THE SOCIO–ECONOMIC IMPACT OF MAUNE KHOLA MICRO–HYDRO POWER:

A Case Study of *Dhuligada VDC, Darchula* District, Nepal

A Thesis Submitted to

The Central Department of Rural Development,

Tribhuvan University,

In partial fulfillment of the requirements for the

Degree of the Master of Arts (M.A.)

In

Rural Development

By

Soniya Rai

Central Department of Rural Development

Tribhuvan University, Kathmandu

T.U. Regd.: 6-1-40-1857-2005

Roll No.: 281601

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DECLARATION

I hereby declare that the thesis entitled **The Socio-Economic Impact of Maune Khola Micro-Hydro Power** submitted to the Central Department of Rural Development, Tribhuvan University, is entirely my original work prepared under the guidance and supervision of my supervisor. I have made due acknowledgement to all ideas and information borrowed from different sources in the course of preparing this thesis. The results of this thesis have not been presented or submitted anywhere else for the award of any degree or for any other purposes. I assure that no part of the content of this thesis has been published in any form before.

Date : 2015-03-11

2071-11-27

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Soniya Rai

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RECOMMENDATION LETTER

The thesis entitled **The Socio-Economic Impact of Maune Khola Micro-Hydro Power** has been prepared by Soniya Rai under my guidance and supervision. I hereby forward this thesis to the evaluation committee for final evaluation and approval.

……

Prof. Dr. Chandra Lal Shrestha
Supervisor and HOD, Central Department of Rural Development

Date: 2015-03-23
2071-12-09

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Approval Letter

The thesis entitled **The Socio-Economic Impact of Maune Khola Micro-hydro Power** submitted by Soniya Rai in partial fulfillment of the requirements for the Master's Degree (M.A.) in Rural Development has been approved by the evaluation committee.

Evaluation Committee

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Prof. Dr. Chandra Lal Shrestha
Head of Department

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Prof. Dr. Mangala Shrestha
External Examiner

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Date: 2015-03-24
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ACKNOWLEDGEMENTS

This research report is prepared as a thesis in the partial fulfillment of the requirement for the master's degree in rural development. The basic objective of the study is to identify the socio- economic impact of the Maune Khola Micro-Hydro Project (MKMHP) in Darchula district.

This thesis would never have been completed without the generous help of many individuals. First of all, I would like to express my hearty gratitude to my supervisor Prof. Dr. Chandra Lal Shrestha, HOD, Central Department of Rural Development of T.U., for his considerable care, exhortative and substantial time extended to me during the whole course of this research.

I would, therefore, like to express my sincere gratitude to Maune Khola Micro-Hydro Power for its support in providing genuine information about the study area. I am very thankful to Mr. Karan Singh Badal who has significantly helped me in conducting survey of the project affected area. I am equally grateful to Mr. Tilak Singh Pela, Mr. Shyam Sundar Chaudhary, Mr. Narendra Bahadur Singh, and Mr. Arun Kumar Mahara for their timely support and encouragement in preparing this report.

I have no words to express my sincere gratitude to my family. Without their unconditional love and support, this thesis could have never been completed successfully. At last, I have pinned hope that this study will be of some help for the rural policymakers and scholars conducting research on Micro-hydro and its socio-economic impacts on marginal communities of rural Nepal.

Date: March, 2015 Soniya Rai

ABSTRACT

In general, this study attempts to appraise the importance of electricity in the development of Nepal. This research, however, focuses on the significance of the micro hydropower project in the context of Dhuligada VDC of Darchula. Obviously, Nepal lacks capital, infrastructure, and technology to install large hydropower projects. In such case, it is rather wise and practical to install small hydropower for it can be installed with small amount of capital. So, we can encourage the private sector to invest on it. Likewise, it does not demand as sophisticated technology as the large projects do. Moreover, it is free of hazardous environmental impacts. In all, it, unlike the big projects, has more positive impacts than negative ones. So, the small hydropower projects can play a key role in the overall development of Nepal. The present study has attempted to bring these aspects of the small hydropower projects into the limelight through the study of impacts of Maune Khola Micro-Hydro Project in the overall sectors of the study area, Wards 4, 5, and 7 of Dhuligada VDC Darchula. Nepal has immense endowment of water resources. It is expected that electrification will create various opportunities of development activities in the rural areas. Neither are traditional sources in the position to meet the requirements of energy nor are they sustainable.

The Maune Khola Micro-hydro Project is a run-off-river type project with 41 KW of capacity. The construction work of this project started in 2008 and completed in 2011. It has brought about various impacts on socio-economic aspects of people residing in the surrounding areas of the project. The project has benefited 484 households of the study area. The socio-cultural norms and values have changed due to the concentration of large number of people from diverse backgrounds. The level of awareness in people has significantly increased. The project has created abundant opportunities for knowledge and skill. So, their economic status has become better than before. PAFs include the caste groups such as Chhetri, Brahmin, and Dalits in the study area, however, is dominated by the Chhetri community.

This study aims to find out the household electricity consumption of the people on the project area and to examine the socio-economic impact of Maune Khola Micro Hydropower Project on the targeted area. The MKMHP has been able to bring about profound socio-economic changes. The implication of MHP for rural development is

an introduction of a modern technology which has prepared rural communities for undertaking rural industrial activities, nurturing entrepreneurship and production of entrepreneurs in rural areas. The MKMHP not only provides energy for lighting but also helps greatly in improving health & sanitation, social & economic behaviors, educational and other productive industrial activities in the Dhuligada VDC of Darchula. For undertaking this research, the researcher has applied both qualitative and quantitative research methods.

In conclusion, installation of micro hydropower project like Maune Khola Micro Hydro Project is relevant/significant from various angles in the present context of Nepal, e.g. to fulfill the national demand of electricity, protect environment, uplift living standard of rural people, enhance economic activities in the rural areas and reduce regional imbalance of development.

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LIST OF ABBREVIATIONS/ACRONYMS

AEPC: Alternative Energy Promotion Center

AP: After Project

BP: Before Project

CBS: Central Bureau Statistics

FGD: Focus Group Discussion

HHs: Households

INGO: International Non-Government Organization

KM: Kilometer

KII: Key Informants Interview

KW: Kilowatt

MA: Master of Arts

MKMHP: Maune Khola Micro-Hydro Project

NEA: Nepal Electricity Authority

NGO: Non-Government Organization

NPC: National Planning Commission

NMHDA: Nepal Micro Hydro Development Association

TU: Tribhuvan University

VDC: Village Development Committee

TWB: The World Bank

CHAPTER – ONE

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. Being a small country but rich in hydropower resource, Nepal boasted its first hydropower plant in a way back 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 the date less than 2% of the overall hydropower potential has been explored. Nepal's electricity generation is dominated by hydropower. The entire scenario of energy use of the country the electricity is a tiny fraction. So far, hydropower plants having capacity between 100 KW and 10 MW are considered to be Small Hydro (NEA, 2007). Government of Nepal is trying hard in fulfilling the ever increasing demand of electricity in the country, particularly in rural area.

In Nepal, Pharping Micro Hyrdo (500 KW) was the first hydro plant established way back in 1911. But after a long interval of 25 to 29 years, two other hydro plants namely Sundarijal—900 KW (640 KW after interchanging of frequency from 50 Hz to 60 Hz), and Panauti—2400 KW came into operation. The demand of electricity has 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 the population in Nepal has access to electricity through grade and off-grade system. Nepal's tenth Five Year Plan (2002 to 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)

Micro-hydro technology is electrical energy generation system from water resources with installed capacity respectively up to 100 KW to 3 MW 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 project 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 renewal source of energy for the potential exist 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 100 KW for the power generation up to 100 KW. 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 5 KW capacity. The Government of Nepal (AEPC 2011) fixed cut-off point of 5 KW 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 15 GJ. There is great disparity in the energy consumption attitudes, aspiration and life style when the energy is divided into 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 of 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.

Studies on gender and micro hydro power have shown that men and women have different views on the benefits of the plants. For men, the biggest advantage is increased quality of life and better education for children whereas the women saw the advantage in reduced workload, expenditures and an improved health care. Women in developing countries spend much time on domestic duties that are necessary for the family to survive. Quite often, they have to walk long distance to collect wood and water. Indoor cooking is done over open fire, bad light, which are both harmful for their eyes, time consuming and unhealthy due to smoke.

1.1.1 Energy Source of Nepal

Commercial and traditional fuel has remained as two principal source of national energy. 90 percent people are living in rural areas that are consuming traditional energy source. In urban areas, people are consuming traditional energy. Commercial energy is rarely available in rural areas where they use firewood and diyalo to light 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. Except biogas other forms of renewable energy contribute to lighting energy.

Traditional Energy Source

It is clear that sustainable energy is supplied by firewood, animal dung, agriculture residue; which cover 90.5 percent of total energy consumption leaving 9.5 percentages to commercial source. Supply of fuel wood cannot be maintained from uncontrolled deforestation which is the main source of traditional energy shared 67.6 percentage. 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 resource, which is one of the most important natural (traditional) resources of the country. Total traditional energy is shared of fuel wood by 67.6 percent (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. At present agriculture residue constitutes 15 percentage 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 percent 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 percent 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 import petroleum product and coal have been increasing every years. Economic Survey 2008 shows that consumption of traditional and commercial source of energy is estimated to grow by 2.2 and 9.7 percent 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). The major solar power station in Nepal in Simikot (Humla) and Gamagadhi (Mugu) have setup capacity of 50 K.W. each and can generate electricity from solar power (NEA.2003).

Wind Energy

Utilization of wind energy is still at the research stage in Nepal. But while considering its geographical feature 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

Hydroelectricity is the main resource, which will ultimately become the dominant source of indigenous energy resource. It has been calculated that the size of theoretical hydropower potential based on average flow of six thousand rivers is 83,000 MW whereas technically potential 114 major schemes are identified where the total capacity of those schemes is 45610 MW. Those are economically potential major hydropower schemes whose benefit cost ratio is more than one amount 42330 MW (Mishra S.N., 2000). With such capacity current utilized Hydro-electricity is 549.2 MW (NEA, 2003). Nepal has 6000 rivers having capacity to generate electricity. So Nepal is rich energy sector if all that resource 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 a MHP on the rural livelihood in the remote village, Dhuligada, Darchula 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

and the degree of industrialization of country. Therefore, energy is the basic requirement of development, without which the peace of economy cannot be accelerated.

1.2 Statement of the Problem

Despite of higher technological advancements in the field of energy generation, many developing countries are facing energy problems. The major problems of energy are raising price of fossil fuel, depleting forest resources, increasing environmental degradation etc. Nepal is no an exception in this regard. 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 into 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 mainly consumed in rural Nepal.

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 its victims. In addition, the lighting objective is being fulfilled by kerosene lamps which also create pollution.

Rural people especially women have to spend much of their working hours in collecting fuel woods. Students' 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 areas 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 connection 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 Maune Khola Microhydro Power Project in income, health & sanitation, and education sector of the study area?

- What are the sustainable measures implemented in Maune Khola Micro-hydro Power Project?

1.3 Objective of the Study

The general objective of the present study is to find out the benefit of micro hydro power for remote rural area, where it is basically difficult to distribute the national transmission line and to evaluate the socio-economic impact of the MHP project in Dhuligada VDC of Darchula district. Besides, the study has the following major objectives:

- To find out the household electricity consumption of the people in project affected area,
- To examine the socio-economic impact of Maune Khola Micro-Hydropower project on the targeted area,

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 socio economic aspect of rural people. Outcomes of the study will help assess the impact of MHP on income, and livelihood of local people of Dhuligada VDC, Darchula, Far-western Nepal.

1.5 Limitations of the Study

This study has been conducted to analyze the impact of micro hydro power project on socio-economic condition of the people who live in Dhuligada VDC of Darchula.

This study is confined with the following limitations:

- It is the case study of Dhuligada VDC which may not be applicable on other VDCs of the country.
- For data collection, I needed to frequently visit the study area, which is far away from Kathmandu, which is my current address. It is not be affordable due to lack of budget.

- This study has generated the primary data which is original but sample size is limited. Consequently, the outcomes may not be similar to the outcomes of national level study.
- The study narrowed only some limited variable and ignores many variables which can affect the detailed results.

1.6 Organization of the study

This study has been organized in to five chapters. The first chapter deals with the introduction. It includes the general information of micro hydro, statement of problem, objective of the study, significance of the study, organization of the study. The second chapter presents the review of literature Review. The third chapter deals with the research methodology. It includes rationale for the selection of study area, research design, nature and source of data, universe and sampling, data collection technique and tools, household survey, interviewed with key informants, observation, interview, data analysis. The fourth chapter presents the data presentation and analysis with profile of the study area. The last chapter of the study offers summary/finding, conclusion and suggestion. Appendices and reference have been kept at the end of this report.

CHAPTER – TWO

LITERATURE REVIEW

2.1 Literature Review

In the international arena, MHP is often studied as a 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 significantly less negative environmental impacts than larger schemes (Clancy and Redeby, 2000). MHP is also taken as a technology demonstration and its investment is considered as an important social infrastructure and also has positive impact on schools, hospitals, business, agriculture/industries, and so on.

The definition of Micro hydropower varies in different countries and can even include system with a capacity of a few megawatts. One of the many definitions for micro hydropower is: hydro system up till a rated capacity of approximately 300KW capacity. The limit is set to 300KW because this is about the maximum size for most standalone hydro system not connected to the grid and suitable for "run of the river" installations. (Wim Jonker Klunne, 2013)

Microhydro or small-scale hydro is one of the most environmentally being energy conversion options available, because unlike large scale hydropower, 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 services since 1970s. Electricity generation from micro-hydropower started after 1980s and was add-on activity at that period. Around 1990s micro-hydropower started getting recognized as a means of providing electricity in rural areas. Initial micro-hydro schemes were primarily addressing the need of processing, agricultural products and

subsequently rural communities installed a large number of turbine mills. (AEPC/ESCAP, 2008)

According to Subsidy Policy for 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 uses. The Government of Nepal and various Development Partners have been providing financial and technical support to increase the access to clean renewable energy. 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. Reductions in per-unit program costs over time were driven by progressive declines in capacity development 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 option for improving access to a modern, sustainable energy service in rural areas is the promotion of decentralized and integrated rural energy systems that are cheaper, more environmentally friendly and easy for local people to operate and manage. (Neupane M., Sharma B., 2009)

The best approach to harnessing people's potential to develop rural energy systems is the provision of self-governing institutional mechanisms for inclusive participation and empowerment based on a decision-making process that is transparent and builds consensus. Community mobilization of community members is key to 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 systems with appropriate guidance and capacity building. Decentralized institutional frameworks and operational modalities are required for wide scale promotion of rural energy systems (Neupane M., Sharma B., 2006).

Nepal is among the world's poorest and least developed countries. The Human Development Index 2012 ranks Nepal 138th out of 182 countries (Table 1; UNDP, 2012). Rural-urban disparities are still large in Nepal. Urban poverty stands at around 10 per cent, compared to about 35 per cent in rural areas, where 85 per cent of the people live. While 80 per cent of households are involved in agriculture, the sector contributes only 35 per cent of Gross Domestic Product (GDP) and has high underemployment rates and low productivity. Expansion of rural electrification is one of the five key elements. Expansion of rural electrification is one of the five key elements under the Agriculture Perspective Plan to improve the agricultural sector.

Micro-hydropower (MHP) scheme 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 Webster Electricity is a term referring to the large body of physical phenomena 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 in 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 have 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 causes and consequences of these countries' achievements and the challenges that they face today and in the decades to come.

According to Energy sources and supply in Nepal (Oct, 2006) by Karki, Nepal has vast potential hydro- resources, the economic potential for hydropower is estimated at 43000MW. Yet hydro- electricity accounts for only 1% of total energy supplies, firewood 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.

NEA, (2013), ′Community Electrification′ As a part of the government policy to promote community participation in rural electrification, the business group carried out community based electrification in various parts of the country and handed over the facilities to the community for the operation. The government provided 90% of the capital cost of electrification, and remaining 10% of the capital cost was borne by the community. NEA is responsible for maintenance of HT line where as communities/users group is responsible for maintenance of LV distribution system. The public response to this initiative of NEA has been overwhelming. Altogether, about 73000 households have been provided with electricity by the end of FY 2012/13 through 94 community groups.

Nepal hydro & electric limited, (2013), by BPC, Nepal Hydro & electric limited (NHE) was established in 2042 B.S. by Butwal Power Company Ltd, Aistom Power Norway As, Kvanerner energy (formally sorumsandverkstand) As Norway, Butwal Technical Institute and Himal Hydro and General construction Ltd, As the shareholders. NEHS capabilities include design, manufacturing and installation of hydropower equipment, mainly covering various types of hydraulic gates, stoplogs, trashracks, panstock pipes, medium size turbine housing, micro/mimi turbines and

substations and repair of electromechanical equipment. Some of the major jobs completed during fy 2069/70 are as follows:

- ShaniBheriseel truss bridge at Rolpa district.
- Hydro-Mechanical works of 10MW. Siprin HEP at Dolakha district.
- Runner repairing of NEA, Middle Marsyangdi, NEA Modikhola, NEA Sunkoshi and NEA Trishuli.
- Runner repairing of Khimti, Bhotekoshi BPC Jhimruk, Khudi and Other IPPS works.
- Substation works of NEA good Lamahi, NEA chameliya HEP.
- Supply of substation equipment of NEA Butwal and Birgunj sub station.

The company posted a total sales turnover of NPR 451 million during the fy 2069/70. A few of the major contracts like that of Adhikhola up grading project and Chameliya Hydro Electric project could not be completed because of the delay caused by the designated civil contractors. Similarly, due to the delay caused by the Indian customers authority in granting approval to take items to India for hard coating.

Around 65 privately run firms/companies are there in this trade these days to render services to establish micro hydropower projects to generate of 5000 Kilo Watt of electricity annually in the country. The plants up to 1000 Kilo Watt capacity are to be known as micro hydropower as defined recently where as it was limited to 100 Kilo Watt in the past. The schemes of 5 Kilo Watt or less, now, have to be known as pico. Nepal Micro Hydropower Development Association was established, in 1992, by eight privately run micro hydropower development firms/companies to set as an umbrella organization of those dedicated to serve the nation with micro hydropower technology, skill and expertise. The Association is also to support formulating policies, plans and programmers to concerned agencies. Likewise, professional welfare is one of its objectives. (NMHDA)

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 regions. Nepal is facing many problems with respect to hydro-power development. There is lack of capital, skilled manpower, technical knowledge, sufficient market and economic status of people as well as country.

Mosewr M.C. (1989), in "Gender Planning in the Third World," says that the United National Decade for women (1976-85) has played a crucial part in highlighting and publicizing the important, but often previously invisible role of women in the economic and social development of their countries and communities and the 'plight' of low income women in third world economies. Researchers have moved away from a preoccupation with the role of women within the family, towards an understanding of the complexities of women's employment. Research on both waged workers and those in the informal sector, in urban and rural areas, have assisted in identifying both the importance and the diversities to world economies. Policy makers have begun to shift their focus from a universal concern with welfare oriented, family concerned programs, which assumed motherhood as the important role of women in the development process of diversity of approaches emphasizing the productive role women. The so called women in development (WID) approach adopted by the United States Agency for International Development (USAID) with its underlying contribution to the development and had an important influence in popularizing income generation.

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 authors propose remedies as well. 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 hydroelectricity generation" concisely illustrates the essence of professor Sarfoh's discussion in the book.

The author examines the energy consumption practice of West Africans and the potential of several energy resource endowments of the sub region. They further added 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.

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 hydropower, which has vast potential has remained virtually not so utilized. Biogas is not an important energy, which is technically limitation in hills and mountain even in Terai. Nepal's hill and mountain areas occupied under development infrastructure make life hard for rural population. Women generally hear the full responsibility of household chores and share work in the farm and also fuel collection for energy requirement. This increases workload for the women. This makes women's daily life more difficult. The report mainly concentrated on women who are responsible for reproduction and bring up all the time spent to the next generation and care on a daily basis of all family members. Moreover they generally work hard but paid low wages and offer security low valuation of women's work, few legal rights, 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 supplied 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. In conclusion; this report talks stainable development as the keyword for need oriented, self-reliant and environmentally sound development and says that increased economic activities will require more energy input. Nepal relies excessively on the form of renewable energy, i.e. wood obtained from forest and its role in balancing ecosystem has been decreasing. 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.

Environmental impacts if they are not designed consciously to protect the environment. ITDG (1999) concludes that MHP can cause unacceptable negative or these impacts are not mitigated properly. The scale of MHP impacts is small enough to reasonably mitigate them without any significant adverse environmental impacts at affordable costs. Landslides or land erosion ranks highest among the possible negative impacts of MHP. The universal positive environmental impact from MHP is reduction of greenhouse gas emission through substitution of kerosene used for lighting. MHP geared towards electric cooking can conserve forest as well as reduce green-house gas emission. As already mentioned earlier MHP has positive gender impact. The involvement of women in MHP promotion is still at the low profile. In this connection the participation of woman community organizations in MHP promotion is appreciable initiative. Efforts in this direction will be at the interest for the MHP promotion.

Pandey (2009), In Nepal, the installation of MHP has been supported by bilateral donors and banks who 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 rural enterprises as less-productive members of the economy. Moreover, 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

the rural household who are deprived of electricity especially, in mountainous region like “Sikles”. 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 using qualitative as well as quantitative.

Jha (1995) stated that one of the major reasons for poverty and backwardness of the Nepalese economy is due to the power deficit. Shortage of power creates a problem in the development of agriculture, industry, trade and other sector of economy with the view of meeting power shortage, it is needed to generate power in small and micro level. The small and micro-hydropower play crucial role in increasing productivity of the agriculture sector and including the processing of agriculture product. The lifting irrigation in the hill area is also promoted by the development of small and micro hydropower. Addition to this, the food processing and cottage industry will get benefit from the development of micro-hydropower.

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 to isolated pockets areas of the countries. The micro hydropower is also important from the consideration 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 on results. Micro hydro plants have been a very good worth for promoting the Clean Delivery Mechanism (CDM) by reducing carbon emission. About 10 million kg of CO_2 is saved every year by MH households in Nepal. Selling that carbon can also be listed as income generating way from micro hydro. Studies show that, household's 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 of our survival without energy. Energy is compulsory for the development purposes. After

the utilization of the energy properly and aptly 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 fossils fuels and other commercial form 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 plagued 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, 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 thereby 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 percent 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.

This study has drawn from an extensive range of methodologies. It is varied from selection of appropriate micro hydro sites, extensive review of literature, preparation of specific approach for the impact assessment on MDG, preparation of a checklists

and questionnaires, field visits, use of participatory techniques, interviews, baseline data, participatory analyses and consultations to gather the necessary information.

Bose (1997) has mentioned that the construction of such a big dam in mountain leads to great controversial issue. The constructions of such large dam in the mountain environment in seismic zones create a great sensitive issue for further disaster and hazards. For example, Tehri Dam Project in Uttar Pradesh. He further stressed that development must be centered on the people with utmost conservation to the environment. In a democracy, the development process must be participatory in nature. He suggested that in the name of science and technology, development should not become culturally incentive and there should be detailed planning for disaster management.

The report prepared by REDP, and Government of Nepal (2000) has included the information of rural energy sectors. The principle 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 has tried to demonstrate the development path of rural energy sector, to review on rural energy sector policy and to raise the issues and give the solution of the rural energy sector problems for the sustainable development.

The 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 store etc. This report connate that the increased population increase the demand of resources that puts further pressure on the forest which is already in determine processes in Nepal. Desertification, ecological instability, loss of biodiversity, drying up of water springs is some of the serious environmental consequences of massive deforestation. So most of the energy needed can be fulfilled by the big hydropower projects but which is focused only one urban area. This effort has largely ignored the rural population. This report raises the major issues and focuses on the promotion of rural energy.

This study glimpses the present trend of micro-hydropower, illustrating that most of the MHP schemes have been installed for mechanically driving agro processing unity like grinder huller and oil expeller, whereas other and uses are few and far from low application and the local resources utilization through micro-hydro plants. The report concludes that there are inconsistencies in policies support and implementation of

micro-hydro and other rural energy technology. These inconsistencies are lack of technical and managerial skills of operation and main finance among the rural population; cooperation among the delivery agencies and inadequate information about the technology in rural sector.

Hamal S. (2001) explains that rural and hill areas have undergone deforestation due to insufficiency of alternative energy i.e. electricity and women overworking in farm, time consuming and non-monitoring and highly backwardness.

The author further explains that energy is required to fulfill the day to day needs, which includes cooking, heating, lighting and productive activities such as transportation, irrigation, cottage industries, etc. Energy shortage has been recognized as major constraint in economic development and it contributes to further deteriorate the environment, creating a vicious cycle in rural life by deforestation. Women are the main user of household energy. They are the main persons responsible for collecting fuel wood or the managing of other energy sources such as doing crop residues etc. Deforestation has made the women's work harder. The increasing walking distance to fetch fuel materials has proven to be a work burden. Most of the rural women are not yet exposed to the existing source of electricity and women are found to fetch and gather fuel materials.

Gurung (2003) has focused on the situation of utilization of the expenditure pattern on water field. He mainly focused on Hydro-energy which is the prime source of energy for the sustainable development for civilization, industrialization and development. So, hydro energy is essential for equitable development. Similarly, if we can generate hydropower that is the boon for environment-friendly projects, it becomes essential for construction and mining purposes, deep drilling activities using hydro energy.

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 decades towards the national poverty reduction strategy (PRS) reviewed in detail. This study is designed to analyze PRS as well as MDH targets. The two primary objectives of this study were to undertake comparative analysis of changes before and after REDP intervention. The program REDP achieved the improvement on several targets. The

targets launched are among them. It gets improvement on the way of women empowerment which is the indicator of millennium development goal in which it is found to be directly influenced by REDP's initiatives with the approximately half population of the total women interviewed holding higher portion in various community based organizations. This is also proved with positive response from community elders. This also established the significant role of REDP in achieving greener and sustainable environment (MGDs) and that REDP's holistic approach plays the key role in hitting a number of MDG's targets simultaneously positive changes in many indicators confirmed the prime role of energy in the development process of the rural community studies. Considering that REDP is providing energy services in an integrated manner including, skill development, enterprise development, information services institutional and capacity building, fuel supply, technology many fracturing operations and maintenance etc. with encouraging outputs it can be considered as the best practice model operating so far in Nepal.

Gonzalez et. al. (2007) studied the impact on development and environment due to MHP in Bolivian communities. The study examined nine hydropower projects in Bolivia. The gist of the study is there was significant change on education, health status, comfort level, self-confidence and feeling of possession due to the micro hydro project. Hydropower is able to reduce 54 percent of the household expenditure for energy related expenditure such as candles, kerosene, LPG, and batteries. It created part time job opportunities as well as established and enhanced the quality of small business and save time for travel to buy lighting fuels. Due to the electrification, education status of students uplifted and study hours increased. They conducted basic literacy classes for adults in 5 communities. In addition, new educational tool have been purchased such as computer rooms, TVs, DVDs, projectors and so on. The health status of local people improved due to the reduction of smoke generated by firewood at home and the risk of fire was also reduced.

There has been rapid change on communication and social life. So, households have TV and radio and more public telephones have been installed in three communities. Public lighting provided security in the night for walking and with cheap lighting people stay long at night for productive works. Hydropower has contributed to equality between indigenous and non-indigenous people in Bolivia. The hydropower has positive effects on local and global environment. The most remarkable aspects are

the reduction of the emissions 16.6 tons of CO_2 equivalents every month. The sustainability of the project guaranteed in all its dimensions economically, institutionally, technically and environmentally.

Dhungel (2009), in his thesis have analyzed the financial and economic condition of micro hydro power in Nepal. His thesis started with a background of the economic condition and energy scenario of rural Nepal. Then it is followed by the introduction of micro-hydro power and its role in the development of rural areas of Nepal. The final portion and primary objective of his thesis consists of financial and economic analysis of micro hydro systems in rural Nepal. In this regard, relevant data concerning three MH systems had been collected. The financial analysis of all three system show that only one is the privately owned system. Lastly, an economic analysis of one of those three MHPs is conducted which shows that JVIH system can be highly effective mean to increase the economic welfare to the people in rural areas even though they might be in weak financial situation. However, bearing in mind the need to ensure the long-term sustainability of these MH systems in daily varying situations, the financial viability of a system therefore becomes a crucial consideration.

Bista (2011) has compared users and non-users group Tarakhola MHP located in Tara VDC of Baglung to examine the impact of MHP on education, health and access to information. The result of the study has shown the positive impact of MHP on education, health and information.

According to her results, the numbers of passed students are more in user groups than non-user groups whereas school dropouts are less in user group and more in non-user group. The number of ill household members from respiratory and eye related problems are less in user group. The households of user group have ownership of electric devices and information technology.

Joshi (2011) has mentioned that energy is important for economic development. The pace of economic development cannot accelerate without the development of hydropower. The development of production sector in the economy depends on the development of the energy sector. In the hilly and mountainous area, almost all households are found to have consumed traditional sources of energy for cooking, heating, lighting and other necessary activities. Traditional energy sources cannot be

sustainable to fulfill energy requirement. From the present analysis, it has been observed that most of the people depend on forest for energy sources and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortage of fuel wood, soil erosion, deterioration of the fertility of soil etc. Deforestation leads to deterioration of water resources and hampers both electricity generation and drinking water. The utilization of energy is concerned on urban areas and most of the rural areas have been passed by this power development. The hydropower project has brought about change in socio-economic, cultural and other aspects of people living in the project located area.

Singh (2011) analyzed the income and employment generation by the project in project area of mini hydro power project. The study has analyzed problems associated with the project. The study has concluded that the project helps to raise income level of local people by establishment of new business and it drastically grounded the expenditure of people on the traditional energy. The health condition of people sufficiently improved and people have access to the modern medical equipment due to electricity. Preservation of forest increased sufficiently due to the reduction of dependency of people on the firewood. The educational status of the students uplifted as they could utilize their evening time as well as nights for study.

Regmi (2012) has analyzed the present condition of energy system in Nepal. The summary conclusion of her findings includes the need for proper utilization of natural resources like water to achieve the development goal. By proper ingathering of rest water resource by aptly trained manpower and investment on water resources, dependency on foreign countries could be vanished. One of the alternative ways to increase the energy 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 in 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 for the government that private sector is not capable to develop sufficient hydropower projects to satisfy the demand. So, public sector must play an important role for sustainability of hydro power projects.

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 cooperation 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 'Mul Mantras'). These principles include organizational development, skills enhancement, capital formation, technology promotion, environmental management, and empowerment of vulnerable groups and communities. The support organizations work with villagers to establish community organizations, and to ensure that at least one male and one female from each household are members of a community organization. Multiple community organizations form a wide range of functional groups based on common interests. The groups may focus on interests such as micro-hydropower, income generation, forestry, biogas, and poultry farming. The functional groups consist of representatives from all community organizations, ensuring representation from men, women and vulnerable groups.

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 cooperative, 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 live in the rural area.

CHAPTER – THREE

RESEARCH METHODOLOGY

3.1 Rationale of the Study Area

Maune Khola Micro-Hydropower Project lies in Darchula district; one of the mountainous district of Mahakali Zone in Far-westren region of Nepal. In Darchula, the MKMHP with 41 KW of capacity is installed by using the water of Maune Khola, which is situated in the north of the VDC. That is also tributary of Mahakali River. It is an important and popular project in Darchula district. This project is playing very important role for rural electrification in Dhuligada VDC of Darchula.

3.2 Research Design

This study is based on explanatory research design. The study has investigated the socio-economic impact of micro hydropower projects in rural sectors and has find 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 installation of micro hydropower project such as economic activities, income, information, education etc. Thus this study is done descriptive, analytical and explanatory.

3.3 Sampling Procedure

The universe of the study is the household of Dhuligada VDC, Darchula district. Out of total 240 households of Ward No. 4, 5, and 7 of this VDC, this study is done in 84 households through simple random sampling. To fulfill the purpose of the study the researcher has taken 35% households from each ward which represents our universe of 240 households.

3.4 Nature 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 has applied both qualitative and quantitative data.

3.5 Source of Data Collection

3.5.1 Primary Data

Primary data has been collected from the field survey. For this purpose the following tools and techniques have been applied in this research:

a) Observation: The researcher has visited to the project site and observed its impacts on education, health & sanitation, agriculture & employment.

b) Interview Schedules: Interviews are taken with the local area people and asked the impact of micro hydro power. The researcher has asked a number of questions and asked for the suggestions regarding the Project.

c) Questionnaire: A questionnaire has been developed prior to project visit. The questionnaire is developed in such way that it covers demography, health and sanitation, agriculture and animal husbandry, sufficiency of agriculture product, income and expenditure pattern, human resource, resource of fuel, kind of stove and forest and electricity. The project has occupied land of total 25 households who are considered as directly project affected families and they are selected to fill up questionnaire.

3.5.2 Secondary Data

Secondary data has been collected from different source of governmental and nongovernmental organization such as; AEPC/NRREP, VDC, Related bulletins, journals, published report, knows and official etc.

3.6 Method 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. have use for simplifying data for comparison for data analysis. According to attributes and features of data the required tables and figures have created and textually. This study declares

on socio-economy impact of MKMHP on Dhuligada VDC, ward no. 4, 5, and 7, of Darchula district.

3.7 Data Analysis and Interpretation

Data collection is used to describe a process of preparing and collecting data. The purpose of data collection is to obtain information to keep on record to make decision about important issues, to pass information onto others. Primarily data is collected to provide information regarding a specific topic. Various techniques like table, graph, charts, statistical tools, computer software etc. are employed during the research study.

CHAPTER- IV

DATA PRESENTATION AND ANALYSIS

This chapter presents the analysis of data and presents their interpretation with the help of table, bar-diagrams and pie charts. Section 4 presents the profile of the project and the household information of the users. Section 4.1 presents the Maune Khola Micro Hydro Project details and 4.2 presents the household information separately. Section 4.3 presents the socio-economic impacts whereas Section 4.4 presents the other impacts of MKMHP in the project affected area.

4.1 General Background of the Study Area

The study area, Dhuligada VDC is located in the Darchula district, a marginal, rural mountainous region of Far-western Nepal. The road distance from Kathmandu to Darchula is about 1043 Kilometers. The geographical location of Darchula district is: $80^{o}22^{"}$-$81^{o}9$" East (Longitude) to $29^{o}36^{"}$-$30^{o}15$" North (Latitude). Dhuligada VDC is located about 43 kilometers southwest of district headquarters and is surrounded by Khar VDC in North, Ranishikhar in South, Sipti in East and Dhap in West. The total area of Dhuligada VDC is 28 sq km that constitutes of the total population of 4,727 according to National Population Census 2011. For fulfilling the energy needs of vulnerable communities of Dhuligada VDC, Maune Khola Micro Hydro Project has been established in 2008. With its total capacity of 41 KW, the project has been serving electricity total 484 households of 5 wards. Purposively for ease of study, I've taken 270 benefitted households of 3 wards viz. 4, 5, 7 respectively. Out of 240 households 84 households have been taken as a random sample size. Because of small scale of plant, the electricity generation is very low. Most of the households use electricity for lighting and watching TV. The plant is operating about 15 hours except 11pm to 8am in a day. The project is being operated by REP (supported by UNDP) and local community.

4.1.1 Installation Cost of the Project

The production capacity of Maune Khola Micro Hydro Project is 41 KW and the total installation cost of this project is about Rs. 1,50,85,148. The financial arrangement for this project was accomplished as follows:

Subsidy (REDP): Rs. 6975000/-

Equity Investment

DDC : Rs. 7,54,257/-

VDC : Rs. 15,08,514/-

Community Contribution: Rs. 9,68,000/-

Total Budget: 1,02,05,771/-

4.1.2 Maintenance Cost of the Project

Maintenance is necessary for any type of projects to operate smoothly for a long run. Maintenance of the project helps to make it sustainable. For Maune Khola Micro-hydro Project, the maintenance cost has to be bear by DDC, VDC, and local community.

4.1.3 People's Perception about Improvement of the Village using MKMHP

Installation of Micro-hydropower 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. Of the total 90 respondents, almost all mentioned that the role of the project is vital for their living standard. Life become easy and children's reading habits improved 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.

4.2 Household Information of the Project Affect Area

4.2.1 The Households Participation of Ward No. 4, 5, & 7

Micro hydro has played the vital role for electrification in the rural area of Nepal. This Maune Khola Micro Hydropower Project has benefitted total 5 wards of Dhuligada VDC including wards 4, 5, 6, 7, 8. Despite limited time and budget requirements, this case study has been conducted carefully to make it more effective, reliable, and comprehensive by including the sample households of 3 wards of the PAF. Out 240 total benefitted households from three wards, 84 households have been taken as

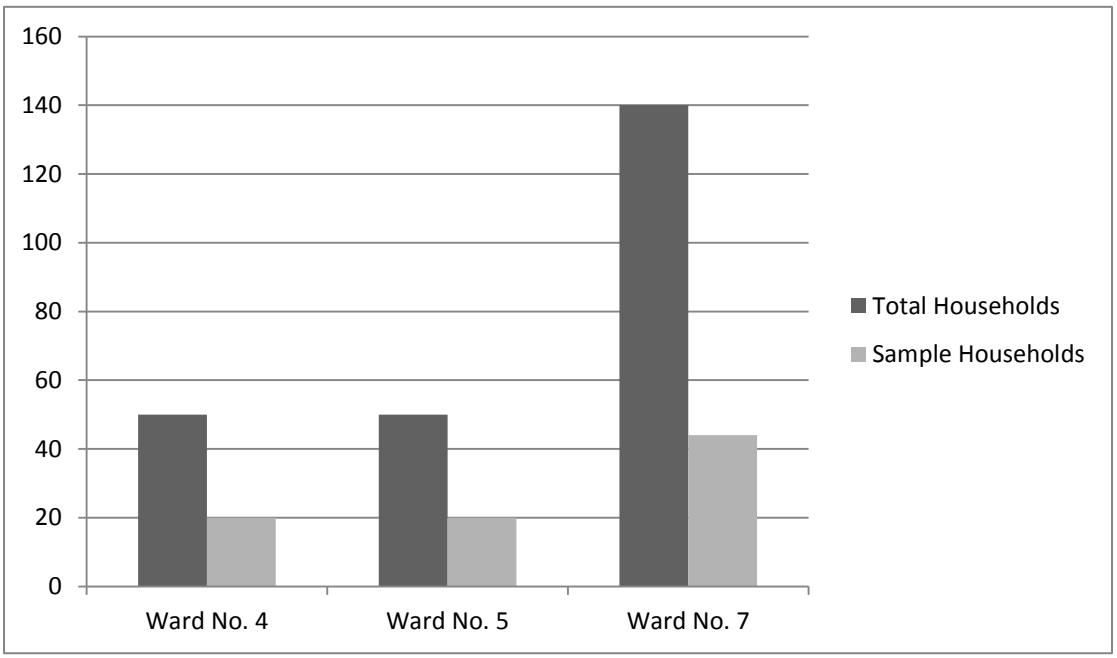
random sample. The ward wise distribution of respondents of this study is shown in the table below:

Table No 4.1

Ward Wise Participation of Respondents

Wards	Total Households	Sample Households from Ward
Ward No.4	50	20
Ward no. 5	50	20
Ward no. 7	140	44
Total	240	84

Field Survey, 2015



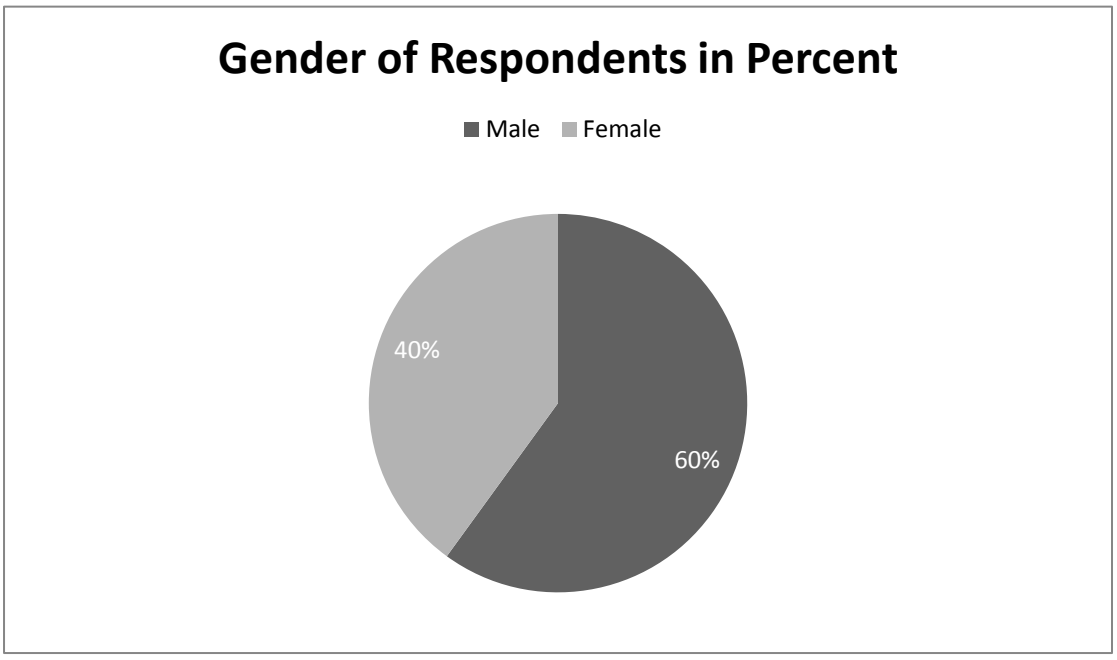
The above Table No. 4.1 depicts that out of 84 respondents, the higher number of respondents were from Ward no. 7 because large number i.e. 140 households are benefitted from that ward.

4.2.2 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 household heads in most of the families. Of the total sample, 60% (50) were male respondents where female respondents were only 40% (34). The gender-wise participation percentage of respondents of study area has been presented in the pie chart below:

Pie Chart 4.2

Gender wise distribution of respondents



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

4.2.3 Age Group of Respondents

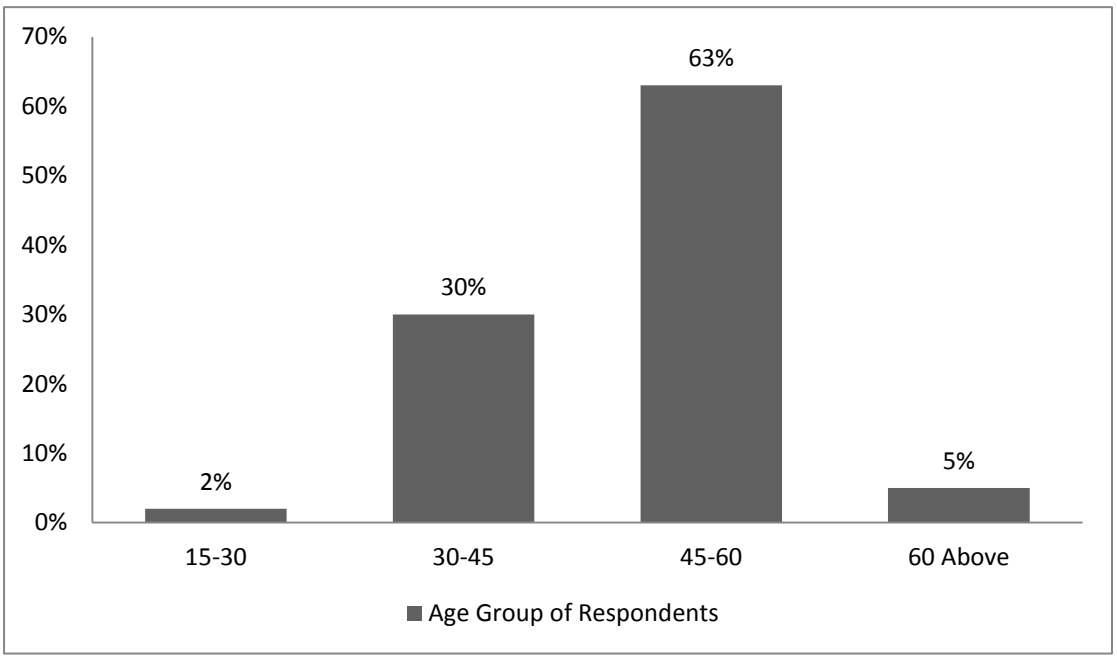
According to the age, the respondents were divided into four groups. The questions were asked to the respondents aging above 15 years as shown in the table 4.2 below:

Table No. 4.2

Age Group of Respondents

Age	Frequency	Percent
15-30	2	2
30-45	25	30
45-60	53	63
60 above	4	5
Total	84	100

Source: Field Survey 2015



The study shows that the majority of respondents were among (45-60) age group i.e. 53 out of 84 respondents (63%) lie in the age group 45-60. The age-group (30-45) pertains to the 30%, age-group (60-above) consists of 5%, and 15-30 age-group contains only 2% of the respondents.

4.2.4 Caste of Survey Household

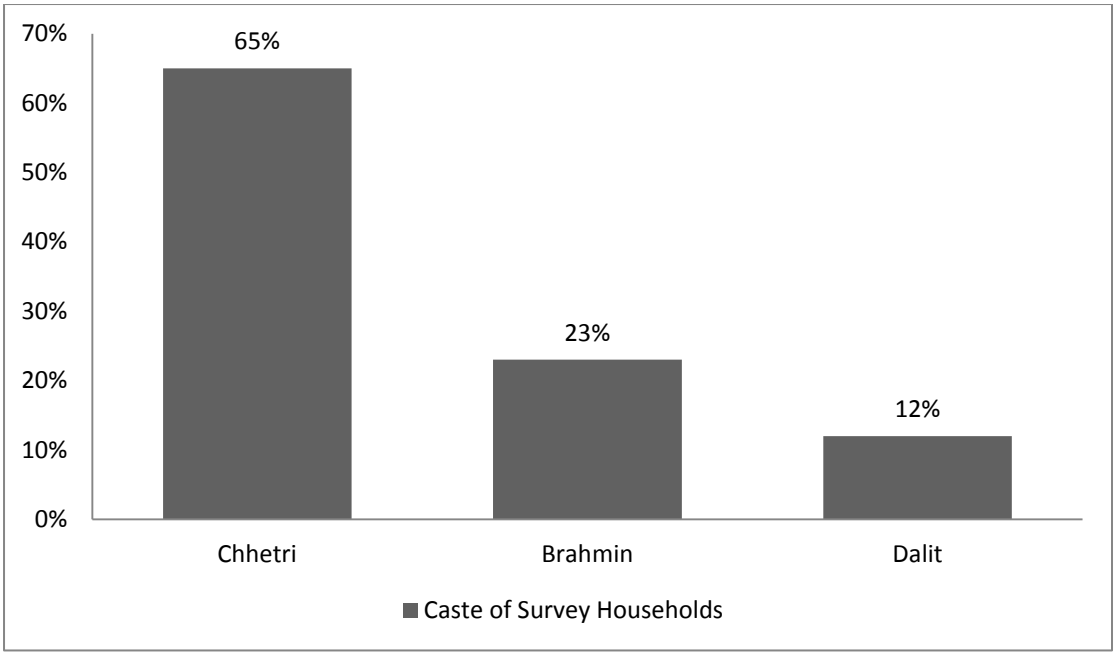
Heterogeneity and multiplicity are the figures of the study area. Various castes like Brahmin, Chhetri, and Dalits are in existence in the villages. Among the total population of the study area, Chhetri is the dominant cast followed by Brahmins, and Dalits with the least population. Doteli is the common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

Table No. 4.4

Caste of Survey Households

Cast	Frequency	Percent	Cumulative Percent
Chhetri	55	65	65
Brahmin	19	23	88
Dalit(Tamata, Lohar)	10	12	100
Total	84	100	

Source: Field Survey 2015



Of the total households, the highest portion, 65% respondents are Chhetri. Brahmin and Dalit respondents are only 23% and 12% respectively.

4.2.5 Main Incomes Sources of Households

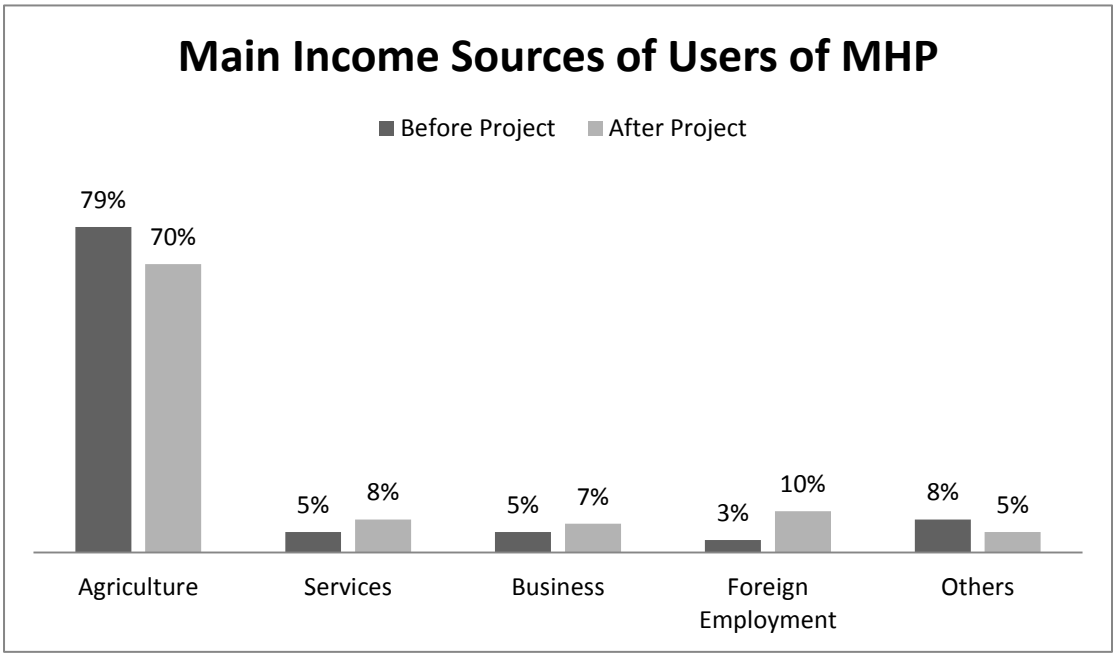
Agriculture, service, foreign employment etc. are the main occupation/income sources of the survey households. Other occupation includes business and daily wage. The main income sources of households in the study area is shown in the table below:

Table No. 4.5

Main Income Sources of Households

Income Sources	Before Project		After Project	
	Frequency	Percentage	Frequency	Percentage
Agriculture	66	79	59	70
Services	4	5	7	8
Business	4	5	6	7
Foreign Employment	3	3	8	10
Others	7	8	4	5
Total	84	100	84	100

Source: Field Survey, 2015



As per the survey results, major income source of study before seems to be Agriculture (79%) while other incomes sources include Services (5%), Business (5%), Foreign Employment (3%), and other incomes sources (8%). Slight changes have been found in the incomes sources of project affected families. After project, Agriculture (70%), Services (8%), Business (7%), Foreign Employment (10%), and other incomes sources (5%) have been found. The study before and after the project shows that their financial habits are affected by agriculture. The community is based on agriculture.

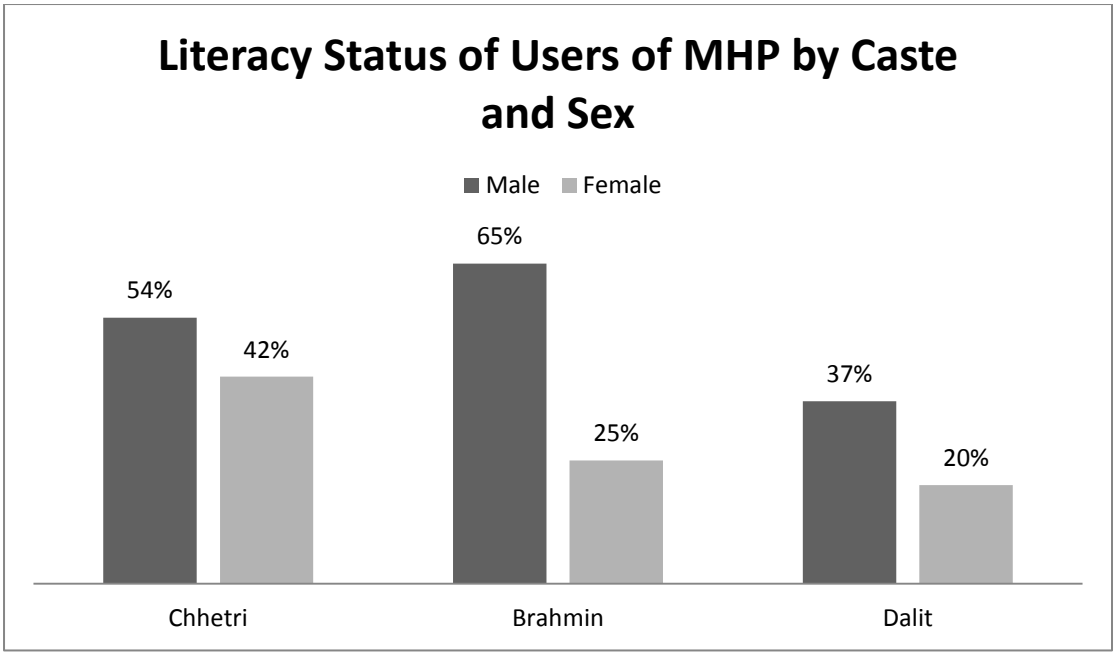
4.2.6 Literary Status of the Study Area

Table 4.6

Literacy Status of the Study Area by Caste Group

S.N.	Caste Group	Total population	No. of Literate people		
			Male	Female	Total
1.	Chhetri	328	103	74	177
2.	Brahman	116	56	19	75
3.	Dalit	60	18	4	22
Total		504	177	97	274

Source: Field Survey, 2015



Literacy is one of the most significant indicators to measure people's living standard. The total population of the study area is 504, of which 247 (49%) were males and 257 (51%) were females. The average literacy rate of the study area is found to be 54%. Out of total population, 328 (65%) were Chhetri, 116 (23%) were Brahmin, and 60 (12%) were Dalits. The literacy rate among Chhetri Community is about 54%, while the literacy rate among Brahmin and Dalit Communities are 65% and 37% respectively. But the literacy rate by sex has shown different results in the study area. Out of total literate population, only 42% of Chhetri, 25% of Brahmin, and 20% of Dalit women population is literate. It shows that female literacy rate in the study is only 38%. The female literacy rate before project was even poorer than the current rate. The Maune Khola Micro Hydropower Project has brought about some positive changes in the literacy status of the project affected area.

4.3 Socio - Economic Impacts

4.3.1 Health and Sanitation

4.3.1.1 Drinking Water

The people of the Users of MHP as well as whole study area drink taps (piped) as well as stream water. But the pipeline water and improved stone taps are increasing day by day. Before the project started 15.5 and 3 Users of MHP used to drink water of pipe. Tap and well sources respectively. Quality of piped water has improved. At the

completion of the project, 18.4 and 11 Users of MHP are drinking water of pipe. Tap and well sources respectively. The number of users of piped water is increasing.

4.3.1.2 Use of Toilet

Sanitation is one of the indicators of living standard of the people. Before the project start there were only 5 *Kachchi* toilets in all Users of MHP. They improved their habit and started to use toilet. But due to their poor economic condition, they haven't built modern toilets yet. The use of Kachchi toilet has increased by 46.67 percent and reached from 5 to 20. After the completion of the project only one PAF has made Pakki (Modern) toilet.

4.3.1.3 General Treatment

Before the project start, people of the Users of MHP used to follow domestic as well as traditional approaches like, witch-doctor (*Dham, Jharki*) for general treatment. However, they follow witch doctor for no longer. They use domestic approach and some people go to health post. Frequently repeated diseases are, diarrhea, Cold-cough, dysentery etc., Health post was only one the health institution for medical treatment of all Users of MHP before the project start. Nowadays, health centers and private clinics are available there for medical treatment.

4.3.1.4 Land Holding

Table 4.7

Land Hold in of Users of MHP by Caste Group and its Kinds

(*in Ropani***)**

S.N.	Caste Group	No of HH	Kinds of Land (khet)					
			Irrigative	Non-irrigative	Total	Bari	Pakho Bari	Grand total
1.	Chhetri	55	737	342	1089	472	181	1742
2	Brahmin	19	209	190	399	247	95	741
3	Dalit (Tamata, Lohar)	10	50	150	200	80	80	360
Total		84	996	682	1688	799	356	2843
Percent					(59.38)	(28.10)	(12.52)	(100)

Source: Field Survey, 2015

Out of 2843 Ropani of land, total irrigative and non-irrigative land held by Chhetri, Brahmin and Dalits is 1688 Ropani (59.38%) whereas 799 Ropani (28.10%) of land is Bari, and 356 Ropani (12.52%) of land is Pakho Bari. The total land holding by Chhetri only is 1742 Ropani, whereas the land holding by Brahmins and Dalits are 741 Ropani and 360 Ropani respectively.

Most of the land plots of Users of MHP are cultivatable. Out of some plots of land are situated in the bank of Maune Khola River where the project is situated. The project has occupied nearly 50 Ropani of land which was provided by 25 Users of MHP. Total land held was 2843 Ropani before the project. However, they have only 2793 Ropani of land after the completion of the project.

Advantages of the MHP in Locality

MHP played the vital role to uplift the human drudgery in the village. Using this project, people are able to live in the clean light in night which has made their night life easier. Without MHP people were compelled to use traditional, time-consuming, and environment polluting sources of energy. Now, after launching MHP, people have established medicals with modern facilities, other form of businesses, computer institutes, and so on which help to generate economic activities and improve the economic condition of the villagers. MHP helps to raise the social condition, improvement in health, increase the reading habits of the children and so on.

Change Seen in Village Using MHP

Electricity is the foundation for any kind of development activities. MHP helps to change the holistic scenario of the village, it plays vital role to make the infrastructure in the village. The sanitation condition of the village has changed a lost as every houses made the toilet. MHP project has made sustainable changes in the village. MHP has helped the villager to improve their economic condition in so many ways.

Related Factors Responsibility about Sustainability of the Project

To sum up, it is known that repairing and maintenance is necessary for every non-living things. Therefore, MHP must need repair and maintenance that make things sustainable. The government or related donor agencies not only install the project but they also supervise the project to know whether the project is in good condition or not. They must regularly be in touch to the users and households also have to inform them continuously about the condition of the project.

For a power house to operate and sustain, it needs regular maintenance and repairing activities. User consciousness and community participation is compulsory for the project to sustain longer. During the research time, all the respondents were ready to do anything for the betterment of the project if need be. Women participation on project is crucial as 'men and women are two wheels of a same chariot'. So, equal opportunity and participation in necessary for the proper usage and maintenance of MHP.

Management committee must be responsible and aware about running the project smoothly and sustainably. They all need to be accountable for any kind of imbalances in the project.

4.4 Impact of MKMHP

4.4.1. Introduction

It has been known that every hydropower project has positive and negative impacts on social, cultural and economic aspects of the concerned area and its surroundings, environmental impacts of small hydropower are limited. MKMHP has influenced various aspects of physical and social economic aspects of human being in the project site. Dhuligada VDC wards 4, 5, and 7. It has as well as indirect and positive as well as negative impacts. It has following socio-economic impacts.

4.4.2 Impact on Infrastructural Development

Project has positive impact on the development of infrastructures. Telephone service available at Dhuligada and surrounding area is the outcome of the project. Electricity has been available in the project area due to the project. Local market was set up at the project site.

4.4.3 Impact on Heath and Sanitation

People are conscious of their health and sanitation. They started to visit clinics and hospitals instead consulting with witch doctor (Dhami, Jyotish, Jhankri). Mothers have learnt how to take care their child. Most of the people made Pakki toilet. Quality of drinking water has improved but all households have net access of clean drinking water. During the construction period local people were benefited from the medicines and health service from the project site. However, it has been stopped after operation.

4.4.4 Impact on Education

People are aware of the importance of education for women because of the use of T.V and other educational institution. Now girls go to school in a large number. But as far as higher education is concerned, local people (male as well as female) are still backward. Some people have started to send their children to boarding school. Some women have taken skill-oriented training. Before the project, children used to go to

bed early because there was no electricity and they had to face difficulties for managing kerosene for lighting. But after the installation of the MHP, their reading habits have changed a lot. Now, they are eager to study till late night which has highly improved their educational quality.

4.4.5 Impact on Employment

The project has created a significance employment opportunity to the local people. Many people were benefited by the project during the construction period. After operation of the project, it has provided 7 local people with permanent job and 7 people with seasonal job. Similarly, more than 500 got employment opportunity during the construction period of the project some local people are getting temporary employment. There was also opportunity for seasonal employment in the project with their desire, skill and capacity. On top of that, number of people in trade, small manufacturing and service sectors too has increased significantly after the installation of MHP due to availability of clean energy for lighting.

4.4.6 Impact on Skill Development

People of the local area involved and saw the project construction method during the construction period. It helped them to develop technical skill of construction methods. Some youth had explored their skills such as civil works. Welding metal works electric wiring etc. developed during the construction period in other places

4.4.7 Impact on Population

The project has influenced the individuals due to the construction activities and land occupying. 150 (51.30 percent male and 45.70 percent female) of total 25 Users of MHP are directly influenced due to the land holding by the project. Most of the households have been directly influenced by the project. But the people of site's surroundings are also influenced indirectly.

4.4.8 Impact on Land Holding.

Out of 2843 Ropani of land, total irrigated and non-irrigated land held by Chhetri, Brahmin and Dalits is 1688 Ropani (59.38%) whereas 799 Ropani (28.10%) of land is Bari, and 356 Ropani (12.52%) of land is Pakho Bari. The total land holding by

Chhetri only is 1742 Ropani, whereas the land holding by Brahmins and Dalits are 741 Ropani and 360 Ropani respectively.

Most of the land plots of Users of MHP are cultivatable. Out of some plots of land are situated in the bank of Maune Khola River where the project is situated. The project has occupied nearly 50 Ropani of land which was provided 25 Users of MHP. Total land held was 2843 Ropani before the project. However, they have only 2793 Ropani of land after the completion of the project. Hence, the project affected landholding of the Users of MHP negatively.

4.4.9 Impact on Agricultural Products and Its Market

The total agricultural projects have not decreased by large amount because some Users of MHP bought land by spending composition. In aggregate production of paddy and maize of Users of MHP has decreased by 18 muri and 35 muri respectively. But millet has neither decreased nor increased because its farming land is in same area. Some family has started wheat farming and farming of off season vegetable.

Local market of local product at Darchula bazaar has developed. Throughout the projects construction period, the producers sold their products from their own house. Due to agricultural infrastructure development, local people could easily sell their products in local market and in good price. That's why project has made positive impact on local product and this market. However, the project has occupied some significant irrigative lands of local people and also has diverted the flow of irrigation; it has created some new technological changes, and employment opportunities. Despite the decrease in agricultural productivity, this project has helped local people to make their livelihood better and easier.

4.4.10 Impact on Livestock

Livestock of all Users of MHP have increased by 11.45 percent. People known the advantage of livestock husbandry. They earned large amount of money by selling livestock amount of money by selling livestock during construction period of the project. The people were attracted to livestock husbandry due to the rise of price of cattle. In short the project impact is positive in livestock husbandry.

4.4.11 Impact on Market Price

Some nature gifted goods e.g. gifted goods e.g. stone sand and pebble etc. become economic goods, due to the project. Now wage rate of different kinds of labor has increased by more than 90 percent in comparison before the completion the project. Market price of construction materials has increased by 100 percent and market price of food crops and meat have increased by around 50 percent. In conclusion market prices of commodities have increased heaving due to the installation of the project. It means that market is being expanded.

4.4.12 Impact on Income Sources

Traditional income sources have improved. Now, people have started vegetable farming and increased livestock husbandry. Business has been expanding day by day. The project has provided employment opportunity to the wage labor time to time. Service and foreign employment as the sources of income have attracted the people. Hence, the income of the people, themselves, consumes most of the agricultural production. So that average agricultural cash income is limited, wage labor porter, service and foreign employment are sources of cash income of the local people.

4.4.13 Impact on Expenditure Pattern

The average expenditure has increased by 49.23 percent now in comparison to before the completion of the project. People's total spending has increased due to the rise in market price of commodity high consumption growth of child, increase population etc. now, people spend the largest amount of money on clothing and on education and health, festival, food, social activities, and so on. Expenditure pattern of the people have changed.

4.4.14 Impact on Electrification and Consumption of Energy

In comparison before the completion of the project, number of electrified households of the study areas and Users of MHP has increased by 40 percent 9 (HHs) and 42 percent (5 HHs) respectively. Electricity user households have increased. Brahmin, Chettri electricity user household have increased but other group are still far away from this facility.

Electricity has substituted the cell and acid battery in electrified households. As an industrial use of electricity numbers of rice/flour mill, oil mill and saw mill, operated by electric power in the electrified area of Darchula have increased by 42.65 percent 20 percent and 30 percent respectively. The project beneficiary families now have access to Computers, Television, Mobiles, and other electronic goods.

Some people become experts in wiring and repairing the electric line. Consumption of Kerosene and battery has decreased heavily by more than 90 percent in the project areas. Public forest has become community forest. Total consumption of fuel wood of Users of MHP has decreased by 10 percent however; price of fuel wood has increase by 45 percent per quintal.

Table 4.8

Electricity Consumption by Households

Unit Consumption	Observation	Mean Units	Minimum Units	Maximum Units
Peak Season	84	27.5	15	40
Off-Season	84	17.5	10	25
Total	84	45	12.5	32.5

Source: Field Survey, 2015

The table 4.8 depicts that, the electricity consumption by household is min 15 to max 40 where the average consumption is 27.5 units during the peak season. However, during off-season, the households consumed min 10 to max 25 units where average consumption is 17.5 units. In general, the total average consumption of electricity is minimum average of 12.5 units and maximum average of 32.5 units here total average of 45 units have been consumed by households. The households that only use electricity for lighting purpose consumed the monthly average of 12.5 units.

The management committee of MKMHP has made a rule that the minimum charge for each household per month is only Rs. 60 up to 15 units. The national grid

customers pay Rs. 10 per unit where the customers of MHP get cheaper electricity in comparison to the central grid.

Table 4.9

Monthly Payments for Electricity Use

Monthly Payments (Per Months)	Observation	Mean (Rs.)	Minimum Payment (Rs.)	Maximum Payment (Rs.)
Peak Season	84	275	60	300
Off-Season	84	175	60	160
Average Payments	84	225	60	230

Source: Field Survey, 2015

The table 4.9 shows that, the households paid maximum of Rs. 60 to Rs. 300 during Peak season while the minimum of Rs. 60 to Rs. 160 during the Off-season where the average payment is Rs. 225. The data shows that the households who mainly used MHP for lighting purpose pay Rs. 60 per months. MHP is the cheapest energy sources in comparison to the national grid.

4.4.15 Role of Compensation

The composition is used to fulfill various needs of Users of MHP. 17.39 percent Users of MHP used their compensation to purchase land (Khet) which is better for productive quality than their lost land. Some Users of MHP have become free form debt-load. Some Users of MHP invested their compensation on business. Indeed project become very fruitful for those Users of MHP who obtained large amount of compensation. Inversely, the project became bad for those Users of MHP who obtained little amount of compensation instead of their lands.

CHAPTER - V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This study attempts to appraise the importance of electricity in economic development. It also discusses about hydropower potentiality and its present status in Nepal and impacts of MKMHP on socio-economic condition of people in the area around the project. This study has its prime focus on the socio-economic impact of MKMHP and it is based on primary data collected through field survey. It is expected that the results from this study will provide valuable information for policymakers and help utilize the resources in the most positive sector for energy generation. The main objectives of the study are to examine the socio-economic impact of Maune Khola Micro-hydro Power Project on income and employment generation in Dhuligada VDC, to know how has the project contributed for improving livelihood of local communities, to get insights for the sustainable development in the rural parts of the country and so on.

This chapter is the concluding chapter of the present study. The first part summarizes the findings from the study, the second part draws some conclusions while the third part tries to provide some valuable recommendations for the project to run smoothly in a long run.

5.1 Summary

Hydro power is a non-polluting, environment-friendly, renewable, locally available and reliable source of energy. To meet the national energy objectives and for the effective electrification of the remote rural areas, small scale hydropower plants have found to be vitally effective. Traditional sources of energy are not sufficient to meet the energy demand. The use of fuel is also costly and it negatively exert pressure on the environmental balance and other sectors of economy.

Electricity is the basic prerequisite for development. Energy is the prime mover in the process of economic development and its per capita consumption has been regarded sometimes as one of the indices for economic development. Energy consuming

pattern is also regarded as one of the important indicators of measuring development status of the village. In the context of Nepal, micro hydropower seems to be an important source of energy generation, especially in the rural and remote parts of the country.

Micro hydropower has been able to bring about profound socio-economic changes. The implication of MH for rural development is an introduction of a modern technology. This prepares rural communities for undertaking rural industrial activities, nurturing entrepreneurship in rural areas and production of entrepreneurs in rural areas. This study reflects the overview of Nepalese rural energy sources status and discuss various energy issues through a field survey of Dhuligada VDC of Darchula. The study has discussed various merits of MHP system. It not only provides energy for lighting but also helps greatly in improving health and sanitation, social and economic behaviors, educational and other productive industrial activities of the rural areas.

Being descriptive in nature, this study is designed to find out the socio-economic impact the Maune Khola MHP in Dhuligada VDC has made on the project affected areas. This study has been conducted from the direct interview method with 84 respondents. Those respondents were selected by simple random sampling. The following are the major findings of this study:

The main castes in the study area are Chhetri (65%) followed by 23% of Brahmin and 12% of Dalit population and all of them are Hindu. Agriculture is the main source of income while other income sources include services, business and foreign employment. The main sources of energy without MHP were firewood for cooking, kerosene for lighting in all households in the area. Now, MHP is being the source of energy in the village which reduces the extra expenditure on traditional energy sources. 100% of MHP user respondents agreed that MHP helped them a lot in improving the health condition of the people; it has minimized the respiratory and eye infection the significant extent. People are using computers and the facility of electricity has created some employment opportunities for local people. Using electricity, local residents are able to make their life easier. Reading habits of their children has improved a lot, local forest is preserved and sanitation status too has improved to a larger extent.

5.2 Conclusion

The demand for electricity is higher in comparison to the generated capacity. During this decade, hydropower projects are being installed rapidly within our country.

The study area is dominated by Chhetri and Brahman about various impacts on the life style of local people of the project area and its surrounding.

The socio-cultural norms and values have changed due to the concentration of large influx of people from divers place background. The level of awareness has increased in people. Opportunity knowledge, skill etc. are available in the area and their economic status has become better than before people are attracted towards service foreign employment and business instead of traditional occupations such as agriculture livestock husbandry etc.

Nobody has been forced to migrate due to the project despite the project has occupied about 50 ropani land. Some Users of MHP purchased better cultivatable land by using compensation. Some Users of MHP used compensation to pay debt invest on business and so on. Women in the study area are still backward. But their status is improving smoothing with time. Now they are aware of sanitation health, nutrition, child care and family planning. Their role in economic decision and overall decision about family is increasing day by day.

The consumption of the electricity is very low in the study area. There is a need to increase the consumption of the electricity. Out of the total population, 20 percent people are still living in darkness. In conclusion the installation of micro hydropower projects like Dhuligada micro hydro project is rather than significant from various angles in the present context of Nepal.

As for the environmental Dhuligada micro hydro projects are concerned, they are almost ignorable. Likewise, it does not affect the human settlement as much as the large projects do. Obviously it helps to raise the living standard of people living in the surroundings area of the project. It helps to fulfill the demand of electricity in the rural area.

5.3 Recommendations and Suggestions

- Government should emphasize the development of infrastructures in remote, hilly and mountainous districts which support the development of hydropower.
- Detailed survey and estimation should be conducted to identity and install Maune Khola Micro Hydro Project which can which can be invested by foreign Donor Agencies.
- The multipurpose hydropower project should be installed to promote industries especially cottage and small scale industries and irrigation facilities.
- Strong financial agencies should be established to facilitate the investment on the development of micro hydropower project.
- The environmental friendly, technically feasible and economically profitable hydropower plants like Maune Khola Micro Hydro Project should be installed.
- Small hydropower project should be installed in rural, isolated and hilly areas.
- Priority should be given for the development of small hydropower project because it helps to reduce regional imbalance of development, meet the local and national demand for electricity and implement, large scale project as export oriented project.
- The private sector should be encouraged to develop hydropower specially Micro- hydropower projects like – Maune Khola Micro Hydro Project.
- Efficient plants and equipment like that Maune Khola Micro Hydro Project should be issued in hydropower project, which many help to generate high power at low cost.
- Electricity duty should be reduced to encourage small and cottage industries in rural areas e.g. saw mill, herbal product industry. Cold storage, cheese and ice cream factory etc.
- Siren or any other alternative system should be keep in the project site to save people from any kind of possible dangers.

- Participatory approach should be adopted to involve local people in the developmental activities as far as possible.
- In every opportunity preference should be given to the local people.
- A portion of project's revenue should be invested to launch various programs for raising the living standard of the people.
- The compensation should be paid on time through the easy procedure for Users of MHP.
- Income generation programs should be launched by project in the study area.
- Local people should be also ready and conscious to help the upcoming projects and program and grab advantages.

In short it is recommended that mitigation measures must be closely monitored and upcoming hydropower project should avoid the short comings of the Maune Khola Micro Hydro Project. This is the lesson we must learn from the MKMHP to develop other hydropower project to develop other small hydropower projects throughout the hilly areas of our country.

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APPENDIX

The study of socio-economic impact of MKMHP

(Only for project affected families Users of MHP)

Survey Household Questionnaire

Zone…… District……V.D.C……. Ward No…….

1. Personal Questionnaire:

a) Name of the respondent: …….

b) Sex: Male [ ] Female [ ]

c) Age: ……

d) Total no. of family members: ……

e) Cast: Brahmin [ ] Chhetri [ ] Magar [ ] Others [ ]

f) Religion: Hindu [ ] Buddhist [ ] Others [ ]

g) Educational Level: ……

h) Relationship with the household head: …….

2. Family structure by age, sex and education:

Table No. 1

Age-Group	Male	Female	Education	No. of person
0-15			Literate	
15-30			Illiterate	
30-45			Primary (1-5)	
45-60			Secondary (6-10)	
60 above			SLC above	
Total				

3. Main occupation of the family:

a) Agriculture [ ] b) Business [ ] c) Service [ ] d) Labor [ ] e) Other [ ]

4. Which is the main source of energy in your family?

a) Traditional Energy

Fuel-wood [ ] Animal Waste [ ] Others …….

b) Alternative Energy:

Bio-gas [ ] Micro hydropower [ ] Solar home system [ ]

others……

c) Commercial Energy:

Petroleum Products [ ] Electricity [ ] Others……

5. Female Education of Users of MHP:

Table No. 2

	Total Female >14 Years	**Illiterate**	**Literate 5 Class**	**5-10 Class**	**College**
BP					
AP					

6. What kind of energy do you use to cook food?

a) Fuel-wood [ ] b) Bio-gas [ ]

c) Electricity [ ] d) Others [ ]

7. (I) What are the positive aspects of MHP project?

a) To create employment b) To establish the industries

c) To start TV, computers, laptop etc. d) Social conduct

e) Social norms f) others

(II) What are the negative aspects of MHP project?

a) Lack of irrigation b) Damage of Land

c) Deforestation d) Miss utilization of electricity

e) Accident f) Others

8. How do you utilize your leisure time?

a) Agricultural work [ ] b) Household activities [ ] c) Productive works [ ]

d) Others……..

9. Do you feel relaxed in lighting after the installation of MHP system?

a) Yes [ ] b) No [ ]

c) To some extent [ ] d) Cannot say [ ]

10. Market rate observation of goods and services in the study area:

a) Market price of foods:

Table No. 3

Price of various kinds of food									
	Paddy /muri	**Rice/ muri**	**Maize/ muri**	**Wheat/ muri**	**Oil/ ltr.**	**Ghee/ kg.**	**Milk/ ltr.**	**Curd /ltr.**	**Millet/ muri**
BP									
AP									

b) Market price of meat items (per kg.)

Table No. 4

Price of Meat and Fish					
	Mutton	**Chicken**	**Buff**	**Fish**	**Pork**
BP					
AP					

c) Wage-rate and price of construction materials:

Table No. 5:

Wage-rate per head			**Price of construction materials**				
skilled	semi-skilled	Unskilled	sand/tin	cement/bag	stone/pile	wood/ft^3	Iron/kg

11. Electricity

a) Consumption of electricity in units (monthly):……

b) Electronic goods

Table No. 6

Electronic goods	BP	AP
Radio/Tape		
TV/Deck		
Emergency Light		
Iron/Fan		
Charger/Fridge		

12. Women-empowerment (participation on employment, political leadership, decision making and other sectors)

Table No. 7

	BP	**AP**
Job holder		
Engaged in business		
Actively participated in politics		
Live in abroad for study or employment		
Leading of organization/institution/group		
Decision about whole family (percent)		
Economic decision (percent)		

13. Annual income and expenditure of your family:

Table no. 8

Source of income	**BP**	**AP**	**Remarks**	**Expenditure**	**BP**	**AP**	**Remarks**
Agriculture				Clothing			
Business				Health			
Services				Education			
Pension/Interest				Festival			
Industry				Miscellaneous			
Others							

14. Land ownership of the family (in Ropani):…….

15. What are the available facilities which support socio-economic aspects, medium of transportation and required time to reach those destinations?

Table No. 9

Destination	**Located Place**		**Medium of transportation**		**Transportation Time**	
	BP	**AP**	**BP**	**AP**	**BP**	**AP**
Primary School						
High School/College						
Health Institution						
Banks						
Cooperatives						
Agriculture Service Center						
NGOs						
Market						
Phone Facility						
Road Access						

16. How did the project impact on social value, culture, norms etc.?

a) …….. b)… …….
c)……..

17. What are the main problems of the study area?

a)…….b)……

18. What is type of your house?

a) Pakki b) ArdhaPakki c) Kachchi

19. What is your main source income?

a) Agriculture b) Business c) Service d) Others

20. Who keep the household income or money?

a) Male b) Female c) Both

21. Who collects the firewood?

a) Male b) Female c) Both

22. Health and sanitation:

Table No. 10

	BP	**AP**
Source of Drinking Water	**Pipe/Well/Tap**	**Pipe/Well/Tap**
Quality of Drinking Water	Better/Good/Bad/Unknown	Better/Good/Bad/Unknown
Kind of toilet	Open/Kachchi/Pakki	Open/Kachchi/Pakki
Institution for treatment	Domestic/Health Post/Center Activities	Domestic/Health Post/Center Activities

23. Agricultural production of Users of MHP (BP/AP) in muri:

Table No. 11

General Crops	Total Production		Average Production		Average Product of each Users of MHP	
	BP	AP	BP	AP	BP	AP
Paddy						
Maize						
Wheat						
Millet						

24. Literary Status of the study area by caste group and sex:

Table No. 12

SN	Caste Group	Total Population	No. of Literate People		Total
			Male	Female	
1					
2					
3					
4					
5					
Total					

25. Demographic study of project area:

Table No. 13

SN	Caste Group	Sex		Total	Percent	No. of HHs
		Male	Female			
1						
2						
3						
4						
5						
Total						

26. Kind of used of forests and consumed fuel-wood by Users of MHP:

Table No. 14

Kind of forest	Quality of consumed fuel wood by Users of MHP		Monetary Value of Fuel Wood			
	Total in quintals	Average in quintals	Price per quintals	Total Price	Avg. price	
Private and Community Forest						BP
Private and community Forest						AP

27. Finally, do you have any comments?

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