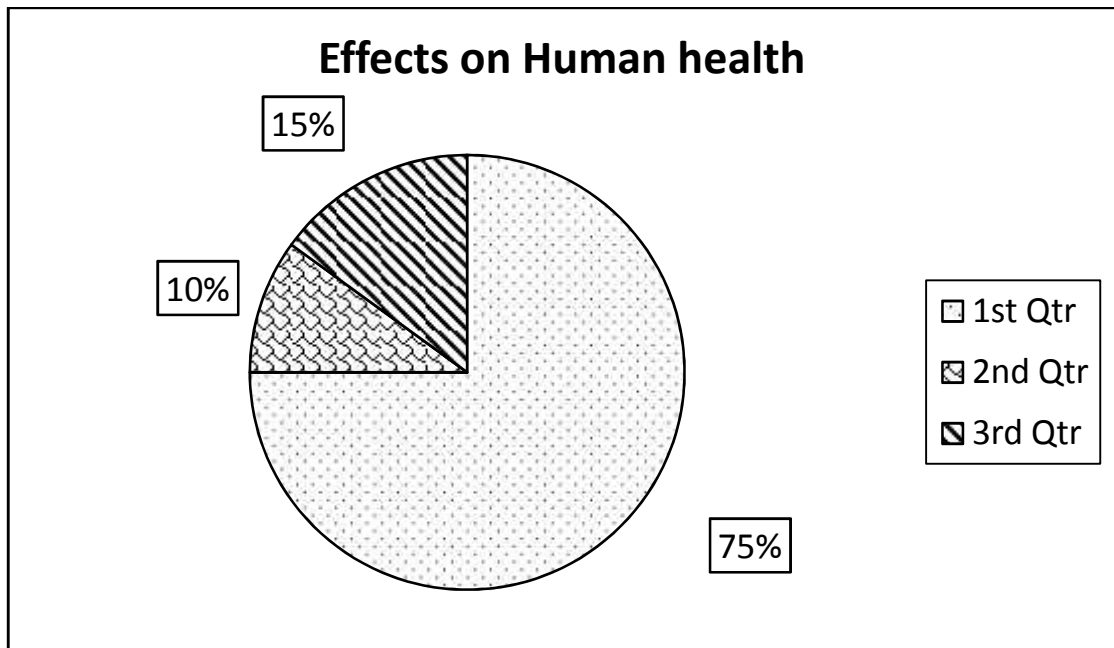
Effects of MHP in human health may be positive and negative both. It is attempted to find out how many respondents positively and negatively affected by this MHP with reference to human health.

**Table 4.14: Effects of Project on Human Health**

<b>Effects</b>	<b>Number</b>	<b>Percent</b>
Positive	30	75
Negative	4	10
Not change	6	15
Total	40	100

**Source: Field Survey, 2016**

**Figure 4.6: Effects of Project on Human Health**



The table and the above pie chart present the effects on human health. Out of total 40 respondents maximum percent i.e. 75% reported that the electricity has occurred positive effects on human health. Minimum proportion i.e. 10% reported that there is negative effects and 15% reported that neither there is positive nor negative change on their health.

To sum up, people of rural areas have been mostly using the firewood and kerosene for lighting or lamp. After the MHP people have drawn up the use of kerosene and firewood as lamp then they are far away from such types of smoking and feeling easy and healthy.

#### **4.2.5 Attitude of Women**

Women are backward in our society with reference to every issue. They are not given priority in different sectors. Men and women are known as two wheel of a same cart but it is limited only in saying not in reality. It is attempted to find out the attitude of women towards the MHP and use of electricity by a question positive, negatives alternatives.



**Table 4.15: Attitude of Women towards MHP**

<b>Attitude</b>	<b>Number</b>	<b>Percent</b>
Positive	37	92.5
Negative	3	7.5

**Source: Field Survey, 2016**

The above table shows that the attitude of women towards the MHP and use of electricity. Out of 40 respondents the highest proportion i.e. 92.5% reported that they have positive and remaining 7.5% respondents have negative attitude towards the MHP and use of electricity.

#### **4.2.6 Effects on Bio-Diversity**

To do any constructional activities we have to go against the rule of nature at that time we have to make the maximum use of natural resources that leads towards the decline of bio-diversity. In order to know about the effects on bio-diversity during the construction of this MHP a question was asked to 40 respondents whose response is mentioned in the following table.

**Table 4.16: Effects on Bio-diversity**

<b>Effects</b>	<b>Number</b>	<b>Percent</b>
Yes	4	10
No	36	90
Total	40	100

Source: Field Survey, 2016

Among 40 respondents the highest proportion i.e. 90% respondents reported that bio-diversity is not affected and the remaining 10% reported that there is effect on bio-diversity due to the MHP project.

In addition it can be concluded that because of the establishment of MHP the bio-diversity is not much affected as it disturbs the lifestyle of water animal.

### 4.3 Sustainability of MHP

The invention is anything is not better itself, but also repairing and maintenance should be necessary. There is not worth of construction in the absence of sustainability. For this purpose this third of chapter four includes the ways of sustainability of MHP in rural area. What kind of methods and ways should be implemented for maintenance, which is must be responsible for operation and maintenance, here is attempted to explain the ways of sustainability. Related data are tabulate and analyzed respectively.

#### 4.3.1 Responsibility of Community People for the Sustainability

For the sustainability of any constructional work there is a big hand of community people. In the absence of active efforts of community people no construction work can be long lasting following table shows that either the community people are responsible for the sustainability of MHP.

**Table 4.17: Responsibility of Community People**

<b>Responsibility</b>	<b>Number</b>	<b>Percent %</b>
Yes	37	92.5
No	3	7.5
Total	40	100

**Source: Field Survey, 2016**

Among 40 respondents the highest proportion of i.e. 92.5% reported that they themselves are responsible and remaining 7.5% reported that they are not responsible for the sustainability of the MHP.

#### 4.3.2 Access of Community People towards MHP

Development works are done for the community people. If there is not proper access of all community people towards such development work then the sustainability of

such work cannot be long lasting. So, for the durability of such development work there should be the proper access of all community people. The following table shows the access of community people to use electricity.

**Table 4.18: Access of Community People to use Electricity**

Access	Number	Percent %
Yes	32	80
No	8	20
Total	40	100

**Source: Field Survey, 2016**

Among 40 respondents the highest proportion i.e. 80% reported that they have proper access to use electricity and remaining 20% reported that they have not got the proper access to use electricity.

In addition we can conclude that there must be the proper access of all community people for the sustainability of MHP.

#### **4.3.3 Ownership of MHP**

For the smooth conduction of any project there must be the ownership. The development work cannot be durable in the absence of ownership. Thus the following table shows the ownership of this MHP

**Table 4.19: Ownership of the MHP**

Ownership	Number	Percent %
Community	10	25
NGO	25	62.5
INGO	5	12.5
Total	40	100

**Source: Field Survey,2016**

Regarding the ownership of this MHP the highest proportion i.e. 62.5% reported that there is a ownership of NGO (REDP Baitadi). Likewise 25% reported that there is the ownership of community people and remaining 12.5% reported that there is the INGO's ownership.

#### **4.3.4 Availability of Skilled Manpower**

The sustainability of the project depends on the availability of skilled manpower. If there is the availability of skilled manpower then the sustainability of the project can be extended. Table 5.17 shows the availability of skilled manpower.

**Table 4.20: Availability of Skilled Manpower**

<b>Skilled Manpower</b>	<b>Number</b>	<b>Percent %</b>
Yes	36	90
No	4	10
Total	40	100

**Source: Field Survey,2016**

Among 40 respondents of the study area the highest proportion i.e. 90% reported that there is the availability of the skilled manpower and remaining 10% reported that there is not availability of skilled manpower.

In conclusion, we can say that there must be the availability of skilled manpower for the smooth conduction and sustainability of any project.

#### **4.3.5 Equal Participation**

Equal participation refers to the proper participation of both male and female in the maintenance of any project. But in the context of our society women are given less importance in each and every sector. If there is not equal participation of people belong to different class, gender and caste then the sustainability of any project cannot be imagined. It is attempted to find out the equal participation in the maintenance and use of electricity by a question yes, No.

**Table 4.21: Equal Participation**

<b>Equal Participation</b>	<b>Number</b>	<b>Percent</b>
Yes	26	65
No	14	35
Total	40	100

**Source: Field Survey,2016**

The above table shows the highest proportion i.e. 65% reported that there is equal participation in the use and maintenance of MHP and remaining 35% reported that there is not equal participation in the maintenance and use of electricity.

To sum up, equal opportunity and participation is necessary in the maintenance and use of electricity. Due to the lack of awareness and traditional thinking women's participation is constituted in low proportion.

#### **4.3.6 Stakeholders of the MHP**

The major responsibility of stakeholder is to maintain, invest for the sustainability of the project. In this study it is attempted to find out the stakeholder of the MHP.

**Table 4.22: Stakeholders of the MHP**

<b>Stakeholders</b>	<b>Number</b>	<b>Percent</b>
VDC	4	10
Local government	6	15
All	30	75
Total	40	100

**Source: Field Survey, 2016**

The table presents the stakeholders for the maintenance and investment. Among 40 respondents the highest proportion i.e. 75% respondents reported that there is stakeholder ship of all local bodies, 15% local government and 10% stakeholder ship goes to VDC.

### 4.3.7 Proper use of Electricity

The durability and sustainability of project depends on the proper use of electricity. Proper use refers to the right use of electricity in different sectors like factory, at home and for the developmental work. The following table shows the proper use of electricity.

**Table 4.23: Proper Use of Electricity**

<b>Proper use</b>	<b>Number</b>	<b>Percent</b>
Yes	16	40
No	14	60
<b>Total</b>	40	100

**Source: Field Survey, 2016**

Regarding the proper use of electricity a question was asked to 40 respondents among which 40% reported that there is the proper use of electricity and remaining 60% reported that there is not the proper use of electricity.

## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Summary

Energy is extremely important component in the development process for providing social and economic benefits to the people. It remains an essential ingredient of human progress and prosperity. Rural electrification is envisioned as a catalyst for socio-economic development of rural areas. Despite the country's huge hydropower potential, rural people are compelled to live in darkness. Low load factor, very limited use of electricity, lack of infrastructure and scattered settlement mean that electrification through grid extension is not a profitable venture for NEA and hence it is resistant to extend its grid to such areas. However a large number of small rivers and streams in such locations imply that enough electricity could be generated on smaller scale to meet the energy demands of the scattered hilly rural areas. Such decentralized production of power is also in harmony with the subsistence nature of rural economies, which tend to be self-sufficient in basic needs. Hence, such production of power can spread the benefits to isolated rural communities. Nepal has occupied the second position in the field of the water resource in the world. The feasibility is shown there may be the possibility of 83,000 MW electricity but now a day's load shading is seen as burning issue in Nepal. In this complex context lower power MHP may be noteworthy in the rural area of Nepal.

Micro-Hydro power plants having a capacity less than 100 KW are classified as Micro-Hydro. The factors that have contributed to the development of Micro-Hydro programs to its present stage are the relatively low cost of investment, short construction of time periods, indigenous technology and simple operation of the plant.

The Haat VDC site was chosen for the study so as to ascertain and discuss about the socio-economic impacts, beneficial and adverse impacts of a community-owned MHP. REDC has played a key role in the facilitation of the technology in this village

by involvement with the DDC, VDC and other agencies. Hence, to analyze the effectiveness of a community owned MHP.

Multiple approaches were adopted to study the effects and impacts of MHP. The literatures on micro-Hydro project and also the policies, programs and plans were exhaustively reviewed.

This is a descriptive study designed to find out the socio- economic and environment impact of micro hydro project of hat VDC Baitadi.

The study of the village showed that the majority of the villagers are happy with the newly installed MHP. However, they expressed the present level of tariff is high for them. The frequent interruption in power supply due to technical problems and the inefficiency of the operators made them suspicious about the long term sustainability of the plant. The villagers also expressed their interest to diversify the end use of electricity through pump irrigation and starting various new income generation activities. One of the salient features of this MHP is that each households shares an equal amount of power and pay equal tariff.

This study conducted from the direct interview method among 40 respondents those respondents were selected by random selection the major findings of study are as follows:

Proportion of chhetri caste is found highest 60% i.e. in study area. The living standard of 92.5% respondents has changed after electricity. The highest proportion of respondents i.e. 92.5% reported that there is the positive change in health .75% respondents reported that their family income is increased after electricity. Most of the respondents reported that there is enough facility of irrigation in the research area. 95% respondents have reported that the drinking water supply is not affected after electricity. 90% respondents have reported that the education status of their children has been improved.

85% respondents have reported that there is not environmental degradation after electricity. The highest percentage of respondents 62.5% reported that the MHP affected the social and cultural aspect positively. 82.5% respondents are satisfied with



electricity. 65 % respondents reported that there is the equal participation of women. The highest percentage of respondents i.e. 90% reported that the biodiversity is not affected after MHP. The maximum percentage of respondents i.e. 62.5% reported that there is the ownership of NGO (REDP). The 40% respondents reported that the electricity is properly utilized.

## **5.2 Conclusion**

Lower scale MHP may be most useful in rural and remote area. There is sufficient feasibility of such types of lower scale MHP but neither governmental nor private sector's vision goes there.

With regard to Baggad MHP, there is sufficient and quite reliable supply of water in the stream. Although, villagers are not quite satisfied with the tariff, they are very happy with the electrification of the village and take it as a source of prestige for the village.

Although REDC has played a facilitative role in the establishment of the plant. Plant is owned, operated and managed by the community themselves. Hence every decision regarding the power distribution, price setting etc. is taken care by the villagers themselves. The involvement of male and female from each household in the community organization (CO) makes this plant even more unique than the others.

The lack of proper technical knowledge among the operators as well as the frequent technical problem in the plant is a source of concern. It takes long time to maintenance of the plant. Frequent interruptions in electricity supply have hampered the daily lives of the villagers. There is no visible effect on the reduction in the consumption of fuel wood among villagers, although it has reduced the kerosene and dry cell consumption.

Baitadi district is known as main place of ethnic diversity which is presented by Brahmin, Chhetri and Dalit. Electricity is closely related with the human life therefore all respondents' living standard has been changed after MHP. After the electricity facility most of the respondents' family income is increased. In rural areas, farming and keeping livestock is main occupation but the respondents have not been able to

meet their annual food needs by that occupation. There is needed irrigation facility in the study area. After electricity facility students have been using evening time for study therefore it is found that the education status of student is improved.

The origin of drinking water and MHP used water is in different places. So the project has not affected in drinking water in most the study area. To make the MHP sustainable, repair and maintenance and operation schedule is prepared in power house. Regarding equal participation of men and women is not found for the maintenance and use of electricity in many parts of the study area.

### **5.3 Recommendations**

On the basis of the analysis of the study, many problems like lack of proper maintenance of the hydro power infrastructures on time due to the inadequacy of skilled manpower, unavailability of power to economically backward population due to the high tariff rate of electricity per unit, unequal gender participation, insufficient funds for repair and replacement of worn out parts of hydropower, etc. To address these problems, following recommendations are to be followed:-

- ) Appointment of required skilled manpower for proper and timely maintenance of the hydropower.
- ) The users must be motivated for proper management of power plant.
- ) High tariff rate per unit should be reduced to such level that it could easily be available to economically backward population.
- ) Proper funding for maintenance and repair.
- ) Coordination between different facilitating and implementing agencies need to be established to minimize the cost, overlap, conflict and to avoid similar mistakes.
- ) Monitoring and backstopping of MHP plants should be done regularly.
- ) Motivation of operators and supports to provide them additional trainings.
- ) Equal participation of every related sectors for efficient management.
- ) The log books should be kept for the plant, the databases must be maintained on various aspects like problems, solutions, duration of use etc.

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**ANNEX-I**

**The Study of Socioeconomic Impact of BMHP**

**(Only for Project Affected Family Users of BMHP)**

**Survey House Questionnaire**

**1. General Information**

a) Name of the household head.....

b) Sex:

i) Male .....ii) Female.....

c) Age .....

d) Total no. of family members:.....

e) Caste

i) Brahmin..... ii) Chhetri .....

iii) Dalit..... iv) others.....

f) Religion

i) Hindu.....ii) Buddhist..... Others.....

g) Educational Level:.....

h) Relationship with the household head .....

## **Socio-economic and Environmental Impact of Bagagad Micro Hydropower Project**

### **Objective-I**

#### **To Study the Socio-economic and Environmental Impact of Bagagad Micro Hydropower Project**

1. Which is the main source of Energy in your family?
  1. Traditional energy
    - i) Fuel wood..... ii) animal waste..... iii) other.....
    - ii) Alternative energy
      - i) Bio-gas..... ii) Electricity.....
      - iii) Solar home system.....
  2. Have your living standard been changed after this micro hydropower?
    - i) Changed..... ii) Not changed..... iii) Neutral.....
  3. What is the status of your family income after having electricity?
    - i) Increased..... ii) Decreased..... iii) No changed.....
  4. What kind of change occurred on your health after the project being implemented?
    - i) Positive ..... ii) Negative..... iii) No change.....
  5. Is there irrigation facility in your farmland?
    - i) Yes ..... ii) No.....
  6. Is the project affected to drinking water supplies?
    - i) Yes ..... ii) No.....

7. What is the educational status of your children after this micro hydropower ?

i) Improved..... ii) Not improved..... iii) Unknown.....

8. Have you felt any environmental degradation after the establishment of this micro hydropower ?

i) Yes ..... ii) No.....

9. What is your main source of income?

i) Agriculture..... ii) Business.....

iii) Service..... iv) Foreign employment.....

v) Others.....

## Objective-II

### To Find out the Attitude of Community People towards BagagadMicrohydropower Project

1. What effects have you felt in social and cultural aspects after this project ?  
i) Positive..... ii) Negative.....
2. What effects have been occurred in the livelihood from this project ?  
i) Change in business ..... ii) Change in agriculture.....  
iii) Change in health ..... iv) No change.....
3. Are you satisfied with this micro hydro project ?  
i) Satisfied..... ii) Not satisfied.....
4. What sorts of effects have been occurred in the health aspects of community?  
People?  
i) Positive ..... ii) Negative .....
5. What is the attitude of women for the utilization of electricity ?  
i) Positive ..... ii) Negative .....
6. What is your attitude towards this hydropower project ?  
i) Positive ..... ii) Negative .....
7. Does your micro hydropower project affect the bio diversity ?  
i) Yes ..... ii) No.....



### Objectives- III

#### To Study the Sustainability of Micro hydropower Project in Rural Areas

1. Are you equally responsible for the sustainability of this hydropower project?  
i) Yes ..... ii) No.....
2. Do all the people of this community have proper access to use electricity?  
i) Yes ..... ii) No.....
3. Under whose ownership is this micro hydro project running?  
i) Community..... ii) NGO.....  
iii) INGO..... iv) An individual ownership.....
4. Are there some skilled manpower to manage the project for its sustainability?  
i) Yes ..... ii) No.....
5. Is there an equal participation of both male and female for the sustainability of this hydropower ?  
i) Yes ..... ii) No.....
6. Who are the stakeholders of this micro hydro power project?  
i) VDC..... ii) DDC.....  
iii) Local government ..... iv) All.....
7. Is there any transparent policy made for the repairing and renovating if damaged?  
i) Yes ..... ii) No.....
8. Is electricity produced by this hydropower is utilized properly?  
i) Yes ..... ii) No.....

## **ANNEX-II**

### **Key Informant Interview**

1. When did you establish this micro hydro power?
2. What is the electricity producing capacity of this micro hydro power?
3. How many people are facilitated by this hydropower project?
4. Who encouraged you to establish this micro hydro powerproject?
5. Where do you use the money collected from the consumers?
6. Are there any misunderstanding or disputes created among the people regarding the distribution of electricity?
7. What challenges have faced for the sustainability of this hydro power-project?
8. What types of technologies are adopted after the establishment of this micro hydropower?