CHAPTER ONE
INTRODUCTION

1.1 Introduction

An institutional set up is defined as identifying and grouping the activities to be performed, assigning them among individuals and creating authority-responsibility relationship among them. It is the collection and integration of various factors required to achieve the planned goals. According to Fayol, "To organize a business is to provide it with everything useful to its functioning raw materials, tools, capital and personnel." This organizing involves bringing together the human and material resources for the achievement of organizational/institutional goals.

In current usage the word organizing is popularly used in two senses: One is as a structure and another as a process. As a structure, it is a blue printof how management likes to perform the various functions. Organization structure is the results from the organizing/set-up process, which is the basic framework of an organization /enterprise. It is the framework of relationship of persons, operating at various levels to accomplish common objectives. According to Koontz and O'Donnel, "Essentially it is the creation and maintenance of an intentional structure of roles." It is a continuous a formal structure with definite authority and clear responsibility. It is not only establishes authority relationships but also provides a system of communication. In a larger concern, the structure is planned initially by the design of the major components and then by establishment of relationships among The structure of an organization shapes and influences the behavior and interaction of community people.

As a process, it is a dynamic concept and it determines arranges groups and assigns the activities of the institutional to achieve the common goals. According to Louis Allen, "Organizing is the process of identifying and grouping the work to be performed, defining and delegating responsibility and authority and establishing relationships for the purpose of enabling people to work most effectively together in accomplishing objectives."

Similarly, According to Stoner (1996), "Organizing is the process of arranging and allocating work, authority and resources among an organization's members. So they can achieve organization goals."

It involves the following process:

- Determining and defining the activities involved in achieving the objective laid down by the management.
- Grouping the activities in a logical pattern.
- Assigning the activities to specific positions and people.
- Delegating authority and fixing of responsibility for carrying out such assigned duties.
- Coordination of these activities and authority relations.

Hence, an instructional set-up is one the major functions of management. It is performed by all managers and it is a continuous a process. The success or failure of the institution/organization depends upon sound and efficient. An institutional has needed to follow certain principles or organizing to formulate and develop sound and efficient organization with unity of objectives, specialization, span of control, exception, scalar principle (chain of command), unity of command, delegation responsibility, authority, efficiency, simplicity, flexibility, balance and unity of direction.

An institutional set-up is a systematic combination of people, function and physical facilities. In every organization both formal and informal set-up are necessary for group activities such as Human resource activities management, technology management, financial sustainability mobilization management, rules and regulations and so on. Just as two blades are essential to make pair of scissors workable.

Thus, set-up function helps in increasing efficiency and reduces the operation cost through avoiding repetition and duplication of activities.

This study is focused on the institutional set-up micro-hydro power in Lokhim VDC, Solukhumbu district. This has also its own limitations and boundaries. The results of micro-hydro programme in the Lokhim VDC areas include empowerment of people, gender equity and equality and environment conservation. It has contributed to

drudgery reduction. There has been a positive impact on women as a result of the wider social mobilizations process.

1.2 Background of Study

Nepal is a mountainous country. Hence most of the areas are very remote and for from the approach of the modern technology. The rural sector is occupying an important place in the national economy of the country in the sense that high percentage of population more than 85% live in the rural areas. The overall performance of the country in the area of socio- economic development is largely influenced by the development of the rural areas. The level of development of the rural areas as compared that of the urban areas lagged far behind even to these days. The rural sector is largely traditional and under developed in the country.

Energy is extremely important component in the development process for providing economic and social benefits to the people. It remains an essential ingredient of human progress and prosperity. Energy consumption is on rise with the increase in development activities, population growth, rural sector, urbanization, industrial expansion and other economic activities. Those countries that have had rich supplies of energy available to them have released substantially higher rates of industrial growth and a corresponding increase in the gross development product (GDP). For the country's economic development, it requires access to secure, affordable and sustainable energy. The development countries have large- scale centralized systems for power generation and industrial production. But a large population in the developing world lives in a state of low financial resources and poor energy availability. The developing world has to think in terms of evolving strategies and methods to meet their requirements from systems utilizing. The renewable energy sources available in their geographical domain. In Nepal too, the energy sector and its interaction with the economy represents an important determinant for the economic policies (WECS 2006, P.3).

The country's economy does not provide enough economic bases for a large-scale investment exploiting hydro-potentials and for laying transmission and distribution network in rural areas. Renewable energy, such as Micro-hydro power, in this context can play a role of catalyst in rural development. Nepal is a mountainous country with significant potential of green and renewable energy.

Renewable energy technologies are being presently promoted in Nepal through several organizations. Among various organizations, Rural Energy Development Programme is one of major organization. To address the aspects of the decentralized energy planning and management in Nepal. REDP was initiated in 1996 with the joint effort of Nepal Government and United Nations Development Programme (UNDP). Initiated with covering 5 hilly districts in the 1st year, 10 districts in the 2nd year and 15 districts in the 4th year of its operation under the REDP-I phase, the REDP-II phase is functional in 25 hilly districts since 2004 with the joint effort of HMG/N, UNDP and the world bank. The program aims to support the community managed and community oriented development initiatives, the implementation of CM process with its six basic principles is organization development, capital formation, Skill enhancement technology, promotion, environment management and women's and VC's empowerment.

The Dudu Khola Micro Hydro power system project was reported as feasible for detail study and assessment of Micro-Hydro Power system preliminary surveyed by DDC, DEES, Solukhumbu for detail feasibility study and an assessment of the Dudu khola MHS, a contract was signed between GREAT Nepal JV Development Network P.Ltd. and DDC, DEES, Solukhumbu on behalf of Dudu khola MHFGH. In accordance to that contract, this report is the final outcome of the technical and socio-economic aspects of the field survey and interaction during meeting with Dudu Khola MHS functional group and villagers.

1.3 Statement of the Problem.

Solukhumbu is one out of seven remote districts of Nepal. Though, it is the remote and backward district it has unique importance that Mount Everest stand over here to the North. Due to the popular trekking destination some villages around Solu salleri (district headquarter) have taken economic and educational advantages of tourism. However, majority of the villages are yet back ward and far beyond the committees in Solu but many villages are still in miserable condition. Lokhim Village Development Committee is one of these most back ward villages of solukhumbu.

Lokhim Village Development Committee has very poor infrastructure development, without which such as integration is not possible. Existing technical, infrastructure has become insufficient to the Lokhim Village as per its natural, social, cultural and

financial phenomenon, with the aim of providing energy, lighting as per the country's growing demand in fostering practical and manpower in technical education for this intellectuals, local leaders, local community and other administration has come in conclusion to develop physical infrastructure of MHP for the development of MHP local communities provided the land.

For this Nepal is considered much liberal and made mode legal provisions of the institutional set-up area of micro Hydro Power. But in practically, the provisions are not well run insufficient for the rural communities. As well as poor implemented. The main cause behind it is political instability, lack of knowledge on set-up of micro-hydro power, financial risk, technical risk, administration problems and management problems and so on. And project cost and social cost is light expensive due to geographical domain.

I have selected such an issue and research is conducted under this. But we still have a number of problems relating to the instructional set-up of micro Hydro Power but now there all are unanswerable and it needs to answer one by one.

This study has tried to answer the following research questions:

1. Will Total resources available help reduce the human drudgery, especially of women and children in the rural region?
2. What are the roles of Micro Hydro Power in rural development?
3. What is the impact of MHP on rural communities?

1.4 Objectives of the study

Micro-Hydro Power projects are necessary for economic development of the rural development. The general objective of the study is to assess the role and impact of Micro-Hydro Power project on rural development of the rural region. The specific objectives of this study are as follows.

1 To find out the socio-economic characteristics of users of Micro Hydro Project.

2 To examine the role of Micro-Hydro Project in increasing income generation activities and investigate various facilitating factors for the products, local technical and managerial skill availability of technology as well as financing.

3 To analyze the problems in MHP.

1.5 Significance of the study

The above study is fully concerned towards the institutional set-up of micro Hydro power of rural development. This study aims to provide the information on the water resource available for the micro Hydro promotion in Nepal in sustainable way. The study has also recommended the initiatives that should be taken case while an institutional set-up of Micro Hydro power in rural settlements and implementing the micro hydro promotion in rural development. This study helps to policy make how to get efficient administration, optimum use of human resources, Growth and diversification, optimum use of new technology, coordination, communication, training and development and facilitates administration, promotes specialization encourages growth and stimulates creativity. As well as this study helps to how to manage. Human resources management, resource management, financial management technology management and risk management and so on.

1.6 Limitation of the study

- This study is done for partial fulfillment for the degree of the Master of Arts (M.A) in Rural development.
- This study has focused on the institutional set-up of micro Hydro power of IMicro Hydro in rural development.
- This study in mainly based on the primary as well as secondary data available and District Development committee, District energy and environment section (DEES) and concerned Micro Hydro Power (MHP)
- Validity of secondary a data relies opens the source.
- This study has focused primary limitations and other limitations.

1.7 Organization of the Study

The whole study has been divided into six chapters.

CHAPTER ONE: - INTRODUCTION

This chapter has been deals with introduction. This includes background, statement of problem, objectives of the study, signification of the study, limitation of the study and organization of the study.

CHAPTER TWO: - REVIEW OF LITERATURE

This chapter deals with the review of available literature. It includes review of books, journals, and web sites and research gap etc.

CHAPTER THREE: - RESEARCH METHODOLOGY

This chapter explains the research methodology used in the study, which includes research design, source of data, population and samples, method of data analysis etc.

CHAPTER FOUR: - POLICIES AND STRTEGIES ON MICRO-HYDRO PROJECT

The fourth chapter explains the government policies, legal framework, financial mechanism, human resource development and policy implications.

CHAPTER FIVE: - DATA ANALYSIS AND INTERPRETATION

The five chapter which is the important chapter of the study, has included analysis of data and interpretation.

CHAPTER SIX: -SUMMARY, CONCLUSION AND RECOMMENDATION

The six chapter summarizes the main conclusion of the study and offers suggestions, recommendation and other supportive document has also been incorporated for further improvement and conclusion of the study.

A references and annexes has also been attached at the end of the study.

CHAPTER TWO
REVIEW OF THE LITERARURE

2.1 Concept

A literature review is an essential part of all studies. It is a way to discover what other researchers have covered and left in the area. A critical review of the literature helps the researcher to develop a thorough understanding and insight into previous research works that relates to the present study. It is also a way to avoid investigation problems that have already been definitely answered. Thus a literature review is the process of locating, obtaining, reading and evaluating the research literature in the area of the student's interest. The purpose of literature review is to find out what research studies have been conducted in one's chosen field of study and what remains to do. The primary purpose of literature review is to learn not to accumulate. It enables the researcher to know.

2.2 The Theoretical Reviews

Utilization of water of the fast flowing rivers along the steep slope is not quite a new practice for Nepal. Long Long ago people have been found to be quite enough to take the advantage of the steep gradient of the hilly terrain and water resources of the streams and the consequent generation of water power and proved their foresight by constructing mills (ghattas) at convenient place for economic profit. At the same time they have also raised high walls with huge prayer wheels (mani) that revolve round the clock for spiritual gain and these wheels moved incessantly with the power generated from ordinary water mill. It is no wonder then that Nepalese people obviously carried away by the oft quoted figure of 83,000 mw (shrestha, 1968) as the ultimate potential for the development of hydroelectricity in Nepal been building "castles in air " and listening to the promise of "inexpensive and plentiful hydropower for all in the country " "Lucrative export to neighboring countries" and so on. According to some other scholars it can still be extended to at least 125,000 mw if floods would be regulated by constructing a series of dams at appropriate places (Sharma 1983). However, on the basis of what have been experienced regarding the hydroelectricity development since the "discovery" of the potential a very crucial question has come up: "Is the approach best suited to Nepal for developing these

water resources?" The unequivocal message that has been received is "electricity is the responsibility of the government and as many will get it as government has resources enough for." Unfortunately government has only had enough resources to provide electricity to 15 percent of the population so far in almost a country of its development since the first hydroelectric power station generating 500 kw was installed at Pharping during the regime of Chandra Shamsher JBR in 1911. When there was probably no systematic hydro power development in our giant neighbors India and China. In 1934, another plant come into operation at Sundarijal with an original capacity of 900 kw, which later was reduced to just over 600 kw. After the advent of democracy in 1951 the development of small hydro power plants was seemingly pushed to the bottom of the government priorities since attention was focused more around the construction of larger hydro power projects of "mega" dimension.

But it must be realized that the larger hydro- electricity generating plants serve best only the high demand and more accessible areas around the cities as well as their peripheries and the clustered settlements in the Terai. Besides they take a longer time to complete. The electrification of remote, Less accessible places in the hills called for an alternative, as it was neither economically feasible to construct large hydropower stations in view of the negligible demand as compared to the significant potentially, nor topographically possible to extend the transmission lines from the central gird, consuming the valuable time and enormous amount of money. So for Nepal at the present time, instead of building "castles in the air" it will therefore be better to "start from what we know and build on what we have. Significant and well proven capability for the construction of Micro, Mini and Small hydro power plants already exists in Nepal. "Small is beautiful," They say: and particularly for a country like Nepal, Where science and technology is still in an early stage of development small but appropriate technology is what is needed for sustainable development and financial sustainability of the hinterland. Micro Hydro projects are, therefore, among those which need to be encouraged for the generation of energy to integrate agricultural pursuits, small industrial projects and since atlantes with an objective of accelerating steady social- economic development. HMG has realized this need and the full appreciation of the hydro power potential of the hills and mountains is very

well reflected in the thrust to disseminate small hydropower technology in suitable Location throughout the country.

It has been to the credit of HMG that the necessary infrastructure was gradually introduced to encourage the participation of the private sector. At the same time realization of the fact that there are various favorable factors for achieving the desired goal in MHP development such as relatively low capital investment requirement in terms of absolute amount, short construction periods, existing large micro hydro potential, indigenous technology of manufacture within the country, simple operation, government incentives in the form of loans and subsidies and the involvement and interest of many international agencies including several INGOs, has definitely aroused the enthusiasm and interest of the local entrepreneurs regarding the installation of MHP plants in different parts of the country, with the encouraging support of the financial intermediaries such as Agriculture Development Bank of Nepal and technical intermediaries such as NEA and other investors National institution such as WECS, NEA and RADC as well as international organization such as ITDG, ICIMOD and UNDP are found to have played active roles in preparing training materials, set-up of MHP as well as examining the socio- economic, culture and institutional issues, along with the safety concerns that ensure the sustainability of micro-hydro installations. At the same time manufacturers themselves within their limited financial and technical resources train operators during the installation of plants.

Although the research and development activities regarding the Micro-hydro power development are rather limited some useful works have been carried out by the Development Consultants Services(DCS), Deutsche Gesellschaft for TechnisheZusammenarbeit / German Agency for Technical co-operation (GTZ), Intermediate Technology Development Group (ITDG), Research Centre for Applied science and Technology Tribhuvan university (RECAST/TU), Butwal Technical Institute (BTI) Balaju Yantra Shala(BYS) and Kathmandu metal industries (KMI).

Nepal has over 6,000 rivers of length over 2 km Therefore the total the theoretical potential of micro hydro set-up in rural communities.

2.3 Reviews of previous studies

The literature related to the study of Micro- Hydro power project was calculated and reviewed Reports and past studies, done by AEPC (REDP), Energy sector Assistance programme (ESAP), Nepal Electricity Authority (NEA) , National planning commission(NPC), banks/ financing institutions, private companies (consultants, manufactures, suppliers, installers) and report from different communities individuals and companies owning MHP projects were collected and reviewed. Available articles, reports and other literature containing relevant information about the MHP sector capacity were reviewed. From this review the researcher gained knowledge from other organization that has been supporting the development of Micro-Hydro Power set-up in rural areas.

Similarly, several reports and maps regarding regional geology and structure of Solukhumbu District areas are available from the published books and maps. They are of limited uses regarding detailed geological/ geotechnical assessment for the identified micro-hydro schemes. However they provide good background on regional geology and structure of the areas.

Similarly, It was owing to the various measures adopted mainly in the last 15 years that Nepal saw the installation of several MHP plants in the different hilly areas. In a national seminar, jointly organized by ADB/N and ICIMOD in 1994 on Mini and Micro - hydro power Development in the Hindu Kush Himalayan Region (Joshi and Amatya 1994) it was recommended that a study should be conducted to find out the number of operating installations. Thus, a need was felt to find out the actual status of the MHP plants installed in Nepal. As a first step, a study was carried out in1995. (Earth consult, 1995) and it revealed that there were 933 private MHP plants installed in various parts of the country in addition to 156 peltric sets up to the end of September 1995. Until the beginning of the year 2000 it has been reported that about 1500 micro- hydro power schemes have been installed in Nepal (CADEC 2000). But it is not yet known how many of them are actually operating to meet the intended objectives. So even if we roughly estimate that installed capacity of each scheme is 10 km on an average the total contribution of the MHP will be as much as 15 kw in total, although further national survey that may be undertaken in future will give us a true picture of the situation.

1.EAST consult 1982 Socio-economic Evaluation study of Small Turbines and Mill Installations, summary volume 1,Final Report; sponsored by Small Turbine and Mill Project, Development and Consulting Services ,Butwal ,Nepal.

The study was conducted to evaluate the performance and impact of small turbines and mills that had been installed by the Small Turbine and Mill project of Development and Consulting Services in Butwal. The study examines the technical performance. Its impact on both the mill owners and their customers and impact on the community's mode of living. Specific examination have been directed toward such issues as consumer satisfaction, efficiency of crop production and other benefits/costs vis-à-vis traditional methods, income distribution pattern, and the role of the small turbines in national development.

According to study findings, the mill has not replaced the traditional methods of processing cereal grains, a large part of which are still processed in the dhiki and janto. There has been a positive impact on the time and labor with the impact being especially significant on women. Oil processing has a winder influence area than that for cereals. It is mostly the rich households that have benefitted most from the milling technology as they do a large part of their grain processing in the turbine mills. The study further concludes that there has been a positive impact of the milling technology in the rural communities but it has not resulted in perceivable change in life styles. The positive impact of the mill as regards convenience in processing was universally indicated by the users. The study says that there may be a negative impact on the low income households in the short run because they have little or no cash incomes.

On the management side study findings indicate that technically the mills are grossly managed. Prices varied according to sites and except for two partnership concerns, the mills did not maintain accounts. Conflict in the use of water have also been pointed out, where it has to be diverted for irrigation and low water discharge during peak demand periods is shown as a major limiting factor in the smooth operation of the mills. Profits varied in the different mills and was lower for those who invested a large portion of their own capitals against loans.

The study goes on to recommend steps that need to be taken to make the milling technology more beneficial to the users and also to improve performance. Specific recommendations have been made in such areas as water rights, O&M, pricing,

training to owners and operator on technical and financial aspects as well as on preventive maintenance. The need for feasibility studies before mill installations and continuous research and development exercise by turbine manufactures have also been emphasized. The study further recommends that waiting time could be saved through an effective communication system and more profitable ventures could be attached to the milling activities through rural-based industries and other productive ventures. Mill lighting has been recommended to improve efficiency and better financing arrangement through the ADB/N for further dissemination of the milling technology.

Many of the findings of this study have also been corroborated in the present study. The O&M problem still remains unaddressed and that had a direct impact on the operation of the mill. The poor people, however have not benefited at all from the milling technology and this important finding is in contrast to the 1982 study because after more than seven years since that study was conducted there has not been any changes in the conditions of the poor whereas this factor was assumed to be only a short-term phenomenon.

Many of the issues raised by the study have yet to be addressed. This is pioneering study based on primary observations. It remains a major contribution to the study of agro-processing in the rural hills of Nepal and the issues raised are still very pertinent to planner and policymakers even today.

2. East consult 1985 UMN-DCS Rural Electrification Programme in Nepal: Final Report of an Evaluation Study sponsored by ITDG, UK and the United Mission to Nepal.

This report is the result of an intensive survey of the mill sites in Turture and khaireni, both of which are also examined in this present study. The study evaluated the impact of rural lighting in these settlements and proposed a list of recommendations.

Many of the conclusions of the study are still valid. The low income level of the rural households is cited as an important reason why there is slow dissemination of electrification. Electricity has contributed to macro-level national savings in kerosene imports but its impact on rural productivity is minimal. It has contributed to an unquantifiable increase in well-being in that it has made these settlements livelier and

some households have reported longer periods of study by their children. Electricity is used for domestic lighting and not for any productive activity.

Electricity from micro-hydro turbines is useful only for compact settlements near mill-sites and not for spread-out villages of Nepal where transmission distances outweigh benefits. Tariff collection problems, lack of knowledge regarding elementary operation and maintenance and unauthorized use of electricity are some of the major identified operational problems. Obtaining government license was a major difficulty in the past; but now due to deregulation of electricity generation up to 100 KW, the issue has been resolved.

The report makes important recommendations regarding further development and dissemination of this technology. Inter alia, it suggests that the manufacturer should reduce the O&M service costs to assist the mill owners in properly operating their machines; that the manufacturer develop circuit breakers to arrive at a technical solution to curb unauthorized use of electricity (which has now been done in the form of positive Temperature Coefficient Thermistors-PTC's);that financing institutions and the government consider low interest loans for electrification for financially marginal rural lighting schemes; that the ADB/N simplify and decentralize its procedures for loan approval; that the government regulate prices by fixing a maximum rate ceiling; that an orbiting institution or mechanism be evolved to resolve disputes between users and suppliers; and that multipurpose use of water consider important factors such as pricing and regulations.

Many of the recommendations remain valid. However, the present level of hindsight indicates that the local "market" is a better regulator of prices than a government agency at the center and that electrification is such a paying proposition in flourishing commercial centers that only very special instances and/or specific items may require subsidy. In general, it may be commented that the present study finds Khaireni continuing success but regarding Turture, the initial optimism is no longer present.

3. Similarly, Ewbank preece 1986 ODA Evaluation of Micro-hydro projects in Nepal; Brighton, Sussex, U.K.

This is a report which evaluates the roles of ITDG and the UMN in micro-hydro development in Nepal. It concludes that the main proponents of micro-hydro

development in Nepal are working in too isolated a fashion and many important donor agencies such as UNDP, the World Bank, USAID, etc. are not aware of the important and effective work being done by them. The programme of UMN and DCS are also not integrate into the national plan. It recommends more research and technical efforts to ensure that productive uses of electricity are developed and asks that UMN, DCS and ITDG publicize their success so that other funding agencies can take note and integrate their efforts in rural electrification with those of UMN. It also recommends that UMN increase its staff to accelerate the implementation of the micro- hydro programme.

Many of the conclusions and recommendations are made specifically to the UMN and ITDG and thus have only marginal relevance to this present study .However, an important point need; to be made regarding the comment that UMN integrate its efforts with the national governmental efforts. Judging from the fact that UMN/DCS/ADB efforts in disseminating micro-hydro technology have achieved a significantly higher success rate than governmental efforts (as described in review no.5 below), it could probably be better recommended that the continuing success be accelerated without linking with failures. If governmental agencies wish to understand why the UMN/DCS/ADB are more successful, they should be helped to the maximum extent possible.

4. Similarly, ADB/N Nov.1987 A study on Impact of water Turbine in Nepal; Agricultural Development Bank Evaluation Division at the Head Office, Kathmandu.

This is an econometric study of the water turbines installed by ADB/N in Nepal. A sample of 35 private turbines were selected out of a total of 460 covering four development regions and 8 different districts. It gives details of land holding, literacy, as well as other social parameters of the owners. The performance of these turbines are also discussed in detailed. Electricity generation was described as a new phenomenon with only 20% of the sample having installed generators in addition to agro-processing. The average Bank loan to these amount to Rs. 80,676 (or 70% of the total costs of establishment) because of poor consumption of water, returns from electricity were judged as not very encouraging. There was an average of 50% subsidy which made the annual income positive. Without subsidy, the annual income

was negative with an average loss of 1654. Only the cross-flow turbines of the central Development Region showed positive income with and without subsidy.

The report makes some important recommendations. It is suggested that the Bank and the concerned manufacturing companies coordinate their efforts with involved parties for better transfer of technical expertise. It recommends a subsidy of 50% on canal construction costs to encourage entrepreneurs to opt for a permanent type of civil structure. Constant follow-up supervision should be made by the Bank with the manufacturers to help turbine owner in carrying out this matter. Wherever turbines are introduced, the bank should encourage other integrated development activities to enhance agriculture and cottage industry which would use the services of the turbine.

This report is an important contribution to monitoring the efforts of ADB/N in the direction of turbine technology introduction in particular and rural development in general. The Bank should conduct this type of monitoring effort on a continuous basis and observe how and if its recommendations are being implemented.

2.4 Review of Micro-Hydro Policy issues.

Fifth Five Year Plan (1975/76-1979/80)-For the first time small hydro-power was mentioned.

- Sixth Five Year Plan (1980/81-1984/85)-ADB/N launched Rural Electrification Project (1981).
- HMG/N waived the licensing requirement for MHP (1984)
- Eighth Five Year Plan (1992/93)-1996/97) - The target for MHP development was fixed for the first time.
- Nine Five Year Plan (1996/97-2001/02)-MHP target of 5MW.
- HMG/N established AEPC (1996).
- REDP was initiated (1997).
- NEA announced the policy of purchasing electricity from independent power producers (1998).
- ESAP was initiated (1999).

  Policy has significant impact on the Micro-hydro projects established, management, mobilization and utilization of resources. All the Micro-hydro

Projects have to conform to the legislative and policy provisions and the rules and regulation formulated the smooth running of MHP.

2.5 Conceptual Framework

In conformity with the principle of regional balance in development activities, the growth of hill economy assumes special significance. The inaccessible terrain of the hills has made life for the inhabitants a continuous struggle and daily drudgery. Furthermore, development cannot effect unless the entire population is encompassed in the mainstream of economic program and prosperity. These are enrolled to study. The study area has been selected in Lokhim VDC, which is in Solukhumbu District, because 520 households are willing to use electricity for domestic purpose like for lighting, coking, grind mill, rural carpentry, rice huller, video hall, Dairy industry, photo studio, computer centre and so on. But people in the project site have weak economic condition. So they are willing to contribute labor force in the project set-up. They are also willing to provide local materials like stone, stand, Bamboo and wood. Leadership role to mobilize local community for the self help development is lagging behind.

The local community has shown interest and willingness to construct the MHP set-up. Similarly, they have shown internet in mobilizing local resources in building Micro Hydro power project. Much need to be done to work in self motivates the local people to work in self- help approach.

Concept is the collection of facts it depends upon the development variables or independent. These are inter-related to each other. The study aims to an institutional set-up of Micro Hydro power connected with the objectives and verify it to get into the valid conclusion. The interlinks of causes and effects are under listed below.

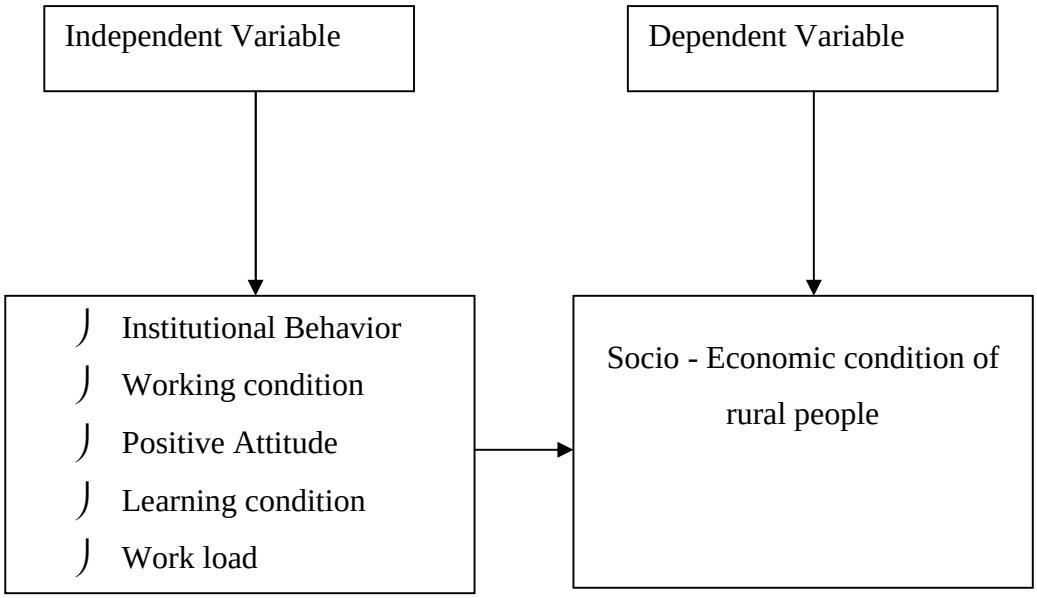

Fig: Conceptual model showing specific variables and scheme of their relationship

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Rationale of the selection of the study area.

To fulfill the objective of research, Dudu Khola Micro Hydro Power system 52 kw, Lokhim VDC, Solukhumbu has been selected because it has its own biophysical conditions and socio-economic environment which act as the suitable stage properties for the enactment of socio-economic development in general and micro-hydro power development and its utilization in particular.

3.2 Research Design

To conduct the research, it is needed an appropriate procedure or plan to be followed for the research. This is called research design. Design is a plan or frame to conduct the research before the situation arises in which the decision is to be carried out. It is conceptual design within which the research to conducted. It constitutes the blueprint for the collection, measurement and analysis of data. In this study, It is scheduled to conduct research of Micro-hydro power system in the Dulu Khola Micro Hydro Power System 52 kw, Lokhim VDC, Solukhumbu. There are over all 737 Households. It is known through looking at District Development plan records. Among this number, there are 520 households benefited by the installation of Micro-Hydro Power. Here, I have to select to 50 households among 520 households from the systematic lottery sampling methods. For this purpose, I have to make 520 cheats and given to the 50 symbol among 520 households and all the selected 50 households among the 520 households. The aim of this study is to explore and describe the hidden realities connected with the households. It is more difficult to get interviewed or other implementation procedure to get out the information about the Micro-hydro power projects connected with them. For this purpose 50 households are selected as the sample size through systematic random sampling with lottery methods assuming that there techniques will be more plausible. By employing the interview schedule technique using the predetermined questions, the Dissertant asked every question to each of them to conduct the research. Pre-Scheduled questionnaire are not enough to expose out all the real facts, so the dissertant conducted other techniques to find them more out. The types of research design adopted for this study is exploratory and

descriptive in nature to get the reliability and validity of the research data. The exploratory research design is adopted to explore the new variables connected with the existing problems of micro-hydro power. Similarly descriptive research design is employed to get valid conclusion from the analysis of existing phenomenon of micro-hydro power concerning with the rural development.

3.3 Nature and Source of Data

Data are to be collected from both primary and secondary sources. Primary data have been collected from the sample respondents. And secondary data are collected from the various books, Journals, Internet, reports and other sources.

3.4 Universes and Sampling Unit of Analysis

Dudu Khola Micro-Hydro Power system 52 kw, is the unit of analysis in this study. There are altogether 520 household benefited, which is the universe of the study. For this study, to choose the unit as a sample systematic random sampling with lottery method has been adopted. By using that sampling, 50 households are selected as the sample size.

3.5 Data collection Techniques

Following method are used to collect the necessary data for the research purpose.

I. Interview Schedule

Interview schedule was adopted for generating information of micro hydro power project at the Lokhim VDC through semi-structure questionnaire.

II. Indirect Interview with key informants.

All the facts are not taken and covered in the interview schedule. Some facts are very difficult to expose out. Interview schedule doesn't cover the hidden realities such as attitude and perception so it needs the indirect interview/observation.

3.6 Reliability and validity of data

The questionnaires were made, taking into consideration all the important parameters required to meet the objective of the study. The questionnaires were prepared to

obtain information on village like, population, ethnicity, infrastructures, grind mill and income generating activities in the area etc.

In this phase, most of the works was done. The detailed survey of the study area was done in this stage. Also, various policies pertaining to Micro Hydro Power were reviewed and discussions were held with the government, non-government and other key players in this sector.

i) Field Study

Stratified sampling was done in all the wards where electricity was supplied. Care was taken that representative sample was from all the sectors of the scattered village. Equal number of respondents was selected from all the wards of the electricity supplied village. A total of 5o respondents were selected and interviewed with questionnaires. The information was verified by discussion with different groups of people and through observation of the overall situation. Most of the qualitative information was extracted through field observation.

ii) Meeting with Concerned Institutions

Meeting with persons from various institutions involved in the MHP sector was held. The DDC, DEES, VDC office of Solukhumbu, the READ and AEPC was visited to discuss several issues like technical, socio-economic, policy and subsidy issues

3.7 Data processing and Analysis

Collected facts are numerically impressed as well as codified. All the collected data are codified,classifiedfied and tabulated and analyzed differently by using simple statistical tools.

CHAPTER FOUR

POLICIES AND STRATEGIES ON MICRO HYDRO

Until Sixth Five Year Plan, only hydro power and forestry were covered in Energy Policy. In the Seven Five Year Plan, the government started to attach due important to the development of alternative energy sources. Government provided subsidies to those who installed MHP turbines and biogas plants. However, clear policy was still lacking.

WECS initiated a task to develop a national energy policy in 1989/90 and a workshop was held to have consensus on the policy. The policy emerged form the workshop was revised and expanded in the Eight Five Year Plan (1992-1997). The energy policy encouraged the development of renewable and alternative energy technologies to reduce the dependence on traditional (biomass) and imported fuels (non-biomass). Its objective also included ensuring that such development and consumption off energy does not have any adverse effect on the environment.

4.1 Government Policies

The Fifth Five Year Plan (1975/56-1979) for the first time mentions small hydro power, which included hydro power plants of MHP range as one of the means for rural electrification. Under this plan, HMG/N in 1975 established Small Hydro Power Development Board (SHDB). During the Six Five Year Plan (1980/81-1984/85), period in 1981. ADB/N launched Rural Electrification Project with a view to promote rural electrification through MHP.

In 1984, the HMG/N waived the licensing requirement for MHP and deregulated MHP produced electricity price. In 1985, HMG/N adopted a policy of capital subsidy ranging from 50% to 75% for electrical and transmission cost components of MHPs up to 100KW capacity to encourage private sector in Hydro Power development. This policy became instrumental to promote MH Projects on private initiatives. After 1985, the installation of more than 70% of private MHP until 1996 gives and indication of the impact of subsidy. Additionally, HMG/N also waived income tax form MHP earnings.

In the Eighth Five Year Plan (1992/93-1996/97), the HMG/N for the first time fixed a 5 MW capacity target for MHP development. However, only 24% (1199 KW) of the target was fulfilled. For the current Ninth Five Year Plan (1997/98-2001/02) the MHP capacity development target is 5.2 MW.

In 1997, the HMG/N established Alternative Energy Promotion Centre (AEPC) as an agency designated for facilitating promotion of alternative energy sources, one of which is MHP. The government has also been able to mobilize donor funding for development of MHP, which includes UNDP funding in 1993/94. Micro-Hydro Power Is also one of the components of newly initiated DANIDA funded Energy Sector Assistance Programme (ESAP).

The government through WECS has been funding for Micro-Hydro Power study program. Micro-Hydro Power inventory study has been completed for 32 of 55 hilly districts.

4.2. Legal Framework

Water Resource Act. 2049 (1992), Electricity Act, 1992 and Electricity Rules, 1992 set legal framework for the promotion of MHP. The framework has created generally favorable environment for investment on MHP. The water resource Act has made provisions for dealing with as well as minimizing the water resource disputes that can cripple the MHP. Micro-Hydro power policy, 1992 and Electricity Act, 1992 categorically mentions that power generated in any place in Nepal could be transmitted to other places using the Integrated Nepal Grid System.

HMG/N has hence taken indirect policy measures too, to promote MHPs by promulgating Hydro-power Development Policy, 1992 and Electricity Act 1992. The statements in the legal documents pertaining to MHP are:

i. No license shall be required to operate hydroelectric project having a capacity of up to 1000 KW. However, if the project having a capacity of 100 KW to 1000 KW is to be operated, a notice to that effect with necessary particulars should be given to the concerned agency before commencing the work of the project.
ii. A license should be obtained by submitting an application to the Ministry of Water Resources for carrying out a hydroelectric project with a capacity of

more than 1000 KW. Feasibility study and other necessary information shall be included along with the application submitted for a license and a decision shall be made within 120 days from the date of submission of such application as to whether such license is to be issued or not. The validity of the license shall be of a period of 50 years in maximum.

iii. In order to make up-to-date, less expensive and more productive the hydroelectric projects, transmission and distribution line constructed and completed by the government sector and owned by it, necessary agreements may be made with private sector for their whole or partial operation.

iv. No royalty shall be imposed to the electric power generated through hydroelectricity plants having the capacity of up to 1000 KW. In case electricity is produced through hydroelectricity plants of more than 1000 KW, the producer of such electricity shall pay the government a sum of NRs.100.00 per KW annum and 2% of the average sale price per unit (KWh) as royalty up to the period of 15 years starting from the date of commercial production.

v. An exemption of income tax shall be given to the projects of private sector generating and distributing electricity from the hydroelectricity project up to the capacity of 1000 KW.

The private sector producer may itself fix the selling price of the electricity produced from the hydroelectric project having a capacity of up to 1000 KW and operated by it and distributed accordingly.

The construction or operation of hydroelectricity project shall be made in such a way that it would be have minimum adverse effect on the environment.

His Majesty's Government shall, on request, make available land to the private sector for the construction of hydroelectricity project on the same ground as it acquires land for any institution under the Land Acquisition Act, 2034 (1977). If the land is owned by the government, it shall be made available on lease throughout the period of license.

4.3 ORGANIZATION

ADB/N initially played a leading role in the promotion of MHP by providing financial as well as technical assistance. Later, due to reorientation of policy of ADB/N, it limited itself to banking function. This resulted in a gap for leadership for the promotion of MHP. This gap now is re- bridged by the establishment of AEPC, which is designated for the promotion of MHP along with other renewable energy resources.

The hosts of institutions presently supporting MHP promotion, in addition to AEPC are:

i. Agriculture Development Bank, Nepal.
ii. Water and Energy Commission Secretariat.
iii. Institute of Engineering, including and autonomous body, Centre for Energy Studies.
iv. Intermediate Technology Development Group (ITDG).
v. Development Consultancy Services.
vi. Rural Energy Development Programme (REDP), supported by UNDP.
vii. Remote Area Development Committee.
viii. NGOs/INGOs.
ix. Private sector organization in research development, manufacturing and dissemination.

4.4 Financial Mechanism

In 1985, the government introduced a subsidy for MHP. According to the scheme, it provided a subsidy of 75% for electrical component cost for remote mountainous areas and 50% for the rest of the country. This translated to a subsidy of about 20-25% of the total plant cost for stand-alone plants. However, this subsidy policy and other specific assistance proved to be inadequate in achieving the government targets for the promotion of MHP. Financial analysis of numerous MHP has shown that financial rate of returns of MHP is site specific. Financially MHP has been viable where potential existed for economic development and where MHP has succeeded in triggering economic development. Hence, there can be no universal subsidy rate that impact equally in financial viability of all MHP in the country. This subsidy was initially channeled through ADB/N alone, which monopolized lending for MHP. To

complicate to situation, various donors and local authorities like DDC, VDC and local institutions are providing various levels of subsides. The government by setting the target for developing 5 KW of MHP in Ninth Plan has expressed its commitment to the development of this sector and allocated on an average a subsidy of NRs.37.3 million per year.

However, a new scheme presently replaces this subsidy scheme. This new proposed subsidy scheme for MHP is as follows.

i. For the development of new MHP up to 3KW, especially for peltric sets, a subsidy of NRs.55,000 per KW is fixed. For MHP above 3 KW and up to 100 KW, a subsidy of NRs.70,000 per will be provided.

ii. For the existing water mills a subsidy of NRs. 27,000 per KW will be provided if the add-on project is for the generation of electricity for the rural areas.

iii. The subsidy scheme for the transportation cost of equipment and components.is based on the walking distance between the MH plants and the nearest road and is classified as follows:

Class	Walking Distance	Subsidy (per KW)
Class A	Walking distance more than 5 days	NRs.21,000
Class B	Walking distance between 2 to 5 days	NRs.8,750
Class C	Walking distance less than 2 days	No subsidy

iv. For rehabilitation of MHP, the subsidy per KW will be 50% of the proposed cost or NRs. 35,000, whichever is less.

Hence, this new subsidy policy implemented by AEPC is envisioned to replace the shortcoming of the previous policy. Alternatively, it will encourage investment in plants having capacity greater than 3 KW. It is also got incentive for the conversion of

the existing water wheels into multipurpose power unit generating electricity as well as for the rehabilitation of the MHP plants. The subsidy on transportation cost will further encourage the installation of MHP in remote locations.

4.5. Human Resource Development

Emphasis has to be placed on the development in human resources for Micro-Hydro sector, if it is envisioned to be a viable and sustainable system of energy. In the past, human resource for MH has developed mainly through experience of fresh and enthusiastic professionals rather than through experienced hydropower professionals. Human resources involved in MHP may be broadly classified into three groups – Professional involved in planning and design, manufactures and manpower involved in operation.

Recently, Institute of Engineering (IOE) has started its contribution for institutionalizing the human resource development of MHP through different activities like establishment of Centre for Energy Studies (CES). It is also planning to initiate Master Degree Program in Renewable Energy Resources, elective coursed related to Micro- Hydro Power and offering short-term training.

4.6 Policy Implications

The HMG/N policies and the establishment of several agencies, particularly the AEPC, apparently show that there is a good potential for rural electrification through MH development. This is necessary to create a conducive environment for development. The MHG/N policies, specifically subsidy and deli censing have positive implication on MHP. The present policies, however, need to be refined and made comprehensive by incorporating all actors into the single policy net to achieve the desired outcome.

The resent subsidy policy seems to take account the remoteness and into geographic location of the site into consideration. Since the potential entrepreneurs and communities will be given a fixed quota subsidy based on the capacity of the plants, they will be encouraged to invest in large capacity plants. They also have the incentive of minimizing the cost, since subsidy is based on the capacity unit of the plant rather than on the location basis. However, its impact is yet to be seen.

Nevertheless, there some conflicts and shortcoming in some of the policies relating to this sector. For instance, the policy statement of waiving license requirement implies that no fiscal or other facilities can be provided to such industries without the industry registration. There have been cases of closures of micro hydro projects due to

diversion of water for irrigation purpose. So, even though hydroelectricity is ranked as fourth priority sector for water resource, there are high risks for entrepreneurs investing in micro- hydro. Entrepreneurs may also be hesitant to invest in micro hydro projects as policy says that government can acquire and develop water resources for the purpose of extensive public use and turn them over to a user's association.

The lack of clarity over compensation can create dispute between NEA and the MHP owner as the policy states t6hat MHP may be replaced by small
hydropower plant/grids. Also because NEA has to provide compensation if it extend its grid to existing private power in the form of micro-hydro, etc. NEA is hesitant to extent its grid in areas where MHP are already installed.

The imposition of custom duty on alternators imported for micro hydro generators but no such duty on alternators for diesel/petro generators imply that the cost of such diesel engines is lower, and hence they are competing well with MHP.

These are some of the anomalies in the policies that have to be addressed properly to provide impetus to the micro-hydro sector.

CHAPTER FIVE

DATA ANALYSIS AND INTERPRETATION

5.1 Introduction

Micro-Hydro Project is located in Lokhim VDC of Solukhumbu District. Solukhumbu distric lies in the Sagarmatha Zone. Eastern Development Region of Nepal. It is one of the mountainous regions with full of slope terrain and cultivated land. The MHP Project is situated at about 1043m about AMSL. The nearest road head are at Jiri and Okhaldhunga. It takes about 3 days walk for normal and about 5 days for loaded porter to reach the MHP Project location.

Geologically, MHP Project is predominated by Sedimentary and Metamorphic rock consisting of shade, mudstone and limestone. MHP project lies on the left bank of Dudu Khola. The total length of the headrace canal is about 575 meters.

There are about 737 households in Lokhim VDC. The number of households are beneficiary area is 520.There are different ethnic groups located in that area like Rai, Tamang, Sherpa, Dalits, Kami etc.

In the context of public facilities, there are Secondary, Lower Secondary and Primary Schools in the project area. There is also health-post, Post office, Finance banks, VDC Office etc.

The MHP Project is established in 2nd April 2008.

The cost of the Electrification project is as follows:

Agency	Amount in Rs.
REDP/AEPC (Subsidy)	5,980,000
DDC	5,89,998
VDC	1,179,997
Bank Loan	1,904,140
Community Equity	15,85,834
Community Cash	15,60,000
Total Cost	11,799,969

Thus, MHP project electrification is useful to local community like lighting, grind mill, ago-processing rural carpentry, rice huller, video hall, dairy, photo studio, lokta refining, computer Centre etc.

The community is quite satisfied with the mill and its performance. According to some respondents, the mustard processed in the mill produced almost double the amount of oil than from the use of the traditional method.

People in the community still have not let the mill displace the traditional methods of processing paddy, maize, Wheat, Millet (kodo) oilseed and small amounts are still processed in the Dhiki and Janto. However, The MHP project has been a very positive impact on the community as a whole. Electricity has proved to be a major money earner in recent time.

There is a general consensus among people of the community, especially among the women and children, that life has become easier after the installation of MHP.

The Dudu Khola Micro- Hydro Power Project in Solukhumbu District is located in the Lokhim VDC. The source of water for the plant is Dudu Khola, which is perennial river. The power output of the plant is 52 KW and its command area include a total of 502 households in the wards of the village, viz, 1, 2, 3, 4, 6, 7, and 8. The plant was commissioned in july 2008 at a total cost of NRs.11,799,969.00. The following are the other technical details of the plant.

Power:	52 KW
Head:	151.58 meters
Canal Flow:	1020 liters per second
Canal Length:	575 meters
Design:	70 Lps
Headrace pipe:	560(280mm.OD, HDPE, 2.5kgf/cm)
Power House:	Internal dimension (5.5-3.5-2.7m) (Stone masonry with mud mortar)
Penstock:	M.S .Pipe, 225 MM ID 4 MM thickness, 82m, 5 MM thickness, 175m, 6 MM thickness 56m
Turbine:	Double Jet Pelton 78 KW shaft output
Generator:	100 KVA, 3 Phases, 50 H2, 1500 RPM Synchronous
Transmission Length:	71.37 Km.

5.2 Family Structure

The average of family size of all surveyed households was found to be 8.25. Majority (56%) of the households fall in a category having a family size of 5-12 persons. Less than20% of households had a family size greater than 12 and 25 % households had family size less than 5.

Table 5.1: Family Structure

Family size	Number of household	Percent
1-5	15	30%
6-12	25	50%
>12	10	20%
Total	50	100

Source: Field Survey, 2014

The size of household affects the socioeconomic condition of family. Lower household family size can mean less demand in the house for resources and energy as well as better cooperation in the family. Larger family size on the contrary is characterized by more demand for energy and resources, more problems and lack of cooperation. However. In the villages it was generally found that larger household size correlated with better economic status because of more workforce and hence more economic activities.

Among the electricity users, none of the family fell into deprived group category. However, there was some variation in the economic status of the users group. 20% of the respondents did not grow enough on their own feed family for the whole year. They had to rely on working as a wage labor in the village or had to go outside of village in search of jobs. In this way they had to work for almost 12 months.

Table 5.2: Food Sufficiency

Condition	Number of Household	Percent
Food Sufficient for 12 months	40	80%
Food not Sufficient for 12 months	10	20%
Total	50	100

Source: Field Survey, 2014

5.3 Major Source of Income

50The major source of income for the most of the villagers was agriculture. That is, almost 95% of the families were involved in agriculture in one form or other and it was their major source of income. Here, agriculture include both crop cultivation and livestock production.

Around 20% of the respondent reported that they had to work as wage labor since the production from agriculture was not enough for all year around. They either worked in the village or some went on to nearby areas and also went to trekking for income.

Some 15% had involvement in service while another 15% involved in other activities such as business, shop-keeping etc.

Table 5.3: Major Source of Income

Major source of Income	Number of household	Percent
Agriculture	45	90%
Wage Worker	2	5%
Service	1	3%
Other	2	2%

Source: Field Survey, 2014

The result obtained above is typical to rural areas of Nepal. Major proportions of population in the area depend on farming as well as livestock production to meet their basic requirements. Hence, the larger share of the monthly tariff paid by villagers came from on-farm activities.

5.4 Business Activities in House

Only 15% of the respondents said that they conducted any business activity in their house. 85% of the households did not have any such business activity in their house.

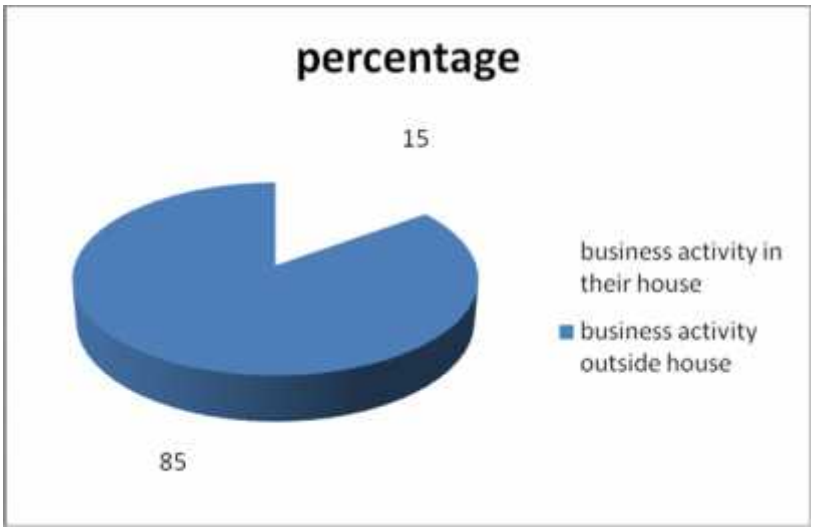

Figure 5.1: Respondents conducting Business Activities in House

These business activities included milling, shop-keeping, poultry. From key informants it was found out that other business activities in the village included small-fishing production, incense stick making, sewing etc.

Most of these business activities were new to the villagers and it was the result of electrification. However, lack of sufficient funds precluded many enthusiastic villagers from involving in these new income- generating activities.

5.5 Infrastructure Development priority

Among the respondents, some 60% accorded highest priority to irrigation as an infrastructure needed to boost the development of village. Around 55% prioritized for drinking water while 20% gave emphasis on transportation and road development.

Table 5.4: Infrastructure Development Priority for the Area.

Infrastructure	**Number of Households**	**Percent**
Irrigation	30	60%
Drinking Water	10	20%
Transportation	10	20%

Source: Field Survey, 2014

Many of these villagers believe that the surplus electricity from MHP during slack hours could be utilized to operate pumps to extract water from the the Dudu khola for irrigation. However, due to altitudinal and spatial. variation in the distribution of agriculture fields, at least 4 pumps working simultaneously is needed to accomplish the task. This in fact will be a costly investment for villagers. So it is perceived that people are looking for additional opportunity to diversity the use of electricity by utilizing the slack hours surplus power. It seems the task is quit feasible if they buy pumps by utilizing the saving from their community. This indeed will have more of their lands irrigated, which in turn increases their crop productivity, especially the chiliy, onion, vegetables, Maize, Barley, Oil, Paddy, Wheat, Which are one of the their main cash crops

5.6 Electrical Appliances Used

All the4 houses having connection to electricity were using bulbs for lighting purpose. Additionally, 75% of households also had radio, tapes. No other household electrical appliances were being in the homes of respondents.

Table 5.5: Electrical Appliances Used in the Households

Appliances	Households	Percent
Lights	50	100%
Radio/Tape Recorder	50	100%
Television	5	10%
Other (Rice Cooking)	5	10%

Source: Field Survey, 2014

The use of TV in the village had started only after the installation of MHP plants. And the use of radio and cassette player was also increasing and many had planned to buy such gadgets.

5.7 Advantage and Disadvantage of Electrification

The main advantage perceived by all the respondents was the lights the MHP has brought in their homes. Very few perceived the additional opportunity such as milling, husking and other business promotional opportunities the MHP has brought. Other advantages included, creation of employment opportunity, facilitation of their access to education, entertainment and leisure activities. Similarly, it helped them in keeping their house clean, cooking food, gave them more time to work even late in the evening.

Virtually no one reported anything directly about its disadvantage, but through general observation it was found out that they were afraid of electrocution that could result from naked wire or fallen poles. They were also concerned about the higher

prices of electricity. They were found most critical about the frequent interruption in the supply. Some also found TV disturbing the children as well as adults.

The result was typical to the study area. Their fear of shock was relevant in view of the death of at least one person from electric shock and one other accident of similar nature. Given the low surplus income of many households, they had little interest in doing new business due to lack of funds.

5.8 Lighting Methods prior to electrification

All respondents unanimously replied that prior to electrification; they all used Tuki (a traditional lamp). The fuel used for such traditional lamp was kerosene. The average monthly consumption of the surveyed households was calculate to be 2.8 liters.

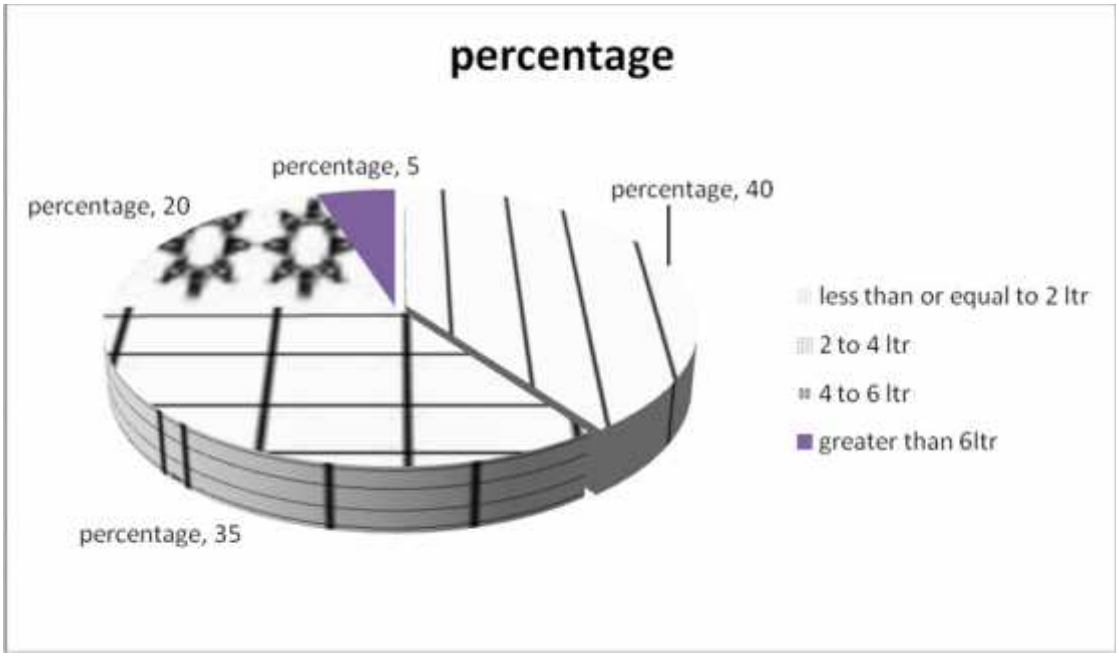

Figure 5.2: Kerosene Consumption in Liters Per Household prior to Electrification

Some 40% of the people replied that they used less than or equal to 2liters of kerosene per month. 35% said their consumption of kerosene was from 2 to 4 liters. Only 20% consumption kerosene between 4 to 6 liters while for the remaining 5%, consumption was greater than 6 liters.

Their consumption pattern of kerosene was dependent on their average family size, the number of school going children, and also their economic activities. Their consumption slightly increased during working seasons.

5.9 Kerosene Consumption after Installation of MHP

Due to frequent interruption in electricity supply, they were still found using Tuki and hence kerosene. However their consumption of kerosene had definitely decreased. Their present average usage per household was 1 liter for each household. Hence, the average reduction in consumption of kerosene was 1.8 liters per household.

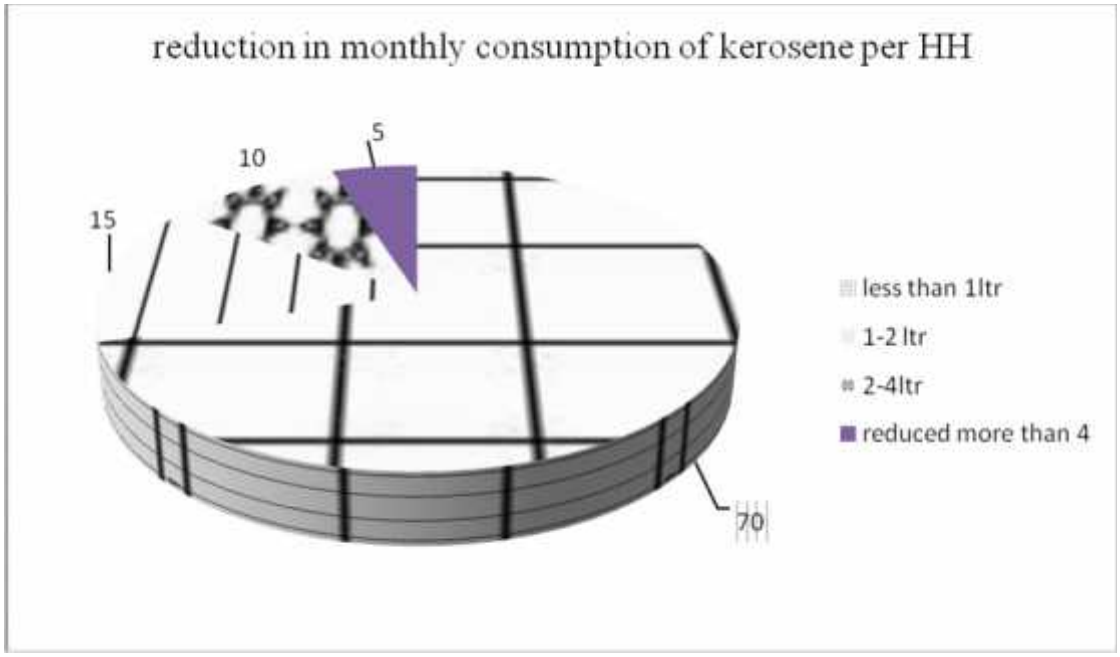

Figure 5.3: present Monthly Consumption of kerosene per HH

Of the total 70% of the respondents had reduction in kerosene consumption less than 1 liter per month. Similarly, 15% had reduced by 1-2 liters. Some 10% had their consumption reduced by 2 to 4 liters, while only 5% had their consumption reduced by more than 4 liters.

Current price of kerosene being NRs 180 to NRs 200 per liter, (One bottle) the average reduction in the investment is calculated to be NRs.180. Respondents were

also unanimous that they now had to pay less for kerosene than they previously had to pay.

The average reduction of 1.8 liters is just around 85% reduction in the consumption of kerosene usage for lighting. At current market price, the monetary value of reduction is just NRs.180. This does not justify the high installation cost of MHP and higher tariff rates paid by the villagers for electricity. However, for proper justification, due consideration must be given to other non-monetizes and aesthetic values brought about by electrification.

5.10 Battery Usage

Prior to electrification dry-cell batteries were used for radio, cassette player and flashlight by some 35% of the respondents. The average dry- cell consumption of users was calculated to be7.7 batteries. Their present consumption of dry cell averaged to 4.14 cells. Hence, the average reduction of dry-cell consumption was 3.57 cells per month households.

Taking the present cost of battery to be NRs. Per piece, the average reduction in cost of battery amounts to NRs.35.7.

The result hence shows that those who initially used dry-cells for radios, tapes etc. were reaping a greater benefit from electrification by paying a fixed NRs.100 tariff per month. The 35% who initially used dry- cells were generally better off economically and could afford such gadgets. However, electricity had not completely replace their battery usage because electricity was not supplied whole day and also there was interrupted supply.

5.11 Satisfaction with Supply

Some 75% respondents expressed satisfaction while 25% were not fully satisfied over the newly established MHP plant and the electrification. Even those who were satisfied had some concerns with the electricity supply.

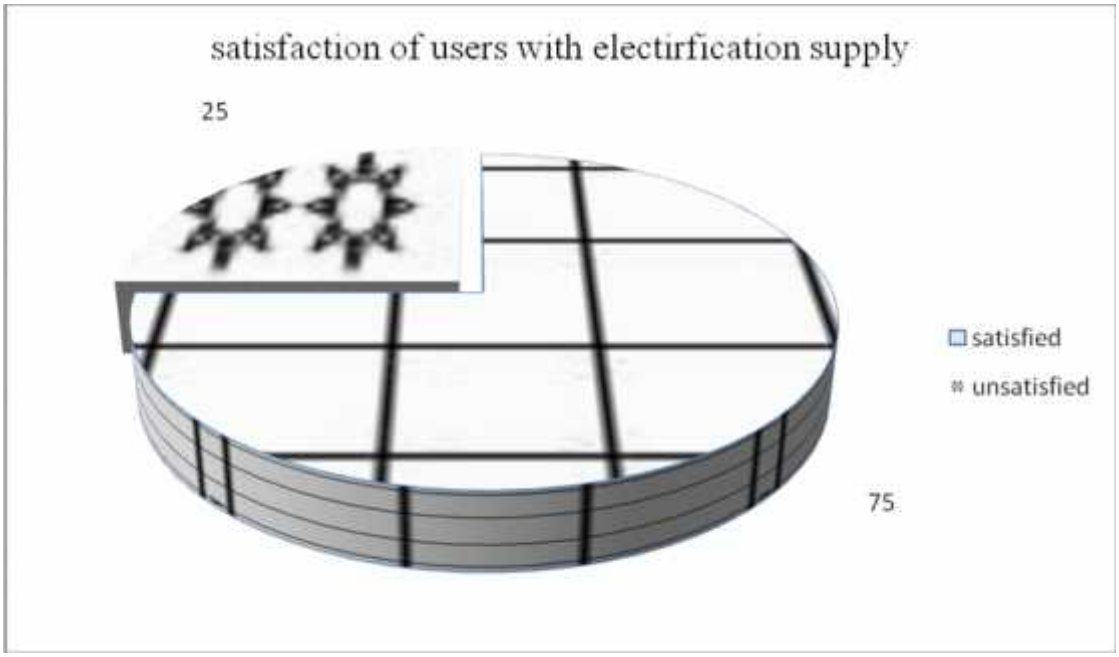

Figure 5.4: Satisfaction of Users with Electrification Supply

Their dissatisfactions and concern was relevant in view of frequent interruption in the supply. They were also discontent about fixed electricity tariff, which many viewed as too expensive for them.

However, in the long run when their manpower are better trained, the end use of electricity diversified, there a possibility of reducing tariff for household users. These will indeed help them of their concerns and dissatisfaction.

5.12 Reason for Dissatisfaction

Some reasons for dissatisfaction were the lack of post-installation services, low and fluctuating voltage that frequently fused their bulbs. At least one respondent complained about her MCB, which did not support more than 5o Watt of power. The breakage of canal by flood and regular technical problem in the plant made some them raise question about the sustainability of plant in the long run.

Hence, their main suggestions were to have skilled operators in the plant, collect the tariff on the basis of power usage. And also suggested replacing the old worn-out poles, which pose them serious threat during rainy season and storm.

People wanting a reduction frequent technical problem and interruption in power supply raises a serious question on the MHP plant as well as on the technical know-how of the operators. And also, many of their bulbs fused in the early evening hours, when the power supplied fluctuated to a higher voltage.

5.13 Interruption of Power During Regular Supply.

25% of the respondents replied that the interruption ranging from 5-10 days per month. The main reason for this interruption was the technical problem in the plant itself. Other reason for the interruption was the breakage of the canal by flood when the supply was interrupted for nearly a month. During intense rainfall and storms the plant was intentionally shut for safety reasons. Villagers were quite considerate to such shutdowns. Sometimes, interruption for about 3 to 10 minutes was frequent.

Given the lack of proper technical know-how of the operator, the concerns raised by the villagers were relevant. Although even a 3 to 10 minutes interruption can be problematic in the future when the end uses of electricity is diversified, it can be taken for granted for present situation. However, villagers cannot tolerate 5 to 10 days of interruption in power supply for long. Whether this is due to technical reasons in the plant itself due to shortcomings of the operators, it certainly raises a serious question about the sustainability of the plant in the long-run. Each time there has been technical problem, some costly equipment's have been replaced. For the time being, the plants installers were replacing it for free because such was the contract made with manufactures of plant. When contract period gets over, the villagers will have to pay for the equipment's as well as for the outside technicians for any further problem. This indeed will be a serious threat too MHP sustainability if the technical problems that had been observed continue its pattern. Hence, it will be in the best interest of the community that their operators are properly trained such that they can handle simple technical problems, thus, minimizing the power interruption.

5.14 Energy Usage in House

Houses having connection to electricity use general tungsten bulbs and as well as CFL lamps. Of the total 85% had 5 or lesser number of bulbs in their house whereas, 10% of the households used ranging in number from 3 to 10 per households. Less than 5% had kept more than 10 bulbs in their house.

Among these users, some 40% were using general tungsten bulbs only, 5% used CFL left only. The remaining 55% of the households had used the combination of both tungsten bulbs and CFL lamps.

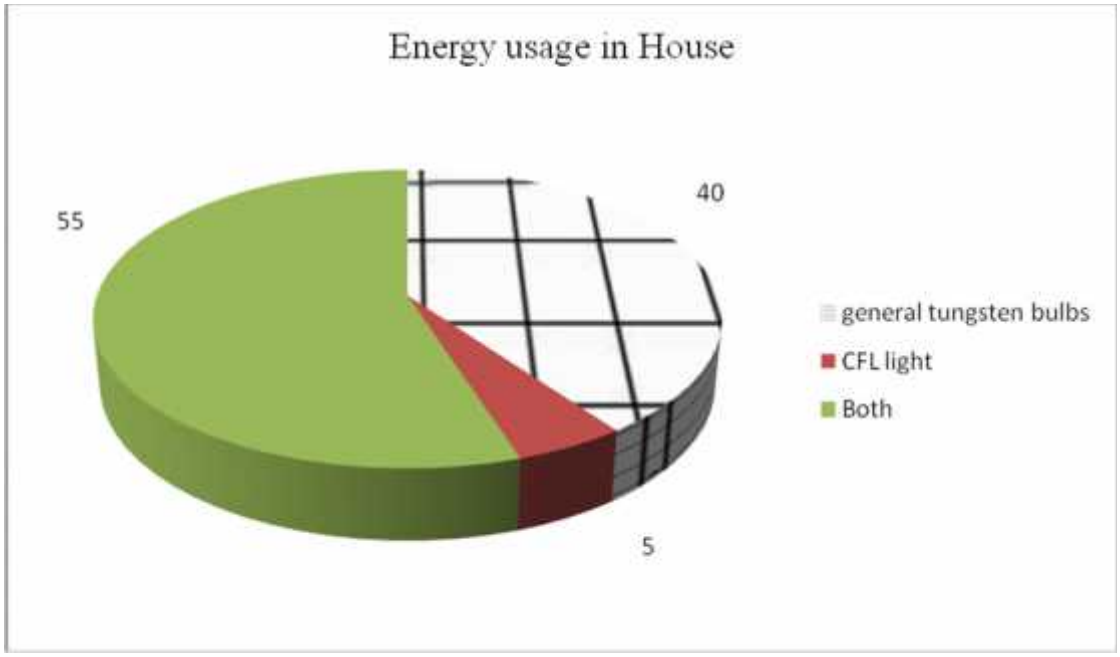

Figure 5.5: Types of Electric Lamp Used by Households

The average lighting hours for the households was 13 hours. It was depending on the seasons, they light the bulbs at 6 in the evening keep it as such up to 10. Some persons were also using lights in the early morning to do household chores and to offer puja etc. However, the use in the morning was limited to less than 2 hours for most households.

As for cooking purpose, they rely heavily on fuel wood. Fuel wood met the energy demands for cooking for 100% of the households. People who 100% gathered fuel wood. And the energy demand for entertainment was met though electricity and dry-cell batteries.

Households having less demand for lights used tungsten lamps only as cost of such bulbs are cheaper. However, households in need of additional lighting used a combination of both CFL and tungsten bulbs. Although, the cost of CFL is higher, it is more efficient in giving better quality lights by consuming less power. So the use of

CFL bulbs was popular in the village. The villagers had to use Tuki during the interrupted supply.

Those using smaller number of bulbs had smaller family size they were generally using tungsten bulbs, and the rating of power such bulbs were less than or equal to 25 Watt. On total, they were no exceeding 100 Watt power. Households using more than6 bulbs had a larger family size and more lighting requirement. Because of 100 Watt limit, they were using general tungsten lamps in combination with CFL lamps.

Nevertheless, some households had clearly exceeded this 100 Watt limit, and one family was found using up to 140 Watt, as it was supported by MCB.

Similarly, the use of television, radio, cassette player was during the evening and also during the daytime when the electricity was supplied for milling purpose. And households having enough fuel wood on their own farm. They were collecting the fuel wood from the community forestry.

5.15 Light Sufficiency

The 100 Watt power limit for each household was not sufficient for most of the houses. Some 25% respondent expressed the need for additional lighting in their house.

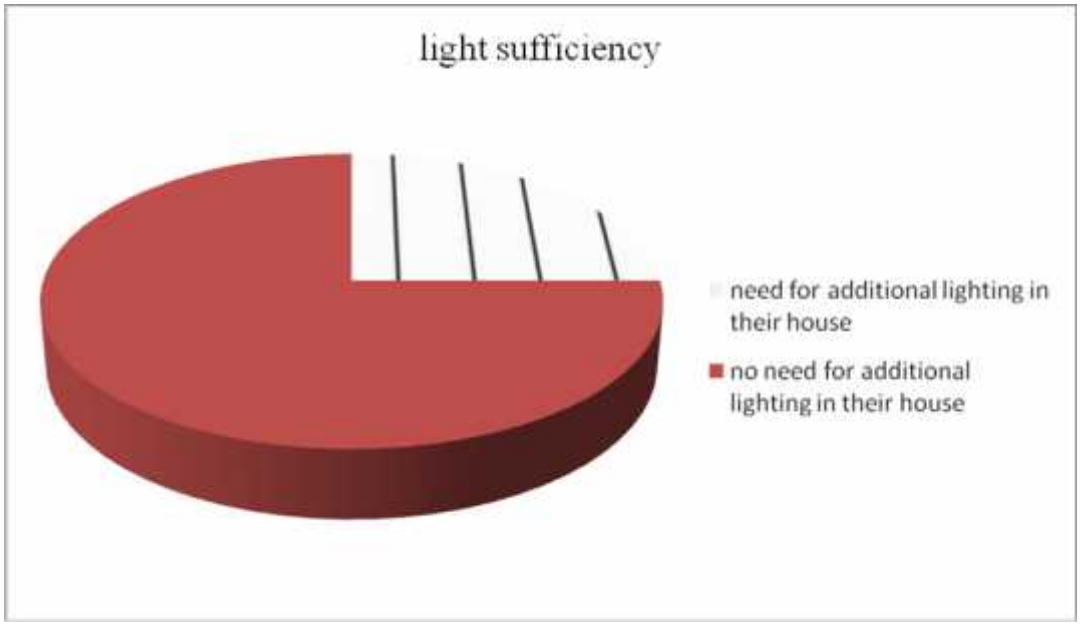

Figure 5.6: Light Sufficiency for Surveyed Households

Those who expressed such need for additional lighting usually had a larger family size were economically better off. Nevertheless, some of the households were found using power even up to 140 Watt, which was supported by MCB. Some of the family could not have afforded to replace the fused bulbs and hence had expressed the need for additional lights. At least one family had problem with MCB that did not support power more than 50 Watt although it was rated at 100 Watt support.

5.16 Replacement of Bulbs since the Installation

Around 70% of the interviewee said that they had replaced the bulbs one time or other. 30% had never replaced any bulbs within the operation period, which was less than one year.

Table 5.6: Households that had replaced Bulbs

	Total Households	Percent
Bulbs Replaced	35	70%
Bulbs Not replaced	15	30%
Total	50	100%

Source: Field Survey, 2014

Of those who had replaced the bulbs sometimes during the year had their average cost of replacement of NRs 90. Some 50% said it cost them from NRs.45 to75 for replacement. For around 20% of the households, the replacement cost ranged from NRs.50 to 100. For another, 15%, this cost ranged from NRs.150 to 200 and 15% respondents reported the cost of replacement greater than NRs.200.

Replacements of bulbs in 70% of the households surveyed indicate that there is a high rate of fusion in the bulbs. This can be attributed to fluctuating high voltage as well as to bad quality of bulbs. The cost of CFL bulbs was significantly higher than the tungsten bulbs. Although the replacement rate of bulbs was high, the cost of for the majority of households was still below NRs. 100, and thus of not much significant threat.

5.17 Socio-Economic Impacts

Socio-economic impacts of MHP included improvement in sanitation (90%), increase in local prestige (80%), Regarding local petty crime rate, 90%replied that it has remained the same. Actually, the village itself was very peaceful. Virtually everyone agreed that it had no effect on the emigration of people. However, 15% of the respondents agreed that MHP had solved the local unemployment problem to some extent and another 15% viewed that there was an increase in their small and cottage industry development.

The improvement in sanitation situation could be due to lights. People could now clean and sweep their houses as well as clean utensils in the evening. The increase in local prestige too is no surprise. The village is lightened during night while other surrounding villagers lived in darkness.

The impact was not much felt on local crime rate since the village itself was a peaceful one. Similarly, there was not much pronounced effect on solving local unemployment problem and neither on small industry development although potential do exist for such development in future.

Increase in Monetary Value of Properties

Since the installation of MHP, the monetary value of their land and other properties had increased as was suggested by some 80% of the respondents. A small portion of respondents (10%), attributed such increase in property values to MHP.

Clearly, the result shows that there were some other contributing factors besides the MHP that had increased their property-value.

Change in Population

The population of the village has increased since the installation of MHP in the village. But since there was little migration activities in the village, such increase in population could not be attributed to MHP.

Change in Production

The respondent had divided opinion on whether their production had increased as a result of MHP. And electrification. 60% respondents said that their income and productivity had increased. However, the remaining 40% of respondents had not had such experience. Those lacking sufficient on-farm production and income, relied heavily on working as wage labor in village as well as outside employment to meet their basic needs as well as to pay electricity tariff.

Cottage Industry Development

There were very few respondents who said that the MHP had increased the cottage industry development in the village. Even smaller was the fraction of people who had involvement in such industries.

Very little involvement of people in cottage industry was primarily due to their poor economic status. That is lack of fund precluded many of the eager villagers from deriving benefit from such involvement. There is indeed a potential in the MHP of the Lokhim VDC to promote and facilitate the small and cottage industry development.

5.18 Impact on Family Activities

The impact of MHP and rural electrification on family members was quantified during the survey. The impacts assessed included a change in work schedule, income generation, leisure activities, education, health and hygiene etc. The respondents were asked to reveal the changes they had experienced in their lifestyle and various other related aspects. The results obtained are as follows.

Impact on Men

The positive impacts perceived by men were the increase in their work schedule (75%), increase in access to entertainment and leisure activities (65%) increase in access to information and entertainment (40%). Although their daily working hours had increased, only 20% reported that their involvement in new income generation activities too had increased. Regarding health and hygiene, some 80% of the respondents agreed that the impact of rural electrification on their health was positive.

Impact on Women

Among women too, majority (70%) had experienced decrease in their sleeping hours, which somewhat correlated with the increase in daily working hours of most (80%) Women. 25% expressed the view that their access to entertainment and leisure activities had increased but for majority of women (55%), such access had decreased. With regard to new income generation activities, involvement of only 10% of women was seen. Similarly, increase in educational opportunities by reported by only 20% of women. However, some 70% women expressed the view that there have been improvements in their health and hygiene condition.

Impact on Children

The positive impacts of electrification as observed in children were the increase in education (90%), health and hygiene (90%), access to information (65%). Almost 85% of respondents said that the sleeping hours of children had decreased, whereas some 60% said that the daily working hours of children too had increased. The increase in entertainment and leisure activities was observed in 30% of children, while for 20% of children, such activities had decreased. There was virtually no change in the income generating activities of children.

Hence, the overall impact of MHP on family members is positive. Due to light they can now stay awake late during night to finish the household chores. This definitely will impact their generation of income during the working seasons. More works in the evening means that their sleeping hours was decreased. They now also enjoy more leisure activities, people had started buying radio, cassette player, television etc. for entertainment. Through these media, they can now get updated on the current world affairs and happening around the Nepal. More access to information will definitely help strengthen the democratization process in Nepal. Since, women had to do most of the household chores, their access to such media was comparatively lower than men and children.

The replacement of kerosene lamps by electricity means that they no longer faced the pollution caused by smoke and soot from traditional lamp. This in turn had improved their health status. Such impact was strongest on school going children. Now children could stay even late to study.

Meager increment in the new income generating activities may be due to the inadequacy of the users to derive the maximum benefit from electrification. This may also be due to the unavailability of necessary funds among users or due to their ignorance to such opportunities. In future it is hoped that as users increase their productivity and have more saving, more people will exploit such new opportunities. Certainly, giving more of the concessional loans to enthusiastic users help them in this regard. So, in reality, MHP do have the potentiality to involve more people in new income generation activities.

5.19 Economic Impact

All the respondents reported a decrease in kerosene consumption after electrification. Among who used dry cell bulbs, 70% reported a decrease in dry cell consumption, while for 20% of household the consumption remained same. However, some respondents reported in increase in consumption of dry cell batteries. For 80% of the respondents, the expense on bulbs and lights had increased while for remaining 20% the expense on such items had remained constant.

Table 5.7: Change in expenditure on fuel and Appliances

Expense on	**Increased**	**Decreased**	**No change**	**Total Respondents**
Kerosene	-	20	-	20
Dry cell batteries	1	7	2	10
Bulbs and tubes	16	-	4	20
Others	-	-	-	-
Total	17	27	8	50

Source: Field Survey, 2014

The decrease in kerosene consumption was the result of the replacement of traditional lights by electric bulbs. However, the frequent fusing of bulbs had increased their cost. The increase in dry cell consumption for the one respondent could be attributed to his high usage of radio, tapes during the day and night when electricity is not supplied.

5.20 Cost and Tariff

Of the total 45% of the respondents felt the present level of tariff very high for them, while 20% said that it was moderately high and the other 35% felt the cost to be average for them.

Usually the respondents who felt the tariff high had smaller family size and less need for electricity. Economically better off people, having higher demand for electricity felt the present level of tariff to be reasonable. The result obtained was quite expected one because of the distribution of power and mode of payment of tariff. Each household was given a 100 Watt power and each had to pay a flat NRs.100 per month and also charge according to sub-meter.

Among the respondents who felt the cost high wanted the tariff to be reduced by some was that since each had worked equally for the installation of MHP, hence their share of power should be equal. The other reason for this hesitation was the fact that in future when their family size house they have to pay an additional installation cost of about NRs.9000, which is supported to represent the labor contribution towards the MHP installation.

5.21 Involvement in MHP

Since the villagers themselves owned the MHP, all the users were involved in the MHP through various community organizations (CO), and functional groups (FG). One male and female from each household had involved in the community group. Other forms of involvement to the MHP was in the form of operator, secretary, manager etc.

This type of involvement is unique in its own regard. Equal participation of women implies that gender concerns are taken into consideration. Whenever, any decisions has to be made or any issues to be resolved, the view of the community is always honored. The saving made through COs help the needy villagers get financial support easily. Hence the facilitative role played by REDP to involve the community though participatory approach is one of the key factors the success of the program in the village.

5.22 New Opportunities brought by MHP

More than 80% of the respondents felt that MHP has indeed brought them new opportunities. However, the involvement of people in exploiting these new opportunities was quite small. Even significantly lower was the share of women in these new opportunities.

Some works they had recently started included, establishment of mill for husking and polishing of rice, poultry farming fishing, incense-stick making, etc.

5.23 Future plans of the Users of MHP

Many of the respondents said that they have thought about exploiting the new opportunities brought by MHP, and hence to promote their business and work. However, almost 50% said that they had such plan. Their new plants included installation of Grind mill (Grinder),Rural Carpentry, Rice Huller, Video Hall, Dairy, Photo Studio, Lokta, Computer Centre, sawmill, oil-expeller, sewing a

nd tailoring, poultry, livestock farming etc. However, they also raised many raised many constraints in this regard. Some of their concerns included, the unavailability of sufficient fund, lack of proper skill of time etc.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary

Energy is extremely important component in the development process for providing social and economic benefits to the people. It remains an essential ingredient of human progress and prosperity. Rural electrification is envisioned as a catalyst for socio-economic development of rural areas. Despite the country's huge hydropower potential, rural people are compelled to live in darkness. Low load factor, very limited use of electricity, lack of infrastructure and scattered settlements mean that electrification through grid extension is not a profitable venture for NEA and hence it is hesitant to extend its grid to such areas. However, a large number of small rivers and streams in such locations imply that enough electricity could be generated on smaller scale to meet the energy demands of the scattered hilly rural areas. Such a decentralized production of power is also in harmony with the subsistence nature of rural economies, which tend to be self- sufficient in basic needs .Hence, such production of power can spread the benefits to isolated rural communities.

Micro-Hydro power plants having a capacity less than 100 KW are classified as Micro- Hydro. The factors that have contributed to the development of Micro- programs to its present stage are, the relatively low cost of investment, short construction periods, indigenous technology and simple operation of the plant. The de-licensing of such plants and the incentives provided by government and the involvement of other national and international agencies also played a crucial role for its development.

Nevertheless, MHP are criticized on the grounds of low load factor and hence low financial return. However, the socio-economic and environmental benefits perceived by the communities should be given more value that the financial cost incurred.

The Lokhim VDC site was chosen for the study so as to ascertain and discuss about the socio-economic impacts, beneficial and adverse impacts of a community- owned MHP. READ has played a key role in the facilitation of the technology in this village

by involvement with the DDC, VDC and other agencies. Hence, to analyze the effectiveness of a community owned MHP, the Lokhim VDC site was chosen.

Multiple approaches were adopted to study the effects and impacts of a MHP. The literatures on Micro-Hydro project and also the policies, programs and plans were exhaustively reviewed. Both quantitative and analytical tools were used to investigate the situation. Key informants were consulted to discuss various issues pertaining to this sector. The study primarily focuses on how electrification through MHP in the hilly areas of rural Nepal have impacted the users. The situation of the villagers before and after electrification is hence compared.

The review of the policies and programs shows that there is a good intention on the part of the government to develop the Micro-Hydro project. Despite this, some of the statements on policies conflict with the good intentions of the government.

The study of the village showed that the majority of the villagers are happy with the newly installed MHP. However, they expressed the present level of tariff high for them. The frequent interruption in power supply due to technical problems and the inefficiency of the operators made them suspicious about the long-term sustainability of the plant. The villagers also expressed their interest to diversify the end-use of electricity through pump-irrigation and starting various new income generation activities. One of the salient features of this MHP is that each household shares an equal amount of power and pay equal tariff.

Energy should be developed as a means of alleviating poverty and reducing drudgery on the communities. Hence, the conventional “blanket approach” to technology dissemination need to be abandoned by the government and the line agencies. The current distribution system of power and tariff system need to be reviewed, because majority of the villagers expressed dissatisfaction on the existing tariff system.

Thus, prior to dissemination of any new technology in rural areas, the pre-feasibility as well as detailed feasibility studies needs to be carried out. The social, economic, culture and religious beliefs of the stakeholders and their willingness to adopt the new technology should be properly assessed. For community projects, the participatory approach to planning and implementation of implementation of community based

Micro-Hydro projects through participatory approach will bring fruitful results to the communities in the long run.

Several studies have been conducted to check the viability of the technology, mill services, operational and maintenance issues as well as performance evaluation of rural lighting program, their future prospects etc. A review of some of the past, studies has been made in this study to up-date the past information available. Although many areas were covered by these studies, there still remain enough areas for investigations especially when questions like who are the real beneficiaries and why have to be answered.

6.2 Conclusion

As Nepal has tremendous water resources, Micro-Hydro power is one of the prominent options for supplying the electricity for enhancing livelihood and human prosperity of the rural people.

On the basis of the reviewed of policies, plant, results and discussions as well as on the basis of literature review, various conclusions have been reached. The salient ones are presented below.

Given the diverse topographic features of Nepal and due to the uniqueness of each area, a decentralized energy system planning is the need to properly address the energy issue of the country. The establishment of AEPC and the periodic review and amendments of policies and programs shows that there is good intention on the part of government to develop the Micro-Hydro power project sector as a source of alternative energy for Nepal, particularly the rural areas. Although the current subsidy policy is not site specific, it has taken the remoteness of the plant into account by giving subsidy on transportation. Nevertheless, many loopholes still exist in these policies, which need to be adequately addressed.

With regard too Dudu Khola MHP, there is sufficient and quite reliable supply of water in the stream. Although, villagers are not quite satisfied with the tariff, they are very happy with the electrification of the village and take it as a source of prestige for the village.

Although READ has played a facilitative role in the establishment of the plant, the plant is owned, operated and managed by the community themselves. Hence every decision regarding the power distribution, price setting etc. is taken care by the villagers themselves. The involvement of male and female from each household in the Community Organization (CO) makes this plant even more unique than the others.

Through such involvement, it is aimed at addressing gender issues in the management of project. The fact is MHP has brought flexibility in gender role. Power-operated mills now replace traditional grinding and rice husking activities. Even though this has diversified the workload and saved time, some extra workload is added, particularly to women.

The lack of proper technical knows among the operators as well as the frequent technical problem in the plant is a source of concern. When something goes wrong in the plant, they have to visit Kathmandu for technical support. They were also found to be concerned about worn-out poles.

Frequent interruptions in electricity supply have hampered the daily lives of the villagers. There is no visible effect on the reduction in the consumption of fuel wood among villagers, although it has reduced the kerosene and dry cell consumption.

The present study concluded the maximum time save after installation of MHP. The research also came to conclude that the work efficiency (work time) for household was increased by 1 and half hour/day after installation of MHP. Likewise, important reasons behind the installation of MHP were for lighting, smokeless environment, kerosene fuel, education, better

6.3 Recommendations

On the basis of the analysis of this study, the following recommendation has made, which may help to further research that will be conducted in the same issue in the days to come.

6.3.1 For policy and Decision Makers

The policy should be revised periodically and refined in a timely manner, taking in to account the spatial and socio-economic diversity of the country. The subsidy policy should be given special consideration since this has been the main incentive on part of private investors as well as the community to install MHP Plants in various parts of the country.

The loan procedure should be simplified and made accessible to rural people. Provisions should be made such that even the poor and disadvantaged groups can borrow loans to involve income generating activities. Proper monitoring and evaluation of such loans should be done to ensure that beneficiaries do not misuse those loans.

The loan to MHP should be concessional, that is, lower interest rates on such loans. Provision of proper incentive for R&D should be made.

The establishment of repair stations in remote locations should be encouraged through incentives. Decentralized planning must be followed for successful implementation of Micro-Hydro projects because such technology tend to be site specific.

6.3.2 Community, Users, Operators, Managers

The log books should be kept for the plants. The databases must be maintained on various aspects like, problems, solutions, duration of use etc. The users must be motivated for proper management of power plant.

Specific programs for occupational castes and marginalized users should be designed to increase their capability to use power. The primary end use of the electricity is for lights. Other end uses are running small agro processing mills and small cottage industries. There is ample opportunity for further industrial use during the day and also during late nights when villagers do not need lights.

New income generation beneficiaries have generally been the wealthy families than for the poor and disadvantaged ones. The involvement of READ in this village is laudatory. Its program not only focuses on electrification but on the rural development as well.

Although many of the villagers want the tariff reduced and even the Micro-Hydro functional group was willing to do so, care must be taken that the tariff fixed in such a way that enough surplus net income is generated to cover major repair and depreciation cost and so on. The saving should be enough such that in future, they are able to replace the MHP plant with a new one as the need may arise.

Incentives need to be provided to the poor and disadvantaged group so that they also enjoy the electricity. Certainly reviewing the present system of power distribution and tariff collection will help many of the villagers in this regard.

The operators need to be motivated and supported to get additional training.

The saving of CO's need mobilization for various income generating activities that uses electricity. Especially, fund should be mobilized to the development and establishment of small and cottage industries. To encourage the utilization of off-peak power, incentives need to be given to industries for such utilization. Their tariff should be fixed on the basis of their energy use.

There need to be a constant exploration of new end use of electricity. Pump irrigation seems a viable option, so investment on such technologies has to be encouraged. Similarly, experimentation with Bijuli Dekchi, which has been successful at other location of the country, need to be encouraged.

6.3.3 Implementing Agencies

Diversification of end-uses, training in maintenance of technology and plant management must be focuses. Co-ordination between different facilitating and implementing agencies need to be established to minimize the cost, overlap, conflict and to avoid similar mistakes. Also monitoring and backstopping of MHP plants should be done regularly. Programs should be focus the deprived and poor section of the society. Energy system development programs should not be done in isolation. It should be actually aim at uplifting the overall living standards of the rural population. Similarly, the "blanket- approach" to technology should be avoided**.**

6.3.4 Other R&D Institutions

The main source of concern for many of MHP plants has been low-load factor. For the improvement of this situation, various products that are appropriate in the context of Nepal. One example of such a technology is the Low Voltage Cooking Pot (Bijuli Dekchi), which is being efficiently used in many areas of Nepal.

Other method of utilizing off-peak power would be to use air/water heat-storage cooker. It has a bank of packed pebbles, which is heated through electric element and heat stored at around 500 C. To use these for cooking or heating, air or water circulated through pebbles and supplied to the cooking chamber where it heats the pan. And many of these technologies are already available, more R&D and promotional efforts are needed to make such alternative applications more attractive and viable. Some modifications should be made in such equipment's and technologies such that it is suited for use in Nepali households.

Likewise, low power supply to households from many of the MHP, preclude its end-use for household cooking purpose. To overcome this situation new technologies need to be evolved. For instance, the slack-period electricity can be used to electrolyze water. Hydrogen derived from such process can be used for household cooking. Experiments done with this technologies elsewhere have been shown promising. However, to suit the Nepalese situation, R&D institutions must be involved in proper experimentation with these technologies, if Micro-Hydro project is truly envisioned to be viable option as an alternative source of energy.

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Annexs

Respondent No.

A.PERSONAL

NAME:

AGE: SEX:

ADDRESS(Permanent)

MUNICIPALITY/VDC: WARD NO. DISTRICT:

Village:

General Information:

B. OF FAMILY QUESTIONNAIRE:

1) What is the size and structure of your family?

a. Joint/Nuclear b. No. of members:

c. Parents:mother/father/both/none alive_____

2)What kind of occupation does your family do?

a. Agriculture b. Wage labour c. Domestic worker d.Service (govt./private)

c. Business d.Animal husbandry

Establish date of MHP:_____

C.LOCATION AND OWNERSHIP

1) Name/Identity of MHP:_____

2) Type of Ownership (1) Community (2) Co-operative (3) Partnership (4) Other (mention)_____

3) Travel Route:

Road name:_____ point of Disembarkkation(road head):_____walking distance to location (km):_____walk hours_____other relevant travel information:_____

4) When did you connected to electricity

D. RDUCATIONAL AND PERSONAL MATTERS.

1) Please give the information of education status of your family member above 5 years of age?

Status of Literacy	Male	Female
Formal Education		
Bachelor and above		
S.L.C. and iner		
6-10		
1-5		
Non-formal Education		
Literate (read and write)		
Illiterate		

2 What are the major and secondary occupation or income sources and amounts of your family before and after MHP above 16 years?

S.N	Major Befor MHP occupation	Income Amount	After MHP Occupation	Income Amount	Secondary BeforeMHP Occupation	Income	After MHP Occupation	Income Amount
1	Agriculture							
2	Wage Labor(Ag)							
3	Wage Labor(Non Ag)							
4	Animal Husbandry							
5	Business/Trade							
6	Government job							
7	NGO job							
8	Remittance foreign job							
9.	Traditional skill based work							

3) Do you have own land?

a. Yes b. No

4) How many rooms in your home?

a. 1 b.2 c.3 d. 4

5) What kind of crops do you cultivate? And give annual production and sold quantity, it market price per unit?

Name of crops	Unit	Total production	Self consume	Sell out	Annual Incme(Rs.)
Maize(Muri/kg)					
Millet(Muri/kg)					
Wheat(Muri/kg)					
Rice/Paddy(Muri/kg)					

Pulse (Muri/kg)					
Mustard(Muri/kg)					
Potato9Muri/kg)					
Others					

6) How many animal do have have?

Animal Type	Number	Self Consume	Sold out
Ox/Cow			
Buffalo			
Pig			
Hen			
Goat/ Sheep			
Others			

E. Energy source for lighting before Installation:

1)

S.N	Before Installation of MHP
1.	Kerosene
2.	Diesel
3.	Battery

2) Uses of Electricity after Installation of MHP:

S.N	Uses of Electricity
1.	Lighting
2.	Agro-processing
3.	Income generation
4.	Others

3) How do you contribute during the plant construction?

a. Cash b. Labor c. Both

4) While Electricity produced from Dudu Khola what will be impact on community people?

a. Agriculture b. Drinking water c. Business.

d. Socio-economic e. Environment f. All above.

3) Please mention the use of Energy for various activities sector before and after MHP.

S.N	Activities	Before MHP	After MHP	Increased	Decrease	Same
1.	Cooking					
2.	Pot cleaning					
3.	Look after child & elder age					
4.	Water collection					
5.	Fuel					
6.	Others					

4) Tick the Electrical instruments/appliances used in household before and after Installation.

S.N	Appliances	Before MHP	After MHP
1.	Radio		
2.	T.V		
3.	Multi fuel stove		
4.	Others		

5) Please mention fill the ownership/use of electrical instrument before and after MHP.

S.N	Items	Before MHP	After MHP	Change Increased/Decreased.
1.	Radio			
2.	T.V			
3.	Satellite			
4.	Battery charger			
5.	Pickle expellee			
6.	Rice cooker			
7.	Multi fuel stove			
8.	Others			

6) please mention the change in working hours of male and female in day and night after MHP.

S.N	Change Status	Male		Female	
		Day	Night	Day	Night
1.	Increased hours				
2.	Decreased hours				
3.	Same hours				

7) Please mention the change in studying time during night after MHP Installation.

S.N	Changed status	Hours/day
1.	Increased	
2.	Decreased	
3.	Same	

8) Please fill the sources of Information about MHP.

S.N	Sources of Information	Tick	Remarks
1.	Radio		
2.	Relative/ Neighborhood		
3.	MHP related company		
4.	Others		

9) What are your top five major purposes using electricity?

S.N	Purposes	Rank (Top 1 to 5)
1.	Lighting	
2.	Kerosene Fuel save	
3.	Income generating	
4.	To save forest reduce	
5.	Social status	

F. Impacts of MHP:

What Changes have you experienced in your household after the connection of electricity through MHP.

Impact on Family Members:

Impacts	Men	Women	Children
Daily work schedule			
Sleeping hours			
Walking time			
Access to information			
Access to entertainment			
Leisure activities			
Education			
Health and hygiene			
Income generating activities			
Others			

Impact on Socio-economic:

Impacts	Increased	Decreased	No change
Local petty crime rate			
Sanitation			
Local prestige			
Out-migration for employment			
Local unemployment problem			
Small industries development			
Others			

Impacts on Economic:

Expenses on	Increased	Decreased	Same
Kerosene			
Candles			
Dry cell batteries			
Bulbs and tubes			
Others			

G. Income Generating Activities:

1) Please write information about Involvement of male and female in income generating activities before and after MHP Installation?

S.N	Income generating program	Before MHP		Remarks	After MHP		Remarks
		Male	Female		Male	Female	
1.	Agro-processing						
2.	Small and Cottage industries/Business						
3.	Saving and Co-operative						
	Others						

2) Have you taken loan for any income generating works after Installation of MHP?

a. Yes b. No

If Yes, from where_____ how much_____ Interest rate____

Have you paid it?

a. Yes b. No c. Under Installment payment_____

3) Purpose of taking loan?_____

4) Have you taken loan in MHP electrification process?

a. Yes b. No

If Yes, from where_____ how much_____ Interest rate_____

Under Instalment payment_____

Have you paid it? Yes,_____

No_____

5) Since the installation of MHP, has the monetary value of properties increased?

a. Yes b. No

6) Has MHP increased the cottage industries & Micro-enterprise development in your family?

a. Yes b. No

If Yes, What type of industries/micro-enterprise.

i) Ii) iii)

7) Has MHP increased your income/ production?

H.Time of electricity provide from MHP

1) In the time saved, have you started new occupation?

a. Yes b. No

If Yes, enumerate works i) ii) iii)

Who does these works?

Male

Female

Time_____ Morning_____Afternoon_____Evening_____

2)Would the community have preferred to be on the national grid rather than receiving power from the MHP?

a. Yes b. No c.Don't know

Reason:_____-

3)How many hours of manual labor used for grinding/ husking saved per day by women and children before and after MHP installation?

Before MHP Installation	After MHP Installation
-	-

I.Environmental Problems

!) Has there been any positive/ Negative environment Impacts?

a.Yes b. No

Positive impacts:_____

Negative impacts (Specify):_____

2) Is there any water right conflict before MHP installation?

a. Yes b.No

J. Problems

1) Has MHP damaged the agricultural field (Khet/baari) during construction of MHP?

a. Yes b. No.

2) Has someone lost his/her Khet/baari due to MHP?

3) If Yes, how much Khet and baari?_____

Total area:_____ Tentative cost:_____

Is there any conflict?

a. Yes b.No.

4) Compensation been paid?

a. Yes b. No

5) Have landslide problems in canal existed before MHP implementation?

If Yes, Why such site had been selected?

If Landslide problems came after MHP implementation then what are the causes?_____