SOCIO-ECONOMIC IMPACT STUDY OF SMALL HYDRO PROJECT IN SOLUKHUMBU:

A Case Study of Salleri Chialsa Small Hydro Power Project Salleri, Solukhumbu, District

Submitted to;

Central Department of Rural Development,
Faculty of Humanities and Social Science
Tribhuvan University in Partial Fulfillment of the Requirements
For the Degree of the Master of Arts (M.A.) in Rural Development

Submitted By

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April, 2017

DECLARATION

I hereby declare that the work reported in this thesis entitled **Socio-Economic Impact Study of Small Hydro Project in Solukhumbu: A Case Study of Salleri Chialsa Small Hydro Power Project Salleri, Solukhumbu, and District.** Submitted to the Central Department of Rural Development, Tribhuvan University entirely is my Original work prepared under the guidance and supervision of my supervisor. I have made due acknowledgement to the ideas and information borrowed from different sources in the course of preparing this thesis. The result of this thesis have not been presented or submitted anywhere else for the award of any degree or for any other purposes I assure that no part of the content of thesis has been published in any before.

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RECOMMENDATION LETTER

This is to certify that Mr. Brihaspati Rai has prepared this dissertation entitled " **Socio-Economic Impact Study of Small Hydro Project in Solukhumbu** : **A Case Study of Salleri Chialsa Small Hydro Power Project Salleri, Solukhumbu, District**" under my guidance and supervision in the partial fulfillment of the requirement of the course thesis writing of Master of Arts in Rural Development. Therefore, this dissertation report is recommended for its evaluation and approval.

…….

Mr. Bishnu KC

(Supervisor)

March, 2017

Date

2037/12/20

2017/04/02

APPROVAL LETTER

A dissertation entitled " **Socio-Economic Impact Study of Small Hydro Project in Solukhumbu** : **A Case Study of Salleri Chialsa Small Hydro Power Project Salleri, Solukhumbu, District**" has been submitted by Brihaspati Rai for the partial fulfillment of the Requirement for the degree of Master of Rural Development in Humanities and Social Sciences. The Evaluation Committee has approved this dissertation

Evaluation Committee

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Prof Dr. Prem Sharma
(Head of the Department)

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Date: 2073/12/27
2017/04/09

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Brihaspati Rai

2017

ABSTRACT

An abstract of the dissertation Faculty of Humanities and Social Science for the Master of Arts in Rural Development submitted on March, 2017.Title:“Socio-Economic Impact Study of Small Hydro Project in Solukhumbu. A Case Study of Salleri Chialsa Small Hydro power project Salleri, Solukhumbu, District”

This abstract of the dissertation illustrates how the entire study has been conducted. This dissertation is quantitative study of Ward no 5 & 6 of Dhudhkuda Municipality The major objective of the study was to know socio-economic impact of small hydro power project (SCECO) on community people of Dudhkunda Municipality. The specific objective of the study was to know improved lifestyle of community people who are the beneficiaries of the project.

The study design is quantitative. It was conducted in Dudhkunda Municipality. 110 households were selected as sample size for the study. Random sampling method was used to collect information from field. Questionnaire was used as method to collect data from the field

The study area was found socially diversified with different ethnic groups with Sherpa as largest ethnic community. The social status of different communities people who are beneficiaries of the project were fond improved as their children education was found improved. Economic condition of the people was found improving as they were found involving in income generating activities such as running hotels and lodge and shops after establishing hydro project.

The project has played a vital role in rural development. It is concluded that the implication of hydropower project for rural development are: introduction of modern technology in rural context, which developed technical capabilities in the village needed for rural development, introduction of industrial management concept, introducing of entrepreneurship in rural village. Proper management for operation and maintenance is the essential factor for any hydropower program. The study recommends that before initiation the plant in any area training should be provided as grant from the side of government for its future sustainability.

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ABBREVIATIONS/ACRONYMS

ADB/N	Agricultural Development Bank, Nepal
AEPC	Alternative Energy Promotion Centre
BSP	Biogas Support Programme
CADEC	Community Awareness Development Centre
ESAP	Energy Sector Assistance Programme
GHG	Green House Gas
ICIMOD	International Centre for Integrated Mountain Development
INGO	International Non Governmental Organization
IREF	Interim Rural Energy Fund
ITDG	Intermediate Technology Development Group
MGSP	Mini Grid Support Program
MHP	Micro Hydro Power
MHPP	Micro-Hydro Power Plant
NEA	Nepal Electricity Authority
NGO	Non Governmental Organization
REDP	Rural Energy Development Program
RET	Renewable Energy Technology
RETRUD	Renewal Energy Technology for Rural Development
RRA	Rapid Rural Appraisal
RRESC	Regional Renewable Energy Service Centre
RWSSSP	Rural Water Supply and Sanitation Support Program
SDC	Swiss Development Cooperation
SCECO	Salleri Chialsa Electricity Company
UMN	United Mission to Nepal
UNDP	United Nations Development Programme
VDC	Village Development Committee
WECS	Water and Energy Commission Sector

CHAPTER-I

INTRODUCTION

1.1 Background of the Study

Of a total of 147,181 sq km area of Nepal, two-third of its land area lies in the mountains and hills where the people live in several isolated and scattered villages. Most of these rural villages lack even basic infrastructures. Of the main physical infrastructures, introduction of electric power in these areas helps the people not only to live in darkness to the light but also in opening the door for several development opportunities.

Electricity supply through national grid line in such area is an expensive proposition and a matter of long time prospects considering the poor national economy of Nepal. Abundant of water flow through these isolated areas in the form of rivers and rivulets are not fully utilized. Productive utilization of this renewable natural resource is possible through hydropower production. Thus, development of hydropower by harnessing this natural resource is the solution for creating development opportunities and to relieve the people from darkness to lighting in these areas.

Energy plays a significant role in the economic and technological advancement of any society and consequently, plays an important role in advancing human welfare. It also has a direct bearing on sustainable development of the hilly regions where the demand for energy is high and availability is low if compared to the areas in the plains. The hilly regions of the country suffer from the general impediments of difficult terrain, poor accessibility, poor transportation and communication facilities and poor living condition of the people. Large parts of the hilly regions are not electrified. To laying of transmission lines across those regions poses a problem because of the long distance to be covered and the existence of hills, mountains, ridges, valley etc.

As such, the project of laying transmission lines from the existing grid network becomes an extra-ordinarily costly proposition. The problems of laying of

the transmission lines are not likely to be solved in an immediate future. Up-keep of the lines is an equally tough job in view of the frequent occurrences of storms, landslide, snowfalls, etc. Diesel generators, as an alternative for producing electricity is also not an answer as the transportation cost of the fuel is prohibitive for such hilly regions,. Therefore, there is no choice except to turn to decentralized renewable sources of energy.

Amongst the renewable energy, hydropower occupies an important place. There are several advantages of hydropower generation. They have essentially zero fuel cost and are pollution free (MOEST, 2006). The time involvement right from commencement of small hydropower development to commissioning period is very low i.e. ranging from one to two years. The operation and maintenance of small hydro projects are simple and can also be done by trained people. It is free from environmental threat, submergence of land, loss of agricultural land, dislocation of habitation and ecology of the region.

Chialsa Hydropower

The 600 kW Salleri Chialsa Hydropower Project supplies electricity to some par of Dudhkunda municipality in Solukhumbu district of Sagarmatha zone. The project was constructed with the fund and technical support of Swiss Development Cooperation (SDC) and Nepal Electricity Authority (NEA). Presently, the power project is running under the company act 2051 with the share of SDC, NEA and beneficiaries local households. Creation of facility alone does not necessarily benefit the all the intended population. Socio-economic-politico environment has great bearing in benefiting people and sustainability of created facility largely depends on its' acceptance and use. Technical, managerial and financial aspects are also the determining factors in ensuring the sustainability of development intervention in a given setting.

Research and studies on the socio-economic impacts of the small hydropower projects are found to have been done in relatively accessible areas and no studies are found on the projects in difficult and remote areas of Nepal, like the project in concern. Therefore, this proposed study is aimed to assess the impact in such difficult and remote areas. The proposed study on the proposed project is aimed at assessing

the existing socio-economic climate of the locality and impacts on the socio-economic life of the local people to identify the problems and constraints in creating anticipated/planned impacts. Based on the findings of the study, it will make suggestions and recommendations which will help the concerned actors and agencies to direct the project in creating positive impacts among the target population and to take mitigation measures so as to help improve the socio-economic condition of rural area. The study will collect information on socio-economic life of the people under the command area of the project and assess the before and after project situation of the people. Structure questionnaire and checklists will be the main information collection tools.

Mass meeting, focus group discussion, personal contact, literature reviews etc will be the main method of information collection. In addition, key informants such as school teachers, community leaders and local politicians will also be solicited. The collected data will be collated manually and processed in computer. Descriptive statistics such as mean, mode, percentage will be used and relationship statistical tools will be utilized wherever relevant.

1.2 Statement of the Problem

Small-hydropower program is being promoted in rural Nepal by NEA and other development agencies aiming at improving the living conditions of people, creating, employment and economic opportunities at local level. Available research and studies done in several development project implemented in Nepal reveal that not all section of the people are benefited from the development interventions,

In case of small hydropower development project, research and studies in assessing the impacts on the target beneficiaries are very little. Whatever periodic research and studies are being done is confined to relatively accessible area and no studies of the proposed nature are found to have been done in remote area. Therefore, this proposed study is aimed to fill the existing gap.

1.3 Objectives of the Study

The overall objective of the proposed study will be to assess the socio economic impacts of the Hydro Projects. The specific objectives are to:

- To collect information on existing social-economic status and practices in the project area including cast, religion, education.
- To know socio- economic impacts of project on livelihood development of the community people of the project area.
- To identify the problems that beneficiaries have been facing to get benefits from project.

1.4 Research Questions

Assessment of the small hydro project in the socio-economic status of the people is the overall objective of the study. Specifically, the proposed study is aimed to answer the following:

- What is the current socio-economic status of the community?
- What type of socio-economic impact does hydro project have in the development of the community?
- What are the problems and constraints in front of translating the anticipated outcome among the target population?

1.5 Limitation of Study

- This study is completed for partial fulfillment for the degree of the Master of Arts (M.A) in Rural Development.
- This study has focused on the institutional set-up of Hydropower in Rural Development.
- This Study in generally based on the primary as well as secondary data available and DDC, SCECO, Municipality, NGO and concerned Hydropower.
- Validity of Secondary a data relies opens the source.
- This study has primary limitations and other limitations.

CHAPTER-II

REVIEW OF THE LITERATURE

2. Review of Theoretical Studies

The objective of the study is to know socio-economic impact of the hydro project in sustainable development of the community. Therefore, in the study, rural development theories, local development policies as well as empirical studies will be reviewed and identified the research gaps for further study.

2.1 Thematic Review

Small- hydro is an indigenous and source of energy for which the potential exist in the almost the Hindu –Kush Himalayan Region which includes Afghanistan, Bhutan, China, Myanmar, Nepal and Pakistan. Small- Hydro is generally is define as decentralized small scale water power plant less than 100kw for the power generation up to 100kw MHP (Micro Hydro Power) have gained enormous popularity in developing countries during the last for decades (Koirala 2011).

Micro-hydro can provided electricity services micro hydro generation is a cost effective and law impact technique for power generation that effects a potential solution for ruler electrification in Nepal in the study seems that of 1300064kw micro hydro project electricity was generated during 1962 to 2005 (AEPC 2005) while the total of 11742kw electricity have generated during 2006 to 2011 (AEPC data book 2011).

Micro hydro is generally defined as decentralized small scale water power plant that generate electricity power up to 100kw and server nearby householders thoughts a local grid for power generation up to 100kw micro hydro project have gained enormous popularity in developing countries last of four decades this included Pico hydro schemes up to 5kw capacities.

Small- hydro technology is electrical energy generation system from water resources with installed capacity respectively up to 100kw to 3mw of electric power this technology has been successful to extend and explains rural electricity in rural areas. It has been found this in Srilanka for instance many micro-hydro plants have been initially installed primary to improve the quality of life by providing electric

light. And in Peru the key question for many project developers was “how long wills the plan last crater or how quickly the capital will be back”. Similarly in Nepal after passing the era testing and assessing the technical to increase access to rural energy seems for basic lighting facilities (Parajuli 2011).

Nepal has great potentiality of 83000mw it is estimated that 42000mw of economically feasible hydropower potentiality less than2% of this potentiality has been explored. Nepal’s electricity generation is dominated by hydropower through is the entire centurion of energy use of a country the electricity is a tiny fraction only few percentage of energy needs is fulfilled by electricity. So, far, hydropower plants having capacity between 100kw and 10mw are considered as small hydro’s (NEA 2007).

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

The electricity demand in Nepal is increasing by about 10-12% per year. About 44% of population in Nepal has access to electricity through grad and off grad system in Nepal’s ten five year plan (2002 to 2007) aims to extend the certifications within country and export to India for mutual benefit. The hydropower policy 2006 seeks to promote private sector investment in the sector of hydropower development aims to expend the electrification with in the country and export.

Hydro Power Classification in Nepal as per Installed Capacity

Type	Size
Pico-hydro power	up to 3 kW
Micro-hydro power	3 kW to 100 kW
Mini-hydro power	above 100 kW but not exceeding 1000 kW

	(1MW)
Small hydro power	above 1 MW but not exceeding 10 MW
Medium hydropower	above 10 MW but not exceeding 300 MW
Large hydropower	Above 300 MW

Source: ICIMOD, 1999

Electricity is basic pillar of Nepal's economy which helps to enhance stander of living of people by different angle among which make life style of people easier. There is establishment of large industries to small industries which as used ruler materials. That can extend the rural development uplifting the sustainable livelihood and economic upheaval.

2.2 Rural Development Theory

Agriculture and rural development are two basic pillars in the fight against rural poverty and for the enhancement of food security. Agricultural activities determine the livelihoods of most of the poor all over the world. The territorial approach to rural development may help to implement sector strategies and to attain the goals of aid effectiveness. This approach to rural policy formulation and implementation promotes joint-action among rural agents, coordination between the different administrative levels of government and articulation among different sector policies addressing the problems of rural areas (agriculture, education, health, infrastructure, employment).

Per capita is GDP of the major indicators of development of a country, high GDP implies high productivity. Productivity is raised through improvement in technology and energy inputs to support the new technology. Heat and mechanical energy are the two major forms of energy used in productive activities. The major energy resources for heat applications in rural hill area in Nepal are fuel-wood, agricultural residues and dung, and for mechanical applications muscle power and traditional watermills. Fuel-wood seems to be adequate for supporting productive activities that require heat input. But muscle power and traditional watermills have

serious limitations for meeting mechanical energy requirements for productive activities. For example muscle power or watermill is an inferior to electric heaters used in handmade paper industries, the superiority of electric heater lies not only in the rate of production of pulp but also in its quality (REDP, 2001).

2.3 Reviews of Policies

In Nepal, micro-hydro power, solar photovoltaic systems, Bio-gas, improved ghatta, solar thermal plants and improved cook stoves are includes in renewable energy. The GON as well other bilateral and multilateral agencies, non-governmental organizations and private organizations are engaged in the development of renewable energy. Government has practiced different policies.

The Fifth Five Year Plan (1975/76 to 1979) for the first time mention small hydro power, which included hydro power plans of MHP ranges as one of the main means of rural electrification. Under this plan, HMG/ in 1975 established small hydro power development board SHDB. During the Six Five Year Plan (1980/81 to 1984/85) period in 1981. ADB/N lunched rural electrification project with a view to promote rural electrification through MHP.

In 1984, the HMG/N waived the licensing requirements for HMP and deregulated MHP produced electricity price. In 1985, MHG/N adopted a policy of capital subsidy raining from 50% to 75% for electrical and transmission cost component of MHPs up to 100KW capacity to encourage private sector in hydro power development.

In the Eight Five Year Plan (1993/93 to 1996/97), the HMG/N for the first time fixed a 5MW capacity target for MHP development. But, only 24% (1199KW) was fulfilled as well as in Ninth Five Year Plan (1997/98 to 2001/02), the MHP capacity development target is 5.2MW. In 1997, the MHG/N established Alternative Energy Promotion Center (AEPC) as an agency designated for the facilitating promotion of the alternative energy sources, one of which is MHP. In tenth plan government of Nepal has a plan of producing electricity by wind energy equivalent to 20 kW and conducting wind mapping in 20 districts. However, the review is yet to be done.

Many development agencies are now convinced that the provision of affordable, sustainable energy services will substantially facilitate the achievement of many of

the UN agreed Millennium Development Goals to eradicate poverty and improve the general wellbeing of communities. Integration energy with rural development activities will definitely contribute to poverty reduction. Micro-hydro systems have been in use in Nepalese hills for centuries in the form of vertical water wheels which are traditionally known as "Pani Ghatta". It has been estimated that about 25000 such traditional "Pani Ghattas" are in operation all over Nepal. However they have very limited efficiency, they are just sufficient for grinding maize and millet even in low efficiency, the result taking long time to process the grain. The cross-flow turbine had developed Nepal in 1961 and MPPU (Multi Purpose Power Unit) in early 1980s.

Now a day various turbines like cross-flow, Pelton, Propellor, Francis, Turgo etc. are in operation in the world as well as in Nepal. Because of the increasing price of fossil fuels and problems of distribution in hill and mountain, the efficient use of MPPUs and turbines became the focus alternate in rural communities.

2.4 Review of Empirical Studies

Productivity is raised through improvement in technology and energy inputs to support the new technology. Heat and mechanical energy are the two major forms of energy used in productive activities. The major energy resources for heat applications in rural hill area in Nepal are fuel-wood, agricultural residues and dung, and for mechanical applications muscle power and traditional watermills (AEPC, 2000).

Biogas (popularly known as 'Gobar Gas' in Nepal) is a byproduct of "anaerobic digestions" of organic wastes such as plants and crop residues, wood and bark residues and human and animal manure. It is an important and viable energy resources thus have expanded throughout the globe in the past two decades. Biogas at first was introduced in Nepal after the demonstration of it as model in Godawari, Lalitpur, in 1955, by Father B. R. Saubolle (Hora P., 1999, P-45).

Acharya (1983) she has mentioned the contribution of hydroelectricity to Nepalese economy. It plays significant role by developing various fields such as agriculture, industries, transportation, social services etc. water resources is the Nepal's greatest asset by unfortunately very significant portion has been harnessed to this date. She says that there is unequal distribution of electricity in different

development regions. Nepal is facing many problems with respect to hydro-power development.

There are lack of capital, skilled manpower, technical knowledge sufficient market and economic status of people as well as country. Transferring of solar radiation into electricity is termed as solar system. The solar system includes solar water heater, solar dryer and solar photovoltaic, which produce solar thermal, heat and electricity. The solar home system is feasible for Nepal where there is no alternative to produce electricity (Acharya, 1993).

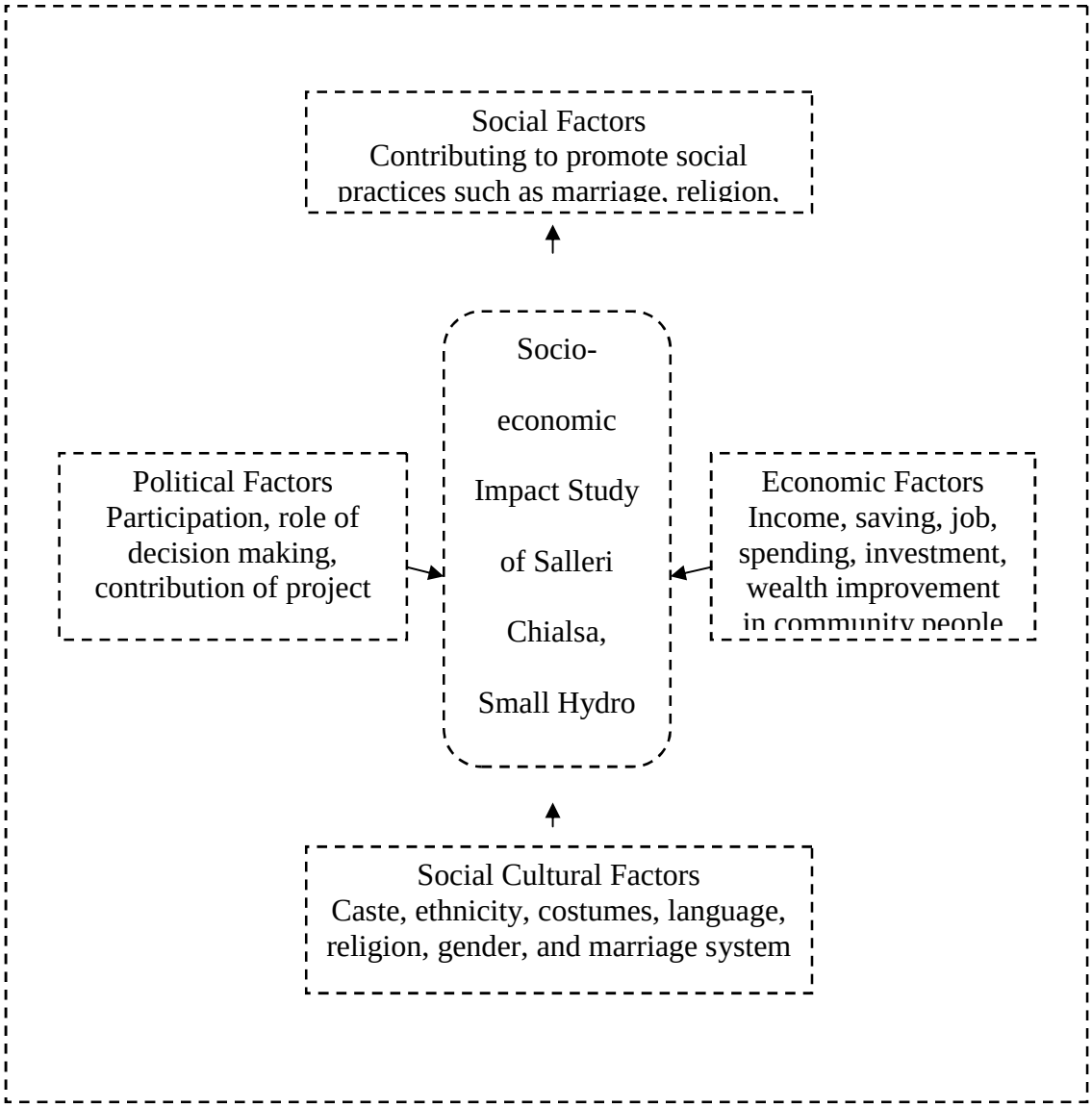
Shortage of power creates a problem in the development of agriculture, industry, trade and other sector of economy with the view of meting power shortage; it is needed to generate power in small and micro level. The small hydropower play crucial role in increasing productivity of the agriculture sector. It further helps to promote of agriculture product. The lifting irrigation in the hills area is also promoted by the development of small and micro hydropower (Jha, 1995).

Rural and Hill areas have under gone deforestation due to insufficiency of alternative energy; i.e. electricity and women over working in farm time consuming and non-monitoring and highly backwardness (Hamal, 2001). The author further explains that energy is required to fulfill day - today needs, which includes cooking, heating, lighting and productive activities such as transportation, irrigation, cottage industries, etc. Dhungel (2009) further in his thesis says that financial and economic condition of micro hydro power in Nepal. His thesis started with a background of the economic condition and energy scenario of rural Nepal. This is followed by the introduction of micro-hydro power and its role in rural development of Nepal.

MHP has positive impact on education, health and information. Bista (2011) also has presented same finding in his study of user and non-user group Tarakhola MHP Tara VDC Baglung which shows that micro-hydro power has great importance in rural development of our county in practice. In the same way, Joshi (2011) has mentioned that energy is important for economic development. He further says that income source of mountain region is different than the terai and hilly region as mountain region almost all people have found using traditional means of energy whereas in terai and hilly reason people found using electricity. On the other hand,

they empirical study on energy and development further shows that use of energy is very mandatory for economic development. Use of energy can help to reduce the dependency of foreign county. Investment in hydro-project is creating opportunities within countries that provides job opportunities for people in their indigenous places and earn for their family needs (Regmi, 2012.). The empirical studies has finding that development of micro-hydro power in our context is one of the very important infrastructure of the rural development. It does not only promote economic aspect of the people but also helps to promote socio-economic aspect.

2.4 Conceptual Framework



CHAPTER-III

REARCH METHOLODGY

3.1 Research Design

The proposed study will utilize both the secondary and primary sources of information. Review of the relevant publication and literature from Salleri Chialsa Electricity Company (SCECO), NEA, Alternative Energy Promotion Center (AEPC), United Nations Development Program (UNDP), Water and Energy Commission Secretariat (WECS) and other INGOs will be the main secondary source of information and data. Primary information and data will be collected through key informant interview with the people under coverage area of the said small hydro project. Holding mass meeting, focused group discussion and meeting with the key informants will be the other sources of data in order to achieve the objectives of the study. The following will be the research design of the study

3.2 Rationale of the Selection of the Study Area

To fulfill the objective of research, Salleri Chialsa small hydro project 600 kw, Salleri, Solukhumbu has been selected because it has its own biophysical conditions and socio-economic environment which act as the suitable stages properties for the enactment of socio-economic development in general and small hydro-power development and its utilization in particular.

3.3 Nature and Source of Data

Data are to be collect from both primary sources. Primary data have been collected from the sample respondents and secondary data are collected from the various books, Internet, report (NGO, INGO, District office and SCECO office), newspaper, and other sources.

3.4 Universes and Sampling

Salleri is the Headquarter of Solukhumbu district. Its absolute location lies between 27o 28' 10" north to 27o 33' 40" north Latitude and 86o 32' 45" east to 86o 37' 10" east longitude at the height of about 1600-2800 m above mean sea level. Now there are various modern city facilities after having the facility of electricity. Most of

the houses are of general hill type in village. RCC houses can be seen in bazaar area. Sherpa is the dominant caste in Salleri Bazar (DDC F/Y 2074/074).

The whole project area covers around 65 km2 in the Solu Khola Vally and comprises of 22 settlements in Dudhkunda Municipality with more than 1645 households. The project name Salleri Chialsa Electricity Project has been taken from the supply area "Salleri" (pine forest) and "Chialsa" at the top of the hill (where Tibatian refugee started settlement after they came during the Tibet China conflict in 1960).

In the study, Salleri Chialsa Hydropower Project (600 kW) is taken as sample of the study that supplies electricity to some par of Dudhkunda municipality in Solukhumbu district of Sagarmatha zone. The project was constructed with the fund and technical support of Swiss Development Cooperation (SDC) and Nepal Electricity Authority (NEA). Presently, the power project is running under the company act 2051 with the share of SDC, NEA and beneficiaries local households. The beneficiaries of the project is in total 1645, therefore, this study examines impact of hydro power in socio-economic aspect of the beneficiaries in particulars.

3.5 Sample Design and Sample Technique

A list of the beneficiary population of the small hydro project was collected from the Salleri Chialsa Electricity Company in Salleri, Solukhumbu. This was served as the sampling frame statistically 110 households were selected following simple random technique. Then after, a separate list of the selected households were prepared and interviewed, using the structured questionnaire.

Accordingly, information about the impacts in the socio-economic status of the population under the small hydro project was also solicited from the key informants.

3.6 Data Collection Techniques

In order to meet the objective of the study, following data collection techniques was used while collecting data for the analysis.

3.7 Reliability and Validity of Data

Reliability and validity are very important aspect in research. They are used to examine whether the study has ensured quality or not as per the objective, therefore,

in order to maintain validity, whatever instrument will be used only use after asking with supervisor. This study will be both qualitative and quantitative; therefore, survey instrument will be used getting approval from supervisor.

In the same way, in order to maintain reliability, planning of the interview question will be planed, checked, and cross-checked and asked with pears and consulted with supervisor; simple question in Nepal language will be asked. Probing method will be used to go in depth. At the time of doing observation, proper attention will be given; enough time will be given to participants to express their understanding.

3.7.1 Field Study

Stratified sampling was done in all the wards where electricity applied. Care was taken the representative sampling was from different the sectors of the scattered village Random number of respondents was selected from ward no 5 & 6 where electricity was available. A total of 110 respondents were selected an interviewed with questionnaires. The information was verified by discussion with different people and during observation of the overall situation.

3.8 Data Analysis and Presentation

Data analysis has a key role play in the entire research work from the very beginning to the end of the final study (Flick, et al., 2009). Six steps were used to organize data for analysis, and interpretation (Creswell, 2012). Firstly, Data was collected and compiled and transcribed into text. Secondly, transcribed text was read identified and central them was derived, code was given and group and regroup was done, thirdly, similarities and dissimilarities were dispatched.

Fourthly, patterns and process were identified and date were presented in table figure and discussed. In the fifth step, finding and conclusion was analyzed and interpreted com comparing with existing literatures and theory, and then after finally, findings was shared with my supervisor, teacher and peer and experts, to ensure quality standard.

CHAPTER-IV

DESCRIPTION OF THE STUDY AREA

4.1 Physical Features of Electrification Area

Salleri is the Headquarter of Solukhumbu district. Its absolute location lies between 27o 28' 10" north to 27o 33' 40" north Latitude and 86o 32' 45" east to 86o 37' 10" east longitude at the height of about 1600-2800 m above mean sea level. Now there are various modern city facilities after having the facility of electricity. Most of the houses are of general hill type in village. RCC houses can be seen in bazaar area. Sherpa is the dominant caste in Salleri Bazar (DDC F/Y 2074/074).

The climate of Salleri and surrounding beneficiary Rural Municipalities varies with its altitude. With an elevation range of 1600-2800 m, the region lies in the temperate to cold temperate zone with severe winters (temperature may fall below -5°C at the elevation of Salleri) and humid summers. Annual rainfall amounts to 1800 mm. Yak [Chauri gai] are the common animal of the place. Pine tree [Salla] is the fauna of the place.

The whole project area covers around 65 km2 in the Solu Khola Vally and comprises of 22 settlements in Dudhkunda Municipality with more than 1645 households. The project name Salleri Chialsa Electricity Project has been taken from the supply area "Salleri" (pine forest) and "Chialsa" at the top of the hill (where Tibatian refugee started settlement after they came during the Tibet China conflict in 1960).

4.2 Demography of Project Benefited Municipality

The project is situated in Dudhkunda Municipality which consist 9 wards but 5 and 6 are beneficiaries of the project. The demographic characteristic of the 5 and 6 ward s of the municipality is presented below:

Table 4:1: Population and Household of 5 and 6

	HHS	Male	Female	Population
5	800	1533	1578	**3111**
6	469	917	942	**1859**

Total	**1269**	**2450**	**2520**	**4970**

Source: DDC Profile F/Y 2073/074, Solukhumbu

4.3 Social Condition

The Salleri Chialsa Electricity Project has been electrifying almost all the wards of Dudhkunda Municipality of the 5 and 6 wards of Solukhumbu district. The settlement of Salleri, Phaplu, Naya Bazar, Dorpu, Garma and Chialsa where electrified by the project are huge and dense. Salleri bazar is the major market centre of the area. Sherpa, Rai, Tamang and Newar are the major cast residing in beneficiary area whereas Brahman and Chhetri proportion is very less in the area.

Table 4.2: Caste Wise Population of Dudhkunda Municipality

Caste	Salleri	Percentage
Sherpa	2474	45.34
Tamang	1255	23.00
Newar	656	12.02
Kami	575	10.54
Chhetri	308	5.64
Rai	65	1.19
Damai	57	1.04
Magar	27	0.49
Gurung	16	0.29
Sunuwar	13	0.24
Brahman	6	0.11
Lepcha	5	0.09
Total	5457	100

Source: VDC Profile, Salleri VDC 2009

4.4 Education Status

The project area, Dudhkunda Municipality has comparatively more educational facilities compared to other Rural Municipality of Solukhumbu district. The project area has one campus, two higher secondary schools, four secondary schools (two English medium private schools) and five primary schools.

4.5 Status of Women

Overall status of women in the project area is good. As the ethnic majority of village is Sherpa, Rai, Tamang and Newar, the status of women of Sherpa is generally female dominant. Women are active in social work and developmental work/project management. In decision making process also the females are taking active participation. Literacy rate of women in the area is low in comparison to male.

Most of the women in the project area are housewife only. Their major works are limited to the inside of their house. Very limited women of the project area are employed but that can be taken as negligible. But the women from the Sherpa family are actively involving in the business like hotel and lodge.

Women are considered to be subordinate to men in house but some women are taking the farming responsibility because their husbands are in outside the house to work. Generally, men are active in outside social work and women in household chore. But now a day's 'Ama Samuha' - an organized group of mothers working in organizing women and towards work in favor of rural women's right, saving, credit, training and empowerment.

4.6 Language

The language composition of project area is dominated by Sherpa language. Some ethnic groups are using their mother tongue but in public place and social work, they like to speak in Nepali national languages.

Table 4.3: Sampled Population and Their Languages

S.N.	Language	Sampled Population	Percentage
1	Sherpa	50	**45.45**
2	Nepali	35	**31.82**
3	Tamang	10	**9.1**
4	Newar	9	**8.18**
5	Rai	6	**5.45**
	Total	**110**	**100**

Source: Field Survey 20017

4.7 Economic Status of Project Area

In Dudhkunda Municipality there was no significant economic activity before the installation of hydropower. Though, Salleri being the Headquarter of the district, the modern communication and entertain facilities were there and as well as modern economic activities were taking place. After development of hydropower, the economic activities of the area increased significantly.

4.7.1 Occupation

The main occupation of the people of the project area is agriculture. Being near to the top of the world The Mount Everest; people are getting opportunity to work in the tourism sector as guide, cook and porter. Foreign employment of youths is also popular. The occupational distribution of the people in the project area is given below.

Table 4.4: Occupational Distribution of Project Area

S.N.	Occupation	No of HHS	Percentage
1	Agriculture	47	42.73
2	Business/enterprise	15	13.64
3	Foreign job	11	10
4	Laboring	8	7.27
5	Official Job	14	12.72
6	Others (Treaking, Hotel/Lodge)	15	13.64
Total		**110**	**100**

Source: Field Survey

4.7.2 Agriculture

The main occupation of the project area (Dudhkunda Municipality) is agriculture. There seems subsistence agriculture rather than professional/mass production. Some people of village are producing some cash crop vegetable but in very limited. For mass use of vegetables and other food, the Municipality should depend on other Rural Municipalities and Tarai. The major food grains of the project area are potato, maize, millet, wheat, barley and mustard and major vegetables are

cauliflower, cabbage, radish, carrot and seasonal green vegetables. Apple, peach and palm are the major fruits available in the area.

4.7.3 Livestock

Livestock rearing is also the main occupation simultaneously with land farming. Most sampled households use to rear/keep livestock of various types. The major livestock among the sampled household are yak, sheep, horse, goat, ox, poultry, pig etc. Some low castes (Dalit) families are keeping pig and poultry as professional manner. But among Sherpa; sheep, yak, horse, cow and goat are the major livestock they rear. There is facility of livestock service centre in project area.

4.7.4 Business &Trade

The main business opportunities in the project area are handicraft, hotel, lodge, trekking guide/porter/cook and foreign employment. Youths in the area are found engaged in tourism sector (guide, cook, porter) and foreign employment in India, Gulf, Europe and America. After the advent of electricity in the area from project, there are entries of some new business such as cable television, computer training institute, computer hardware and software maintenance shop, video and high vision hall, grill workshop, photo lab etc.

People of project area are benefiting from these new business opportunities. Before that people have to depend on Kathmandu for those facilities. The reliable electricity from the project is the benefit for the people of project area to make their lives comfortable.

4.8 Sample Households Source of Income

From the field survey it is identified that the income very different among the people in the project area. There are single source and double source of income among these households. There are small farmer to too high class businessmen in sampled households.

Most of the youth of the project area went to foreign country to work. These countries vary from India, Gulf to first world countries of Europe and America. The foreign employment trend is not new for project area. In some high income range family, at least their one person is in foreign developed country.

Table 4.5: Sampled Household Income Source

Income range (per month)	No. of HHs	Percentage
Below 5000	4	3.64
Rs.5000 to Rs.10,000	26	23.63
Rs.10,000 to Rs.50,000	63	57.27
Above Rs.50,000	2	1.82
Did not Answer	15	13.64
Total	110	100

Source: Field Survey.

4.9 Infrastructure Development

Infrastructure development of the project area is being developed before than the past time. Establishment of the hydro project has contributed a lot to infrastructure development of the project area, particularly in road and communication infrastructure development which are presented in the following.

4.9.1 Transportation and Communication

The project area is about days walk from Okhaldhunga where the seasonal motor road facility is available. Within the project area, there is an airport which is the modern way of transportation. Recently Okhaldhunga-Salleri road is in the process of construction. To carry foods and materials, it needs to depend on porter and mules.

Regarding communication facility, now there is CDMA telephone, landline phone of 500 lines, CDMA sky phone and mobile phone facility is available in the project area. Two companies are providing the facility of cable television of more than 30 channels to around 500 households. Computer institutes, color photo lab and offset press are also established. So, the project area is more facilitated in information and communication.

4.9.2 Sanitation

Overall sanitation awareness of project area is high in comparison of other Rural Municipality of the district as the area lies in the district headquarter of Solukhumbu district. The literacy rate is high in project area so, sanitation awareness

is also high. Most of the youths have been working in European country. Drinking water supply district office, District Development Committee, Community Base Organization and other organization will be the related organizations to enhance the sanitation awareness in project area.

4.9.3 Drinking Water

Overall drinking water status of the Municipality and project area is positive. All the settlements of the area have been facilitated by gravity flow water system.

4.9.4 Institutional Set Up

All the district level government offices are established in the Salleri area. Some local Non-Government Organizations and Community Based Organizations are working as non-governmental organizations which are the pillars of the village development. The hydropower project is operated by joint venture Company of locals, Nepal Electricity Authority and Swiss Development Cooperation.

4.10 Project Description

The Salleri Chialsa Hydropower Project is located at Solu Khola, ward no. 6 of Dudhkunda Municipality of Solukhumbu district. The district lies in Sagarmatha zone of Eastern Development Region of Nepal. The project site is about 1 hour walk from Salleri - the Headquarter of Solukhumbu district. Similarly, the project site is located at the south side from Salleri. The salient features of the project as per the project detail design report and as per field survey are as follows:

Table 4.6: Salient Features of Salleri Chialsa Hydropower Project

- © Type : Run of the River
- © Canal Length : 448.75 m
- © Nominal water consumption : 1250 l/sec and 1350 l/sec
- © No. of Units : 3
- © Power output : 360 kW
- © Net Head : 19.6 m and 24.6
- © Turbine : Cross-flow, 600 mm and 640mm runner diameter
- © Generator : 3 phase, synchronous, brushless
- © Governor : OSSBERGER GERMANY, Electro hydraulic

© Station Factor : 49%

© Supply availability : 98 %

© Transmission : 11 kV transmission line of 32.2km

© Distribution : Underground distribution system, with cables more than 60km

4.10.1 Management and Operation

Salleri Chialsa Electricity Company has a lean management with 13 competent staffs to manage and maintain the system to required standard. The holders of ordinary shares-representing the decision-making body of the company - are the local people, so-called “domiciled householders”, who hold 48%, and the Nepal Electricity Authority and the Swiss Development Co-operation with 26% each.

The preference shares (investment) are held equally by Salleri Chialsa Electricity Company the Nepal Electricity Authority and the Swiss Development Co-operation has an active Board. There are altogether 9 members of which 3 are elected from the local electricity users, 3 represent Nepal Electricity Authority and 3 are from Nepal Electricity Authority General Manager acts as the member secretary to the Board.

4.10.2 Tariff and Connection Policy

Salleri Chialsa Electricity Company Tariff is based mainly on the fact that a considerable part of the connections are not metered and that individual load control switches automatically cut out when the permissible power off-take is exceeded. The tariff is divided into five main levels (with sub-levels within levels 3, 4 and 5) defined by the permissible power off-take during peak and off-peak times.

Every tariff level has to pay a fixed rate, which reflects partly the cost of standby power and partly the fixed cost of investment related to very connection. Levels 1 and 2 pay a fixed rate only and are not equipped with meters. Levels 3, 4 and 5 are metered and have to pay a fixed rate, as well as a differentiated, depressive price per consumed unit (kWh). Levels 1, 2, 3/1 and 3/2 are grouped in the “domestic” category, with maximum possible power consumption of 0.1kW, 0.5kW, 1kW and 2kW; level 4/1 and 4/2, known as the “Service” category, covers connections to schools, hospitals, hotels and lodge, government offices, cottage industries, with a

maximum power off-take of 4kW (level4/1) or 8kW (level 4/2); Level 5, the "Industry" category, is specially designed to promote day consumption, by low unit prices with a permissible off-peak power off-take of some 20kW (or even more), which is drastically curtailed by a timer-relay device during peak hours.

To get a line, as per connection policy, the house wiring must meet the Salleri Chialsa Electricity Company technical standards and the relevant customer has got to get the wiring checked by Salleri Chialsa Electricity Company or Salleri Chialsa Electricity Company certified wireman.

Table: 4.7: The category of electricity users and tariff structure

Level	Adm. Power (kW)	Fixed Rate (NRs/mth)	Exempted (kWh)	Further (kWh)	Further (kWh)	Price Per Unit (NRs/ kWh)
1	0.1 max	130	-	-	-	-
2	0.5 max	400	-	-	-	-
3/1	1.0 max	425	75	90	all	8.00
3/2	2.0 max	530	75	90	all	8.00
4/1	4.0 max	850	100	90	all	8.00
4/2	8.0 max	1300	120	95	all	8.00
	Off peak peak					
5/1	>10.0 max 0.1	430	80	85	all	6.00
5/2	>10.0 max 0.5	590	80	85	all	6.00
5/3	>10.0 max 2.0	1030	120	90	all	6.00

Source: Salleri Chialsa Electricity Company Limited (F/Y 2072/073)

4.10.3 Electricity Uses

The electricity use of Salleri Chialsa Hydropower Project is divided into domestic and industrial sectors (Table 6.3). The uses such as lighting, heating, cooking, entertainment (playing radio, TV, cassettes), computer, and freezing in addition industrial appliances are observed in project area.

Table 4.8: Electricity Users of Salleri Chialsa Hydropower Project

SN	Level	No. of Connections	Percentage	Remarks
1	1	513	46%	Lighting
2	2	268	24%	Lighting
	Total	*781*	*70.00%*	
3	3/1	19	2%	Lighting & Heating
4	3/2	117	10%	Lighting & Heating
	Total	*136*	*12%*	
5	4/1	149	13%	Lighting & Heating
6	4/2	16	1%	Lighting & Heating
	Total	*165*	*14%*	
7	5/1	9	1%	Industrial
8	5/2	7	1%	Industrial
9	5/3	22	2%	Industrial
	Total	38	4%	
	Total	**1120**	**100%**	

Source: Salleri Chialsa Electricity Company Limited.

Table 4.2 indicates clearly that about 70 percent households are using electricity for lighting only. About 26% households have electric heating facility and 14% connections have involved in enterprises business. Connections of level 3 and 4 include the domestic and business users such as government offices, NGOs/INGOs, hotel & lodge, computer institutes, electronics service centers and shops.

4.10.4 Agro Processing

There are 8 agro processing unit consisting rice huller, grain grinder and oil expeller. These agro-processing units are owned by private entrepreneur. The agro-processing facility is the major contribution of the hydropower.

4.10.5 Grill Workshop

There is one grill workshop owned by private entrepreneurs. Grill workshop is another major facility for local people. The workshop is used for minor type of metal works. Other major uses of electricity are in the operation of cable television, computer institute, poultry, furniture workshop etc.

4.10.6 Financial Status of Salleri Chialsa Hydropower Project

In many prospects, Salleri Chialsa is a pioneer hydropower project. Many of the political concepts in the new Hydro Power Development Policy 1992 of Government of Nepal were prepaid and first confirmed through the setting-up Salleri Chialsa Electricity Company shareholder company, foreign shareholding, tariff authority, operation mode, staffing etc. Salleri Chialsa Electricity Company is the one and only private electricity utility with a sizeable local shareholding.

At present, there is no other similar case in Nepal. The main promoters of the company are Nepal Electricity Authority and Swiss Development Cooperation. The total cost of the preference share was NPR 5, 75, 12,000 which is equally divided to NEA and SDC. Similarly, the company was formed including locals with NEA and SDC with the ordinary share value of NPR 10, 00,000. The ordinary share was distributed as 50% to locals and 25% each to Electricity Authority and Swiss Development Cooperation. The share detail is as follows:

Table 4.9: Share Structure of Salleri Chialsa Electricity Company Limited.

S.N.	Preference Share	Amount (NPR)	Percentage
1	Preference Share from Nepal Electricity Authority	2,87,56,000	50%
2	Preference Share from Swiss Development Cooperation	2,87,56,000	50%
	Total	57,512,000.00	100%
S.N.	Ordinary Share	Amount (NPR)	Percentage
1	Ordinary Share from Nepal Electricity	2,50,000	25%

	Authority		
2	Ordinary Share from Swiss Development Cooperation	2,50,000	25%
3	Ordinary Share from locals (connected households)	5,00,000	50%
	Total	10,00,000	100%

Source: Salleri Chialsa Electricity Company Limited.

From the above Table 6.3, the investment amount is mainly contributed by Swiss Development Cooperation and Nepal Electricity Authority and locals have involvement in management and operation to form as a legal company.

4.10.7 Income and Expenditure

There are various power distribution categories hence the income from end-uses and household lighting is quite difference. Most of the end-uses are owned by the private entrepreneur except owner of the plant.

In case of expenditure the major expenditure topics are salary to project staff, repair and maintenance, office expenses and miscellaneous expenses. Table 6.6 shows the income and expenditure of the hydropower project as of present actual basis.

Table 4.10: Annual Income and Expenditure

Particulars	Amount (Rs.)
Operating Income	
Sales of Electricity	18,350,035.00
Miscellaneous Surcharges/Income	7,568,818.19
Total Operating Income	25,918,853.19
Operating Expenses	
Personnel Cost	
Power House Expense	6,168,514.85
Repair and Maintenance	2,141,114.22

Total Operating Expense	8,309,629.07
Operating Profit	17,609,224.12
Other Income	
Income from Investment/Interest	1,787,047.32
Depreciation Being revenue portion of Grant Aid	1,903,549.43
	3,690,596.75
Other Expenses	
Depreciation	5,887,120.00
Administrative Expenses	1.244,827.16
Management Expenses	501,643.29
Provision for Employees' Bonus	677,833.60
	8,311,424.05
Profit before Tax	2,479,123.16
Provision for Taxation	1,327,327.30
Deferred Tax Expenses/ income	1,472,768.81
Net Profit	10,188,265.71

Source: F/Y 2072/073Salleri Chialsa Electricity Company Limited.

CHAPTER - V

SOCIO-EONOMIC IMPACT ANALYSIS OF SALLERI CHIALA HYDRO POWER

5.1 Impact Analysis of Micro-Hydro Project

There are lots of positive impacts of electrification in the project area. As the project covers the two wards Dudhkunda Municipality of Solukhumbu district, the impact study was carried out as per the project coverage. Total 1645 households were electrified from the project and some and end-users have been installed by the electric power of Salleri Chialsa Hydropower Project. The impact analysis study relates how the hydropower affected the local people on social aspect, economic aspect with gender participation, what is the status of gender participation.

Likewise the analysis is also relates to the role of hydropower in rural electrification. Due to the communication facility in the area, people are more conscious, they are more curious about the news (Local and international) than before. Some households are getting income by establishing some small industries. Similarly some people get the job in the area after electrification. A perception and fact survey was conducted in the project area. The results of the survey are given below.

5.1.1 Social Impacts

Since the hydropower installation in Salleri, peoples are more benefited than before. People learned the optimum use of hydropower. The average family sizes of ward no 5 and 6 Dudhkunda municipality.

Local people have positive perception towards hydropower. Field observation reveals that children's study hour increased due to electricity in the area. Children are more enthusiastic in reading in electricity than before in local kerosene lamp. Table 5.1 shows the children's reading habit.

Table 5.1 Children's Study Hour after electrification

Description	No. of respondents	Percentage
Increased	99	90
Decreased	-	0
Both	3	2.73
Don't know	8	7.27
Total	**110**	**100%**

Source: Field Survey

By analyzing the above table, 90 percent respondent has the conviction that electrification increased the reading habit of children. None of the respondent said that hydropower decreases the study hour of children. Some respondent said don't know mean either their children are out of their home or they have no reading children. But it can be concluded that hydropower helped to increase the reading hour of children.

5.1.2 Health and Sanitation

Sanitation and health can help to identify the villager's magnitude of civilization. Overall health and sanitation status in Dudhkunda Municipality is positive. During the field visit people's perception were asked pertaining to health & sanitation impact due to electrification. After electrification local people have got rid from the smoke of Tuki. Their houses are clean than before due to the replacement of Tuki by electric bulb. People are using radio, T.V, computer and other electric appliances which are the awareness generating gadgets regarding sanitation and health. Table 5.2 shows some additional about health and sanitation.

Table 5.2: Health and Sanitation Condition among Respondents

Aspect	Improved			Total
	Yes	No	Don't know	
Improvement in children's Health	101(91.82%)	3(2.73%)	6(5.45%)	110(100%)
Aspect	To visit Doctor/dhami			Total

	Occasionally	Frequently	Normally	No Response	
Frequency of Visit to Doctors/Dhamis	75 (68.18%)	8 (7.27%)	7 (6.37%)	20 (18.18%)	110(100%)

Source: Field Survey

By analyzing the above table, about 91.82% of respondents have said that village's cleanliness and sanitations have been increased due to electrification. Some 2.73 percent have negative perception and remain 6 percent are unknown about the matter.

Likewise, some 68.18% respondents have said that they visit the doctor or dhami occasionally, whereas 6.37% respondents are visiting the doctor or dhami frequently and normally and 20% respondents do not replied about the question. In case of common diseases and common method of treatment villagers have different perception. Same are firstly consulting to local doctor and some illiterate often consult to Dhami/Jhankri.

5.1.3 Communication and Entertainment

By the advent of electricity in the area, there are the introduction of new communication and entertainment facility. These facilities are the main means of human awareness and communication. Out of the total sampled respondents, 80.9% respondents owned radio/cassette, 63.63 % respondents owned television and 60.9% respondents found having telephone/mobile. Table 5.3 depicts more details.

Table 5.3: Means of Communication and Entertainment

Means of Communication, Information	No. of respondent	Percentage
Radio	89	80.9%
TV	70	63.63%
Telephone Facility	67	60.9%

Source: Field Survey

Analyzing the above table the facility of communication and entertainment is positive. Thus due to the entertainment facilities people become clever, educated and civilized.

5.1.4 Electricity and Change in People Lifestyle

By the advent of electricity to the village people's life style have changed as well as fashion style. Radio, television and computer make people more conscious, aware, informative and clever with regards to all aspects of society. Most of the respondents households responded that electricity has helped to improve the lifestyle of their family while few said that no lifestyle change due to electricity. The receptivity power has been increased among the residents. Similarly, people become more adoptive. People have learned many-many good things like hygiene, sanitation, health, and environment due to electricity. Children's' fashions have been changed. They are now demanding more fashionable goods than as before.

The food habits, dress wearing style, speaking technique to outsiders have been changed due to the advent of electricity. But some villagers observed that children demanding more expensive clothes than as before which is difficult to manage such expensive things for their parents. Such kind of problem has brought by the electrification. Similarly, villagers' agricultural styles, using the toilet and so many day to day lifestyles have been changed due to the advent of electricity in that village.

5.1.5 Education and Skill Development

Overall education status ward no 5 and 6 municipality is positive. People are highly educated in the project area. Some people found highly educated and some are studying abroad in medical and engineering stream. Overall awareness about the education is good. Some adult literacy classes were started in evening time for illiterate adult. Youths are enthusiastic to learn new skills to utilize the electrical power as professional basis. As the area is the route to Mount Everest base camp, different types of people are walking through the area.

Moreover due to the frequent visit of technician to the village the youth learnt so many technical matters about rural technology. Some youth who previously were unemployed started to do new cottage industries. Some are engaged in electronic service center and information technology business in small scale.

School present ratio is also increased after electrification. People have started to send their daughter to school due to the awareness. Some low caste (Dalit) people residing

nearby the area have got new opportunity development in newly opened various types of industries. These are the backward class caste in Nepal. But after electricity due to different direct and indirect cause, their educational awareness is going to increase. These all facts reveal that there is positive trend in social change through electrification in ward no 5 and 6

5.1.6 Electricity and Public Service

Electricity is the key actor of development after the infrastructure, Road. Moreover, people are benefiting by electricity in their village. In Nepal, hydro electricity can be the advantage for rural villages. For the transformation of rural hill area of Nepal, hydro electricity is the key element. The provision of electricity doesn't provide a new motion for societal change through combination of modern technology, new skill and information and its results in civilized society. The key sectors of public services such as health post, veterinary, school and other social organizations are the main amalgamation in society. Until and unless enabling the integration between electricity and such organization the electricity can't be the vital turning point to change the society.

5.1. 7Acculturation and Electricity

Culture is main aspects of ornament of society. For every society culture plays the role of identity. The project area of Salleri Chialsa Hydropower has got their self identity with regards to culture. Now modern communication and entertainment gadgets are promoting the new things to the village especially to link the village to the outer world. Similarly, T.V. video, radio, cassette player, computer and other entertainment and communication facilities are the key players to introduce acculturation to the societies. Some modern scientists told that acculturation is mandatory to change and transform the society. These various forms of acculturation is begin to see in the project area of the Ward no 5 and 6.

5.1.8 Health Impact of Hydropower

Before the electrification villager were using the kerosene lamp for lighting. However some were using solar lamp. Due to the carbon emission produced by kerosene burning, overall environment was affected before. Eye dieses are decreasing. Other diseases like respiratory problems are also in decreasing state.

5.1.9 Electricity and Gender Equity

Gender means social sex. Gender refers to the responsibility given by the society each of them. Gender wise participation of Salleri Chialsa Hydropower Project is positive. Women's involvement is remarkable for utilization of electricity for lighting, cooking and other use. One interesting matter is that every day women's hand first goes to the electrical appliance's switch first to switch ON and OFF. Considering these important fact, the impact of Salleri Chialsa Hydropower Project and gender was assessed by exclusively interviewing the women who were the head of the family i.e. 26 women were interviewed in the sampled households. In the project area the status of women participation is good. Women are the main manager of household management. Regarding the electricity consumption women controls the consumption unit than men. Although there are not any industries solely operated by women but in hotel, restaurant, lodge/guest house, photocopy, fax, photo studio and computer institute, women's involvement is considerably high.

They are assisting their male partner in doing these works. Before the hydropower, most of the household's grains milling works were done by women. That means women were the main carrier of grain to the agro-processing mill and some were processed grain by operating Janto (traditional manual grain grinder). But after the advent of electricity and introduction electricity operated mill, most of the previous women's work have been changed into men's responsibility. Women drudgery is also reduced remarkably.

5.2 Economic Impact

Overall economic impact of Salleri Chialsa Hydropower Project is positive. The perception of villagers regarding the economic impact is also positive. The major economic contribution of the project is described here under. Economic impacts of project are direct and indirect. Income increment through the electricity among respondent is illustrated in table 5.2.

Table 5.2: Income Generation Affected by Electrification among Respondents

	Respondents			Total
	Affected	Not Affected	Don't know	
Respondents	77	24	9	110
Percentage	**70**	**21.82**	**8.18**	**100%**

Source: Field Survey, 2017.

Table 6.8 shows that about 70 percent respondents have positive responses of income generation from electrification. Very little 21.82 percent had replied that they have not got additional income after electrification but they have to keep some additional money to pay the tariff. Seven percent of respondents are found not having interest on the question. Besides these people are involving other occupation before and after the electrification which helps them to pay the tariff regularly.

5.2.1 Electricity and Industrial Change

Ward no 5 and 6 of Dudhkundha Municipality are not so remote compare to other Rural Municipality of the district. Salleri is a Headquarter of the district. Before electrification, people used to do their muscle power for grain grinding and oil expelling. There was one agro mill at Nayabazar running by turbine mill but that was almost insufficient for all the wards so they do these works manually at their home.

After the advent of electricity the rural area turned into industrial area for agro processing works. There is the flood of such drudgery reducing industries like huller, grinder, oil expeller etc. Most of the modern communication and IT facilities are established in Salleri. They are very much benefiting the people of project area. That makes possible due to the electrifications. About 54 numbers of connections are taken for industry and business are running from hydropower.

5.2.2 Economic Impact of Industrial Change

Previous Nepali society had based upon barter system that means goods exchanging system. Now most of the society has been made monetized due to the market expansion effect. The project has contributed promising market expansion in

the project area of Salleri and Garma. There are lots of private industries established by the electricity of the project. Some important industries are described below:

5.2.3 Furniture

Altogether there are two furniture industries in the project area operated through the electricity. Furniture workshop has been established in Salleri, Nayabazar and in Salleri bazaar. During the field visit time the owner of the furniture is interviewed and he said that he is happy towards the hydropower project. His furniture business is increased due to electricity. Now his net profit per month is about NPR 10,000 which is a large earning in rural area. His version is satisfactory in economic and social point of view.

5.2.4 Agro Processing Mill

There are altogether eight agro-processing mill scattered through the project area. All the agro processing mills are owned by the individual entrepreneurs. Huller and grinder are common for all and only three of them having oil-expeller. The owners say that their profit is good due to the facility of lower charge of electricity provided by the company for industrial use. Not only their profit but the processing charge of agro-processing is low compared to other area which is the benefit to the villagers also in saving the money. Hence we can conclude that the economic impact of hydro power to agro-processing is significantly high.

4.2.5 Agricultural Production and Electricity

Though there is not direct relation between agriculture and electricity. But due to the communication and information facility through electrification, local villagers can learn about modern agricultural technique, agricultural tools and extension, about fertilizer and pesticides/insecticides and other lots of information. In this way we say that there is the relationship between agriculture and electricity.

5.2.6 Environmental Impact of the Project

Hydro-electricity is clean energy. Most of the alternative energy can be taken as clean energy. Moreover it is environmentally friend in point of view of construction. In society hydro power brings positive environmental impact after its

installation. Due of use of electricity by households, there is significant reduce of using firewood’s for cooking that helps to decrease environment pollution. In the same way, use of electricity for industrial purpose has reduced use of fuel for generating and lighting that had decreased use of CO2 and Carbon Mono Oxide which are the source of environment pollution. After establishing project in the area, beneficiaries were found stating using electricity instead of using tradition means of energy that has positive impact on environment.

CHAPTER - IV

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Findings

The Salleri Chialsa Hydropower Project is a promising attempt in point of view from technical and socio-economic impact. The courage of company cannot be forgotten. This hydropower has changed the project area from rural village in to rural city. The socio-economic impact study of project has given some findings, conclusions and recommendations which are described hereunder.

- Study area was found diversified in terms of casts. 12 castes were found living in the place where as Sherpa were found largest population by45.34 percentages.
- Five languages were found spoken such as Sherpa, Nepali, Tamang, Newari and Rai where as Sherpa language dominant language by 45.45.
- Children health and satiation condition was significantly improved than other by 91.82 percentages.
- Children study was found increased after electrification by 90%.
- Project has found contributing in communication development. 80.9 percent people were found listening Radio whereas 63.63 were found using T.V and 60.9 % people were found using telephone.
- Different occupations such as agriculture, business enterprise, foreign job, laboring, official jobs, tracking, hotels and lodge were found dominant occupation people following, however, agricultural was found largest by 42.72.
- Income range per-month was found significant. People were found earning 5000-50000 above. But, 10000-50000 per-month earning was found highest earning of the people by 57.27 percentages.
- Income level of the people was found increasing. 70% people were found affected with increasing in their income after electrification.

Summarizing all finding shows that the socio-economic impact of the project in livelihood development of the community people of the project area is significantly co-related as establishment of project has contributed to improve social aspect such as health condition, education, gender equality and cultural aspect. In the same way, the project has found contributing in the development of the people of project areas in economic aspect as people income has been found improving and changed due to help of establishing new business and industry.

6.2 Conclusions

The project has played a vital role in rural development. It is concluded that the implication of hydropower project for rural development are: introduction of modern technology in rural context, which developed technical capabilities in the village needed for rural development, introduction of industrial management concept, introducing of entrepreneurship in rural village.

The hydropower installed in Salleri from Solu Khola has not only provides clean and smokeless energy for lighting, heating and cooking but also helped in improved health condition, save time, easy to work at night and more efficient on income generation as well as productive work.

Electricity becomes the daily life of rural people. They could not assume electricity less village because they are accustomed to use electricity. It has been concluded that women are more benefited by the project in many aspects. The economic impact of the project is clearly visible in project area.

People are running agro-processing unit, furniture, grill industry, computer institute, photo studio, color lab and cable television in their own village which earns more money than as before the project. Electrification has brought flexibility in gender roles. Tradition Dhiki, Janto has been replaced into modern agro-mill.

No any gender and cast ethnicity bias have been seen while in distributing power to the area. By considering the above conclusions, it can clearly be said that small hydropower plant is a facilitator for rural socio-economic change and development and in gender perspective.

Also it plays the vital role in rural electrification. But it needs regular monitoring, evaluation, research and development. The study on hydro power in

relation to rural development has not been done. But, this study has found that there is co-relation between hydro-project and rural development. As finding of the study shows that hydropower can be one of the very important infrastructure as like others for rural development, therefore, the study recommends as:

6.3 Recommendations

- Proper management for operation and maintenance is the essential factor for any hydropower program.
- Before initiation the plant in any area training should be provided as grant from the side of government for its future sustainability.
- During implementation local materials should be used as more as possible.
- Proper evaluation of the socio-economic setting, technical and managerial capabilities and adequate survey and design must be ensured while carrying out feasibility studies.
- Proper accounting and management training should be provided to the owner/developer/users committee.

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Annex-1

Questionnaire for Household Survey

1. Personal Information

a) Name of the household head : .....

b) Sex : ☐ Male ☐ Female

c) Age: .....

d) VDC: ....., Village / Tole ..... Ward No.: .....

2. Respondent's Full Name : .....

a) ☐ Male ☐ Female

b) Age: .....

c) Caste : Brahmin ☐ Chhetri ☐ Kirat ☐
Newar ☐ Sherpa ☐ Others (specify) .....

d) Religion: Hindu ☐ Christian ☐ Buddhist ☐
Islam ☐ Others (specify).....

e) Education: ..... f) Relationship with household head.....

3. Family structure by age, sex and education

Age group	Male (Number)	Female (Number)	Education			Primary (1-5)			LSS (6-7)		SS (8-10)		Higher	
			Male literate	Male illiterate	Female literate	Female literate	M	F	M	F	M	F	M	F
(0-15)														
(15-30)														
(30-45)														
(45-60)														

Above														

4. Main occupation of family

   a) Agriculture ☐ b) Business ☐ c) Service ☐

   d) Foreign job ☐ e) Laboring ☐ f) others (specify).....

Economic Aspect

5. How long the family has been staying here?

   a) One generation ☐ b) Two generation ☐ c) More than two ☐

6. What is your family's annual income?

   a) Rs. ..... in cash b) ..... in goods c) Others (specify).....

7. Annual Expenditure:

S.N.	Item/particulars	Expenses (NRs.)	Remarks
1.	Clothing		
2.	Food		
3.	Feast & festivals		
4.	Health care		
5.	Education		
6.	Fuel		
7.	Interest on loan		
8.	Others (specify)		

8. Energy consumption

S.N.	Type	Source	Unit cost	Easily Available	Moderate Avai.	Hardly Avai.
1.	Fire wood					
2.	Kerosene					
3.	Agriculture					
4.	Waste					
5.	Biogas					
6.	Electricity					
	Others					

9. Average Landholding of the Family

S.N.	Land Type	Area (Ropani)

1.	Unirrigated land holding	
2.	Irrigated	
3.	Kharbari	
4.	Forest	
5.	Others (specify)	

10. What was your daily working hour before electricity project?

    .....

11. Have your working hour increased after electricity project?

    If yes, How much hour per day? .....

    If no, Reason.....

12. What is your additional income from changed works (electrification)? .....
13. Have you get some such new opportunity development after electrification?

    a) Yes ☐ b) No ☐

    What are those opportunities?

14. What types of home appliances that you use in your house after joining electricity from the project?

    Electric bulb

    Tube light

    Computer TV/VCD/Radio

    Rice cooker

    Banjul Dench

    Heater

15. Do you have any livestock/poultry that you run after this project establishment?

    If yes, fill the following table.

S.N.	Types	Numbers	Monetary value
1.			
2.			
3.			

16. Have you felt that your financial condition has been improved by electrification?

    a) Yes ☐ b) No ☐

    If yes, give reason.....

17. Is plant from your house?

    a) Yes ☐ b) No ☐

18. Are you not able to use electricity due to being economically poor?

    a) Yes ☐ b) No ☐

19. Are you not able to join electricity, due to different process/system of joining?

a) Yes ☐ b) No ☐

20. How much is the monthly tariff of electricity? .....

(..... Rs per watt per month / **or**..... Rest. Per unit per month)

21. What is your average monthly bill? Rs.

22. What is your saying on present electricity tariff?

a) Affordable ☐ b) Unaffordable ☐ c) Too high, Reason for.....

23. Is your income sufficient to pay the monthly tariff?

a) Yes ☐ b) No ☐ Reason for:

.....

If No, how do you pay your charge? .....

24. Are you paying electricity tariff/change regularly?

a) Yes ☐ b) No ☐

If no, give reason.....

25. Are you satisfied about the tariff system of electricity of this plant?

a) Fully satisfied ☐ b) Satisfied ☐ c) Don't satisfied ☐

d) Totally dissatisfied ☐ e) don't know ☐

B. Social Aspects

1. Is the drinking water facility in your community?

a) Yes ☐ b) No ☐

2. Is electricity used to supply water?

a) Yes ☐ b) No ☐

If yes, specify travel distance

If no, what is the alternative?

Reason for:

3. Has your day-to-day work been comfortable after electricity?

a) Yes ☐ b) No ☐ d) don't know ☐

4. With the use of electricity, is there any change in the society?

.....

5. What about your children's study hour after electrification?

a) Increased ☐ b) Decreased ☐ c) Both ☐ d) don't know ☐

Reason for:

6. Have you felt that your children's health has been improved after electrification?

   a) Yes ☐ b) No ☐ c) Don't know ☐

7. Is your family member out-migrated now?

   a) Yes ☐ b) No ☐

   If yes, I) Destination..... ii) Duration..... iii) Remittance.....

8. Which of the energy source do you use for cooking?

   a) Fire wood ☐ b) Kerosene ☐ c) Biogas ☐

   d) Briquettes ☐ e) Electricity ☐ f) Animal waste/dung ☐

   g) others.....

9. Which type of energy do you use to lighting purpose?

   a) Electricity ☐ b) Biogas ☐ c) solar ☐ Others.....

10. How long time do you spend to collect the firewood in a day?

11. Has the electricity improved the social integrity of your community?

    a) Yes ☐ b) No ☐ Reason for.....

12. Do you think that the electricity has made your cultural function, Programme more interesting and ease?

    a) Very much ☐ b) to some extent ☐ ot so much c ☐ t all ☐

13. How often do you consult the local doctor (Dhami/Jhankri)?

Maps and Photographs

Solukhumbu Distric Map

Power House site Salleri Chialsa Electricity Company Limited

Power House Phase – I & II

Power House Phase -III