SOCIO-ECONOMIC IMPACT OF MICRO-HYDRO PROJECT

(A Case Study of Angsarang VDC, Panchthar District in Nepal)

A

Thesis

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Submitted By

Shanta Devi Adhikari

Roll No: 176/2066

TU Reg No.: 6-2-40-1761-2005

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CENTRAL DEPARTMENT OF ECONOMICS
Office of the Head of the Department

RECOMMENDATION LETTER

The thesis entitled 'Socio-Economic Impact of Micro-Hydro Project: A Case Study of the Angsarang VDC, Panchthar District in Nepal' has been prepared by Shanta Devi Adhikari under my supervision. I hereby recommend this thesis for the examination by thesis committee as a partial fulfillment of the requirements for the Degree of Master of Arts in Economics.

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Prof. Dr. Kamal Raj Dhungel
Thesis Supervisor
Central Department of Economics
T.U, Kirtipur, Kathmandu
Nepal

Date: 25/02/2014

TRIBHUVAN UNIVERSITY
CENTRAL DEPARTMENT OF ECONOMICS
Office of the Head of the Department

APPROVAL LETTER

The Thesis 'Socio-Economic Impact of Micro-Hydro Project: A Case Study of the Angsarang VDC, Panchthar District in Nepal' submitted by Shanta Devi Adhikari to the Central Department of Economics, Faculty of Humanities and Social Science, Tribhuvan University, in partial fulfillment of requirements for the Degree of Arts in Economics has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of said degree.

Thesis Committee

……..…….
Associate Prof. Dr. Ram Prasad Gyawaly
(Head of the Department)

……..……
Associate Prof. Dr. Neelam Kumar Sharma
(External Examiner)

…….
Prof. Dr. Kamal Raj Dhungel
(Thesis Supervisor)

Date: 04/03/2014

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Shanta Devi Adhikari

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ABBREVIATIONS

ADB	:	Agriculture Development Bank
AEPC	:	Alternate Energy Promotion Center
CBS	:	Central Bureau of Statistics
CEDA	:	Center for Economic Development of Administration
DoED	:	Department of Electricity Development
EI	:	Electronic Instruments
ESMAP	:	Energy Sector Management Assistance Program
FGD	:	Focused Group Discussion
GoN	:	Government of Nepal
GW	:	Giga Watt
HHs	:	Households
INGO	:	International Non-Government Organization
KW	:	Kilo Watt
LP	:	Liquid Petroleum
MGDs	:	Millennium Development Goals
MHP	:	Micro-Hydro Plant
MHS	:	Micro Hydro Scheme
MoEST	:	Ministry of Environment, Science and Technology
MoF	:	Ministry of Finance
MW	:	Mega Watt
NEA	:	Nepal Electricity Authority
NGO	:	Non Government Organization
NPC	:	National Planning Commission
NT	:	Nepal Telecom
PAFs	:	Project Affected Families
PRA	:	Participatory Rural Appraisal
PRS	:	Poverty Reduction Strategy
UN	:	United Nations
UNDP	:	United Nations Development Program
USAID	:	United State Agency for International Development
VDC	:	Village Development Committee
WB	:	World Bank
WID	:	Women in Development

CHAPTER – I

INTRODUCTION

1.1 Background of the Study

Nepal located at the top of Himalayas has about six thousands rivers and rivulets hurling towards India with huge potentiality of hydropower generation. Being a small country but rich in hydropower resource Nepal boasted its first hydropower plant in a way back in 1911 considering the geographical situation small and medium size hydropower project seems more suitable in Nepal. Nepal has great potentiality of 83000mw it is estimated that 42000mw of economically feasible hydropower potentiality less than2% of this potentiality has been explored. Nepal's electricity generation is dominated by hydropower through is the entire centurion of energy use of a country the electricity is a tiny fraction only few percentage of energy needs is fulfilled by electricity. So, far, hydropower plants having capacity between 100kw and 10mw are considered as small hydro's (NEA 2007). Government of Nepal is trying hard in fulfilling the ever increasing demand of electricity in the country particularly in rural area.

In Nepal pharping micro hydro of 500kw was the first hydro plant established way back in 1911. But after a long interval of 25 to 29 years two other hydro plants namely sundarijal 900kw (640kw after interchanging of frequently from 50 Hz to 60 Hz) and panauti 2400kw came in to operation the demand of electricity increased manly on wards from 60s bigger hydro-power increased almost 20 times (Ghemere 2007).

The electricity demand in Nepal is increasing by about 10-12% per year. About 44% of population in Nepal has access to electricity through grad and off grad system in Nepal's ten five year plan (2002 to 2007) aims to extend the certifications within country and export to India for mutual benefit. The hydropower policy 2001 seeks to promote private sector investment in the sector of hydropower development aims to expend the electrification with in the country and export (www.welcomenepal.com).

Micro- hydro technology is electrical energy generation system from water resources with installed capacity respectively up to 100kw to 3mw of electric power this technology has been successful to extend and explains rural electricity in rural areas. It has been found this in Srilanka for instance many micro-hydro plants have been initially installed primary to improve the quality of life by providing electric light. And in Peru the key question for many project developers was "how long wills the plan last crater or how quickly the capital will be back". Similarly in Nepal after passing the era testing and assessing the technical to increase access to rural energy seems for basic lighting facilities (parajuli 2011).

Micro- hydro is an indigenous and source of energy for which the potential exist in the almost the Hindu –Kush Himalayan Region which includes Afghanistan, Bhutan, China, Myanmar, Nepal and Pakistan. Micro- Hydro is generally is define as decentralized small scale water power plant less than 100kw for the power generation up to 100kw MHP (Micro Hydro Power) have gained enormous popularity in developing countries during the last for decades (koirala 2011) micro hydro can provided electricity services micro hydro generation is a cost effective and law impact technique for power generation that effects a potential solution for ruler electrification in Nepal (parish 2002) in the study seems that of 1300064kw micro hydro project electricity was generated during 1962 to 2005 (AEPC 2005) while the total of 11742kw electricity have generated during 2006 to 2011 (AEPC data book 2011).

Micro hydro is generally defined as decentralized small scale water power plant that generate electricity power up to 100kw and server nearby householders thoughts a local grid for power generation up to 100kw micro hydro project have gained enormous popularity in developing countries last of four decades this included Pico hydro schemes up to 5kw capacities. The government of Nepal (AEPC 2011) fixed cut of point of 5kw as the subsidy policy.

Low level of economic development is also reflected in the level of per capital energy consumption in Nepal. The per capital energy consumption in Nepal is 15GJ. There is great disparity in the energy consumption attitudes aspiration and life style when divided energy into three parts by three sources namely traditional, commercial and renewable, traditional energy occupied 87.8% commercial energy 11.5% and renewable energy 0.4% of the total energy consumption in MOELGON (2012). In the

present condition of Nepal energy plays vital role of fulfillment of resources. It is the primary need for all is not a sustainable used connect to diverse process such as lighting bulbs charging battery is burning fuel and propelling machines.

Studies on gender and micro hydro power have shown that men and women have different views on the benefits of the plants. For men the biggest advantage in reduced quality of life and a better education for the children where as the woman saw the advantage in reduced work load expenditures and an improved health care. 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 bad light, which are both tinning for their eyes time consuming and unhealthy due to all the smoke the more time

1.2 Statement of the Problem

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

In ruler area people are responsible for 3cs cooking, caring, cleaning. Cooking itself is being cooking by fuel wood mostly in ruler area it creating indoor pollution intern women and children can becoming victims. In addition lighting objective is being fulfilled by kerosene. Kerosene lamp can create pollution.

Rular people especially women have to spend much of their working hours in collecting fuel woods. Students study hours in affected due to the lack of lighting facilities houses. They may suffer from the eye inflection ENT inflection etc. Due to

the smoke of fuel wood all those problems arise due to the lack of commercial sources of energy which wood negative impact of the human capital formation in the area.

Lack of energy supplied in rular areas as a chronic problem. In many developing countries less than 10% of the ruler population has access to electricity. Rular electrification through conventional means such as grid connection or diesel generators is very costly production is available in some countries.

Some research questions right be relevant as follows:

- What are the impacts of Nibukhola IV Micro-hydro poroject in income, information and education in the study area?
- What are the sustainable measure implemented in Nibukhola IV Micro-hydro project?

1.3 Objectives of the Study

General objective of the study is to evaluate the socio-economic impact of Micro-Hydro Power on women users in Angsarang VDC (Village Development Committee) of Panchthar district. Besides this, the study has following major objectives.

- To study the impact of Nibukhola IV Micro-hydro project in income, information, and education of the people.
- To study the people participation about sustainability of Micro-Hydro Project.

1.4 Significance of the Study

Electricity is basic pillar of economy which helps to enhance stander of living of people by different angle among which make life style of people easier. There is establishment of large industries to small industries which as used ruler materials. This study has been round on the pivot of impact MHP on the socio economic aspect of the ruler women. Outcomes of this study will help to access the impact of the MHP on income of the women of the Angsarang VDC of Panchther eastern Nepal.

1.5 Limitation of the Study

This research will be conducted to analyze the impact of micro hydro power project on socio-economic condition of the women who live in the Angsarang VDC. This study will be confine in the limitations.

- It is the case study of Angsarang VDC which may not be applicable on the other VDC of the country.
- For counting data I have must the VDC which are far way from Kathmandu may present they my guide lives.
- Present study may require the frequent visit which cannot be affordable due to the lack of budget.
- The present study will generate the primary data which will be original but sample size is limited which outcome may not be as similar as national level.
- The study narrowed only some limited variables and ignores many variables which may affect on study area.

CHAPTER – II

REVIEW OF LITERATURE

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

Micro-hydro schemes have significantly less negative environmental impacts than larger schemes (Clancy and Redeby, 2000). MHP is also taken as a technology demonstration and its investment is considered as an important social infrastructure and also has positive impact on schools, hospitals business and agriculture/industry.

It can be calculate that after 2003 the total growth of Micro-hydro power during 2006 to first half of 2011 in 11,742 kw specially the first half of 2011 shows twice the growth rate in kw that the last two years (2009-2010). According to AEPC Report (2011) total 68 micro-hydro schemes had been established during 1962 to 1985. After this 805 number micro-hydro scheme have been established during 1986 to half of the 2011. The number of schemes seems to be more than twice just in the first half of 2009 to 2010 from this study.

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

Moser N.C. (1989) "Gender planning in the third world." The United Nations Decade for women (1976-85) has played a crucial part in highlighting and publicizing the

important, but often previously invisible role of women in the economic and social development of their countries and communities and the 'plight' of low income women in third world economics. Researchers have moved away from a preoccupation with the role of women within the family, toward an understanding of the complexities of women's employment. Research on both waged workers and those in the informal sector, in urban and rural areas, have assisted in identifying both the importance and the diversities to world economies. Policy makers have begun to shift their focus from a universal concern with welfare oriented, family concerned programs, which assumed mother hood as the important role of women in the development process of diversity of approached emphasizing the productive role of women. The so called women in development (WID) approach adopted by the United States Agency for International Development (USAID) with its underlying rationale that women are an untapped resource that can provide an economic contribution to development and had an important influence in popularizing income generation.

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

The authors propose remedies a full assessment of present and future energy needs change in fundamental features of the politics and economics of various countries expansions of electricity to rural populations and regional cooperation in hydropower development.

The author’s observation that "more availability of resources and the advantages which hydroelectric power offers have not as yet induced any appreciable level of hydro-electricity generation" Concisely illustrates the essence of professor Sarfoh’s discussion in this book.

The author examines the energy consumption practice of West Africans and the potential of several energy resource endowments of the sub region The further states that only the development of hydropower from West Africa’s. river systems can satisfy those needs. As domestic sources of energy, hydroelectricity will be cheaper

and more accessible than foreign oil and less damaging to the environment than the depletion of forests for firewood. The author implies a relationship between the obstacles to hydropower development and domestic politics and economics while such a relationship might very well exist, the author does not demonstrate it.

Sarfoh is less than convincing in his conclusion that hydropower represents the best alternative sources of energy for west African, especially when one conditions the formidable obstacles that outlines. The net result of the obstacles is a significant reduction in hydropower generated,. necessitating the closing of some hydropower plants and the purchase of private generators by industries and individuals West Africa's hydropower projects thus become unreliable, inefficient and very costly sources of energy.

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

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

WECS (1995) examined the needs of energy in our lives cannot think of survive without energy. Energy is compulsion for the development purposes after the utilization of the energy properly and aptly then the status of education, condition of health, development of infrastructure, transportation facilities are gear up which leads

a country on the prosperous way of development due to which living standard of people automatically sky up and it is vital for economic development and employment, it is also a critical factor for Shortage of biomass fuels has forced urban households and industries to switch from biomass fuel to imported fossils fuels and other commercial form of energy. Deforestation and desertification are threatening 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 example farmland technology and capital for investment.

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

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

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

Bose (1997) has mentioned that the construction of such a big dam in mountain leads to great controversial issue. The constructions of such large dam in the mountain environment in seismic zones create a great sensitive issue for further disaster and hazards. For example Tehri Dam project in Uttarpardesh. He further stressed that development must be cantered on the people with most conserving to environment. In a democracy, the development process must be participatory in nature. He suggested that in the name of science and technology, development should not become culturally incentive and there should be detailed planning for disaster management, natural disasters as well as man made is necessary.

HMG/N (2000) this is fairly informative prepared by REDP, which has include the information of rural energy sectors. The principle aims of this report are to give the message to the people about rural energy related areas; to appraise the impacts of energy and its related components. It tries to demonstrate the development path of rural energy sector, to review on rural energy sector policy and to raise the issues and give the solution of the rural energy sector problems for the sustainable development.

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

This study glimps, the present trend of micro-hydropower, illustrating that most of the MHP schemes have been installed for mechanically driving agro processing unity like grinder huller and oil expeller, whereas other and uses are few and far from the low cost application and the local resources utilization through micro-hydro plants. The report concludes that there are inconsistencies in policies support and implementation of micro-hydro and other rural energy technology. These inconsistencies are lack of technical and managerial skills of operation and main finance among the rural

population; weak, cooperation among the delivery agencies and inadequate information about the technology in rural sector.

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

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

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

Win Rock International Nepal (2006) give the argument on the role of energy for poverty alleviation and uplift the living standard of the in terms of education, health, sustainable, environment and women's empowerment. Similarly it measured quantities efforts of different power agencies and the decades towards the national poverty reduction strategy (PRS) reviewed in detail. This study is designed to analysis PRS as well as MDH targets. The two primary objectives of this study were to undertake comparative analysis of changes before and after REDP intervention. The program REDP achieved the improvement on several targets on the target launched

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

Gonzalez et. al. (2007) studied the impact on development and environment due to MHP in Bolivian communities. The study examined nine hydropower projects in Bolivia. The gists of the study are there was significant change on the education, health status, comfort level, self confidence and feeling of own-ness due to the micro-hydro project. Hydropower able to reduce 54 percent of the household expenditure for energy related expenditure such as candles Kerosene, LPG and batteries. There were creation of part time job as well as there is establish and enhance the quality of small business and save the time for travel to buy lighting fuels. Due to the electrification education status of student uplifted and study hours increased. There was continuing of basic literacy for adults in 5 communities additionally. New educational tool have been purchased such as computer rooms, TVs, DVDs, projector etc. The health status of local people improved due to the reduction of smoke generated by firewood at home and there is reduction of risk of fire.

There has been rapid change on communication and social life, so household have TB and 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. Hydro-power has contributed to equality between indigenous and non indigenous people in Bolivia. The hydropower has positive

effects on local and global environment. The most remarkable aspects are the reduction of the emissions 16.6 tons of CO_2 equivalent every month. The sustainability of project guaranteed in all its dimensions economically, institutionally, technically and environmentally.

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

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

The number of she passed student are more in users group than non-users group whereas school dropout students are less in users group. The no. of ill household members from respiratory and eye related problem are less in users group. The households of users group have ownership of electronic devices and information technology.

Joshi (2011) has mentioned that energy is important for economic development. The pace of economic development. The pace of economic development can not be accelerate with out 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 can not be sustainable to fulfil energy requirement. From the present analysis it has been observed that most of the people depend on forest for energy sources and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortage of fuel wood, soil erosion, deterioration of the fertility of soil etc. Deforestation leads to deterioration of water resources and hampers both electricity generation and drinking water. The utilization of energy is concerted on urban areas and most of the rural areas have been by passed by this power development. The hydropower project has brought about change in socio-economic, cultural and other aspects of people living in the project located area.

Singh (2011) analyzed the income and employment generation by the project in project area of mini- hydro power project. The study has analyzed problem associated with the project. The study has concluded the project helps to raise income level of local people by establishment of new business and it drastically grounded the expenditure of people on the traditional energy. The health condition of people sufficiently increased and people has access to the modem medical equipment due to electricity preservation of the forest increases sufficiently due to the reduction of dependency of people on the firewood. The educational status of the student uplifted by using evening time for study due to electricity.

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

sufficient hydropower projects to satisfy the demand, so, public sector must play a sustainable role for important of hydropower project.

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

CHAPTER – III

RESEARCH METHODOLOGY

3.1 Study Area

The government of Nepal has divided nation into 5 development regions, 14 zones, 75 districts, 58 municipalities, 3915 V.D.C for the adequate development of the country. Angsarang VDC is located in the far-east of panchthar district. The total area of Angsarang VDC is 24.038 sq km which constitute of total population around 3500. The site of study in the Angsarang VDC, ward no 5 use Nibukhola 4 MHP.

Nibukhola IV MHP is located on barbate village of Angsarang V.D.C. The total capacity of the Nibukhola IV MHP is 16 kW which has been distribute to ward no 5 to the total of 165 HHs. Because of small scale of plant, the electricity generation is very low; most of the households use electricity for lighting and watching TV. Some households have used for cooking purpose and some others installed small scale firm/industries. The plant is operating about 19 hours expect 11pm to 4 am in a day. The project is run by village; the minimum cost of electricity was Rs 100 in beginning but now it is only 70 per household up to 15 units.

3.2 Research Design

This study is based on explanatory research design. This study was investigating the socio-economic impact of micro hydro electricity in rural sector. This study finds out how people are benefitted by project and its impact on people. Beside, the study an attempt to describe the benefits experienced by households of the project affected areas after the installation of micro hydro electricity such as economic activities, income, information, education etc. Thus this study is done descriptive, analytical and explanatory.

3.3 Source of Data Collection

This study aims to study explicate the utilization of micro hydro electricity and socio economic impact of Nibukhola IV MHP on the people of that V.D.C. So, this study is based on qualitative and quantitative from questionnaire though household interview survey. Some key informant interview took from project introduced people. Thus, the primary data was collect from user and non user households of the study area. Similarly the secondary data was collected from different sources such as economic survey, CBS report and publication of Nepal Electricity Authority (NEA), publication of AEPC, feasibility report, journals, internet and document from individuals, experts and organization related to micro hydro electrify.

3.4 Sample Size and Sampling Procedure

There are 215 households of Angsarang V.D.C ward no 5. The total 165 households are affected by the project and other 50 households have not affected by the project. The sample size is taken equally in the micro-hydro user and non-user group. Mainly 42 households are sample. According to the ward wise user and non user household's ratio by using simple random sampling to fulfill the purpose of the study. This research is based on the information collected from the sample households, selected simple random sampling method.

3.5 Data Processing

A work sheet was prepared through the complete questionnaire incorporating the use of electricity for the purpose. 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.

3.6 Data Collection Tools and Technique

For this study, data about the effectiveness of the electrification has been collected through direct personal interview with the help of structured questionnaire among directly Project Affected Families (PAFs) in the society since the installation of

Nibukhola IV MHP. The structure questionnaire or unstructured interviews and observation methods was applied to collect the both qualitative and quantities data in the survey.

3.6.1 Questionnaire Survey

TO generate the accurate data from households survey of micro hydro users, structured questionnaire was prepared. The respondents were required to fill up questionnaire. To find out the respondent's attitude the impact of MHP in different sector in the village the questions were provided them to fulfill in their own views.

3.6.2 Field visit and Observation

Field visit was conducted by collecting the name lists of each household during October to November 2013 who was benefited by this micro hydro electricity and selection was done by simple random sampling method. To hear the people perception and get the real situation of MHP in village field visit is essential.

3.6.3 Key Information Interview

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

3.7 Data Analysis

The data has been tabulated and analyzed according to the objective to study. The data analysis is descriptive as well as analytical. Data was analyzed with the help of computer programmer's strata and excel. Simple statistical tools like Tables; Pie chart was used for data analysis. Descriptive methods have been used for qualitative data.

CHAPTER – IV

DATA PRESENTATION AND ANALYSIS

This chapter presents the analysis of data and presents their interpretation with the help of table, bar-diagrams and pie charts. Section 4 presents profile of the project and the household information of the users. Section 4.1 presents the Nibukhola IV MHP project details and 4.2 presents the household information separately.

4.1 Nibukhola IV MHP Project Information

The study site, Angsarang V.D.C is located in the far-east of Panchthar District. The total area of Angsarang V.D.C is 24.038 sq km that constitute of total population around 3500. Angsarang V.D.C, ward no 5 utilize Nibukhola IV MHP. The wards 1, 4, 6are located from this project because of geographical structure and these wards use another MHP named Nibukhola III. Nibukhola IV MHP is located in Barbote village of Angsarang V.D.C. The total capacity of the Nibukhola IV MHP is 16 kW, which has distributed to ward no 5 of 165 HHs. Because of small scale of plant, the electricity generation is very low; Most of the households use electricity for lighting and watching TV. Some households have used for coking purpose and some other installed small-scale industries/firm. The plant is operating about 19 hours expect 11pm to 4am in a day. The project is running by villagers, the minimum cost of electricity was Rs 100 in beginning but now, it is only Rs 70 per households up to 15 units.

4.1.1 Installation Cost of the Project

The production capacity of this MHP is 16 KW; the total installation cost of this project is about Rs 23, 11,111.Ruler Electrification Development project (REDP) provided around 13, 60,000. The initial face only 165 households are participated and they collected total cash 9,36,000 (Rs 6000 per house) they also contribute labor force for 65 days which valuation was Rs 230 per day which is in total Rs 950,950. The consumer of this project now become 165 households and each new consumer of the village have to pay Rs 15,000 to the management committee of the project.

4.1.2 Maintenance Cost of the Project

To run the any type of constriction for long run, repairing and maintenance is necessary's. There is not worth of construction in the absence of sustainability. There is a need to repair non-living things regularly for run it in well condition. For this project, the maintenance cost has been beard by public themselves. In this initial phase of the project, the cost was maintain from households' per week deposit fund but now it is maintains from monthly charge which is pained by household for using electricity.

4.1.3 People Perception about Improvement of the Village Using MHP

The modern facilities mostly affected all human being using such facilities it is expected that there most change in living stander of human. Actually living stander refers to the higher living. Of the total 42 samples, each respondent said MHP played vital role to improve the living stander of the villagers. Because of light in night, night life become easy and children reading habits improved significantly. The installation of rice mill, dairy and NTC tower help to make the life style easier and most of the people participate in economic activities. By using the electrical instruments (TV/computer/radio) people learn many thinks and they changed their taking style, dress up behave to others and care about the sanitation of the village etc.

4.2 Household Information of the Project Affected Area

4.2.1 The Households Participation of Ward No. 5

Micro hydro has played the vital role for electrification in the ruler area of Nepal. This Nibukhola IV MHP project-electrify areas are ward no 5 of the Angsarang V.D.C. In these study areas, Barbote has scatter settlement in comparison to the other wards. To make the study more effective/reliable, questionnaires were asked equally according to the population tile of ward no 5 with the help of sample ransom sampling. The ward wise distribution of respondents of this research each shown the table no 4.1 below

Table 4.1

Tole Wise Participation of Ward No. 5

Tole of Ward No. 5	Total Households	Sample Households of Ward No. 5
Barbote	130	30
Nasuwa	20	7
Sisne	15	5
Total	165	42

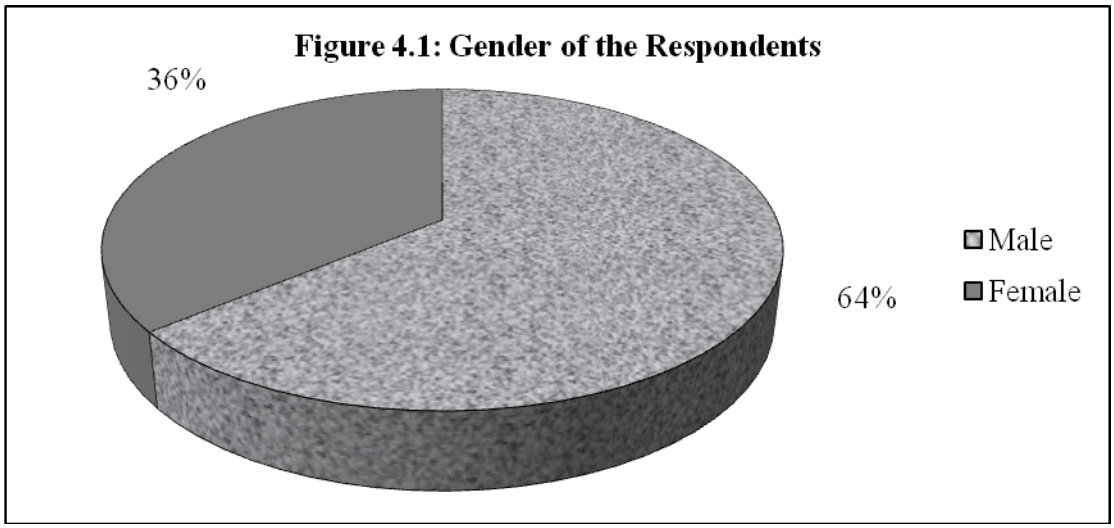
Source: Field Survey, 2013

The above table 4.1 depicts that out of total 42 respondents, higher numbers of respondents 30 were from Barbote because large number 130 households are live there whereas least number of respondents was for Sisne .Due to the thick settlement of people in Barbote respondents were more than from other

4.2.2 Gender of the Respondents

There was a significant imbalance in the participant respondents regarding gender. The population ratio of male and female are nearly 50-50 but female respondents were fewer in number than male this research because in many households male were head of the family and the society is patriarchal so male participation was larger number compares to female in this sampling process. Of the total sample, 64 %(27) were male respondents where only 36 % (15) were female. The gender wise participation percentage of respondents of study area has presented in pie chart 4.1

below.



From this pie chart, we can say that the study area was still male oriented. In the social work, male had played the leading role whereas female are follower of them. Due to the less activeness of female and shaming to speak, female respondents were less in number than the male respondents.

4.2.3 Age Group of Respondents

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

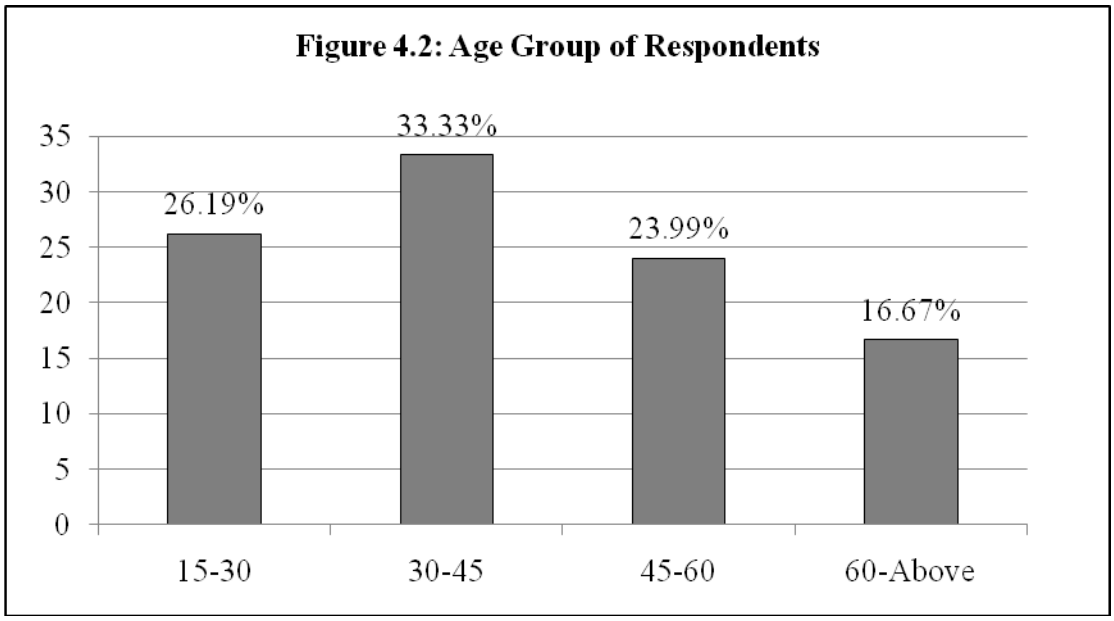
Table 4.2

Age Group of Respondents

Age	Frequency	Percent
15-30	11	26.19
30-45	14	33.33
45-60	40	23.99
60-Above	7	16.67

Total	42	100

Sources: Field Survey, 2013



Source: Field Survey, 2013

This figure 4.2 depicts that, the higher portion 33.33%respondents are from age group 30-45 and 23.99%are from45-60.Similarly, from age groups 15-30 and above 60 are 26.19% and 16.67% respectively.

4.2.4 Household Members by Sex

Of the total 42 households, every households found having son whereas two houses had found daughter less houses. It shows that the villagers have desire of son instead of daughter. First priorities give to birth son than daughter. The household members by sex of study area has presented in table 4.3 below.

Table 4.3

Household Members by Sex

Number of Male and Female	Household (male)	Household (female)
1	-	1
2	6	10
3	15	12
4	10	9
5	3	5
6	4	5
7	-	1
8	2	-
9	-	-
10	2	1

Source: Field Survey, 2013

From the Table 4.2 highest number of households male-female ratio is 3.3 then 4:4 and 2:2 male-female ratio households. The households have 10 male members and 1 house has 10 female members. Thus, we can conclude that most of the family is joint family in study area as well as dominant.

4.2.5 Caste of Survey Household

Heterogeneity and multiplicity is the figure of the study area, various castes like Brahmin, Chhetri, Magar, Gurung, Limbo and Dalit are in existence in the villagers. Among the total population of the study area Brahmin and Chhetri are dominant cast group compares to Janajati and Dalits. Nepali languages is common communicative language of all cast. The table 4.4 shows the distribution of respondents by caste/ ethnicity.

Table 4.4

Caste of Survey Households

Cast	Frequency	Percent	Cumulative Percent
Janajati	18	42.86	42.86
Chhetri	15	35.72	78.58
Brahmin	5	11.9	90.48
Dalit	4	9.52	100

Sources: Field survey 2013

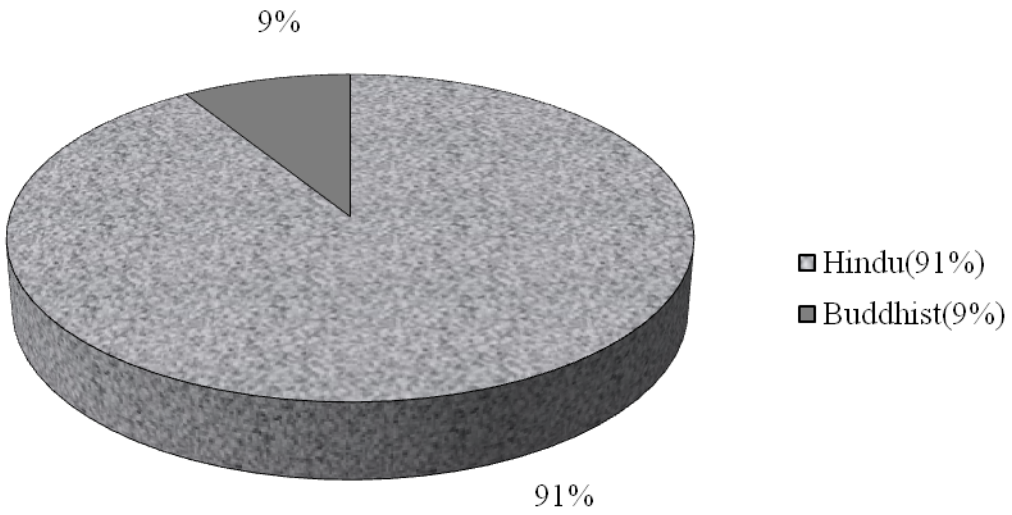
Of the total households, the highest portion 18 (42.86 %) respondents are Janajati 15(35.72%) is chhetri. Brahmin and d Dalit respondent are only 5 (11.9%) and 4(9.52%) respectively.

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

4.2.6 Religion Practice in Survey Area

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

Figure 4.3: Religion Practice in Survey Area



Source: Field Survey, 2013

The pie chart 4.3 depicts that, the majority (91%) of the people religion practiced is Hinduism were as 9% households were Buddhist following the sample selection procedure. The people believed on Hinduism religion in study arrears is dominant portion as national figure.

4.2.7 Main Income Sources of Households

Agriculture, service, self oriented business, Foreign Employment are the main occupation/income sources of the survey households. Other occupation includes daily wage, fishing etc. The frequency and the percentage of survey households has

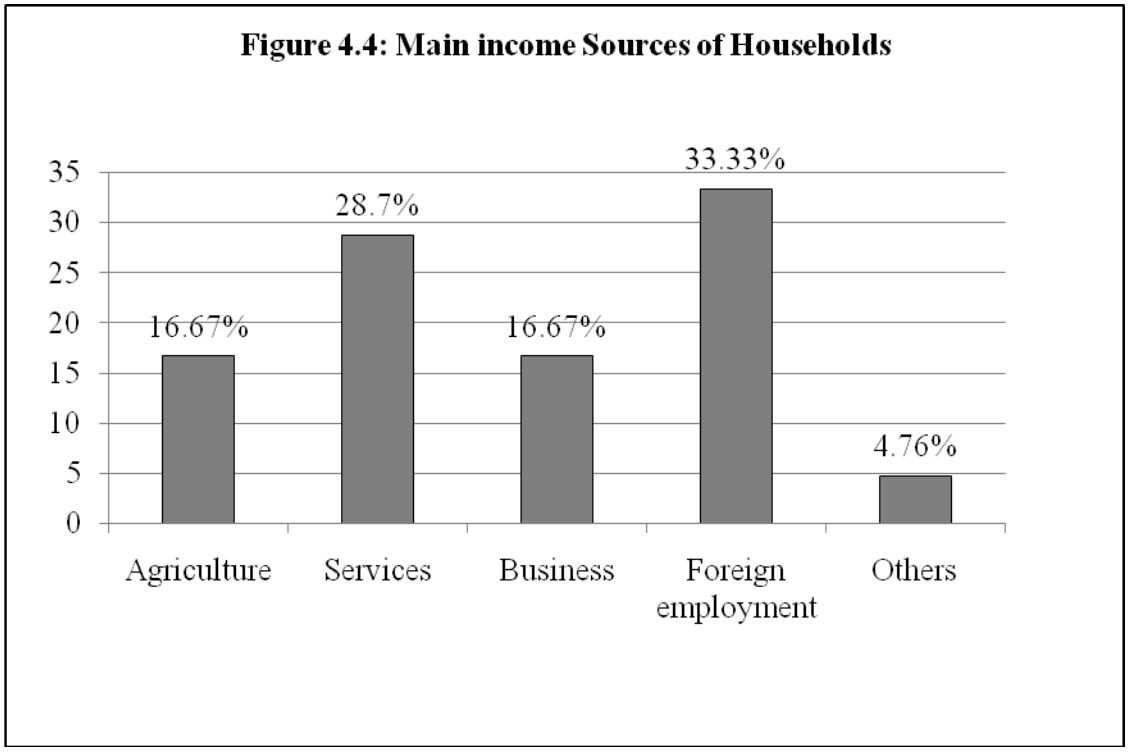
presented in the table below Most of the households are depend on foreign employment .Although, out of 45 households are involved in agriculture but some households are totally depends on agriculture were agriculture is there main income sources.

Table 4.5

Main Income Sources of Households

Income Sources	Frequency	Percent
Agriculture	7	16.67
Services	12	28.7
Business	7	16.67
Foreign employment	14	33.33
Others	2	4.76
Total	42	100

Source: Field Survey, 2013



Source: Field Survey, 2013

The figure 4.4 shows that, the people14 (33.33) are dependent on foreign employment. The households 7(16.67) are totally depend on agriculture. 12(28.57) are involved in services sector. 7(16.67) people are engaged on their own business and 2(4.67) are in others such as daily wages.

4.3 Socio-Economic Impact of Nibukhola-IV MHP in the Study Area

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

Socio-economic feature of study areas depicts the development status of that village. The sociological and economic characteristics such as religion, education, employment, health and environmental situation have a significant influence in the economics of the village and living stander of the people. In the survey area, project affected householdsare165 were only 42 sample household((along one school) were taken to find out the socio-economic impact of MHP on household, role of MHP for sustainable change in project affected areas and people attitude and contribution/willingness to pay for sustainability of MHP.

4.3.1 Socio-Economic Impact of the MHP in Project Affect Area

4.3.1.1 MHP Role in Rural Electrification

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

reasonable cost in needed area. Hence, it is the easy and chief way to provide electricity in remote areas of Nepal.

4.3.1.2 How MHP Help to Rural People?

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

4.3.1.3 Electricity Consumption Units by Households

The electricity consumption units are seems different according to the purpose. The households used electricity only for lighting/radio purpose consumed very low units then TV/computer/cooking purpose. The minimum and maximum consumed units of electricity by households are presented in table 4.4 below.

Table 4.6

Electricity Consumption by Households

Unit Consumption	Observation	Mean Units	Minimum Units	Maximum Units
Maximum Units	42	25.5	15	40
Minimum Units	42	16.5	10	25
Total	42	42	12.5	32.5

Sources: Field Survey, 2013

The table 4.5 depicts that, the electricity consumption by household is min 15 to max 40 were average consumption is 25.5 units in the peak section. However, in off-section household/business firm consumed min 10 to max 25 units were average 16.5

units. In general, total average consumption of electricity is mean average 12.5 units to max average 32.5 units where as total average 42 units have been consumed by households/business firm. The households who are only used electricity for lighting purpose consumed monthly average 12.5 units only.

4.3.1.4 Monthly Payment For Electricity Used

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

Table 4.7

Monthly Payments for Electricity Uses

Monthly Payments (per months)	Observation	Mean(Rs)	Minimum payment(Rs)	Maximum Payment(Rs)
Max. payments	42	280.11	60	2000
Min. payments	42	172.89	60	1800
Average Payments	4	226.50	60	1900

Sources: Field Survey, 2013

The table 4.7 shows that, the households paid max Rs 60 to Rs 200 and min Rs 60 to Rs 1800 where the average payment is Rs 226.50. The data shows that the households who manly used MH for lighting purpose pay Rs 60 per month but who run the firm/business used to pay min Rs 1800 to Rs 2000 where the average payment is Rs 1900. In additional, MH is the cheapest energy sources in comparison to the national grid.

4.3.1.5 Establishment of Industries Using MHP

Electricity is the basic perquisite of development. It is the foundation to generate any socio economic activities. The life is very difficult as well as being back ward due to

able to use modern technology in the absence of power. After MHP, people lunched various industries in this 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 using MH in village is presented in the table 4.8 below.

Table 4.8

Establishment of Industries using MHP

Firms	**No. of Industries/Firms**
Poultry firm	1
Furniture	2
Sawmill	1
Agro mill	3
Dairy	1
Computer institute	1

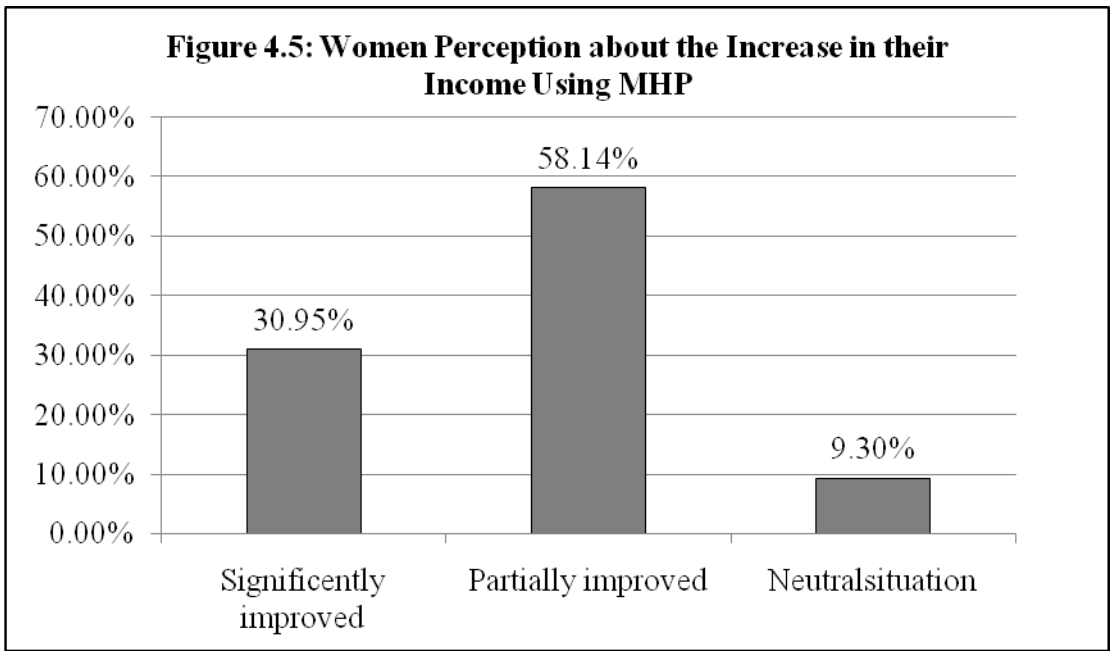
Source: Field Survey, 2013

The table 4.8 depicts that, villagers installed 13 small-industries/firms where around 15 villagers have partially/fully job. The villager's life becomes easier after install rice mill and able to generate income from these firms. Farmer generates income regularly after installed dairy by selling milk to dairy holder. The others business such as stationary medical and food shop has been run which generate the income as well as make the social life easy too.

4.3.1.6 Women's Perception about the Increase in their Income Using MHP

Those respondents who have able to use the electricity properly, who have sufficient knowledge and ways about electricity facilities, they have been able to increase family income. Those women who have credit of loan when interested in MHP, they reported that their family income has increased. Some of the respondents reported that their income neither increased nor decreased. Out of 42 users respondents i.e. 25 (58.14%) households woman has partially increased by woman education, farming

vegetable, Ginger, mushroom etc, similarly users 42 respondents, only 4(9.3%) households woman has in neutral situation. The percentage and the frequency of women income generation using MHP is presented the figure 4.5 below.



Source: Field Survey, 2013

However, among them 13(30.95%) households woman have got significantly increased their income level. Most of the users women get raised their income level partially/fully by getting chance to involve on different economic activities then MHP nonusers women.

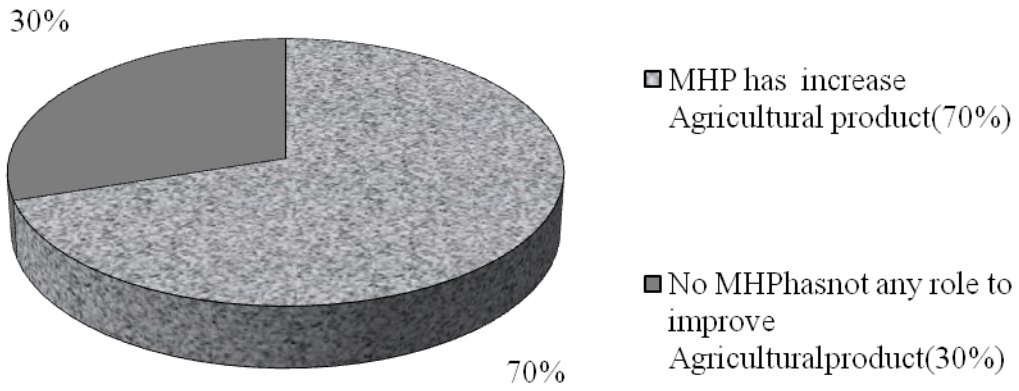
4.3.1.7 Condition of Employment Using MHP

Using the installation of the project, the employment opportunities in the village have raised directly and indirectly. One operator and one electricity consumption charge collector are employed in this project. By installing the industries, around 15 people are directly involved in those firms. Others businesses run in the village were the people are able to create fulltime or partial job.

4.3.1.8 Agriculture Product Promotion due to MHP

In our country more than 80 percent, people are involved in agriculture. This study area being the village, 100 percent people here adopt the agriculture but not fully dependent on that. Around 70 percent people have been grabbing the facilities to raise their product directly or in directly using MHP. The people perception about agriculture product is presented in figure 4.6.

Figure 4.6: Agriculture Product Promotion Due to MHP



Source: Field Survey, 2013

Nevertheless, 30 % cannot take any facility to raise agriculture product. Among 70 percent, 40% household respondents fully used the facilities such as regular irrigation and others facilities whereas 30 % used in partially. Thus, MHP help to raise the agriculture products of many households.

4.3.1.9 Possession of Various Electric Instruments by User and Non-user Group

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

Table 4.9

Possession of Various Electrical Instruments by User and Non-user Group

S.N.	Electrical Instruments	Possession%, MHP Non-user Group	Possession% MHP User Group
1	Radio/tape recorder	90%	100%
2	TV/Computer	13.18%	95.09%
3	Mobile phone	44%	99%
4	Chargeable battery	8.89%	60%
5	Other instruments	-	58.75%

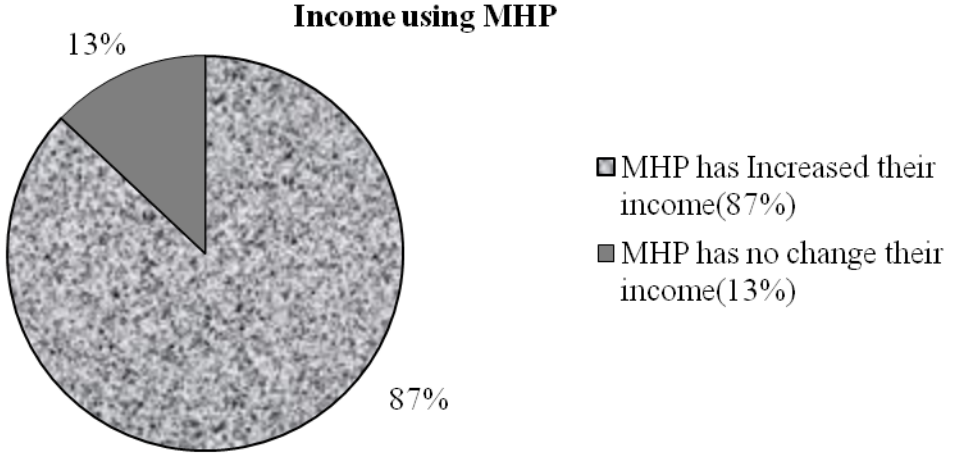
Sources: Field Survey, 2013

MHP non-users, 90% households possess radio/tape recorder. MHP user 100% households possess radio/tape recorder. Here is no significant different in radio use because radio can be run by using battery without electricity. Only 13.1 percent households have TV who has solar light, but don't use MHP. 95.09 percent households have TV and computer use by MHP. Only 44 percent households have mobile phone that has solar but not use MHP. But 95 percent use mobile phone by use of MHP. MHP non-users 8.89use chargeable battery for lighting purpose and MHP users 60% use chargeable battery for multi-purpose. Similarly 58.75 MHP users use rice cooker, Iron, electric judge, heater etc but non-user nonuse.

4.3.1.10 Household Opinion about the Change in their Income Using MHP

By the use of MHP, the firms/industries/shops etc. are installed in the village where the many people are directly or indirectly involved in various working activities. It certainly helps to raise their income level of the households. Of the total sample 87% household have increased their income level by using MHP which is shown in the figure 4.7

Figure 4.7: Households Opinion about the Change in their Income using MHP



Source: Field Survey, 2013

However, 13% people cannot fill significant rise in the income level by using MHP. They are unable to participate any productive work using MHP.

4.3.1.11 The Change in the Total Income of the Households

The income level of the villagers has increased by using MHP. People say that, the general income of the households has risen. By using the MHP people installed the small cottage industries, getting irrigation facilities, time saving to involvement in agriculture help to raise their income. Without MHP minimum income of household was 1 lakhs and the average income was 2.91 lakhs

Table 4.10

The Change in the Total Income of the Household

Households Annual Income	Obs.	Mean (Rs ,00)	Min (Rs ,000)	Max (Rs ,00)
User of MHP	42	327.05	1.20	910
Non-user of MHP	42	291.59	100	900

Source: Field Survey, 2013

Using MHP, The min income become 1.20 lakhs to max 9.10 where the average 3.27 lakhs. The people who involved in business have got significant raise the income level but who are only engaged in agriculture has little change in income.

4.3.1.12 Households' Main Sources of Energy Without MHP

Without MHP, kerosene lamps were widely used for lighting purpose during night, which is known as ''Tuki'', and firewood was used in every household to cook the food. Bio-gas and solar were in very limited houses. Batteries were used for torchlight and to run radio/tape recorders. The energy sources of households without MHP presented in table 4.11.

Table 4.11

Households' Main Sources of Energy Without MHP

S N	Name of Energy sources	Frequency or Households No.	User Percentage
1	Firewood	42	100.00
2	Bio-gas	7	16.67
3	Solar	9	21.43
4	Kerosene	42	100.00
5	Others	14	33.33

Source: Field Survey, 2013

Here, 100% households used firewood and kerosene for coking and lighting purpose respectively. Similarly, 100% respondents used battery for torchlight and radio purpose. Only 7(16.67%) households had bio-gas and 9(21.43%) had solar plant where 14(33.33%) households use others like candle tuki etc.

4.3.1.13 Average Monthly Expenses of Household on these Sources of Energy

By using MHP, the expenditure on traditional energy sources had decreased significantly. Most of the time in village, MH is available, there is no load shading problem as in center grid so people had used electricity most of the time for their tasks. Others sources of energy has been used only in the absence of MH, so that expenditure on energy had reduced, which helps to make the economic condition of household's better, health improvement, reduces deforestation and environmental pollution. The survey household's average per month expenditure on traditional energy sources of MHP users and non-users is presented in table 4.12 below.

Table 4.12

Average Monthly Expenses of Household on these Sources of Energy

S.N.	Name of Energy Sources	Mean expenditure without MHP		Mean expenditure with MHP	
		Frequency	Mean expense per months (Rs)	Frequency	Mean Expenses Per Month (Rs)
1	Firewood	42	1645.46	42	1034.41
2	Bio-gas	7	464.00	7	335.14
3	Solar	9	204.54	9	160.13
4	Batteries	42	158.14	42	31.72
5	Kerosene	42	147.11	13	25.24
6	Candle or other	14	36.23	21	20.18
	Total expenditure		2497.34		1369.55

Source: Field Survey, 2013

The table 4.12 depicts that, 42 had used firewood for cooking and heating purpose where average monthly expenditure before MHP was Rs 1645.46 but now it reduced where monthly expenditure average monthly expenditure without MHP was Rs1645.46 but now introduced to Rs 1034.41. Similarly, in bio-gas, householders expenses was Rs 464.00 without MHP but now it decrease to Rs 235.14 and solar

expenses is reduced from Rs204.34 to Rs 160.13. The batteries users are still 42 households but per month expenditure is reduced as well as most of the users used chargeable batteries using electricity.

The kerosene user households are reduced from 42 to13 and average expenditure reduces from Rs 147.11 to Rs 25.24. The reduction in kerosene use helps to make the better economic status and health condition of households. However, the candle or other energy sources users are raised from 14 to 21 households using MHP but the average per months expenses on candle or others sources is reduced from Rs36.23 to Rs 20.18ti is because these sources are only used in the absent of electricity. The total average expenditure on these energy sources has reduced from Rs 2497.34 to Rs 1369.55 using NHP. Reduction of traditional energy sources help to make the health condition of households members better and save the money too.

4.3.1.14 Effect of Children Study Hours Using MHP

By the use of MHP, the study hours of children have raised. 97percent households are agreed that the performance of the children has improved in the school then without MHP. In the ruler sector, in the absence of electricity, the students (children) are obliged to use kerosene lamp while studying in evening and nighttime. By this situation schooling, aged generation is mostly affected. They cannot study for long time due to the deficiency of enough kerosene and deem light.

Table 4.13

Effects on Children Study Hours Using MHP

Increased Hours	Frequency	Percentage
Up to 1 Hour Per Day	14	33.33
1 to 2 Hour per Day	10	23.81
2 to 3 Hour Per Day	18	42.86
Total	42	100.00

Source: Field Survey, 2013

Of the total 42 sample, 18 (42.86%) households children raised their study time 2 to 3 hours, 10 (23.81%) households children raised 1 to 2 hours and 14 (33.33%) household children raised up to 1 hour only. Hence most of the guardian of schooling children found that their children have been studying at the night time using electricity it can be said most of the student's educational status is improved by using MHP.

4.3.1.15 Change in Children's Daily Activities Using Electronic Instruments

The uses of electrical instruments have caused multiple changes on children's behaviors. Among all the children of the project affected areas got positive changes and learn many things by watching TV or using computer expect some negative outcomes such as watching TV for long time, play game in computer mobile etc. The table 4.14 shows the important percentage on children activities on various aspects.

Table 4.14

Change on Children's Daily Activities Using Electronic Instruments

S.N.	Child's Daily Activities	Improved (percentage)	Not Improved (percentage)
1.	Taking style	95.45	4.55
2.	Dress up	86.67	13.33
3.	Sport	84.44	15.56
4.	Reading Habits	88.89	11.11
5.	Dance	86.67	13.33

Sources: Field Survey 2013

Of the total samples, 95.45% household's children talking style have improved using electrical instruments. Similarly, in dress up, in reading habits and dance has improved 86.67, 84.44, 88.89 and 86.67 percent respectively.

4.3.1.16 Improvement in following Diseases Use of MHP

To find out the impact of Nibukhola IV MHP on health outcomes, each respondents of a household were asked, where they had felt improvement in respiratory disease and eye inflection after the lunched of this project. A list of the diseases along with the percentage of individual perception about these diseases has been presented in the table.

Table 4.15

Condition of Following Disease by the Use of MHP

S.N.	Kind of Diseases	Improved/minimized Using MHP	Not Improved/minimized
1	Asthma	**39(92.85%)**	3(7.15%)
2	Bronchitis	11(26.2%)	31(73.8%)
3	Headache	34(80.95%)	8(19.05%)
4	Eye inflection	39(92.85%)	3(7.15%)
5	Heart diseases	22(52.38%)	20(47.62%)

Source: Field Survey, 2013

Eye infection and asthma diseases have been significantly minimized after the lunched of MHP in the study area. Out of 42 respondents, 39(92.85%) got improvement in asthma and eye inflection. Due to the use of modern electronic instruments, people learned many things by watching/hearing different program on TV/Radio and changed their concepts about health and sanitation. Similarly, in headache, heart disease, and bronchitis diseases have been improved by 34(80.94%), 22(52.38%), 11(26.2%) respectively. By minimizing in the used traditional energy source and learning from the use by modern technology, the people health condition gets improved than without MHP.

4.3.1.17 Improvement on Household Member's Daily Activities Using Electronic Instruments Using MHP Operation

In village area, people use two types of electronic instruments (EI) one is radio/tape recorder another is television. From Radio, we can only hear but from TV we can hear as well as see the things happened in national and international level. Learning by

seeing is faster and easy than by only hearing. Using MHP most of the household were unable to watch TV but now almost all the hours have TV. The lifestyle of the villagers has changed. We asked the respondents in the different ways to know about what is the impact of electrical instruments in the lifestyle and this has presented in the table below.

Table 4.16

Improvement on Household Member's Daily Activities Using Electronic Instruments

S.N.	Households Daily Activities	Improved (percent)	Not improved (percent)
1	In fashion/dress up	95.56	4.44
2	In behavior with other people	91.11	8.89
3	Thinking/Talking style	77.78	22.22
4	Listening News	91.12	8.88
5	Watching/Listening musical program	97.20	2.80

Source: Field Survey, 2013

Of the total sample , due to use of electrical instruments 95.56 percent household people said that they have feel the change in the trend of fashion/dress up but 4.44 people could not feel such. Listing news on TV/radio was 91.12 percent whereas watching/listing Musial program on TV/radio was 97.20 percent. 91.11 percent respondents said EI changed their behavior and 77.78 percent people said that they found change in their thinking/talking style. Hence, electrical instrument helps to change the lifestyle of the households' members.

4.3.2 Sustainable Development in the Study Area and Sustainability of MHP

4.3.2.1 Per Week Hour Spend By Households to Collected Firewood User and Non-User of MHP

Every household's has used less quantity of firewood by using MHP, so that the time for collection firewood reduced significantly than non users. Without MHP people used to stay in front of the firewood woven and kill the time involving them in

gossiping the night. Now, people watch TV instead to staying before firewood woven for long time. Some houses uses rice cooker. Firewood collection time reduced quite significantly, which has shown in table below.

Table 4.17

Per Week Hours Spent to Collect Firewood User and Non- User of MHP

Hours Spent	Obs.	Mean hours	Min. hours	Max .hours
In Firewood collection (non-user of MHP)	42	6.56	4	10
In firewood collection (User of MHP)	42	4.18	3	8

Source: Field Survey, 2013

Households in the project affected area spent 4 to 10 hours to collect the firewood per week but now they spent 3 to 8 hours only. This is the positive symptoms of electricity in conservation of natural resources and environment.

4.3.2.2 Situation of Local Forest Resources Using MHP Operation

Of the total respondents, 100 percent respondent got forest condition is improved than non-use of MHP. The infrastructure development may affects in natural resources like forest, due to the less consumed of firewood, used of LP gas, Electrical instruments for cook as well as the community forest programs helps to safe the forest. Due to people, consciousness and trend to take domestic animal in less numbers than without use of MHP are reasonable to improve the forest. This is the positive symptoms of electricity in conservation of natural and environment.

4.3.2.3 Lighting Sources of Households in the Project Affected Area

Using MHP, the main sources of the lighting have been electricity of the villagers whereas the consumption pattern of others traditional sources of energy have been changed using MHP. By reducing the consumption of traditional sources of energy make the environmental conditional better as well as help to make the well social life.

Table 4.18

Lighting Sources of Households in the Project Affected Area

S.N.	Sources of Lighting	Numbers of Users	Average Uses Hours Per day	Minimum Hours	Maximum Hours
1	Bio-gas	7	2.23	1	4
2	Solar	9	3.77	2	8
3	Kerosene	13	1/3	1/3	1/3
4	Candle	9	1/3	1/3	1/3
5	Chargeable batteries/torchlight	44	1	1	1
6	Micro-Hydro	42	8.94	6	14

Source: Field Survey, 2013

Of the total Sample households, electricity is used minimum 6 hours to maximum 14 hours on the average 8.94 per households. Without MHP project every household used kerosene, among them all most household was main sources for lighting but now it consumed only 13 hours kerosene and 9 hours use candle on the average 1/3 hours per day and 44 houses used chargeable batteries/light on the average 1 hour per day. From this, we can conclude that in the absence electricity occasionally these sources are used for energy. Similarly, Bio-gas is used by 7 households 1 to 4 hours and solar is used by 9 households 1to 8 hours per day. Hence, MH is the most used energy sources whereas others are used only in the absence of electricity.

4.3.2.4 Sanitation Status Using MHP

People must be careful about indoor sanitation. In the negligence of sanitation there may happen different kinds of problems. Human health has been risky without sanitation. It is hoped that the people would be able to get awareness and sensitive about sanitation using modern electrical instruments. During the survey time of the project, the aid organization has lunched the awareness program about sanitation in the village and every household had compulsion to built toilet before the completion

of the project. Angsarang VDC also declared as the 'Khula Dasa Muktha VDC. By using the electrical instruments like TV/radio/computer, the conceits of the people have changed and they begun to care indoor and outdoor sanitation. In the negligence of sanitation there may happen different kinds of problems. Using this MHP, 100% respondents said that the village become neat and clean than without MHP.

4.3.2.5 Effects of MHP Operation in Health Condition of Family

Smoke from firewood and kerosene had made the health condition of the people poor in village. Staying in front of firewood for long time caused the housekeepers health worse and children health also damaged by kerosene used as a means of light to read. Indoor air pollution could lead to serious health problems such as respiratory diseases and eye infection. Having micro hydro electricity at home reduces indoor air pollution by decreasing the use of kerosene and firewood, which lessen the risk of respiratory problems and eye infection. By using electrical instruments, people have been listening/watching about health tips and educational program, which help to change their health condition, and they tend to use fresh and healthy things. The expenditure on treatment has reduced and the saving amount cans use in others productive purpose. Thus, MHP has impact on multidimensional way; it helps to uplift the living standard in village.

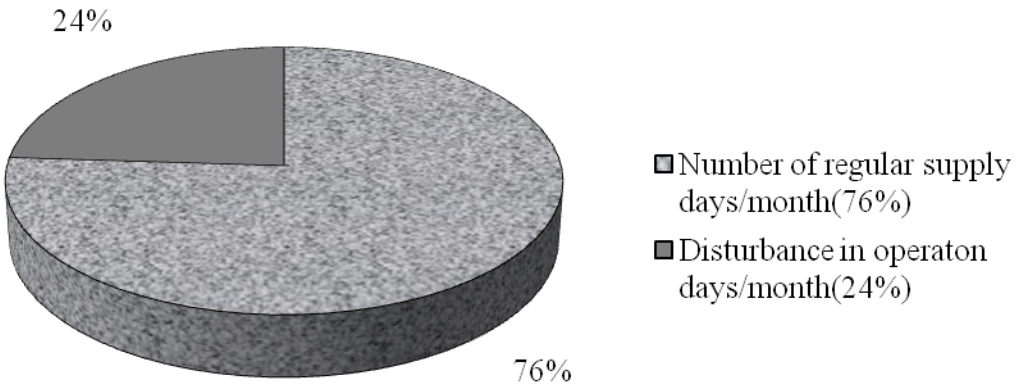
4.3.2.6 Communication Condition of this Area Using MHP

This is the era of science and technology so the internet, communication are the basic need of the people. Most of the people of this study area introduced with mobile phone and youth are familiar with internet in mobile. The communication of this area is significantly improved then without MHP. Nepal Telecom (NT) built network connection tower in the top of the village which makes the entire villages communication will be still in poor condition because 10 KW electricity power is need to run this tower, now this insufficiency was fulfilled by the installation of this MHP.

4.3.2.7 Regularity in Electricity Supply

MHP played the vital rural for rural electrification in the villagers of Nepal. Due to the technical problems like unable to work by machine, landslide on 'kulo', supplying pole cracked due to air or being old etc. has been seen occasionally restriction on supply on power, otherwise MHP is regular in electricity supply. The average regularity in electricity supply is 76% per month by MHP.

Table 4.8: Regularity in Electricity Supply



Source: Field Survey, 2013

However 24% respondents said that there is irregularity in electricity.

4.3.2.8 Advantage of the MHP in Locality

MHP played the vital role to uplift the human drudgery in the village. Using this project, people are able to live in light in night, which made the nightlife easier? Without MHP, people compiled to use Wokhal, Jato, Ghatta to grain, this consumed

more time of villagers as well as make villagers' life complicate. Now, by lunching the agro mill villagers' life complicate. Now, by lunching the dairy, stationary, medical and others business help to generate economic activities and improve the economic condition of the villagers. MHP helps to raise the social condition, improvement in the health, increased in reading habits of children of the villagers. Children education and others activities are improving.

4.3.2.9 Change Seen in Village Using MHP

Electricity is foundation for any kind of development activities. MHP helps to change the holistic scenario of the village it plays vital role to make the infrastructure in village. The sanitation condition of the village is change where every house have made toilet. Villagers announced 'Khula Disha Mukta Chhetri', which help to improve their health. Using this project there can be seen sustainable changes such as built Nepal Telecommunication Tower, which make the communication better. Others industries such as milling, dairy, etc. make the villagers life very easy and other business are run in village which improved the economics status of the villagers.

4.3.2.10 Household's Feeling/concept with the way of MHP Working

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

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

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

4.3.2.11 Willingness to Pay for Sustainability of the Project by Households

Invention of anything is not only better itself, but also repairing and maintenance should be necessary. There is no worth of construction in the absence of sustainability. Of the total sample, 100 percent households are ready to pay more amounts then the prevailing rate for well maintenance of machine and project sustainability.

Table 4.19

Households Willingness to Pay per Unit for Sustainability

	Obs.	Mean (Rs.)	Std. Dev. (Rs)	Min (Rs)	Max (Rs)
Willingness to pay	42	8	0.88	6	10

Source: Field Survey, 2013

Now, household play average Rs 8 per unit electricity but they are ready to pay average Rs 8 per unit for sufficient power and its sustainability. Household are ready to provide voluntary labor force if the project need.

4.3.2.12 Related Factors Responsibility about Sustainability of the Project

To sum up, it is known that repairing and maintenance is necessary for every nonliving things. Therefore, MHP must need repair and maintenance that makes things sustainable. The government or related donors agencies not only provide aid but they must supervise the project condition weather the project is in well condition or not. They must regularly enquiry to the users as well as households also have to inform to them continuously about the condition of the project.

There is necessary of operation and maintenance/repairing schedule in power house to make it sustain. User concise and community participation is compulsory to sustain the project. During the research time, all the respondents become ready to do any things for the betterment of project if than need. Women participation on project crucial because ‘’ Men and Women are two wheels of a chariot’’ so, equal opportunity and participation is necessary in maintenance and use of electricity.

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

CHAPTER – V

SUMMARY, CONCLUSIONS AND RECOMMENDATION

This study is focused on studying the socio-economic impact of Nibukhola IV hydro project. It is based on the primary data collected through the field survey. It is expected that the results from this study will provide valuable information on the policy makers or utilize the resources in the most positive sector for energy generation. The main objectives of the study are to examine the socio-economic impact of Nibukhola IV MHP on income and employment generation in Angsarang V.D.C.; panchthar District to explore the problems associated with the MHP and suggested solution for its sustainable development, and to examine socio-economic impacts of hydro power project in ruler areas. This chapter is the concluding chapter of the present study. The first part summarizes the finding from the study, the second part draws some conclusions, and third part lists some recommendation that can be from the conclusion of the study.

5.1 Summary

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

Electricity is the basic prerequisite of development. Energy the prime movers in the process of the economic development and its per capita consumption has been regarded some times as one of the indices of economic development. Energy consuming pattern is also regarded as one of the important indicators of measuring development status of the village. In the Nepalese context, micro hydropower seems as an important energy source, especially in the project affected area.

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

This is the descriptive study designed on find out the socio-economic impact of Nibukhola IV MHP project of Angsarang VDC, panchthar. This study has been conducted from the direct interview method with 42 respondents. Those respondents were selected by simple random sampling. The major finding of the study area pointed as follows:

The main cast in the studios area is janajati and chhetri (78.58%) Dalit and Brahmin are 90.48% people practice Hindu religion. Foreign employment is the main income sources of village. The main sources of energy without MHP were firewood for cooking and kerosene for lighting for almost all the households in this area. Now MHP being the source of energy in the village, it reduce the over expenditure on traditional energy sources. MHP users 100% respondents are agreed that MHP helps to improve the health condition of the people and it minim seethe respiratory disease and eye infection. By the use of MHP people installed industries such as rice mill ,saw mill, computer institute, poultry firms etc and create the employment opportunities whereas 93% households has raised their income. Agro mill make the especially women life easy and the living stander of the respondent has changed by

using MHP. Agriculture production has increased by irrigation, others facilities like rice mill and furniture also raise the villagers income level. Position of various electricity instruments has increased by using MHP, which make the villagers life easy and help to change the life of people.The study habit of children has been increased and children's performance in the school has improved in holistic ways. The situation of local forest condition has improved. The sanitation status of the village improved using this MHP. Most of the households are ready to pay more amounts to maintain the project and make it sustainable.

5.2 Conclusion

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

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

5.3 Recommendations

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

The electricity power generation should be increased by further investment as demand is high then supply. Lack of timely maintains is another problem technically. So, the

technicians should be provided by Government to maintenance MHPs. The sustainability of MHP is another issue. The dam constructed is located at the weak area as well as ‘Kulo’ is built on sloppy area. So there is fear of landside. The dam and ‘Kulo’ should be repaired for more securely. House should use electricity for more productive activities. Small industries need to be established in the village. So that the MHP’s revenue can be increased and further investment can be made. Non-users group should be promoted to use of MHP. Government needs to formulate appropriate policy and should allocate resources for MHP to maintenance and repair.

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Questionnaire

1. General information of Respondents

S.N.	Questions	Code/Answer
1.1	Name of the village	
1.2	Ward no	
1.3	Name of house hold head	
1.4	Gender	1.Male 2.Female
1.5	Age of respondent	
1.6	Number of household members	Male……. Female…..
1.7	Caste	1.Brahmin 2.Chetteri 3.Janjati 4.Dalit 5.Others
1.8	Religion	1.Hindu 2.Buddhist 3. Christian 4. Kirat 5.Others
1.9	Main occupation of household members	1.Agriculture 2.Services 3.Selfowend business 4.Foregin employment 5.Others

2. MHP and Rural Electrification

2.1 When was the MHP established (year)

……..……

2.2 Do you agree MHP system has played vital role in rural electrification?

1. Yes
2. No

2.3 If yes, how MHP helped in rural electrification?

……..……

2.4 How much units of electrification do you consume per month?

Maximum……. Minimum…….

2.5 How many hours per day you do access to electricity for the following purpose?

(Write in complete hours)

1) Lighting ……..
2) Cooking ……
3) TV/Radio ……
4) For business purpose ……
5) For agriculture purpose ……
6) Personal use …….
7) Other specify …….

2.6 How much money do you pay for electricity per months? Write in total Rs.

Maximum……. Minimum…….

2.7 What is the installation cost of the project? Rs.

Rs……..…

2.8 How much did you self fund to install MHP? Rs.

Rs……..…

2.9 From where you maintain the maintenance cost of the project?

1) User
2) User committee
3) The place owner

3. Socio-Economic Impact

3.1 Do you think participation in the project has improved the status of the village?

1. Yes
2. No

3.2 Have you done the productive work by using MHP system?

1. Poultry farming	1.Yes	2. No
2. Furniture	1.Yes	2. No
3. Sawmill	1.Yes	2. No
4. Dairy	1.Yes	2. No
5. Agro mill	1.Yes	2. No
6. Computer	1.Yes	2. No
7. Other specifies	1. Yes	2. No

3.3 Do you find that after involving on productive work it helped to increase your income level?

1. Yes
2. No
3. to some extent
4. difficult to say

3.4 Number of employed person at the project affected area.

Users……. Non-users……..

3.5 Dos the project helps to promote the agriculture product?

1. Yes
2. No

3.6 In your opinion, how it helped?

1. Regularly
2. Sometimes
3. Irrigulary

3.7 What type of industry is installed in your village?

1) Milling
2) Furniture
3) Irrigation
4) Drinking water
5) Knitting
6) Other specify

3.8 How many electrical instruments do your household posses User and Non-user of MHP?

Instruments

1) Radio	User	Non-user
2) TV	……	…….
3) Refrigerator	……	…….
4) Computer	……	…….
5) Cell phone	……	……..…
6) Chargeable battery	…….	…….
7) Others specify	…….	…….

3.9 Specify the annual income of the family. Total in Rs.

Before…….. After ……

3.10 What is the status of your family income using MHP?

1) Increase
2) Decrease
3) No change

3.11 How much money do you spend on these energy sources? Specify in Rs.

	User	Non Users
1) Kerosene	……	……...
2) Battery	……	……...
3) Candle	……	……...
4) Firewood	……	……...

3.12 What is the main source of energy in your family (Non-users of MHP)

1) Firewood
2) Bio-gas
3) Solar
4) Kerosene
5) Others

3.13 Using MHP, is your children study hours decreased?

1) Yes
2) No

3.14 How much time has been increased?

1) Up to 1 hour
2) 1 to 2 hours
3) 2 to 3 hours
4) More than 3 hours

3.15 Has their performance at school increased?

1) Yes
2) No

3.16 Have you seen the following changes in the activities of your children due to watching TV using computer?

1) Talking style	1.Yes	2. No
2) Dress up	1.Yes	2. No
3) Sport	1.Yes	2. No
4) Reading habit	1.Yes	2. No
5) Dance	1.Yes	2. No
6) Others	1.Yes	2. No

3.17 Have you seen any changes in following activities to household to household members using electrification?

1) In fashion 1.Yes 2. No
2) In behavior 1.Yes 2. No
3) In thinking 1.Yes 2. No
4) Others 1.Yes 2. No

3.18 What is the impact of project in infrastructure development?

Positive……

Negative……

3.19 Is there regularity in the electricity distribution?

1. Yes
2. No

3.20 Are you satisfied with the way MHP working?

1. Very satisfied
2. Satisfied
3. Neutral
4. Non-satisfied

3.21 What should be done for the sustainability of the project?

From government side …….

From user side……

From management side……..