

CHAPTER - I

INTRODUCTION

1.1 Background of the Study

Energy is the basis need for all the sectors; moreover, energy is necessary in every step and moment of human life. The world has been modernized through energy. So energy is the yardstick for the economic development of a country in 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. Adequate and affordable supply of energy is basis pre-requisite for socio economic development of a nation.

The trend of energy consumption is predominated by traditional sources particularly fuel wood. Over utilization of forest creates serious environmental problem. Fossil fuels (petroleum and coal) are imported. It needs a large amount of foreign currency. Nepalese economy however is facing problems like trade deficit debt trap, and unfavorable balance of payment on one hand. In the other hand, the use of solar energy is negligible and wind energy is still as survey stage. But the water resource is immensely available in Nepal and hydropower is clean renewable, pollution free, reliable and easily available. It is the best alternative among all the available energy in the context of our country.

Nepal is the first richest country in water resources in Asia and the second richest in the world. Nepal has about 6,300 large and Small River hurling from the Himalayas and high mountains towards the plain and Terai. The total length of those large and small rivers 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 hydropower potential of these rivers is estimated about 83,290 MW of and which 45,520 MW (54.69 percent) and 42,133 MW 50.59 percent) are technically and economically feasible. The country's theoretical potentiality occupies 2.27 percent of world's potentiality of hydropower. However, Nepal has generated only 615.959 MW hydro-

electricity up to the end of up to 2008/09. It is 0.67 percent and 1.33 percent of the theoretical and economic potentialities respectively. Out of the total installed power, 463.136 MW and 152.713 MW power have been installed from public and private sectors respectively. Total installed capacity has reached 615.959 MW including thermal power (NEA, annual report, 2008/09).

By first eight months period of FY2008/09, (79 MW) Middle Marsyangdi Hydropower Project built under the German Government assistance was commissioned, started commercial production, and connected to national grid. Construction of other two projects, i.e., (30 MW) Chameliya Hydropower Project in Darchula of Far-West Region, and (14 MW) Kulekhani III in Makwanpur were underway. Domestic investment has been garnered to carry out construction of Upper Tamakoshi Hydropower Project, the project was transformed into a company, and construction of access road and other works have started. Humla and Mugu, where solar energy has been only source of electricity, construction of (500 KW) - Heldung under construction has been completed, while construction of (400 KW) Gamgad is underway for dependable electricity services in those two districts.

There are four scales of hydropower projects in Nepal i.e. mega, large medium and small. The aim of installation of mega and large medium and small hydropower project is to fulfill long-term national demand and export to India and other SAARC countries.

In the context of Nepal, Pharping Hydro plant (500 KW) in 1911 is supplying electricity in Kathmandu. Then 24 years later second hydropower project Sundarjal (900 KW) was generated in 1935 A.D. Now its capacity is 640 KW. The development of hydropower went ahead in progressive path smoothly. Only 2077 KW power was installed from hydropower at the starting date of economic plan in 1956 AD. Every plan has been making plans and implementing this program about the development of hydropower in Nepal. Unfortunately first five year plan did not achieve the goal of power installations only preliminary works were completed. But other plans more or less achieved the goal of hydropower development. Even in holiday plan period (Since 1990/1992) we achieved 71000 KW power due to the completion of some projects.

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 concerned area and its surroundings. Similarly, huge capital investment is required to install large-scale hydropower projects. For this, government should either take foreign debt or invite foreign investors to invest. In both cases foreign experts and technicians would be used. Consequently, the generation cost of large projects is found comparatively higher than that of small projects despite the generation cost of large-scale projects should be lower than the small ones in accordance with the principles of economics. In reality the result is found just opposite. That's why 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.

Hydropower, which is reliable and highly potential, has not been exploited more than 1 percent out of the total theoretical potentiality yet. Forest resource, one of the major sources of energy, has dwindled over time due to its continuous exploitation for domestic and commercial uses. WECS (1994-95) has estimated that forest and shrub land occupy 4,520.94 thousand hectare. The depletion rate of forest is 2 percent per annum. This indicates that deforestation, due to various causes, is a current problem. Deforestation, desertification and environmental degradation disturb eco-system and ultimately affect the development. Hydropower can play significant role to substitute fuel wood, and help to control environmental degradation.

At present the effort of the government and Nepal Electricity Authority (NEA) is not adequate to harness the vast power generation potentiality of the country and meet the growing demand in the short run. Electricity act – 1992 has facilitated wide business opportunities to local and foreign investors for developing hydropower projects. In this regard, the government has already granted permission to independent power producers to develop hydropower project.

1.2 Statement of Problem

Nepalese economy is based on traditional agriculture. In addition to agriculture other sectors of economy such as industry, trade and commerce, transportation,

communication and tourism are not developed yet due to their inadequate electric power and financial resources. The absences of infrastructures like road and transmission line. Hydropower development cannot be achieved more over infrastructures are required for proper exploitation of other available resources in the country. In short, economic development has not got proper acceleration due to insufficiency of electricity.

All scale of hydropower projects is viable in Nepal. Large dam and reservoirs are needed for large scale hydropower projects life and marine life of the concerned area and its surroundings similarly huge capital investment is required to install large scale hydropower project. For this government should take foreign debt or invite foreign investor to invest. In both cases foreign experts and technicians would be used consequently. The generation cost of large project should found comparatively higher than that of small project. Despite the generation cost of large scale project should be owner than the small one in accordance with the principle of economics in reality. The result is found just opposite. That's why the large capacity of electricity and ultimately, it has got to bear extra load of debt.

The marginalized people are living in remote rural areas which lack balance of regional development. To some extent, the development cannot be promoted in rural areas in the absence of the electricity. The research questions of this study are as follows.

- a) What is the role of hydro project in uplifting income and employment in the study area?
- b) What is the social and environmental effect of the project in the study area?

1.3 Objectives of the Study

The general objective of the study is to evaluate the socio-economic contribution of small hydropower in Chuwa VDC (Village Development Committee) of Parbat district. However, the specific objectives of the study are listed below-

- a) To examine the role of the hydropower project in uplifting income and employment in the study area.

- b) To analyze the social and environmental effect of the project in the study area.

1.4 Significance of the Study

Hydropower is the only feasible and rational solution in solving the energy crisis in case of Nepal. Hydropower is environment friendly and non-polluting system of energy. It has less direct impact on ecology and environment compare to other energy sources. This source not only assists but also the economy. As no fuel is used and we also know that the prices of fossil fuel are rising very high so not much cost in made on production of electricity and no imports are needed to be made which saves money.

The life standard of the people after development of the project has changed vastly. The project uses local people share for the development because of which people also benefited after the development of the project during the operation phase. Development of local and small industries is also accelerated by Lower Modi-1 HPP. Use of firewood has been reducing due to abundant supply of electricity which has benefited both environmentally and also the health of the people. Other than that, no imports are needed to be made which saves money. A reliable and high quality supply of energy has positive effects on the living situation of the people and their opportunities for income as well as on the social and economic development and employment in a country. Hydropower projects create jobs both directly in construction and operation as well as indirectly. The use of energy increases labor and capital productivity in the agricultural and the manufacturing sector and enables the expansion of the production.

As electricity is significant in the development so the researcher has conducted a researcher as a small hydro power project. An outcome from this research may be helpful to other individuals and institutions to implement programs effectively such type of project. Research will help to know externalities for other project and programs and to implement this type of project. Socio-economic impacts of this project inform us the role of project in the socio-economic upliftment of a community. Finding of this research may be valuable information to those peoples, institutions

that are interested about people of related area. The study will be helpful to conduct further researches from governmental sectors as well as private sectors.

1.5 Limitations of the Study

This research has been conducted for academic degree this study is focused on the socio-economic impacts of the hydropower project in the development of Nepal Lower Modi-1 hydropower project. It has been taken as a case study. The study primarily focuses the characteristics of the communities and social impacts caused by the project at the local area. Every study has some limitations. The limitations of the study are as shown below -

- a) The generalization derived from this study may not be equally applicable to other sectors and high budgeted projects.
- b) This study will not include every person of the area. Only 90 respondents will be taken as sample size.
- c) The analysis of data are based on simple statistical tools, more complex and sophisticated tools are not been used.
- d) The study narrowed only some limited variables and ignores many variables which may affect on study area.

1.6 Organization of the Study

The study is divided into five chapters. The first chapter is the introduction that deals with the background of the study, statement of problems, objectives, significance, limitations, organization of study, introduction of the study area and introduction of the Lower Modi-1 hydropower project. The second chapter is about the review of literature that is divided into international and national context. The third chapter is for research methodology that contains research design, nature and sources of data, population sampling and sampling procedure, tools and method of data collection and method of data analysis. The fourth chapter is the data presentation and analysis that explain the general feature of respondents, role of project in income and employment, social and environmental effects of project. The fifth chapter contains major findings, conclusion and recommendations.

1.7 Introduction to the Study Area

- a) **Geographical Features:-** Chuwa VDC is one of the 55 VDCs of Parbat district that lies to the east of Kusma headquarter city in Dhaulagiri zone of the western development region of Nepal. This VDC borders the Durlung and Bajung VDC in the north, Katuwachautari and Pipaltari VDC in the south, Shivalaya VDC in west and Tilahar and Pakuwa VDC in the East. Chuwa is located in between longitude 83° 41'42" E to 83°42'49" and latitude 28°13'9" to 28°14'10" N at an altitude ranges from 729m to 1443 m above the mean sea level. It is located 264KM west from Kathmandu and is about 2Km far from the District headquarter Kusma. The main access to the site is along the Pokhara-Baglung highway from Pokhara. Regular public transportation service is available there from Kathmandu and the district headquarters of Parbat. (Source: MLRM, Survey Department 2016)
- b) **Climate:-** Chuwa VDC lies in hilly region of the Nepal. Since the Climate is dominated by topographical variations, the catchment area experiences sub-tropical to temperate climate and is influenced by the monsoon season. The region receives an annual rainfall of 2500 mm and the temperature ranging from 7.5°C to 32.3°C. The annual maximum temperature in the project generally occurs in May-July and the minimum temperature occurs in December-January.
- c) **Population Distribution:-** Chuwa VDC having total population of 1759 has 9 wards from the total 433 households. Female population is higher than the male population in every ward. Total population of male is 773 and female population is 986. The distribution of the population according to ward no. is shown in the table below.

Table 1.1 : Ward Wise Distribution of Population

Ward No.	Total Household	Male	Female	Total
1	39	79	98	177
2	46	83	110	193
3	41	71	90	161
4	57	102	144	246
5	44	78	93	171
6	61	120	153	273
7	55	92	112	204
8	46	73	90	163
9	44	75	96	171
Total	433	773	986	1759

Source: Census Report 2011.

d) Demography:- According to the Census taken by the Chuwa VDC in 2011 the total population was 1759 that constituted 53.05 percent female and 43.95 percent male population. As shown in table 1, the child population from the age of 0 to 4 was 155 of which 43.87 percent represented girls. The school going population from the age of 5 to 16 was 528 and in this age group male population represented 48.10 percent. The economically active population from the age of 17 to 65 was 965 whereas female were 582 and male were 383. The population of elderly people, above 65 of age was 111. In this age group female population (55.86 percent) was higher than male population (44.14 percent).

Table 1.2 : Distribution of Population according to Sex and Age

Age Group	Below 4	5-16	17-65	Over 65	Total
Male	87	254	383	49	737
Percentages	56.13	48.10	39.69	44.14	43.95
Female	68	274	582	62	986
Percentages	48.87	51.90	60.31	55.86	56.05
Total	155	528	965	111	1759
Percentages	8.81	30.02	54.86	6.31	100

Source: Census Report 2011.

e) Ethnic Composition:- Chuwa VDC is rich in ethnicity. So there are different ethnic group in the study area. Mainly there are few Janajati (Magar, Newar, Gurung),

Brahmin, Chhetri, Dasnami, Thakuri and Dalit (Kami) people. In this VDC altogether 433 households with 9 ethnic groups were living. Their distribution is presented in table below -

Table 1.3 : Distribution of Population According to Ethnicity

Ethnic Group	Population	Percentages
Bhramin	776	44.11
Chhetri	359	20.40
Magar	89	5.05
Newar	24	1.36
Kami	100	5.68
Gurung	19	1.08
Thakuri	14	0.79
Sanyasi/Dasnami	51	2.89
Others	18	1.0
Total	1759	100

Source: Census Report 2011

f) Educational Status:- In the study area there were 1 private boarding school, 1 government secondary school and 2 primary schools. There were total 922 school level students in the study area. The distribution of students according to their educational level is shown in the table below. The total population of the Chuwa VDC is 1759 whereas 76 percentages is literate. There are 87.46 percentage male literates and 67.43 are female literates. Chuwa VDC is close to Kusma headquarter where most of the students go for their further education or even for secondary education and higher secondary level.

Table 1.4 : Distribution of Students according to Educational Level and Sex

Level	No of students				Total	
	Male		Female			
	No.	%	No.	%	No.	%
Primary	252	57.14	263	54.68	515	55.86
Lower Secondary	105	23.81	133	27.65	238	25.81
Secondary	84	19.05	85	17.67	169	18.33
Total	441	47.83	481	52.17	922	100

Source: Field Survey 2014

Among the total students enrolled in the different level of education 52.17 percent were girls and 47.83 percent were boys. The number of students enrollment in the primary, lower secondary and secondary level is recorded 515,238 and 169 respectively. The proportion of girl enrollments in the schools is higher as that of the boys which indicates the local people's awareness regarding the right of education for girls.

g) Religion:- The majority of people in the Chuwa VDC were found to follow Hinduism. Out of the total population 1759, the majority 1662 (94.5 percent) people practiced is Hinduism where as 84 (4.8 percent) people are Buddhist and 13 (0.7 percent) people are practicing Christianity.

h) Festivals:- Dashain, Tihar, Maghe Sakranti, Chaite Dashain, Baisakh Sakranti (New year day), Ashad Pandra, Saune Sakranti, Krishna Janmastami, Janai Purnima, Teej etc. are the major festivals are the common festivals for the Hindu community that are also celebrated by the Buddhist people as well. Losar (Paush Pandra) and Buddha Purnima (Baisakh Purnima) are the major and most important festival of the Buddhist population specifically the Gurung and Magar community.

i) Language:- Almost all people in this VDC speak Nepali. Gurung, Newar and Magar ethnic groups may also speak their own language but Nepali is common. Also young generation can speak English and Hindi languages.

j) Drinking water supply and sanitation:- Out of the total household (433) in this VDC, 100 percent HH is served by piped drinking water system. Only 87.3

percent of the total population has access to toilet facility whereas flush toilet user are 286 (66.05 percent) HH and ordinary toilet user are 92 (21.25 percent) HH and 55 (12.70 percent) have no access to the toilet.

k) Health:- There is a health post located in ward no. 9 of this VDC where one senior health assistant, two health assistant, two ANM nurse are serving to the local people for the health treatment. This health post often organizes health and sanitation awareness program, basic vaccination, mother-child services, nutrition program and family planning advice services. a village household clinic program is also implementing by this health post in every month in different villages of the VDC to serve local population for the treatment of the major diseases, a number of medical facilities (private and public hospital, clinic) are available in Kusma headquarter that is easily accessible from the VDC. People have access to Pokhara city for the further medical facility and health experiment in nursing home, teaching hospital and public and other private hospital which are 53 Km far from the village.

l) Social Institutions:- A social organization plays a vital role in the upliftment of economy of a certain area. There were one NGO and one INGOs working in the study area. An NGO named NESDO is working for women empowerment and co-operative organizations. An INGO named JICA is also working in the field of agriculture and natural conservation in Chuwa VDC.

m) Bank and Co-operatives:- In the study area there were 2 co-operative limited, 1 microfinance and 2 devolvement banks. The list of Banks and co-operatives functioning in the study area are Unnati Micro Finance, Krishi Shakari, Himchuli Sahakari, Gramin Bikas Bank and Muktinath Bikas Bank.

1.8 Introduction of Lower Modi-1 Hydropower Project

Lower Modi-1 hydropower project lies in Chuwa VDC of Parbat district. (Now it lies in Kusma municipality Ward No- 8) Modikhola is one of the tributaries of Kali Gandaki river. It drains south west down to its confluence with Kali Gandaki river. The hills on either of the Modikhola are characterized by rugged topography with rock exposure. The vegetation covers in the area ranges from the mixed forest to bush and barren land.

The project is "run of the river" type project on Modikhola of Chuwa VDC of Parbat District. The construction of the project had started in early 2010 and was completed in August 2012. The project started generating electricity since September 2012 with connection to national grid. The commercial operation of the project began in November 2012, since then the project is adding 61.01 GWT of energy annually to the national network.

It is connected to Modi substation about 8 km (to NEA Dimuwa substation-23 Towers) away from the project site, and it is linked to the 132Kb transmission line to separate turbines of high Mega Watt, each have been installed at the power house. The electricity is generated from two generating machines consisting of vertical Francis type turbine and vertical shaft synchronous type generator. The power generated is partially distributed in the local vicinity. The project has an installed capacity of 10 MW. The project utilizes the potential head of 50m with the longitudinal section of 2.45km.

The project has been developed with an investment Rs 1.92 billion, with major investors being the private sector and local residents. The project received over 75 percent investment from eight banks. Project officials claim Lower Modi-1 is the largest project developed using local technicians, local investors and local investments. United Modi Hydropower Ltd. has signed a 30 year power purchase agreement (PPA) with the NEA, after which the latter will assume the projects ownership. It will start making profits after three years and the investment will be recovered within 14 years. China's Huan Lingling company had undertaken the electro-mechanical work for the project.

CHAPTER - II

REVIEW OF LITERATURE

A literature review is an evaluation report of information found in the literature related to the selected area of the study. It gives the theoretical base for the research. The purpose of literature review is to convey to the reader what knowledge and ideas have been established on a topic. It surveys the literature in the chosen area of study. It demonstrates a familiarity with a body of knowledge and establishes the credibility of the research. It is required to justify the research. It identifies the data sources and relationship between concepts and further consideration.

2.1 International Context

Burton and Holland (1983) have detailed how a rural village in Columbia was able to set up a communal saw mill and used the surplus generated power from domestic purposes and thereby involving the whole community in the process. The authors point out that this community's biggest motivation for investment was the need to raise the quality of their children lives. Hydropower is fueled by water. So it's a clean fuel source and it won't pollute the air like power plants that burn fossil fuels, such as coal or natural gas hydroelectric power is a domestic source of energy, allowing each state produces their own energy without being reliant on international fuel sources. Impoundment hydropower creates reservoirs that offer a variety of recreational opportunities, notably fishing, swimming and boating. Most water power installation are required to provide some public access to the reservoir to allow the public to take advantage of these opportunities. Hydropower facilities can quickly go from zero power to maximum output. Because hydropower plants can generate power to the grid immediately, they provide essential back-up power during major electricity outages or disruptions. Power efforts produce a number of benefits such as flood control, irrigation and water supply.

Moser (1989) has explained that the United Nations decade for women (1976-85) has played a critical 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 flight of low income women in third world economics.

Sarfoh (1990) has studied that Africa has the highest potential for hydropower development. Author argue that hydropower was not developed to the required level in west Africa because of the initial high cost of hydropower plants, low domestic power and ignorance of hydro resources and future energy needs. As domestic source of energy, hydroelectricity will be cheaper and more accessible than foreign oil which is damaging the environment that the depletion of forest for firewood. Hydropower represents the best alternative source of energy for West African, especially when one condition formidable obstacles that outlines. The net result of the obstacle is a significant reduction in hydropower generated; necessitating the closing of some hydropower projects and the purchase of private generators by industries and individuals of west Africa's hydropower projects has become unreliable, inefficient and very costly source of energy.

Ummar and Khan (2006) have expressed the small hydropower project were constructed with an initial major principle to make available the electricity for lightening to the rural households not including its commercial demand at the beginning. Gender equality was also not considered during the planning stages. The activities of all the individuals including men, women, and children were positively affected by the program. An effort has been made to focus on the routine of those women's served by the program and what improvements has been made in case of production and life routine. Like other rural communities, men were mostly involved in farming activities including plowing, cutting, harvesting, sowing etc. as well as female members of the household have routine work includes childcare and home maintenance. Electricity supply from project bring improvement to women at cottage level, due to which there were increased in income as well as improved their life standard and facilitate the rural women to perform their tasks at home. Electrification from the micro hydropower also gives economic benefits by saving money spent on batteries and kerosene oil.

Gonzalez et.al. (2009) has studied about impact on development and environment due to micro hydropower in Bolivian communities. The study examined nine hydropower projects in Bolivia. The gist of the study was that there was significant change on the education, health status, comfort level, self-confidence and feeling of own-ness due to the micro hydropower projects. Hydropower is able to reduce 54 percentages of

household expenditure for energy related expenditure such as candles, kerosene, LP gas and batteries. There was creation of part time job as well as there is establishment of and enhance the quality of small business and save the time for travel to buy lighting fuels. Due to the electrification educational status of the students was uplifted and study hours were increased. There was continuing of basic literacy for adults in 5 communities additionally. New educational tools have been purchased such as computer, TVs Projectors etc. The health status of local people was improved due to the reduction of smoke generated by firewood at home and there was reduction of risk of fire.

There has been rapid change on communication and social life, so household have TV, radio and 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. Hydropower has contributed to equality between indigenous people in Bolivia. The hydropower has positive effects on local and global environment. The most remarkable aspects are the reduction of the emission 16.6 tons of Co₂ equivalent very month Hydropower project guaranteed in all its dimensions economically, institutionally, technically and environmentally.

Khennas and Barnelt (2000) have concluded that men and woman have a different view of the benefits from the hydropower plant. For men, the biggest advantages were leisure, quality of life and a better education for the children whereas women saw the advantage in reduced work load, expenditures and an improved health status.

Electricity is vital to social and economic development. Its support of wide-ranging activities and service improves quality of life, increase labor productivity and encourages entrepreneurial activity. Its stable supply of power allows households to improve living conditions, helping to meet heating, lighting, and cooking needs across income levels. And it is key input in economic production, making good and services across all economic sectors possible. It is also vital to basic social services such as education, health care, clean water supply and sanitation.

Wilkins (2002) has stated that women in developing countries spend much time on domestic duties that are necessary for the family to survive. Often they have to walk long distance to collect wood and water. Indoor cooking is done over open fire in bad

light, which both are tiring for their eyes, time consuming and unhealthy due to all the smoke. The more time women spend cooking and collecting wood and water, the less time they have for children care, educational and income generating activities. The household tasks could be more easily done if they have had access to electricity. An electrical water pump could reduce the time and ache of walking far with heavy buckets. Electricity used for light in the household makes cooking and other indoor activities processed much faster and the light would also give women a chance to study or carry out income generating activities after sunset. Outdoors street lights are a base for a more secure environment. Information and contacts are gained very quickly through information technologies. Children in developing countries should have a chance to find modern technologies in school. Through electricity, from a Projectors, computers, TV, video and radio all run.

World Bank (2008) has reported that electricity has resulted in health and education, employment, quality of life and productivity. The quality of electric light is substantially higher than the light from the commonly used kerosene lamps. When kerosene lamps are replaced the air quality is also improved since smoke from kerosene lamps emit particles. Which are damaging to one's health. Increased use of television and radio improves people's awareness about health issues and other factors also. Lighting provides possibility of more time for children for their studies, extended working hours and in home business. Electricity also improves the quality of institutions like schools, health facilities by extending working hours and allowing the use of electrical equipment.

Korkeakoski (2009) has mentioned that electricity supplied by micro hydropower enhances income generation and enables inhabitants to make savings on expenses for kerosene, gasoline, batteries etc. Increase in income and living standard reduces the probability of health problems, hunger and malnutrition. Moreover, women's and children's work load decreases since they have to spend less time in energy related tasks. As mentioned above, that does not only reduce physical impairments resulting from the heavy tasks, but also reduces the risk of harassment and sexual assault. The community safety in general improves due to street lighting at night. Furthermore women and children have more productive time which can be used for studying and thus improves the education standard. Electricity supply allows lighting at night and

gives inhabitants the chance to study during evening hours. Later also improves the communities; social life, since community gathering at night are possible and it benefits from electrical devices. Furthermore telecommunication is enhanced people get more aware of the outside world which gives them more knowledge.

Ahlborg and Hammer (2010) have studied that the main goal and motivation for small hydropower is related to individual and social development. The authors divide some of the important benefits of electricity into direct, potential and long term benefits. The direct benefits include improved living standard, better health care, education, communication etc. Potential benefits include increased income from productive activities, water pumps and mills etc. Long term benefit indicates the economic and social development of the society and the whole nation.

Koschel (2013) has stated that hydropower improves the standard of living and income opportunities for the people and to support a sustainable economic and social development through a reliable, high quality and environment-friendly supply of energy. Hydropower creates short and medium term employment during the construction and operational phase of a power plant. Hydropower has both direct and indirect effects. Direct effect involved in the planning construction, mechanical engineering industry, services. It is directly involved in the agricultural benefits but also individual manufacturing sectors such as food and textile industries, transportation will be benefited from the hydropower.

Gull (2004) has studied Azad Jammu and Kashmir micro hydro power projects. Hydropower projects are one of the options through which the objectives of economic development of poverty- alleviation can be achieved in practical way. Provision of energy could help in the creation of appropriate industrial based at cottage level in the areas where micro hydropower potential exists yet deprived of basic facilities which will create job opportunities and do value addition to the agricultural products. Majority of our rural population is engaged in the sector of agriculture. Drying out of foods and vegetables would be possible through development of latex techniques, and the export to cities will weaken the vicious circle of poverty. Micro hydropower projects can support many schemes, such as rice and flour mills, block and concrete industry and some of the available minerals based industries.

Calderon (2005) has explained the economic benefit of the micro hydro systems were revealed by its role in the development of small business like grocery shops, engineering workshops and mechanical based small business. It facilitates Textiles producers to produce more and export it to near cities as well as bakeries in the locality were capable to manufacture all the products, which they were , import from other towns. This process of economic progress of the area made it more attractive to local residents of different communities as well as people from other areas were willing to invest in these areas.

Tshering and Tamang (2004) have concluded that the electricity lighting has particularly improved the quality of lives of students, house wives and the rural households and improved conditions in the quality of services of basic health units. Once electricity service is made available to a rural home, it enhances their rural income activities. They find more productive time under better light. Electrical devices have become very handy for people and over all exposure to health hazards from smoke created by fuel, wood has been reduced. The quality of social life has also greatly improved once electricity is made available.

Rural electrification services will greatly enhance the quality of Bhutanese people to improve upon their socio-economic living conditions. It is an established fact that after provision of electricity supply, the quality and Standard of Education of rural students improve due to electric lighting and increased working hours. More time is thus available to concentrate on economic generating activities thereby enhancing the family income and contribution to the socio economic growth of the society. Hydro powers are geared towards contributing to achieving economic self- reliance and overall socio-economic development of the country. The people have benefited from the project road access, grid electricity, school and hospitals during projects construction period and other income generating activities including employment opportunities of the projects.

GSER (2016) has mentioned that with the good planning and good management, hydropower is a catalyst for the improvement of people's lives. Hydropower offers the possibility to assist in meeting basic human needs. Hydropower has the multi-purpose benefits include drought management, income generation and tourism. Hydro project

also bring significant macroeconomic and societal benefits, employment opportunities, both during and after construction.

Rehman and Anis (2008) have analyzed the introduction and implementation of the hydropower project affects the employment opportunities through multiple channels with all channels having positive impact on employment level. The direct creation of employment opportunities includes labor force required to work on construction of project and labor force required to draw and maintain transmission lines. Both skilled and unskilled manpower would be employed in such projects. Hydropower might stimulate employment opportunities in many industries like cement, steel, as well as in transportation. Increased expenditure raises level of income which in turn raises demand for goods and services. Hence stimulate employment opportunities. Creation of employment opportunities due to provision of electricity to more and more industries; Azad Jammu Kashmir is severely underdeveloped in industries and one major reason for this low performance is absence of electricity. Provision of electricity might stimulate industry, creating more employment opportunities. Hydropower projects are cheapest source of creation of consumable energy. Providing cheap energy to industries might create surplus revenue for firms which can be utilized for further investment creating more employment opportunities. Therefore, to uplift level of employment at local and national level, hydropower can play very important role.

WSHDR (2013) has stated that hydropower is a well-developed small-scale renewable energy, which can contribute to the improvement of electricity access in rural areas and be part of the solution for socially inclusive sustainable development. Small hydropower is a locally available renewable energy resource that can be used for electrification both on and off grid in a clean, efficient and secure manner. It has a high tariff payback ratio while serving to mobilize financial resources locally. Such economic benefits may contribute to the long term socio- economic development of populations that are small in group, dispersed and geographically isolated, combating their vulnerable status with autonomous electricity generation and a resilient micro grid network.

Many countries including several small island states rely on diesel for electricity generation. Soon they will be impacted by increasing petroleum prices and growing

trade deficits. Small hydropower may provide greater energy independence and economic stability, as well as contributing to climate change mitigation. Even in countries that are fully electrified, small hydropower may contribute to achieve renewable energy targets, energy diversification and energy independence.

Meder (2011) has explained that environment effects of micro hydropower plants of Ethiopia. The researcher concluded that the electricity provided by the small hydropower has a positive impact on the communities' health situation, since it decreases indoor air pollution and the risk of fire. Moreover it allows the use of electrical devices for medicine and groundwater pumps. Latter reduce water borne diseases due to contaminated surface water due to the enhanced technical equipment. More doctors and teachers are attracted to the mostly remote areas which further improve health and education services.

2.2 Nepalese Context

Mathema (2013) has stated that hydropower project exhibits positive implication on the local society besides making electricity available to the whole nation. Hydro power of Nepal is recognized as one of the most feasible and potential sector for green economy. The high potential of the hydro power sector is to help transform Nepal towards a green economy. The population of Nepal relies high on traditional energy supplies – commonly fuel wood which produced high Carbon dioxide (CO₂) emissions and its gathering disrupts eco-system functioning. Hence replacing fuel wood with hydro power can considerably reduced carbon emissions, which results from hydropower development during construction and from other sources are negligible.

East Consult (1990) has analyzed that the socio-economic impact of micro hydropower plants on rural economy of Nepal. This study is more related to the issues of mill ownership's and management performance such as mechanical agro-processing and electricity, it impact on both entrepreneur and consumers. According to the findings of the study, the electricity has provided psychic and indirect beneficiaries to longer hours of study, improvement of health, some weaker work's etc. and has been made to community more attractive for transaction such as trekking but the economic productivity cannot be expected since the source of electricity is not

predictive. Tariff collection problems, lack of knowledge in operating and maintenance and authorized use of electricity are identified in the problems side. The rural people have no cash income to pay the electricity change. So, it is very much difficult for them.

WECS (1995) has examined the needs of energy in our lives cannot think to survive without energy. Energy is compulsion for the development purposes after the utilization of energy properly 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 uplift and it is vital for economic development and employment. It is also a critical factor for shortage of biomass fuels has forced urban households and industries to switch from biogas fuel to imported fossil fuels and other commercial form of energy. Deforestation and desertification are threatening or traditional energy supplies and agro-base rural economy. These shortage of biomass fuel in rural sector have energy care and needed to promote rapid economic growth to meet the basic need of rural families is also plagued by the lack and other resources.

Jha (1995) has stated that one of the major reasons for poverty and backwardness of the Nepalese economy is power deficit. Shortage of power creates a problem in the development of agricultural industrial, trade and other sectors of the economy. With a view of meet the power shortage, there is need to generate power from not only the medium or mega projects but also small scale hydropower projects. The small hydropower projects may play a crucial role in increasing production and productivity of the agriculture sector, including the processing of agricultural produce. Lift irrigation in the hills can also be promoted in a meaningful way through the development of small hydropower. The food processing and cottage industry might benefit a lot from the development of small hydropower. The small hydropower might contribute significantly by providing electricity to the rural areas and even to the isolated pocket areas. Since electrification is related to productivity, the small hydropower might help to increase the working efficiency of the rural people. Small hydropower is important from the consideration of national welfare in diverse fields, such as conservation of forest, creation of self-employment opportunities and also promotion of the tourist industry. Small hydropower projects do also mobilize the

local, talent, labor and materials, which is very important for the development of the rural area. The researcher also emphasized the implementation of small hydro projects by adopting is required it provide supporting services such as agriculture extension input supply, marketing services credit facility etc. and development of capabilities of the farmers.

ICIMOD (1999) has pointed that in the past, the implementation of alternative energy technologies has not been very encouraging. Despite there attractive economic and financial performance, potential in the overall energy scenario is still unrealized. A number of issues have emerged related to their development. The issues can broadly be classified as social issues (non-acceptance of technologies), planning and policy issues (lack of willingness at, the policy level), institutional issues (non-existence of responsible coordinating bodies), financial issues (high initial investment) technical issues (weak infrastructure), and managerial issues (lack of marketing skills).

Upadhyaya (1975) has mentioned that electricity is a substitute of oil and fuel wood. Electric power installation was started since 1911 AD in Nepal but motion of development activities was very slow. If we develop hydropower, it can be used in various sectors such as ropeway, trolley, streetlights, industries, domestic uses and so on. It plays significant role to reduce unemployment and poverty in the country. We can produce more goods having high quality at low cost by using electricity. We can earn more foreign exchange by selling electric power. Definitely, it will help to regain favorable trade balance and balance of payment. Development of electricity really brings economic revolution to the country. Increasing demand of electricity is encouraging to develop hydropower.

Bhattarai (2012) has studied that the establishment of hydropower project opens up immense opportunities for social and economic upliftment of the rural communities, if, other crucial aspects like basic road infrastructure for transportation, promotion of income generation, tourism development and small industrial activities based on local resources available in the local area etc. develop the rural and remote area of Nepal. This helps to reduce the migration of skilled and non- skilled manpower. Therefore there is no doubt that the hydroelectricity is the key of economic development. If there is the sufficient development of hydroelectricity it brings the positive change in all sector of the economy.

Acharya (1983) has mentioned that the contribution of hydroelectricity to Nepalese economy. It plays significant role by developing various field such as agriculture, industries, transportation, social service etc. There is unequal distribution of electricity in different development regions. Nepal is facing many problems with respect to hydropower development. There are lack of capital, skilled manpower, technical knowledge, sufficient market and economic status of people as well as country.

Singh (2011) analyzed the income and employment generation by the project in project area of mini hydropower project. The study has concluded the projects helps to raise income level of local people by establishment of new business and it drastically grounded the expenditure of people on the traditional energy. People have access to the modern medical equipment due to electricity preservation of the forest increases sufficiently due to the reduction of dependency of people on the fire wood. The educational status of the students is also uplifted by using evening time for study due to electricity.

Rana-Deuba (2001) has suggested that access to modern energy produced by small hydropower in Nepal has resulted in or contributed to the establishment of micro enterprises especially for women. In mountain villages women traditionally bear the burden of energy collection and use, so any changes in energy source and usage thus affect women disproportionately. The availability of electricity itself, as well as the time freed up through electricity use enables income generation opportunities especially for women. In a village in the Annapurna Conservation area, a couple started a poultry farm with their free time and hot water generated through electricity.

Hamal (1995) has explained the fact that rural and hill areas have under gone deforestation due to insufficiently of electricity and women over working in farm time consuming and non-monitoring and highly backwardness. Energy is required to fulfill day to day needs, which includes cooking, heating, lighting and productive activities such as transportation, irrigation, small business and cottage industries etc. Energy shortage has been recognized as the major constraint in the socio-economic development and it contributes to further deteriorate the environment creating a vicious cycle in the rural life by deforestation.

Ghimire (2007) has stated that Nepal as predominantly an agricultural economy and about 85 percent of the economically active population is engaged in agriculture. Still 80 percent of the energy need of the country is met by the traditional energy sources such as fuel wood, agro residue and animal dung. It is of around 26 million has electricity through different sources like national grid, isolated small and mini hydro systems as well as solar home systems so far. But, most of the population living in rural areas using electricity mainly hydropower is with regard to hydropower development and present status in Nepal. It is also has focused on the national development through hydropower project development. Small and mini-hydro power plants will be developed where electrification can't be provided through inter connected Nepal's power system. Hydropower is a non-polluting, environment friendly, renewable and reliable source of energy needs to be exploited to the fullest potential possible. To meet the national energy objectives small scale hydropower are effective for the rural areas.

Dahal and Shrestha (2014) have concluded that hydropower schemes must have significant role in poverty alleviation, and raise the economic standard of the society. Electricity approach, infrastructure development are the positively influencing factors for making the society beneficial to fresh drinking water and irrigation, flood control, fishing profession development has convinced the people on the positive side of hydropower development in Nepal, and we have seen many places uplifting of the overall social status. The researcher has said that the benefit of rural electrification is incontestable, especially for the enhancement of rural people's livelihood. Evidence from other developing countries revealed that to electricity in combination with simultaneous access to markets and other infrastructure have contributed to growth of rural areas in clear and compelling ways.

Gurung et. al. (2011) has mentioned that the contribution of small hydro power on rural development. They concluded that village electrification have brought significant positive change in rural livelihood. Results revealed that children have less propensity to go for wood collection once their home have been connected to hydroelectricity. Traditional kerosene lamps like Tuki and Panas were completely abandoned and firewood consumption was reduced. Electric Lights in household extended the day by providing additional hours for evening reading and work. The

micro hydro based electricity was used to power modern agro-processing mills in village which reduced drudgery for women. An Author also concluded that hydro power based electricity reduces CO₂ emission significantly. Thus the study comes to a conclusion that hydropower provides clean, affordable and sustainable energy both locally and globally.

K.C. (2072 B.S) has defined that a green economy is the economy which results in improved human well-being, social, equity and reducing environmental risks and ecological scarcities. Hydro power as a renewable, efficient and reliable source of energy enhances green economy. Electricity from hydro power can be used in lighting, power supply for electric appliances, water heating, refrigeration, space heating, cooling and water pumping. Hydro power development can help to shift country towards green economy by enhancing environmental, social and economic benefits.

MOWR (2001) has explained that the contribution of hydropower development in Nepal could speed up the economic development as well as social development. Hydropower development enhances environmental protection, employment opportunity, poverty reduction etc. in the country.

Gurung (2004) has focused on the social mobilization and eventually on the assessment of impacts on the local people for the sustainability of energy related development activities in the rural areas. Considering the contextual facts of socio economic inequality along with the peculiar geophysical diversity this paper has made a conclusion that social and economic inequalities, low growth rates, unbalanced development approaches, discrimination, exclusion, environmental deterioration and inappropriate policies lead to a vicious circle of poverty in Nepal.

Hora (1994) has mentioned that the alternative energies more popular and available, continuously renewable, non-polluting, efficient, widely distributed and based on simple as well as flexible energy source is micro hydropower in Nepal. It is technically feasible as well as economically viable and the most appropriate technology for Nepal indeed, micro hydropower projects are not sufficient to meet the national demand of electricity on one hand. We have no economic resource, technology and skilled manpower to install large-scale hydropower project on the

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 limited scale.

Upadhyaya (2051 B. S.) has explained in this article that source of small rivers is reducing day by day due to the environmental degradation. Nepal's large-scale hydropower projects are costly in comparison to India and China. Besides this, there are other causes as well. So, Nepal neither can export due to the high generation cost nor can its people consume (because their purchasing power is declining. Nepal is facing the problems of debt trap. If Nepal generates large-scale projects (either by taking foreign loan or by bringing foreign investors), that may be expensive one hand and Nepal should bear large burden of foreign debt on the other hand. So, installation of cheap and small scale projects which are possible to install by using local resources to fulfill annual national demand of electricity and participation in decision making are alternative measures for development of small scale hydropower projects instead of large scale hydropower project at present context. He also recommends that we should know the relationship of water resources with other sectors to develop all of them simultaneously.

Paudel (1996) has studied about the development of hydroelectricity during different plan periods and major projects. Harnessing our water resources is easier to say than to do as the wide topographical variation has created hitch in our development efforts. However, this variation can be turned into nature's gift and ultimately can pave the steps for economic prosperity. Proper utilization of the water resources is essential for generating electricity and reducing the import of expensive petroleum products. Hydropower projects seem to have brought some changes in attitude, behavior, habit and consciousness of the local people. It has mainly contributed to transportation, market and communication facilities. The physical characteristics and rivers naturally affect Nepal's hydropower development activities and human interaction. He concludes that small hydropower plants, which may be the only means of rural electrification in the country, are viable at present.

Shrestha (2006) has mentioned that the development of the hydroelectricity is possible due to the enormous water resources as well as favorable topographic and

climatic condition. Hydroelectricity has tremendous advantages for the people, and it helps to develop energy sector of economy. Electricity is one of the infrastructures of upgrading the socio-economic condition of nation. The proper utilization of electric power accelerates the motion of national development. Our experience shows that the developed countries like Japan, UK, USA, China, France etc. achieved advancement in time through electric power. The hydroelectricity has become economically attractive because it is renewable and environment friendly. He has discussed the role of hydroelectricity in various economic as well as non-economic sectors. Industries, agriculture, transportation, social services and other sectors can be promoted by the utilization of electricity.

Bhadra (2005) has defined about the condition of hydroelectricity in Nepal. He emphasizes that the use of electricity and fuels have been found to be accelerating thought the rate of economic growth has remained same in Nepal for decades. This is because Nepal could not adopt the appropriate policy to utilize the water. But it is obvious that in every sectors of development it has vital role. The problem is rather terrifying because of the cheap price of electricity but the lower generating capacity, and low invests.

Awasthi (2010) has examined the socio-economic impacts of Chameliya Hydropower Plant in the adjoining area. This study has concluded that the socio-economic impacts of the project are moderate in absolute term and satisfactory in relative term. The project has provided sufficient drinking water and employment opportunities to the local people and electricity supply has extends the social and recreational activities.

Joshi (2011) has mentioned that energy is important for economic development. The pace of economic development cannot be accelerated without hydropower development. The development of productive sector of an economy depends on development of the energy sector. In the hilly and mountainous area, almost all the households are found to have consumed traditional sources of energy for cooking, heating, lighting and other necessary activities. Traditional energy sources cannot be sustainable to fulfill energy requirement. From the present analysis it has been observed that most of the people depend on forest for energy sources and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortage of fuel wood, soil erosion, deterioration of the fertility of soil etc. Deforestation leads to the deterioration of water sources and hampers both electricity

generation and drinking water. Hydropower occupies a very eminent place in the energy sector of Nepal. The utilization of energy is concentrated on urban areas and most of the rural areas have been by-passed-by this power development. The hydropower project has brought about changes in socio-economic, cultural and other aspects of the people living in the project located area and its surroundings .To find socio-economic impact and to introduce the total effect of the project at the study area is main objective as well as quantitative method is used the study find the every kinds of socio-economic and environmental effect in the study area as well as surrounding area.

2.3 Research Gap

This Research is primarily based on the base of facts and findings and a reconnaissance with a field study survey. The main objective of this research is to analyze the social and environmental aspects of the lower Modi-1 hydropower project along with the income and employment generation from this project.

As per the analysis from the past research, similar to this project there had been some research gaps regarding the analytical data and findings. Also the effect of the project in the local level considering the basic needs like food, shelter, local economy and education was not found to be studied in depth. In this research, a in-depth study considering the field data and field survey to find the exact effect of this project regarding the basic need of the local level has been explained. Also in the social and environmental part of this project, detailed study with appropriate field survey data, analysis and findings has been done into base level.

So this research is able to fulfill the gaps in the findings and analysis that had been remained in the previous research. This research has been based on analytical data obtained from field survey and research of various articles. Thus the articles presented on this research are more over accurate and based on the facts. This research also deals with social and economic as aspects. Giving both aspects equal importance, these aspects are our primary objectives. There has been a research gap as various similar research analytical data and findings. This research article tends to fulfill such research gap by providing analytical data survey reports and more articles based on actual findings and research. This research also can be used by various governmental and private sectors for further research and studies.

CHAPTER-III

RESEARCH METHODOLOGY

Research is a careful and detailed study into a specific problem, concern or issue using the scientific method. A research is carried out in a systematic order where this chapter deals with the method and process of study.

3.1 Research Design

This research was based on descriptive and analytical research design. It is exploratory because the study aims at exploring the socio-economic condition of the community adjoining area of Lower Modi-1 hydropower project.

3.2 Source of Data

This study was done in Chuwa VDC. Mainly the data was based on primary sources. So, the sources of data for this study were the annual report of Lower Modi-1 hydropower project and the response of respondents of the study area.

3.3 Nature and Sources of Data

In this study, qualitative data were generated from questionnaire through household interview survey. And quantitative data like income employment and social status was also collected. Primary data has been taken through field visit, focus group discussion and household questionnaire. The researcher himself visited the research area in order to collect the required data for the study. Similarly, secondary data were taken from the NEA annual reports, the Central Bureau of Statistics, VDC office file and Lower Modi-1 hydropower project report. Literatures in the study were gathered as secondary data from books, articles, newspaper etc. Likewise the data taken for the analysis from the questionnaire, field visit and group discussion is considered to be primary data.

3.4 Population, Sample and Sampling Procedure

Chuwa VDC has 433 households that have been closely affected by the hydropower project. So, the population of the study is 433 households. The study area and respondents were selected by using census and random sampling methods. The total

population of the study area was found to be 1759. Out of which 90 households were selected as sample households under the proportional distribution in the 9 wards of the VDC as shown in table.

Table 3.1 : Ward wise Sample Distribution

Ward No	Total HHs	%	Total sample HHs
1	39	9	7
2	46	10.63	10
3	41	9.47	8
4	57	13.16	12
5	44	10.17	10
6	61	14.08	15
7	55	12.08	11
8	46	10.62	9
9	44	10.17	8
Total	433	100	90

3.5 Tools and Methods of Data Collection

a) **Questionnaire Survey:-** Structured Survey Questionnaire was prepared to collect Necessary information. The questions were filled up by taking interview with the household head or member of households to collect the required information on socio-economic impact of hydro project.

b) **Focus Group Discussion:-** Focus group discussion is a important way to find out the actual picture of socio-economic impact Lower Modi-1 hydropower project on the adjoining area. This discussions is very useful, not only in measuring advantage and disadvantage of project put also means of learning about the further project. Therefore, the focus group discussion was held in the study area. The researcher went to the study area and discussion was done with the local people.

c) **Field Visit Observation:-** Socio-economic status such as education, food availability, animal possession and other socio-economic characteristics as housing, drinking water facility etc. were considered through direct observation on field visit according to the checklist. The data was recorded while observing the households

3.6. Data Organization and Processing

A work sheet was prepared through the complete questionnaire tool. The collected data classified according to its nature and characters. To make the analysis more reliable and easier, different data sheets have been prepared for different variable. Field questioner is carefully checked for possible errors. The data is carefully edited and processed by computer program state and excel then the required pie-chart, bar diagram and table is generated by using computer software program.

3.7 Tools and Methods of Data Analysis

With the completion of field part of the survey, the processing of finding part begun. Therefore, all the materials collected during the field work were properly coded by giving code number to each response with the help of code manual. After collecting data, the raw data was edited and decoded then the data was kept together in same kinds of tables and figures. Tabulation process was done manually.

CHAPTER - IV

PRESENTATION AND ANALYSIS OF DATA

This chapter attempts to analyze information received from the structural as well as un-structural questionnaires, observation and informal discussion. Analysis will be basically focused on the examinations of the basic parameters, which are directly or indirectly related to the objectives of the study. The result obtained from the observation and field survey is systematically arranged in figures and tables in different subheadings as follows.

4.1 General Features of the Respondents

The general features of the respondents give information about the basic characteristics of the current population of the study area. The following are the general features of the respondents in the study area.

4.1.1 Age and sex distribution of Respondents

Age, sex composition are the basic demographic characteristics, which play an important role in the population analysis because these traits directly influence the nationality morality and marriage. Similarly, other population parameters such as occupation, education are also influenced by age and sex composition in the context of our country. It also represents the family size and structure of the VDC. The age and sex composition of the sample is presented below.

Table 4.1 : Sample Distribution by Age and Sex

Age Group	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
0-15	-	-	-	-	-	-
15-30	10	16.96	6	19.36	16	17.78
30-45	21	35.59	7	22.58	28	31.11
45-65	25	42.37	18	58.06	43	47.78
65 above	3	5.08	-	-	3	3.33
Total	59	100	31	100	90	100

Source: Field Survey 2014

Above table shows that the number of male respondents is higher than female, taken the sample household. The economically active human resource is considered to be 15-65 age groups. Therefore the percentage of working population of the total sample population is 94.45 percent where, 56.66 percent of male and 34.44 percent of female are economically active and rest 5.55 percent are economically inactive.

Survey has found that people below 15 years and above 65 years fall under economically inactive and are not usually seen in the any productive work and job market. The age group of 0-15 and above 65 should not involved in any income generating activities but our culture is bounded in such way that they are assured to be involved various type of household works, such as rearing of cattle and goat, looking children, fetching water, cleaning house, cooking food, collecting fuel wood and so on.

4.1.2 Educational Status

Education is the key indicator of the human development. It plays a vital role in the efforts of any endeavor to uplift a society and it has a positive role in the success of life. Food, shelter, clothing and education are the basic need of the people. Similarly, attention must be paid for the condition of literacy of the rural farmers as well as the schooling children. Even primary education is a principal mechanism of fulfilling the minimum learning needs of the people needed for effective participation in economic, social and political activities. Towards the survey found that, Chuwa VDC (Study area) has a 1 secondary school and 2 primary schools in different wards. Table No. 2 shows about the education status of the sample respondents.

Table 4.2 : Educational status of Respondents

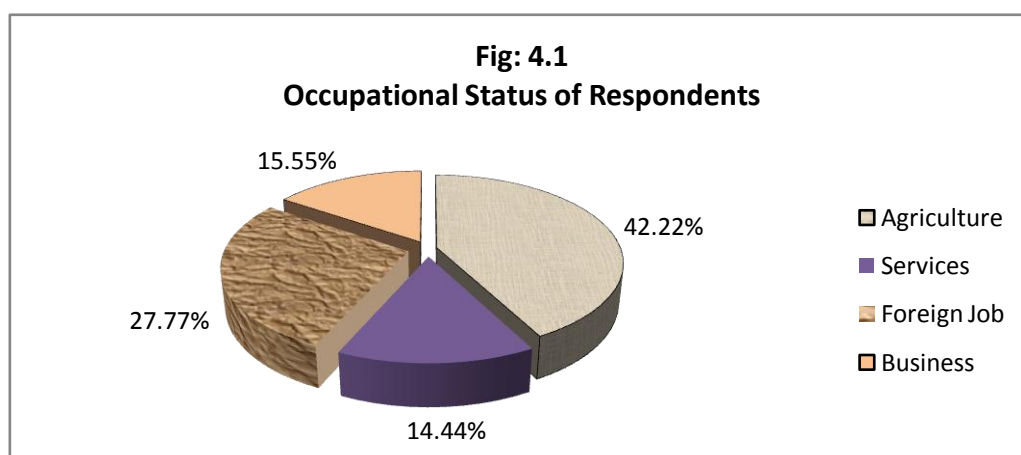
Level of Education	No of Persons	Percentage
A. Illiterate	7	7.78
B. Literate	83	92.22
Primary(1-5)	24	26.66
Secondary(6-10)	42	46.67
10 class or above	17	18.89
Total (A+B)	90	100

Source: Field Survey 2014

Above table shows that 7.77 percent respondents are illiterate and 92.22 percent are literate of the respondents in the study area. The literate population is highly greater than illiterate population. It is observed that the literacy rate in the study area is satisfactory. Out of total literate population 26.66 percent had studied upto primary level, 46.67 percent upto secondary level and only about 18.89 percent have completed school level education. It is found that for higher study students of the Chuwa VDC have to travel to City area and district headquarter.

4.1.3 Occupational Feature

Agriculture sector is the main source of the national income. Agriculture has been the main sector of employment and for income generating activity in this VDC as well like in most in our country. Thus it can be regarded that agriculture is the main source of livelihood for this VDC. But this sector is very backward in the study area due to the lack of irrigation agricultural inputs, training and skill development program. Agriculture and the foreign job are the main sources of income among sample households. On the basis of primary occupation, the dwellers can be divided into four different categories such as agriculture, services, foreign job and business. The occupational status of the sample households is given below.



Source: Field Survey 2014

According to above figure, it is clear that the highest percentage i.e.42.22% of sample households are engaged in agriculture and lower number of population are engaged in business. The number of people involved in foreign job is slightly more than the people are in service sector. Nowadays, people are encouraged to join the service for

their economic security and sustainability. In this area there is a tradition to go to different gulf countries as well as European countries for job.

Among 38 sample households having agriculture as major occupation, 22 sample households had sufficient production for their family whereas the remaining 16 sample households did not have sufficient production for their family so, they had to engage in other works such as porter, labor etc for income generation.

4.1.4 Caste Distribution of Sample Households

Heterogeneity and multiplicity is the figure of the study area, various castes like Brahmin, Chhetri, Magar, Gurung, Limbu and Dalit are in existence in the VDC. Among the total population Brahmin and Chhetri are dominant cast group comparison to Janajati and Dalit. Nepali Language is common communicative language of all caste. The table below shows the distribution of the sample households by caste/ Ethnicity.

Table 4.3 : Distribution of Sample Households by Caste

Caste	No. of Households	Percentages
Brahmin	31	34.44
Chhetri	24	26.66
Janajati	18	20
Dalit	17	18.89
Total	90	100

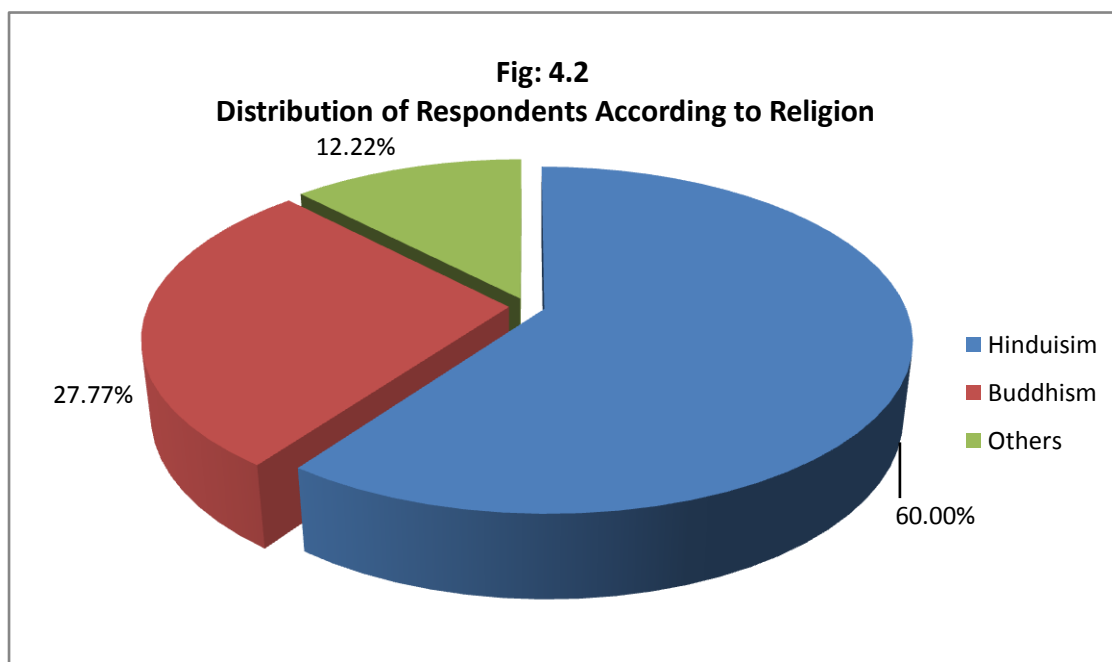
Source: Field Survey 2014

Among the total sample Households, the highest portion i.e. 34.44 percent respondents were Brahmin and 26.66 percent were Chhetri. The no of Dalit and Janajati respondents were nearly same among sample households but there difference in population between Dalit and Janajati.

4.1.5 Distribution of Respondents by Religion

The dominant religion in Nepal is Hindu, more than 70 percentages Nepalese follow Hinduism. In the study area Hinduism and Buddhism was mainly in practice. The

sample household's ratio according to the practice of religion is shown in the figure below.



The pie chart above deices that, the majority i.e. 60 percentages of the sample households practiced Hinduism whereas 27.77 percentages respondents practiced Buddhism. The people believing in Hinduism in the study area are dominant as the national context.

4.2 Role of Hydro Project in Income and Employment Generation

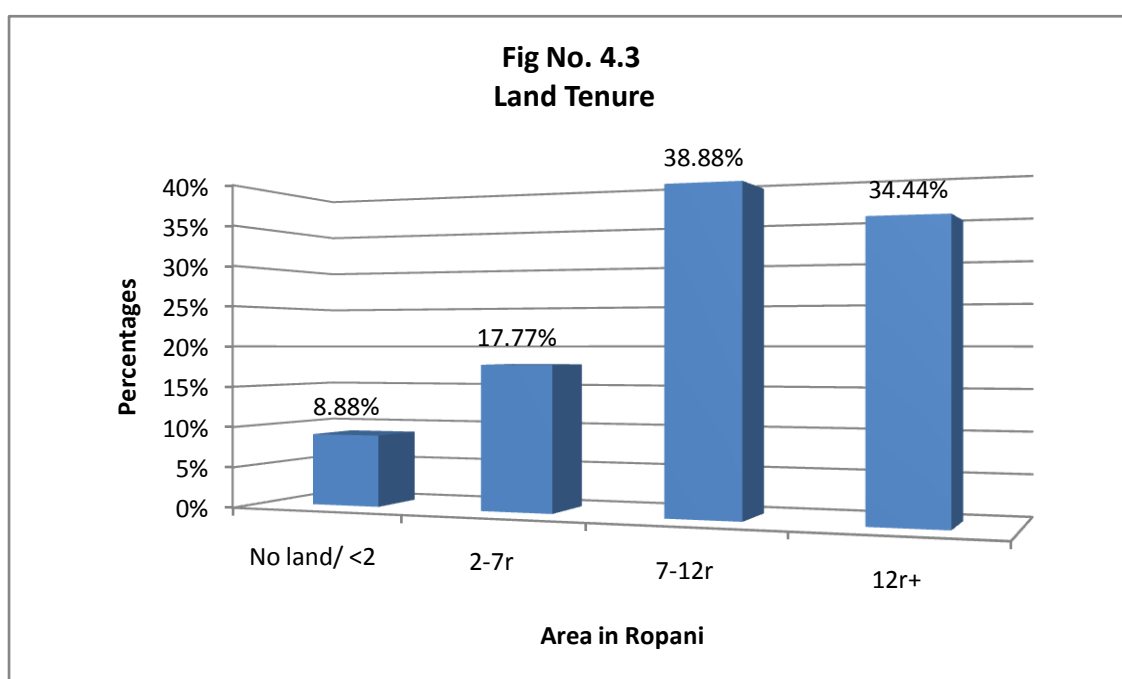
Hydropower project has a significant role on income and employment. The impact of hydropower in Income and Employment is described in following subheadings.

4.2.1 Agricultural Situation

The total area of Chuwa, VDC is about 469 hectares. In the study area, land is the main source of a livelihood. Moreover, the land has social and spiritual value to the local people. Agriculture is the most predominant form of land use in the district. Others include, grazing, residential/village and public lands. The agriculture land is located in the low plains, whereas the upper part of the hill is covered by the forests.

4.2.2 Land Tenure

Most land in the project impact area is owner-cultivated, and very few lands are tenant cultivated. The general land holding pattern of the people in the VDCs is agricultural land. As such, there are two types of agricultural lands in the project area: Khet (Low land) and Pakho Bari (Upland). Khet refers to the field, which have been terraced, leveled and bound for the cultivation of mainly paddy. Khet is highly preferred by the local people because it usually yields three crops per annum. Pakho Bari (non irrigated land) is rain-fed and usually terraced land. Bari is often situated above Khet, so that their run off contributes to the watering of the paddy fields. The other lands are forest- land and thatch – land.



Source: Field Survey 2014

The figure above shows that the majority of sample households i.e. 38.88 percentages had 7-12 ropanis of land. These 12 ropanis include *Khet*, *Pakho Bari* and *Kharbari*. Likewise 34.44 percentages of sample households had 12 ropanis and more land. There were few sample households who do not own land.

4.2.3 Animal Husbandry and Agriculture

Majority of the respondent's households had agriculture as their source of income. Among them the researcher further questioned them about the status of animal

husbandry since animal husbandry and agriculture go side by side. There were no any large scale animal farms but farmers were found to keep buffaloes, goats and cows as source of income. Among 90 sample households 12 sample households did not have any kind of cattle and do not have any agricultural product The table below shows the status of animal husbandry among the sample households in the study area.

Table 4.4 : Livestock Rearing Situation among Sample Households

S.N.	Type of livestock	No of Sample households	Percentage
1	Buffaloes	54	69
2	Cow/Ox	21	27
3	Goat	59	76
4	Others	23	29

Source: Field Survey 2014

According to table No 3 majority of sample households had goats and buffaloes as major cattle in their family. Out of 78 sample households engaged in animal husbandry only few were engaged in bee keeping and fish farming which are listed in others category. People in the study area use ox to plough the field since modern technology is not available in the study area. Buffaloes are mainly used for milk and milk products but somehow buffaloes are also used as flesh source in the study area.

4.2.4 Annual Family Income Level of Sample Households

Income level determines the resource mobilization, living standard, education level and health also. Generally, it is believed that high level of income increases the quality of life. In the study area, there are many sources of income such as agriculture, government job (service), foreign job, business, laboring and others. It is generally difficult to figure out the individual household income because the numbers of households do not like to respond to question about their income because of the fear of publicity of their economic status. Specially, it is difficult in a society like our where material wealth is used as a tool to place a family or an individual in the hierarchy of society. As a result, respondent answers this question with caution. To estimate the household income, the probable source of a household income has to be considered, such as sales of agricultural products, animal products, salary, labor wage. The annual income level of the sample households is shown in table below.

Table 4.5 : Distribution of Sample households by Annual Income

S.N.	Income Level (in Rs.'000')	No. of Sample households	Percentage
1	Below 50	5	5.56
2	50-100	15	16.67
3	100-150	22	24.44
4	150-200	29	32.22
5	Above 200	19	21.11
	Total	90	100.00

Source: Field Survey, 2014

Above table states that most of the sample households, i.e. 32.22 percent have annual income level Rs 150,000 to 200,000 and second largest number of respondent have 100,000 to 150,000 annual income (i.e. 24.44%). Survey found that the households, who have low level of income, are those who are engaged in agriculture sector due to lack of knowledge about modern techniques of farming. Survey also found that the households who have higher annual income are involved in business and foreign job.

4.2.5 Main Energy Sources for Cooking

The main sources of energy used for cooking food are fuel wood, agricultural wastes, animal dung, electricity, kerosene etc. In the study area fuel wood is main source of energy for cooking all of the households depend on fuel wood to some extent.

4.2.6 Types of Cooking Stove

Survey found that about 66.66% sample respondents households use fuel wood for cooking purpose to some extent. The source for the fuel wood is the forest around the Chuwa VDC. In the study area, only about 43.44% percent households used improved cooking stove (ICS) and LPGs for cooking purpose. The use of ICS has decreased the consumption of fuel wood which can be shown in table below.

Table 4.6 : Type of Cooking Stove

S.N.	Type of stove	No. of Households	Percentage
1	Improved Cooking Stove (ICS)	30	33.33
2	Traditional Cooking Stove	60	66.66
	Total	90	100.00

Source: Field Survey 2014

Forest is the main source for the supplement of fuel wood in VDC which has been one of the main reasons for the forest depletion. Most of the forest covered area lies in the western and northern part of the VDC. Supply of fuel wood from their own resources is directly related with land occupied by each household. The people with more land have access on more fuel wood, while having less land produce less fuel wood. There is a trend of planting trees for fuel-wood and to feed animals. In the study area, only about 35 percent sample households collect the fuel-wood from the private forest and most of them i.e. 65 percent of the households fetch fuel-wood from community forest, which can be represented table below.

Table 4.7 : Source of Firewood

Type of Forest	No of Sample households	Percentages
Private	21	35
Community	39	65
Total	60	100

Source: Field Survey 2014

4.2.7 Establishment of Industries

Small hydropower plants have to some degree been successful in creating some jobs, like those who manage the pumps, and engineers and mechanists who manufacture and maintain the plants. Since management committee members of the plants work on a voluntary basis, they receive no compensation. Therefore, it is necessary to study to what degree micro hydropower stations have in increasing or creating jobs. It is also necessary to study enterprises that have come up after electricity was introduced.

Electricity is the foundation of any socio-economic activities. The life is very difficult as well as being backward due to in ability to use to modern technology in the absence of power. After hydro project, people lunched varies industries in the study area, which help to raise the income level of the people as well as make the villagers way of living much easier. The firms that lunched after project in village are presented as below:-

It is observed that villagers installed 13 small industries where around 17 villagers have partially/fully involved in job. The villagers life become easier after installation of Rice mill, Saw mill, Oil expeller and Spice mill and able to generate income from

these firms. People generate income after installation of Bakery, Furniture and Poultry. The other business such as: Hotel, Stationary, Photo Studio and Medical have been run which generate the income as well as make the social life easier too.

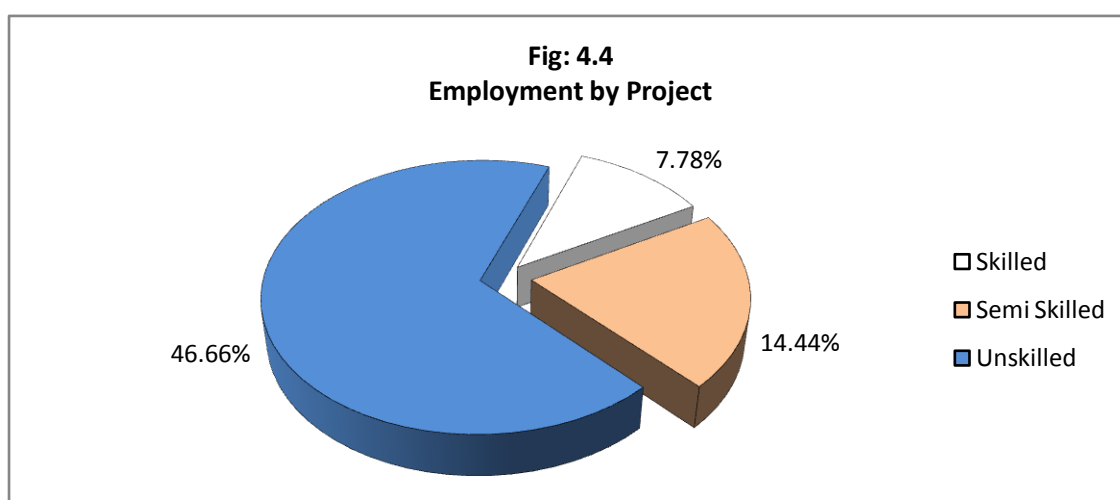
Table 4.8 : Establishment of Industries after Project

Firms	Number of industries
Rice mill	3
Poultry firm	5
Spice mill	1
Oil expeller	1
Bakery	1
Furniture	2

Source: Field Survey 2014

4.2.8 Employment of Locals in Hydropower Project

After the establishment of Lower Modi-1 Hydropower Project, there has been an employment opportunity for the peoples of Chuwa VDC. All types of manpower are needed in a Hydropower Project. Skilled manpower such as engineers, semiskilled manpower such as technicians and raw/unskilled manpower such as labors were employed in the project. The following table shows the participation of sample households in the project for job and income generation.

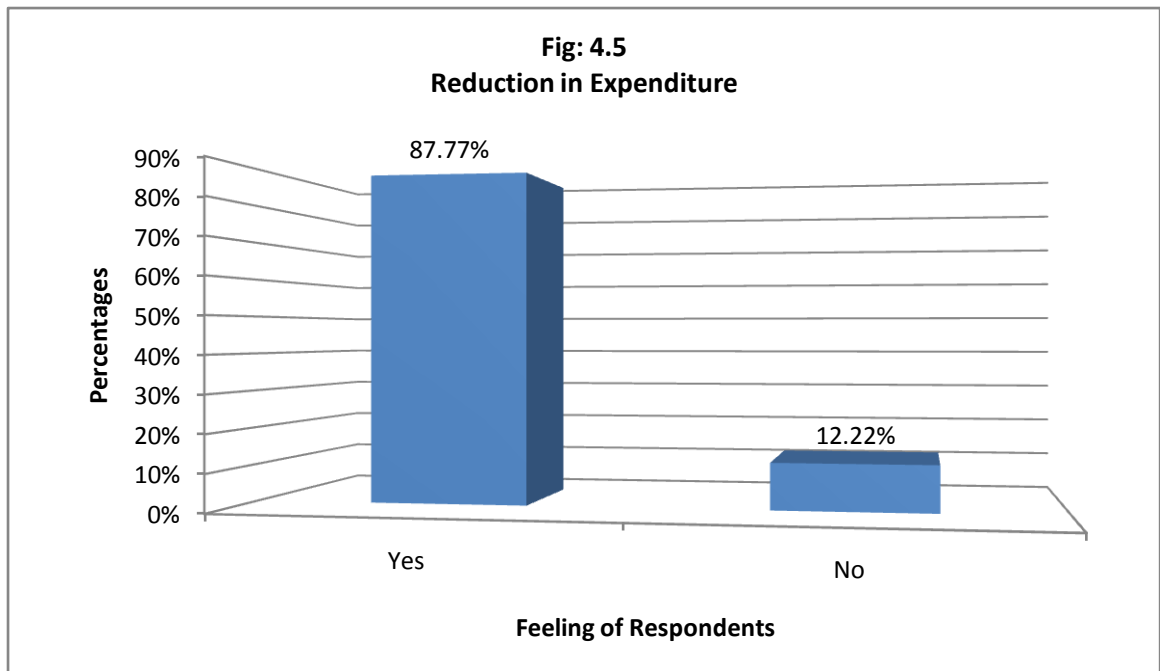


Analyzing the figure above it was seen that out of total sample households only 62 sample households i.e. 68.88 percentages had any one or more family members got

job opportunity in the project. Among those employed manpower majority was of unskilled manpower such as labors. Only 7.78 percentage of skilled manpower were found to get job opportunity in the project.

4.2.9 Reduction of Expenditure

After the establishment of the project, people of Chuwa VDC were found to use electricity as the major source of energy. The use of kerosene oil, candles and other sources of light was reduced. The reduction in use of such products leads to the reduction of expenditure. The figure below shows the feeling of respondents towards the reduction of expenditure after electrification.

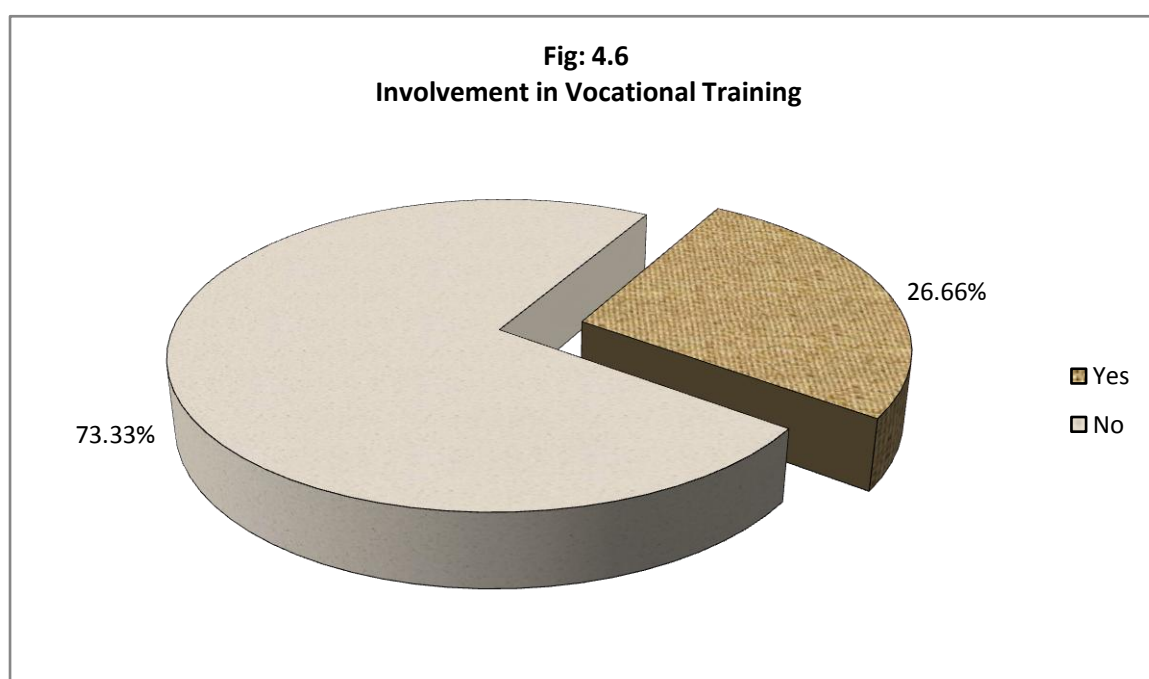


Source: Field Survey 2014

According to the figure above majority of respondents felt the reduction in expenditure but some respondents i.e. 12.22% respondents felt no reduction in expenditure after electrification. Some respondents feel that there is not regular supply of electricity in the study area so they are compelled to get alternative source of energy for electrification.

4.2.10 Involvement in Vocational Trainings

Economies are no longer based only on the accumulation of capital and labor forces but on knowledge and information. Vocational training is an important employability factor. Although it does not generate jobs by itself, it greatly helps individuals to compete for available work posts, or to keep whatever employment they have. The trainings on various topics like Improved Farming for women, Carpentry, Stone Masonry Trainings, Bar Bending Training, Leadership Trainings etc. conducted by Lower Modi- 1 hydroelectric project have encouraged the local people to start new income generating activities efficiently. The following figure shows the involvement of sample households in vocational trainings.



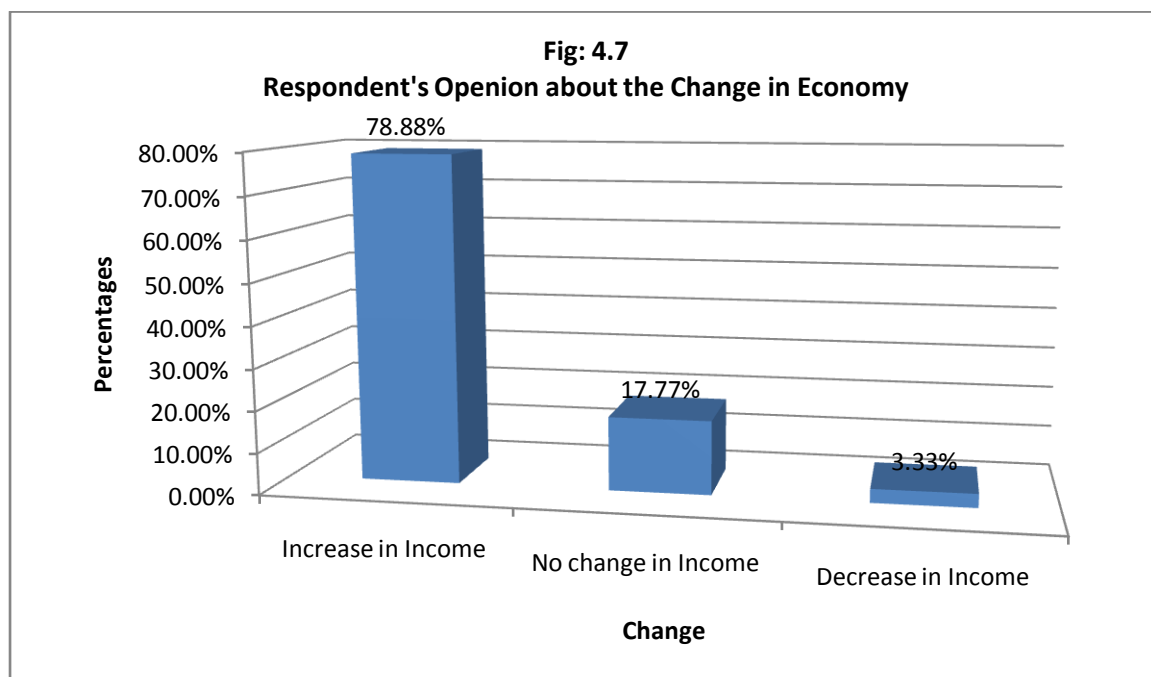
Source: Field Survey 2014

Analyzing the figure above it is clear that the majority of sample households have not participated in the vocational training programs launched by the project.

4.2.11 Respondents Opinion about the Change in Income after Project

By the use of Project, the firms/industries/shops etc. were installed in the VDC from where many villagers got employment opportunity directly or indirectly. It certainly helps the upliftment of economy of the sample households. The following figure

shows the feeling of respondents regarding the change in economy after the establishment of the project.



Source: Field Survey 2014

Analyzing the figure above it is clear that the majority of respondents felt the increase in their economy after the establishment of the project. Out of total respondents 78.88 percent respondents felt the increase in economy, 17.77 percent respondents did not feel any change in their economy and the remaining 3.33 percent respondents felt decrease in their income after the establishment of the project.

The project is found to affect the economic condition of the sample households. After electrification the villagers had been engaged in different productive works in different fields which directly or indirectly make positive change in their economy.

4.3 Social and Environmental effects of Project

Hydropower project has affect on following social and environmental aspects which are serially arranged in following subheadings.

4.3.1 Drinking Water

The sample households as well as whole study area drink taps (piped) water. But the pipeline water and improved stone taps are increasing day by day. Before the project

started locals used stream and well as source of drinking water. Quality of piped water was improved.

4.3.2 Use of Toilet

Sanitation is one of the indicators of living standard of the people. Earlier, there were only few *kacchi* toilets in the study area and no *pakki* toilets. They improved their habit and started using toilet. But, due to their poor economic condition, some sample households haven't built modern toilets yet. The use of *Kachchi* toilet had decreased in last few years in the study area. Out of total sample households only 11 i.e. 12.22 percentages used *kacchi* toilet whereas the remaining sample households used *pakki* toilets.

4.3.3 Health Services/Facilities and Problems

Indoor air pollution is due to smoke from firewood and smoke of kerosene for the lighting purpose which leads to the serious problems on the people's health. People are suffering from asthma and eye infection due to indoor air pollution. Hydroelectricity has a prominent role in reducing indoor air pollution by decreasing the use of firewood and kerosene. Ultimately it is the environment friendly which helps to conserve the jungle and helps keep fresh environment.

The project may also have indirect benefits on health though increase in access to information. Households with micro hydro may listen to radios, watch television, and watch educational videos more often than households without micro hydro which may bring about positive changes in their health choices and health seeking behavior in general.

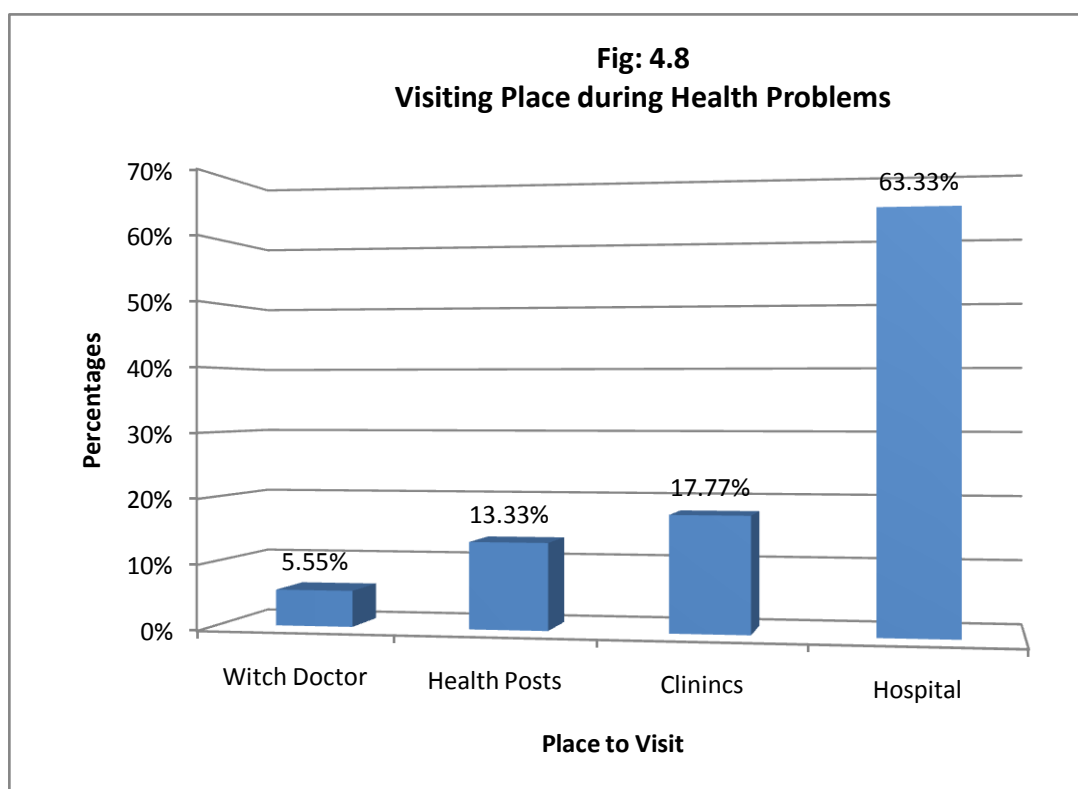
There is one health post in the study area which is providing health services in the study area. After the establishment of the project the health status of sample households was found to improve somehow because electrification reduces eye problems and indoor pollution which cause respiratory system related problems. The following table shows the view of respondents towards the reduction in health problems after the establishment of the project.

Table 4.9 : Improvement in Health of the Respondent's Households

S.N.	Improving Percentage	No. of Households	Percentage
1	Below 20	24	26.67
2	20-40	28	31.11
3	Above 40	16	17.78
4	Cannot say	22	24.44
Total		90	100

Source: Field Survey 2014

Above table shows that most of the sample households i.e. 31.11 percent, agreed that their health has been improved 20 to 40 percent after electrification and it has been note that these percent of households constituted more number of children and old members. Similarly, 26.67 percent of the sample households feel that their health has been improved less than 22 percent and only about 24.44 percent respondent's states that they cannot say anything about it. Survey found that 75.56 percent sample respondents agree that the health expenditure of the households decrease after the use of eclectic bulbs. The following figure shows that peoples visiting place during health problems.



The figure above shows that the majority of the sample households visited governmental as well as private hospitals during health problems. Among total participated sample households 63.33 percentages of sample households visited Hospitals whereas very few i.e. 5.55 percentages of sample households had traditional thought and visited witch doctor when they have health problems. Few sample households were also found to visit Health posts and Clinics during health problems. The awareness level regarding health was found satisfactory in the study area.

4.3.4 Pollution by Project

There are different kinds of pollution. In this study it is attempted to find out the status of environmental pollution. Is there seen any kinds of pollution after hydropower plant? If so what kinds of pollution have occurred?

Most of the infrastructure may be the cause of the environmental degradation and pollution. In this situation a question was asked whether there was environmental pollution or not in the study area. Out of the 90 respondents 76 (84.44%) reported that there is no any kind of environmental pollution and remaining 14 (15.55%) respondents reported there is environmental pollution even after project.

Table 4.10 : Status of Environmental Pollution after the Project

Pollution	Number of households	Percentage
No	76	84.44
Yes	14	15.55
Total	90	100

Source: Field Survey 2014

In addition, positive and negative result occurs after every change but disadvantages must be dominated by advantages. So after the project there is not bad environmental pollution in the study area. Out of 90 total respondents only 14 respondents reported that there is environmental pollution after the project. Out of 14 respondents maximum proportion i.e. 5 (5.56%) respondents reported air pollution occurred in the place, 3 (3.33%) respondents reported water pollution and 2 (2.22%) respondents reported dust.

Table 4.11 : Type of Pollution Occurred after the Project

Type of Pollution	Number	Percentage
Landslide	2	2.22
Water pollution	3	3.33
Air pollution	5	5.56
Rock fall	2	2.22
Dust	2	2.22
Total	14	15.55

Source: Field Survey 2014

4.3.5 Cultural and Socio-economic Effect in Different Phases

Hydropower project has affect on following Cultural and Socio-economic aspects which are serially arranged in following subheadings.

a) Pre-Construction Phase:-Seriously project affected family (SPAF) are those whose houses and land both are temporarily or permanently occupied by the project. Since, no houses are occupied by the project, there are no SPAF.

Furthermore, the people whose land is temporarily or permanently occupied by the project has been defined as project affected family (PAF). As per the data, around 12 families have been affected from the construction of the hydropower project. These families lost about 22 ropani of land. Almost all the construction site lies in the public area, so the amount of compensation for the land was low. Those affected families are defined as PAF, are compensated, since they have housing in other places and only their farm land is lost. The project, took land as per the need, the left over fragment of the land are useless. This also accounts the loss of utility or production to the owner. The impact is moderate in magnitude, site specific in extent and long term in duration.

b) Construction Phase:-The acquisition of land for the permanent and temporary construction work camps have some socio-economic impacts. The construction work camps are constructed in both the powerhouse and headwork site. At these sites, deforestation is occurring for firewood. In the project sites, partly kerosene is being used for cooking, but some workers are using firewood, which has impact on natural resources or mainly accessible forests and bushes. About 100

laborers stay in construction camps during the peak period. These camps have impact on social, cultural and natural resources. The magnitude of impact is low; extent is site specific and duration is long-term.

No houses are necessary to be relocated from the project impact areas. All the houses are far apart from the project area, so that need not be relocated. The impact in public ritual places is moderate in magnitude, site specific in extent and long-term duration is very low. The impact is insignificant.

c) Operation Phase:-The project may compensate the severely affected people according to their expectation. They are hired for different jobs according to their qualifications during the construction stage, but many of them were out of work when construction works were completed. Some of them, who lost their compensation money in unnecessary things, started thinking that the project took their livelihoods.

When construction work was completed, almost all the workers left the area except few staff and workers required for the operation of the project. This sudden fall in the number of people decreased the demand for commodities dramatically. Market for local products was lost. Many local people were out of work. All these decreased incomes of local people severely due to loss of business job and market. The suddenly declining economic activities led to depression among local people.

4.3.6 Increase in Study Hours

It is obvious that electrification brings access to light which helps in the increment in study hours. The early morning and late evening hours can be utilized for studying. The data shows that electrification has brought positive impact on study time duration.

Table 4.12 : Change in study hours in Average (per day)

Increase in study hours	Numbers of respondents
Up to 1 hours	44
1 to 2 hours	32
2 Hours and above	14
Total	90

Source: Field Survey 2014

Out of the 90 respondents surveyed household, 44 said that the study hours of students is increased by 1 hour, 32 of them said the study hour was increased by 1 to 2 hours and 14 of them feel that study hour of students was increased above 2 hours on daily basis.

4.3.7 Impact of Electrification on Performance at School

Electrification has brought a positive impact on the performance of student on school. It is due to the increase in study hours as well as use of modern technologies in teachings. The table below shows the more in the performance of students after electrification.

Table 4.13 : Impact on Performance of School

Percentage	Number of students	Percentage of students
Up to 5%	30	33.33
5% to 10%	25	27.77
10% to 15%	18	20
15% to above	17	18.88
Total	90	100

The above table shows that 33.33% of the student have increase their marks by 5%, 27.77% of student increased their marks by 5% to 10%, 20% of students increased their marks by 10% to 15% and 18.88% of total surveyed student increased their marks by 15% and above.

4.3.8 Impact on the Use of Modern Appliances in Teaching

As the modern equipment are electricity bound, electrification has brought an increment in use of model electrical appliances overall. In teaching too, there is a significant rise in the usage of it. The table below shows the increment on the use of electrical appliances in teaching.

Table 4.14 : Change in the use of Modern Appliances in Teaching

Appliances	Quantity
Projector (days per year)	5
Computers (Number in school)	60
Other electronic devices (Numbers in school)	16

The table 4.14 shows that the number of days for the use of the projector is about 5 days per year. The use in the number of Computers after electrification increased in the study area, since the students had access to electronic devices in school as well as in house.

4.3.9 Change in Behavior of Family Members

The use of electrical instruments has caused multiple changes in family member's behavior. In the study area people mainly use: Television, Computers and radios. These instruments help the villagers to get in touch with the whole world. Internet and Television let the people know about foreign cultures, traditions and system which may bring the change in social norms. The researcher asked the respondents about the change in family members after the use of technological devices. The following table shows the result.

Table 4.15 : Change in Behavior

Behavior	Improved		Deteriorated		Total	
	No.	%	No.	%	No.	%
In fashion	23	25.55	67	74.44	90	100
Talking style	59	65.55	31	34.44	90	100
Sports	74	82.22	16	17.77	90	100
Knowledge of current affairs	51	56.66	39	43.33	90	100

Source: Field Survey, 2014

The table above somehow shows that there the behavior of the family members was deteriorated. Majority of respondents felt the influence of technology such as Internet, Mobile Phones and Television has brought negative influence among the adults and teenagers. Instead of using traditional dresses they were found to use modern western civilized dresses. Among 90 respondents, 65.55 percentages respondents feel the improvement in talking style since the family members get frequent listening practice of international language. The children were found to understand better English than before. The touch in technology led the family members to know about the current affairs in the country as well as the whole world.

CHAPTER – V

MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Major Findings

Some major findings made by the researcher after completing the research work are listed below.

- i) It was found that that 7.78 percent people are illiterate and 92.22 percent are literate among the sample households in the study area. The literate population is highly greater than illiterate population.
- ii) The highest percentage of sample households had agriculture as major occupation. Among 38 sample households having agriculture as major occupation, 22 sample households had sufficient production for their family whereas the remaining 16 sample households did not have sufficient production for their family.
- iii) Majority of the respondents households were found to own 7-12 ropanies of land. Some respondent households did not own land.
- iv) Respondent's households were found to have buffaloes and goats as major livestock since 59 sample households had goats and 54 households had buffalo.
- v) The researcher found that the majority of respondents had annual income of 150,000 to 200,000. Among 90 sample households 5.56 percentages had below 50 thousands of Annual Income whereas 32.22 percentages had 150,000 to 200,000 of annual Income.
- vi) Altogether 13 small scale industries including rice mill and poultry farm was established in the study area.
- vii) Very low percentages of sample household were engaged in Lower Modi-1 hydropower project as skilled manpower. During construction phase various skilled, semiskilled and unskilled manpower were employed in the project but the no of employees decreased during operational phase.

- viii) Among the sample respondents 78.88 percentages respondents felt increase of income whereas 3.33 percentages respondents felt decrease in income after the establishment of the project.
- ix) After electrification the use of modern technologies has relatively increased in the study area which helped the students in their performance. About 27.77 percentages of sample respondents felt the performance of students increased by 5 to 10 percentages.
- x) The vocational training programs launched in the study area was not found effective since majority of respondents were not found to involve in such trainings.
- xi) Chuwa VDC was found to have better facility of drinking water since every household of the study area were found to use tapped water.
- xii) The use of *Kacchi* toilet was found to decrease in last few years. The study area was declared *Khula Disha Mukta Chhetra* few years ago which indicates the better situation in sanitation.
- xiii) There is only one health post and one private clinic in the study area. Since the study area is near to the district headquarter, most of the respondent households were found to visit district hospital and private hospital at the district headquarter.
- xiv) Although the number of respondents visiting health centers and clinic were relatively high, few respondents were found to have superstitious belief in *Dhami/Jhakri*.
- xv) After the establishment of the project the people in the study area had found the improvement in one's health. Majority of respondents replied that the improvement in Health was increased by 20-40 percentages.
- xvi) Only few respondents feel pollution by the project. Water pollution and air pollution were the major pollution by the project.
- xvii) After electrification the behavior of the household members was significantly changes. Majority of the respondents felt deteriorated in fashion style. Among 90 respondents 67 percentages respondents felt deteriorated fashion style, 65.55 percentages felt improved talking style.

5.2 Conclusion

Lower Modi-1 hydropower project is not specifically installed for the electrification at the local level as it has been connected to the national grid. Electrification in this district has been a continuous process as most of the VDC's are now electrified by the power provided by this project. The project is going through the process of up gradation in its power generation capacity. The study has revealed various contributions on education, health and economy. It has mapped out the contribution income and employment by the project and the necessary measures to solve it which can be concluded as follows:

Small hydro power project has positive impact on income and employment. It helps to rise in income and employment by helping in the establishment of new business. Respondents have started to use electronic devices therefore hydro power project has affected on social and cultural properties like changing in clothing, knowledge and thinking. Hydro power project reduces the expenditure on different energy source of energy in the rural area. By the use of hydro power, the health condition also gets improved. Major environmental pollution has not been seen after the project but minor pollution has been found. Students have been using evening time for study therefore it is found that study habits of students have improved. And their educational activities also positively changed. Electrification of the study area has brought improvement of health of individuals. The number of people affected with disease that has relation with electricity was found to be decreased. The frequency of visit to hospital has increased which shows an increase in the number of health institutions and increase in medical facilities at local level.

5.3 Recommendations

Rural energy development program has been providing rural electrification, environmental management and poverty alleviation to some extent in the rural part of the country. The development efforts need to be reviewed and more progress based on the use of alternative energy should be implemented. Appropriate policy on pricing, market arrangement and energy quality regulation needs to be developed for the sustainable growth of rural energy. Small hydropower deserves the high priority in view of its role in the socio-economic development of Nepal. It is a fact that unless the

small hydropower sector is provided with adequate technical, financial and management support, it will not be able to contribute to national development to the extent one can expect from it. Hence, the specific recommendations are as follows:

- i) Alternative energy resource should be made available to minimize the pressure on forest.
- iii) Appropriate policy pricing, market arrangement and energy quality regulation needs to be developed for the sustainable energy development in the rural part of the country.
- iv) An integrative approach to promote small hydropower development needs to be adopted.
- v) The subsidy program encourages the development of hydropower system. Government has done right thing by providing subsidy. But subsidy should be provided according to the structure of the cost not by the district wise.
- vi) Nepalese government should invest and give priority for private sector to make small hydro power rather than large hydro power because small hydro power can be carried out by the Nepalese economy and Nepalese resources.
- vii) Simple and transparent procedures for loan sanctioning should be developed and institutionalized.
- viii) Technology promotion and entrepreneurial development programs should be organized.
- ix) Proper evaluation of the socio-economic setting, technical and managerial capabilities and adequate survey and design must be ensured while carrying out feasibility studies.
- x) Technical training is need in both public and private sectors particularly at the operative level to improve present standards.
- xi) Government should give guaranty for peace and invest friendly environment to attract foreign investment.
- xii) Capabilities should be built up at village level for operation, maintenance and repairing.

- xiii) Small hydro power project can be completed in short period of time so people get service in short time, so government should priorities small hydro power project.
- xiv) Domestic Investors should be encouraged rather than international investors.

Appendix – 1

A Structural Questionnaire

The study of socio-economic contribution of Lower Modi-1 Hydropower Project only for project afflicted families PAFs)

1) General Information of the Sample Household:

a) Name of Respondent:

Age: Sex: Education: Religion:

b) Information of other family members

S N	Relation with informant	Sex	Age	Education	Occupation
1					
2					
3					
4					
5					

c) Spoken language: -----mother tongue:.....

d) Status of house and land, house only land only/both.

i. House: Pakki/Kachch ii. Shed/cell: No. Kind:

2. What is the source of drinking water?

i) Pipeline ii) Well iii) River/Stream iv) Pond

3. What kind of Toilet do you use?

i) Pakki ii) Kacchi iii) Open

4. Where do you go to cure health problems?

i) Witch Doctor ii) Doctors/Clinic iii) Health Post
iv) Hospital

5. How much land is owned by your family?

i) Khet: ii) Pakho Bari iii) Others:

6. Is your family engaged in agriculture and animal husbandry?

i) Agriculture only ii) Animal husbandry only iii) Both iv) None

- a) What is the source of irrigation for agriculture?
i) Rain water ii) Stream/ Rivers iii) Underground water iv) None
- b) How much cereal and cash crops do you produce annually in average?

Crops	Crops	Production (per Ropani)	Total Production
cereal	Paddy		
	Maize		
	Wheat		
	Millet		
cash	Oil seed		
	Other		

- c) Is there proper facility of market to sell your products?
i) Yes ii) No
- d) What is the no of livestock?
i) Buffaloes: ii) Cows: iii) Goats: iv) Sheep:
v) Others (Specify):
- e) Is your production sufficient for your family?
i) Yes ii) No

7. What is the average annual income of your family?

Source of income	No of respondents	Income
Agriculture		
Business		
Services		
Pension/interest		
Industry		
Other		
Total		

8. Has the project been beneficial to the locals
i) Yes ii) No

- a) (If Yes) How has the project been beneficial?
- i) Employment Generation ii) Environment Sanitation
- iii) Irrigation iv) Others
9. How has the project ensured local Participation?
- i) Ownership ii) Management iii) Employment
10. Is there any training facility provided to the local community to increase human resource capacity?
- i) Yes ii) No
- a) (If Yes) What kind of training has been provided?
- i) General ii) Work Specific
11. Has the electricity produced been used for productive purpose?
- i) Yes ii) No
- a) (If Yes) If yes mention the purpose.
- i) Lighting ii) Manufacturing iii) Irrigation iv) Others
12. Are your family members employed in this project? If yes how much do they earn?
-
13. Did you feel environmental degradation due to this project?
- i) Yes ii) No
- a) (If Yes) What type of degradation did you feel?
- i) Landslide ii) Rock fall iii) Deforestation iv) Air pollution
- v) Water Pollution vi) Others
14. Is there any governmental and non-governmental change after the establishment of the project? If yes what is that?
-

15. Do you feel the reduction of expenditure in energy sources like Kerosene, Batteries, and Candles etc?
 - i) Yes
 - ii) No

16. Have your family members been migrated for employment?
 - i) Yes
 - ii) No
 - a) (If yes) Where have they migrated?
 - i) District Headquarter
 - ii) City areas/Capital City
 - iii) Abroad

17. Are there any infrastructural development after the establishment of the project?
 - i) Yes
 - ii) No
 - a) (If yes) what are they?
 - i) Transportation/Road
 - ii) Drinking water Facilities
 - iii) Communication
 - iv) Health Services
 - v) Educational Facilities

18. What should be done for the sustainability of the project?

.....

19. What kind of effects are seen in health after the establishment of the project?
 - i) Asthema
 - ii) Nausea
 - iii) Cholera
 - iv) Others

20. Do you have any suggestion for the betterment of the project and socio-economic status of the people of the study area.

.....

APPENDIX – II

Check list

1. What is the location and condition of the study area?
2. What are the differences between before and project (no---- no. of electrified HH, lightness, use, load shading/regularity of power supply, kind of line no. of operator / technician, monthly duty).
3. How did the electric power substitute to the other fuels such as fuel wood, kerosene, solar, bio-gas, acid battery, cell battery (inpercent).
4. What did the project affect on environment?
5. What and how did the project assist on construction of infrastructures?
6. How did the project impact on social value, norms, culture etc?
7. What things were innovated due to the project?
8. What are the possibilities of new economic activities in local area after the project?
9. What were the advantages during the construction period of the project to the local people?
10. What are the advantages and disadvantages of the project?
11. What were/are the main problems of the study area before the project started/after the completion of the project?
12. How many people of the local area got/getting employment in the project?
13. What did the project affect community forest?
14. What kind of projects and programmes, which may advantageous, are needed to implement in this area?

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

Destination	Located Place	Transportation Time	Medium of Transportation
District Headquarter			
District court			
HMG's Offices			
Primary School			
High-school Collage			
Health Institution			
Banks			
Co-operative			
Agri. Service Center			
NGO			
Market			
Road Access			
Phone Facility			
Airport			
Grinding mill			

REFERENCES

- Acharya, K. (1983). *Hydroelectricity development in Nepal and its contribution to Nepalese economy*. M. A. Thesis, CEDECON, T.U., Kirtipur, Kathmandu, Nepal.
- Ahlborg, H. & Hammer L. (2010). *Drivers and barriers to rural electrification in Tanzania and Mozambique-grid extension, off-grid and renewable energy sources; Environmental system analysis*, Chalmers University of Technology, Goteborg, Sweden.
- Atiq-Ur-Rehman & Anis, H. (2008). *Impact of hydropower projects on economic growth of AJK*. IIIU, Muzaffarbad, Pakistan.
- Awasthi, A.R. (2010). *Socio-economic impact of Chameliya hydropower project in the adjoining area*. M.A. Thesis, CEDECON, T.U. kirtipur, Kathmandu, Nepal.
- Bhadra, B. (2005). *Hydropower development in Nepal, problems & prospects*. Madan Dahal ed. Nepalese economic textbook of M.A. Kathmandu, Nepal.
- Bhattarai, B. R. (2012). *Jalabiddut: arthik vikas ko mul adhar viddut*. Vol 1, NEA, Kathmandu, Nepal.
- Burton, J. & Holland R. (1983). *Micro-hydropower as an energy source of rural Columbia*. Appropriate technology Vol.10, London, UK.
- Calderon, J.C. (2005). *Social impact evaluation project fund for the promotion of micro-hydro power stations*. Intermediate technology department group, Peru: 19-25. Online: www.practicalaction.org/media/download/6471
- CBS (2011). *Population census*. Central Bureau of Statistics, Kathmandu, Nepal.
- Dahal, S. & Shrestha, R. (2014). *Sustainability of micro – hydropower in Nepal: a case study of Rukum district*. Report of IOE graduate conference, China.
- DHM, (2016). Department of Hydrology and Metrology, Nepal.
- East Consult (1990). *A report of study on functional status of private micro-hydropower plant in Nepal*. ICIMOD, Kathmandu, Nepal.

- Ghimire, H. K.(2007). *Small hydropower development opportunities and present status in Nepal*. Presented paper in international conference on small hydropower- hydro Sri Lanka.
- Gonzalez, et.al. (2009). *Micro hydropower plants in the Andean Bolivian communities: Impact on development and environment*. Article in Geophysical Research Letters.
- GSER (2016). *Global survey of energy resources report 2016*.
- Gull, H. (2004). The technology of micro-hydro power plants for alleviation of poverty. *Journal Quarterly Science Vision Vol: 9*, Pakistan.
- Gurung, et.al. (2011). Socio economic impact of a micro hydropower plant on rural livelihood. *Scientific Research and Essays, Academic Journal* .
Online:<http://www.academicjournals.org/SRE>
- Hamal, S. (1995). *Water and energy commission secreteriate bulletin vol. 6*
- Hora, P. (1994). *Role of micro hydropower in the rural electrification of Nepal*. M.A. thesis of geography, TU, Kirtipur, Kathmandu, Nepal.
- ICIMOD (1999). *Manual for survey and layout design of private micro-hydro power plants*, Kathmandu, Nepal.
- Jha, H.B. (1995). *Sustainable development of small hydropower in Nepal*. CETS, Lalitpur, Nepal.
- Joshi, K.P. (2011). *Socio-economic impact of Surma Devi small hydropower Project*. M.A. thesis, CEDECON,T.U.,Kirtipur, Kathmandu, Nepal.
- K.C., Anup (2072 BS). *Hydropower development, ecotourism and green economy in the context of Nepal*.
- Khennas, S. & Barnelt, A. (2000). *Best practices for sustainable development of micro hydropower in developing countries*. A final synthesis report, London.Online:www.microhydropower.net/download/bestpractcsynthe.pdf
- Korkeakoski, M. (2009). *Impact of micro hydropower based electrification of rural livelihoods*. Case study Nammong in LuangPrabang Province, Lao PDR.
- Koschel, H. (2013). *Energy and employment: A case study of hydropower in India*, KFW, Germany.

- Mathema, et.al. (2013). *Can hydro power drive green economy for Nepal*. Online:
<http://www.scirp.org/journal/jep>
- Meder, K. (2011). *Application of environment assessment related to GIZ ECO Micro hydropower plants*. Sidama Zone, Ethiopia.
- MOLRM (2016). *Ministry of land reform and management*. Survey Department, Nepal.
- Moser, M.C. (1989). *Another Development with Women', a view from Asia development Dialogue vol. v*, New Delhi, India.
- MoWR (2011). *Ministry of Water Resources*, Kathmandu, Nepal.
- NEA (2008/09). Nepal Electricity Authority, *Annual Report*, Kathmandu.
- Poudel, N. (1996). *Hydroelectricity development in Nepal*. M.A. thesis, Central Department of Geography, T.U.,Kirtipur, Kathmandu, Nepal.
- Rana Deuba, A. (2001). *Rural microhydro development program- Nepal*. Energia News, Vol. 4.
- Sarfoh, A. J. (1990). *Hydropower development in West Africa' : A study in resource development*, New York, America.
- Shrestha, B.K. (2008). *Role of hydroelectricity in economic development*. M.A. thesis, Department of Geography, T.U.,Kirtipur, Kathmandu, Nepal.
- Singh, et.al. (2011). *Power and people: the benefits of renewable energy in Nepal*. ESMAP, World Bank, Washington, D.C., America.
- Tshering, S. & Tamang, B. (2004). *Hydropower- key to sustainable, socio economic development of Bhutan*. Presented report to the United Nations symposium on hydro power and sustainable development, Beijing China.
- Ummar, F. & Khan, A.S. (2006). *Electrification benefits for woman in Chitral*. Pakistan.
 Online: http://www.energia.org/fileadmin/files/media/en_122006_ummar.pdf
- Upadhyaya, G.S. (1975). *Electric power and its role for economic development*. M.A. thesis, CEDECON, T.U.,Kirtipur, Kathmandu, Nepal.

- Upadhyaya, R.P. (2051BS). *Jalsrotko barema sunnu bujnu parne kura haru'*, *Yugsambad Saptahik*, Tuesday, Jestha 3, 2051.
- WECS (1995). *Socio economic issues in energy development*. Kathmandu, Nepal.
- Wilkins, G. (2002). *Technology transfer for renewable energy*. London: The royal institute of international affairs and Earthscan publication ltd. U.K.
- World Bank (2008). *The welfare impact of rural electrification: a reassessment of the cost and benefits*. The independent evaluation group, World Bank, Washington D.C.
- WSHDR (2013). *World small hydropower development report 2013*.