

# CHAPTER I

## INTRODUCTION

### 1.1 Background of the Study

Any form of energy is of great importance for development of a nation. Energy is necessary for us as fuel for cooking and transportation, infrastructure development, and to do any sort of activities even only for our survival. Peoples are using energy from the origin of human beings to till now. The sources and form of energy seems varied from time to time. In the very beginning of human race they used to eat their food without cooking, they used to travel on foot from place to place, and they work manually to develop infrastructure that they need. But today's world is vast varied from the ancient one; human has searched, developed and used many forms of energy. Among the various forms of energy hydropower is the most pronounced as white gold as it is pollution less, renewable and cost efficient in the long run.

Nepal is one of the richest countries in the world in terms of water resources having 2.27 percent of total electricity generation capacity of the world. So development of hydro-electricity may be the milestone for economic development of our nation. Theoretically, the potential hydro power capacity is 83,000MW of which only an estimated 43,000 MW deemed commercially exploitable (Kafle, 2005)

Nepal is small mountainous country and about 85% of its area is still rural. Due to its rugged topography development of large hydro-power projects is costly and difficult. So, special rural electrification scheme needs to be adapted to isolated rural communities scattered in the hills all over the nation because electrification through national grid is exceedingly expensive. Today, only 15% of the total population has access to electricity through national grid connection. Due to the consciousness about the negative environment and socio-economic impact of large scale hydropower development, electrification through micro-hydropower emerges as viable for rural electrification in Nepal (NPC, 2002/07).

Solar and wind energy sources are technically complicated and highly expensive, Biogas is suitable only in warm areas. Furthermore, among various available technologies for generation of electricity including solar, biogas and wind Micro Hydro electricity

is the most proven, most reliable and potentially cost effective. Micro hydro systems have been in use in the Nepalese hills for centuries in the form of horizontal water wheels which are traditionally known as "Pani Ghattas". Various kinds of micro-hydro technologies such as propeller turbines, cross flow turbines, pelton wheels, multipurpose power units (MPPU) Peltric sets and improvements in traditional ghatta (water wheels) better system efficiency have been developed in the past to tap water resources more effectively.

The distribution of micro-hydro units is influenced, among other things by proximity to the manufacture, the extent of development of the region, donor support and the availability of electricity from NEA, with the bitter picture of energy, it is clear that hydroelectric power is suitable sources of energy which is non fossil and non polluted. Hydropower is the major component of the Nepalese energy scenario considering all these obstacles. Nepal Government has reduced the socio-economic disparity by giving the importance in the rural electrification through micro hydropower projects. Micro-hydropower system (MHPs) is increasingly adopted in many countries of the world, both developed and developing countries. Hydro-power installation with a total generating capacity of less than 100 KW are classified as micro-hydropower stations which is not necessary to register to the government, and plants between 100KW to 1000KW are called mini-hydro. Other hydropower plants between 1000KW to 10MW are called small hydro and more than 10MW capacities are classified as medium and big hydro.

Dangsing Village Development Committee (VDC) of Kaski district Gandaki zone in western development region of Nepal was selected as the study area. It is located in the hill and mountain region of the country, which is about 45 KM north-west from the headquarter Pokhara of Kaski district which is the headquarter of Gandaaki zone and Western development region as well. Tikhedhunga micro-hydropower project lies in Dangsing VDC ward no 7, Tikhedhunga. It was established in 2054 BS which is generating 40KW electricity. The project was established under the technical and financial support of Annapurna Conservation Area Project (ACAP), a trust for nature conservation.

The project lies in world famous Annapurna Trekking Route so tourism is another main source of income for the people of the project area. Being located in the tourism area the project is also helpful for the tourism development of that area.

## **1.2 Statement of the Problem**

Despite of higher technological advancement in the field of energy generation many developing countries are facing energy problems. The major problems of energy are rising price of fossil fuel, depleting forest resources including environment degradation etc. Nepal is not an exceptional country in this regard. In the Nepalese context solar, water and wind energy have not been fully exploited. High consumption of fuel wood is a traditional sources of energy leading to deforestation which have resulted in to natural disasters such as soil erosion flood, landslides and deforestation etc. Firewood is the most common and traditional source of energy for Nepal. It represents about three fourth of total energy consumption which is manly consume in rural Nepal.

In ruler area people are responsible for 3Cs cooking, caring, cleaning. Mostly cooking is done in fire wood in rural area. Which creates indoor pollution and women and children may suffer from it. In addition lighting objective is being fulfilled by kerosene. Kerosene lamp can create pollution.

Rural people especially women have to spend much of their working hours in collecting fuel woods. Students study hours in affected due to the lack of lighting facilities houses. They may suffer from the eye infection ENT infection etc. Due to the smoke of fuel wood all those problems arise due to the lack of commercial sources of energy which wood negative impact of the human capital formation in the study area. Lack of energy supplied in rural areas as 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 connection or diesel generators is very costly production is available in some countries.

The main focus of the study is on the following question:

1. What are the impacts of hydropower projects in income and employment generation in Dangsing VDC?

2. What are the impacts of hydropower projects on education and health of people in study area?

### **1.3 Objectives of the Study**

The general objectives of the study is to evaluate the socio economic impact of the micro-hydro power projects (MHPs) in uplifting the life standard of the rural people by generating income and employment, to study the management of the MHPs and the specific objectives are as follows:

1. To examine the impact of Tikhedhunga Micro-Hydro Power project on income and employment creation in the study area.
2. To examine impact of micro-hydropower project in health and education in the study area.

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

Hydroelectricity is the most effective and sustainable form of energy in Nepal, as it is outcome of the water resources. However, due to lack of capital, and technical manpower, the mega hydro projects are still not easy and feasible source of energy in Nepal. Further, the electricity generated by large projects has not been sufficient to urban areas though the national grid transmission and distribution is urban centered, hence it is not so helpful to the poverty of rural area. In this context, the MHPs have greater significance to reduce the rural poverty by generating income and employment directly or indirectly. However, one major problem is lack of sustainability of such MHPs, which lessens the effectiveness of such projects after the completion and lead to waste of resources.

The result of the study will be helpful to individuals and institutions for the implementation of the programs in rural areas. It will also be helpful to the existing micro hydropower project to maintain their sustainability. The results of the study will be the useful for the policy makers to formulate policy for the development of micro hydropower in rural area.

### **1.5 Limitation of the Study**

Study of Tikhedhunga micro hydropower project has been taken as a case study. The study focuses on the socio-economic impacts of Thikhedhunga micro hydropower project at the local area and the research has been limited in wards 7 and 8 of Dangsing VDC of Kaski district. The generalization derived from this study may not equally applicable to the other sectors. The field survey is conducted in a single season.

### **1.6 Organization of the Study**

The present study is organized in five chapters. The first chapter is an introductory part of the study covering the background of the study, followed by statement of the problem, objectives of the study, significance of the study and limitations of the study. The second chapter covers the review of some of the theories concerning the literatures related to micro hydropower at national and international level. The third chapter provides a glimpse of the methodology used. The fourth chapter covers the analysis of data. The fifth chapter presents the analysis of the problems and management of MHPs and finally, the fifth chapter presents the summary, conclusions and recommendations.

## CHAPTER II

### REVIEW OF LITERATURE

Study in the rural energy source like micro-hydropower system is a very important topic in the sense that, it required a wide range of literature during the work. Basically, study was carried out on the literature related to the micro-hydropower. The extensive study was carried out in various publications and reports also, which provides various important information related to research work. In the context of the research and development of MHP technology, Nepal is still in its fledgling stage, so there is no adequate study about the role of MHP in rural electrification as well as its socio-economic impact in the rural areas. Perhaps certain government, non-government and private institutions carried out its some studies.

#### 2.1 Review of Literature in International Level

**Brodman (1981)**, in his study “socio-economic impact of rural electrification: Lessons from central java” has depicted the socio-economic impact of Klaten rural hydropower project in Indonesia. This study is primarily based on primary data. This study has found 88 percent of the business in the study area had installed of electricity project, 77 percent of the electricity adopters with school children reported that electricity had caused in increase in their study time, more than 80 percent of respondents said that electricity had made the village safer due to lightening of the village paths, more than 70 percent of electricity adopters and non adopters opined that electricity had benefited them by stimulating night time activity. Business work had increased 11 percent of the interviewed household increases their income by using electricity in their home industries, 33 percent of the business respondent reported that electricity use had developed their business, 50 percent of the business respondents and 43 percent of household respondents said that employment opportunities had increased due to electrification.

Therefore his study has thus concluded that rural electrification is the most viable and most benefited source of energy in rural area. Thus he concluded that Klaten rural hydropower has contributed to enhance the living conditions and expand the capabilities of the people in java in a clean and sustainable way.

**Sarfoh (1990)**, has examined that Africa has the highest potential for hydropower development. It is also behind other regions in developing that potential Sarfoh argue 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 and ignorance of hydro resources and future energy needs. The authors propose remedies a full assessment of present and future energy needs change in fundamental features of the politics and economics of various countries expansions of electricity to rural populations and regional cooperation in hydropower development. The author's observation that "more availability of resources and the advantages which hydroelectric power offers have not as yet induced any appreciable level of hydro-electricity generation" Concisely illustrates the essence of professor Sarfoh's discussion in this book. The author examines the energy consumption practice of West Africans and the potential of several energy resource endowments of the sub region. The further states that only the development of hydropower from West Africa's river systems can satisfy those needs. As domestic sources of energy, hydroelectricity will be cheaper and more accessible than foreign oil and less damaging to the environment than the depletion of forests for firewood. The author implies a relationship between the obstacles to hydropower development and domestic politics and economics while such a relationship might very well exist, the author does not demonstrate it. Sarfoh is less than convincing in his conclusion that hydropower represents the best alternative sources of energy for West African, especially when one conditions the formidable obstacles that outlines. The net result of the obstacles is a significant reduction in hydropower generated, necessitating the closing of some hydropower plants and the purchase of private generators by industries and individuals West Africa's hydropower projects thus become unreliable, inefficient and very costly sources of energy.

**Hora (1996)**, in her thesis she explains that it is technically feasible as well as commercially viable and the most appropriate technology for Nepal indeed, micro hydro-power projects are not sufficient to meet the national demand of electricity on one hand, we have no economic resources, technology and skilled man power to install large scale hydropower project on the other hand, small scale hydropower project can play very important role and other mechanical forms of energy for agro

processing. Furthermore, it is also capable of providing rural electrification to a limited scale.

Hilly topography and enough availability of water resources so the huge potential for micro-hydropower in the country. Micro-hydropower help to reduce the alarming deforestation, import of petroleum products thereby playing a vital role to improve the economic condition of the people. Agriculture Development Bank of Nepal (ADB/N) not only providing loan and subsidies but also providing resources survey, feasibility studies, promotion of manufactures, involvement of technical assistance and training has financed over 90 percent of the private MHPs in Nepal. It may not generate electricity in dry season. Likewise the skilled manpower may not be able available to get it repaired. Sufficient research has not been carried out yet. These are a few problems involved with MHPs.

This study has drawn from an extensive range of methodologies. It varied from selection of appropriate micro-hydro sites; extensive review of literature; preparation of specific approach for the impact assessment on MDG, preparation of checklist and questionnaires; field visits; use of participatory techniques; interviews, base line data, participatory analysis and consultations to gather necessary information.

**ICIMOD (1998)**, Report, has been carried out some case studies on renewable energy technology. Study highlighted the importance of micro-hydropower in terms of reducing drudgery for women, as it reduced the time taken in agro-processing activities and also provided opportunities for women to engage in income-generating activities and literacy classes in the evening. Regarding legislative and regulatory issues, the study highlighted some points. Such as, the water resources act 1996 did not specify the right of prior use of water resources form micro-hydropower projects; the private sector shied away from research activities because of the inadequacy of laws on patent and intellectual property rights lack of formal standardization of procedures and guidelines and resulted in errors in flow measurements and demand estimation at the feasibility study stage of project, as well as negligence regarding safety features in micro-hydropower plants and entrepreneurs often found it difficult to get financial assistance from ADB/N for micro hydro if a diesel mill or other water turbine existed within three kilometers of the vicinity. This has not only affected hydropower development but also created situation of monopolies.



**USAID (2006)**, “Micro-hydropower in Afghanistan: An audit lessons and conclusions” state that the advent of micro hydro installation in Afghanistan can be traced to 1916 in Jubal Saraj of Parwan Province. However, till to-date Afghanistan’s rural energy supply is overwhelmingly dependent on biomass resources such as fuel wood, agricultural residue and animal wastes. It is revealed from literature review and discussions with stakeholders that about 85% of Afghanistan’s energy needs are met by such traditional fuels, having has led to significant lost of tress in the country.

The country’s power grid has been severely damaged by year of war, and less than 10 percent of its population currently has access to electricity, with Kabul, for example, suffering severe power shortages.

Afghanistan’s rugged and difficult topographical terrain coupled with scattered settlements from constraints to connect the rural communities to cost-effective energy services. The best alternative is to develop stand alone systems to meet rural demand.

In the country most of the MHP installation efforts have focused on supply of energy for lighting a typical first step. However, the prevailing approaches to energy use are unsustainable and have imbalanced the indigenous settings of rural livelihood. Energy development is not treated as a multifaceted activity but in fragments, and its integration with irrigation, water supply, agriculture, forestry or small scale cottage industries is not exploited for development.

Based on knowledge gained from the field audit of MHP sites and on information available concerning site development programs of the donor community and other surveys, a number of principals can be concluded from this experience. The purpose in identifying-both bad and good experiences-and apply them in positive way in order to move the MHP development activities along in a sustainable system.

**Uganda (2006)**, also has an enormous potential from its mini-hydro energy resources in non-Nile sites, which have not been fully exploited and can be developed for independent grids to supply power in isolated area of the country. A recent report from Uganda Renewable Energy Association (UREA) shows the some of potential mini-hydro site for development. Hydro resources are abundant in Uganda, especially along the Nile and till date only 320MW capacities of hydro projects have been

installed. At the same time, the electrification level of 25M population is very low with only 1% electrified in rural area.

Under the Electricity Act, 1999, of the Power Sector Reform and Privatization Strategy, the Electricity Regulatory Authority (ERA) was established to regulate generation, transmission, distribution, sale, export, import, and charge rate, terms and conditions of electricity services provided by transmission and distribution companies' investigation. The non-Nile mini-hydro sites are available on about 71 rivers with the total capacity about 200MW. Only a few have been developed for small power supply schemes. Although recent studies indicate that the market for SHP in Uganda is indeed strong, a key concern for Uganda SHP projects will be on the financing aspects.

**Jahidul Islam Razan et.al (2006)**, in their study "A comprehensive study of micro-hydropower plant and its potential in Bangladesh" they have examined the current power crisis of Bangladesh has been discussed. Necessity of exploring energy from alternative sources and impact of micro-hydro as an alternative source has been presented. Since micro-hydropower plant requires terrain and availability of high steam flow rate, so it has a good potential in the north-eastern hilly regions of Bangladesh which is also evident from the presented data. Due to the abundance of rivers and canals, Bangladesh has a god run-off river micro-hydro potential but it is yet to be explored. A primary guideline of economic feasibility and a way of raising necessary fund have been proposed.

No development strategy can be implemented without power. Bangladesh is still very much dependent on fossil fuel for power generation. But the country has limited resources which are likely to be finished very soon. On the top of that, burning of fossil fuels has very negative environmental consequences. Now-a-days, the world is much more concerned than ever before about the environmental degradation caused by the existing pattern of fossil fuel use. As a populous country with small energy resources, our concern is even greater. Proper consideration of parameters to explore potential sites can also inspire the interested individuals and can work as an incentive to establish micro-hydro plant for local use. Due measures of establishing decentralized small-scale water power or micro-hydro schemes can prove it as an effective eco-friendly source of power generation, as international funds for green

energy are available which can be a great appreciation for government to explore this option also.

**Bhutan (2009)**, the Royal Government of Bhutan puts great emphasis on providing electricity to all residents by 2020 and on financing social programmes through revenues from exports of electricity to India. Estimated revenue from hydropower energy exports is to be around at least 30% of total state revenue; and major institutional restructuring in the electricity industry. Today, the power sector programme for rural electrification is gaining momentum. It is geared to meet the aspirations of the rural communities and the Royal Government through electrification by locally generated hydropower and grid-supply extension. Under the 9<sup>th</sup> Five-Year Plan the Government aims to electrify 15,000 rural households, covering all 20 districts of the country. The vision is full electrification of the country by the year 2020.

Electricity empowers communities, resulting in more community activities and strengthening solidarity among members of the community. On the other hand, the socio-economic impact - interpreted from the macro-economic level - is less evident. Community economies are too weak to permit investment in new machinery or equipment that could raise agricultural productivity. Very few farmers can afford to buy new electrically powered rice-mills, for instance. As yet, the impact of rural electrification on the local economies cannot be seen directly, in terms of higher family incomes through the use of new techniques, or greater agricultural productivity - only indirectly: Having more spare time enables the villagers to engage in additional income activities like weaving, kitchen gardening, small services, etc. Electricity is a prerequisite for further investments in the agricultural sector, and that only two years at most had passed since electricity was introduced in these villages. Once the density of monetarization (the actual amount of money circulating in local rural economies) increases, there will be more investments in new machines and technologies. The most vulnerable population is females - of all ages - and they were the ones to suffer the most from various health problems before electrification. Since women do most of the kitchen and food-preparation work, they are the first to benefit from the greatly improved hygiene and sanitation situation at home. Electricity brings new possibilities for education and media use. With the advent of electricity, people have become more exposed to change and new ideas. As the means of communication are changing, with

a 'bigger window' to the outside world - and this is a challenging new situation for the whole of society.

The impact of electrification on the quality and the standard of living in the rural societies is quite high, so that rural electrification is indeed an efficient tool for poverty alleviation. As yet, direct economic impacts - in terms of higher cash income and higher macro-economic productivity - are not visible. It will take time and more monetary investment possibilities before a statistically significant increase in economic productivity can be observed in the agriculture-based communities of rural Bhutan.

**Korkeakoski (2009)**, in her study "impact of Micro-Hydropower (MHP) Based Electrification on Rural Livelihoods: case study of NamMong MHP, Lao PDR" has examined the long term impacts of renewable energy from micro-hydropower on poverty reduction. The main objectives of the study are:

- To examine the short term and long term impacts of electrification on rural livelihoods and
- To find out the villagers experiences from electricity and impacts related to electrification

The study has found that people have felt better and wanted to develop themselves and their surroundings, social status has changed with the introduction of electricity and electrical devices; electricity has enabled access to information and learning and made communication easier within and outside the community. Women and children have less workload, more productive time and choices, when to work, improved status and safety after the electrification. Children have more choices when to study, studying is easier and they have become smarter and more active. Electricity has created choices when to work and given people more productive time especially in the evenings and mornings. Electricity has enabled increase in income through new livelihood activities and by making old livelihood activities carried out easier and quicker, workload and working time have decreased for all. Life has become more convenient, healthy and safe. People have been spending more time on watching TV, interaction among the community members has lessened and cultural ways of

dressing, singing and living have changed especially among teenagers. Community life has benefitted from electrical devices such as TVs, CDs etc.

Further the micro hydropower dam has not negative impacts, but the introduction of electricity has encouraged more people to move into the village, thereby causing less forest resources and fish available and reduction in water quality. Electrification has not improved access to health and education facilities, it has not improved access to market and banking facilities, but has been helpful in preparing products for markets. Access to information and knowledge has improved. Access to new activities and income generation has also improved.

**Francine (2010)**, in his book “sustainable development with micro hydro scheme in remote areas in the Amazon region” it was possible to prove that micro-hydro schemes can be successfully installed in unelectrified remote areas in Brazil, providing electrify for isolated communities or substituting diesel generators that are not cost-effective and emit carbon dioxides. This study was able to demonstrate that Brazil still has thousands of communities without access to electricity that could benefit from hydropower in small scale and that this option is for more advantageous than the diesel generators.

The pilot projects show us that the intervention needs to go beyond the energy supply, incorporating a broader scope that includes the community’s welfare and allow is success in the long term. The inhabitants need to have educational support to understand and embrace the program as their own. Their economic activities need to be stimulated or improved to complement their incomes so they can afford to pay for the electricity or some kind of subsidy needs to be given.

It is very important to note that in all the successful projects, the community has a strong sense of ownership or an external sponsorship, which keeps the projects working partially or entirely, independently from the planning or management plan that was established previously. The unsuccessful projects haven’t made a planning that contemplates the time after installation and initial operation and haven’t involved the community in the projects community. Consequently, there were no local leaderships to assume and carry on the “business” after it started to work.

In the specific case of the Amazon communities, it is vital to fix the inhabitants in their sites and preserve their traditions and culture, adapting their lifestyle with the electricity supply and generating a sustainable and environmental friendly growth. This study was able to show the micro hydro units are eligible to be approved in the clean development mechanism scheme, saving carbon emissions that would be generated if diesel units were used to supply electricity in remote area in Brazil.

## **2.2 Review of Literature in National Level**

**East Consult (1990)**, in the study report “Socio-economic impact evaluation of the MHP schemes in rural communities of Nepal” has examined the study especially reports to the evaluation of micro-hydro power, its socially acceptance and economic viability. It encompasses many studies areas of micro-hydropower. But it especially focuses to the investigation on such questions like who are the real beneficiaries and to what extent do those get benefit. This study is interested to know the constraints prevailed in rural energy. It also keeps the interest to finding the answer of the question who gets the access to the rural lighting and why? This study was conducted in Turture of Tanahun district Karmasingsh of Ghorkha, Buling Arkhala of Nawalparasi, Karputar of Lamjung, Arghali of Dolpa and Karnali of Baglung district.

This study has been centered to the socio-economic evaluation of the impact of private and community owned micro-hydro schemes on members of rural communities who are not the owners of micro-hydro schemes. It focuses to the target groups and aims to enhance the knowledge about relationship between nature and MHP scheme. The objectives of the study are to examine the characteristics and perception of those local people who are benefited by micro-hydro. It especially examines the satisfaction / dissatisfaction ratio of micro-hydro power users and tries to recommend for action to maximize the benefit to the rural poor. It also tries to establish the indicators for monitoring the effects of any such actions.

According to the finding of the study, the viability of this technology under the set of technical and social circumstances, which prevails in perceived benefit, accrues to the mill owner as well as the community. It reveals that; in one hand, agro-processing makes positives impact on community saving the drudgery, especially to women and in other hand, it is not effective to the case starved people. It says it is not fully beneficial where the time is consumed by the transportation to mill and waiting,

although it depends upon the located area of mill from the settlements. The study indicates that only one or two percent of the customers make payment in kind for the service of the mills who cannot afford the cash payment. But about (3 to 8%) of village inhabitants are poorest, of the poor in most of rural areas of Nepal who do not use, the mills even with payment in kind because they do not have such affordability also. It further indicates that except the oil processing kol, the traditional agro-processing mills, such as Dhiki and Janto have not been replaced at all because this turbine mills have not yet been able to reduce the risk reliance of the community in comparison with traditional sustainable practices. The study has concluded further that micro hydro schemes could play an important role as a viable source of energy in the rural area by providing electricity at low cost, helping to establishment of small rural industries and improving health and educational status of rural people.

**Rijal (1999)**, shows that traditional energy forms predominate in the energy sector in Nepal. About 91 per cent of the total final energy consumption (260 million GJ) in 1994/95 was met by traditional forms of energy such as fuel wood 81 per cent, agricultural residues 4 per cent and animal waste 6 per cent, the rest came from commercial sources such as petroleum products 7 per cent, coal 1 per cent and electricity 1 per cent. There has been little change-in energy transformation over the last decade. The share of traditional energy has declined only marginally, from about 95 per cent in 1984/85 to 91 per cent in 1994/95.

**Upadhaya (2009)**, in his thesis paper “Evaluating the effectiveness of micro-hydropower project in Nepal” submitted in San Jose State University, united state of America. It provides recommendations for developing long-term viable micro-hydro projects in Nepal and elsewhere. In his study investigates the efficacy of community based micro-hydro projects in two remote villages, Luwan Ghalel and Ghandruk, as well as the role of public participation. She explained that, on a technical level, the projects did very well in terms of funding, detailed survey and design, and reliability; they performed poorly in user satisfaction, social stability, sustainable end-use, and tariff collection.

**Karki (2010)**, has evaluated the social and economic impacts of Rupatar micro hydropower, a mini hydropower in eastern Nepal, in the study area and has concluded that the plant has positive impact on health, education, information and

communication, drudgery reduction, income increment and in totally on overall living standard of the people in the study area. His study has shown that the plant has been aid for social and economic upliftment of the study area however, operation and maintenance is a major problem for the plant. So his study has recommended that training should be given to the villagers, preferably to married women, about the operation and maintenance of the plant.

**Gurung (2011)**, in their research paper “Micro-hydropower: A promising decentralized renewable technology and its impact on rural livelihoods” talks about the awareness about the benefits of micro-hydro based electricity has increased among the rural households followed by increasing demand for modern energy technologies in rural parts of Nepal. Improvement in health education, environment and agriculture are some of the pronounced local benefits from MHP projects in rural household. Access to electricity reduces drudgery for women in rural areas allowing them to have enough time to be involved in other household related activities including income-generation and social and community developmental activities. Similarly, electricity lights in rural households extend the day providing additional hours for evening reading and also, reduced drudgery for children in Nepal.

The government of Nepal has initiated the production and distribution of several renewable energy technologies in order to solve the energy problem in rural areas as well as to provide clean and sustainable energy for rural households. Among several renewable technologies, micro-hydropower (MHP) has been one of the most promising and commonly adopted decentralized (off-grids) technologies in Nepal. It also provides economic benefit to the country through reduced deforestation. Thus, MHP is the best technology which provides a renewable, sustainable and clean source of energy to poor rural households in Nepal.

**Singh (2011)**, analyzed the income and employment generation by the project area of Dorgi mini hydro project. The study has analyzed problem associated with the project. The study has concluded the project helps to raise income level of the local people by establishment of new business and drastically saved the expenditure of people on the people on the traditional energy. The health condition of the people in the project area increased sufficiently and people has access to the modern medical equipments due to electricity. Preservation of forest increased sufficiently due to the reduction of



dependency of people on the firewood. The education status of the students has been uplifted due to electricity because they can study more hours in evenings.

**Bhattarai (2012)**, the article entitled “Jalavidyut: aarthik vikas ko mul aadhar” published in vidyut (1012). He analyzed that establishment of hydro power project opens up immense opportunities for social and economic upliftment of the rural communities, if other crucial aspects like- basic road infrastructure for transportation, promotion of Income generation, tourism development rural electrification and small industrial activities based on local resource available in the local area etc develop the rural area of Nepal. This helps to reduce the migration of skilled and non skilled manpower. Therefore, there is no doubt that the hydro electricity is the key of economic development. If there is the sufficient development of hydro electricity it brings the positive changes in all sectors of the economy. He concluded that hydro electricity contributes to sustainable development, rural electrification, industrialization, tourism development etc.

**Regmi (2012)**, analyzed the present condition of Nepalese energy system. The summary conclusions of her finding are there should be need of proper utilization of natural resources like water to achieve the goal of development. By proper harvesting of rest water resource by generating aptly trained man power not only by the formation of new hydro projects but also maintaining and optimizing the existing hydropower plants, which may become panacea to control the wave of problem and has been grossly overlooked for these reasons. The development of hydropower of Nepal has always been dictated by many constraints and conditions. Projects are selected by planning procedure which is deliberately designed to produce a ‘no option’ situation in decision making. It is too late to understand and government that private sector is not capable to develop sufficient hydropower project to satisfy the demand, so, public sector must play a sustainable role for important of hydropower project.

**Kendal (2013)**, in his thesis “Socio-economic impacts of Nunthala Khola micro hydropower project” has evaluated that Nunthala khola micro hydro project has a upbeat impact on enhancement of education status, improvement on health and awareness on information and entrepreneurship of people live in Dhamja VDC as a whole. People gain lighting facilities which helps to increase study more and which

helps to decrease diseases by reducing indoor pollution. He also evaluates that access to information has been increased after the installation of the project.

He analyzed that the percentage of children's improvement on education performance at school and number of women in literacy class has increased significantly after the installation of MHP. He also analyzed MHP also increased entrepreneurship.

**KC (2013)**, in his thesis "Socio-economic Impact of Micro Hydro Power Project, A Case Study of Pachuwakholra Micro Hydroelectricity Project, Kandebash VDC, Baglung" has concluded that lower scale MHP may be most useful in rural and remote areas of our country. There is sufficient feasibility of such types of lower scales MHP. He has analyzed that MHP has positive impact on income and employment. It helps to rise in income and employment by helping in establishment of new businesses. MHP reduces the expenditure on different energy sources like: firewood, kerosene, biogas etc. So, it can be less expensive source of energy in the rural area. Due to the installation of MHP, the health condition also gets improved. The expenditure on health has gone down due to the reduction in the number of respiratory diseases from smoke. People get access to modern medical equipments due to electricity. Before electricity, people have been using maximum firewood as light or lamp and cooking but when MHP established the need of firewood has reduced which has helped to conserve forest. Electricity is closely related with human life therefore all respondent's living standard has been changed after MHP. Electricity supply has extended the social and recreation activities i.e. purchase and use of Tape Recorders, Radio, TV, Refrigerators, Iron, computer, rice cooker etc. The status of sanitation has improved after electricity facility. After electricity facility, studying hours of students have been increased. It has been found that education status of students of student has improved. To build the sustainable, repair, maintenance and operation schedule should be necessary therefore there is operation schedule in powerhouse.

**Adhikari (2014)**, in his thesis "Socio Economic Impact of Micro-Hydro Project: A Case Study of the Angsarang VDC" has concluded that MHP has positive impacts on income and employment. It helps to rise the income and employment by helping in the establishment of new business. MHP reduces the expenditure on different energy. People who don't have MHP use maximum firewood as fuel but people who use

MHP use less firewood, therefore all respondents who have use of MHP have been changed their living standard. The status of sanitation has improved by the use of MHP. By the use of MHP studying hour of students have been improved then non-users. MHP reduces the expenditure on different energy sources like: firewood, kerosene, biogas etc. So it can be a less expensive source of energy in rural area. MHP users have improved their education status. To repair, maintenance and operation for the MHP management committee is fully responsible.

**Chalise (2014)**, in his unpublished thesis “Socio-economic impact of Gandaki mini hydropower project in Rivan VDC of Kaski district” has concluded that the efforts to promote micro-hydro power in Rivan VDC have substantially contributed in the development efforts of the villagers as a whole. This village is an example. MHP without any doubt brought significant socio-economic benefits to their communities. However, the living standards of MHP communities are still vulnerable. In addition, a number of aspects of MHP schemes still require a lot of improvement to enable the projects to run more smoothly. The MHP programme has definitely improved the economic status of the consumers. It has replaced kerosene as well as diesel and dry cell immensely. The agro-processing, rice huller, grinder, oil-exPELLER and such other end-use have immense opportunity to increase the employment and then yearly income.

By studying above mentioned international and national literatures related to MHP the researcher came to know that MHP is very much useful to improve socio-economic conditions like education, health and sanitation, employment and income generation and in living standard of people as a whole in rural area of Nepal. Different researchers have done similar researches of different MHPs located in different rural part of Nepal but no one has done research to analyze socio-economic impact of Tikhedhunga Micro Hydro Electricity Project and has tried to explore its impact on the people of project site which is a research gap for the researcher.

Such type of projects are not only benefitting to the society but as well as to the environment. MHP has long life and less operational issues, this makes it as one of the most suitable source of energy in Nepal.

## **CHAPTER III**

### **RESEARCH METHODOLOGY**

This chapter discusses the methodology followed in the study. The study has been 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.

#### **3.1 Research Design**

Research design is an overall framework or plan for the activities undertaken during the course of research work. This study was carried out on the basis of explanatory research design. This study was investigating the socio-economic impact of micro hydro electricity on rural sector. This study finds out how people are benefitted by project and its impact on people.

Beside the study is an attempt to describe the benefits experienced by households of the project affected areas after the installation of micro hydro electricity such as economic activities like employment, income, health and sanitation, education and about how the project can be made sustainable. So, study done is descriptive, analytical and explanatory.

#### **3.2 Nature and Sources of Data collection**

This study aims to explore the utilization of micro hydro electricity and socio-economic impact of Tikhedhunga Micro Hydro Electricity Project on the of the people of Dangsing VDC. So, this study is based on qualitative and quantitative data from questionnaire through household interview survey. Some key informant interview was taken with the people who introduced the project. Thus the primary data was collected from user households of the study area. Similarly the secondary data was collected from different sources such as economic survey, CBS report, Central library TU, and publication of Nepal Electricity Authority (NEA), feasibility report, journals, internet and documents from individuals, experts and organization related to micro hydro electricity.

### 3.3 Sample Size and Sampling Procedure

The total numbers of 132 households in two different wards are affected by the project. Out of total 132 households 45 household and have been picked up for the sample from both of the wards by using stratified simple random sampling to fulfill the purpose of the study. This study is based on the information collected from the sample households, selected by stratified simple random sampling method.

**Table No. 3.1**

#### **Selection of Sample**

<b>S.N.</b>	<b>Word No.</b>	<b>Total Household</b>	<b>Sample Household</b>
1.	7	49	17
2.	8	83	27
	Total	132	45

### 3.4 Data Processing

A worksheet was prepared through the complete questionnaire incorporating the use of electricity for various purposes. The collected data is classified according to its nature and characteristics. To make the analysis more reliable and easier, different data sheets have been prepared for different variables. Field questionnaire is carefully checked for possible errors. The data are carefully edited and processed by computer excel and required pie-chart, bar diagram and table is generated by using computer software program.

### 3.5 Data collection tools and techniques

For this study, related data has been collected through direct personal interview with the help of structured questionnaire among project affected families (PAFs) in the society since the installation of Tikhedhunga Micro Hydro Power Project. The structured questionnaire or unstructured interviews and observation methods were applied to collect the both qualitative and quantitative data in the survey.

### **3.5.1 Questionnaire Survey**

To generate the accurate data from household survey of micro hydro users, structured questionnaires were prepared. The respondents were requested to fill up questionnaire. To find out the respondent's attitude the impact of MHP in different sectors in the village the questions were provided them to fulfill in their own views. Questionnaire like filling household information, education and health status of family, employment and income status were given to the respondents.

### **3.5.2 Field Visit and Observation**

Field visit was conducted by collecting the name lists of each household during April to May 2014 who was benefited by this micro hydro electricity and selection was done by stratified simple random sampling method. To hear the people's perception and get the real situation of MHP in village the questions were provided them to fulfill in their own views.

### **3.5.3 Key Informant Interview**

To know about MHP and its role in the society, key informant was taken from some expertise as well as social man in the study site. Key informant interview was conducted by applying the explanatory method to gather the information about the project and its impact on the on the affected area.

### **3.6 Presentation and Data Analysis**

The data has been tabulated and analyzed according to the objective of the study. The data analysis is descriptive as well as analytical. Data was analyzed with help of computer programme excel. Simple statistical tools like Tables, pie-chart etc. were used for data analysis. Descriptive methods have been used for qualitative data.

## CHAPTER IV

### PRESENTSATION AND DATA ANALYSIS

#### 4.1 Introduction

This chapter attempts to analyze the collected data and information for pursuing the objectives of the study and deriving the major findings of the study. First of all, it presents the brief introduction of Tikhedhunga Micro Hydropower Project site with demographic features. This chapter deals with the analysis of impact of Thikhedhunga Micro Hydropower Project on employment and income creation, health and education in project site. This chapter also identifies the methods to maintain the hydropower sustainable. The impact of Tikhedhunga Micro Hydropower Project is analyzed by comparing gradual changes on socioeconomic condition of the project site before and after. The questionnaire and observation are analyzed in descriptive form.

Socio-economic condition shows the development status of the project site. The sociological condition such as religion, sanitation, health, caste, education and economic condition such as employment and income have great importance on the economy of the village and living standard of people.

#### 4.2 Socio-economic Condition of Project Site

##### 4.2.1 Age Groups

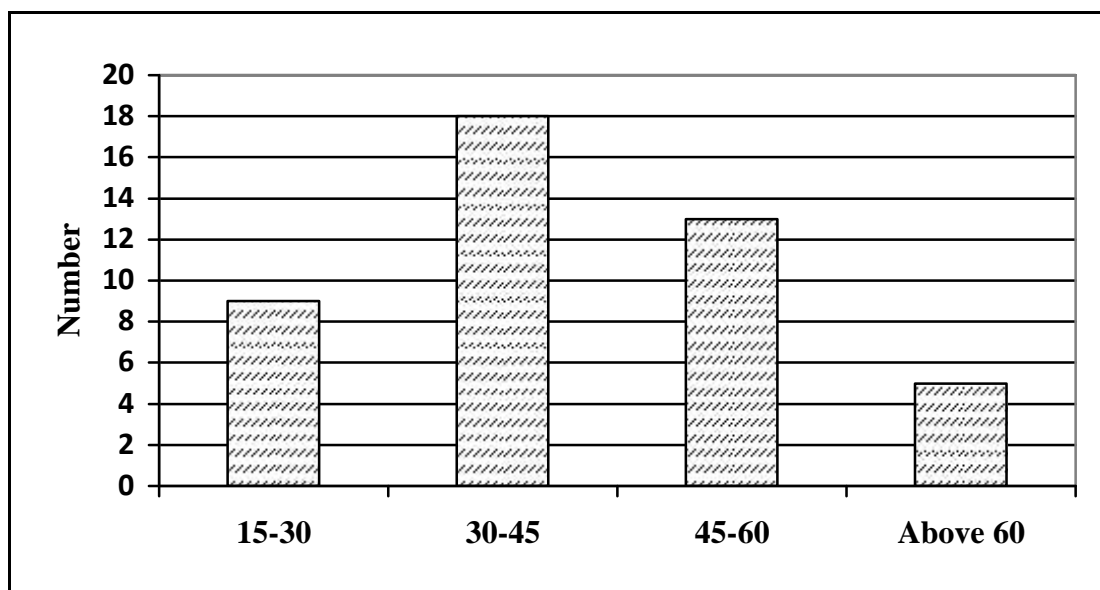
The respondents are divided into four groups according to their age. The questionnaires were asked to the responds aging above 15 years. Then it was divided into four groups as 15-30, 30-45, 45-60 and 60 above. This shown as below

**Table No. 4.1**  
**Age Groups of Respondents**

S.N.	Age Group	Respondents
1.	15-30	9
2.	30-45	18
3.	45-60	13
4.	Above 60	5
	Total	45

Source: Field survey, 2014

**Figure 4.1**  
**Age Group of Respondents**



Source: Field survey, 2014

Figure 4.1 explains that highest portion (40%) respondents are from age group 30-45 and 28.89% are from the age group 45-60. Similarly from age group 15-30 and above 60 are 20% and 11.11% respectively.

#### **4.2.2 Gender of Respondents**

Though the number of female population is more or less equal to population of male there was a significant imbalance in the participation of respondents. The participation of female respondents was only 40% where as participation of male as respondents were 60%. The gender wise participation of respondents of study is presented in pie chart below.

**Table No. 4.2**  
**Participation Percentage of Respondents by Gender**

S.N.	Respondents	Number	Percent
1.	Male	27	60
2.	Female	18	40
	Total	45	100.00

Source: Field survey, 2014



By viewing the above pie chart we can conclude that the project site is still a male dominated society and female are the followers of male. In social works male have played leading role. Due to more household responsibilities and less involvement in social works female respondents were less in numbers than male respondents.

### 4.2.3 Occupation of Households

The main occupation of household in the project site is agriculture, livestock farming, service, alcohol fermentation, fishing and foreign employment.

About 33% of households are engaged in non-agricultural economic activities where as about 67% of households are engaged in agricultural economic activities. Various types of occupation prevailing in the project site are given below.

**Table No. 4.3**  
**Occupational Distribution**

<b>Occupation</b>	<b>Percentage</b>
Agriculture	66.71
Service	17.77
Foreign employment	13.33
Others	2.22

Source: Field survey, 2014

According to data presented above, out of total economically active population about 67% of population is engaged in agriculture sector and about 18% are in service. Similarly about 13% and 2% of people are in foreign employment and others respectively.

### 4.2.4 Caste of Survey Households

The census of Nepal 2011 reveals that there are 126 caste and ethnic groups in Nepal. It shows that Nepal is rich in caste and ethnic groups. Different caste of people use different language for community. The project site also includes the various castes like Brahmin, Chhetri, Gurung, Magar, Thakali and Dalits. Nepali language is common language of communication. Table 4.4 shows the distribution of responds by caste / ethnicity.

**Table No. 4.4**  
**Caste of Households Survey**

<b>Caste</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative percent</b>
Brahmin	9	20.00	20
Chhetri	12	26.67	46.67
Gurung	14	31.11	77.78
Magar	2	4.44	82.22
Thakali	3	6.67	88.89
Dalits	5	11.11	100

Source: Field survey, 2014

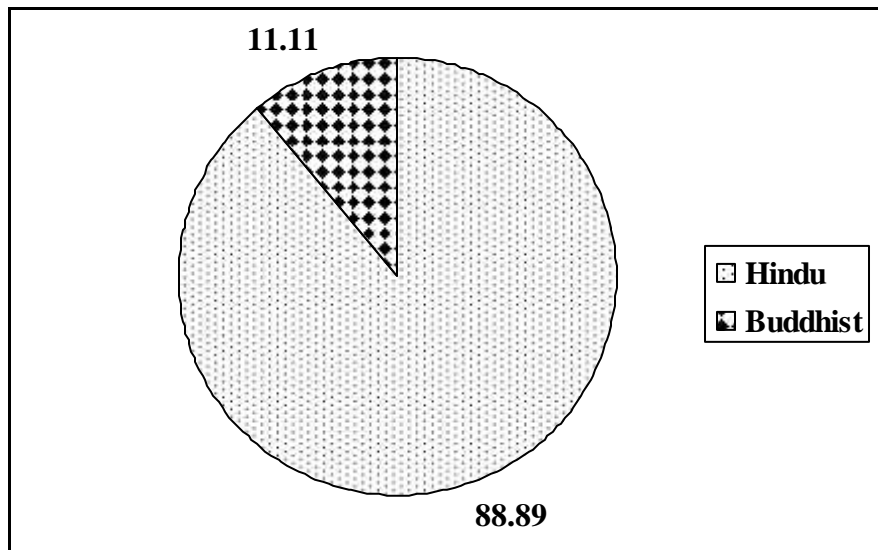
Out of total households the highest percent (31.11%) of respondents are Gurung. Chhetri occupies 26.67% of total respondents. Then after Brahmin, Dalit, Thakali and Magar occupy 20%, 11.11%, 6.67% and 4.44% respectively.

Table shows the cumulative percentage of Janajati ( $31.11 + 4.44 + 6.67 = 42.22$ ) is high but people from different caste are lived in study area. Therefore, we can say that Nepal is rich in caste/ethnic groups.

#### **4.2.5 Religion Practice in Project Site**

The dominant religion in Nepal is Hindu, about 80% Nepalese people practice Hinduism and only around 20% of people practice Buddhism, Christian and others. In the study area, respondents practice Hinduism and Buddhism. The respondents' ratio according to religion has presented in the pie chart 4.3 below.

**Figure 4.2**  
**Religion Practice in Survey Area**



Source: Field survey, 2014

The pie-chart 4.3 depicts that, the majority 88.89 of the people practiced Hindu religion and only 11.11% of households were followers of Buddhism. It shows that the people following Hinduism are dominant as national figure.

#### **4.2.6 Household Member by Sex**

One of 45 household, every household found having son whereas three household had found daughterless hence. It shows that the villagers have desire of son instead of daughter. First priorities give to birth of son and daughters are less preferred. The household members by sex of the study area has presented in table 4.3 below.

**Table No. 4.5**  
**Household Members by Sex**

<b>Numbers of male and female</b>	<b>Household (male)</b>	<b>Household (female)</b>
1	-	2
2	8	10
3	15	13
4	11	10
5	3	5
6	4	5
7	2	-
8	-	1
9	-	-
10	2	1

Source: Field survey, 2014

From the table 4.3 highest number of household's male female ratio is 3:3 then 4:4 and 2:2 male-female ratio households. The 2 households have 10 male members and 1 house has 10 female members. Then, we can conclude that most of the families are joint family in study area.

### **4.3 Social Impact of the MHP**

#### **4.3.1 Impact on Education**

The impact of electricity from micro hydropower plants on education shows how MHP helped to increase the standard of education. This study is focused on the changes occurred in this field of education for detail different related data are tabulated and interpreted as follows.

##### **4.3.1.1 Impact of Electricity on Study Habits after MHP**

Owing to the access to electricity, the academic performance of children is greatly influenced in the project site of TMHP (Tikhedhunga Micro Hydropower Project) of Dangsing VDC. Electric lights in households extend the day providing additional hours for evening reading and also, reduced drudgery for children. The level of lighting provided by the modern electric lights in the households is more efficient and

brighter than that provided by Tuki and Panas. The micro-hydro based electricity has indirect impact on school student. Generally, children used to go with mother while grinding or collecting firewood.

**Table No. 4.6**  
**Impact of Electricity on Children Study Habits after MHP**

<b>Increased Hours</b>	<b>Frequency</b>	<b>Percentage</b>
Less than one hour	15	33.33
One to two hour	13	28.89
Two to three hour	9	20.00
More than three hour	8	17.78
Total	45	100

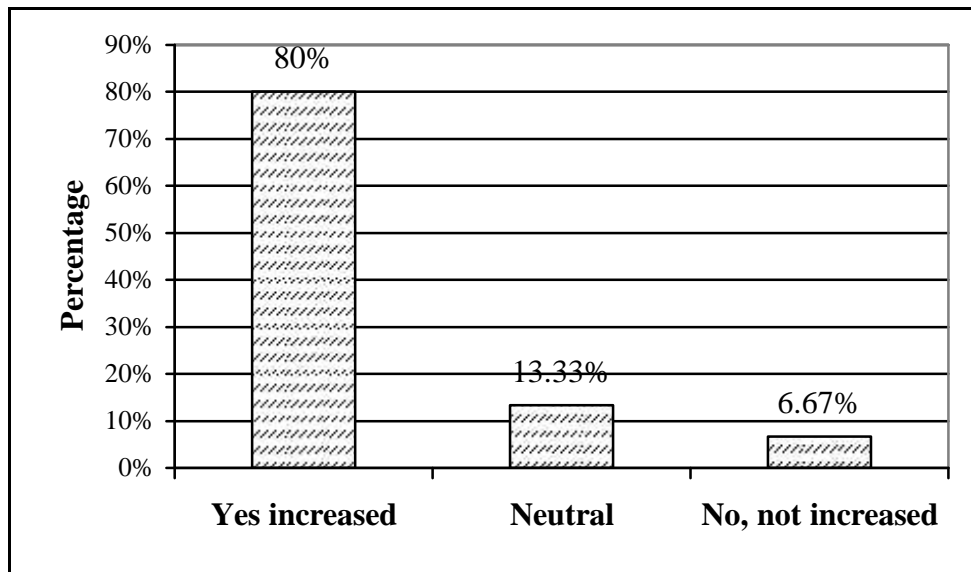
Source: Field survey, 2014

Table shows that, out of 45 sample, 15 (33.33%) HHs children raised their study less than one hour, 13 (28.89%) HHs children raised their study one to the hour 9 (20%) HHs children raised their study two to three hour and, 8 (17.78%) HHs children raised their study more than three hour. It can be said that most of the student's education status is improved after MHP installation because most of the Guardian of school children found that their children have been studying of the night time using electricity. There is the positive affect by MHP in the study area.

#### **4.3.1.2 Involvement in Literacy Classes of Night**

After the installation of MHP the number of women and adult in literacy class has increased. Before the installation of MHP they use Tuki and Panas to get light. So, they feel boring to go to literacy class classes. Out of 45 respondents large number of respondents said that involvement in literacy class at night has increased, some said involvement was same as before i.e. natural and small number of respondents said no it has decreased the involvement in literacy classes because some of the women and adult stay at their home watching television, which is shown in fig below.

**Figure 4.3**  
**Involvement in Literacy Class at Night**



Source: Field survey, 2014

Figure explains that 80% of respondents said that the involvement in literacy classes has increased significantly. Hence it can be concluded that MHP helps to increase the status of literacy.

#### **4.3.1.3 Use of Electricity in Teaching Learning Activities**

Electricity generated from MHP is not only used to increase the study hours of students and involvement of adults and woman in literacy classes but it also helps to increase teaching learning activities. Electricity helps to use multimedia like computer, laptop, DVD player, VCD player, internet for teaching learning activities.

In some cases of teaching and learning activities we can explain the things by showing videos, objects, diagrams, process with the help of multimedia. Not only this, internet helps to increase the horizon of knowledge.

#### **4.3.2 Impact of Project on Health**

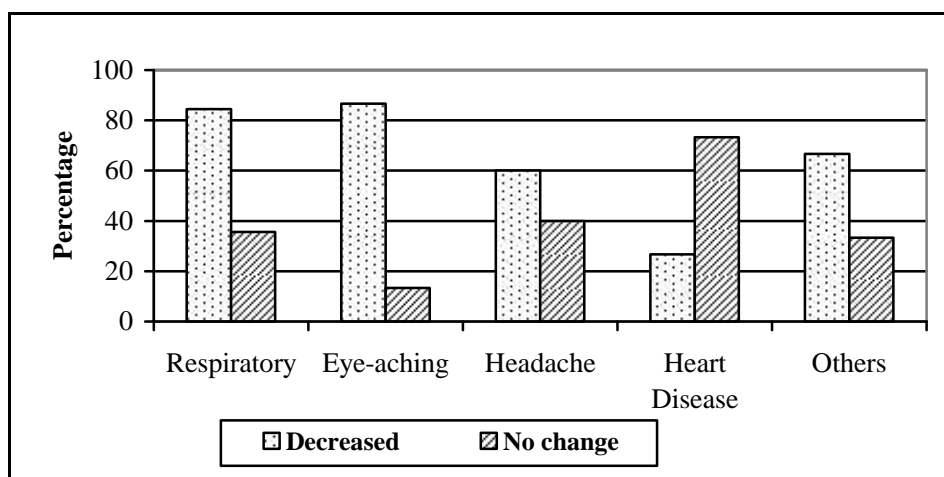
Impact of MHP on human health may be positive and negative both. The MHP in the village has improved the general health conditions significantly as MHP provides clean and smoke free energy unlike firewood. The use of kerosene lanterns for lighting has been completely stopped and the use of firewood reduced significantly in

the village. The connection of electricity in the households reduced indoor air pollution and hence reduces the incidence of vision and several diseases.

#### 4.3.2.1 Impact of MHP to Decrease Different Health Problems

It is attempted to find out how many respondents of the project influenced area are positively and negatively affected after MHP with reference to human health.

**Figure 4.4**  
**Impact of MHP to Decrease Different Health Problems**



Source: Field survey, 2014

The figure presents the impact of project on human health. Out of total 45 respondents maximum proportion i.e. 39 (86.67%) reported that the electricity has decreased eye aching problem and 6 (13.33%) respondents reported that electricity has not decreased eye-aching problem. Similarly, out of 45 respondents 29 (64.44%), 27 (26.67%) and 30 (66.67%) have reported that electricity has helped to decrease respiratory, headache, heart disease and others diseases respectively. But the respondents who reported that the electricity have no change to decrease diseases like respiratory, headache, heart diseases and others are 16 (35.56%), 18 (40%), 33 (73.33%), 15 (33.33%) respectively.

To, sum up, people of rural areas have been using firewood and kerosene for fuel and lighting. After the MHP people have down up the use of kerosene and firewood or fuel and lamp significantly which help them to be away from smoke of firewood and Tuki and feeling easy and healthy. So the diseases are decreased after the MHP.

#### **4.3.2.2 Use of Toilet**

Proper use of toilets in community is related with health and sanitation of the community. The use of toilets is increased rapidly. In this field survey, 100 percent of households have toilet in the study area. There are 87 percent Pakki toilets and 13 percent kachhi toilets. It shows the good indication for good health sanitation and environment pollution. Having toilet is one of the indicators of human development index. The above mentioned data shows that use of open toilet has decreased with the construction of MHP. Use of modern toilets and covered toilets has also increased by 86 percent and 14 percent respectively.

#### **4.3.2.3 Sanitation Status Using MHP**

People must be careful about indoor sanitation. In the negligence of sanitation there may happen different kinds of problems. Human health has been risky without sanitation. It is hoped that the people would be able to get awareness and sensitive about sanitation using modern electrical instruments. During the survey time of project, the aid organization has launched the awareness program about sanitation in the village and every household had compulsion to built toilet before the completion of the project. Dangsing VDC also declared as the 'Khula Disa Mukta VDC'. By using the electrical instrument like TV/radio/computer, the thinking of the people have changed and they begun to care indoor and outdoor sanitation. In the negligence of sanitation there may happen different kinds of problems. Using this MHP, almost all respondents said that the village become neat and clean than without MHP.

### **4.4 Economic Impact of MHP**

#### **4.4.1 Direct Job Creation and Establishment of Industries**

To some degree micro hydropower project have been successful at creating some jobs like manager/accountant who keeps records of income and expenditure of the MHP, operators who operate daily to apply and cut electricity, engineers and machinists who manufacture and maintain the plants. Since management committee members of the plants work on a voluntary basis, they receive no compensation they are not supposed to be employed. The following post holding persons are directly employed due to establishment of MHP.



**Table No. 4.7**  
**Direct Job Creation by the MHP**

Post	Number
1) Manager / Accountant	1
2) Operators	2
3) Machinists (on part time basis) *	2
4) Engineer (on part time basis)*	1
Total	5

Source: Field survey, 2014

\*Machinists and Engineer are called on part time basis for routine maintenance and in case of emergency failure of the plant.

Similarly, electricity is the basic prerequisite of development. It is the foundation to generate any socio-economic activities. The life is very difficult as well as being backward to get modern technology in the absence of power. After MHP, people launched various industries in the study area, which help to raise the income level of the people as well as make the villagers way of living much easier. The firms that lunched after MHP in village are presented in the table 4.6 below.

**Table No. 4.8**  
**Establishment of Industries after MHP**

Firms	No. of industries/firms
Poultry firm	2
Dairy	1
Furniture	2
Sawmill	1
Agro mill	3
Computer institute	1
Total	10

Source: Field survey, 2014

Table 4.6 depicts that, villagers installed 10 small industries / firm / institutes where around 17 villagers have part-time /fulltime job. The villager's lives become easier after installed agro mill and able to generate income from their firms. Farmers

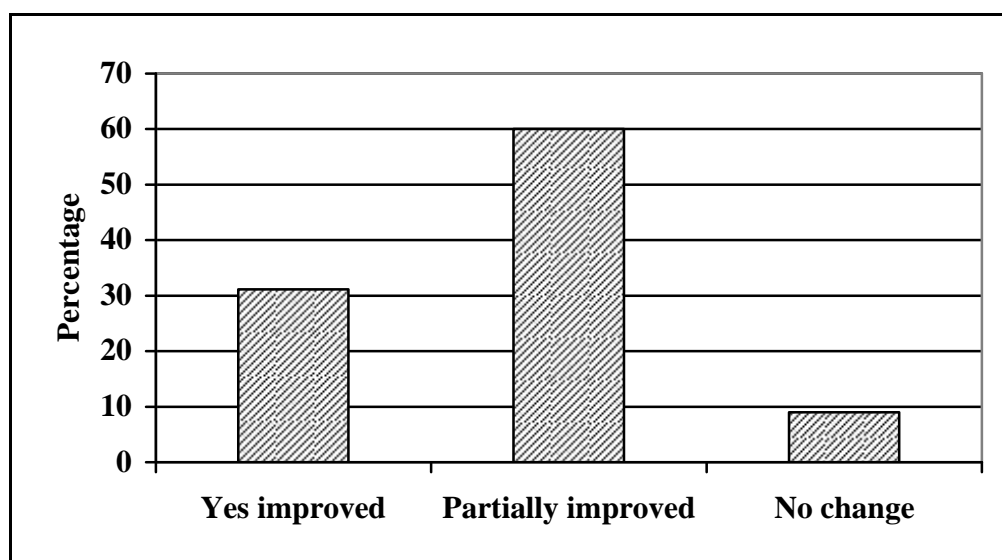
generate income regularly after installed dairy by selling milk to dairy holder. The others business such as food shop, stationary, medical and photo studio has been run which generate the income as well as make the social life easy.

#### 4.4.2 People's Perception about the Increase in their Income after MHP

Respondents, who have sufficient knowledge about electricity and are able to use electricity properly, have been able to increase family income. Out of total 45 respondents highest proportion i.e. 27 (60%) reported that their family income has partially increased. Among 45 respondents, only 4 (8.89%) respondents reported their family income is in neutral situation. The percentage and the frequency of households about income generation/increase after MHP is presented in the figure 4.6 below.

**Figure 4.5**

**People's Perception about the Increase in Their Income after MHP**



Source: Field survey, 2014

However, among them 14 (31.11%) households have got significantly increased their income level. Most of the people get raised their income level partially / fully by getting chance to involve in different economic activities.

#### 4.4.3 Condition of Employment after MHP

Employment creation, investment in environmentally friendly technology and development of small and decentralized industrial infrastructure are some of the benefits to nation. After the installation of the project, the employment opportunities

in the village have raised directly and indirectly. One manager/accountant, two operators are employed in full time basis in this project and two machinist and one engineer and employed in part time basis. By installing the industries, around 35 people are directly involved in those firms. Therefore, employment has been increased after the installation of MHP. Once employment opportunities are increased in decentralized way providing access and opportunities to the poor people, the sustainability of rural society can be promoted.

## **4.5 Sustainability of the Project**

### **4.5.1 Meaning**

The meaning of 'sustainable' is 'that can continue or be continued for a long time'. It mean that how the project can be made long lived or for how long period of time can the people of project of time of the project, it but also seeks the continuity or discontinuity in between the long period of the project. Construction of infrastructure and installation of plant only does not work for a long period of time. It also requires routine maintenance, maintenance during failure of the plant, maintenance of the project if it failed to work due to natural calamities like landslide, flood, thundering etc. To sum up the meaning of the sustainability of the project is to make the project to generate electricity continuously. In the absence of sustainability there is no meaning of construction of the project.

### **4.5.2 Problems appeared in the MHP**

As we know that living beings are caught by different types of diseases and suffer from many problems during their life, similarly the MHP once installed, it also faces various problems during production of electricity and its distribution. There are some of the problems faced by the project, management committee and the user group, which are as follows.

#### **1. Lack of capital**

The MHP is located in remote area of Kaski District, the people the remote area not having enough income source they didn't collect the money to establish the MHP. So, fund collection for installation and sustainability of the MHP is the major problem of

the project. In the absence of capital it is difficult to purchase modern technology as well as to increase the capacity of the project.

## **2. Problem of water management**

Due to rugged topography it had become difficult to construct Kulo and water reservoir. It becomes costly due to presence of hard rocks in the way of and in the place where reservoir was constructed. Not only this due to landslide and flood the flow of water to MHP is blocked due to which regularity in generation and supply of electricity is blocked.

## **3. Lack of technical knowledge**

Nepalese people do not have access to technical knowledge. In the present context technical knowledge is necessary to install the project and operate it. If, there occurs technical problem in the plant it is not possible to solve the problem. It is necessary to call technician from Pokhara and Baglung or from even from Kathmandu.

## **4. Low market demand**

Every company's wants to profit but rural people are not sufficient to buy the electricity produced from MHP at expensive rate. Large production companies also are not interested to go to rural area. This results in low demand for electricity. Most of the rural areas consume less power due to less number of financial activities.

## **5. Socio-political problem of the country**

Most of the least developing countries suffer from political problem. Similarly, here in Nepal, local and central political views and policy are different from different political parties. So it creates the problems of local developing issues. So, for political credit the political parties may hinder the pace of development activities.

## **6. Corruption**

All the systems that may be political or bureaucracy of Nepal is corrupt. Nepal's political parties, communities groups, donor groups and leaders are engaged to make personal profit. It is found that management committee tries to misuse the money in different way.

## CHAPTER V

### SUMMARY, CONCLUSION AND RECOMMENDATION

This study is focused on studying the socio-economic impacts of Tikhendhunga Micro Hydropower Project. It is based on the primary data collection through the field survey. It is expected that the results from this study will provide valuable information to policy makers to utilize the resources in the most productive sector for energy generation. The main objectives of the study are to examine the socio-economic impacts of Tikhedhunga MHP in project site of Dangsing VDC, Kaski, to explore the problems associated with the MHP and suggest solution for its sustainable development, and to examine socio-economic impacts of hydropower project in rural areas. This chapter is the concluding chapter of present study. The first part summarizes the finding from the study, the second part draws some conclusions, and third part lists some recommendations that can be taken from the conclusion of the study.

#### 5.1 Summary

Generation and use of electricity is symbol of modern civilization because most of the modern electrical and electronic devices use electricity. Electricity is also renewable, pollution free, locally available and reliable source of energy. To meet the notional energy objectives, small-scale hydropower plants are effective for the electrification of remote areas.

Traditional source of energy are not sufficient to the energy demand. The use of fossil-fuel is also costly and its exam use decreases the balance of payment of the economy. Over use of firewood creates various problems, like landslide and flood.

For socio-economic development of a economy energy plays basic and vital role. Without production and consumption of energy the pace of development halts. Energy produced from MHP and its consumption is regarded as one of the indictor of measuring development status of the village. In the Nepalese context, education, sanitation, income and employment creation. So, it is an important for socio-economic development.

Micro hydropower has been able to bring about profound socio-economic changes. The implication of MHP for rural development is an introduction of modern technology in rural context. These prepare rural community for undertaking rural industrial activities, boosting of entrepreneurship in rural areas. This study reflects the overview of Nepalese rural energies sources status and discusses various energy issues through a case study of Tikhedhunga MPH, Dangsing, Kaski. The study has discussed various merits of MHP system; it not only provides energy for lighting but also helps in improving health condition saves time, makes easy to work of night is more efficient income generating as well productive work.

This is the descriptive study designed to find out the socio- economic impact of Tikhedhunga MHP project of Dangsing VDC, Kaski. This study had been conducted from the direct interview method with 45 respondents. Those respondents were selected by random sampling. The major findings of the study area are as follows.

- ) The main caste in the study area are Gurung (31.11% ) Cheetri (26-67%), Brahmin (20%), Dalits, Thakali and Tamang where about 88.89% of people practice Hindu religion. Agriculture is the main source of village.
- ) The main source of energy before MHP was firewood for cooking and Kerosene for lighting purpose for almost all the households in this area. Now MHP being the main source of energy in the village, it reduce the over expenditure on traditional energy sources.
- ) Most of the respondents are agreed that MHP helps to improve the health condition of people and it minimize the respiratory diseases eye infection, headache and others except heart diseases.
- ) After MHP, people installed industries such as furniture, Dairy, poultry farming, sawmill, Agro mill and one, computer institute, which create the employment opportunities and about 90% of the respondents realized that their income has raised significantly or partially.
- ) 100% of respondents are agreed that MHP has increased the study hours of students in house and about 93% of responds accepted that MHP has helped to increase the involvement in literacy classes.

- ) All of the respondents said that sanitation rates of the village improved after this project.
- ) About 91% of the respondents have realized that the MHP has been helpful to increase the income level of people.
- ) Most of the respondents said that MHP has been successful to increase employment level of the village by creating direct jobs as well as by helping to create self owned business.
- ) From this field visit we can see that there are various problems that hinder to the sustainable development of MHP.

## 5.2 Conclusion

Lower scale MHP may be most useful in rural and remote areas of our country. There is sufficient feasibility of such types of lower scale MHP. MHP have brought significant socio-economic benefits to their communities. However, the living conditions of MHP communities are still vulnerable. In addition, a number of aspects of MHP schemes still require a lot of improvement to enable the projects to run more smoothly. The MHP programme has definitely improved the economic status of the consumers. It has replaced kerosene as well diesel and dry cell immensely. Furniture, Dairy, poultry farming, sawmill, agro mill and computer institute have immerse, opportunity to increase the employment and then yearly income.

Such types of projects are not only benefiting to the society but as well to the environment. MHP have long life and less operational issues, this makes it as one of the most suitable source of energy in Nepal.

- ) Kaski district is known as main place of Gurung. Therefore higher percentage of respondents was found Gurung, which are listed in Janajati.
- ) MHP has positive impacts on income and employment. It helps to rise in income and employment by helping in the establishment of new businesses.
- ) Before electricity, people have been using maximum firewood as light or lamp and cooking but when MHP established the need of firewood has reduced which helped to conserve forest.

- ) The status of sanitation has improved after electricity facility.
- ) After electricity facility, studying hours of students have been increased. It has been found that education status of students has improved.
- ) Due to the installation of MHP, the health condition also gets improved. The expenditure on health has gone down to the reduction in the various diseases like respiratory diseases, eye aching, headache etc.
- ) Electricity is closely related with human life therefore all respondent's living standard has been changed after MHP.
- ) To build the MHP sustainable, repair, maintenance and operation schedule should be necessary therefore there is operation schedule in powerhouse. For this purpose management committee is fully responsible.
- ) Electricity supply has extended the social and recreation activities i.e. purchase and use of tape recorders, radio, TV, refrigerator, iron, computer, rice cooker etc.

### **5.3 Recommendation**

The following recommendation can be made by considering the finding and conclusions of this present study.

- ) MHP helps to increase the level of employment and income. So, capacity of MHP should be increased to increase access to electricity.
- ) Since MHP helps to increase the study hour of children as well as adult enrollment in literacy classes, it helps to increase the literacy rate of country.
- ) The condition of health and sanitation increases after installation of MHP which increases the living standard of people. So, more MHP projects should be installed in rural areas of the country.
- ) Construction and installation of MHP helps to increase access to information technology, mass-media, telecommunication, net-internet, etc which helps to increase the living standard of rural people.
- ) The consumption of electricity should be increased towards the productive sectors, business firms, educational sector etc. It helps to increase employment, income, knowledge etc and life becomes easier.



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# Appendix-I

## Questionnaire

Central Department of Economics

University Campus Kirtipur

Tribhuvan University

Kathmandu

A survey on Socio-economic impact of Tikhedhunga Micro-Hydropower project in Dangsing VDC, Kaski.

This questionnaire is primarily designed for the thesis writing purpose of M.A. in Economics of T.U. You are kindly requested to fill up this questionnaire below:

### 1. Household information

1.1 Name:	1.2 Ward No.:
1.3 Gender:	1.4 Age:
1.5 No of HH Men <input type="checkbox"/> rs F <input type="checkbox"/> M	1.6 Occupation:
1.7 Caste:	1.8 Religion

### 2. Education and Health Status of Family

#### 2.1 Family information

S.N.	Name	Relation with head of Family	Sex	Age	Education
1.					
2.					
3.					
4.					
5.					
6.					
7.					

## Appendix - 2

### Questionnaires For Key Informants

#### A. Chair person of MHP.

Name : Hom Bahadur Gurung

Address: DAngsing - 8 Tikhedunga.

#### Please fill up the followings

1. What is the total number of households using electricity of TMPH ?

S.N.	Ward No.	Households
1		
2		

2. What is the number of small level industries running by using electricity of TMHP ?

S.N.	Firms / Industries	No. of Firms / Industries
1		
2		
3		
4		
5		
6		
7		

3. What are the direct job created by MHP ?

S.N.	Post	Number
1		
2		
3		
4		
	Total	

**B. Manager of MHP**

Name: Dharma Raj Paudel

Address: Dangsing-7, Sudame

Please fill up the followings

1. What are the problems related to the management of MHP? Please Write.

a.

b.

c.

d.

e.

f.

2. What can be done to provide electricity regularly?

a.

b.

c.

d.

e.

f.

3. How electricity should be used to increase employment and income/

a.

b.

c.

d.

e.

### C. Operator of MHP

Name: Mangal Sunar

Address: Dangsing-8, Tikhedhunga

Please fill up the following:

1. Is the supply of electricity is regular?

a. Yes                       b. No

2. How many hours of a day electricity is supplied.

hrs.

3. What are the problems while operating with the plant?

a.

b.

c.

d.

e.

f.

4. What can be done for regular supply of electricity?

a.

b.

c.

d.

e.

f.