

**SOCIO-ECONOMIC IMPACT OF KOYAKHOLA
MICRO-HYDRO THIRD PROJECT:
A Case Study of Khamlalong VDC of Terhathum District**

**A Thesis Submitted to
Central Department of Rural Development
Tribhuvan University, Kirtipur, Kathmandu, Nepal
In partial Fulfillment of the Requirements for
The Master Degree of Arts (M.A)
In
Rural Development**

**Submitted by
DES BAHADUR LIMBU
Exam Roll. No: 280978
TU, Regd. No: 6-1-10-20-2006
Central Department of Rural Development
Tribhuvan University
Kirtipur, Kathmandu
September, 2016**

DECLARATION

I hereby declare that the thesis entitled **Socio-Economic Impact of Micro-Hydro Third Project: A case Study of Khamlalung VDC OF Terhathum District**, 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 acknowledgements to all ideas and information borrowed from different sources in the course of preparing this thesis. The result of this thesis has 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.

.....

Des Bahadur Limbu

TU, Reg. No: 6-1-10-20-2006

Date: 2073/05/16

(September 1, 2016)



TRIBHUVAN UNIVERSITY
त्रिभुवन विश्वविद्यालय
CENTRAL DEPARTMENT OF RURAL DEVELOPMENT
ग्रामीण विकास केन्द्रीय विभाग

विभागीय प्रमुखको कार्यालय
कीर्तिपुर, काठमाडौं, नेपाल ।
Office of the Head of Department
Kirtipur, Kathmandu, Nepal.

Ref. No. :

Date मिति

RECOMMENDATION LETTER

The thesis entitled **Socio-Economic Impact of Koyakhola Micro-Hydro Third Project: A Case Study of Khamlalong VDC of Terhathum District**, has been prepared by **Des Bahadur Limbu** under my guidance and supervision. I hereby forward this thesis to the evaluation committee for final evaluation and approval.

.....
Professor Dr. Prem Sharma
(Supervisor)

Date: 2073/05/16
(September 1, 2016)



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Office of the Head of Department
Kirtipur, Kathmandu, Nepal.

Ref. No. :

Date मिति

APPOVAL LETTER

The thesis entitled **Socio-Economic Impact of Koyakhola Micro-Hydro Third Project: A Case Study of Khamlalong VDC of Terhathum District**, submitted by **Des Bahadur Limbu** in partial fulfillment of the requirements of the Master's Degree (M.A) in Rural Development has been approved by the evaluation committee.

Evaluation Committee

.....
Prof. Dr. Prem Sharma
(Supervisor and Head of Department)

.....
Prof. Dr. R.K. Shah
External Examiner

Date: 2073/05/26 (11 September, 2016)

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Des Bahadur Limbu
September, 2016

ABSTRACT

The present study entitled "Socio-Economic Impact of Koyakhola Micro-Hydro Third Project" is an attempt to find out the socio-economic impacts of Micro-hydropower project in Rural Area of 2, 3, 4 and 7 wards of Khamlalong VDC of Terhathum district. This study especially reports to the evaluation of socio-economic impact and socially acceptance and economic viability of Koyakhola Micro-hydropower Third Project in Khamlalong VDC of Terhathum district. It encompasses many studies area of micro-hydropower. But it especially focuses on the investigation of such questions like who are the beneficiaries and to what extent do they get benefit. This study is focused on studying the constraints prevailed in rural energy of Nepal. It also keeps the interest to find out the answer of the questions who gets the access to the rural lighting and why?

As electricity is regarded as a major infrastructure of development, every place should be facilitated with it. But majority parts of our country have to spend their life in darkness because of which they are facing so many problems related to their daily life situations. Such problems like not proper access to modern science and technology, education and other occupations in which they are involved.

The main objective of the study is to evaluate the impact of the micro hydropower projects (MHPs) in rural development and socio-economic aspects through income, health and sanitation, education and information technology and suggest solution for sustainable development of MHPs.

The study has employed both primary and secondary sources of data collection. Under the primary sources, the study has been based on questionnaire, interview and direct observation of the project site and affected areas. To meet the objectives of the research, 60 respondents of the study area i.e. Khamlalong VDC (ward no. 2, 3, 4 &7) of Terhathum district were selected as the primary sources of data. Likewise, different reports and official publications regarding hydropower plants have been taken into consideration for the statistical data. In order to conduct this research, procedure was used to select 60 respondents of Khamlalong VDC (ward no. 2, 3, 4 &7) of Terhathum district as a research methodology. A questionnaire was used as the tool for data collection and finding out the socio-economic impacts of micro-hydropower projects in Rural Area. In addition to it, direct observation and interview methods are

also adapted to collect information regarding knowing about socio-economic impact about MHP.

The study found mixed socio-economic impact of the project on the project affected areas. About 80% of the respondents are seems to be satisfied with the MHP and about 20% of the respondents are seems to be dissatisfied with this MHP. The study further finds out that the population has not completely substituting electricity for firewood. In the study area 70% students' performance at school is improved after MHP installation because children have been studying at the night time using electricity. People are suffering from asthma, bronchitis, eyes infection and heart diseases due to indoor air pollution. Hydroelectricity has a prominent role in reduce indoor air pollution by decreasing the use of firewood and kerosene. Electricity from a micro hydro plant makes it possible to use overhead projectors, computers, TV, radio, refrigerator, chargeable battery, mobile and internet. This increases the living standard of the people in the study area.

To sum up, installation of small hydropower projects like Siudigadh Micro-hydro Power Project is significant for several angles like, to fulfill national demand for electricity, project environment, uplift living standard of rural people.

ABBREVIATIONS/ACRONYMS

AD	:	Anno Domini
AEPC	:	Alternative Energy Promotion Center
CBS	:	Central Bureau Statistics
DDC	:	District Development Committee
Etc.	:	Etcetera
FGD	:	Focus Group Discussion
HHs	:	Households
i.e	:	That is
INGO	:	International Non-Government Organization
KII	:	Key Informants Interview
KW	:	Kilowatt
LPG	:	Liquid Petroleum Gas
Ltd	:	Limited
MA	:	Master of Arts
MHP	:	Micro Hydro Project
MW	:	Mega Watt
NEA	:	Nepal Electricity Authority
NGOs	:	Non-Government Organizations
NPC	:	National Planning Commission
NMHDA	:	Nepal Micro Hydro Development Association
PAF	:	Poverty Alleviation Funds
REDP	:	Rural Energy Development Program
SHDB	:	Small Hydro Development Board
TU	:	Tribhuvan University
TV	:	Television
\$:	Currency of united State
UK	:	United Kingdome
UNDP	:	United Nations Development Program
USAID	:	United State Agency for International Development
VDC	:	Village Development Committee
WID	:	Women in Development
WWW	:	World Wide Web

TABLE OF CONTENTS

Title	Page No.
DECLARATION	i
RECOMMENDATION LETTER	ii
LETTER OF APPROVAL	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	vii
LIST OF FIGURES	viii
ABBREVIATIONS/ACRONYMS	ix
CHAPTER ONE: INTRODUCTION	
1.1 Background of the Study	1
1.2 Statement of the Problem	3
1.3 Objectives of the Study	5
1.4 Significance of Study	5
1.5 Limitation of the Study	6
1.6 Organization of the Study	7
CHAPTER TWO: LITERATURE OF REVIEW	
2.1 Micro Hydropower Technology	8
2.2 Empirical Literature	8
CHAPTER THREE: RESEARCH METHODOLOGY	
3.1 Introduction	21
3.2 Research Design	21
3.3 Nature and Sources of Data	21
3.4 Sample Size and Sampling Procedures	22
3.5 Field Visit and Observation	22
3.6 Key Information Interview	23
3.7 Data Analysis	23

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1 General Information of Study Area	24
4.1.1 Installation Cost of the Project	24
4.1.2 Maintenance Cost of the Project	24
4.1.3 People Perception about Improvement of the Village Using MHTP	25
4.2 Households Information of Project Area	25
4.2.1 The Households Participation of Word No 2, 3, 4 and 7	25
4.2.2 Age Group of Respondents	26
4.2.3 Gender of the Respondents	27
4.2.4 Caste of Survey Households	28
4.2.5 Religion Practice in Survey Area	29
4.2.6 Main Income Source of Households	30
4.3 Socio-economic Impact and Status of Electricity Consumption of Koyakhola Small MHTP in the Study Area	31
4.3.1 MHP Role in Rural Electrification	31
4.3.2 How MHP Helps to Rural People?	32
4.3.3 Electrification Consumption Units by Households	32
4.3.4 Monthly Payment for Electricity Used	33
4.3.5 Possession of Various Electric Instruments by Users' and Non-Users'	34
4.3.6 Household Main Source of Energy without MHP	35
4.3.7 Average Monthly Expenses of Household on these Sources of Energy	35
4.3.8 Establishment of Industries Using MHP	37
4.3.9 Changing in Living Standard	38
4.3.10 Status of Family Income	39

4.3.11 Change in Health	40
4.3.12 Irrigation Facility	41
4.3.13 Effect in Drinking Water	41
4.3.14 Status of Education	42
4.3.15 Change in Children's Daily Behaviors Using Electronic Instruments	43
4.4. Sustainability of MHP	44
4.4.1. Responsibility of Community People for the Sustainability	44
4.3.2 Access of Community People towards MHP	45
4.4.3 Availability of Skilled Manpower	46
4.4.4 Equal Participation	46
4.4.5 Stakeholders of the MHP	47
4.4.6 Proper Use of Electricity	48
4.4.7 Household's Feeling/ Concept with the Way of MHP Working	49
4.4.8 Related Factor's Reasonability about Sustainability of Project	49

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings	52
5.2 Conclusion	54
5.3 Recommendations	55

REFERENCES

APPENDICES

LIST OF TABLES

Table No.	Title	Page No.
4.1	Ward-wise Participation of Respondents	26
4.2	Age Group of Respondents	26
4.3	Caste of Survey Households	28
4.4	Main Income Sources of Households	30
4.5	Electrification Consumption Units by Households	32
4.6	Monthly Payment for Electricity Uses	33
4.7	Possession of Various Electrical Instruments by Users' and Non-Users' ³⁴	
4.8	Households Main Source of Energy without MHP.	35
4.9	Average Monthly Expense of Households on these Sources of Energy	36
4.10	Establishment or Industries Using MHP	37
4.11	Changes in Living Standard after Electricity	38
4.12	Status of Family income after Having Electricity	39
4.13	Health Condition	40
4.14	Situation of Irrigation in Farm	41
4.15	Effects of Project on Drinking Water Supply	41
4.16	Status of Student's Education after Electricity	42
4.17	Changes in Children's Daily Behaviors Using Electronic Instruments	44
4.18	Responsibility of Community People	45
4.19	Access of Community People to Use Electricity	45
4.20	Availability of Skilled Manpower	46
4.21	Equal Participation	46
4.22	Stakeholders of the MHP	48
4.23	Proper Use of Electricity	48

LIST OF FIGURES

Figure No.	Title	Page No.
4.1	Age Group of Respondents	27
4.2	Gender of the Respondents	27
4.3	Cast of Households Survey	29
4.4	Religion Practice in Survey Area	29
4.5	Main Sources of Households	30
4.6	Households Main Source of Energy without MHP.	35
4.7	Changes in Living Standard after Electricity	38
4.8	Status of Family Income after Having Electricity	39
4.9	Health Condition	40
4.10	Effects of On Drinking Water Supply	42
4.11	Status of Education	43
4.12	Stakeholders of the MHP	48

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Nepal is landlocked mountain country, which is sandwiched between China and India. It copied 0.03 percent of the world and 0.3 percent of the Asia. Nepal is located in between the altitude of $26^{\circ} 27'$ to $30^{\circ} 27'$ North and the longitude of $80^{\circ} 04'$ East to $88^{\circ} 12'$ east, the countries react angular is shaped and its average length from east to west is 885 km and the breadth from north and south is 193 km. Nepal is divided on the various bases such as topographically mountains, hills, terai, river basis-wise, Koshi, Gandaki, Karnali. Likewise, in five development regions, fourteen zones, seventy five districts 3276 VDC and 191 municipalities administratively (CBS, 2011).

Through the history of human being major advantages in civilization has been accompanied by the increased consumption of energy. Moreover, energy is necessary in every step and moment of human life. The world has been modernized through energy. So, energy is the yard stick for the economic development of the country in this modern age. The degree of economic development is largely determined by per capita energy consumption. Energy, as an indicator, shows the living standard of people. Demand for energy is gradually increasing along with growing population and economic activities. Large amount of foreign exchange is required for petroleum fuel. Because of absence of production of petroleum products with in the country, hydro-electricity power generation is justified. It is non-polluting and available energy resource with in the country.

Nepal is the richest country in water resources in Asia and the second richest in the world after Brazil. Nepal has about 6300 large and small rivers hurling from the Himalayas and high mountains towards the plain area of Terai. And also we have innumerable streams, rivulets, glaciers, lakes, ponds and underground water stock. The total length of this large and small river is about 45,000 km. The perennial nature of Nepalese rivers and the steep gradient of the country's topography provide ideal conditions for the development of some of the world's largest hydropower projects in Nepal. The total potential of this rivers is estimated about 83,290 MW of which

45,520 MW (54.565%) and 42,133 MW (50.59%) are technically and economically feasible from 93 and 63 sites respectively. www.welcomenepal.com

In Nepal, Pharping micro hydro of 500 KW was the first hydro plant established way back in 1911. But after a long interval of 25 to 29 years to others hydro plants namely Sundarijal 900 Km (640 KW after interchanging of frequently from 50 HZ to 60 Hz) and Panauti 2400 MW came in to operation, the demand of electricity increased mainly onward from 60s bigger hydro power increased almost 20 times (Ghimire,2007).

The electricity demand in Nepal is increasing by about 10-12 percent per year about 44 percent of population in Nepal has access to electricity through great and off grad system in Nepal Tenth Five year plan (2002-2007) aims to extend the certification within country and export to India for mutual benefit. The hydro power policy 2001 seeks to promote private sector investment in the sector of hydro power development aims to expend the electrification with in the country and export. (www.welcomenepal.com).

Despite the fact that various promotional and motivational measures have been adopted to involve the private sector and communities in the generation and distribution of hydropower under the Electricity Act (1992) and various policies and periodic plans, progress in hydropower has been far from satisfactory. According to An Approach Paper to the thirteenth plan (FY2013/14-2015/16), by the end of the TYP in the EY 2012/13 the installed capacity of the power generation centre connected in to the national guide was only 705 MW out of which the Nepal electricity. Authority contributed 473 MW and the private sector, 232MW the national guide covered 59 districts. The TYP target for measuring capacity was 184 MW the actual addition was only 21 MW.

The major energy sources of Nepal are forest organic matter, petroleum products, hydro-electricity and coal. Other alternative energy sources are wind, solar and biogas, which are gradually being used. However, Nepalese energy sector is dominated by traditional sources of energy such as fire wood, agriculture residue and animal dung. The process of converting the solar energy in to electricity and other kind of energy in other to meet the need of modern industry, transport, household activities and others, in general, has been found to be very costly. The small hydro

development Board (SHDB) was formed in 1975 AD to implement small hydro installation in remote areas, particularly, at district headquarters. It was unable to fulfill its ambitions plan because of technical, financial and managerial problems and also due to the lack of overall condition and forward planning in this sector. Moreover, the need of energy has been emphasized and programs related to this sector was started to include in every plan. The programs have covered implementation of big, middle and small hydro projects.

1.2 Statement of the Problem

Nepalese economy is based on traditional agriculture. In addition to agriculture, other sector of economy such as industry, trade and commerce, transportation, communication and tourism have not yet been developed fully due to the inadequate electricity power and financial resources in the absence of infrastructures like road and hydropower, transmission, development cannot take place. Moreover, infrastructures are required for proper exploitation of other available resources in the country. In short, economic development and growth has not accelerated due to insufficiency of electricity.

The demand of energy is increasing even though per capita consumption is very low in the country. Many less developed countries are facing energy problem due to rising price of petroleum products and high rate of depletions of the forest resources. Nepal is no exception in this issue.

The pattern of energy consumption is based on traditional sources such as fire wood, dung. The over exploitation of forest resources creates serious environmental problems. Petroleum products are utilized for transportation, operation of machines and so on. The use of petroleum products creates environmental problems. And also large amount of foreign currency is needed to import the petroleum products. Nepal has limited sources of foreign exchange as a result; Nepal is facing a problem of debt trap, trade deficit and unfavorable balance of payment. All the petroleum products have to be imported from India and abroad. The cost is very high due to poor infrastructure of the country.

Hydropower is the only appropriate technology to fulfill the energy demand of the rural hills, terai and urban areas. The hydropower is one of the well-known energy

sources. This energy source is continuously renewable, non-polluting, widely distributed and which is available in Nepal, operation system of hydropower is flexible and in process no fuel is needed as a whole we can say that hydropower technology is a very simple technology that suit to supply energy for isolated rural areas, hills and mountains of the country. So, micro and small hydropower plants installation is one of the most appropriate methods of substitution for other energy sources.

All scales of hydropower projects are viable in Nepal. Large dams and reservoirs are needed for large- scale hydropower projects which definitely affect human life and marine life of the concern area and its surroundings. Similarly, huge capital investment is required to installed large-scale hydropower projects. For this, government should either take foreign debt or invite foreign investors to invest. In the both cases foreign expert and technician would be used. Consequently the generation cost of large project is found comparatively higher than that of small projects despite the generation costs of large scale projects should be lower than the small ones in accordance with the principle of economic. In reality the result is found just opposite. That's way the large capacity of electricity cannot be exportable because of high cost in comparison to the generation cost of neighboring countries. Likewise, Nepal cannot consume all the potential capacity of electricity and ultimately it has got to bear extra load of debt.

The source of water is often insufficient during the dry season to generate electricity in full capacity and small dams are affected by flood in rainy season. Though the technology is simple, there is the problem for reparation. The plant cannot be repaired without technicians assistant. On the other hand, micro hydropower can fulfill the demand of electricity in backward and isolated rural areas where disadvantaged and marginalized people live. Indeed, micro hydropower project have not been installed in adequate number in target areas yet. The marginalized people are living in remote rural areas that lack balances of regional development. The development in such rural areas to a large extent has not been achieved in the absences of electricity.

Research questions of the study are as follows,

1. What is the impact of Koyakhola micro hydropower third project in socio-economic status of people?

2. How is the sustainability of micro hydropower project in rural area?
3. What is the status of electricity consumption in project affected area?

1.3 Objectives of the Study

The general objective of the study is to evaluate the socio-economic impact of the micro hydro power project in Khamlalung VDC (ward no 2, 3, 4 and 7) of Terhathum district. Besides, the study has the following major objectives:

- To assess the impact of Koyakhola micro hydro power project in socio-economic status of the people.
- To explore the sustainability of micro hydropower project in rural area.
- To study the status of electricity consumption of the rural people in project affected area.

1.4 Significance of Study

The development of all sector of on economic depend on energy the utilization of energy specially electricity is centered in urban area and most of the rural areas have been passed by the existing energy development schemes in Nepal, generally sources of energy are divided in to broad two part viz. traditional and commercial. Almost all the household are found to have consumed traditional sources specially fuel wood for domestic use and other necessary activities of people's life in the hilly and mountain area. Electricity can significantly diversify rural activities. The electricity can raise the living standard of people. Advantages of electricity are as follows:

Electricity make human life easier by providing domestic as well as non domestic facilities creates employment opportunities in the presence of electricity, electronic devises may available. The improved both quality and quantity of communication and education.

- Establishment of large, middle, small and cottage industry as result creates improved both quality and quantity of communication and education.
- Electricity helps discover, develop, expend and promote new techniques and technologist in various sectors.

- It helps develops infrastructure that are precondition for the economic development. In fact there is correlation between development and electricity.
- Improvement in extracurricular activities, which help raise the living standard of the people.

1.5 Limitations of the Study

Every study has been its own limitation. This study has been conducted to analyze the impact of micro hydro power project on socio-economic condition of people who live in the Khamlalong VDC (ward no. 2, 3, 4 and 7) of Terhathum district.

The study is confined to analyze following limitations:

- It is the case study of Khamlalong VDC which may not be applicable on the other VDC of country.
- The study requires the frequent visit which cannot be affordable due to the lack of budget.
- For counting data I have must the VDC which area far away from the Kathmandu may present they my guide lives.
- 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 narrow only some limited variables and ignores many variables which may effected on study area.

1.6 Organization of the study

Altogether this study is divided into five chapters. This first chapter deals with general background, statement of the problem, objectives, significance, and limitation and organization of the study. The second chapter literature Review deals with the review of the literature on micro-hydropower. 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 shows the Data presentation and Analysis and the last chapter Summary, conclusion and recommendations provide conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE OF REVIEW

2.1 Micro Hydropower Technology

Micro hydro is a well-proven technology, relying on a non-polluting renewable and indigenous resource, which can integrate easily with irrigation and water supply projects.

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

With the current population rise in many developing countries there is much greater demand to generate more electricity and also to distribute it to people so that they do not get left behind in the race to develop. Electricity provision to rural communities results in a better quality of life for householders, but also has positive impact on schools, hospitals, business and agriculture/industry.

2.2 Empirical Literature

Review of literature is an essential part of the all research work. A critical review of the literature helps the researcher to develop through understanding and insight in to previous research work that relate to the present study. For the purpose of the study of this subject, literature of various writers is reviewed. The literature is reviewed from the thesis presented by students. Reports and papers represented in seminars, journals and published by various concerned agencies and books on the concerned topic.

Limited research has been conducted on socio economic impacts of small hydropower projects. However there are many studies in other sector of hydropower project. Generally the studies on medium and large scale hydropower project have been conducted to identify various types of impacts created by the development of hydropower project. Many publications, reports these dissertations articles on journals newspapers which are related to the hydropower are reviewed in the thesis. Those literatures which are closely related this research have been reviewed as follows.

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.

World Bank (1998) in its publications 'Nepal: Power Sub-sector Review' tried to critically examine the present status, problems and projects of hydropower Nepal.

The major of finding and conclusion of the study are as follows:

- Nepal power sub-sector faces numeration hurdles to its development. In the lack of while –define tariff policy and institutional weakness in the sub-sector, primarily in Nepal Electricity Authority.
- Government of Nepal reviews the efficient exploitation of this resource as one of the Nepal's most important economic proration because of the needs to reduce substantially the cost and improve the availability of the power to the domestic market and the potential for export of competitive price hydropower to India.
- Excess electricity export to India represents Nepal's most alternative medium and long term foreign exchange earning options. However, government of Nepal has still not bought the detailed strongly to meets this strategy.
- Nepal's power system is still in the early phase of development. The average consumption of electricity is 25 KWh/month which in one of the lowest on the world.

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

Micro hydro or small-scale hydro is one of the most environmentally benign 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).

Thapa (2004) in this article says that development of hydropower has been doubled in twelve years of restoration of democracy in comparison to thirty years of Panchayat. Statistically, existing capacity of hydropower is more than 600 MW now. It was only 281MW capacities before twelve years. Per capita energy consumption reached around 60KW per year now. However it was less than 20 KW at that time. Total number of customers as reached 970,000 from 290,000 during that period. Now, NEA became capable not only to solve the problem of load shading but also to export. Now liberal hydropower policy facilitates investor in the various cases then private sector has been attracted and it become has developed the local industries which create the employment opportunities. Like which, it helps to raise the value of goods and services performed the integrated energy system of Nepal and positive impact on overall economy. National capital skill, knowledge technician and technologies have become capable to apply hydropower plants after came of the new policy private sector has generated about 145MW electricity in Nepal in this period.

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 users. 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).

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

Pokharel (2003) has stated that clean energy need to change three story of Nepal as the country with the lower energy use and the highest potential. We can't afford to wait any larger. Denmark and Nepal share a vision of sustainable energy for all, and as long time patterns, we have delivered concrete result in the cast twelve years, more than 1 million households have benefitted from our common engagement to accelerate access renewable energy technologies in rural Nepal. This has helped many woman, children and families to better health, it has created green jobs, and it has mobilized billions of rupees of local environment in the renewable energy sector. At

the same time the alternative energy promotion center has become a driver of change in developing the renewable energy sector in Nepal.

Acharya (1983) in his article has mentioned the contribution of hydroelectricity to Nepalese economy. It plays significant role by developing various fields such as agriculture, industries, transportation, social services etc. water resources is the Nepal's greatest assets but unfortunately very significant portion has been harnessed to this date. She says that there is unequal distribution of electricity in different development regions. Nepal is lack of capital, skilled manpower, technical knowledge stuffiest market and economics status of people as well as country.

Gurung (2003) has focused on situation of utilization of the expenditure pattern on water field. He mainly focused on hydro energy became prime for the sustainable development for civilization, industrialization and development. Similarly, if we can generate hydro power that is boon for environment. Environment friendly projects so they look forward to hearing this in near future energy becomes essential for construction and mining purpose deep drilling activities are possible by using hydro energy.

Bista (20011) has compared users and non users Tarakhola KHP Tara VDC Baglung to examine the impact of MHP on education, health and access to information result of the study has shown the positive impact of MHP on education, health and information.

The number of she passed student are more in users group than non-users group whereas school dropout student are less in user group. The number of ill households members from respiratory and eye related problem are less in users group. The households of users group have ownership of electronic devices and information technology.

Singh (2011) has analyzed the income and employment generation by the project area of mini-hydro power project. The study has analyzed problem associated with the project. The study has concluded the project helps to raise income level of local people by establishment of new business and it's drastically grounded the expenditure of people on the tradition energy. The health condition of people sufficiently increase and people have access to the modern equipment due to electricity preservation of the

forest increase sufficient due to the reduction of dependent of people on the fire wood. The educational status of the student is uplifted by using evening time for study due to electricity.

Regmi (2012) has examined the present condition of Nepalese energy system. The summary conclusion of finding are there should be needed of proper utilization of natural resources like water to achieve the goal of development. By the proper harvesting of rest water resources by generating aptly trained power and investment on water resources dependency on foreign country could be vanished. One of the alternative ways to increase the energy power not only by the information of new hydro projects but also maintaining and optimizing the existing hydropower plants, which may became panacea to control the wave of problem and has been grossly overlooked for these reasons. The development of the 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 the government that private sector is not capable to develop sufficient hydro power projects to satisfied the demand so, public must play sustainable role for important of hydropower project.

Thapa & pradhan (1995) in their article said that hydropower is Nepal's major resources endowment. Numerous attractive run-off-river and multipurpose hydro schemes have been indentified but remain under development. They explain the strategy of water resources development that saving in transportation cost environmental benefits, foreign exchanges from large power project, agriculture, industrial products and other modern manufacturing output to be stimulated by power supply. Small and micro hydro potential remain virtually used in the hilly and mountain area, despite. Nepal's small size only about 10.5 percent of the total population has had the access of electricity (where about 40 percent of domestic connection is concentrated in the Kathmandu valley). The installed capacity of hydropower station developed until new worked out less of than one percent of potential identified up to that date. Nepal's energy scenario reflects an imbalance between energy constipation that energy resources endowment development of water resources is essential in order to meet human needs like increasing agriculture and industrial production, meeting energy needs and earning foreign exchange from power export. They have pointed out that high investment requirement for the

development of hydropower and lack of financial resources to the major constraints at present.

Bastola (1990) in his article has said that geographical and geological condition of the country has been rise to such a river system in our country. It surveys that sum of the cheapest hydropower station can be developed in the country. Fifteen million kilowatt hydropower potentiality of our country is so much greater compared to our composition. It can be exhaustible for our economic uplift. We can most look for market, external input for isolated hill area, medium size project to meet national needs in relation to entry, irrigation water supplies and large scale projects primarily for export and securing navigation facilities from lower riparian to ease the difficulties by Nepal's landlocked status. Rivers are not only the ornaments of the country, but also diamonds if they are properly utilize by involving a long term plan for its development. Fifth development plan has (NPC, 1970) scouted to distribute the benefit of economic and social development High priority has been given in bringing rural electrification to the hill regions economic activities are not sufficient over there. However there are rivulets whose capacities range from 1 to 200KW.

Mosewr (1989). has ssggested 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

. Policy makers have begun to shift their focus from a universal concern with welfare oriented, family concerned programmers' which assumed 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.

Dahal & Mund (1996) in their edited book published by NEFAS is another valuable and marvelous publication in this regarded also. This publication includes five major areas of social economy and national development in the content of Nepal. These are out ward oriented economic nationalism, local development people's participation. Self-help organization and cottage and small scale industries. In this article. Out ward oriented economic nationalism Madan Kumar Dahal has discussed about water resources. He says that Nepalese economic future lies in the water resources which follow pricelessly from Nepal to India. The present estimated commercial potential of water resources in the Nepal if harnessed properly through bilateral regional international co-operation not only Nepal but the whole SAARC region will be benefit.

Moser (1989) in his article said that the United Nation decade for women (1976-85) has played a crucial part in highlighting and publicizing the important, but often previously invisible role women in the economic and social development of their countries and communities and the 'plight' of low income women in the third world economic. Researchers have moved away from a pre occupation which the role of women within the family towards an understanding of the complexities of women's employments. Research on both ways workers and those in the informal sector in urban and rural areas have assist in identifying both the important and the diversities to world economics motherhood as the important role of woman in the development process of diversity of approaches emphasizing the productive role of women. The so called women in development (WID) approach adopt by the United States agency for international development (USAID) with its underlying rationale that women are an untapped resource that can provided an economic contribution to development and had an influence in popularizing income generation.

Joshi (2011) in his article has mentioned that energy is important for economic development. The pace of economic development can't be accelerating without hydro-power development. The developments of productive sector in the hilly and mountaineer's, all households are found to have consumed traditional source of energy for cooking heating lighting and other necessary activities. Traditional source of

energy can't be sustainable to fulfill energy requirement. From the present analysis it has absorbed that most of the people depend on forest for energy source and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortages of fuel, wood, soil erosion; deterioration of the fertility of soil etc. deforestation leads to deterioration of water sources and hampers both electricity generation and drinking water. The utilization of energy is concerned on urban areas have been by passed this power development. The hydropower project has brought about change in socioeconomic, cultural and other as pest of the people living in the project located area.

Sarfoh (1990) in his article has examined that Africa has the highest potential for hydropower development. It is also behind other regions in developing potential Sarfoh argue that hydropower was not developed to the required level in West Africa because of the initial high cost of hydro power plants low domestic power makes and ignorance of resources and future energy needs.

The authors purposed reminds of full assessment of present and future energy needs changed in fundamental features of the politics and economics of various countries expansion of electricity to rural population and regional co operation in hydropower development.

The authors observed that 'more availability of resources and the advantage which hydro electric power offers have not as yet as yet included any appreciable level of hydro electricity generation' concisely illustrated the essence of professors Sarfoh's discussion in this book.

The author examines the energy consumption practice of West African's and the potential of several energy resources endowments of the sub regions. The further states that only the development of hydropower from West African's river system can satisfy those needs. As domestic sources of energy, hydro electricity will be cheaper and more accessible then foreign oil and less damage to the environmental then the depletion of forest firewood. The authors imply a relationship between the obstacle to hydropower development and domestic politics and economic while such a relationship might very well exist, the author does not demonstrate it.

Sarfoh is less than covering in his conclusion that hydropower represents the best alternative sources of energy for West African, especially when on conditions the formidable obstacle that outlines. The net result of the obstacles is a significant reduction in hydropower generate, necessitating the closing of some hydropower plant and the purchases of private generators by industries and individuals West African's hydropower project those becomes unreliable, insufficient and very costly sources of energy.

Jha (1995) has 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, industries, trades 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 hydro plays crucial role in increasing productivity of the agriculture sector and including the processing of agriculture product. The lifting irrigation in the hills area is also promoted by the development of small and micro hydro power. Addition to this the food processing and the cottage industries will get benefit from the development of micro hydro power.

By considering the fact of only two percent total rural population has access to electricity, the small hydro power play vital role in providing electricity to the rural areas and even to isolated pocket areas of the countries. The micro hydro power is also important from the consideration of national welfare in divers fields, such as conservation of forest, creation of self employment opportunities and also promotion of the tourist industries. Since electrification is related to productive the small and micro hydro power help to increase the efficiency of rural power.

Wechs (1995) examined the needs of energy in our lives can't think of survive without energy. Energy is compulsion for the development purpose 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 leads 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 biomass fuel has forced urban household and industries to switch from biomass fuel to imported fossils fuel and other commercial from of energy. Deforestation and desertification are threatening or traditional energy supply

and agro-base rural economy. These shortages of biomass fuel in rural sector have energy care and needed to promote rapid economic growth. To meet the basis need of rural families is also plagued by the lack and other resources example farm land technology and capital for investment.

Bose (1997) has mentioned that the construction of such a big dam in mountain leads to great controversial issue. The construction of such large dam in the mountain environmental in seismic zone creates a great sensitive issue for further disaster and hazards. For example Tehri dam project in Utter Pradesh. He further stress that development most centered on the people with most conserving tone environment. In a democracy, the development process must be participatory in nature. He suggest that in the name of science and technology development should not become culturally incentive and there should be detailed for disaster management, natural disasters as well as manmade is necessary.

GoN (2000) is fairly informative prepared by REDP, which has included the informed action of rural energy sector. The principle aims of the report to give the massage to the people about rural energy related areas, to appraise the impact of energy and the related components. It tries to demonstrate the development path rural energy sector, to review on rural energy sector policy and to raise issue and to give solution of the rural energy sector problems for the sustainable development.

The report mainly focused on the information of execution of working to increases the level of energy services to poor citizen in the village of Nepal through technological development including micro hydro, solar bio gas, and improved cooking stoves, etc. this report can't that the increased population increased the demand of resources that puts further pressure on the forest which already in determine process in Nepal. Desertification, ecological instability, loss of bio diversity, drying up of water springs is some of the serious environment consequences of massive deforestation. So most of the energy needed can be fulfilled by the big hydropower project but which is focused only on rural area. This effort has largely ignored the rural population, this reports raise the major's issues and focused on the promotion of the rural energy.

This study gimps, the present trend of micro hydropower, illustration that of the MHP scheme have been installed for mechanically driving agro processing unity like grinder huller and oil expeller, whereas other and use are few and far from the low

cost application and the local resources utilization thought micro hydro plant. The report concludes that there are inconsistencies in policy 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, weak, corporation among the deliveries agencies and inadequate information about the technology in rural sector.

Gonzlez (2007) studied the impact of development due to micro hydro power in Bolivian communities. The study examined nine micro hydro power projects in Bolivia. The gist of study is, there is significant change on the education, health status comfortable, self confidence and felling of own-ness due to the micro hydro project. Hydro power able to reduce 54 percent of the household's expenditure for energy related expenditure, such as candles, kerosene, LPG and batteries. There were creation of part time job as well as there is establish and enhance the quantity of small business and save the time for travel to buy lighting fuels. Due to electrification education status of students up lifted and study hours increase. There was counting of basic literacy for about in five communities additionally. New educational tool have been purchased such as computer rooms, DVDs, projectors etc. the health status of local people improved due to reduction smoke generated by fire wood at home and there is reduction of risk of fire.

There has been rapid change on communication and social life, so households have TV and radio more public telephone has been installed in three communities. Public lighting gives security for night for walking and with cheap lighting people stay for productive work more time at night. Hydro power has contributed to equality between indigenous and non indigenous people in Bolivia. The hydro power effects on local and global environment. The remarkable aspects are the reduction of the emission 60.6 tone of equivalent every month. The sustainability of project granted in its entire dimension economically, institutionally, technically and environmentally

Dhungel (2009) in his thesis has analysis the financial and economic condition of micro hydro power in Nepal. His thesis started with a back ground of economic condition and energy scenario of rural Nepal. Thesis is followed by the introduction micro hydro power and its role in rural development in Nepal. The final person and primary objectives of his thesis consist 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 analyses of all three systems show that only one the privately owned system, which is community-owned, each in weak financial conditions. Lastly, an economic analysis of one of the those three MH system is conducted which shows that JVIH system can be highly effective means to increase the economic welfare of the people in the rural areas, even though they may be in weak financial situation. However, bearing in mind the need to ensure the long term sustainability of this MH system in delivering series, the financial viability of a system therefore becomes crucial consideration.

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 the above studies love mainly related with the study of micro-hydro project. Actually micro hydro power project is very necessary for rural area. Most of these studies try to analysis the problem prospect, economical evaluation and technical assistance of MHP. Some limited study has analyzed the impact of the MHP to assess education, health, information of people live in rural area

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The government of Nepal has divided nation into five development regions, fourteen zones and seventy five districts for the adequate development of the country. Khamlalong VDC is located in the far-east from headquarters of Terhathum district. Khamlalong VDC is touched with Hangpang and Nighuradin VDC of Taplejung district. The sites of the study in the Khamlalong VDC ward no 2, 3, 4 and 7 uses Koyakhola Small Hydropower Project.

Koyakhola Small Hydropower is located on Lingden Virkuna of Khamlalong VDC. The total capacity of this project is 29 KW which has been distributed 95% households. Because of small scale of the plant, the electricity is used for lighting and watching TV. Some households have used for cooking purpose and some others installed small scale firm. The plant is operating 18 hours in a day. The project is run by villagers; the minimum cost of the electricity was Rs. 100 in the beginning but now it is only 90 per household up to 25 units.

3.2 Research Design

Research design is an overall framework or a plan, structure and strategy of investigation to obtain answer to research questions. Also, research design is an arrangement of condition for collection and analysis of data in manner that aims to combine relevance to the research purpose with economy in the procedure (Selltiz and others 1959). This study was combined with both an explorative and descriptive research. Both the qualitative and quantitative techniques were used depending on the nature and source of data information.

3.3 Nature and Sources of Data

The study aims to study explains the utilization of micro hydro electricity and socio economic impact of Koyakhola small hydropower on the people of Khamlalong VDC. So, this study is based on qualitative from questionnaires through household interview survey. The nature of the study is descriptive as well as analytical.

Both the primary and secondary sources of data have been collected.

i) Primary Data

Primary data have been collected from the respondents by conducting structural and nonstructural interviews at household level. Informal discussion and simple field observation are the major methods for the data collection.

ii) Secondary Data

The following mentioned are the main sources from where secondary data have been collected.

Economics surveys, VDC profiles, CBS reports and publications of Nepal Electricity Association (NEA), publication of AEPC, feasibility reports, journals, internet and document from individuals, experts and organization related to micro hydro electricity.

3.4 Sample Size and Sampling Procedures

The total numbers of 241 households in this VDC were affected by the project. Out of total 60 households were picked up for the sample according to the ward wise user household ratio by using simple random sampling to fill the purpose of the study. This is based on the information collected from the sample household, selected from the simple random sampling method.

3.5 Field Visit and Observation

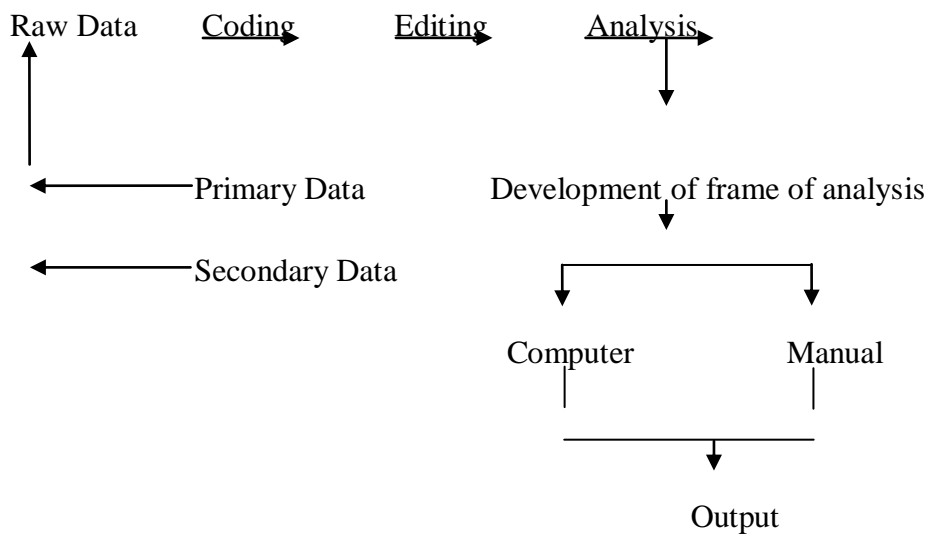
Field visit was conducted by collecting the name lists of each household who were benefited by this micro hydro and selection was done by simple random sampling method. To hear the people perception and get the real situation of MHP in village field visit was conducted.

3.6 Key Information Interview

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

3.7 Data Analysis

The data was tabulated and analyzed according to the objective of the study. The data analysis was descriptive as well as analytical. Data was analyzed with help of computer programmer's strata and excel. Simple statically tools like tables; pie-chart were used for analysis. Descriptive methods have been used for qualitative data.



CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

This chapter presents the analysis of data and presents their interpretation with the help of table, diagrams and pie charts. Section 4 presents profile of the project and the household information of the users. Section 4.1 present the Koyakhola small MHP project detail and household information separately.

4.1 General Information of Study Area

The study site is mainly located in ward number 2, 3, 4 and 7, Khamlalong VDC of Terhathum district. Which is located at the East from the headquarter of Terathum district. Khamlalong VDC is touched Hangpang, Nighuradin VDC of Taplejung district. It takes about five hrs by bus from the district headquarter (Myanglung) in summer and winter season but there is no transportation facility in rainy season. Total population of study area is 1371. Among them males are 704 and females are 667. Most of people are limboo and other are Sherpa, Tamang, Dalit, chhetri, Brahma respectively. Koyakhola Small Hydropower is located in Lingden Virkuna of Khamlalong VDC. The total capacity of this project is 29 KW which has been distributed in 241 households. Because of small scale of the plant, the electricity is used for lighting and watching TV. Some households have used for cooking purpose and some others installed small scale firm. .

4.1.1 Installation Cost of the Project

The production capacity of the MHP is 29 KW. The total cost of the project is about Rs. 11008727. PAF provided Rs 3669957. Community cooperative provided 1084350. VDC provided 1735470. Other organizations provided Rs. 4518950. Rs. 3669597 cash was collected from user households.

4.1.2 Maintenance Cost of the Project

To run the any type of construction for long run, repairing and maintenance is necessary. There is not worth of construction in the absence of sustainability. There is a need to repair non-living things regularly for run it in well condition. For this project the maintenance cost has been by public themselves. In this initial phase of the

project, the cost was maintain from households per week fund but now it is maintains from monthly charge which is paind by households for using electricity.

4.1.3 People Perception about Improvement of the Village using MHP

The modern facilities mostly affected all human being such as facilities it is expected that there most change in living standard of human. Actually living standard refers to the higher living. Of the total 60 samples, all respondents said MHP played vital role to improve the living standard of the villagers. Because of the light in night, night life became easy and children reading habits improved significantly. The installations of rice mill, dairy and others technical tools help to make the life style easier and most of the people participate economic activities. By using the electrical instruments (TV/Computer/Radio) people learn many thinks and they changed their taking style, dress up others and care about the sanitation of the village etc.

4.2 Households Information of Project Area

4.2.1 The Households Participation of Word No 2, 3, 4 and 7

Micro hydro played the vital role for electrification in the role of Nepal. This Koyakhola micro hydro third project-electrify areas are 2, 3, 4 and 7 word no of VDC. In this study area Khanigau of word no 7 has scatter settlement in comparison to other words. To make the study more effective or reliable, questionnaires were asked equally according to word wise population with the help of simple random sampling. The word wise distribution of respondents of this study is shown in the table below:

Table 4.1: Ward- Wise Participation of Respondents

Wards	Total Households	Sample Households of Wards(2,3,4 and 7)
Ward No. 2	87	22
Ward No. 3	63	18
Ward No. 4	48	12
Ward No. 7	43	8
Total	241	60

Source Field survey, 2016

The above table 4.1 depicts that out of total 60 respondents, higher number of respondents 22 were from ward No 2 because large number 87 households are live. Due to the thick settlement of people in ward no 7 few than from other.

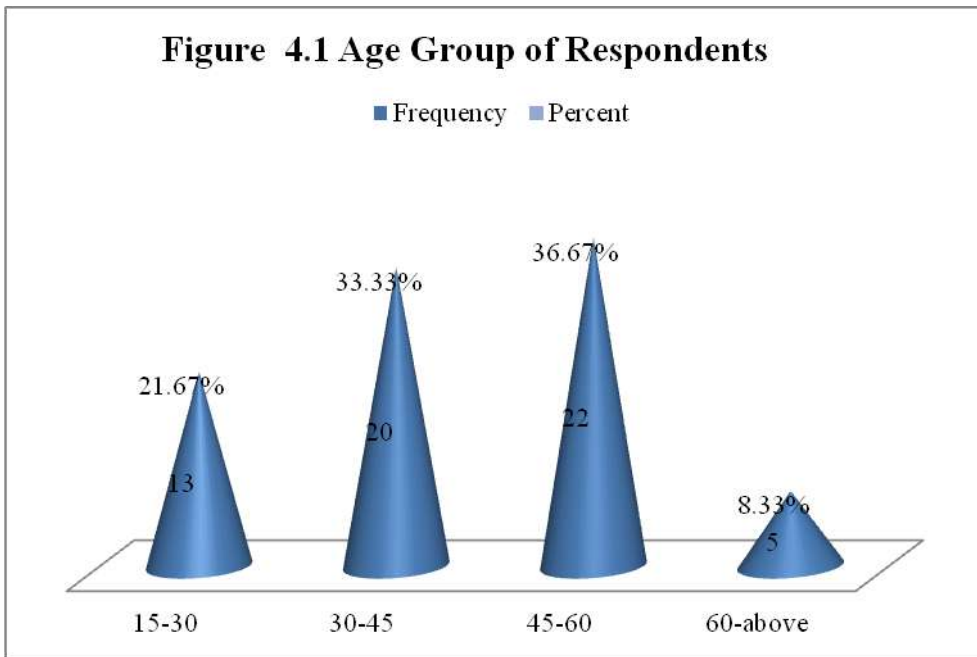
4.2.2 Age Group of Respondents

According to the age, the respondents were divided into four groups. Questions were asked to the respondents aging above 15 years which is shown below:

Table 4.2: Age Group of Respondents

Age	Frequency	Percent
15-30	13	21.67
30-45	20	33.33
45-60	22	36.67
60- Above	5	8.33
Total	60	100

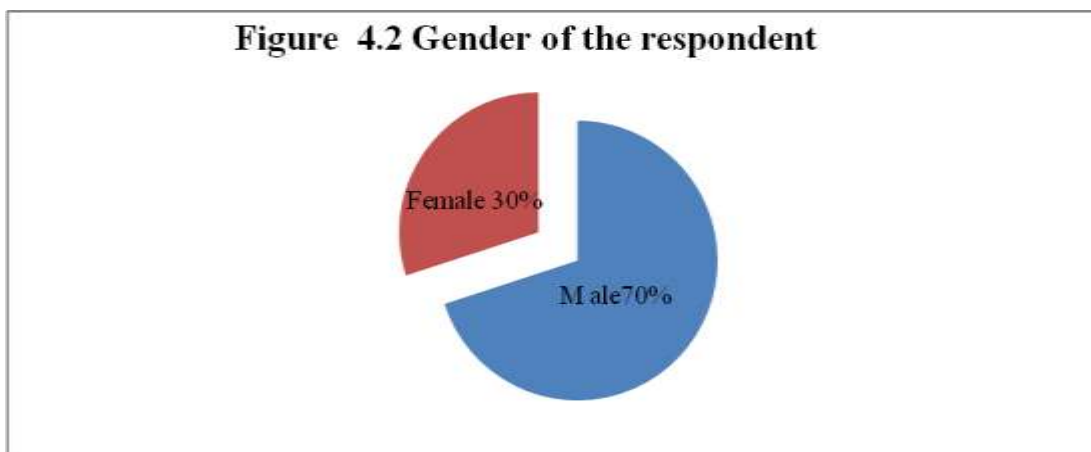
Source: Field Survey, 2016



From age groups 15-30, 30-45, 45-60 and 60- above are 21.67, 33.33, 36.67 and 8.33 respectively.

4.2.3 Gender of the Respondents

There was a significant imbalance in the participant respondents regarding gender were fewer in the number than male this research because in many households male were head of the family and society is patriarchal so male participation. The population ratio of male and female are about one third but female respondents participation was a large number compared to female in this sampling process. Of the total sample 70% (42) were male and 30% (18) were female. The gender wise participation of respondents of study area has been presented in pie chart in 4.2 below:



4.2.4 Caste of survey Household

Heterogeneity and multiplicity is the study area. Various castes like Brahmins, Chhetri, Limbu, Tamang, Sherpa, Rai and Dalit are existence in the village. Among the total population of the study area Limbu and Sherpa are dominant caste group compare to Brahmin and Chhetri. Nepali is common commutative language of all caste. The table 4.3 shows the distribution of respondents by caste/ethnicity.

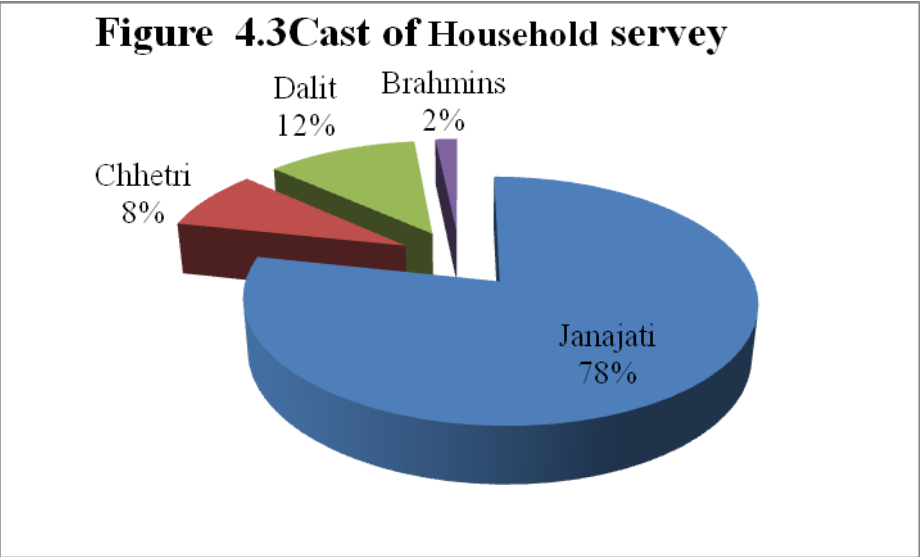
Table 4.3: Caste of Survey Households

Caste	Frequency	Percent
Janajati	47	78.33
Chhetri	5	8.33
Dalit	7	11.67
Brahmins	1	1.67
Total	60	100

Source: Field Survey, 2016

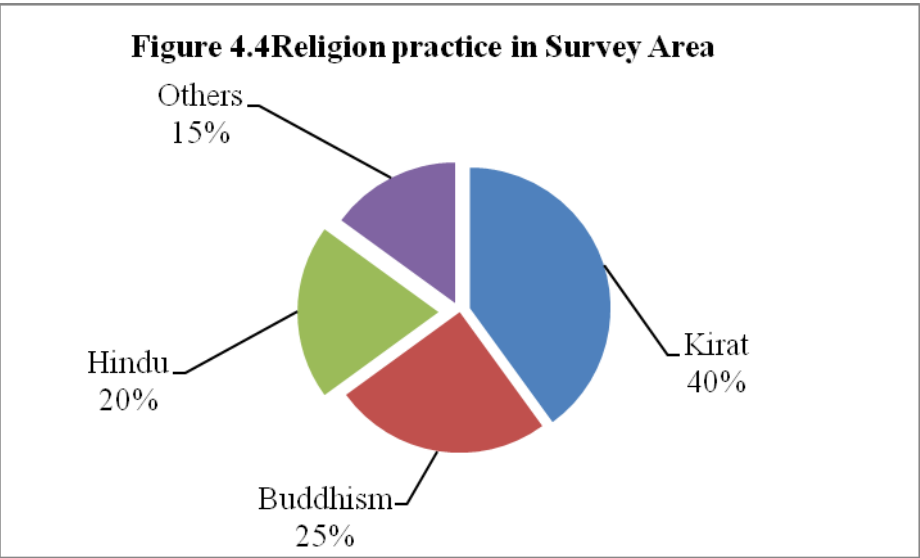
Of the total households, the highest portion 47(78.33%) respondents are janajati, 7(11.67) are dalit, 5(8.33%) are Chhetri and 1(1.67%) are Brahmins respectively.

Janajati and dalit are in highest portion but people from different caste lived in the study area. Therefore, we can say that Nepal is rich in caste/ethnic. Nepal is also known as common garden of different caste/ethnicity and language.



4.2.5 Religion practice in Survey Area

The dominant religion in Nepal is hindu. About 80% Nepalese people practice Hinduism and only 20% people practice Buddhism, Christian and others. In the study area, respondents practice kirat, biuddhism, hindu and others. The respondent's ratio according to the relation has been presented in the pie chart 4.4 below.



The pie chart depicts that, the highest (40%) of the people religion practices is Kirat where (25%) Buddhist, (20%) Hindu respectively, (15%) households are unknown as religion.

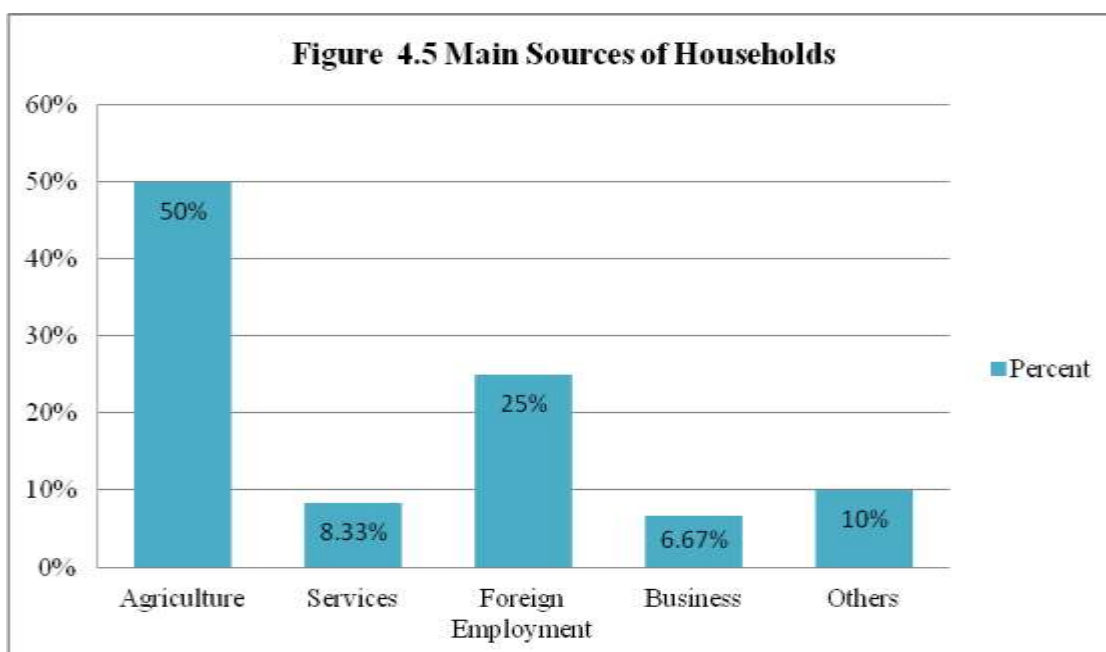
4.2.6 Main Income source of Household

Agriculture, service, self oriented business, foreign employments are the main occupation/income source of the survey households. Other occupation includes daily wage, fishing etc. the frequently and the percentage of survey households has presented in the table below. Most of the households are depend on foreign employment. Although, out of 100 households are involved in agriculture but some households are totally depends on agriculture, so agriculture is the main income source.

Table 4.4: Main Income Sources of Households

Income Source	Frequency	Percent
Agriculture	30	50
Services	5	8.33
Foreign Employment	15	25
Business	4	6.67
Others	6	10
Total	60	100.00

Source: Field Survey, 2016



Source: Field Survey, 2016

The figure 4.4 shows that, the people 30(50%) are dependent on agriculture. The households 15(25%) are dependent on foreign employment. 6(10%) are dependent on others such as daily wages. 5(8.33%) are dependent in service sectors. 4(6.67%) are engaged on their own business.

4.3 Socio-economic Impact and status of electricity consumption of Koyakhola Small MHTP in the Study Area

This chapter presents the analysis of data and their interpretation with the help of table, bar-diagram and pie chart. Section 4.3 presents the socio-economic condition, status of electricity of the project affected area and sustainability of the project as well as the sustainable change in village after the establishment of MHP. Section 4.3.1 presents the of socio-economic impact and status of consumption of MHP and 4.3.2 presents the sustainability of MHP and impact of MHP for sustainable change in village.

Socio-economic feather of study areas depicts the development status of that villager. The sociological and economic characteristics such as education, religion, employment, health and environmental situation have a significant influence in the economics of the village and living standard of the people. In survey area, project affected households are 241 were only 60 sample households were taken to find out the socio-economic impact of MHP and status of consumption on households, role of MHP for sustainable change in the project affected area and people attitude and contribution/willingness to pay for sustainability of MHP.

4.3.1 MHP Role in Rural Electrification

Cent percent respondents accepted that MHP plays the vital role to electrification in the rural area. Before this project, they compelled to live kerosene lamp light. If villager were waiting to central grid, they may be still in the dark light. They have to easy access to get central grid due to the scatter settlement and topographical difficulties. Hence MHP is the best energy sources for rural areas electrification. Due to our unique land topography, thousands of big rivers and small rivulets falling from mountain to plan area, micro hydro project can easily lunch in low and reasonable cost in needed area. Hence, it is easy and chief way to provided electricity in remote area of Nepal.

4.3.2 How MHP helps to Rural People?

MHP effects on villager in multi-dimensional ways (light, sanitation, health, communication) in project affected areas. Most of the people use it for lighting purpose, which makes their nightlife easier, installation of mobile tower at village with the help of (electricity) from, MHP, people get easy communication access. Children reading habits and life style have change. Because of drain (Kulo) of MHP, people are getting irrigation facility, which help to raise agriculture production. May small scale industries like agro mill, sawmill makes people life style easier than before. People attitude and behavior have changed by using the electrical instruments (radio/computer/TV).

4.3.3 Electrification Consumption Units by Households

Electricity consumption units are seems deferent according to the purpose. The households used electricity only for lighting/ radio purpose consumed very low units then TV/cooking purpose. The minimum and maximum units of electricity by household are presents in the table 4.5 below.

Table 4.5: electrification Consumption Units by Households

Unit Consumptions	Observation	Mean Units	Minimum Units	Maximum Units
Maximum Units	60	27.5	15	40
Minimum Units	60	17.5	10	25
Average	60	45	12.5	32.5

Source: Field survey 2016

The table 4.5 depicts, the electricity consumption by households is min 15 to max 40 were average consumption is 27.5 units in the peak section. However, in off section households/business firm consumed min 10 units to max 25 units were average 17.5 units. In general, total average consumption of electricity is mean average is 12.5 units to max average 32.5 units where as total average 45 units have been consumed by house/business form. The household who are only used electricity for lighting purpose consumed monthly average 12.5 units only.

4.3.4 Monthly Payment for Electricity Used

The management committee of MHP project makes the rule that payment by households of to 15 units is only 60. The min charge of per month for each household is 60, which cost Rs. 4 units. The national grid customers pay Rs. 10 per units where customers of MHP get cheaper electricity in comparison to central grid.

Table 4.6: Monthly Payment for Electricity Uses

Monthly Payment	Observation	Mean (Rs.)	Min. Payment	Max. Payment
Max. Payment	60	280.11	60	2000
Min. Payment	60	172.89	60	1800
Average Payment	4	226.50	60	1900

Source: Field Survey 2016

The table 4.6 shows the household paid max. Rs. 2000 and min. Rs. 60 to 1800 where the average payment is Rs. 226.50 The data shows that the households who mainly used MHP for lighting purpose pay Rs. 60 per month but who run the firm/business used to pay min. Rs. 1800 where the average payment is Rs. 1900. In additional, MHP is the cheapest energy sources in comparison to the national grid.

4.3.5 Possession of Various Electric Instruments by Users' and Non-Users' Group

Without MHP, the people in the study area use few electrical instruments like radio, tape recorder using battery. In very limited houses, TV and computers run by using solar light. By using MHP the possession of the electrical instrument has increased significantly. People have now access different information and entraining facilities. The table below shows that the situation uses of electrical instruments by user and non user group.

Table 4.7: Possession of Various Electrical Instruments by Users' and Non Users'

S.N	Electrical Instrument	Possession % MHP Non-User's	Possession % MHP User's

1	Radio/tape recorder	90.00	100.00
2	TV/computer	13.18	95.09
3	Mobile phone	44.00	99.00
4	Chargeable battery	8.89	60.00
5	Other instruments		58.75

Source: Field Survey 2016

MHP non- user, 90% household posses radio/tape recorder. MHP user 100% household's posses radio/tape recorder. Here is no significant different in radio use because radio can be run using battery without electricity. Only 13.18% households have TV who has solar light but don't use MHP. 95.09% households have TV and computer used by MHP. Only 44% household have mobile phone that has solar but not used MHP. But 95% used mobile phone by use of MHP. MHP non user 8.89% uses chargeable battery for lighting purpose and MHP users 60% use chargeable for multipurpose. Similarly 58.75% MHP user use rice cooker, iron electric jug, heater etc. but non user no use.

4.3.6 Household Main Source of Energy without MHP

Without MHP, Kerosene lamps where widely used for lighting purpose during night, which is known as "Tuki", fire wood was used in every household to cook the food. Bio- gas and solar where in limited houses. Batteries were used for torch light and to run radio/tape recorders. The energy sources of households without MHP

Table 4.8: Households Main Source of Energy without MHP

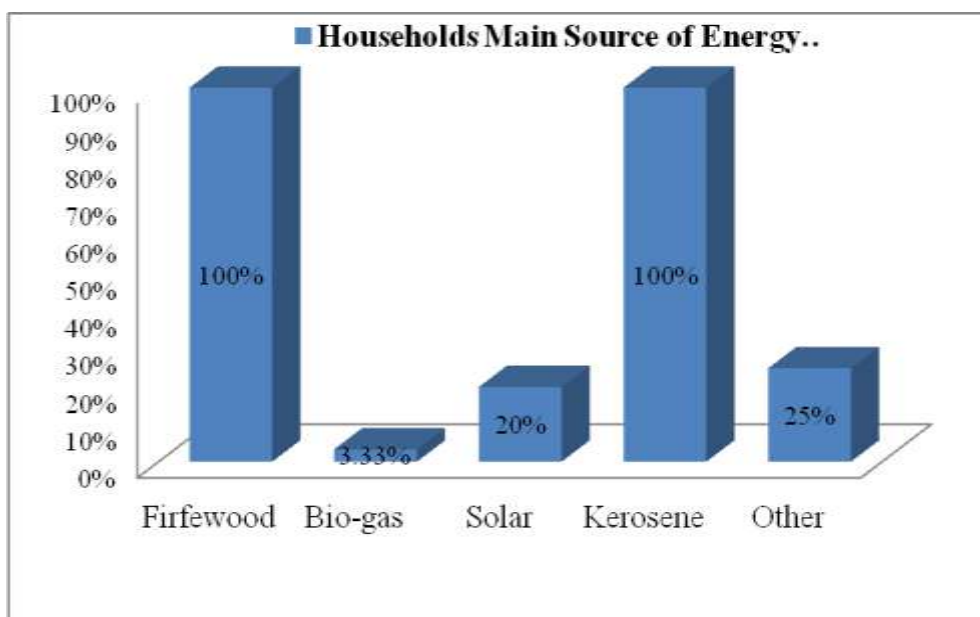
S.N	Energy source	Household	Percentage
1	Fire wood	60	100

2	Bio-gas	2	3.33
3	Solar	12	20
4	Kerosene	60	100
5	Others	15	25

Source: Field Survey 2016

Here 100% household used firewood and kerosene for cooking and lighting purpose respectively. Similarly 20% of the household used the solar and 100% of the household were used the kerosene here. Also table shows the 25% of the household were used other source of energy here.

Figure. 4.6: Households Main Source of Energy without MHP.



4.3.7 Average Monthly Expenses of Household on these Sources of Energy

By using MHP, the expenditure on traditional energy had energy had decreased significantly. Most of the time in village, MHP is available, there is no load shading problem as in center grid so people had used electricity most of the time for their tasks. Others sources of energy has used only in the absence of MHP, so that expenditure on energy had reduced, which helps to make the economic condition of households better, health improvement, reduces deforestation and environment energy sources of MHP users and non-users n presented in table 4.11

Table 4.9: Average Monthly Expense of Households on these Sources of Energy.

S.N	Energy Source	Mean Expenditure without MHP		Mean Expenditure with MHP	
		Frequency	Mean Expense Per Month (Rs.)	Frequency	Mean Expenses Per Month (Rs.)
1	Fire wood	100	1715.46	60	1023.43
2	Bio-gas	14	458.00	14	342.11
3	Solar	18	211.54	18	157.16
4	Batteries	60	164.14	60	33.62
5	Kerosene	60	145.11	36	26.21
6	Candle/Other	40	32.23	45	21.17
	Total Expenditure		2726.46		1603.07

Source: Field Survey 2016

The table 4.12 depicts, that, 60 had used firewood for cooking and heating purpose whereas average monthly expenditure before MHP was Rs. 1715.46 but now introduced to Rs. 1023.43 Similarly, bio-gas household expenses was Rs. 458.00 without MHP but now it decreased to Rs. 342.11 and solar expenses is reduces from Rs. 211.54 to Rs. 157.16. The batteries users are still 60 households but per months expenditure is reduce as well as most of the users used chargeable batteries using electricity.

The kerosene user households are reduced from 60 to 36 and average expenditure reduces from Rs. 145.11 to 26.21. The reduction in Kerosene use helps to make the better economic status and health condition of household. However, the candle or other energy sources users are raised from 40 to 45 households using MHP but the average per month's expenses on candle or other sources in reduced from Rs. 32.23 to Rs. 21.17, it is because these sources are only used in the absent of electricity. The total average expenditure on these sources has reduced from Rs. 2726.48 Rs. 1603.07 using MHP. Reduction of tradition energy sources helps to make the health condition of households members better and save the money too.

4.3.8 Establishment of Industries using MHP

Electricity is the basic prerequisite of development. It is the foundation to generate any socio-economic activities. The life is very difficult as well as being backward due to not being able to modern technology in the absence of power. After MHP, people launched various industries in the study area, which help to raise the income level of the people as well as make the villager way of living much easier. The firms that launched using MHP in village is presented in the 4.10 below.

Table 4.10: Establishment of Industries using MHP

Firms	No. of industries/farms
Agro mill	4
sawmill	2
Dairy	1
Computer institute	3
Furniture	1
Poultry firm	1

Source: Field Survey, 2016

The table 4.10 depicts that, villagers installed 6 small industries/farms where around 15 villagers have partially/full job. The villager's life has become easier after install rice mill and able to generate income from these firms. Farmer generates income regularly after installed dairy by milk to dairy holders. The others business such as stationary medical and food shop has been run which generate the income as well as make the social life easy too.

4.3.9 Changing in Living Standard

The modern facilities mostly affects on human being. After using such facilities it is expected that there must change in living standard of human life. Actually living standard refers to the higher living. The table 4.11 shows that aggregate status of living standard after electrical facility.

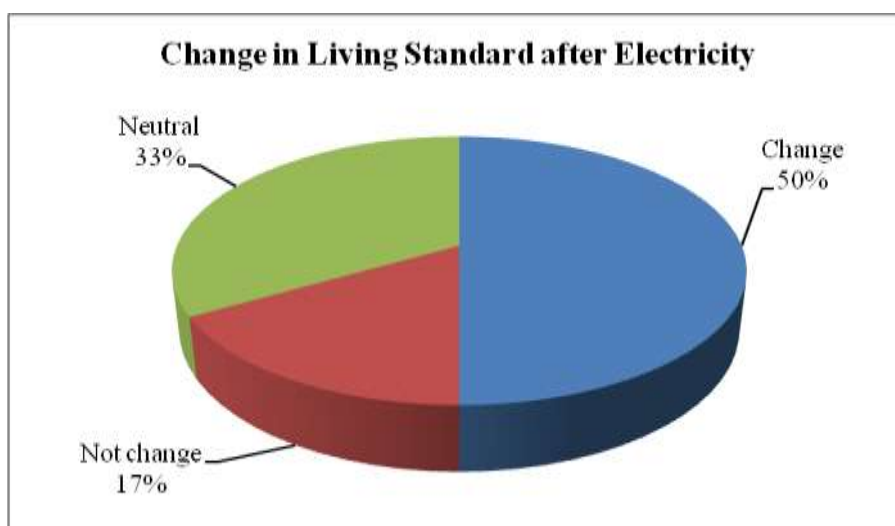
Table 4.11: Change in Living Standard after Electricity

Change	Number	Percent
Change	30	50
Not change	10	16.67
Neutral	20	33.33

Source: Field Survey, 2016

It is expected that modern facility like electricity may affect in human life style. So, this table shows the status of living standard of respondents. The questions were asked to respondents that have their living standard been changed after the MHP. In addition, it is proved that electricity is one of the most affecting factors of living standard.

Figure 4.7: Change in Living Standard after Electricity



4.3.10 Status of Family Income

Table 4.12: Status of family income after having Electricity

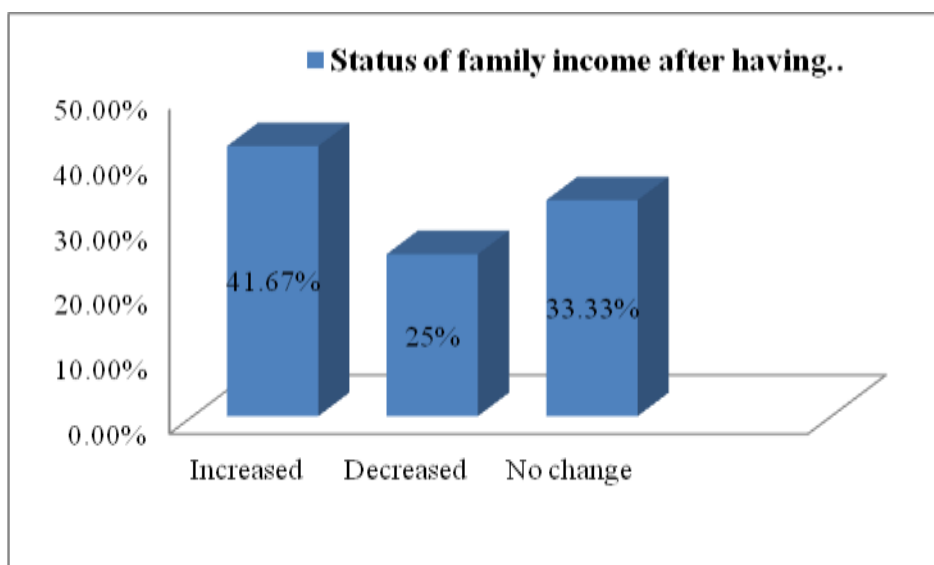
Status	Number	Percent
Increased	25	41.67
Decreased	15	25
No change	20	33.33

Total	60	100
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Source: Field Survey, 2016

The table shows that the status of the family income of respondents. Out of total 60 respondents highest proportion i.e. 25 reported that their family income has increased. Among 60 respondents only 15 reported their family income decreased after using electricity and remaining 20 respondents reported that their family income is in neutral situation. To sum up, those respondents who have able to using the electricity properly, which have sufficient knowledge and ways about electricity facilities, they have been able to increase family income. Those people who have credit of loan when interested in MHP. They reported that their family income decreased. Some of the respondents' income neither increased nor decreased.

Figure 4.8: Status of family income after having Electricity



4.3.11 Change in Health

It is said that health is wealth when people are health them can contribute a lot of the development of the nation. The health condition of an individual can be decreased because of various factors such as the improper use of traditional source of energy can also be harmful for the health of people. Electricity can vital role for the improvements of the health of people as it helps to treat the patients at the time of

illness as it helps to run different machineries which are used for the treatment. So, the following table shows about health condition in the survey area.

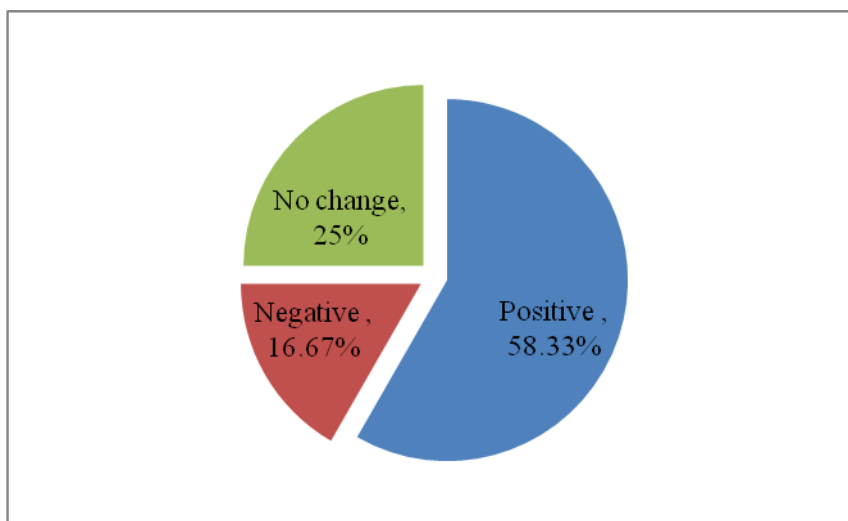
Table 4.13: Health condition

Status	Number	Percent
Positive	35	58.33
Negative	10	16.67
No change	15	25

Source: Field Survey, 2016

The above table shows the facts that 58% reported that they have felt positive change, 16 % people felt negative and 25% felt so no change in health after the establishment of MHP.

Figure 4.9: Health condition



4.3.12 Irrigation Facility

Irrigation is known as the important factor for farming. There is no chance of maximum production of crops in the absence of irrigation. The study area is located in hilly region. It is attempted to find out that either there is facility of irrigation or not.

Table 4.14: Situation of Irrigation in Farm

Irrigation	Number	Percent
Yes	15	25
No	45	75

Source: Field Survey, 2016

The above table shows that the availability or situation of irrigation in study area. Out of 60 respondents, maximum proportion i.e. 75% respondents reported that they have not irrigation facility in their farm. Remaining only 25% respondents has irrigation facility in their farm.

To sum up, irrigation is necessary to produce sufficient crops and other eating sources but the absence there in not proper management of irrigation in rural and hilly regions. This may also affects negatively in socio-economic status.

4.3.13 Effect in Drinking Water

Some of the constructions may affects on different sectors. Electricity is nearest to water. Therefore, it may affects on drinking water on some places but not everywhere. This table 4.15 presents the situation that is the effects of projects in drinking water supply.

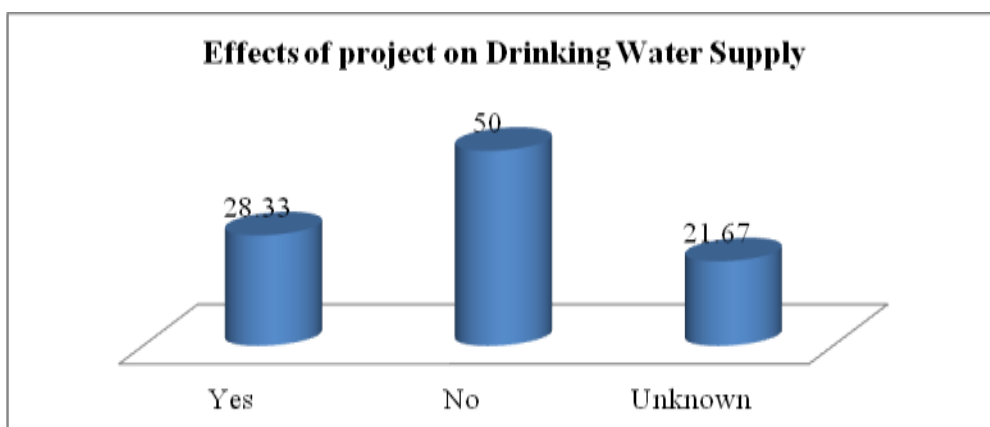
Table 4.15: Effects of project on Drinking Water Supply

Effects	Number	Percent
Yes	17	28.33
No	30	50
Unknown	13	21.67
Total	60	100

Source: Field Survey, 2016

Out of 60 respondents, maximum proportion i.e. 50% reported that the project has no effects on drinking water. Similar, 28% reported that the project has affected the drinking water supply and 21% respondents reported that unknown about the effects on drinking water supply.

Figure No.10: Effects of project on Drinking Water Supply



4.3.14 Status of Education

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

Table 4.16: Status of Student's Education after Electricity

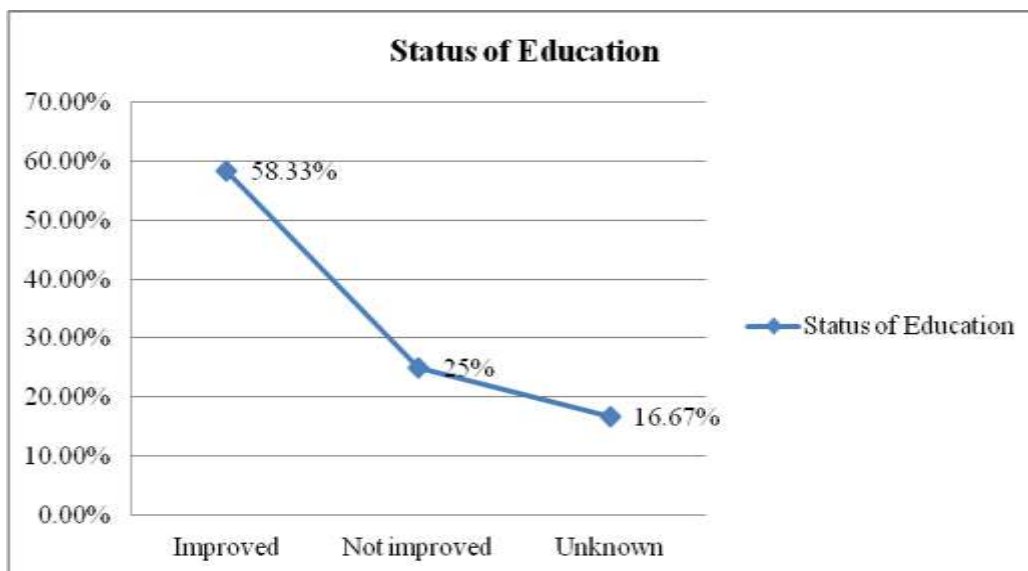
Status	Number	Percent
Improved	35	58.33
Not improved	15	25
Unknown	10	16.67
Total	60	100

Source: Field Survey 2016

The questionnaire that I had distributed to 35 respondents 58.33% of them reported that education status of their children is improved. Lowest proportion i.e. 16.67% respondents were unknown about the education status of their children and 25% respondents reported that their children's education status is not improved.

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

Figure 4.11: Status of Education



4.3.15 Change in Children's Daily Behaviors Using Electronic Instruments

The uses of electrical instruments have caused multiple changes on children's behaviors. Among all the children of the project affected area got positive changes and learn many things by watching TV or using computer expert some negative outcomes such as watching TV for long time, playing game on computer, mobile etc. Table 4.17 shows the important percentage on children activities on various aspects.

Table 4.17: Change in Children's Daily Behaviors Using Electronic Instruments

S.N.	Childs Daily Activities	Improved Percentage	Not Improved Percentage
1.	Talking style	93.47	6.53
2.	Dress up	87.74	12.26
3.	Sports	83.77	16.23
4.	Reading habit	89.91	10.09

5.	Dance	86.87	13.13
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Source: Field Survey 2016

Of the total sample, 93.47% household's children talking style have been improved using electronic instruments. Similarly, in dress up, in reading habits, in sports and dance has been improved by 87.74%, 89.91%, 83.77% and 86.87% respectively.

4.4. Sustainability of MHP

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

4.4.1. Responsibility of Community people for the Sustainability

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

Table 4.18: Responsibility of Community People

Responsibility	Number	Percent
Yes	45	75
No	15	25
Total	60	100.00

Source: Field Survey, 2016

Among 60 respondents the highest proportion of i.e. 75% reported that they themselves are responsible and remaining 25% reported that they are not responsible for the sustainability of the MHP.

4.4.2 Access of Community People towards MHP

Development works are done for the community people. If there is no proper access of all community people towards such development work then the sustainability of such work cannot be long lasting. So, for the durability of such development work there should be the proper access of all community people. The following table shows the access of community people to use electricity.

Table 4.19: Access of Community People to use Electricity

Access	Number	Percent
Yes	42	70
No	18	30
Total	60	100

Source: Field Survey 2016

Among 60 respondents the highest proportion of i.e. 70% reported that they have proper access to the use of electricity and remaining 30% reported that they have not got the proper access to the use of electricity.

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

4.4.3 Availability of Skilled Manpower

The sustainability of the project depends on the availability of skilled manpower. If there is the availability of the skilled man power then the sustainability of the project can be extended. Table 4.20 shows the availability of skilled manpower.

Table 4.20: Availability of Skilled Manpower

Access	Number	Percent
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Yes	43	71.67
No	17	28.33
Total	60	100

Source: Field Survey 2016

Among 60 respondents of the study area the highest proportion of i.e. 71.67% reported that there is the availability of skilled manpower and remaining 28.33% reported that there is not the availability of skilled manpower.

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

4.4.4 Equal Participation

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

Table 4.21: Equal Participation

Equal Participation	Number	Percent
Yes	40	66.67
No	20	33.33
Total	60	100

Source: Field Survey 2016

Among 60 respondents of the study area the above table shows that the highest proportion of i.e. 66.67% reported that there is equal participation in the use and maintenance of MHP and remaining 33.33% reported that there is not equal participation in the use and maintenance of MHP. To sum up, equal opportunity and participation is necessary in the maintenance and use of electricity. Due to the lack of awareness and traditional thinking women's participation is constituted in low proportion.

4.4.5 Stakeholders of the MHP

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

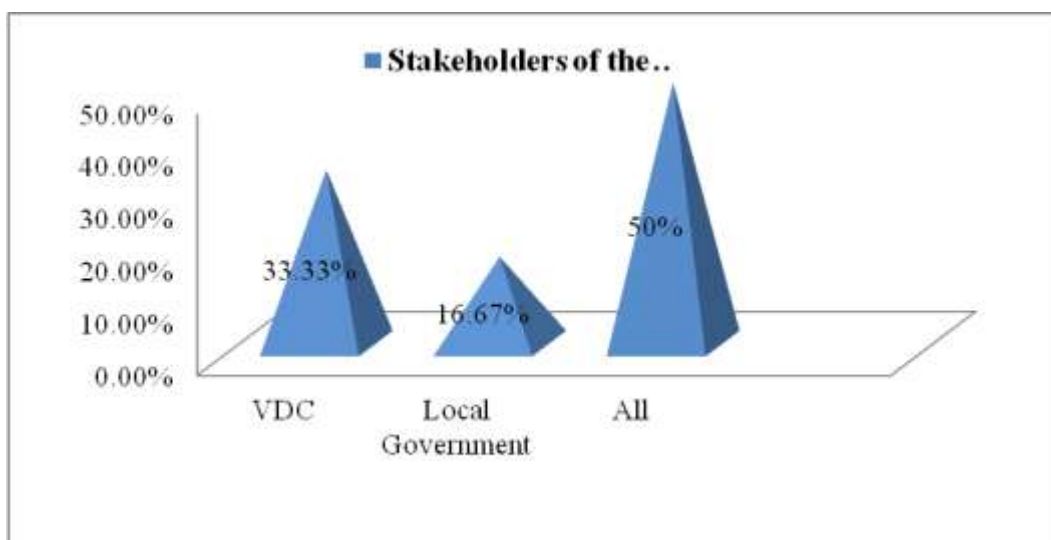
Table 4.22: Stakeholders of the MHP

Stakeholders	Number	Percent
VDC	20	33.33
Local Government	10	16.67
All	30	50
Total	60	100

Source: Field Survey 2016

The table presents the stakeholders for the maintenance and investment. Among 60 respondents the highest proportion i.e. 50% respondents reported that there is stakeholder ship of all local bodies, 33.33% VDC and 16.67% stakeholder ship goes to local government.

Figure No. 4.12: Stakeholders of the MHP



4.4.6 Proper use of Electricity

The durability or sustainability of the project depends on the proper use of electricity. Proper use refers to the right use of electricity in different sectors like factory, at home

and for the other development work. The following table shows the proper use of electricity.

Table 4.23: Proper use of Electricity

Proper use	Number	Percent
Yes	42	70
No	18	30
Total	60	100

Source: Field Survey 2016

Regarding the proper use of electricity a question was asked to 60 respondents among which 70% reported that there is the proper use of electricity and remaining 30% reported that there is not the proper use of electricity.

In conclusion, it can be said that the proper use of electricity is a must for the sustainability of the project.

4.4.7 Household's Feeling/ Concept with the Way of MHP Working

Felling or concept refers the any kind of response towards the things. People have either satisfaction toward electricity.

What they have been felling using MHP established. It is attempted to find out what is the feeling of people towards electricity in the study area. The households who only used MHP for lighting purpose has got satisfaction but the households who run the industries has not fully satisfied with it. Because, the insufficient of power supply people are unable to installed new firm in the village. Households are unable to use rice cooker, refrigerator regularly, which make the people life uneasy.

Hence, electricity facility closely related to human life. Electricity made the human life easier and comfortable. In rural areas, electricity is a strange. So must of the respondents satisfied by the electricity. MHP remove the load-shedding problem of the villagers unlike centre grid.

4.4.8 Related Factor's Reasonability about Sustainability of project

To sum of up, it is known that repairing and maintenance is necessary for every nonliving things. Therefore, MHP must be needed repair and maintenance that makes things sustainable. The government or related donors agencies not only provide but they must supervise the project condition weather the project is in well condition or not. They must regularly enquiry to the user as well as household also have to inform to them continuously about the condition of the project. Feeling or concept refers the any kind of response toward the things. People have either satisfaction toward electricity.

The households who only used MHP for lighting purpose has got satisfaction but the households who run the industries has not fully satisfied with it. Because, the insufficient of power supply people are unable to installed new firm in the village. Households are unable to use rice cooker, refrigerator regularly, which make the people life uneasy.

Hence, electricity facility closely related to human life. Electricity made the human life easier and comfortable. In rural areas, electricity is a strange thing. So must of the respondents satisfied by the electricity. MHP remove the load-shedding problem

Management committee must be responsible to run the project well. Responsibility is also known as accountability. Some have to accountable when he/she got certain response. Most of the respondents said, management committee should take responsibility of project and they should lunched the awareness program in community as well as maintains the project in time.

The system of micro-hydro power in Nepal has been small units. While the government level, private sector, public participations these types of groups manage the micro-hydro power projects. In this micro-hydro projects are managed the local committee and these are follows:

1) Management Committee

Where the micro-hydro plant, there are one management committee and committee are managed the income and system of micro-hydro. If there is any problem committee manage the meeting and issues to operate the micro-hydro project.

2) Manager

Management committee selects the one manager and manager manages the income and expenditure to operate micro-hydro system. Manager collects the money who uses the micro-hydro and manage the file, manage the meeting when committee wants to discuss the issues of operate the micro-hydro plants.

3) Operator

Operators are managing the power house; they manage the water and the power supply time to time. If any problem of machine they inform the management committee and check the power supply, line and aware the power supply house.

4) Consumer/Electricity User Member

The main body of micro-hydro power system is consumer. All of the operation system is manage the consumer. Management committee, manager, operation and other system is selected and uses the power of consumer.

CHAPTER FIVE

SUMMAR OF FINDING, CONCLUSION, AND RECOMMENDATIONS

This study is focused on studying the socio-economic impact of Koyakhola small hydro power project. It is based on the primary data collated through the field survey. It is expected that the result from this study will provided valuable information on the policy makers or utilized the resources in the most positive sector for energy generation. The main objectives of this study are to examine the socio-economic impact of Koyakhola small hydro power on income and employment generation in ward no 2,3,4 and 7 of Khamlalung VDC, Terhathum district to explore the pommels associate with the MHP and suggested solution for its sustainable development, and to examine socio-economic impacts of hydro power in rural areas. This chapter is the concluding chapter of the present study. The first part summary from the study, second part draws the conclusion, and third part lists some recommendation that can be from the conclusion of the study.

5.1 Summary of Findings

1) Energy is a basic requirement for development. The development of all the productive sector of an economy depends on development of the energy sector. In general there are two types of energy sources viz. traditional and commercial. Electrification creates various opportunities of development activities in rural area.

Traditional sources of energy are not sufficient to meet the energy demanded. The use of fossil fuel is also costly and it negatively pressurizes on the balance of payment in the economy. Over pressure on forest creates various problems.

2) Hydro power is the nonpolluting, environmentally friendly, renewable, locally available and reliable source of energy. To meet the national; energy objectives, small-hydro power plants are effective for the electrification of remote areas. Traditional source of energy are not sufficient to meet the energy demand. The use of fuel is also costly and it is negatively pressurizes on the balance of payment in the economy. Over pressure on forest creates the various problems.

3) Electricity is the basic prerequisite of development. Energy the prime movers in the process of the economic development and its per capita consumption has been regarded some times as one indicates of economic development. Energy consuming pattern is also regarded as the one of the important indicators of measuring development status of the village. In the Nepalese contest, micro hydro power seems as an important energy sources, electrically in the project affected area.

4) Micro hydro power has been able to bring about profound socio-economic changes. The implication of MH for rural development is an introduction of a modern technology in rural contest. These prepare ruler community for undertaking rural industrial activities, nurturing of entrepreneurship in rural areas and pretention of entrepreneurs in rural areas. This study reflects the overview of Nepalese energy sources status and discusses various energy issues through a case study of Koyakhola small hydro power, Terhathum District. The study has discussed various merits of MHP system; it is only provided energy of lighting but also helps in improving health condition, save times, make easy to work at night is more efficient income generation as well as productive work.

5) This is the descriptive study designed on field out the socio-economic impact of Koyakhola small MHP project of Khamlalung VDC Terhathum District. This study has been conducted from the direct interview method with 60 respondents. Those respondents were selected by simple random sampling. The major finding of the study area pointes as follows:

- The main caste of the study area is janajati (Limbu, Sherpa, Tamang, Rai) Dalt, Chhetri and Branins. Among them respondents religion practice were kirat, Buddhism, Hindu and Unknown respectively. Agriculture is the main income resources of village. The main sources of energy without MGP were firewood for cooking and kerosene for lighting for almost of the households in this area. Now MHP being the sources of energy of the village, it reduces the over expenditure on traditional sources, MHP user 100% respondents are agreed that NMHP helps to improve the health condition of people and it minim see the respiratory disease and eye infection. By the use of MHP people installed industries such as the rice mill, saw mill, computer institute, poultry firm etc and create the employment opportunities.

- Living standard of 50% respondents has change after electricity.
- 41.67% respondents reported that their family income is increased after electricity.
- The highest proportion of respondents i.e. 58.33% reports that there is the positive change in health.
- Most of respondents reported that there is not the facility of irrigation in the research area.
- 50% respondents have reported that the drinking water supply is not affected after electricity.
- 58.33% respondents have reported that the education status of their children has been improved.
- Study found that most of children's daily activities changed after using electricity.
- 70% respondents reported that main role of responsibility of community should be for the sustainability of project.
- 70% respondents reported that they have access to use electricity.
- The 70% respondents reported that electricity is properly utilized.

5.2 Conclusion

MHP may be most useful in rural and remote areas of our country. There is sufficient of such type of MHP. The conclusion of the study area as follows:

MHP has positive impacts on income and employment. It helps to rise in income and employment by helping in the establishment of new businesses. MHP reduce the expenditure on different energy in the rural area. By the use of MHP, the health condition also gets improved. People who don't have MHP use maximum firewood as light or lamp and cooking but those people who have MHP has reduced which helps to conserve forest. Electricity is closely related with human life therefore all respondents who have use of MHP have been changed their living standard. The status of sanitation has improved by use of MHP. By the use of MHP studying hours of students have been improved then non-users. MHP users have improved their education status. MHP reduces the expenditure on different energy sources like firewood, kerosene, bio-gas etc. So it can be less expensive sources of energy in the rural area. To repair, maintain and operation for the MHP management committee is fully responsible.

5.3 Recommendations

The following recommendations can be made by conclusion the finding and conclusion of this present study;

- Government should emphasize the development of infrastructure on remote, hilly and mountainous districts which support the development of hydropower.
- 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 small hydropower project.
- Small hydropower project should be installed in rural, isolated and hilly area.
- 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 projects as export oriented project.
- Electricity duty should be reduced to encourage small and cottage industries in rural areas e.g. saw mill, herbal product industry. Cole storage, cheese and ice-cream factory etc.
- Siren or any other alternative system should be kept in the project site to save people from any kind of possible dangers.
- Participatory approach should be adopted to involve local people in the development 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.
- 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 advantage.
- The electricity power generation should be increased by further investment as demand is high then supply. Lack of timely maintenance is another problem technically. So, the technicians should be provided by government to maintenance MHPs. The sustainability of MHP is another issue. The dam constructed is located at the week area as well as "kulo" is built on supply area.

So, there is fear of landslide. The dam and "kulo" should be repaired for money securely. House should use electricity for more productive activities. Small industries need to be established on the village. So, that the MHPs revenue can be increased and further investment can be made Government needs to formulate appropriate policy and should allocate resources for MHP to maintain ace and repair.

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