SOCIO-ECONOMIC IMPACT OF SMALL HYDROPOWER PROJECT

(A case study of the Sunkoshi Small Hydropower Project, Sindhupalchok District, Nepal)

A Dissertation

Submitted to:

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Submitted by:

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RECOMMENDATION

It is certified that Mr. **Kabi Raj Paudel** has completed his dissertation entitled "**SOCIO-ECONOMIC IMPACT OF SMALL HYDROPOWER PROJECT"** (A case study of the Sunkoshi Small Hydropower Project, Sindupalchock, Nepal) under my guidance and supervision. To the best of my knowledge, the study brings out very useful information pertaining to the small hydropower development project. I, therefore, would like to recommend it for final evaluation and approval.

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APPROVAL LETTER

The Evaluation Committee has approved this dissertation entitled **"Socio-Economic Impact of Small Hydropower Project"** (A case study of the Sunkoshi Small Hydropower Project, Sindhupalchok, Nepal) submitted by Mr. Kabi Raj Paudel for the partial fulfillment of the requirement for the Degree of Master of Arts in Sociology.

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ABBREVIATIONS

ADB\N-	Agriculture Development Bank, Nepal
AP-	After Implement of the Project
BP-	Before Implement of the Project
CBOS-	Community Based Organizations
CUGS-	Community User Groups
DDC-	District Development Committee
DOED-	Department Of Electricity Development
HHs-	Households
ES-	Economic Survey
ESAP-	Energy Support Assistance Program
FUGs-	Forest User Groups
FY-	Fiscal Year
GON-	Government of Nepal
HEP-	Hydro-Electricity Project
INPS-	Integrated Nepal's Power System
IREF-	Interim Rural Energy Fund
ICIMOD-	International Center for Integrated Mountain Development
INGO-	International Non-Government Organization
IPP-	Independent Power Producer
INPS-	Integrated Nepal Power System
Km.-	Kilometer
KW-	Kilo Watt
MHP-	Micro-Hydropower Project
MOWR-	Ministry Of Water Resources
MW-	Mega Watt
NEA-	Nepal Electricity Authority
NGO-	Non-Government Organization
NIPS-	Nepal Integrated Power System
NPC-	National Planning Commission
NOC-	Nepal Oil Corporation
NRN-	Non-Resident Nepali
P. Ltd.-	Private Limited

PPA-	Power Purchasing Agreement
PAFs-	Project Affected Families
PRSP-	Poverty Reduction Strategy Paper
REDP-	Rural Energy Development Programs
SAARC-	South Asian Association of Regional Cooperation
SHDB-	Small Hydropower Development Board
SHMP-	Small Hydropower Master Plan Project
SHP-	Small Hydropower Project
SN-	Serial Number
SSHP-	Sunkoshi Small Hydropower Project
TV-	Television
UN-	United Nation
UNDP-	United Nation Development Program
UNIDO-	United Nation Industrial Development Organization
VDC-	Village Development Committee
Vol.-	Volume
WECS-	Water and Energy Commission Secretaria

Chapter-I

INTRODUCTION

1.1 Background of the Study

Nepal has an abundant water resource. It is estimated that 2.27% of the world's total hydropower potentially is in Nepal (NPC-2002-07).The total potential power of water of Nepal has been estimate roughly about 83,000MW, of which 42,750MW is economically feasible. At the end of FY2004/05, a total of 556.800 MW hydropower was generate from various projects of the country which is only 0.67 percent compared to total capacity. Similarly, production of thermal power and solar power has been 56.756 MW and 100 KW respectively. Altogether, total electricity production reached 613.557 MW. As of now, all 75 districts of Nepal have access to electricity with reference of Economic Survey 2005/06. The availability of electricity contributes significantly to the overall development of the country on the one hand, and its consumption reflects the economic condition of the other hands. Therefore, it has become highly important to harness the abundant water resources to generate electricity of the development of Nepal.

Nepal is a water-rich country. It is the second richest country in water resources in the world after Brazil. Water is the only potential source of water in Nepal. It can be used in both generating electricity and running water mills. Fortunately, Nepal is endowed with large number of potential rivers, which if harnessed, can supply an immense power the country needs for its development. But very little efforts have been made towards harnessing water resources and developing hydropower. Irrigation, drinking water supply and hydropower are the three prime sectors of water use in Nepal. Hydropower is non-consumptive category of water use.

By water, we can generate electric power. Hydropower means electricity produced from generators that are dividend by hydraulic turbines. Since Nepal

has relatively abundance of fresh water, it gives rises to its comparative advantages in hydroelectricity generation and year round irrigation. Thus, irrigation and hydroelectricity can play a leading role in the development and modernization of Nepal. The common sense idea behind this notion is that both electricity and water can become cheap inputs in the production process, such as electricity for manufacturing industries and water for irrigated agriculture. The tragedy, however, is that the planners and policy makers have largely ignored the hydroelectric potential, the main comparative advantage of Nepal.

The strong need of hydropower development in Nepal lies under the fact that hydropower based economic growth can be promoted only when the electricity generated from water is domestically used for "value addition" and then exported the manufactured goods that will be cheaper or competitive. It is due to lower input price of electrical energy used in manufacturing, which will ensure the fulfillment of the dream of high economic growth rate through the dream of high economic growth rate through the generation of income and employment.

Generation of extra revenue, growth of socio-economic development and improvement in quality of life are the positive impacts of hydropower development. Electricity plays a crucial role in the balance development of agriculture, industry and other sectors. It is necessary to supply power at reasonable price and its effective consumption is also equally important. It is an irony that majority of the country’s population resides in rural areas, whereas transmission lines share in the electricity supplied in the country is grabbed by urban consumers. Therefore, to keeping in mind the fact that country’s all-round equitable development is possible only if electricity supply is made available to the development of the agro industries, irrigation and cottage industries in rural areas, it is imperative to put a special emphasis on rural areas electrification at a large scale.

It is frequently argued that water resources are the back bone of the Nepalese economy, which could be industrial to provide a new lease of life to sinking economy. But it is very sad and misfortunate enough to know that efforts

towards harnessing water resources and developing hydropower have been sluggish with inordinately low production of electricity (613 MW) in Nepal, which is only o.6 percent of total theoretical hydropower potential and 1.3 percent of commercial potential. The poor level of hydropower generation is primarily due to financial resources constraints and inherent delays in project implementation. Nepal's electricity tariff rate is considered to be one of the highest in the region and the domestic electricity charge one of the major cost items in household expenditures (WECS, 2002).

Small hydropower is increasingly finding wide application in many countries of the world; both developed and developing. Small hydro-plant offers several advantages in today's energy markets. It has little or adverse environmental impact; effects on stream ecology are minor ideally - a small hydro system may serve other purposes in addition to power such as water supply, flood control, irrigation and recreation(UN-1982). The role of small and micro-hydropower schemes is significant in extending the electric energy consumption to the rural areas. Due to various factor the extension of transmission lines to the remote villages where the most of the population lives is very costly, therefore, in these cases micro hydro schemes are playing a crucial role.

Hydropower in Nepal has been used in two forms-Mechanical and Electrical. The practice of use of hydropower in the form of mechanical energy in traditional water propelled mills, called Ghattas, goes to time immemorial. However, the first hydropower plant to generate electricity was established in 1911AD with the capacity of 500KW Pharping hydropower plant that was established solely to caster electricity needs of then ruling Rana family of Nepal. For many years, this powerhouse fulfilled the demand of Kathmandu Valley, which was supplemented in 1935 by the constructions of the Sundarijal hydropower station with an installed capacity of 640KW. Till the year 1968, electricity supply to the capital city Kathmandu was served solely by small hydro plants of Sundarijal (640KW) and Panauti (2400KW). After the construction of Mahendra Distal power house with an installed capacity of 1728KW in 1950s, a rapid power development was seen. Electrification

process seems actually have increased up long after the establishments of the democracy in the country. In the fiscal year 2005/06, NEA shows that Nepal's installed hydro-generation capacity is 612.439 MW, of this total power the private sector plans contribute 148.283 MW and the small hydropower existing capacity is 12.792 MW.

For a long time in the past, there was a controversy as to whether the private or public sector should be give priority while lunching development programmers. In Nepal 'Nepal Electricity Authority' is only one authorities monitoring companies of hydropower development sectors, which will continue to encourage private developers to add generation capacity to the power system (NEA2005/6). In addition, connection agreement has been developed and experimented for facility the interconnection of IPPs with the NEA power system. NEA will monitor the progress of the projects for which PPA have been signed (NEA2005/6). Since the hydropower projects developed by the private sectors are essentially run-of –the river (ROR) type, a storage plant is required to maintain the balance between supply and demand. In this regard, NEA will direct its efforts towards developing a storage plant of adequate capacity to bridge the gap between supply and demand in the long run.

Although electricity is being brought to some communities, industries and farms from large central power stations and though 'grid' systems, the part to be played by small generating plants in pioneer electrification work is greater than ever. In developing countries comparatively small parts will often suffice to serve the early needs of the larger towns, even of the capital city. Later the growing demands of these places will justify the installation of larger, more sophisticated and more efficient plants; perhaps ever the intercommunion of two or more townships to form the rudiments of a grid. When this happens it will often be possible to take up the earlier plants from their foundations and to remove them to small or more remote caters of population to perform useful pioneer work further and father into the heart of the country. Even in highly developed countries, small power plants serve an important function in remote places. In developing countries they may serve an important function in

remote place. In developing countries they may serve a spearhead in the electrification process-conditions which are not continue to the early establishment of 'grid' system and townships are likely to remain electrically isolated from one another for a long time small or comparatively small and micro plants can be play an even greater part in such countries than in compact, densely populated lands.

Integrated Nepal Power System (INPS) experienced energy demand of 3134 GWh in FY 2006\07 recording an increase of 8.60% compared to previews year. NEA managed to serve 3051.82 GWh of this demand through various sources. With contribution of 1747 GWh from hydropower and 13.31 GWh from thermal, NEA's own generation reached a record of 1760.73 GWh in FY 2006\07 registering 11.12 % increase compared to previous year (NEA-2007). Power purchase from private producers was 962.26 GWh and import from India amounted to 328.83 GWh. The import increased by nearly 24 % in YF 2006\07. Similarly, peak power demand recoded in FY 2006\07 was 648.39 MW, which is an increase of 7.48% compared to that of the previous year. Generation capacity increased by 4.43 MW though 2 IPP projects in FY 2006\07. NEA forced to opt for load shedding as a last resort to contain the demand that could not be met.

In order to encourage private sector participation in the power sector, GoN has been facilitating the purchase of power from IPPs to meet the growing demand of electricity in the country. The IPP owned 3.45 MW Khudi Khola and 980 kW Baramchi Small Hydroelectricity Projects have started commercial operation from this FY 2006\07 NEA has signed eight Power Purchase Agreements (PPA) with a total capacity of 11.434 MW in the same period.

1.2 Statement of the Problem

Although Nepal's has a huge potentiality of energy resources, it could not fulfill the demand of the Nation. Electricity is available to only about 40per cent of total population (PRSP-2005). Energy is divided into categories according to its sources viz., traditional, commercial and renewable; traditional, commercial and renewable energy occupied 86.71 percent, 12.72 percent and 0.56 percent respectively in Economic Survey 2005/06. The overall energy consumption of Nepal is largely dominated by the use of traditional non commercial forms of energy such as fuel woods, agricultural residues and animal waste but this is in the decreasing trends, this shows that Nepalese economy heavily relies on traditional sources of energy as in the previous year. In this way to fulfill the demand of commercial energy the private sector participation in the production of electricity has been found encouraging in Economic Survey 2005/06.

It is not possible to generate, supply and export electricity only from the public sector. Therefore, it is necessary to involve the both domestic and foreign private investors. Private power producers are playing a crucial role in the development of hydropower sector and minimizing the demand. The efficiency in generation and distribution is increase because of private producers. Hydropower development policy 1992 has openly encouraged the private parties to invest in this sector assuring all the facilities and stability. Beside this in order to encourage local investment in smaller hydropower, up to 50MW of power produce from IPP promoted. Project will be purchase by NEA at pre-dominated tariff rates dominated in local currencies (NEA2002).

Over the past years, Nepal has been experiencing huge shortage of power. Load shedding is common phenomenon. Each year the power is increasing at the rate of 35MW, but in near future there is no way to meet the power shortage in the urban or remote areas, of the country because no plant of medium or mega size could be built in the country until the end of the current century. The few power plants that excise in the country today are not in the position to increase their production capacity; the need for increasing power

through the small hydropower projects (SHPS) is therefore not only desirable but essential.

To better understand the role of water on Nepal's development efforts, it is necessary to probe into the natural asset. Large-scale anthropogenic remolding of the environment from its natural state is more of a social than an engineering problem. A social system can manipulate its surrounding environment to a high degree. The environmental goods and services so procured can be harvested or mined, depending on the degree of local uses of the resource. For example, the American Indians had a high degree of local use of resources with practically no manipulation of nature. Such a change in the scale of social involvement requires commensurate changes in the prevailing social philosophy, which should be translated into the actions of everyday life through some form of sociopolitical consensus. External institutions in a society are a reflection of internal ideas. Technology derives from a favorable set of social attitudes and conditions (Gyanwali, 2001).

The development activities should be going ahead together with local people's needs and their attitude. If the development activities cannot meet their needs and attitude, the project cannot success to implement in long time. So today's the community-based development activities are successfully running. The hydropower development project is directly concern with local people. Who live in the impact area of the project, they are using naturals resources by traditional knowledge and technology as Pani Ghattas, Pani Mills and irrigation system. Because of the modern technology and skills their indigenous knowledge might be effect and looses, which directly impact their social and economic life as well as Pani Ghattas, mills and irrigation.

People's attitude towards privatization has also undergone changed all over the world. In Nepal, a greater role is attributed to the private sector in the various development activities, including the small hydropower sector. The private sector also benefited by taking the small hydropower plants on lease. On the one hand, it has helped to grow entrepreneurship in the private sector and the other hand new management skill is developing. It is due to the

factors that the condition of the small hydropower given on lease is by the large satisfactory.

1.3 Research Questions

This study is mainly based on these questions

(a) Has project done effects or changes in effected people life style?

(b) What are the mains impact areas and issues of the SSHP project?

(c) What are the effected people perception about project works and its impact?

1.4 Objectives

The general objective of the study is to assess the socio-economic impact of SSHP affected area of Sindupalchok. In addition, the objective is to evaluate the expectation and perception about this project before and after implementation.

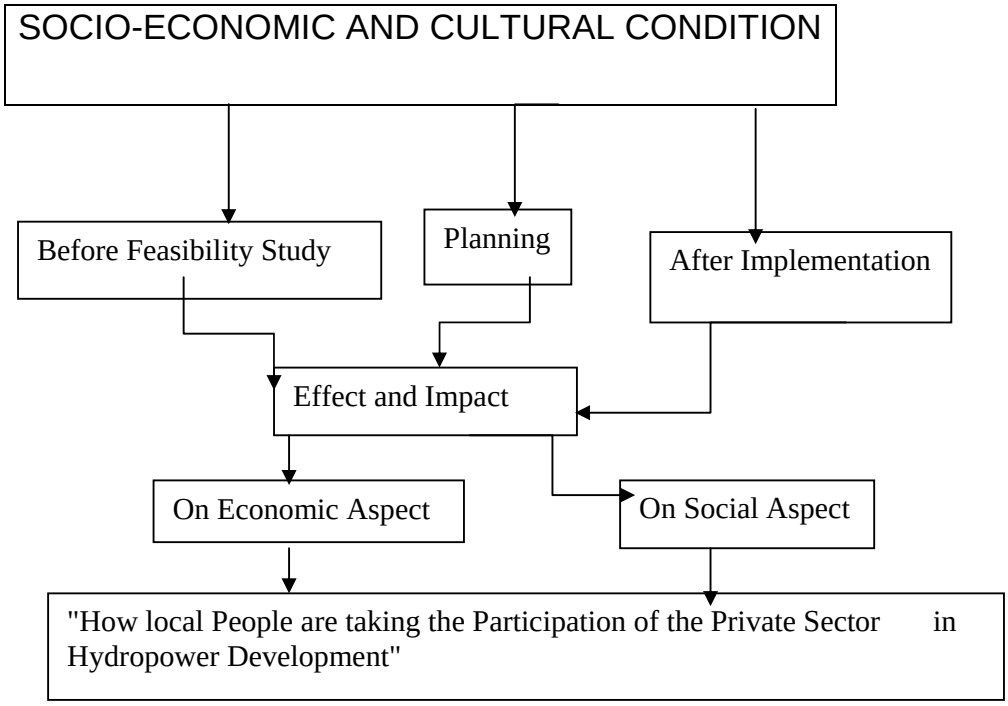
1) To describe the socio-economic characteristic of people at the project site of the SSHP in Sindupalchok district.
2) Find out the attitude of local people affected by SSHP.
3) To identify the mechanism of SSHP and its impact to the daily life of local people

1.5 Theoretical and Conceptual Framework

In this study, the development theory is most suitable for theoretical framework. Development is a process, which enables human being to realize their potential bled self-confidence and lead life's of dignity and fulfillment. It is a process, which fringes people from the rear they want and exploitation. It is a movement away from political, economic and social oppression through development. Present development practice and theory holds the notion that: cultural aspects should receive the central important the development process. Society is a multicultural entity and differences in the norms, values, world views, of local people should be recognize. Development is understood different people are different way of thinking not only developing countries but

also developed. In the development practices, the local people participation is most needs for sustainable development. During the past three decades, the developing world has made considerable economic and social progress. This is evident in both rising income and consumption levels and broad measures of well-being such as life expectancy and educational attainment. At the same time development policies have had different effects on the social and economic well-being of communities, household, and individual over a fairly wide time span (WB1990).

The impact study focuses primarily on how the local rural people take this development project. What is impact after the project? The term impact is often use as synonym to effect. However, there is a subtle difference in the meaning. Impact more relates to quality while effect is measure in quantity. Impact therefore is noticed in the long term. The study will be conduct with this concept. Social impact assessment is a means of investigating and countering these difficulties and should be welcomed in spite of its weaknesses. It can assist researchers in understanding the processes and can help guide the management of social change in advance of implementation of proposed development (Barrow-2001).



1.6 Significance of the Study

The pattern of natural sources of the energy is divided into broad two parts 'Traditional and commercial'. For the search of commercial use of sources, there are disappearing the traditional patterns of use like Ghattas, water mills, irrigation system. On the one hand they lost these traditional type of technology and the others hand they got the modern development activities like as road, electricity, and others. In this situation how to grab the development practices, it is most significant to study.

Many project have been operated for the project is succeeding in terms of end-use efficiency, how for it effects for the up-lift in the life of rural poor, how far the project is succeeding in the terms of overall socio-economic up-lift of rural people in their perception (ultra poor in particular) are leading issues that have been tried to assess by this study. How the project addressed local people needs and their perception has been significantly studies on it.

Socio-economic study is undertaken for all hydro projects in order to coordinate with other sectors for the use of electricity. Monitoring and impact study of SHDPS been under taken to assess the social and economic benefits from electrification such as productivity improvement, employment generation and diversification of products etc. It's often deals with a very broad range of things, and to do so comprehensively and accurately is not easy. Impacts may be felt at the individual level, family level, community level, regional level, national level or even international level.

CHAPTER-II

THE LITERATURE REVIEW

There are different scholar's reports and academician who contributed to the literatures on power development. The relevant studies reports on SHP have been reviewed in this study. Of several literatures about SHP of Nepal, only some of them, which are relevant to the study, have been focused in detail.

The Water Resource Strategy Nepal (2002), emphasizes the creation of enabling environments that allows the hydropower sub-sector to meet domestic need as demanded, while laying the groundwork for viable export of hydropower-based electricity. In the following ten years, substantial benefit has been realized by maximizing hydropower development for different markets, including energy intensive industries and power exports. By the end of 25 years, the hydropower potential of the country would optimally develop.

The highest strategic priority is to meet Nepal's domestic need for electricity at affordable costs. This is an immediate need and the actions required to accomplish it are largely under national control. The strategy seeks to reduce costs as well as deliver cheap power to consume. The strategy is to identify and implement hydropower plants with high head, high sustained base flow throughout the year, fewer seasonal hydrological fluctuations, lower sediment load and dependable geology.

Development of hydropower is essentially a very capital-intensive affair. So Nepal must attract private sector investment in hydropower generation, transmission and distribution, to meet forecasted demand for electricity. Nepal has promulgated various acts and regulations to attract private investors, by virtue of which several IIPs have come forward to develop hydropower project. However, in view of growing electricity demands and the need to attract more private sector investments, these acts and regulations are considered to be inadequate. With the Cabinet approval of the Hydropower Development Policy in December 2001, the process of revising the Electricity Act and Regulations can be expedited.

Nepal Electricity Authority- (2005/2006), had hopes together momentum for economic growth and move towards the process of development. The rebuilding of the economy and the nation as a whole is about to begin. NEA now have to play a bigger and more constructive role than ever to support the energy needs that propel the rebuilding process of the economy. In order to meet the energy demands, NEA continue to encourage private developers to add generation capacity to the power system. And a connection agreement has been developed and implemented for facilitating the interconnection of Pips with the NEA power system.

The peak demand of the integrated Nepal power system (Pips) increased by over 8.21% while the demand for energy grew by 7.71% in the past year despite the fact that the performance of the industrial and tourism sectors was far from being satisfactory. The biggest challenge facing NEA in the present context is the lack of capital for investment in its expansion activities. There has been no significant additional investment from donors as well as from the private sector for expansion of generation and transmission facilities apart from the financing by the government for expansion in rural electrification.

The system peak of the interconnected system was recorded on January 2, 2006 and reached a new high of 603.28 MW registering an increase of 8.21 % over the previous year. The cumulative electrical energy available for use within the NEA system totaled 2,777.42, GHz, an increase of 5.10 % over the previous year's available energy of 2, 642, 75 GHz. The total number of customers at the end of the fiscal year 2005/06 stood at 1,279,902 registering an increase of 120,047(10.35 %) previous year. The domestic category accoutered for 96.08 %of the total customers, industrial category accounted for o.48 % and the non-commercial category for 0.78 %. NEA continues its engagement in rural electrification programs for energy needs of the rural masses to uplift their economic standards through the Government of Nepal (GoN) as well as donor assisted schemes.

WECS- (1993), had carried outmode advantages to the use of alternative energy. It finds that it is an appropriate scale; these can provide cleaner energy and are comparatively begun as regards their effect on the environment. Moreover, Nepal’s rural economy does not provide enough

economic basic for large-scale investment for the exploitation of vast hydropower potentials. In this context, alternative energy can play the role of a catalyst in rural development by providing a modern form of energy. It can effectively help in redacting the drudgery of the rural population and cutting down the time required to collect and use traditional form of energy of such as fuel wood, animal wastes etc; provide a cleaner cooking and lighting environmental to rural women; combat the environmental effects of co2 emission, forest depletion etc; by redacting and replacing the use of the traditional as well as commercial forms of energy. Save convertible currency, resources by substituting improved fuel and has the potential to create the rural employment and increase productivity.

Kumar and Sharma- (1999), have studied on “Small Hydropower” it's mainly focused on the traditional use of water as wheels, Ghattas, water mills, which are very old design and work at very low efficiencies. Water wheels, commonly known as 'Ghattas' have traditionally been used in the mountain areas of the Himalayan and sub-Himalayan regions from ancient times. In the Himalayan region, the main economic activities of the population are still based on agriculture. That why the small-scale hydropower generation is much more effective and efficiency for the energy sources.

Holland- (1983), has emphasized that due to the high and steep topography creates favorable condition for the development. The development of MHP through small streams and runlets to fulfill the rural areas demand in affordable price in the accessible and different mountain terrain where there settlement are scattered and limited few favorable sites. The importance of MHP is in alleviation and rural poverty. In general, to solve electricity problem is to great extent in the development and infrastructure of the country.

According to Goodman, Hawkins and Love- (1981), Water is, thus, only renewable energy source already exploited by man on a large scale with a well-developed technological base to support its continued exploitation. Hydropower is, in fact, a form of no depleting, self-replenishing energy. It is usually the cheapest form of bulk energy; and, in most cases, it is also the

most efficient and least polluting form of power. Hydropower fueled the industrial revolution in England and powered much of the northeast united state until the 1930s and 1940s, when cheap fossil fuel changed the economics of power production, hydroelectric power as part of the solution to the world's energy crisis. The history of small-scale hydroelectric development can provide sound suggestions for helping rural areas of both developed and developing countries achieve an improved standard of life.

Small hydropower plants offer several advantages for today's energy market. Facilities are small and can be both environmentally and aesthetically acceptable. Effects upon steam ecology are minor compared to those caused by large hydropower facilities. And small scales plants may enhance the streams by maintaining water depths sufficient to support aquatic life. Moreover, technology for hydropower plants is well established, and required components are available throughout private industry. Ideally, a small hydro system should serve several purposes in addition to power, such as water supply, flood control, irrigation, and recreation.

ICIMOD- (1991), had prepared for the presented at the seminar on 'Rural Energy and Related technologies, held in Kathmandu from 26 to 28 March, 1991. This paper assesses the development of the micro-hydro systems since the last sixteen years, identifies factors that contributed to the success of this technology, and factors that constrained wider dissemination and promotional efforts. This paper is based on the information collected from six case studies; the paper presents some recommendations and suggestions. It recommends that the success in MHP development is the deli censing of installations below 100 kW capacities.

This paper suggests that, due to the lack of operating knowledge the plants have been facing many difficulties like load shedding. This paper concludes that the government is right in privatizing the installation of micro-hydro units and it has to develop a comprehensive and integrated policy to promote micro-hydro development. This has to be complement by realistic plans of actions in which people can participate with effectiveness and derive tangible banalities. It suggest that a diverse strategy to be adopted given a physical,

cultural and economic condition in the country. The range of activities can be expanded from the provision of expensive construction kits for improving the traditional ‘Ghattas’ to the installation of agro processing and improving the facilities to the larger schemes that integrate electrification with various rural industrialization activities.

Barrow- (2001), has described about the socio-economic assessment in his book "Environmental and Social Impact Assessment". He announced that there is a less clear division in the literature, especially between social impact analyses, Socio-economic impact assessment and social soundness analysis. Social impacts include all social and cultural consequences to human populations that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as member of a society. Social impact assessment in this book, is does much of the literature, to refer to both social and socio-economic impact assessment. The exact definition of social impact assessment is imprecise; it means different things to different people. Some see it as a political means of decision-making, others as a socio political process that facilitates negotiation among interest groups. A growing concern for the goal of sustainable development both environmental and social impact assessment have great potential for those seeking that goal.

Barrow has concluded that the Critics must face the fact that social and economic impacts often greatly overshadow hoped for development benefits. Development that is socio-culturally sound is likely to be economically and environmentally sound; if social impact assessment can identify projects, program and policies that generate few or no social-economic problems, it has great value. Some of the world's most socially politically and economically costly and embarrassing problems might will have been predicted and avoided or more effectively mitigated with social impact assessment.

Reaching sustainable development would probably involve trade-offs that have adverse social and economic impacts at least in the short term. It is also vital to assess whether there are any social institutions or movements that could support or hinder a sustainable development strategy before initiating it,

and to monitor for changes during implementation. Social impact assessment can be linked with public participation to ensure socio-cultural sustainability, not to make such a link is to separate physical development from related social institutions, sustainable development will probably fail. Social impact assessment should be used to help establish such institutions. A few studies have already applied social impact assessment to sustainable community development (seeking sustainable local development). These roles for social impact assessment are important and are likely to increase considerably. Social impact assessment may help increase public awareness.

East Consult- (1990), has done the socio-economic impact of MHP plants on rural economic of Nepal. This study is more related to the issues of mills ownership's and management performance such as mechanical agro-processing and electricity, its impact on both entrepreneur and consumers. According to the findings of the study, the electricity has provided psychic and indirect benefits such as longer hours of study, improvement of health, some wicker work's and has been made community more attractive for transient such as trekking but the economic productivity cannot be expected since the use of electricity is not productive. Tariff collection problems, lack of knowledge in operating and maintenance authorized use of electricity are identified in the problems side. The rural people have no cash income to pay the electricity charge. Therefore, it is very much difficult for them.

Gyawali- (2001), this nuanced, sophisticated and the same time engaging, examination of what have happened to Nepal's premier natural resource has a significance that for transcends both the specific experience of the author's own country and the other sector. Water resources development in Nepal is a function of its history. Historical factors and relationships have determined the rate of economic growth and the level of technology and its use.

Issues in water resources development should be looked at form and historical perspective to see how the problems arose and how they are interlinked. Although water management is a burning issue of contemporary public policy, one sees little interaction between water resources planners and

historians. An historical analysis would provide insights into the background of various decisions over time, into the evolving nature of present problems as well as the reliance of the past to its solutions. In studying the role of the water in a society, it is conventional to start with the different types of use (i.e., power production, irrigation, domestic uses). In this analysis we take a step further back and look at the source of demand- the various actors, their proclivities, and the genesis of their desire the physical system behave differently to deliver to them goods and services of their linking.

Science 1911, when electricity was first generated in Nepal, hydroelectricity development has always been a prerogative of the state. From 1911 to 1951, only two stations with capacities totaling less than 1 MW were commissioned because the socio-system demand was limited to the places of the Rana shoguns. After the advent of democracy, demand for electrical energy has come from a much broader section of the populace, although only 4 percent of Nepal's population at present has access to electricity. This population is today paying about six cents per kWh of electricity, which is what an average North American (With per annual income a hundred times more than the average Nepali) pays. Although the country is described as being rich in water resources, the cost of developing medium-sized hydroelectric projects has been $2000 /kW for the 60MW Kulekhani and $ 3500/KW for the 69-MW Marsyangdi. The small hydro units are costlier at almost $ 5000/ KW. The corresponding figures for hydro development in the Indian Himalaya are less than $ 1000/ KW. This discrepancy can be explained by the existence of a more efficient productive market system in India than in Nepal where the stricture of the state apparatus has a feudal rent-seeking character.

Shrestha- (1995), in his article "Privatization of Power Sector in Nepal", has mentioned that efforts of privatization in power development started in United State of America and United Kingdom since 1980s. Nepal is in its initial stage of privatization of the power sector after it brought out new and liberal water resources policy 1992, Hydropower Development Policy-1992 and Electricity Act-1992. Private sector initiatives and market-oriented behavior are expected to improve the power sector and its performance and efficiency. The number

of hydropower project installed by private sector is increasing day to day. Rural people cannot afford high electricity tariff unless the government provides subsidies. Significant portion of cash flows out of the country as debt services and dividends that create the problem of deficit balance of payment and less attention towards environmental impacts are major demerits pointed out by Shrestha. On the other, power sectors creates more employment opportunity, improvement of socio-economic condition of people, promotion of skill, encouragement to the investor, consciousness, control of environmental degradation, deforestation, and desertification increase in government revenue and assistance to the national economy are more merits of privatization of power sector.

Karki- (1995), in "Small Hydropower and the Development of Agricultural sector" he argues that the small hydropower development can play a pivotal role in introducing the "developing packages". The construction of Mega hydropower projects takes a long time for project preparation and mobilization of external financial resources and its involves a lot of uncertainties as exemplified by Pancheswer, the Karnali high dam Project and Arun III Project. Moreover, without meaningful co-operation from India, it is practically impossible to move ahead for the mega power projects. The writer further writes that ever thought India is having power shortage by 7.1 percent at the national level and 33 percent in Bihar no serious efforts have been made for bilateral development of Nepal's hydropower potential for mutual benefit. Hence, Ministry of Nepal should not pin too much hope on and waste valuable time on its development in the near future, but should proceed with the development of medium, small and micro hydro projects.

Because of the poor performance of the small hydropower plants, due to inadequate maintenance and poor utilization of the generated power is showed the negligible portion. The write suggests that the poor performance of the small hydropower projects should not be generalized for it viability. It is also quite difficult to synchronize the different small hydropower projects developed so far and in the absence of promotional activities, the load factor is quite low which should be increased. His concluded were that the implementation of small and micro hydro projects by adopting the program

approach instead of specific project and by involving the beneficiary customer instead of providing subsidy for each individual should be the motto for implementation. The program approach has been quite effective in the development of the irrigation sector, it supports for the establishment of small agro-based industries and so on. So the planned development of small hydropower projects should be carried out to meet its multifarious use and make it economically viable.

Jha- (1995), in his article "Small Hydropower Development: Cost Effectiveness and Private Sector Participation"' writes that one of the major reasons for poverty and backwardness of the Nepalese Economy is power deficit. Shortage of power creates a problem in the development of agricultural, industrial, trade and other sectors of the economy. With the view to meeting the power shortage, it is needed to generate power not only at the medium or mega level but also at the small and micro level so that each can prove to be complementary rather than competitive to one another.

The small and micro hydropower may play a crucial role in increasing production and productivity of the agricultural sector, including the processing of agricultural produce. The lift irrigation in the hills may also be promoted in a meaningful manner through the development of small and micro hydropower. In addition to this, the food processing and cottage industry might benefit a lot from the development of small hydropower. Electrification is related to productivity, the small hydropower might help increase the working efficiency of rural poor. He concluded that, the small and micro hydropower is also important from the consideration of national welfare in diverse fields, such as conservation of forest, creation of self-employment opportunities and also promotion of the tourist industry. Work on micro hydropower projects can be started by mobilizing local talent, labor and materials, which per se is very important.

Kafle- (2005), in his article -"Hydropower for Sustainable Development of Nepal" in Vidyut Bulletin, argued that hydropower has contributed for poverty reduction and economic growth, shown in developing countries. Though, the regional development and expansion of industries encourages even to the

undeveloped countries for prioritizing hydropower development. Economic and social development and environmental protection are interdependent and mutually reinforcing pillars for sustainable development. The multiple use benefits of hydropower reliability and quality of fresh energy supply caters to a fundamental sustainability goal of poverty alleviation. In social aspects the development of hydropower enables to make easy access of electricity to all over the country with significant impact to reduce poverty and enhance the quality of life in the communities. Asses of electricity in the affordable price promotes new economic activities, empowers women by reducing their domestic work and repetitive chores as fire wood collection, improves health and education services, and provides a cleaner and healthier domestic environment.

He has focused on the importance of hydropower for the reinforcement of environment, social and economic aspects can play a key role for sustainable development resulting poverty reduction and economic growth through regional development and expansion of industry. He has written the increasing trend of electricity use due to people's awareness of improving quality of life and annually increased industrial development in the regional cells for ample opportunity to the investor. The political stability and good governance, government commitment and local and foreign investors interest based on worldwide cooperation is the basic requirement to promote hydropower development of Nepal which is very urgent in consideration of domestic as well as regional demand.

WINROCK- (2004), in this paper mainly focused on the victimized local people from the hydropower development. The development of a hydropower project has mainly benefits, but also precipitates many adverse consequences in the lives of local people. There are three main groups of people who are affected by the development of hydropower projects. The first group involves communities living in the vicinity of a hydropower project who may have been hurt by land acquisition, pollution and other problems. The second group are communities living downstream of a hydropower project who are subjected to problems such as dewatering, flooding etc. the third group involves communities living upstream of a hydropower project who face problems such

as land acquisition by access roads and transmission lines, destruction of natural resources during project construction etc.

This study reviewed the adverse consequences of hydropower development in Nepal as it impacted the lives and livelihoods of local communities. It also discussed the responses of hydropower developers to such adverse impacts. The study has also identified certain conditions that would help to minimize the adverse impacts of the hydropower projects. This study also suggests that there are both direct and induced negative impacts. While hydropower developers seem willing, though not adequacy to recognize and mitigate direct effects, they tend to ignore induced effects. There is a tendency on the part of hydropower projects to underestimate adverse consequences made by hydropower projects consequences made by hydropower projects in the upstream and downstream areas.

Karki- (2004), he has concluded that the important of the energy as one of the prime movers in the process of the economic development and its per capita consumption has been regarded some times as one of the indices of economic development. Nepal is regarded as a poor country because per capita consumption of energy is low as compared to other nations. Nepal's per capita energy consumption stands in very low compare with the developed country; it has been increasing every year. Energy consuming pattern is also regarded as one of the important indicators on measuring development status of the country. In the Nepalese context important energy source, especially in the rural sectors should never be neglected.

Hora- (1974), has focused “Role of Micro-hydro power in Rural Electrification in Nepal” in her study tapping of Smalls Rivers for MHP would help to exploit the available resources of the hill and mountains in the country. If there is the facility of electricity in the villages, the replacement of traditional sources of energy by electricity will be possible. In order to meet rural energy demand, government has given more priority on MHP in Eighth plan (1992-97), and with supply of electricity, kerosene can be easily substitute. In the context of uses of electricity, the integration of irrigation with MHP is most viable in the hills and mountains. She added that mills is another major end-use integrated

in some of the MHP plants for processing grains and expelling oil seed with promotion of MHPs other end-uses like saw mill, battery charging, coupling, fruits vegetable dying etc can be promoted in rural areas. These will help to improve the load factor of the plant and the revenue of the plants can be raise.

NPC- (1997-2002), in the ninth plans has emphasized to participation the private sectors both from domestic as well as foreign private investors in the hydropower development. NPC-2002-07, in the tenth plans has focused on the availability of electricity contributes the significantly to the overall development of the country. Currently the urban population is consuming must of the electricity. Nevertheless, majority of people live in the rural areas, and most of the agro-industries, irrigation and cottage industries are located in the rural areas. As overall development of the nation premises on the development of the rural areas, balanced development can be achieved only through creating opportunity for the equal consumption of power in the rural as well as urban areas. So it has become highly important to harness the abundant water resources to generate electricity for the development of the kingdom.

ITECO- (2001), has studied initial environmental examination on Sunkoshi Small Hydropower Project. It has concluded in the project areas people are using the wood for the main sources of energy purpose to cooking and heating, whereas 66 per cent of households use and 34 per cent household are using kerosene and electricity for these purpose.

Nepal's primary hydropower developer, NEA has in recent time been operating at a loss. Nepal and China have been starting for generating hydropower at same time, 1911 A.D. Actual development of hydropower, GoN should solved the obstacles of hydropower policy as completely. Private as well as non-private developers have submitted 164 applications (810 MW) less than 5 MW and 384 applications (7226MW) as small and large project for taking the license in DOED. But development of hydropower in Nepal has

been extremely slow. In spite of the immense potential of hydropower in Nepal, consumers have to pay one of the highest electricity tariffs in south Asia. Till now, hydroelectricity generation in Nepal has primarily been a public sector undertaking. The government relied heavily on bilateral and multilateral donors for hydropower development. In order to meet the energy demands, private developers should be encouraged to add national generation capacity to the power system. This encouraged the role of private power producers known as IPPs. Private power producers are playing a crucial role in the development of hydropower sector and minimizing the demand. The efficiency in generation and distribution is increased because of private producers. After feasibility and before constructions of the hydropower project it should study the Initial Environment Examination (IEE) and Environment Impact Assessment (EIA). In this study is included physical, biological, socio-economic and cultural impact of the project. Very often, hydropower projects pay attention only to the financial costs. But it is most important to evaluate the social, cultural economic and environmental cost of the project. As a sociological study, we should examine the different impacts issues of the project like occupation, education, a cauterization, people's behaviors, safely resettlement and movement, skill, knowledge, gender etc.

CHAPTER-III

RESEARCH METHODOLOGY

3.1 Study Area Selection

The study area is direct as well as indirect impact area of the Sunkoshi Small Hydropower Project (SSHP) of Sindupalchok, Nepal. Sunkoshi Small Hydropower Project (2.6 MW) has built by Sanima Hydropower Project whose project is financed by purely Nepali entrepreneurs who live abroad, known as NRN (Non-Resident Nepali). This is the ever first project being developed by NRN. Hydropower development is a relatively capital intensive activity, so in this sectors should be attract private sectors like NRN.

The Sunkoshi Khola flows from east to west at the project area. The project is mostly situated in Dhuskun VDC, but other VDCs like Chokti, Karthali and Barhabise is also slightly affected by the project.

Because of shortage of electricity and huge potentiality of hydropower in Nepal, the hydropower project is highly important to generating. For the development activities, the socio economic impact analysis studies are highly important. As I'm highly interested in the study of hydropower sector in the near by area from Kathmandu Valley, I've chosen this site as the most potential one.

3.2 Research Design

This study is specially exploratory and descriptive in nature. Descriptive research designed describes and evaluate the socio-economic impact of the Sunkoshi Small Hydropower Project. It is based on descriptive as well as comparative research design. This study has compared the situation with before and after implement of the SSHP. On the other hand, exploratory research design also conducts for the positive or negative impact of the SSHP.

3.3 Nature of the Data

This study is based on qualitative as well as quantitative data. The qualitative data is most important for descriptive type of analysis. This study has explored the various elements of socio-economic and cultural characteristic of the SSHP's direct as well as indirect impact areas. Therefore, qualitative as well as quantitative data is equally important for this study.

3.4 Sources of Data

The sources of data collection of this study are primary as well as secondary data. The primary data has used more in number than secondary data. Primary data is first hand information's; this has been obtained by semi-structure interview, observation, key informant interview and case study. And the secondary data has been collected by locally published and unpublished literature, Sanima Hydropower (p.) Ltd. study reports, NEA's report and other information from related individuals, institutions, organizations and office.

3.5 Sampling Process

This study mainly based upon the direct as well as indirect impact issues of the SSHP. The impact areas people are living in clusters based on their ethnic/caste and status. Housing patterns are more or less the same, irrespective of caste and economic status of the people. Because of the settlement pattern, the cluster and judgmental sampling have been used. For the detail information of this study, more than 53 households have been selected on. Where 38 HHs are included as semi-structured interviews, 13 persons are included as key informant interviews and 2 Ghattas are included as case study.

3.6 Data Collection Methods

3.6.1 Semi-Structured Interview

Here, semi-structured interview methods have included demography, health and sanitation, agricultural pattern as well as before after comparison of these. Using this technique, I have collected different data concerned with the

project and the local people. I've also collected the supportive mechanism of SSHP and its impact to the daily life of local people.

3.6.2 Observation

Observation is one of the prime sources of data collecting. It is the direct, firsthand observation of daily behavior of people. Researcher watches and observes peoples day-to-day behavior and note 'why people do certain things in certain ways. Used this technique, I have collected different consume items and its market price compare with before and after the project. In addition, I have noted people's perception, attitudes and changing pattern of life style after the project.

3.6.3 Key Informant Interview

In the way of key informant interview, mainly I have taken interview with the key persons of there, like local political leaders, different user's committee, e.g. CBOs and NGOs/INGO members. I have taken Interview with 13 persons, by using this technique. Using key informant interview I have collected about the contribution of SSHP in the local development activities and relation between project's people and locals at the affected areas of the SSHP.

3.6.4 Case Study

Case study is a research strategy which focuses on a single organization, institutions, event, decision, policy or group (Doing Social Research-1999). Some Ghattas are directly affected by the Sunkoshi Small Hydropower Project. In this study I have done two case studies of Ghattas. Case study is in-depth comprehensive study of a social unit that unit a person, a group, a social institution, a district, or a community. In this study, case study method used fortuning about the two affected Pani Ghattas.

3.6.5 Technique of Data Analysis

Different methods and techniques were used in order to complete the data analysis. Different electronic devices used for the data processing and analysis, such as computer, calculator etc. different computer programmers in the statistical tools like graphs, flow charts used in Microsoft word and Microsoft excel for data analysis. The means to find out the average of the different data of the table and other different measures of the static ties are use according to the requirement for the analysis of data. Simple arithmetical tools like addition, subtraction, multiplication and percentage use as necessary.

3.6.6 Limitation of the Study

This thesis is mainly based on the academic purposed. So, it flow certain limitation like time, budget, and manpower. It has also theoretical and methodological limitation on this study. Due to the several limitations, this study tried to cover the project direct and indirect impact areas. This study mainly focused on the Dhuskun, Bahrabise, Choukati and Karthali VDCs where, the impact that occurs by construction of a SSHP-2.6MW is derivation of numerous economic, social, cultural, political and environmental effects. In this study's limitation is socio-economic and cultural impact of the SSHP.

CHAPTER-IV

ENERGY RESOURCES AND HYDROPOWER SITUATION IN NEPAL

4.1 Energy Resources Base

Energy sources have been categorized under three broad types: (I) traditional, (ii) commercial and (iii) alternate or renewable energy sources. This categorization pertains to the modality of use of the resources in abstracting the inherent energy contents. Traditional energy resources include biomass fuels particularly; agriculture residue and animal dung used in the traditional way- which is direct combustion. Technological advances open up ways in which these primary energy sources are used. Commercial sources of energy are fossils fuels (coal and petroleum fuels) and electricity. Alternative energy sources include the micro hydro, solar power, wind power, biogas, briquettes etc; Biomass, Hydropower and Solar power are the three major indigenous energy resource base in the country. Though Nepal has a huge potential of hydropower production, its exploitation has been to a very minimal and therefore it is the biomass sector which dominates the overall energy supply and consumption.

4.2 Traditional Energy Sources

The energy sector in Nepal is characterized by excessive reliance on the traditional sources of energy such as the, agricultural residues and animal waste, is derived mainly from the forest and shrub land. Paddy, maize and sugarcane are the major sources of agriculture residue used for energy purposes. Animal wastes of the livestock mainly from cattle and buffalo constitute a significant source of energy especially for cooking and heating purposes in the domestic sector. Nepal relies mainly on biomass fuels due to the lack of development of other energy alternatives and overall poor condition of the nation. These sources of energy will continue to play a dominant role in the Nepalese energy system for years to come.

4.2.1 Fuel-wood

Fuel wood has become the synonym for energy, particularly in rural and residential sectors of Nepal just because of its huge contribution in total energy system and this situation seems to prevail for a long time to come at least for the foreseeable future.

Fuel wood comes from various sources and the role of forest area is very remarkable in this regard. The major land use types of the country are forest, shrub land, grassland, non-cultivated inclusions, cultivated land other land. Other land includes the snow covered, water bodies, cliff and wasteland. All four categories of land use types have been considered for fuel wood production except other land types.

As mention, forest are the major sources of in Nepal which contribute currently about 60 %in total primary energy supply from reachable areas and its contribution is gradually decreasing over time significant change can be found in the shrub land supply whose contribution increase from 4 % in 1978\79 and 17 % in 2003\04. This is mainly because of increase in the areas of shrub land by about 114 % during the 10 years period of 1994\95 to 2003\04. (ESSR-2006)

Sources of fuel wood supply are generally categorized broadly into types. One is the off-farm source and another is the on-farm. The supply cultivated land is termed as on-farm and supply from other land use types is known as off-farm. Contribution of off-farm supply in the total potential of fuel wood from reachable areas is for higher than that of on-farm supply.

4.2.2 Charcoal supply

Charcoal also is form of wood fuel which is directly derived from the burning of wood components. Its business in Nepal is still illegal and no one legally produce charcoal for commercial purpose. Some sort of illegal trade of charcoal can be found between traditional producers and commercial\industrial users at small scale. Charcoal uses in Nepal are found since immemorial. Its uses are generally found in the commercial sector mostly in restaurant, goldsmiths, blacksmiths, metal crafters and clay producers. Industry is the second largest area of charcoal consuming in the

Nepal. Some amount of charcoal is also used in the residential sector particularly for space heating.

4.2.3 Agricultural Residue

Energy is agricultural residues source in Nepal which directly come from the agricultural crops. Two types of residues are generally considered for energy purpose, one is field residue generated during the crop harvesting and another is process residue derived as the bi product during the agro after harvesting the main crops are named with field residues. Residues coming from agro-processing are called process residues such as rich husk, maize cob, wheat bran etc.

About 1.1 million tons of agricultural residues are recently being consumed in residential and industrial sector for energy purpose. This is only about 5 % of the total potential without considering the fodder value. Therefore, there seems huge potentiality of using agricultural residues for energy use.

4.2.4 Animal Waste

Animal waste particularly dung is not only the second largest source of indigenous energy but it also occupies the second largest position in the consumption tesms. Dung cakes are the poorest from of energy and are regarded as the energy of the poor. However, if animal waste in the form of dung is used in a biogas plant, it turns into a clean from of energy without any adverse effects to the environment and agricultural production.here only the supply potential of animal waste as the during cake is estimated, though it is possible to estimate the potential supply of dung for biogas generation which has been already going popularity in nepal.

People mix animal dung with small piecas of agricultural waste and woody biomass to make dry and rigid from of dung cakes. This form of dung cake is common in the rural parts of the Terai region where natural forest does not exist in nearly areas. About 24% of the total energy requirement of nthe country can be meet by animal dung along if used only for energy purpose. It is important to note here that about 20 % of the total potential of dung production has already been used for energy purpose, which can be a matter of serious concern for subsistence oriented farming system of nepal heavily depands on animal dung for agricultural productivity.

4.3 Commercial Energy

Commercial energy sources in use are petroleum feuls (kerosene, LPG, motor spirit, diesel, aviation fuel and fuel oil), coal and electricity. Of these only hydro-electricity is indigenously produced.

4.3.1 Hydropower Resources

Nepal is a country with enormous water resources. It is estimated that the rivers flowing from nepal contribute about 71 % of the dry season flow and 41% of the total annual average flow of the Ganges. The annual average run-off within the nepalese territory is estimated at 174 billion cubic meters. The change in evalution from the high Himalayas in the North to the plains in the south over a short width of 150 to 230 km generates substantial hydraulic head for development of hydropower. Hydropower utilization is currently about 1.5 % of the proven potential. The total installed electricity generation is about 613.5 MW out of which hydroelectric generation capacity is around 557 MW. Of this total generation of electricity, 603 MW are hooked to the nation grigd, and the remaining areis isolated system comprising 40 small\mini hydro plants, about 2000 micro-hydro and about 1200 pelbric set serving remote areas of the country.

4.3.2 Mini-Micro hydropower

Traditional water wheels (Ghattas) are in use throughout Nepal since early days. These primitive water wheels are being developed for mini-micro hydropower plants for agro-processing and lighting purposes. They are popular for the electrification of scattered and isolated settlements in hilly areas of Nepal. Number of agencies and institutions are supporting the implementation of mini-micro hydropower plants. The government of Nepal is providing subsidies up to 75 % for electromechanical equipment through ADB/N (Agriculture Development Bank, Nepal). In addition to the ADB/N, Danish-funded Energy Support Assistance Program (ESAP) and UNDP's Rural Energy Development Program (REDP) are involved in implementing mini-micro hydropower schemes in the hilly areas (SHDB-2007). There are about 25,000 traditional water mills, and ADB/N has financed more than 500 water turbines ranging from 5 to 20 kW, mostly of the cross flow types

turbines. Mini-micro hydropower plants have an average installed capacity of 6 kW, with an average cost of 600/700 US$/kW, (NEA, SHDB-2007).

4.3.3 Small Hydropower

Established in 1975, Small-Hydel Development Board (SHDB) was engaged in planning, survey, design, implementation and operation/maintenance of small hydropower plants throughout Nepal. Later in 1985, Nepal Electricity Authority (NEA) was formed as per the policy of government of Nepal to look after all electricity related works by merging Electricity Department, Nepal Electricity Corporation and SHDB.

The then SHDB is presently working under NEA as a separate department name as "Small Hydropower and Rural Electrification Department". So far, forty-six small hydropower plants have been established including six plants under construction. Most of the plants are in operation in isolated mode, and only a few of them are connected t the national grid system. Due to operation problems from the public sector (NEA), eleven isolated type small hydropower plants have been leased out to private or community operators. As per the new policy of the government, NEA now is working further to divest the ownership of SHP plants up to 5000 kW and hand over them to local communities or enthusiastic private entrepreneurs.

Existing small hydropower plants are in the Nepal only 44 plants, where included up to 100 kW. Previously called SHP Plants of less than 100 kW are not included. The hydropower development has been extremely slow in Nepal. Till recently, hydroelectricity generation in Nepal has primarily been a public sector undertaking. Small Hydropower and Rural Electrification department is responsible for the planning, construction and operation of isolated small hydropower plants and electrification and extension of grid to remote and difficult hilly regions. A total of 26 isolated hydropower plants and associated distribution network are in operation of which 11 have been leased out to private firms or communities. Other 21 small hydropower plants are connected to national grid out of these plants 9 plants are private IPPs (NEA-2007), for detail mentioned in the index. The private sector is also emerging as an important player in hydropower development. The Independent Power

Producers (IPPs) are the latest institutional innovation in the power sector of Nepal. The IPPs sign Power Purchase Agreements (PPAs) with the NEA to sell electricity.

The first hydropower plant of 1911, which is out of service now, are either operating in isolated mode or connected to the Integrated Nepal's Power System (INPS). In the beginning, all those plants were serving for isolated areas. During the course of grid extension, some of the isolated plants are being connected to the INPS. But, still, there are some very remote areas where extension of INPS in the present context is almost impossible. Therefore, despite loses in operation due to low load demand and operational difficulty, GoN is according priority to run isolated plants either by it (NEA) or through the local communities/companies.

Life in Northern part of Nepal is very difficult due to lack of road accessibility, cold alpine climate and rugged terrain. Supply of electricity is quite important as there are no other sources of energy apart from fuel wood or animal waste. Fuel wood is becoming expensive and scare day by day owing to over use and depletion of forest resources. In the districts like Manang, Mustang, Namche and Solukhumbu where there is a big potential of tourism, electricity supply from small hydropower is playing vital role. Although, replacement of fuel wood by electricity seems to take some time, studies are going on to find new Small Hydropower Projects Sites that can replace fuel wood consumption slowly. Nevertheless, generation of cheaper electricity is a challenging task for both the public and private sector in Nepal due to many inherent reasons. There are two quit successful private companies namely Selleri Chialsa Electricity Company Ltd. (SECO) and Khumbu Bijuli Company (KBC) supplying electricity to Salleri Bazaar of Solukhumbu district and Namche Bazaar of Namche district near Mount Everest respectively. As shown in the above table Salleri-Chaisa has 400 kW capacity supported by Austrian Government and Namche has 600 kW capacity supported by Swiss Government. GoN itself is financing for the construction of Small Hydropower Projects in other Northern district like Dolpa, Kalikot, Humla and Jumla.

4.3.4 Community Rural Electricity

With the restricting of NEA in 2003, a community based generation and distribution mode was envisaged. This is grouped as individual, joint and collective –are named as 'community based generation', 'community based rural electrification' and 'community based operation and maintenance' models.

In each model, the primary condition is to be fulfilled by a community is that, it should be a registered institution as provided by the laws and must be constituted from among the local electricity consumers. In all the models, the community is responsible for the operation and maintenance of leased distribution system and should also be responsible for the payment of electricity consumed including both the technical and non-technical losses of the system.

Among others the following are the main features of community based on grid rural electrification system:

- To develop a coherent framework and suitable concept for cost effective, technically and socially appropriate rural electrification, which well managed by established user cooperative in the rural areas to be electrified.
- To develop and establish user cooperatives to be able to maintain the low voltage distribution system in the load centers.
- To support suitable means for development of productive end-uses application in electrified rural areas.
- To construct cost-effective distribution infrastructure in rural areas, with the aim of connecting as many costumers as possible within the frame work of the budget available either provided by GoN or various other donors.
- To implement, own and operate SHPs up to 500 kW for which GoN had made a provision to provide NRs. 75,000 per kW (1000 US$ per kW) electricity generation.
- Also to implement line extension programs for which GoN is going to provide a grant assistance of 80 percent of the cost of the scheme for rural electrification.

To promote further activity by encouraging the involvement of the population in the operation and maintenance of distribution system, NEA has formulated "community Electrification Regulation 2002" to lease out the extended Re-distribution system to the community.

4.3.5 Small Hydropower Study

Systematic identification of optimum small hydropower potential of the country was deemed necessary, which prompted an agreement with the German Technical Cooperation (GTZ) in 1990 to execute a study project. The project was named as Small Hydropower Master plan Project (SHMP). The project carried out inventory studies of nearly forty small hydropower project sites. Due to some unexplained reasons GTZ pulled out its assistance for the project in 1993. The ambitious objectives of the Master plan project could not be fulfilled within three years. Therefore, GoN and NEA decided to continue the identification of potential small hydropower project sites in around six thousand rivers and streams that crises-cross the country. The main activities of the study project areas as follows:

i. Identification of target areas for electrification
ii. Preparation of load demand forecast of the target areas
iii. Identification of matching small hydropower sites
iv. Field investigation of the hydropower sites in inventory, feasibility and detail level
v. Conceptual layout of the site and cost estimation of the project
vi. Annual energy generation from the project
vii. Economic and financial analysis of the project

The project, so far, has identified eighty potential small hydropower project sites. The study identifies two types of projects- one type of projects that can connected to the national grid system and other type that need to be developed in isolated mode.

4.3.6 Medium & Large Hydropower Projects

Major hydropower plants above 10 MW, which are all interconnected to the national grid system, fall in this category. The main objective of medium hydropower plants in Nepal is to satisfy the domestic demand for power and energy, primarily in those areas that are connected to the national grid system.

Although studies of large hydropower projects and construction of medium sized projects such as Marsyandi Hydropower Project were handled by the ministry of Water Resources in the past, the NEA now is solely responsible for planning, construction, operation and maintenance of the power sub-sector. At present Middle Marsyangdi Hydropower Project of 70 MW is being constructed by NEA after completing Kaligandaki –A Hydropower Project of 114 MW. Private sectors also are engaged in development of medium sized hydropower development after concluding PPA (power purchase agreement) with NEA. Operation and maintenance of existing plants, distribution of generated power, development of transmission systems and study of medium sized projects and small hydropower projects are also undertaken by NEA.

Nepal's power system, at present, is incapable of absorbing electric energy from large hydropower projects. This type of projects can be considered only for the purpose of exporting electricity to neighboring countries- India and China. Exporting electricity to China is a bit difficult due to high mountains and rugged terrain. India is only a viable option for export of electricity in the present context. But, for this purpose, Nepal needs to generate cheap electric energy, and also should improve quality and reliability of power supply system.

4.3.7 Petroleum, Natural Gas and Coal

Though lot of exploration works had been carried out, no proven reserves of petroleum suitable for commercial exploitation have been fund in Nepal. All the petroluem products consumed in Nepal are importented from India or overseas in the refined from for direct consumption. Nepal Oil Corporation (NOC) is the sole organization responsible for the import and distribution of petroluem products. The NOC has the storage facility for all the essencial

petroleum fuel, export for the LPG. LPG is the bottled and distributed by the private companies around all the parts of the country.

Exploration works has found out three potential sites for natural gas in Kathmandu Valley, 47.6 millon m^3 of proven reserve have only been identified in one of the sites and further explorations are being carried out to prove the deposite in other two. So far the probable reserves identified in these two deposits are around 270 millon m^3. These deposits if commercially extracted will not be sufficient to last for a few decates.

There are some small occurrences of coal can be classified in to four major categories; Quateruary lighite of Kathmandu Valley, Coal from Dang, Siwalik Coal and out of these four types identified, the quaterarly lignite deposite of the Kathmandu Valley and Coal from Dang (Mid-Western Nepal) are of economic significance. The Siwalik coal though widely distributed throughout the Siwalik range of the country are by small and sporadic and have not been commercially exploited. Likewise the gondwana coal from the east of Nepal is of low quality and small in size and is of no economic significance.

4.4 Alternative Energy Resources

Alternative energy like, solar,micro-hydro, wind and biogas can play a catalyst in the rural development by providing modern of energy. It can effectively help in reducing of the rural population. Especially the women and the children by cutting down the time required to collect and use traditional from energy and can also reduce the indoor air polution.

4.4.1 Solar

Nepal, being located in favorable latitude, receives ample solar radiation. The average solar radiation varies from 3.6-6.2 kWh\m^3\day, and the sun shines for about 300 days a year. The development of solar energy technology is thus reasonably favorable in many parts of the country.

4.4.2 Wind

Wind is still unharnessed energy resource in nepal. Due to it diverse topography and the consequent variation in the meteorological conditions in the country. Specific areas have been identified as a favorable for viable wind energy genaration. Studies made for the WECS in 2002 indicate that there is

not high potentiality of wind energy in nepal except for some location like Thakmarpha, Khumbu and Khanjiroba, which are again on the high mountainous location and it with no infrastructural development.

4.4.3 Government Policy

The establishment of Alternative Energy Promotion Center (AEPC) in 1997 as the government agency for the promotion of renewable energy technologies, including micro-hydro, led to a refomulation of the subsidy policy of 1985. Since 2000, the AEPC's Interim Rural Energy Fund (IREF), supported by DANIDA, Energy Sector Assistance Programme (ESAP) has administered subsidy to micro hydro. The introduction of new government subsidy policy and delivery mechanism channeled through the AEPC increased the level of subsidy from 20-25% of total investment to 50-75 of the total investment. In addition, subsidy is provided project cycle, productive end-use and quality requirments.

Government has been considering the role of small\micro-hydro since the Fifth Five year Plan (1975-80). In 1984, government de-licensed MHP plants up to 100 kW to encourage the participation of private sector in rural electrification through micro hydropower.

CHAPTER –V

DATA ANALYSIS AND IMPACT AREAS OF PROJECT

This chapter attempts to analyze the information received from field survey by using the semi-structure interview, key informant interview, case study, observation and informal discussion. Where collected different types of socio-economic characteristics of the impact people from the sunkoshi small hydropower project.

5.1 Project Location Area

Sunkoshi Small Hydropower Project (SSHP) lies on the Sunkoshi Khola, which origin at Kalinchok of Sindupachok district, Nepal. Sindupalchok district has several sources of hydropower such as Bhotekoshi (36 MW-2001) and Sunkoshi (10.5 MW-1972) hydropower project. SSHP area lies between latitudes 27^0 46' N to 27^0 48' N and longitudes 85^0 53' E to $85^0$56' E. The project area is about 88 km. Northeast of Kathmandu. The Sunkoshi Khola flows from east to west at the project area. Where the division point of the project is 4 kilometers towards north-east of Barhabise bazaar, linked by an all weather earthen road up to 1.5 km. The project is most situated in Dhuskun VDC, but other VDCs Choukati, Karthali and Barhabise also are slightly affected by the project.

The project mainly affected four VDCs are Dhuskun, Choukati, Karthali and Barhabise, so this study is mainly based on these VDCs, where Dhuskun is mostly affected than others. Population census of 2001 has shown following demographic situation of these 4 VDCs. In the below table shows that the population of male (8800) is greater than female (8635).

Table-1: Population of Location Areas, 2001

S.No	Village Development Committee	Total	Male	Female	Percent
1	Dhuskun	3743	1859	1884	21.468
2	Choukati	2615	1270	1345	14.998
3	Karthali	3690	1850	1840	21.1643
4	Barhabise	7387	3821	3566	42.3687
	Total	17435	8800	8635	100

Source: Census-2001, NPC

5.2 Analysis of Primary Data from Field Survey

5.2.1 Age and Sex Composition of Study Population

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

Table-2: Age and Sex Composition of Study Population

S. No.	Age group	Male	Percent	Female	Percent	Total	Percent
1	0-14	39	25.66	39	27.27	78	26.44
2	15-49	86	56.57	82	57.34	168	56.95
3	50-59	11	7.25	12	8.41	23	7.81
4	Above 60	16	10.52	10	6.99	26	8.81
	Total	152	100	143	100	295	100

Source: Field Survey, 2007

Above table shows that the male population is 51.53 percent and the female population is 48.474, where the male population is greater than female. The economically active human resource is considered to be 15-59 age groups. Therefore the percentage of working population of the total sample population

is estimated as 64.75 percent. This survey has found that people below 15 years and above 60 years fall under economically inactive and are not usually see in the any protective work and job market.

5.2.2 Family Size of Sampled Household

Table-3: Distribution of Household by Family Size

S.No.	Family Size	Frequency	Percentage
1	Less than 5	17	44.73
2	6-8	12	31.57
3	9 and above	9	23.68
	Total	38	100

Source: Field Survey, 2007

Table clearly shows that nearly forty-five (44.73) per cent of the families have less than 5 members in their families. It is followed by 6-8 members occupied more than thirty-one (31.57) percent. The highest family size of 10.4 members occupied more than twenty-three (23.68) percent of the families. The average family size of respondent is found to be 6.97, which is higher than national average 5.5 as well. Nevertheless 44.73 percent of the families have only a small family size (4.5) because of the sample. Based on this study, most of the family occupation is domination by agriculture but after the project some family have got job by the project and some are engaged in business sectors.

5.2.3 Educational Status of Sampled Household

Education is a key indicator of the human development. It plays a vital role in the efforts of any endeavor to uplift a society from repression and scarcity, needs less to say it has a positive role in the success of life. Food, shelter, clothing and education are the basic need of the people. Similarly, attention must be paid for the condition of literacy of the rural farmers as well as the schooling children. Even primary education is a principal mechanism of fulfilling the minimum leaning needs of people needed for effective participation in the economic, social, political and civil activities. Towards the end of 9^{th} five year plan, the literacy rate of the country was only 55 percent

but in the 10th five year plan has declared the education status of the country has remained far below than other SAARC countries.

Table-4: Educational Status of Sampled Household

S.No	Levels of Education	Male	Percent	Female	Percent	Total Percent
1	Illiterate	22	7.45	47	15.93	23.38
2	Literate Lower Primary (1-5)	50	16.95	48	16.27	33.22
3	Secondary (6-10)	62	21.12	40	13.55	34.57
4	S.L.C. Above	18	6.11	8	2.71	8.83
	Total	152	51.60	143	48.40	100

Source: Field Survey, 2007

Above table shows that, 23.38 percent people are illiterate and 76.62 percent are literate of the study population. Where, the literate people are (53.23) greater than the illiterate people. It shows that the literacy rate of the study areas is more than the average national rate (i.e. 55%). About 23.38 percent of total population is illiterate and rest of them is literate in the sampled HHs. As a key informants interview it found that, this project supported different eight educational institutions for building repairmen, building construction, educational tour, teacher's salary and compound-wall construction. In this regard, SSHP helped financial support for building repairmen of Nanda Devi Primary School- Chokati, Kamala Devi Lower Secondary School- Karthali, Sunkoshi Primary Scholl- Bahrabise, Seti Devi Primary School- Dhuskun, Sarada Higher Secondary School- Bahrabise, it also provided economic support to Banshangu Primary School- Ramche, Sunkoshi Multiple Campus-Lamoshanghu, Tauthali Primary School- Tekanpur. Because of supporting to different educational institutions of SSHP, there is increasing the education level of local people.

5.2.4 The Main Occupation of Study Population

Occupation determines the social and economic condition of the people. The construction and operation phase of hydropower project creates different employment opportunities. This is the major benefit of a poor country like

Nepal where unemployment and underemployment rates are high. Employment opportunities are greater during the construction phase than operation of the project.

Obviously, the occupation determines their economic status, which in turn determines their personality and career. Therefore, occupation plays a vital role in determining the development of child and others in every sector of the society. Agriculture domination overall in the Nepal, where most of the people have determine main occupation (80 percent) is agriculture. According to the HHs survey, agriculture is also main sources of income for most of the families even though it is not enough to maintain families throughout the year. Because of the small-land holding as well as low productivity of land, they cannot make a living from their own products. The major portions of the economically active population in the selected households are engaged in agriculture sector 38.644 percent. In the below table shows, 14.92 percent households engaged on business and 8.82 percent are jobholders. This table shows that 32.54 percent are student and other 5.18 percent people are economically inactive, they are old aged person, children and disable.

Table-5: The Main Occupation of Study Population

S.No.	Main Occupation	No. of Persons	Percentage
1	Agriculture	114	38.644
2	Jobs Holder	26	8.813
3	Business	44	14.915
4	Student	96	32.542
5	Economically disable	15	5.184
	Total	295	100

Source: Field Survey, 2007

Sunkoshi Small Hydropower Project employed about 300 people per day during the construction phase and in currently employing more than 20 people, of them 15 employees are locally residential people.

5.2.5 Energy Consumption for Cooking Purposes

The overall energy consumption is largely dominated by the use of traditional non commercial form of the energy such as fuel wood, agricultural residues and animal wastes. In the sample households most of the families have used

firewood for the cooking purpose. More than 84 percent households are using firewood for this purpose. Mainly they are using firewood, bio-gas, electricity and Kerosene for cooking purpose.

Table-6: Energy Consumption for Cooking Purpose

S.No.	Sources of Energy	No. of HHs	Percentage
1	Firewood	32	84.22
2	Bio-gas	4	10.53
3	Kerosene	1	2.36
4	Electricity	1	2.36
	Total	38	100

Source: Field Survey-2007

Above table shows that, firewood, bio-gas, kerosene, and electricity are mainly used for cooking purpose. Where 84.22 percent selected households are using firewood for the cooking purpose. It shows that most of the people are using the traditional forms of energy, others sources of energy like bio-gas 10 percent, kerosene and electricity each of 2.63 percent are using for that purpose of selected households. It shows that the commercial form of energy consumption pattern is very low. Forest is the main source for the supplement of the firewood, which has been one of the main reasons for the forest depletion. Supply of firewood from their own resources is directly related with land occupied by each household. Supply of firewood depend on land, so people who have more land, they have access on more firewood.

5.2.6 Energy Consumptions for Lighting Purposes

The pattern of energy use is growing trend in the renewable and commercial sources as electricity. People are access of electricity lines, they are using electricity for the lighting but who have not access to electricity, are using kerosene for this purpose.

Table-7: Energy Consumption for Lighting Purposes

S.No.	Sources of Energy	Before the Project	After the Project	Percentage
1	Electricity	21	31	81.58
2	Kerosene	17	7	18.42
	Total	38	38	100

Source: Field Survey, 2007

Above table shows that electricity using for lighting purpose is increasing pattern. After the project, electricity user HHs are increasing in 10 HHs, until 7 HHs is using kerosene for the lighting purpose because of not access of electricity. This survey found that, after the rural electrification of the project about 26 percentage people are increasing to use of electricity for lighting purpose. People who have access the electricity; it is becoming the basic needs day to day for their household works. Electricity helps to change their life styles and daily works, e.g. it helps to study for children and easy to others works at evening. In the views of local people, electricity help to conserve the forest, control soil erosion process that aggravates the flood and land slide hazard. So the local people are help to the hydropower development. Electricity is one of the major alternative sources of energy plays vital role to pressure indigenous resources and can be considered as the means of hazard reduction. So harnessing hydropower and make proper distribution is the most priority sector of national development activities.

5.2.7 Drinking Water and Sanitation

Unsafe drinking water and poor sanitation are reason for high incidence of communicable disease in Nepal. The population with access to potable water has 73 percent of Nepal in 2003\04 (PRSP-2005). In this study, 29 households have got facility of drinking water. Even the 13 households are depending on the streams and others sources of water. Who are not facilitated by of supply water, their condition is very unsafe and poor for health.

Table-8: Drinking Water and Sanitation

S.No	Sources of Drinking Water	HHs Before the Project	HHs After the project	Percentage
1	Supplied	25	29	76.32
2	Khola	13	9	23.68
	Total	38	38	100

Source: Field Survey, 2007

After the implementation of this project, the safe drinking water facilitated to people & it's been increased in 10 per cent than before the project implementation. This survey found that mostly the local people are depends on unsafe drinking water and are not facilitated by the supply safe water, their condition of health is very poor.

5.2.8 Toilet Used of Study Population

People who are using modern types of toilet, they are aware about sanitation problem and living standards of them are better. The using pattern of modern types of toilet is increasing in the study population. Until 9 HHs are using opened toilet, but 15 HHs have pakki (Permanent) and 14 HHs have kachchi (Temporary) types of toilet in the sample HHs. They are aware about sanitation problem after the project implement. For example, the toilet user HHs is increased 7.89 percent. It shows that sanitation is one of the indicators of living standard of people. Project also has conducted different awareness program about sanitation and environment conservation at a local levels.

Table-9: Toilet Used of Study Population

S.No.	Types of Toilet	Before the project	After the project	Percentage
1	Pakki	14	15	39.47
2	Kacchi	12	14	36.85
3	Opened	12	9	23.68
4	Total	38	38	100

Source: Field Survey, 2007

5.2.9 Land Status of Study Population (In Ropanies)

Land is the main source of production of families in study population, where, 38.64 percent households are engaged in agriculture sector. Here, 23

households have more than 10 Ropanies and 15 household have less than 10 ropanies lands.

Table-10: Land Status of the Study Population

	Irrigated			Non-irrigated		
	Khet	Bari	Pakho	Khet	Bari	Pakho
Before the Project	180.9	15	30	156	119	30
After the project	130.1	12	30	159	119	30

Source: Field Survey, 2007

This table shows that more than 50 Ropanies cultivatable irrigating Khet (land) have been purchased by the project, but non-irrigating land wasn't purchased in study population. Sunkoshi Small Hydropower Project purchased about 110 ropanies: irrigating or non-irrigating land. Where, more irrigating land was purchased more than non-irrigating. The project affected families, who have lost their land, have got the compensation by the project 35 to 150 thousand rupees of each Ropani. Some families bought cultivatable land by investing cash compensation, some invested in business sectors and some spent their household purpose. Who have lost their cultivatable land; they have decreased crops production in aggregate than before the project. Hence, who have got large amount as compensation of their land they invested in business and bough housing land at Kathmandu but who have got low amount of compensation they spent only for household purpose like for marriage, free from debt and other purpose.

5.2.10 Income Sources, Relation and Conflict Situation Analysis of Impact Area

People were not consciences or totally known about small hydropower project before it implement at there. They were not understood about the important of the natural resources utilization. Project's people were detail discuss with them about project and it's impact before it implementation. At that time, they were discussed with 34 people located in the project surrounding areas; out of interviewed peoples.

Table-11: Situation Analysis of Impact Areas

	Income		Relation with project	Conflict with project
	Increased	Not-increased		
Construction phase	24	26	32	16
After construction phase	15	35	17	0

Source: Field Survey, 2007

This study included different important issues, which was concerned with local people as well as project's owners. Most of the questionnaires were tested on them who were directly or indirectly affected by the project. Mainly the project affect people are divide into two phases, first is project construction phase and second is project generate phase or project post construction phase. At that time people were affected in different issues like conflict, income activities and relation, here conflict or relation with the project and local people. In this situation this study mainly based on comparison with construction and post construction phase of the project. Out of total 51 interviewed, 24 people have increased their income at construction phase but after construction that number was decreased in 9 people and now a day only 15 people have increased income due to the jobs, business and others factors of project. It shows that, people who have increased their income due to the project have positive impact, but who were lost their job after construction they were in negative impact by the project. Likewise, people have good or bad relations with the project were 32, and some people have bad relation because of conflict about compensation and local infrastructures development. But after construction of the project, only 17 people have good relation with the project, they are involve in project job and social services, at the same time others have not bad relation with it and some people argued that they have no relation with the project. At construction period most of them have conflict with the project because of local infrastructure development and about the compensation of their land, house and Ghattas. Where, total 51 interviewed, 16 people had directly conflict with the project. These types of problems have

solved the project by negotiation and consideration with locals but project has no conflict with locals now.

5.2.11 Attitude of Local's Towards the Project at Generation Phase

Out of 51 interviewed, 32 people had relation with project's people at construction phase but after construction phase they have relation only 17 people. This situation indicates that project is becoming isolation with villagers after the construction phase. People, who have relation with project, most of them are getting permanent job by project and others are social leaders but grassroots lay person have no relation with it. People who have not relation with project they have not good attitude towards the project. They complained that the natural resources should not utilized by single institution without them. According to key informant interviewers, local people are not absolutely good and positive towards the project because they are not involve or clearly known about project benefits. Although the project is up-grating different infrastructures development in the local levels like roads, schools, irrigation systems, temples and health institutions etc. They have also got several opportunities like jobs, business, skill development and others. But most of them are only victimized by the project; they could not get any opportunities in pre-construction and post construction phase. It is becoming misbalance between job holders and others. Before the project the general thinking about the Sunkoshi River was equal of local people but after the project they are absolutely change.

Now a days the benefits sharing issues is very much burden issues for the hydropower developers. While there is no doubt that the initiation of these benefit-sharing programs are very positive outcome of recent hydropower development in Nepal, but one question arises ;have they really contributed to social equity and justice? Hydro-Electricity Projects in Nepal began to pay royalty to the government after the enactment of the 1992 Electricity Act. In spite of this, there is no evidence that the central government has launched any specific development programs with this money to promote social equity and justice either directly or indirectly. It was only after the enactment of the

Local Self Governance Act in 1999 that the central government began to distribute part of hydropower royalty to district housing hydroelectric facilities.

5.2.12 Gender and Ownership on the Property, Division of Labor and Education:

Gender equity refers to the concept that men and women should access the available resources according to their requirement. Women are not getting equal chances and opportunities as men to prove themselves. Women are made weaker in all the aspects. This huge gap between men and women has been created by the society as now the society itself is facing the problem of gender discrimination.

The opportunities for the Nepalese women to gain from the development activities have been hindered by illiteracy, poor health, poverty and traditionally conservative attitude towards them. As long as women, who constitute more than 50% per cent of the total population are not fully recognized for their contributions in the development activities of the nation and not encouraged to participate in all phases of development, such development will be incomplete and in the end impossible. The government of Nepal is committed in making women equal and meaningful partner of men in the development process.

Particularly, Nepalese women have not equal access or ownership to the property. The study population shows that there is not equal participation of women to division of labor, not equal ownership on the property and not equal educational status. There are little participation of men for the agricultural and indoors works and women have less control over the property. Usually, the owners of the assets such as houses, lands etc. are the men themselves. In this study, only 2.43 percentage of family has owned the property by women. The concept was developed by traditionally; girls should not be deprived from the bright light of education. In the present context, the government should be responsible enough to provide free education for those families who could not afford for the education. Project had also lunched the different awareness programmers about education for the child, not only boys but also girls. On

the other hand, project has supported fees for two children of each staff of the project.

5.3 Case Study

Case study is a research strategy which focuses on a single organization, institutions, event, decision, policy or group (Doing Social Research-1999). Some Ghattas are directly affected by the Sunkoshi Small Hydropower Project. In this study I have done two case studies of Ghattas. Before the project, Ghattas is the only one means of production of Ghattas owner's but after the project some people have lost their means of production and others are running only four month a year. They have got 15 thousand rupees as compensation of each Ghattas from the project. Where 12 Ghattas were affected by the project and they have got the compensation from the SSHP. Ghattas owners argued that, 15 thousand could not meet compensate of their Ghattas because after the collapsed it they could not get alternate opportunity of employment and they could not invest their compensation to beneficial sectors. After the project some Ghattas were totally closed and some are running only four months (July-October) a year but before the project they could run whenever they want. Because of the scarcity of water Mrs. Dil Maya B.K. bought a new technology and she has started to make wooden pots. People who could not invest the compensation in beneficial sectors, they have got negative impact of the project. Because, their living standards not improving by the project.

Case Study-1

Mrs. Dil Maya B.K, aged 56 years old inhabitant of Sindupalchok district, Barhabise VDC's-9, Sunkoshi Village. She is an illiterate and her occupation is running Ghattas. Dil Maya had two Ghattas downstream of the dam before the project implement. Because of the SSHP decreased in water discharge in dry season (8 months) downstream of the Sunkoshi Khola as a result most of the Ghattas are directly affected. She has established two Ghattas for the commercial purpose. She has received Thirty Thousand rupees as a compensation of two Ghattas. She used to runs Ghattas daily whenever she want but after the project she can runs only four months (July to October) a

year. It became endangered her occupation. In this case she has bought a Bering by getting the compensation; for dry season and she has started to make the wooden pots like Theki etc. her husband helps her for making wooden pots. It can be runs low watering seasons like at dry seasons. She has not any cultivatable land and other income sources, so Ghattas are only one income sources of her family's. Her family are depends on this profession at a long time before.

Case Study-2

Mr. Ganesh Bahadhur Tamang aged 56 years old inhabitant of Barhabise VDC's-9, Sunkoshi village. He is an illiterate and his occupation was running the Ghattas before the project. But after the project his occupation is also becoming endangered because of the scarcity of the watering down stream of the project. He can run Ghattas only four month (July to October) now a day. He has established Ghattas for the commercial purpose. He has no cultivatable land so he was depend on it. He had got fifteen thousand rupees as compensation of a Ghattas but it could not compensate with it. He spent it for household purpose or non-productive sectors and he became unemployed. Because of the project, his living standard is not increasing in comparison with before the project, had paid cash compensation. So it could not compensate common property resources which formed an important part of his livelihood in previous life.

5.4 Impacts on the Sunkoshi Small Hydropower Project

5.4.1 Introduction

It has been known that every hydropower project has positive and negative impacts on social, cultural and economic aspects of the concerned areas and it's surroundings. Environmental impacts are limited of small hydropower. Sunkoshi Small Hydropower Project has impacted in different aspects of physical, socio-economic and cultural aspects of human being in the project sites. There were directly as well as indirectly or positively as well as negatively affected different four VDCs like Chaukati, Karthali, Bahrabise and

Dhuskun by the project. It has following socio-economic impacts have been identify.

5.4.2 Impact on Employment

The construction and operation periods of hydropower project creates several employment opportunities. This is a major benefit of local people where unemployment and underemployment rates are high. In my survey, it indicates that local people's primary expectation from a hydropower project is the prospect of finding well paying jobs for local priority. SSHP employed about 300 people in every day during the construction phase and is currently employing 22 people in the operation phase, where 11 are local employee. It is absolutely positive impact for those because it up-lifts their social as well as economic lives and growing living standard of them as well as their family. But some people are only affected by the project and they could not get permanent job opportunity after the project. There is limited job opportunity at generation period so some people have lost their job, which had got in construction phase.

5.4.3 Impact on Education

There are also examples of SSHP providing support to education as institutions. Education is a key indicator of human development. People without education feel as a blind, so education is eye of us. In this regard, SSHP helped for different 8 education institutions for the building repairmen, building construction, support for teacher's salary and others economic support. This project has established a Sheti Devi Primary School, Dhuskun-7 but still it is not running because of poor management system of the local people. In this regard, SSHP helped various schools and campus at affected areas, for example, supported to Sharada Higher Secondary School Bahrabise's roof construction, educational tour, coaching class, compound wall construction and has been paying for one campus teacher's 50 % salary for three years, likewise, this project has given the financial support to the other schools and campus for the improvement of the educational status of local people. When project has provided different supports, they can improve their educational status. It is the positive impact of the project because local people are aware about the education and can get education comfortably.

5.4.4 Impact on Roads Construction

SSHP has also made important contribution to infrastructure development. Road is a backbone of the development, so its roles in the society is most important. Where, Sunkoshi Small Hydropower project has constructed and repaired different roads at Dhuskun, Bahrabise and Karthali VDCs and also repaired the bridge of Bahrabise to Dhuskun. For example, Sunkoshi Khola to Sukadal road (6 km) has constructed. The people of Dhuskun, Bahrabise, and Karthali VDCs have got facility of transportation by roads that were constructed by SSHP. This is the positive impact for the local people. Project has also built a bridge over the Sunkoshi River at a dam side which has made easy to cross the river for Karthali's people. There are several positive impacts to construct the road by SSHP.

5.4.5 Impact on Irrigation and Drinking Water

SSHP has also supported the construction and repairing the irrigation infrastructure. For example, Bimreni, Bangey Khet and Bahrabise Sinchai Samuha, has provided the economic support for the improvement of irrigation system, SSHP has also supported for pipe purchase to Sunkoshi Khet Sinchai, Dhuskun. After improving the irrigation system, it increases the production of crops and it helps to uplift farmer lives. This project has also provided financial support to purchased drinking water's pipe for Chaukati and Ramche VDCs and for water tank construction to Dhuskun VDC. As a result some houses have got the facilities of safe drinking water. It helps to prevent them from the disease which is caused by polluted water. It is the positive impact to the local people.

5.4.6 Impact on environment

Environmental Protection Act (1997) requires that development projects conduct an Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) to assess of the proposed program on the environment. "Environment" is broadly defined to include natural, cultural and social systems. Environmental regulations 1997 requires hydropower projects of 1 to 5 MW capacity to conduct IEE and projects of above 5 MW capacities to conduct EIA. Keeping on mind, SSHP has tried to mitigate the environmental impact. This project has provided about 17 thousand different types of plants

to the four community forest for the plantation. Presently more than 80 per cent of population depends on forest for fire-wood. Given this subsistence demand on forests, deforestation and forest degradation is natural. So, this project also conduct the different awareness program about conserve the natural resources. The construction of the Sunkoshi Small Hydropower Project reservoir has also led to changes in microclimates. People, who are living in the vicinity of the SSH or downstream of dams, they claim that the weather is becoming warmer than before. After the project, dirty and dryness was increased very much downstream of the dams because of scarcity of water. They also claim that, the water tunnel may be blasting any time and it will destroy crops and land nears the tunnels.

5.4.7 Impact on Health and Sanitation

This project has also supported for the health services. Introduce health facilities for the subsequently made accessible to the local peoples. For example, SSHP has supported to primary health center Bahrabise for building construction and economic support for Bahrabise sound and environment pollution control. Project's people were also counseling to the local people about the health problems and its treatments. It is the totally positive impacts to the local people because it can help to become the aware about health. As a result of this, more peoples are started to visit clinic and hospitals instead of consulting with witch-doctor (Lama, Dhami, and Jhakri). Most of them are using opened toilet or unsafely now a day, so it should be important to counsel for toilet use. They are facing the sanitation problems today, because of lack of sanitation knowledge.

5.4.8 Impact on Different Local Institutions and Organizations

Project has also supported to religious institutions, local clubs and different community user organizations. Religion is a set of beliefs and practices which is based on the idea of the socio-religious community so it has vital role in the society. SSHP provided financial support to the religious institution for example; temple repairmen of Kalika Mai, Siddikali and Kapeyswore temple. SSHP has provided economic supports for two youth clubs and one Mahila Samuha, which helps to develop the unity working capacity, skill power and social services. It has also provided financial support to different Community

Users Groups (FUG) for building, Plantation and awareness programs where people made aware about forest conservation.

5.4.9 Impact on Local Government Revenue: DDCs as well as VDCs Level:

Hydropower development can promote local development in several ways, both directly and indirectly. Some direct benefits also lead to secondary indirect benefits in due course. Direct benefits include employment and income generation, local infrastructure and additional revenue for local development. The development of hydropower can also include enterprise and institutional development as well as capacity building of local communities as a secondary benefit. Contribution to the local government revenue the local self governance regulations (1999) requires that the District Development Committee (DDC) housing a hydropower project be allocated 10 percentage of the royalty received by the central government from that project. After much lobbying from the DDCs, the central government has started disbursing royalty to the districts since 2000\01.

This hydropower project has formulated specific rural development packages. For example, the rural development of SSHP supports various activities such as health and sanitation, women development, income generation programs, forest conservation, rural drinking water schemes, school infrastructure upgrading, rural irrigation systems upgrading, temples infrastructure upgrading etc. Five priority areas have been unanimously identified for use of the money allocated to VDCs; education, agricultural, roads, rural electrification, health, irrigation as well as drinking water and sanitation. The local political leaders and VDC's chair persons have also focused on these five priorities should be given continuity for long time.

5.4.10 Impact on Income Sources

Traditional sources of income have improved after the project. Now, people have started vegetable farming and increased livestock husbandry. Business has been expanding day to day. The project has provided part time employment opportunity to the wage labor. So some families have got the income generation opportunity from the project but who have not got opportunity they are optimistic of this. But people who have sold their cultivatable land to the project and could not invest for beneficial sectors their

income is getting low. People who have got job during the construction period, they are very sad because they have lost their job after the construction.

5.4.11 Impact on Agricultural products and its market

Overall agricultural products have been affected at the project construction areas by the project. The total agricultural productions have not decreased by large amount because some project affected families have bought land by spending compensation and other some irrigation system are upgrading by the project. Most of the paddy and maize production land were affected by the project. In aggregate, other types of crops are not affected due to the project.

The market price of local productions has been increasing about 50 to 100 percent comparison with before the project. Most of the local productions like Ghee, Vegetable items, Meat item and other food item prices have increased after the project. Likewise, wage rate of different labors have increased more than 50 per cent. In the conclusion, market prices of commodities and wage have been increased heavily due to the installation of the project.

5.4.12 Impact on Land Holding

The project has purchased about 110 Ropani land including irrigate-able and non-irrigateable. Most of people have lost cultivatable land and decreased their crops production like maize, rice etc. Although they have got the compensation of land but they cannot get crops production of each year. In this situation, people could not get the fully compensate of their land because they got the money not the land as compensation. Money which they got form the project as compensation, they spent it only for the household purpose like marriage, for debt etc. but some little families have invested on business sectors or purchase land. As a whole, people who have lost their land have not improved their living standard after the project.

5.4.13 Impact on Energy to Local Peoples

Nepal is heavily dependent on indigenous resources as fuel wood, agriculture wastes, animal wastes, imported petroleum products etc. for daily energy consumption. But this share is in decreasing trend. The energy consuming sectors also have been defined as per the economic sector of the country. They are residential, commercial, transportation, industrial and agricultural

sectors. The residential sector consumes almost 90% and the industrial sector share of consumption about 3.5% of the total energy consumption in Nepal, WECS 2004\05. In the study population electricity consumption is almost for the residential sectors. People, who have access the electricity; it is becoming the basic needs for their household purpose and it helps their life styles changes and daily works. It is becoming easy to study for children and other works at evening. In the views of local people, electricity is help to conserve the forest, control soil erosion process that aggravates the flood and land slide hazard. Electricity is one of the major alternative sources of energy plays vital role to pressure indigenous resources and can be considered as the means of hazard reduction. So harnessing hydropower and make proper distribution is the most priority sector of national development activities.

Easy access to electricity can create the conditions for involving people in other development activities. Per capita electricity consumption is also a measure of general well-being. Who have not access to electricity; they argue that, the government of Nepal should give the priority of electrification for them. They have gone to give presser to government as a district levels. Project has also provided to financial support for the electrification at the Chaukati and Karthali VDCs. Some families have got facility of electricity after supporting electrification. It is positive impact of them who have got the facility of electrification.

5.4.14 Impact on Skill Development

People of the local areas were involved with very interestingly about the project construction methods during the construction period. It helped them to develop technical skills of construction methods. Some youths had explored their skills such as civil works, welding, metal works, panting electric wiring etc. Similarly, construction workers acquire valuable skills while working for the hydropower project. Project also trained company staff and local people about various sectors. SSHP has provided various training in skill development like basic plumbing, masonry, scaffolding, basic carpentry etc.

5.4.15 Impact on market development

The presence of a large number of employees with heterogeneous preferences in the construction stage of a SSHP increased the demand for various groups and services. This created new business opportunities for the local entrepreneurs. Markets were established and still they are developing. People who were not directly involved in hydropower project are still taking benefits from markets. They do not need to travel long distances for purchase goods and services. Because of the road access, it's also become very easy to develop the market.

5.4.16 Role of the Compensation

Most of the family who have got the compensation from the project, they used it to fulfill their various needs. In the sampled households, seven households spent compensation for their household purpose. Where, as five households had invested their compensation on business purpose and three households had become free from debt-load. It shows that most of the families had used their compensation for non-beneficial sectors. Indeed, project became very fruitful for those project affected families who obtained large amount of compensation, this made them able to purchase land in Kathmandu and invest business sectors. People who had not invested compensation to the beneficial sectors spent their money for marriage purpose, household purpose; daily expend items etc. that made their living standard lower than before.

CHAPTER-VI

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary

Hydropower as a nonpolluting, environmentally friendly, renewable, locally available and reliable source of energy needs to be exploited to the fullest ambit possible. To meet the national energy objectives, small scale hydropower plants are effective for the electrification of remote isolated areas, and it also can be constructed with less environmental, physical and socio-economical impact. In due course, small hydroelectric plants are economically and physically much more viable to construct in Nepalese context. Thus reliability and stability of power should be given priority for the small scale power production in the present context. For economic and social development dependable supply of electricity is must. In a country where, apart from hydropower, other energy resources are not economically exploitable, its development is an important means to provide reliable and affordable supply of electricity. From many years back, policy makers and planners in Nepal are devising many ways and methods to provide energy to rural areas.

Several issues and areas have been identified as impact from the study of the hydropower project. Hydroelectricity project (HEP) has made adverse impacts in downstream of the dam. For example, there is scarcity of irrigation and drinking water to downstream of the dam. Because of the scarcity of water it has also led to changes in microclimates. People are living in vicinity of the SSHP or downstream people claim that the weather is warmer than before. And it also affected religious and cultural sites and diminished the aesthetic beauty of downstream areas. The vicinity of downstream dam is covered by Ghatta owners; irrigate able land owners and sources of drinking water they are directly affected because of scarcity of water. Hydropower developers should identify with positive and negative impacts by directly or indirectly before the project construction. The issues that directly impact to people are construction of transmission towers, transmission and distribution lines, roads

and others infrastructures development. There are also several issues that are indirectly impacts like skill development, knowledge or awareness, market development, enterprise development, institutional development, capacity development etc.

This "Impacts study on Small Hydroelectricity Project" has conducted house-holds survey, key informant interview, observation and case study. Objectives of this study are to describing the socio-economic base line characteristic of people at the project site of the SSHP, to find out the perception or attitude of local people affected by SSHP. And identify the supportive mechanism of SSHP and its impacts to the daily life of local people. References of this study, find out that male population are greater than female population, the sex ratio is 1.06 out of 295 total study populations. Average family size is 6.97, of them most of them are living in single family. The literacy condition of study population is not better. Out of total study population 15.93 percent female and 7.45 percent male are illiterate. It shows that male literacy is better than female literacy condition. More than thirty-three percent people are depending on agriculture as their main occupation, 32.92 percent are student, 14.32 percent people are engaged on business and 8.82 percent are jobholders.

This study finds out that, the overall energy consumption is largely dominated by the firewood. Out of study population, 84.22 per cent people are using firewood for their cooking purpose and 10.53 per cent people are using Bio-gas for that purpose. And 81.53 per cent people are using electricity for the lighting purpose and 18.43 per cent people are using kerosene because of not access to the electricity lines. After construction the project, electricity user consumers are increase in 16 percent comparison with before the project. They have problems of drinking water and sanitation. Safe drinking water consumers were 65.78 per cent before the project but after the project this number is increased in 76.32 per cent and 23 percent HHs are depending on unsafe drinking water.

As a reference of this study 23 have been holding more than ten Ropanies and 15 HHs have less than ten Ropanies out of 38 HHs. SSHP has bought about 110 Ropanies irrigate able as well as non-irrigate able land. Basically

the land holding trends is decreasing pattern after project bought land. Out of total respondents, 24 have increased their income during the project construction period and at generation period only 15 people have increased their income due to the project cause. Out of total respondents 32 people have good relation with the project and 16 have conflict with about land and others issues. At generation period only 17 people have a good relation with project and no have conflict with project now.

I have taken interview with five VDC's chairpersons as key informant interview. Where, I have included direct or indirect impacts areas of the Sunkoshi Small Hydropower Projects. They are Bishnu Prasad Paudyal- Ramche VDC's, Mekh Bahadhur Khadaka- Karthali VDC's, Krishna Prasad Bhattrai- Choukati VDC's, Vhagawang Thapa- Barhabise VDC's and Khika Prasad Sapkota- Dhuskun VDC's. I have taken three head teachers of the Sarada Higher Secondary, Seti Devi higher secondary and Bansangu Lower Secondary schools. The project had given the financial supports for the infrastructures development to these schools. In this study, I have also taken different four political parties and the leaders of community users groups or CBOs of the affected areas.

Community forestry, biodiversity conservation, renewable energy developments have been regarded as opportunities for livelihoods, employment and income generation in the rural areas. These in turn are expected to have larger impacts on the ability to access health and education services, in the rural areas. SSHP has provided the financial supports for improving the health condition of the rural people. Where, it has supported different institutions and individuals. Project had given for medicine expenses for two individuals of Dhuskun VDC. It had also provided financial support for building construction of the primary health center Bahrabise and Bahrabise Sound and Environmental Pollution Control. Project had given financial support to different eight educational institutions for building repairment, building construction, educational tour, teacher's salary and compound-wall construction. In this regard, building repairmen of Nanda Devi Primary School- Chokati, Kamala Devi Lower Secondary School- Karthali, Sunkoshi Primary Scholl- Bahrabise, Seti Devi Primary School- Dhuskun, Sarada Higher

Secondary School- Bahrabise, it has also provided economic support to Banshangu Primary School- Ramche, Sunkoshi Multiple Campus- Lamoshanghu, Tauthali Primary School- Tekanpur

Sunkoshi Small Hydropower Project has also done important contribution to infrastructure development like road construction and repairmen, improved irrigation system, improved rural electrification and drinking water. For Example, it has constructed road of Bahrabise to Sanopalati, Sunkoshi to Dhuskun, and repaired Karthali to Budepa road, Bahrabise to Dhuskun Bridge. It has also provided to financial support for improved the irrigation system of Bimreni Khet Sinchai Samuha- Bahrabise, Bangey Khet Sinchai Samuha- Bahrabise and Sunkoshi Khet Sinchai- Dhuskun. Project has provided economic support four different drinking water Samuha for pipe purchase and water tank construction of Choukati, Ramche, and Dhuskun VDCs. It has also given economic support for some local clubs and Dharmic institutions, for example; temple repairmen of Kalika Mai, Siddikali and Kapeyswore temple and two youth clubs or one Mahila Samuha for develop unity working capacity, skill development and social services. It has also provided financial support to different Community User Groups (FUGs) and Community Based Organizations (CBOs) for capacity building, Plantation and awareness programs, which helped them being aware about forest conservation and local development.

Local people are positive about the project works and they have suggested to construction the upper Sunkoshi Hydropower Project soon. They have focused on project should help to the local development activities as continuity and sustainability. They have also argued project has better done like different local development activities, employees some local people and utilized the water. But they have complained it is not sufficient for there. Using this technique, finding out, the project has done contribution to the local developments activities and change views of local peoples. As conclusion of this study, I can say this development project creates several positive side-effects for local people. SSHP has created several employment opportunities 300 during the construction and 23 employees in operation phase, where 14 are local residential.

6.2 Conclusions

This study reviewed the current nature, trends and magnitude of benefits from hydropower development in Nepal. It assessed the impact of various sectors in victimized areas. Major benefits from hydropower development in Nepal include: availability of electricity, contribution to government revenue, employment generation, support to infrastructure development such as roads, irrigation facilities, school buildings, temple buildings and health post building as well as support for rural electrification and rural development. The development of hydropower has also led indirectly to the development of markets, enterprise, institutions and local company. This study has focused positive as well as negative impact of the hydropower surrounding areas. Every development projects have done adverse impact. This study has included the possible impact of irrigation system, rural electrification, and impact on existing water uses in the dewatering zone, possible impacts on royalty at local level, local economy due to decreased or increased economic activities, conflict, co-operation, possible impact on class division.

The market price of local productions are increased after the implementation of the project due to the different facilities like meat item, vegetable, milk and grains after increased of its people are encouraged to produce these things and their income is going to increase. Out of total 51 respondents, 24 have increased their income at a construction phase but after construction that number was decreased about in 9 people and now a day only 15 HHs have increased income due to job, business and others factors. Out of total 51 respondents, 32 have had good or bad relation with the project, at construction period. Where, some have had bad relations with it, about conflict of compensation and local infrastructure development. But after construction there is good relation with 17 people, who are involving in job with project and social service. At same time, some people argue that they have no relation with the project. So, it indicates that, the relation with local people is in decreasing pattern rather than increasing. Out of 51 respondents, 16 have had direct argumentation with the project during the construction phase, but the project has solved conflict by negotiation and consideration

with local people. At present, there is no more bad relation with local people; it is better for the project.

Reference of this study, I found about the attitude of the local people toward development is increasing. After the project they are very much aware about the local development activities and are aware about small hydropower development, but before this project they were totally unknown about hydropower development. They are not absolutely good or positive towards the project because they are not involving project benefit. Project has also provided more direct benefits to communities affected by the project. However, additional thorough investigation is needed to evaluate the impacts of the project on social equity at a local level.

6.3 Recommendations

- Hydroelectricity developers should have detail discussion with locally affected people in several issues concerned with the project before it construction.
- Proper evaluation of the socio-economic setting, technical and managerial capabilities and adequate survey and design must be ensured while carrying out feasibility studies.
- Government of Nepal should emphasize to the power development of private as well as public sectors.
- Hydropower project has lengthy gestation periods between the time of decision to construction and generation. So a good relation should be established with local people for a long time period for the sustainable development of project and hydropower in totality.
- The government should invest royalty receive from hydropower project at local level, promote enterprises, and generate more revenue through taxes rather than trying to retain royalty for itself. Royalty could play an important role in generating positive pressure from local communities to construct beneficial dams.
- Local communities should be empowered by creating awareness of individual's rights and responsibilities. Bargaining capacities of these communities should be improved by encouraging them to form

effective organizations. Trainings should be provided to enhance their negotiation skills.

- People affected by a project should be encouraged to participate or take ownership, as appropriate.
- All people who are adversely affected by water resources projects should be made batter off after implementation of the project.
- Project-induced resettlement should be avoided or minimized; if resettlement is required, adequate and timely compensation and rehabilitation measured should be provided to fully offset social and economic losses and to enable those affected to share in the overall benefits of the project.
- Hydropower developers should be made aware of their corporate social responsibility, about hydropower development and its positive as well as negative impacts should be clearly defined as well at local levels.
- Social equity and justice should be included as a development of hydroelectricity project.
- It should be included financial cost as well as socio-cultural and environmental cost of the hydroelectricity project.
- Developers should be accountability and transparent to the local people about project cost and benefits.
- Project should participation for share distribution to the local stakeholders. Its address the fundamental rights of utilization of local natural resources and help to increase of the local stakeholder's income.
- Hydroelectricity project should be established a micro-financial institute in the project area where people who have received the money by the project doing labors during construction period and compensate land and Ghattas owner's can be invest here, because of it will become good relation with a long time.
- To the sustainable development of the hydropower project should be conserves, protects and manages natural resources and ecosystems

while orienting technological, economical and institutional change to meet the needs of present and future generations.

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Annex-1

Existing Small Hydropower Plants in Nepal

S.No	Name of the Plants	District	Installed Capacity(kW)	Year in Operation	Remarks
1.	Pharping SHP	Kathmandu	500	1981	Out of Service
2.	Sundarijal SHP	Kathmandu	640	1935	Grid Connected
3.	Panauti SHP	Kavrepalanchowk	2400	1965	Grid Connected
4.	Phewa SHP	Kaski	1088	1967	Grid Connected
5.	Dhankuta SHP	Dhankuta	240	1971	Isolated, DHQ
6.	Jhupra (Surkhet) SHP	Surkhet	345	1977	Isolated, DHQ
7.	Phidim SHP	Panchthar	240	1981	Isolated, DHQ
8.	Tinao SHP	Rupandehi	1,024	1978	Grid Connected
9.	Baglung SHP	Baglung	200	1981	Grid Connected
10.	Doti SHP	Doti	200	1981	Isolated, DHQ
11.	Jumla SHP	Jumla	200	1982	Isolated, DHQ
12.	Jomsom SHP	Mustang	240	1982	Grid Connected
13.	Seti SHP	Kaski	1,500	1985	Grid Connected
14.	Salleri-Chialsa SHP+	Solukhumbu	400	1986	Isolated, DHQ
15.	Darchula SHP	Darchula	300	1992	Isolated, DHQ
16.	Taplejung SHP	Taplejung	125	1988	Isolated, DHQ
17.	Tehrathum SHP	Tehrathum	100	1988	Isolated, DHQ
18.	Bhojpur SHP	Bhojpur	250	1989	Isolated, DHQ
19.	Khandbari SHP	Sankhuwasabha	250	1989	Isolated, DHQ
20	Bajhang SHP	Bajhang	200	1989	Isolated, DHQ
21.	Chaurjhari SHP	Rukum	150	1989	Isolated, DHQ
22.	Serpodaha SHP	Rukum	200	1990	Isolated, DHQ
23.	Okhaldhunga SHP	Okhldhunga	125	1990	Isolated, DHQ
24.	Bajura SHP	Bajura	200	1990	Isolated, DHQ
25.	Arughat SHP	Gorkha	150	1991	Isolated, Village
26.	Surnayagad SHP	Baitadi	200	1991	Isolated, DHQ
27.	Rupal Gad SHP	Dadeldhura	100	1991	Isolated, Village
28.	Tatopani SHP	Myagdi	2000	1991	Grid Connected
29.	Adhi Khola SHP**	Syangja	5100	1991	Grid Connected
30.	Namche SHP+	Solukhumbu	600	1993	Isolated, Village
31.	Achham SHP	Achham	400	1995	Isolated, DHQ
32.	Kalikot SHP	Kalikot	500	1999	Isolated, DHQ
33.	Dolpa SHP	Dolpa	200	1999	Grid Connected
34.	Syange SHP**	Lamjung	183	2001	Grid Connected
35.	Indrawati Khola SHP**	Rasuwa	7500	2002	Grid Connected
36.	Piluwa Khola SHP**	Sankhuwasabha	3000	2003	Grid Connected

37.	Khudi Khola SHP**	Lamjung	3450	2007	Grid Connected
38.	Baramchi Khola SHP**	Sindupalchok	999	2007	Grid Connected
39.	Puwa Khola SHP	Ilam	6200	2000	Grid Connected
40.	Rairang Khola SHP**	Dhading	500	2004	Grid Connected
41.	Sunkoshi Khola SHP**	Sindupalchok	2500	2005	Grid Connected
42.	Chaku Khola SHP**	Sindupalchok	1500		Grid Connected
43	Chatara	-	3200	1999	Grid Connected
44	Ramechhap	Ramechhap	150	1988	Grid Connected
		Sub Total=	**49549 kW**		

Annex-2

Under construction small hydropower project in Nepal

S.No	Name of Company	Name of the Plants	Location	Capacity(kW)
1	Khoranga Khola Hydro power Co. Ltd.	Phame Khola	PAnchtar	995
2	Thopal Khola Hydro power Co. Pvt. Ltd.	Thoppal Khola	Dhading	1400
3	Gandaki Hydro Power Co. Pvt. Ltd.	Mardi Khola	Kaski	3100
4	Gautam Buddha Hydropower (Pvt.) Ltd.	Sisne Khola SHP**	Palpa	750
5	Kathmandu Small Hydropower Systems Pvt. Ltd.	Sali Nadi	Kathmanu	232
6	Unified Hydropower (P) Ltd.	Pati Khola	Parbat	996
7	Ridi HydroPower Development Co. (P.) Ltd.	Ridi Khola	Gulmi	2400
			Sub Total=	**9873 kW**

Annex-3

Power Purchase Agreement (PPA) Concluded of Small Hydropower

S.No	Name of the Plants	District	Capacity (kW)
1	Daram Khola	Banlung	5000
2	Mailung Khola	Rasuwa	5000
3	Lower Nyadi	Lamjung	4500
4	Upper Mai Khola	Illam	3100

5	Pati Khola	Parbat	996
6	Ridi Khola	Gulmi	2400
7	Seti-II	Kaski	979
8	Lower Chaku Khola	Sindupalchok	1765
9	Narayani Shankar Biomass	Rupandehi	500
10	Phawa Khola	Taplejung	2079
11	Mai Khola	Illam	2400
12	Belkhu Khola	Dhding	320
13	Upper Handi Khola	Sindupalchok	991
14	Siuri Khola		990
15	Tadi Khola	Nuwakot	970
16	Lower Indrawati	Sindupalchok	4500

Sub Total=39869 kW

QUESTIONNAIRE

The study of socio-economic impact of SSHP

Date:

Personal information

1) Name of the Household Head:
2) Caste\Ethnicity:
3) Sex: M\F Age:
4) Religion:
5) Main occupation:
6) VDC Ward No. Village\Tole
7) Marital status: Married\Unmarried
8) Education: Literate [ ], Illiterate [ ], Level of education:
9) Family details:

S.No.	Relation with HH	Sex M\F	Age	Literate*	Occupation*	Marital status	Training

Code:
*Education:
1-illiterate, 2-non formal, 3-primary education
4-lower secondary, 5-secondary,
6-intermidate, 7-higer
*Occupation:
1-Agriculture, 2-Buness, 3-Jobs,
4-Labour, 5-Student, 6-Others

Land Status

10) Do you have own land? (In Ropani)
(a) Yes [ ] (b) No [ ]

11) If yes, mention in Ropani

12) Please mention the following information.

S. No.	Structure	Irrigating		Non-irrigating		Cost of land/ Unit		Access to Road		Leasehold land	
		BP	AP	BP	AP	BP	AP	BP	AP	BP	AP
1	Khet										
2	Bari										
3	Pakho Bari										
4	Housing Land										
	Total										

BP= before implement of project
AP= after implement of project

13) Has project supported\helped you to irrigate your land?
(a) Yes [ ] (b) No [ ]

14) If yes, what kind of support has?

15) If no, why……..

Health and Sanitation

Kinds	BP	AP
Sources of drinking water	Piped\well\khola\others	Piped\well\khola\others
Quality of drinking water	Better\good\bad\unknown	Better\good\bad\unknown
Kind of toilet	Open\kachchi\pakki	Open\kachchi\pakki
Institution to treat	Domestic\witch doctor\health post\center\activist	Domestic\witch doctor\health post\center\activist

Pattern of Energy Use:

16) Before implementation of this project are you lighting electricity?
(a) Yes [ ] (b) No [ ]

17) After of this project are you lighting electricity?
(a) Yes [ ] (b) No [ ]

18) If no, why?

19) Energy use for housing purpose

	Cooking*	Lighting*	Radio\television*	Others
BP				
AP				

Code
*1-firewood, 2-kerosene, 3-electricity, 4-biogas, 5-animal wastes, 6-others

20) Is electricity use more effective and easy for housing purpose?
(a) Yes[ ] (b) No [ ] (c) Unknown [ ]

21) Because of electricity, is your life style changed?
(a) Yes [ ] (b) No [ ] (c) Unknown [ ]

22) If yes, what types of changed has occurred?

23) Is electricity conserves the environment and forest?
(a) Yes[ ] (b) No [ ] (c) Unknown [ ]

24) If yes, how?

25) If no, how?

26) Study on Gender Issues

Accessibility in Control over Resources

Control Access		Resources		Land inheritance		Ornaments		equipment		Pewa - patt		education		Labor	
		BP	AP	BP	AP	BP	AP	BP	AP	BP	AP	BP	AP	BP	AP
	men														
	Women														
	Both														
	Men														
	Women														
	Both														

Information about the Project

27) During the construction period of project, had increased your income?
(a) Yes[ ] (b) No[ ]

28) If yes, how much and which activities

29) Now a day, have increased your income, comparison with before project?
(a) Yes[ ] (b) No[ ]

30) If yes, in which activities

31) Have you any relation with project? Is there any relation between the project and the local people?

(a) Yes [ ] (b) No [ ]

32) If yes, what types of relation?

33) During the feasibility study of the SSHP project, did the project people discuss about project with you?
(a) Yes[ ] (b) No [ ]

34) If yes, what did they discuss?

35) Did they discuss with you during the detail designing?
(a) Yes [ ] (b) No [ ]

36) If yes, what did they discuss?

37) Did the project affect on your property?
(a) Yes[ ] (b) No[ ]

38) If yes, what did affect?

39) Did you get compensation of affected property?
(a) Yes[ ] (b) No[ ]

40) If yes, what did they give to you?

41) If not, why?

Conflict and Confrontation

42) What types of conflict\confrontation occurred during the construction period?

43) How did they solve that conflict?

44) Do community people have conflict\confrontation with SSHP today?
(a) Yes[ ] b) No [ ]

45) If yes, what types of conflict do they have?

46) Do you have conflict with SSHP?
(a) Yes[ ] b) No [ ]

47) If yes, what types of conflict do you have?

48) Have your any suggestion and comment about SSHP?

CHECKLIST-1

For key informant interview

1) Name of respondent:
   Occupation: education:
   Involved CBOs: sex: M\F marital status:
   Address: VDC ward no. village\tole:

2) In your opinion, what have you got the facility after the project?

3) Did the project's people help to the education sector?
   (a) Yes [ ] (b) No [ ]
4) If yes, where and how did they help?

5) Did the project's people help to the drinking water programs?
   (a) Yes [ ] (b) No [ ]
6) If yes, where and how did they help?

7) Did they help to the road construction or repairmen?
   (a) Yes [ ] (b) No [ ]
8) If yes, where did they help?

9) Did the project's people help for the temple and pati/pauwa?
   (a) Yes [ ] (b) No [ ]
10) If yes, mentioned.

11) During the feasibility study of SSHP, did the project people discuss about project with you?
   (a) Yes [ ] (b) No [ ]
12) If yes, what did they discuss?

13) Do you get any facilities after SSHP?
   (a) Yes [ ] (b) No [ ]
14) If yes, what types of facility have you got?

15) Does the project contribute about local development activities?
   (a) Yes [ ] (b) No [ ]
16) If yes, which sectors has done?

17) In your opinion, what should do by SSHP?

18) Do you help SSHP, in yours sides?
   (a) Yes [ ] (b) No [ ]

19) If yes, what do you help?

20) Is that project has conserves the natural resources?

(a) Yes [ ] (b) No [ ]

21) If yes, how

22) If not, why?

23) Do you have conflict of the SSHP?
(a) Yes [ ] (b) No [ ]

24) If yes, what types of conflict do you have?

25) In your opinion, what are the five conflict management way?

26) What are the five improvement works of SSP?

27) What are the five beneficiary work of SSHP?

28) What are the five non-beneficiary work of SSHP?

29) Are you any comment and suggestion to SSHP?

CHECKLIST-2

For the case study of Ghattas

1. Name of Ghattas's owner:
   Age Sex: M\F Education:
   Occupation: marital status:
   VDC ward no. village\tole:

2. How many ghattas did you have? Before implement of SSHP.

3. Did your ghattas are affect by project?
   (a) Yes [ ] (b) No [ ]
4. If yes, what did affect?

5. Do you have Ghatta, now?

6. Did you get compensation from SSHP of affected ghattas?
   (a) Yes [ ] (b) No [ ]

7. If yes, what did you get?

8. If no, why

9. During the feasibility study of the SSHP, did the project people discuss about project with you?
   (a) Yes [ ] (b) [ ]

10. If yes, what did they discuss?

11. Why or what purpose do\did you make ghattas?
    (a) Business [ ] (b) Housing [ ] (c) Others [ ]

12. Before implement of the SSHP, how many months did you runs ghattas?

13. Do you have conflict with SSHP?

14. Are you any comment and suggestion to the SSHP?

CHECKLIST-3

For observation:

I. Who generally make decision in following household activities?

S.No.	Activities	M	F
1.	Agriculture		
2.	Education		
3.	Marketing		
4.	Child care		
5.	Community development activities		
6.	Income generation activity		
7.	Health\sanitation		
8.	Borrowing credits		

II. Institutions and organizations of the project affect areas.

Ins\orgs	School\campus	Hospital\health post	CBOs	NGO\INGOs	Local clubs	Other
BP						
AP						
Total						

III. Market rates of goods and services in the study areas.

1. Wage-rate and price of construction material (in Rs.)

	Wage rate			Price of construction materials					
Period	skilled	Un-skilled	Semi-skilled	Sand \tin	Pebble \tin	Stone \pile	Cement \bag	Wood \f3	Iron \kg
BP									
AP									

2 Market price of food items. (in Rs.)

Period	Paddy \mury	Maize\ mury	Wheat\ mury	Oil\ltr.	Ghee\ kg	Milk\ ltr.	Curd\ ltr.
BP							
AP							

3 Market price of meat items in (kg.)

Period	Mutten	Pork	Chicken	Buff	Fish
BP					
AP					