

CHAPTER-I

INTRODUCTION

1.1: Background of Study

Nepal is a landlocked mountainous country, which is sandwiched between India and China; it is 1,127 km far from the nearest point of the sea. It occupies 0.3 percent and 0.03 percent area of Asia and the world respectively. Nepal is located in between the latitude of 26°22' N to 30°27' N and the longitude of 80° 4' E to 88°12' E. The country is approximately rectangular, its average length from east to west is 885 km, and the breath from north to South is 193 km (Pokharel, 1998).

Nepal is divided on the various bases such as ecologically (Mountain, Hill and Terai) river's basis (Kosi, Gandaki, and Karnali) administratively 5 development regions, 14 zones and seventy five districts, 3915 VDCs and 58 municipalities. Out of the total population 86.06 percent people live in rural areas, and 80.77 percent depend upon agriculture. The landlocked position, rugged topography with limited arable land (17 percent of total land). Poor resource base and high extent of poverty are major economic vulnerabilities Nepali are facing economic problems these days. This makes it susceptible to increasing imports and foreign dependents, Nepal has immense stoke of endowed natural resources, unfortunately we are still poor and the least developed nations because of underutilization of the available resources. On one hand, Nepal's economic growth rate is low. On the other hand, Nepal's economic development is its initial stage. However, more or less, all sectors such as agriculture, industry, trade, and commerce and commutation are in their growing stage along with social services and tourism (Mund, 1996).

Energy is the basic need for all these sectors .Moreover, energy is necessary in every step and moment of human life. The world has been modernized through energy. So, energy is the yardstick for the economic development of a country in modern age. The degree of economic development is largely determined by per capita energy consumption. Energy as an indicator, shows the living standard of people. Demand for energy is gradually increasing along with growing population and economic

activities. Adequate and affordable supply of energy is basic pre-requisite for socio-economic development of a nation.

Nepal is a country rich in natural resources, which can be utilized for renewable energy production, especially in the form of electricity from hydro, solar and wind power. However, due to political, technical and economic challenges the majority of Nepalese people still rely on traditional energy sources such as biomass (fuelwood, dung cake, rice husk) as they lack access to the infrastructure needed for modern energy forms. When it comes to fuel type, biomass fuel from wood constitutes the largest share of the consumed energy (76%), followed by petroleum products (8%), animal waste (6%) and agricultural residues (4%). The demand for petroleum products is solely met by imports, consuming more than 40 percent of the total export earnings of Nepal. The residential sector (mainly cooking, heating, animal feed preparation and lightening) is the most energy-consuming sector with a share of about 89% followed by the industrial and transport sector. Although agriculture remains an important source of growth in Nepal and the largest employment sector for a large segment of the population, its share in energy consumption is low, amounting to 0.9 percent of the national energy used in 2008/2009. This is due to the low degree of mechanization of agriculture (APEC, 2014).

According to Nepalese scholars and energy experts, there is a need for a paradigm shift from top-down and foreign-dependent energy development towards decentralized and self-sufficient energy systems. As in most developing regions, the centralization-paradigm in energy development and management practices in Nepal mainly applies to the supply of energy to urban areas. By contrast, a majority of rural populations are disconnected from centralized energy systems. This is also reflected in the use of electricity as an energy source. According to data from 2010, electricity constitutes only 2 percent of the total energy consumption, whereas petroleum products and coal represent 9 percent and 2 percent, respectively. Approximately 70 percent of the total population has access to electricity and out of this share, 45 percent uses the national grid while 25 percent uses off grid solutions such as solar and micro-hydro power. Currently, Nepal faces structural challenges in its electricity sector such as a burden of price subsidies, low service quality, low bill collection rates

and high losses due to poor network and service coverage experienced under state-owned and controlled systems (Lemberg-Pedersen, 2017).

The trend of energy consumption is predominated by traditional sources particularly fuel, wood. Over-utilization of forest creates serious environmental problems. Petroleum and coal are imported .it needs a large amount of foreign currency. Nepalese economy, however is facing the problems like trade deficit, debt trap and unfavorable balance of payment on one hand, people's per capita income and purchasing power are very low on the other hand. The use of solar energy is negligible and wind energy is still at initial stage. But the water resource is immensely available in Nepal, and hydropower is clean, renewable, pollution free, reliable and easily available.

Nepal is second richest country in water resources in the world. It has total hydropower potential of 83000 MW. Out of which 44000 MW is found economically feasible and about 600 MW is developed which is about 1.5 percent of economically feasible capacity. Hydro-electricity sector has only 1 percent contribution on total energy demand. About 25 percent of the people of Nepal have access to electricity. The trend of energy consumption is predominated by traditional sources particularly fuel, wood. Over-utilization of forest creates serious environmental problems. Petroleum and coal are imported .it needs a large amount of foreign currency. Nepalese economy, however is facing the problems like trade deficit, debt trap and unfavorable balance of payment on one hand, people's per capita income and purchasing power are very low on the other hand. The use of solar energy is negligible and wind energy is still at initial stage. But the water resource is immensely available in Nepal, and hydropower is clean, renewable, pollution free, reliable and easily available (UN, 2011).

Hence, General rural energy demand is fulfilled from forest and agricultural residues. Commercial and industrial energy demand is fulfilled by imported petroleum products or by coal. It is necessary to reduce the use of imported fuel so as to reduce stress in foreign trade and to conserve greenery also. To promote the use of renewable hydro energy in affordable manner, mobilization of domestic fund and other support is necessary. So Government of Nepal has given priority in hydropower development and rural electrification in the country. In this regard, Government has promulgated

Hydropower Policy, Water Resources Act, Water Resources Regulation, Electricity Act and Electricity Regulation and Other Legal Provision to facilitate private investors.

Environmental problems with the dams such as inundation, siltation, negative impacts to river water quality, harm to riparian ecosystems, controversies over monopsony buyer, and the fact that the large projects rely on expensive foreign contracting firms have raised opposition against large-scale hydropower projects in Nepal. Although medium to large-scale hydropower (above 1000 KW) remains the likely choice for meeting Nepal's urban electricity demand, which is growing at an average annual rate of 15 percent, small hydropower is an attractive alternative to conventional power systems in rural and remote areas as a means of achieving rural electrification.

As only 45 percent of the population has access to electricity from the national grid, there are many important micro-hydro schemes designed to meet the rural demands. Hence, as a cheap, renewable source of energy with negligible environmental impacts, small hydropower has an important role to play in Nepal's future energy supply. Accordingly, micro-hydro system is becoming increasingly popular as an energy source in rural areas, which are excluded from the energy grid that transmits power from the large hydropower stations to the major urban areas. In fact, small and micro-hydro power generation is only one component out of the four that include bio-gas generation, solar energy schemes and improved stoves to meet the local need for fuel (NEA, 2015).

The Tenth Plan's (2002-07) key objectives in the power sector include expanding, in a sustainable and environmental-friendly manner, electricity coverage by generating low cost power; accelerating rural electrification to promote economic growth and improve living standards, and to develop hydropower as an important export item. Rural electrification is particularly important in a rural-based economy of Nepal. It plays an important role in accelerating both agricultural and rural development. It could have a catalytic effect on agricultural growth, especially by accelerating shallow tubewell irrigation. In addition to supporting the development of agro-business, the extension of rural electrification would also help modernize cottage industries and improve the living standards of rural households. Accordingly, key programs are aimed at expanding grid based rural electrification, promoting small projects where

grid-based expansion is not possible, and enhancing the capacity of cooperatives for management at local levels. To achieve the objective of increasing rural coverage of electricity over the Plan period, the government's strategy envisages initiating an explicit subsidy policy for grid-based rural electrification. Water Resources Strategy 2002 has formulated 10 different strategies, out of which the strategy for the hydropower development aims to achieve "cost-effective hydropower development in a sustainable manner". The strategy has prescribed short-term (5 years), medium-term (15 years) and long-term (25 years) strategic plan of hydropower development. The target of the strategy is: (a) by 2007, to develop hydropower capacity to meet projected demand of 700 MW, (b) by 2007, laws making national contractors/consultants' participation mandatory in all types of projects promulgated, (c) by 2017, 25 percent of households supplied with electricity, (d) by 2017, 2230 MW hydropower developed to meet projected demand including 400 MW for export, (e) by 2017, 38 percent of households supplied with electricity, (g) by 2027, 60 percent of households accessing the grid-supplied electricity, and (h) by 2027, Nepal exporting substantial amount of electricity (Adhikari, 2007).

There are four scales of hydropower projects in Nepal i.e. mega, large, medium and small. The aim of installation of mega and large hydropower projects is to fulfill long-term national demand and export to India and other SAARC countries. The target of installation of medium scale hydropower projects is to meet national demand for energy by connecting in national grid system. These projects play important role for tourism development, agro-based industries, irrigation and other industries. The installation of small hydropower projects is required for rural electrification. The installment of this type of project is emphasized in those areas where electric power can not supply through the national grid and where infrastructures have not been developed adequately. Likewise, such projects are technically as well as economically feasible at rural areas. It is also preferred in those in those areas where the small and cottage industries can not due to the lack of sufficient energy.

Api Power Company Limited is committed to operational excellence and believes in good governance, corporate citizenship and creating value for Stakeholders. Being a Leading and Responsible hydropower company of Nepal, Api has aligned its

hydropower development plans as demanded by the ambitious hydropower goals of nation.

The Company undertook the task of developing a 8.5 MW Naugarh Gad Small Hydroelectric Project on Naugarh Gad river at Dethala VDC of Darchula district of Far Western Development Region as its 1st Project. This river originates from Api Himalayan Range and is a tributary of Chameliya River. The Power Purchase Agreement for the project was signed on B.S. 19th Baisakh 2067 with Nepal Electricity Authority (NEA) and the power generation license was obtained from Ministry of Energy on B.S. 10th Chaitra 2068. The company started its construction works of 8.5 MW Naugarh Gad Small Hydroelectric project on Magh 2070 and completed successful construction and began its commercial operation on 2nd Bhadra 2072. The Project was successfully operated just in 18 months. The electricity generated from the project is connected to newly constructed Balanch substation of NEA through 4.5 KM transmission line constructed by the company. The power was scheduled to be evacuated through 132KV Balanch-Attariya Transmission line constructed by NEA. Pending the completion of the construction of the transmission line, the power is currently being evacuated via 33kV transmission line from the Balanch substation (APCL, 2014).

The under construction project Upper Naugarh Gad Small Hydroelectric Project 8 MW is a Run-Off-River type Project. The Project is located at 5km upstream of Naugarh Gad Hydroelectric Project Intake which had been successfully operated by the Company. The Project is located in Dhuligada and Shikhar VDC's of Darchula district in Far Western Development Region. The Headworks and the Powerhouse are located at an elevation of 1040.2m and 877m from mean sea level. The Project has installed capacity of 8MW with 163.44m of gross head and 6.43m³/s at 40 percent of exceedence. The Company has obtained the Survey Licence of the Project on dated 7th Jestha 2071 from Ministry of Energy through Department of Electricity Development and completed the detailed Survey of the Project. The Company has entered a Power Purchase Agreement PPA for the Project with Nepal Electricity Authority on dated 12th Kartik, 2073. Company has also obtained the Generation License from Ministry of Energy, Department of Electricity Development on dated 14th Poush, 2073. The Project is financed under the Lead Management of Nepal SBI

Bank Limited with Prabhu Bank Limited. The Project is under construction from 1st Poush, 2073 (APCL, 2014).

1.2: Statement of the Problem

The non-availability of commercial source of energy is one of the major obstacles in the development of rural areas in Nepal. This has not only slowed down the rate of development of new technologies for increasing agricultural productivity but also created excessive dependency on traditional sources of energy including fire wood, agricultural residuals and animal dung. The excessive and unsuitable use of traditional resources has resulted in low agricultural productivity, deforestation and soil-erosion, which creates imbalance in eco-system. The use of the firewood, agriculture residue and animal dung in cooking causes respiratory diseases. Students study hours is affected by the lack of lighting in the houses. All these problems arise due to the lack of commercial sources of energy, which has negatively impact the human capitalformation in the rural area.

The pattern of energy consumption is based on traditional sources particularly fuel wood, dung etc. The over exploitation of forest creates serious environmental problems. Petroleum products are utilized for transportation, operation of machineries and so on. The use of petroleum products creates environmental problems, and a large amount of foreign currency is needed to import the petroleum products. The demand of petroleum products growing day by day, and sometimes we have to face the crises in their supply in the international market as well. Nepal has limited source of foreign exchange. As a result, Nepal has been facing the problem of debt trap, trade deficit and unfavorable balance of payment. All scales of hydropower projects are viable in Nepal. Large dams and reservoirs are needed for large-scale hydropower projects, which definitely affect human life, wild life and marine life of the concerned area and its surroundings. Similarly, huge capital investment is required to install large and medium hydro project. For this, government should either take foreign debtor invite foreign investor to invest. In both cases, foreign experts and technicians would be used. Consequently, the generation cost of large project is found comparatively higher than that of small project despite the generation cost of large-scale project should be lower than the small one is accordance with the principles of economics. In reality, the result is found just opposite.

On the other hand, small hydropower can fulfill the demand of electricity in backwards and isolated areas, where disadvantaged groups and marginalized people live. The marginalized people are living in remote rural areas, which lack balance of regional development. To some extent, the development can not be promoted in rural areas in the absence of the electricity. There is a high potential of hydro power in Nepal and considering that rural communities are isolated and scattered, small-hydro systems is positive aspect on social welfare through improvement in education, health, employment, income and communication.

Some research questions can be raised as:

-) What is the role of Naugarh Gad Small- Hydropower project to strengthen Education in the study area?
-) What is the role of this project for the improvements on Health and sanitation in the study area?
-) What is the role of this project for income and employment generation in Dethala, VDC of Darchula District ?

1.3: Objectives of the Study

The main objective of the study is to evaluate different contributions of the small hydropower project in the rural area particularly socio-economic contributions such as; income, education, health, saving and employment. However the specific objectives are as follows:

-) To examine the role of Naugarh Gad small hydropower project to strengthen educational activities in Dethala VDC, Darchula,
-) To assess the role of this project for the improvements on health and sanitation, and
-) To evaluate the role of this project for income and employment generation in Dethala VDC.

1.4: Significance of the Study

The development of all sectors of an economy depends on energy. The utilization of energy especially electricity is centered in urban areas and most of the rural areas have been passed by the existing energy development schemes in Nepal. Almost all the households are found to have consumed traditional sources specially fuel, wood for domestic use and other necessary activities of human life in the Hilly and Mountainous areas. Hence this study has been rounded on the pivot of impact of small hydro project on socio-economic aspect of the rural people. Outcomes of this study will help to access the impact of the small- hydro project on education, health, employment, information, and technology of the people Dethala VDC of Darchula district.

1.5: Limitations of the Study

This study is focused on the socio-economic contributions of the small hydropower project in the study area i.e. Naugarh Gad small hydropower project. This is a case study of this project. The study primarily focuses on the characteristics of the communities and socio-economic contributions caused by Naugarh Gad small hydropower project at the local area. Some limitations of the study are as follows:

-) It is the case study of Naugarh Gad hydropower project on Dethala VDC which may not be applicable on the other VDC of the country.
-) The data would be depending on social survey, which may not provide the exact picture of society.
-) The study focused only limited area so the generalization of the study may not reliable to other area.
-) The study narrowed only some limited variables and ignores many variables which may affect on study area.

1.6: Organization of the Study

This study has been divided into five chapters. The first chapter deals with general background, statement of the problem, objectives, significance, organization and limitation of the study. The second chapter is about literature review. The third

chapter is about Introduction to study site, Nature of data, Sample selection, Questionnaire design, Method of data collection and Data processing. Fourth chapter deals about the analysis and interpretation of data and fifth chapter includes summary, conclusion and suggestion.

CHAPTER-II

LITERATURE REVIEW

Limited research has been conducted on socio-economic impacts of small hydropower projects. However there are many studies in other sector of hydropower project. Generally, the studies on medium and large hydropower project have been conducted to identify various types of impacts created by the development of hydropower project. Many publications, reports, theses, dissertations, articles in journals and newspapers that are related to the hydropower are reviewed

Poudel (2011) has states that during the price like of petroleum, the debate of new hydropower projects become hot. If there is no much news, the issue falls on shadow, highlighting the present condition of demand and supply of hydropower in Nepal, he states that demand increases when supply decreases. During dry season, the power becomes excess. so the overcome such imbalances on demand and supply, run off river projects are to be slotted to address base load where as peak load is to be met by storage projects like Kulekhani. According to him, after the liberalization of the economy, private sector is still lower than the expectation due to government procedural complication, political instability and insufficient infrastructure.

Though hydropower projects are capital intensive and the government is unable to arrange adequate financial resources to finance such projects, investment of private sector is essential Indian interest for power trade between Nepal and India is very crucial for Nepal to be able to capture the benefit from the Indian power crisis. He concludes that the government should simplify procedural communication. Government has to pay role to create favorable environment for investment by the private sector rather than regulatory and investing role.

Upadhyaya (2051) mentioned that Koshi, Gandaki and Karnali rivers are international level rivers. Total 244MW capacity had been installed till to that date. Nepalese people have been getting neither irrigation facility nor electricity facility adequately. India is taking more advantages than Nepal from large barrage, near to the border, of Nepal's large rivers. Out of the total land irrigated by Koshi and Gandaki irrigation projects, only 2.4 percent lies in Nepal and the remaining 97.6 percent in India. In

other words, he suggests that we should reserve large water resources as USA did. It would be better to install small-scale hydropower projects from small rivers in the present context of Nepal. After becoming capable to invest on our own, we can install large-scale projects at low cost by utilizing our large rivers. Alternative measure to develop hydroelectricity in Nepal at present context is to develop suitable small and middle scale projects, which fulfill annual demand of electricity, by utilizing available local resources. He suggests that people's participation is required to make policy for utilizing water resources as national resources.

Jha (1995) has mentioned 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 agriculture, trade, industrial and other sectors of the economy. With a view to meet the power shortage, there is need to generate power from not only the medium and large projects but also small-hydropower projects. The small hydropower projects might contribute significantly by providing electricity in isolated pocket areas as well as to the grid. Since, the electrification is related to productivity, small hydropower might help to increase working efficiency of the rural families. For the sustainable development of small hydropower, He has emphasized the implementation of small and micro hydro projects by adopting the program approach instead of providing subsidy. Comprehensive institutional base is required to provide supporting services such as agricultural extension, input supply, marketing services, credit facility etc and development of capability of the farmers.

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

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

I. Context of Hydropower Development

Nepal has great possibility of hydropower development if it could integrate with the neighboring countries like china and India. But there is not integrating. Nepal has to adopt the policy low exporting to develop all the sectors but should not adopt no exporting policy.

II. Electricity tariff regime

At present, the Nepalese contest of foreign electricity have been less benefited because of the high tariff regime adopted by the concerned commission so it has proved to be the goose that lays golden eggs! This is because of the system load factor, the system loss and the addition of high percentage of theft loss which is artificial. This may be why less electricity is used in the transportation and industry which is beneficial to all. The market price is distorted and has been favorable just to Nepal Electricity authority (NEA). So for their research researcher are to be done of why it is so.

III. Hydropower- based development strategy

Nepal has increase the electricity through small and micro-hydro gainful employment to preserve the environment and develop radically The generation and distribution of hydro- electricity is to be decentralized as the water resource by nature are so that agriculture modernization and industrialization in all the regimes will be possible Nepal has to adopt the strategies of rural electrification initiative industries, for development Hydro-electricity inputs in hills and mountains will promote cottage industries and transportation in Nepal.

Pokharel (1998) has analyzed that energy is important for economic development. Without it, the pace of economy cannot be accelerated. The development of the productive sector of an economy depends on development of the energy sector. In the

hilly and mountainous areas, almost all the households are found to have consumed traditional sources of energy for cooking, heating, lighting and other necessary activities. Traditional energy sources cannot be sustainable to fulfill energy requirement. From the present analysis, it has been observed that most of the people depend on forest for energy sources and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortage of fuel wood, soil erosion, deterioration of the fertility of soil etc. deforestation leads to the deterioration of water sources, and hampers both electricity generation and drinking water. Hydroelectricity occupies a very eminent place in the energy sector of Nepal. The utilization of energy is concentrated on urban areas and most of the rural areas have been by-passed by this power development. The hydropower project has brought about changes in socio-economic, cultural and other aspects of the people living in the project located area and its surroundings. To find JHP's economic impact and to introduce the total effect of the project at the study area is main objective case study. For this study the qualitative as well as quantitative method is used the study finds the every kind of socio economic and environment effect in the study area as well as surrounding area.

Awasthi (2010) has examined the socio-economic impacts of Chameliya Hydropower Plant in the adjoining area. This study has concluded that the socio-economic impacts of the project are moderate in absolute term and satisfactory in relative term. The project has provided sufficient drinking water and employment opportunities to the local people and electricity supply has extended the social and recreational activities like increasing educational standard, purchase of radio, television, tape recorders etc.

Dhungel (2002) has mentioned that main sources of energies are biomass (traditional), which constitutes fire wood, agriculture waste, animal dung etc. and commercial sources which constitute coal, petroleum products, hydro-electricity etc. Energy consumption in Nepal is dominated by biomass, which accounted for 95 percent, 94.9 percent, 91.7 percent, 86.4 percent and remained shares of commercial energy in total energy consumption in FY 1984/85, FY 1989/90, FY 1995/96, and FY 2000/01 respectively. Average growth of biomass and commercial energy consumption during the FY 1984/85 and FY 2000/01 were 2.4 percent and 10 percent respectively. Combining both an average growth rate was more than 3 percent per annum during

this period. The trend of energy consumption in Nepal during the FY 1984/85 – FY 1995/96 also shows that biomass was growing by 2.2 percent per annum. Similarly, commercial energy consumption was growing by more than 5 percent per annum. Annual growth rate of fuel wood, coal, petroleum products and electricity during the FY 1984/85 to FY 2000/01 were 2.7 percent, 27.2 percent, 12.7 percent and 10 percent respectively. Income elasticity of electro-products consumption and electricity were 1.75 percent and 1.14 percent respectively. He found that elasticity coefficients are greater than one, which reveals that an increase in per capita real GDP will increase to the amount of per capita energy consumption. By assuming 2.24 percent population growth rate and 4 percent economic growth annually, he predicts that energy consumption increase by 4.2 percent per annum during the FY 1994/95 – FY 2004/05.

Phuyal (2004) argued that we have witnessed some very positive changes in the hydropower sector in the post-1990 Nepal. The new and open environment has paved the way for liberalization, which has attracted private sector in the scene. Decentralization, grassroots democracy and system of governance where by local stakes holders can have said the other harbingers of hope. 20 percent of total people have access to the grid-supplied electricity; several thousands are getting benefit from Pico and micro-hydro schemes. Hydropower is the most environmental friendly. There is no dearth of exports and conference papers that hydropower as the only hope for Nepal for alleviating poverty. There is no shortage of market: power demand in Nepal is growing at the rate of 10 percent per annum and India's total energy consumption is expected to double by 2020, which means it will need to add tens of thousands of India, Bhutan and Bangladesh) states stand to gain form the proposed interconnection. Bangladesh can trade its gas power while Bhutan, India and Nepal can trade hydro. Nepal and India, two neighbors had already agreed in principle to enhance the present exchange level from 50MW to 150 MW. In additional to mica, micro, small and medium run-off-river projects, Nepal also needs some storage type projects to meet the raising power demand. Less than one percent of the country's total hydropower potential has been harnessed and nearly 80 percent of the population still does not have access to the grid-supplied electricity. Some of the developments of this past 12 years are testimony that thing can more ahead. Hydropower is Nepal's harbinger of hope.

Sharma (2003) he explains about utilization of water sources and its role in economic development. He mention about hydropower potentiality. He explains the development of hydropower project in Nepal. Pharping (500 KW) be the first installed hydropower project in 1911 in the history of hydropower development of Nepal. Total generated capacity was 2077 MW before the initiation of economic plan (1956). Sixth plan brought out new vision in the development of small hydropower project. He mentions the installed of all scale projects up to that date. Similarly is brought out new policy to develop water resources and hydropower as well. Consequently, private sector has been encouragingly investing in the development of hydropower, it has mentioned region wise distribute, sector wise consumption of electric power within the Nepal. These was 62.6 percent (which is in top position) of total generated capacity in CDR installed until the date of 2001. Similarly WDR, MWDR, EDR and FWDR occupied 30.3 percent, 3.0 percent and 0.5 percent of the total generated capacity development respectively up to the same time.

It seems that most of the total capacity is used by household sector than commercial sector, which are 95.6 percent and 2.3 percent respectively. He points out some problems related to the hydropower for sustainable development of hydropower he suggests to solve the debate between Nepal and India to make and implement appropriate policies about water resources to reduce cost, leakages, integrated approaches national commitment. In short it requires suitable policy and programs to develop small and middle scale project to meet national demand for electric power and it can equitable alternative measure to reduce power imported from India.

Thapa and Pradhan (1995) highlighted that hydropower in Nepal's major resources endowment. Numerous attractive run-off river and multipurpose hydro schemes have been identified but remain underdeveloped. They explain the strategy of water resource development that saving in transportation cost environmental benefits, foreign exchange earnings from large power project, agricultural, industrial products and other modern manufacturing output to be stimulated by power supply. Small and micro hydro potential remain virtually used in the hilly and mountain area, despite. Nepal's small size only about 10.5 percent of the total population has had the access of electricity (whereas about 40 percent of domestic connection is concentrated in the Kathmandu valley). The installed capacity of hydropower station developed until new

worked out less of than one percent of potential identified up to that date. Nepal's energy scenario reflects an imbalance between energy constipation that energy resources endowment development of water resources is essential in order to meet human needs like increasing agricultural and industrial production, meeting energy needs and earning foreign exchange from power export. They have pointed out that high investment requirement for the development of hydropower and lack of financial resources to the major constraints at present.

Pandey (2008) has tried to find out the sustainable rural electrification with the co-operation of local people. The study emphasized the dissatisfaction of consumer due to unable of meeting community-growing demand, so demand driven rural electrification with new technology envisages for reduction of operational cost of NEA through managing people with development of entrepreneurship in rural area to build up better product and quality of electricity services offered in win-win situation to the public and utility both. The program has enriched the adaptive capacity of local communities in rural areas to cope with the Negative impact of environment change and helps communities meet their basic need for energy services and preparing the ground for the achievement of millennium development goal. This program is not limited up to wheat and paddy irrigation but also people have their kitchen garden. Half or one horse power single phase motors and their hand pumps are taped and using ground water commonly in kitchen garden. Thus, this program has also generated local employment in the villages. Local pastures and farm lands have been reforested with native spices and fruit trees. Farmers are selling green vegetable to urban areas rather than bring in their own home town etc. The study found the most positive thing was that forest user groups which are regarded as most successful modality in Nepal have now joining this program expending their income in rural electrification which has helped not only in curbing the illegal export of forest product but has also encouraged conserving local forest. Thus there are reduced firewood users and increased tree planting that reduces CO₂ emissions and carbon sinks in environments. Many schemes in developing countries fail due to lack of entrepreneurship and opportunity for creation of down/up streams integration and market, so this scheme has created entrepreneurship, marketing innovation and social responsibility with equality to develop other products based on electricity. The main gist of scheme is when communities and consumers become stakeholders of the

electricity which they use then those distribution and supply systems provide better services and deliver better return on investment to the institutions and nation.

Joshi (2011) has mentioned that energy is important for economic development. The pace of economic development cannot be accelerated without hydropower development. The development of productive sector of an economy depends on development of the energy sector. In the hilly and mountainous area, almost all the households are found to have consumed traditional sources of energy for cooking, heating, lighting and other necessary activities. Traditional energy sources cannot be sustainable to fulfill energy requirement. From the present analysis it has been observed that most of the people depend on forest for energy sources and livestock. As a result, the deforestation has brought about ecological and environmental hazards along with shortage of fuel wood, soil erosion, deterioration of the fertility of soil etc. Deforestation leads to the deterioration of water sources and hampers both electricity generation and drinking water. Hydropower occupies a very eminent place in the energy sector of Nepal. The utilization of energy is concentrated on urban areas and most of the rural areas have been by-passed-by this power development. The hydropower project has brought about changes in socio-economic, cultural and other aspects of the people living in the project located area and its surroundings .To find socio-economic impact and to introduce the total effect of the project at the study area is main objective as well as quantitative method is used the study find the every kinds of socio-economic and environmental effect in the study area as well as surrounding area.

Mund (1996) has defined that five major areas of social economy and national development in the context of Nepal. These are :Out-ward Oriented Economical Nationalism, Local Development, Peoples Participation, Self-Help Organization and Small-Scale Industries. In this article, "out-ward Oriented Economic Nationalism" Madan Kumar Dahal has discussed about water resources. He says that Nepal's economic future lies in her water resources, which flow pricelessly from Nepal to India. The present estimation commercial potential of water resource in Nepal, if harnessed properly through bilateral, regional and international cooperation, not only Nepal but the whole SAARC region will be benefited. The water resource in Nepal's

most valuable asset and it is commercially unexploited yet. 50 percent of the total; theoretical hydropower potentiality is estimated to have commercial feasibility.

CHAPTER-III

METHODOLOGY

3.1: Study Area

The Naugarh Gad Small Hydroelectric Project is located in Dethala VDC of Darchula district in the Far- Western Development Region of Nepal on the Naugarh Gad River within the Mahakali River basin. Geographically, the site was located between latitude 29° 41' 15" to 29° 43' 08" North and longitude 80° 36' 15" to 80° 36' 38" East (APCL,2014).

The Naugarh Gad is situated in the Far-western Midland part of the Nepal Himalaya. It is a major tributary of the Chameliya River in the Mahakali River Basin. It is a perennial river originating from the Brahma and KorpuLek and meets the Chameliya River 33.55 km downstream at Dethala village. The drainage area of Naugarh Gad lies between the elevations of 800m to 4000m. The major tributaries of the Naugarh Gad are Hopari Gad, LaksariKhola, GophaKhola, GhatteKhola, GundhanKhola, KharKhola; which forms the drainage pattern in general. The basin is characterized by rugged hilly terrain and steep sloped landscape with varying elevation. Shrubs, coniferous trees and grassy lands are found mostly in the basin. The highest elevation at the drainage basin is at about 3992 m amsl in the KopuLek (APCL,2014).

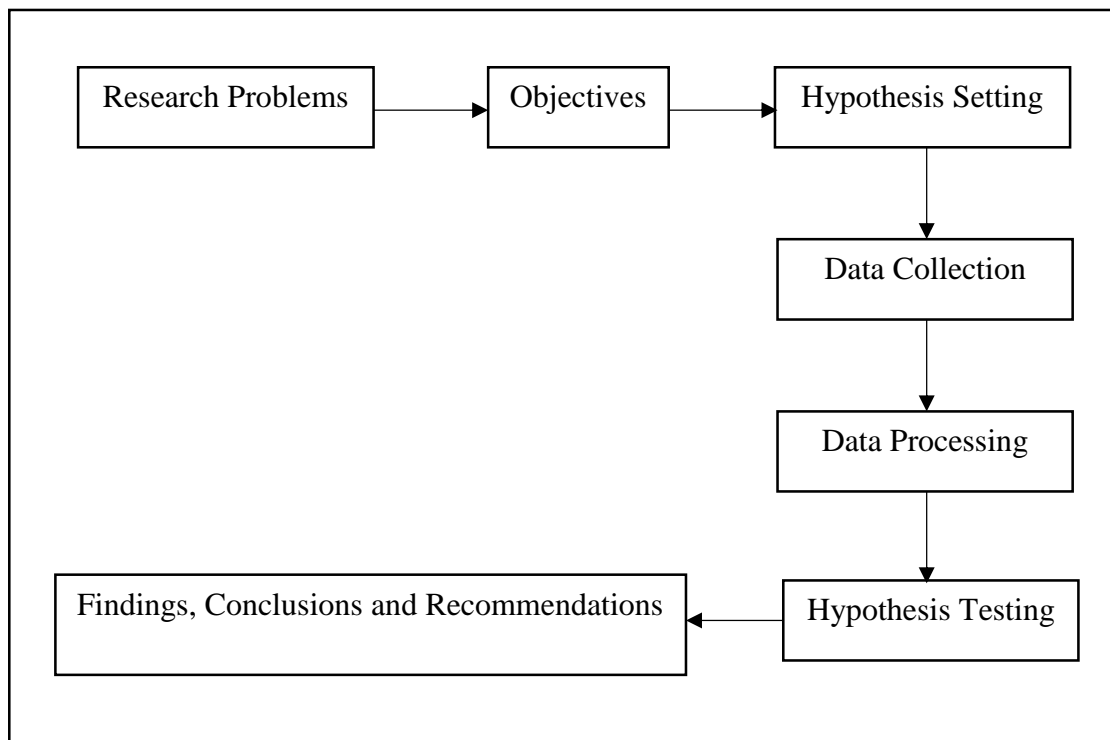
The mountainous area above 3000 m elevation experience snowfall during winter season. There is access from Gokuleswor to Naugarh Gad Hydroelectric Project along the bank of Chameliya River. There is a public bus service from Kathmandu to Attariya and also from Attariya to Gokuleswor which is easily available. From Gokuleswor it is only 6 Km to reach to project site and the road is gravel beyond Gokule which is also access road to Chameliya Hydroelectric Project having PH at Balanch. The alternate access road to district headquarter is already opened along the right bank of Naugarh Gad from Dethala. The Powerhouse site is at Dethala village and headworks site is near to Gholjare village and the road passes nearby headworks site.

Api Power Company Ltd established in 2061 BS, has identified, develop and building 8.5 MW Naugarh Gad Small Hydroelectric Project. The NSHEP is accessible by road from about 16 km from Gokuleshwor on Mahakali Highway on Gokulkeswor-Dhuligada feeder road. There is a earthen road along the project alignment. There is a daily airplane service between Kathmandu and Dhangadhi. The total distance from Kathmandu is 863km following Kathmandu, Narayangarh, Attaria, Dedeldhura, Gokuleshwor to the Site. The Power generated from this project shall be evacuated through 132KV Balanch Substation at Chamelia Powerhouse NEA into national grid. This is one of the national grids under construction in the Far Western Development Region. The power transmission shall be on 33kV single circuit line up to balanch and shall be upgraded to 132kV before connecting to 132kV busbar as interconnection point to National Grid. A Power Purchase Agreement (PPA) between Nepal Electricity Authority (NEA) and Api Power Co. was signed on 2nd May, 2010 (2067/01/19 BS). Power Generation License has been obtained from the Ministry of Energy on 2068/12/10. Initial Environmental Examination (IEE) Report has been approved from the Ministry of Energy. Hydrovision Consulting Company (P.) Ltd., Panipokhari is the design consultant for the feasibility study of the project. For detail engineering design and construction drawing preparation, Clean Energy Consultants P. Ltd. has been appointed as design consultant. This detailed design report has been prepared by the design consultant (APCL, 2014).

3.2: Research Design

This study is based on descriptive research design because it is a fact-finding investigation with adequate interpretation in the context of social research. Thus the study will make an attempt describe the things related to small hydroelectricity such as employment, income, health, education etc in the study area. . The entire designing will be summarized here by following table.

Table 3.2: Conceptual Framework of Research Design



From the above table, it is clearly said that the entire research is started from the research problem raised. Setting objectives and hypothesis setting are the second process. In the third, data collection processing steps are adapted. After testing the hypothesis proper findings, conclusion and recommendations are given to the related institutions. In the data collection process there is applied primary data.

3.3: Nature of Data

This study is mostly based on primary data. And this primary data and information has been collected from field survey. However, some secondary data also have been used according to need from different sources such as survey reports, feasibility reports, journals etc.

3.4: Method of Data Collection

Following methods are applied in this study:

3.4.1: Primary Method

Primary methods are collected from field survey. For this purpose following methods are applied:

Observations:

The researcher visited the project site and thoroughly observed the project site, influenced community, market, places and its surroundings.

Interview with structured questionnaire:

Interviews were taken with educated as well as layman about the impacts of project, interviews were selected from the project catchments area as well as neighboring villages.

A structured questionnaire was developed for household survey which had covered demography, health and sanitation, agriculture and animal husbandry, sufficiency of agriculture product, income and expenditure pattern, human resource, woman and children source of fuel, kind of stove and forest and electricity. This hydropower project has affected total 96 households who were considered as directly project affected families.

3.4.2: Methods of Secondary information

Secondary information has been collected form different sources of governmental and non government organizations such as ministry of water resource (MOWR)

ministry of finance (MOF) water energy commission secretariat (WECS) National Planning Commission (NPC) central Department of Statistics (CBS) Nepal electricity Authority (NEA) department of electricity development (DOED) power Development Fund (PDF). Asian Regional Environment Assessment Program (AREAP) East consult (EC) international center for Interrelated Development (ICIMOD, Center for economic development and administration (CEDA) Community Awareness Development Center (CADEC), Alternative energy promotion center AEPC, office of village Development Committee (VDC), related bulletins, Journals published reports, knows and official.

The study is absolutely based on primary and secondary data, most of the data and information are collected from households of the study area. The data were collected from observation, interview, questionnaire, central library of TU and many other secondary resources center and institution relevant to small hydropower. For the collection of information about socio-economic aspect of Naugarh Gad Hydropower project. The questionnaire was designed to assess the aspect of small hydro power project on education and information technology and health of rural people of Dethala VDC of Darchula district. The questionnaire consisted open-ended as well as closed ended questions.

3.5: Sample Size and Procedure

In the survey area, the total households and population are 633 and 3821 respectively. In this study a total of 90 households/respondents are taken randomly as a sample which covers a total of 475 individuals (14.2%).

3.6: Data Processing Method

Field questionnaire is carefully checked for possible errors. The data are carefully edited and processed by traditional method i.e. Tally bars, then the required tables are generated by using computer software program.

3.7: Tools and Techniques of Data Analysis

Primary as well as secondary data has been used in this study. Since this study is a case study and data analysis has been focused particularly on the primary data, which

were collected by using various methods of primary data collection, secondary as well as primary data have been presented in the table, pie chart, simple bar diagram, sub-divided or component bar diagram and multiple bar diagram have been used to analyze the primary as well as secondary data. Sub divided or component bar diagram and multiple bar diagram have been also used to analyze primary as well as secondary data in this study.

CHAPTER-IV

PRESENTATION AND ANALYSIS OF DATA

Socio-Economic Status of the Study Area

This chapter attempts to analyze the collected data and information for pursuing the objectives of the study and deriving the major finding of the study. It presents the brief introduction of Dethala VDC with demographic features. This chapter deals with the analysis of aspect of the Naugarh Gad hydropower on health, education, income, employment and information technology of this VDC. The aspect of Naugarh Gad hydropower on education, health and information technology would be analyzed by comparing gradual changes on socio-economic condition of the Dethala by the access of electricity (Case) by comparing with before and after. The questionnaire and observation was analyzed in the descriptive form.

Socio-economic features of the study area depicts the development status of the village. The sociological and economic characteristics such as religion, education, employment, health and environmental situation have a significant influence in the economy of the village and living standard of the people. In the survey area, the total household are 633 and total population 3821 in the the whole VDC, where the total population of 475 population and only 90 households are recorded in study area at Dethala VDC ward no. 1, 7 and 8 are taken to find the socio-economic aspect and 90 respondents are taken for the study of socio economic aspect of Naugarh Gad Small Hydro project on household, role of this project for sustainable changes in project affected area.

4.1: Household Information of the Project Affected Area

4.1.1: The Participation by Affected Household's Area

Small hydropower played the vital role for the electrification of the rural areas of Nepal. This Naugarh Gad Hydropower project-electrify covers total wards of Dethala VDC area. The ward-wise distribution of respondents of this

research has been shown in table 4.1. out of the total 90 households, higher number of households (35) from ward no.1 and after that (30) households from ward no 7 and 25 households are from ward no. 8 taken as a study area or project affected family.

Table 4.1: Ward-wise Household Participation

Ward No.	Number of Households	Households Members
1	35	175
7	30	180
8	25	120
Total	90	475

Source: Field Survey, 2016.

4.1.2: Age Group of Respondents

The respondents are divided into four groups. The questionnaires were asked to the respondents aging above 15 years. Then it divided into four groups as 15-25, 26-40, 41-60 and 60 above. The figure 4.2 explains that the high portion 38.88 percent respondents are from 26-40 age group and 27.78 percent are from 41-60. Similarly from age group 15-25 and above 60 are 27.78 percent, and 5.56 percent respectively.

Table 4.2: Age Group of Respondents

Age Class	Respondents	Percentage
15-25	25	27.78
26-40	35	38.88
41-60	25	27.78
Above 60	5	5.56
Total	90	100

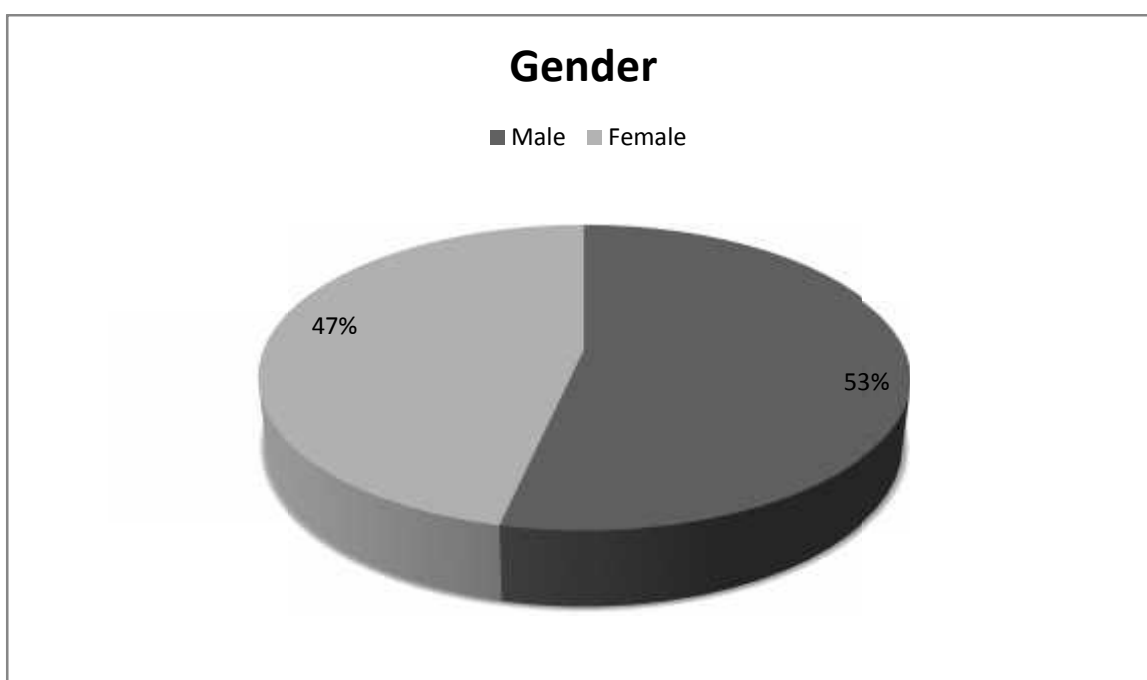
Source: Field Survey, 2016.

4.1.3: Gender of Respondents

Regarding gender there was a significance imbalance in the participation of respondents. The ratio of male and female is got nearly 50-50 percent. But participa-

tion respondents were fewer numbers for this research in the study area. There was only 46.53 percent were female and 53.47 percent were male respondents. The gender wise participation percentage of respondents of study area is presented in table and pie chart below. The study area is still male oriented are female is follower of male. In the social work male have played vital role. Due to the less activeness of female and shaming to speak female respondents were less in numbers than male respondents.

Graph 4.3: Participation Percentage of Respondents by Gender



Source: Field Survey, 2016

4.1.4: Population Distribution of the Study Area by Caste Group and Religion

Nepalese people are categorized into different caste and ethnic groups. The Census of 2011 identified 126 different casts and ethnic groups in Nepal. Caste system is fundamentally based on Hindu religion where as a vertical relationship among the caste exists. Bramhin and Chhetri are in the apex, whereas Janajati and Dalit groups are at the bottom of the social class. The total of 475 population and 90 households are recorded in the study area at ward No. 1,7.8 Dethala VDC Darchula also. Out of the total population the share of male and female are 46:53 percent and 53:47 percent respectively four caste groups such as

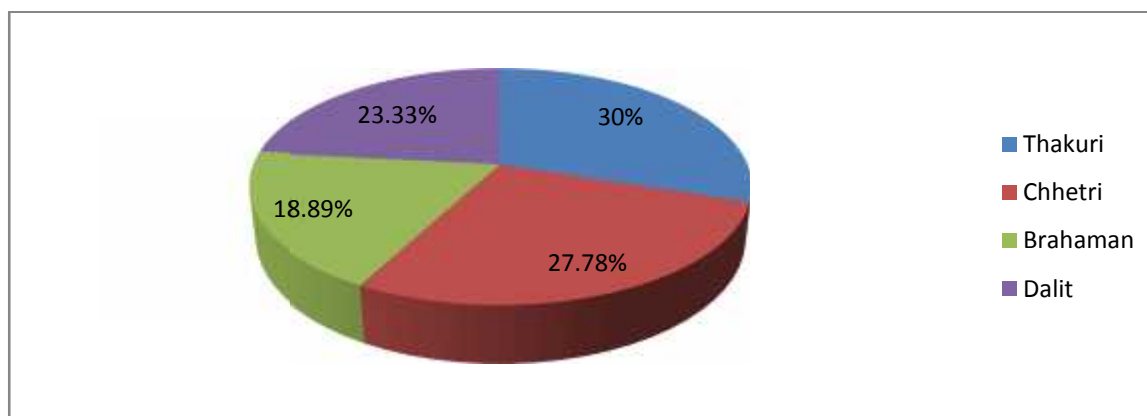
Thakuri, Brahamaan, Chhetri, Dalit (Lohar) are found in the study area. Out of the total caste group Thakuri and Chhetri households are in the highest while other caste groups have the least number of households. Out of the total households number of Thakuri, Chhetri, Lohar and Brahamaan are 27, 25, 21, and 17 respectively in the study area similarly out of the total population those caste groups consist 30 percent, 27.78 percent, 23.33 percent, 18.89 percent correspondingly total number of households population and sex ratio of the overall study area have been presented in the following table.

Table 4.4: Caste Groups Study of Project Area

Caste Group	Sex		Total	Percent	No. of HHs
	Male	Female			
Thakuri	71	69	140	30	27
Chhetri	63	62	125	27.78	25
Lohar	60	65	125	23.33	21
Brahamaan	42	43	85	18.89	17
Total	236	239	475	100.00	90

Source: Field Survey 2016.

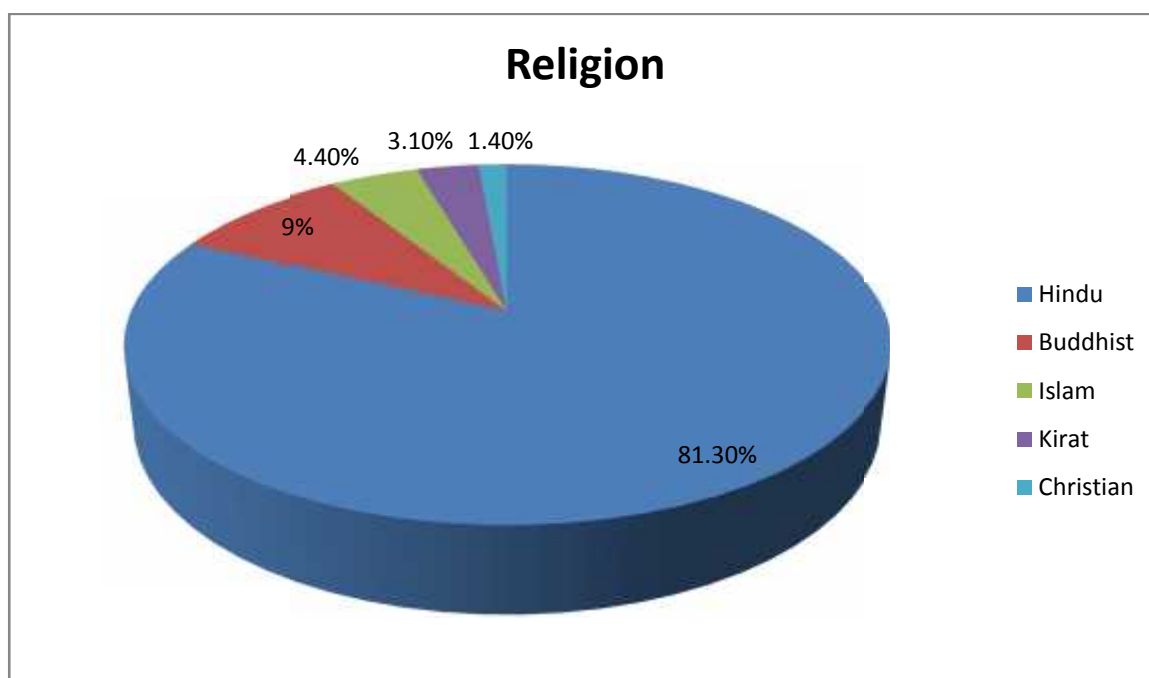
Graph 4.4: Caste Groups of Project Area



Source: Based on Table 4.4

According to the census 2011 of Nepal, there are 81.3 percent of people follow Hinduism, while 9 percent, 4.4 percent, 3.1 percent, 1.4 percent are Buddhist, Islam, Kirat and Christian respectively. Respondent religion practice has been found only Hinduism, Buddhism, Christians.

Graph 4.5: Religion-wise Distribution



Source: CBS, Population Census 2011

Hinduism is the only one religion in the study area. Though it is the homogenous society from the religious aspect but there are some specialties on feast and festivals regarding own caste groups. Generally people celebrate Dashain, Tihar, Tij(Haritalika),Bishu, Chaite Dashain, Chaitali and so on..

4.1.5: Occupation of Household

Agricultural and animal husbandry is main occupation (80 percent) of the study area. Besides agriculture, people are involved in other occupation such as service foreign employment, business and wage labours. Out of the total population of the study area. 325 people are involved in agriculture as well as other occupation. Among the total population of the study area. 70 people are involved in foreign employment,30 people involved in service sector,20 people are involved in business and 15 people are wage labour and other occupation. Agriculture, foreign employment business wage labour and porter are also secondary occupation of limited people in PAFs or the study area.

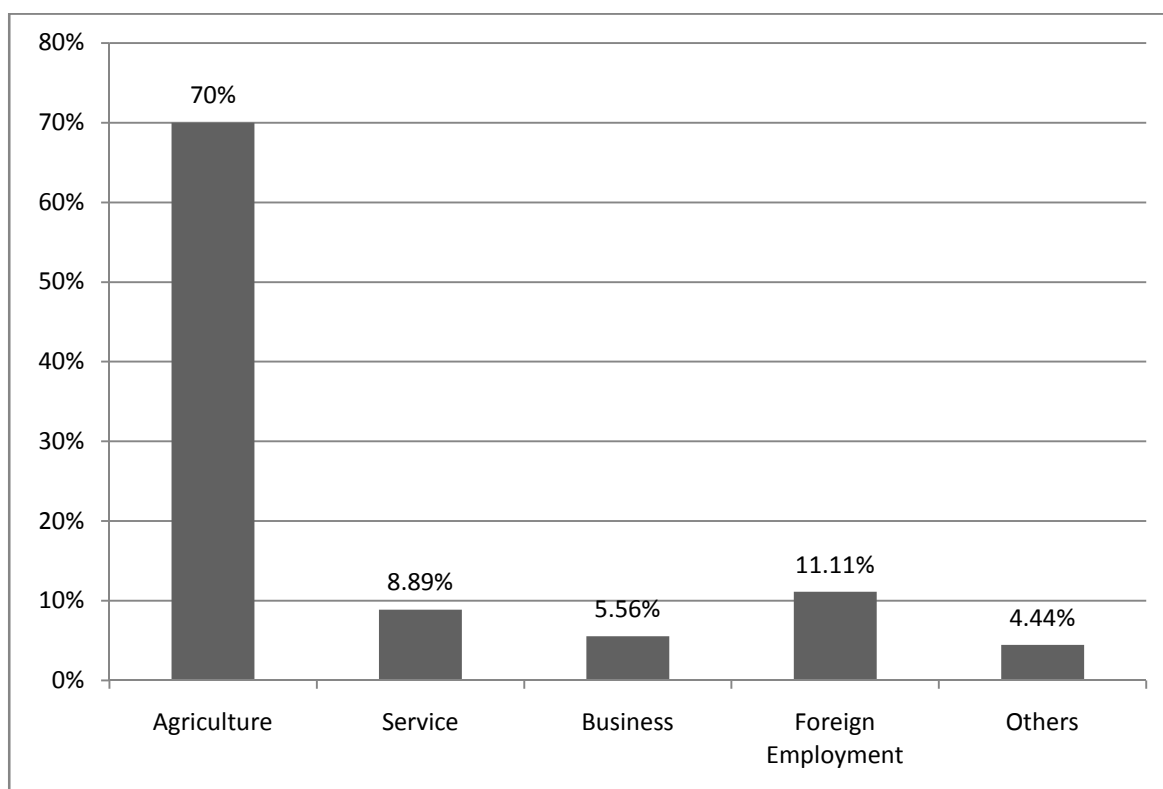
Since, ward no.1, 7, 8 of Dethala VDC are study area so there are 90 household in affected area and there are 90 sampled respondents are taken for the study. According to available data, out of the economically active population 70 percent are involved in agricultural sector, 8.89 percent are in service, 5.56 percent are in self owned business, 11.11 percent are in foreign employment and 4.44 percent other occupation.

Table 4.6: Occupational Distribution of Respondents

Occupation	No. of Respondents	Percentage
Agriculture	63	70
Service	8	8.89
Self owned business	5	5.56
Foreign employment	10	11.11
Others	4	4.44
Total	90	100

Source: Field Survey, 2016

Graph 4.6: Occupational Distribution of Respondents



Source: Based on Table 4.6

4.1.6: Settlement

All people were living in house made by mud and stone with stone roofs (Patthar) before the project started. However, only one house does have a roof made of tin now. The observation has pointed out that some houses are found to have covered their roofs partially with tin (zinc). This figure shows the low level living standard of the local people. Likewise, they have attached cattle Huts and sheds.

4.1.7: Health and Sanitation

Sanitation is one of the indicators of living standard of the people. The modern facilities mostly affect the lifestyle human being. After using such facilities it is expected that there must change in living standard of human. The people of the PAFs as well as whole study area drink taps (piped) as well as stream water. But the pipeline water and improved stone taps are increasing day by day. Quality of piped water has improved. At the completion of the project, Tap and well sources respectively. The number of users of piped water is increasing.

Before the project start there were only 70 Kachchi toilets and 18 modern toilet in all PAFs. They improved Kachchi toilet and started to use modern toilet. But due to their poor economic condition, they haven't built modern toilets all. The use of Kachchi toilet has decreased and use of modern toilet has increased and reached from 18 to 60. After the completion of the project all 90 PAFs has made (Modern) toilet as well as kachchi toilet.

Before the project start, people of the PAFs used to follow domestic as well as traditional approaches like, witch-doctor (Dhami Jhakri) for general treatment. However, they follow witch doctor for no longer. They use domestic approach and some people go to health post. Frequently repeated diseases. Health post was only one the health institution for medical treatment of all PAFs before the project start. Nowadays, health centre and private clinic are available there for medical treatment.

4.2: Electricity

4.2.1: Role of Electricity in the Study Area

The facility of electricity was not available in the study area before initiation of the project. Out of total households of the study area not any one households were electrified at the beginning of the project construction. Up to the study period 96 households are benefited from electricity.

Almost all the household pay the bill of electricity i.e. rate of government. Mostly people use electricity for lighting and playing radio, T.V. etc. In Conclusion the consumption of electricity of the local area and whole study area is low. There is a need to increase the consumption of electricity that helps to uplift the living standard of the people of the study area. At the completion of the project, it helped to electrify the project area and its surrounding areas. However, there is still increasing the demand of electricity.

4.2.2: Use of Electricity for Various Purposes

The lack of sufficient power Naugarh Gad Hydropower is unable to supply the power according to public demand. Therefore people are unable to lunch varies types of cottage industries as well as electronic equipment, as they want to use. Due to insufficient of power, they are compiled to run the installed form in the alternative time. Mainly, Households used NGSHP for lighting purpose minimum 3 to maximum 10 hours from 90 households, 25 households used for cooking purpose minimum 2 hours to maximum 5 hours, 21 households run business where they used electricity 5 to 17 hours per day. For TV/Radio purpose they used 2 to 17 hours and 2 to 6 hours for personal used where as in average 3.6 hours. For others (refrigerator, iron, grander, etc.) purpose used 1 to 10 hours.

Table 4.7: Use of Electricity for Various Purposes

Use of NGSHP	Observations	Minimum hours	Maximum hours
Lighting	90	3	10
Cooking	25	2	5
Business	21	5	17
TV/Radio	60	2	17
Personal use	70	2	6
Others	30	1	10

Source: Field Survey, 2016

4.2.3: Electricity Consumption Units by Household

According to the purpose electricity consumption by units are seems different. The consumption pattern of household is only for lightening purposes, they consumed very low units then business purpose. The minimum and maximum used units of electricity by respondents are presented in table no. 4.5 below. It is observed that 50 households consume 0-20 units, 20 households consume 20-30 units, 15 households consume 30-50 units, 5 households consume 50-250 units per month. The household who are only used electricity for lightening purpose consumed monthly 0-20 units only.

Table 4.8: Electricity Consumption by Household

Units consumption per month	Households
0-20	50
20-30	20
30-50	15
50-250	5
Total	90

Sources: Field Survey, 2016.

4.2.4: Change in Consumption of Energy

Poor rural communities heavily rely on firewood, which is a free resource, as the only cost of firewood collection is physical effort and time. Over exploitation of firewood for household purposes (cooking, heating, and lighting) leads to the degradation of natural forests that ultimately results in scarcity of local resources. Before

electrification, kerosene lamps were widely used for lighting purpose during night which is known as “*tuki*” and firewood was used in every household to cook the food. Biogas and solar were in very limited houses. The energy sources of households presented as below.

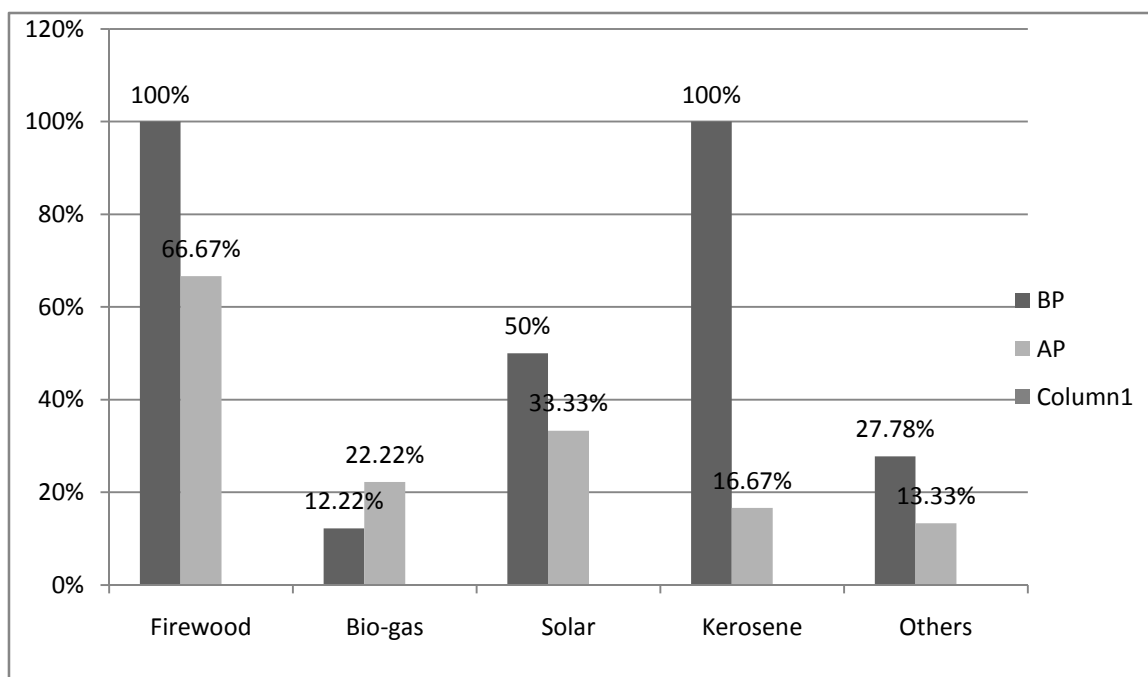
It is found 100 percent of households used firewood and kerosene for cooking and lighting purpose before NGSHP but after the installation of NGSHP it decline at 66.67 percent and 16.67 percent respectively. Only 50 percent people used solar plant and 12.22 percent households had biogas before the project but after the NGSHP solar plant decreases at 33.33 percent and biogas increases at 22.22 percent. 27.78 percent used other sources (Candel, *Diyo* etc.) but after it decreases at 13.33 percent.

Table 4.9: Change in Consumption of Energy

Sources of energy	No of households	Before (%)	No of households	After (%)	Remarks
Firewood	90	100	60	66.67	-
Bio-gas	11	12.22	20	22.22	+
Solar	45	50	30	33.33	-
Kerosene	90	100	15	16.67	-
Others	25	27.78	12	13.33	-

Source: Field Survey, 2016

Graph 4.9 :Change in Consumption of Energy



Source: Based on Table 4.9

4.2.5: Access to Modern Technology

The hydropower brings revolution on the information technology of Case group; almost all of household has Radio and TV. Number of users of refrigerator, mobile, TV and having computer/ laptop is significantly high by comparing with before and after the access on hydro energy. About half of household's family member has access on internet and chat. On the basis of these we can conclude that the hydropower brings revolution on the information technology on the study area.

Almost every household visited in the study area have owned at least one television, and nearly every adult member of the family owned a cell phone. According to them, this was unimaginable before the availability of electricity because even charging a cell phone would have required expensive solar panels that only a few could afford. So, if there was need to make a phone call, residents often had to walk half an hour's way.

It is obvious that 80 percent of households possessed radio before NGSHP but now 100 percent households have. Here is a little bit change in radio use because radio can

be run by using battery without electricity. Only 22.22 percent households had TV who had solar panel, now percentage of TV users increases and became 88.89 percent and computer is now possessed by 27.78 percent households. Number of mobile phone user changed drastically from 16.67 percent to 100 percent after NGSHP. It is because there was no well communication facility in the village before NGSHP. Now, 5.56 percent uses Refrigerator and. Before, the NGSHP 100 percent possesses battery but after the installation of hydropower it declines at 27.78 percent.

Table 4.10: Access to Modern Technology

Instruments	Households	Before Possession percent	Households	After Possession percent
Radio	72	80	90	100
TV	20	22.22	80	88.89
Refrigerator		0	5	5.56
Computer/laptop		0	25	27.78
Battery	90	100	25	27.78
Mobile	15	16.67	90	100

Source; Field survey, 2016

4.2.6: Sources of Income

Agriculture, livestock husbandry, wage earner, business, services and foreign employment were major sources of income of study area before as well as after the completion of the project. Agriculture, Livestock and Husbandry were the key sources of income in the study area before the project started. Agriculture and livestock husbandry, service foreign employment, business and also main sources of income are successively in descending order now. It seems that order of income sources are changing.

4.2.7: Expenditure Pattern

PAFs and people of study area spend their income on food, clothing social activities, festivals, education and health. Few households spend for food. Before the project started, PAFs used to spend the largest amount on clothing. Then they spent on social activities on festivals. However expenditure on education and health has increased now. Although order of expenditure pattern is changing and amount is increasing over

a time due to the increasing of market price and growth of population after the completion of the project.

4.2.8: Impact on Education

Owing to the access to electricity, the academic performance of children is greatly influenced in Dethala VDC. Electric lights in households extend the day providing additional hours for evening reading and also, reduced drudgery for children. The level of lighting provided by the modern electric lights in the households is more efficient and brighter than that provided by *Tuki* and *Panas*. The small hydro based electricity has indirect impact on the school student. Generally, children used to go with their mother while grinding or collecting firewood.

Out of total 90 sampled households, 12 (13.33%) Household's children raised their study less than one hour, 25(27.78%) Households children raised one to two hour, 30 (33.33%) raised two to three hour and 23 (25.56%) Household's children rise more than three hour.

It can be said that, most of student's education status is improved after SHP installation because most of the Guardian of schooling children found that their children have been studying at the night time using electricity. There is the positive affect by NGSHP in the study area their adult also involved in informal education at night such as adult literacy class, women literacy class and pre-primary classes are held in project affected area.

Table 4.11: Impact of Electricity on Children Study Habits after NGSHP

Increased hours	Sample households	Percentage
Less than one hour	12	13.33
One to two hour	25	27.78
Two to three hour	30	33.33
More than three hour	23	25.56
Total	90	100.00

Source: Field Survey, 2016

The hydro project may have vital on the education of children as well as adult. With the availability of light, children can study additional time hours, which may improve their performance in school. Similarly, parents are more aware to their children's

education which also helps to uplift the academic performance of the children. By asking the improvement of their performance at school, participation on any type of literacy class and the dropout of children from the secondary level are taken as the measuring rod of impact of hydro project on the education sector.

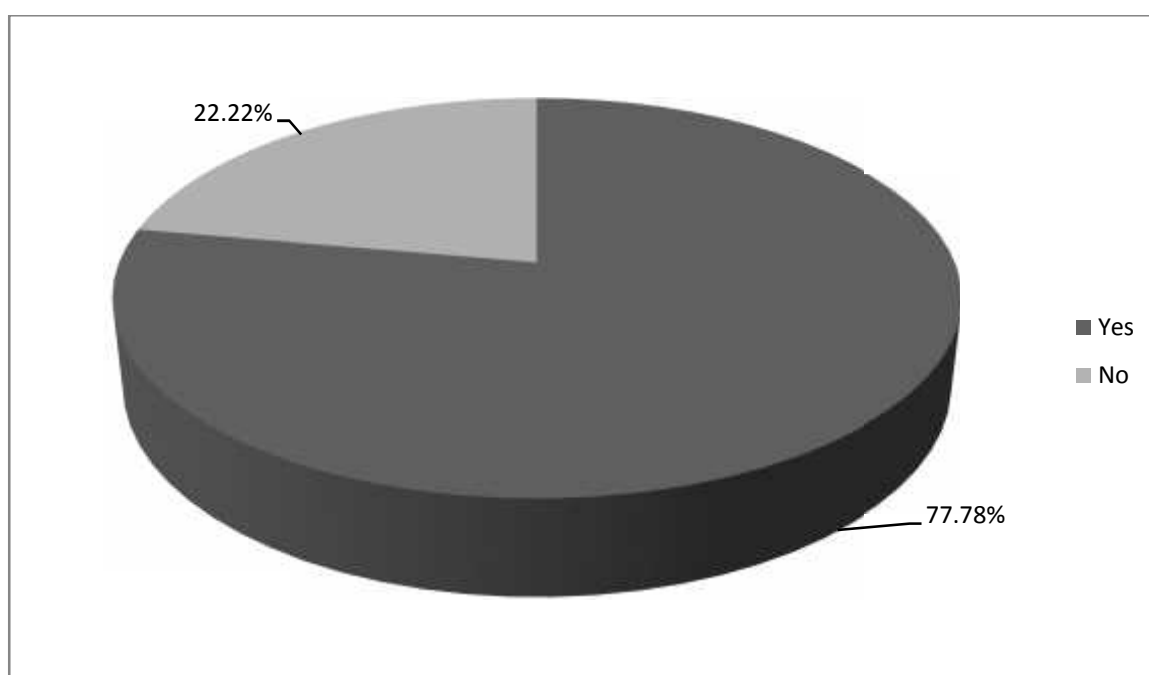
There is too little difference between the improvements of children at school, which might be cause of different factors like: children spent their more time on watching TV, playing Videogames which might be lost their time on unproductive sector like chatting, internet site etc. There is slightly improvement on the performance of student at school. This is an also positive improvement of children at school due to the facility of electricity.

Table 4.12: Improvements of Children Performance at School

Performance at School improved		
	Frequency	Percentage
Yes	70	77.78
No	20	22.22
Total	90	100

Source: Field Survey, 2016.

Graph 4.12: Improvement of Children Performance at School



On the basis of improvement on the performance at school increased or not as well as the participation on Women literacy class as well as adult literacy class similarly rate of dropout student from school were the measuring rod to evaluate the impact on education. Significant percentage of children's improvement on education performance at school similarly large percentage of people participation on women and adult literacy class compare to before installation project and lower number of dropout student from school comparatively to before installation project shows positive impact of Naugarh Gad small hydroelectric project at the Dethala VDC.

Impact of hydroelectricity on access to information has been assessed through the ownership of a number of communication devices, radio listening and TV watching habits. General awareness of various aspects of life is sky up, even in rural lives by information technology. Information technology jumps large steps in the present decade. Rural people updated them by the revolution of information technology.

4.2.9: Advantages of Project in Study Area

In addition modern services directly and indirectly affects in traditional attitudes, eating, speaking, clothing and behavior. So, NGSHP has also affected in social and cultural properties. The table represents the respondent's attraction towards project, so it is attempted to find out the factors affected by the NGSHP. Therefore, the question is asked for them what are the factors attracted by the plant. In this question among the total 90 respondents, highest proportion i.e. 85(94.44%) reported increase in reading habit and the lowest proportion i.e. 10 (11.11%) reported in other factors. Likewise, easy work at night 80 (88.89%), time saving 60 (66.67%) improvement in health 50(55.56%) respectively.

To sum up, when electricity facility is available there increases the use of audio, video visual media and internet. By those types of media new generation can imitate or copy of every things that they have heard or saw. So it is proved that projects has attracted in social.

Table 4.13: Advantages of Project

Factors	Number	Percentage
Improvement in health	50	55.56
Time saving	60	66.67
Easy to work at night	80	88.89
Increase in reading habit	85	94.44
Others	10	11.11

Source: Field Survey, 2016.

4.2.10: Infrastructural Development

Project has positive impact on the development of infrastructures. Road service available at Dethala and surrounding area is the outcome of the project. Electricity has been available in the project area due to the project. Local market was set up at the project site.

4.2.11: Status of Sanitation after Electricity

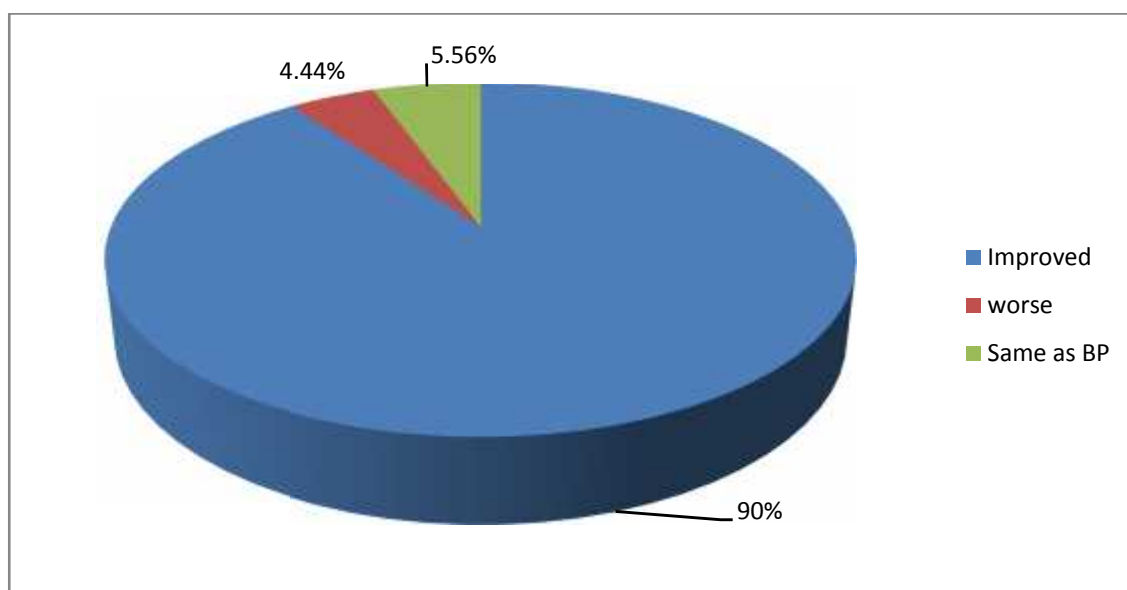
Sanitation is one of the indicators of living standard of the people. The table shows the status of sanitation after electricity with reference to environmental impact. Out of 90 respondents, the maximum proportion 81 (90%) reported the sanitation is improved. 5(5.56%) reported there is not any change occurred and 4 (4.44%) reported there is adverse condition in sanitation after electricity.

Table 4.14: Status of Sanitation after Electricity

Status	Number	Percentage
Improved	81	90
Worse	4	4.44
Same as before	5	5.56
Total	90	100.00

Source: Field Survey, 2016.

Graph 4.14: Status of Sanitation after NGSHP



Source: Based on Table 4.14

4.2.12: Impact on Health

Indoor air pollution is due to smoke from firewood and smoke of kerosene for the lighting purpose which leads to the serious problems on the people's health. People are suffering from asthma and eye infection due to indoor air pollution. Hydroelectricity has a prominent role in reducing indoor air pollution by decreasing the use of firewood and kerosene. Ultimately it is the environment friendly which helps conserve the jungle and helps keep fresh environment. To see the impact on health, this study compares the number of such cases reported among the sampled communities with and without Small Hydro.

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

Out of total 90 respondents, the maximum proportion i.e. 88(97.78%) reported that the electricity has positive effect on Eye infection. out 2(2.22%) respondents reported that electricity may not affect on Eye infection .Out of 90 respondents reported that

the electricity has decreased asthma, bronchitis, respiratory, heart disease and others 85(94.44%), 75(83.33%), 73(81.11%), 55 (61.11%) and 9 (10%) respectively. But the respondents who reported that the electricity has no change in decreasing asthma, bronchitis, respiratory, heart disease and others are in number 5(5.56%), 15 (16.67%), 17 (18.83%), 45 (38.89%) and 8(8.89%) respectively.

Table 4.15: Minimize/Improve the Diseases after Establishment of NGSHP

Kind of diseases	Number of respondents	Yes	Percentage	No	Percentage
Asthma	90	85	94.44	5	5.56
Bronchitis	90	75	83.33	15	16.67
Respiratory	90	73	81.11	17	18.83
Eye infection	90	88	97.78	2	2.22
Heart diseases	90	55	61.11	45	38.89
Others	90	9	10	8	8.89

Source: Field survey, 2016

4.2.13: Employment Status

The project has created a significance employment opportunity to the local people. Many people were benefited by the project during the construction period. After operation of the project, it has provided 6 local people with 27 permanent job and seasonal job. Similarly, more than 700-800 got employment opportunity during the construction period of the project some local people are getting temporary employment. There was also opportunity for seasonal employment in the project in accordance with their desire, skill and capacity.

4.2.14: Impact of Skill Development

People of the local area involved and saw the project construction method during the construction period. It helped them to develop technical skill of construction methods. Some youth had explored their skills such as civil works. Welding metal works electric wiring etc. developed during the construction period in other places

4.2.15: People Perception about Improvement of the Village after NGSHP

Life was hard for the women and men in rural Dethala VDC and the need of access to modern “clean energy” was acute, 100 percent of Dethala’s people lived many years

without access to grid electricity. Earlier, in most of households, families would spend huge amount of their income in purchasing kerosene for lighting and diesel for milling of grain. And the very strange news is that, in village price of kerosene is more than diesel price at present time it was Rs. 110 per ltr. Therefore, average expenditure on purchase of kerosene oil for lighting was Rs. 150 households as normally each family consumes 3 litre/month.

Living standard and the social status in the society; in fact it had also increased economic condition, as they provided enormous service to the village level. Now, it can easily be seen when they settling down to evening news on their color, few have been connected to world by internet facility on computer via mobile phone. There are numbers of application come to energy committee for establishment of small enterprises like grinding mill, food processing unit, huller machine and saw mill etc.

People are engaged in different work for promoting their source of income such as agriculture produce and other locally available natural resources etc. The lighting facilities have helped them to increase their working hours to combat health hazards else would have faced from kerosene wick lamp to assist their children in study affairs to improve. However with access of power villagers are now able to save money and time both also given opportunity to local service provider in the villages with more employment with their increased and efficient service delivery capabilities. Students have good opportunity to read at night; with these direct benefits of the NGSHP has resulted into a better socio-economic condition.

4.2.16: Establishment of Industries and Direct Job Creation

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

Electricity is the foundation of any socio-economic activities. The life is very difficult as well as being backward due to in ability to use to modern technology in the absence of power. After NGSHP, people lunched varies industries in the study area, which

help to raise the income level of the people as well as make the villagers way of living much easier. The firms that lunched after NGSHP in village is presented as below:

It is observed that villagers installed 14small industries where around 60 villagers have partially/fully involved in job. The villagers life become easier after installation of Flour mill, Saw mill, Oil expeller, poultry Firm and Spice mill and able to generate income from these firms. People generate income after installation of Bakery, Furniture and Poultry. The other business such as: Hotel, Stationary, Photo Studio and Medical have been run which generate the income as well as make the social life easier too.

Table 4.16: Establishment of Industries after NGSHP

Firms	Observations	Number of industries
Saw mill	90	2 (2.22%)
Flour mill	90	3 (3.33%)
Poultry firm	90	3 (3.33%)
Spice mill	90	2 (2.22%)
Oil expeller	90	1 (1.11%)
Bakery	90	1 (1.11%)
Furniture	90	2 (2.22%)

Source: Field Survey, 2016.

4.2.17: Impact on entrepreneurship

Large number of people engages with some kind of business. The number of people engaged on their own business like Hardware, Computer maintenance and shell, mobile, TV, Music system is relatively high. The attraction of people on mill and shop like tea, retailer, shoe, bangle, fancy etc. is similar. Engagement of people on poultry firm, hotel and travel also high.

4.2.18: Change in Living Standard

The modern facilities mostly affect the lifestyle human being. After using such facilities it is expected that there must change in living standard of human. Actually living standard refers to the higher living.

It is expected that modern facility like electricity may effect in human life style. So, this table shows the status of living standard of respondents. The question was asked

to respondents that have their living standard been changed or not. After the NGSHP plant, all respondents i.e. 90(100%) reported that living standard has been changed after the NGSHP. In addition, it is proved that electricity is one of the most affecting factors of living standard.

Table 4.17: Change in Living Standard after Electricity

Change	Number	Percentage
Yes	90	100.00
No	0	0.00
Total	90	100.00

Source: Field Survey, 2016.

People are engaged in different work for promoting their source of income such as agriculture product and other locally available natural resources etc. The lighting facilities have helped them to increase their working hours. People who have able to use the electricity properly, who have sufficient knowledge and ways about electricity facilities; they have been able to increase family income.

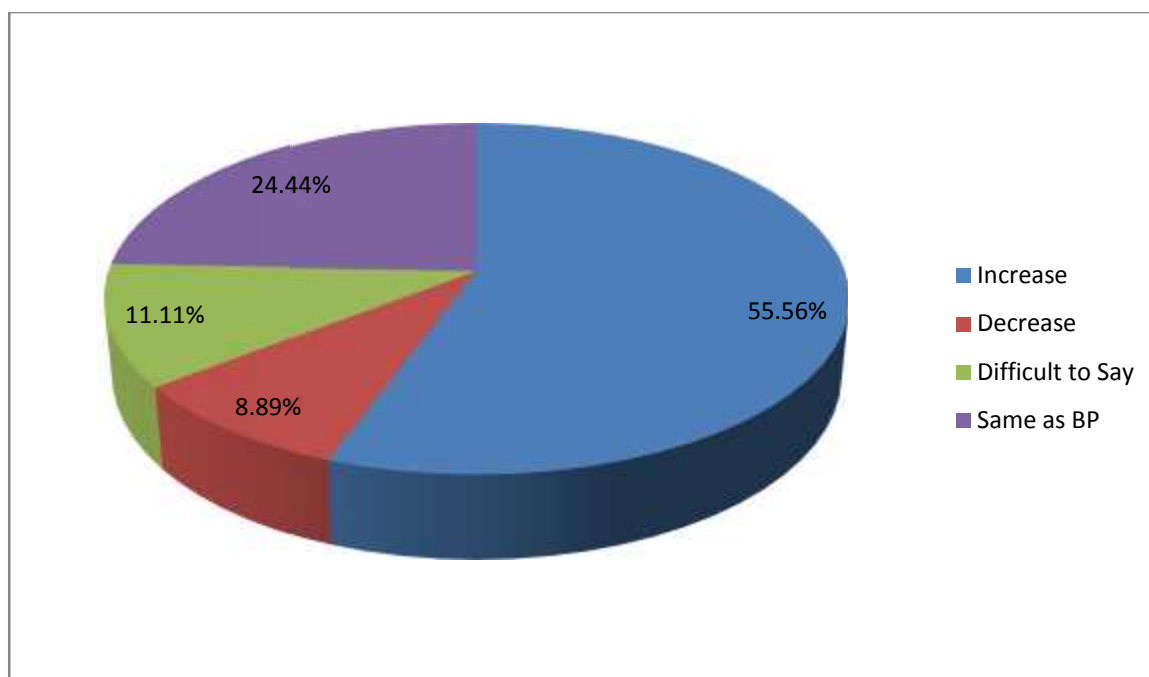
It is observed that 24.44 percent of respondent's income neither increased nor decreased. They are living in neutral position even after electricity. Out of total 55.56 percent respondents reported that their family income has partially increased. Out of total 11.11 percent respondents reported that difficult to say. Out of total 8.89% percent respondents reported that decreased.

Table 4.18: People Perception about Increase the Income after NGSHP

Income level	No of respondents	Respondent in percentage
Increase	50	55.56
Decrease	8	8.89
Difficult to say	10	11.11
Same as before	22	24.44
Total	90	100

Source: Field Survey, 2016.

Graph 4.18: People's Perception about Increase the Income after NGSHP



Source: Based on Table 4.18

4.2.19: Agriculture Product Promotion Due to NGSHP

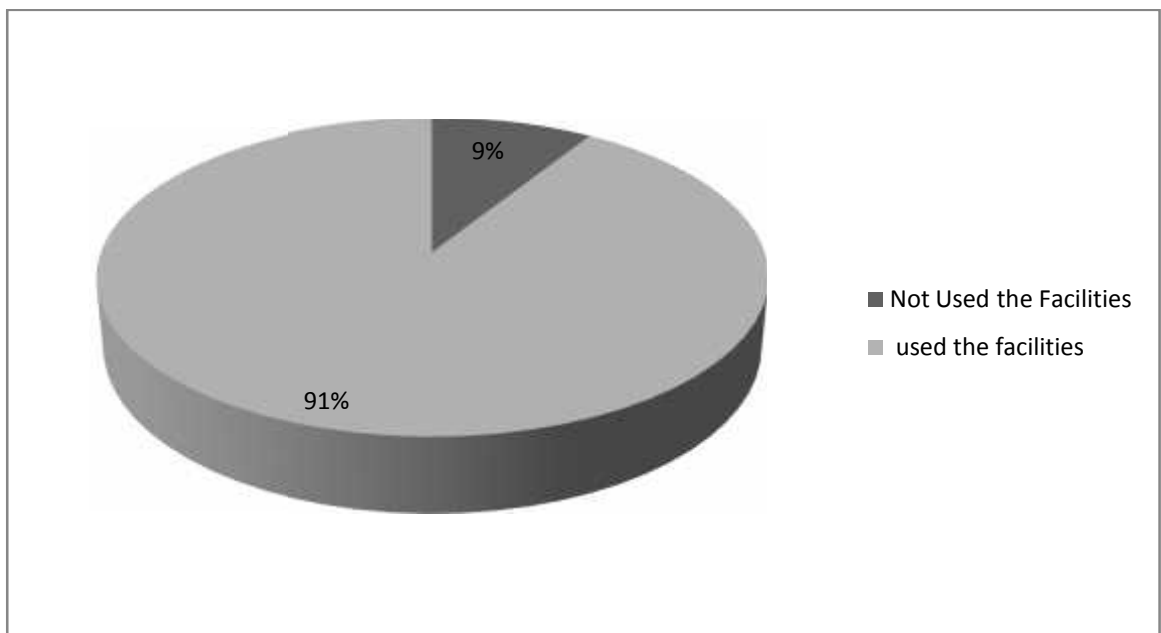
People of PAFs and the study area are engaged in various economic activities particularly in agriculture. The duration of farming in the study area is from November to May. This duration is wheat farming and June to October are paddy, maize, millet farming respectively. Hence, people of the PAFs and the study area are employed for 10 months a year in farming. They have leisure period for the remaining 2 month. But they use such time in cutting fuel wood, doing household work etc.

Project has provided employment opportunity to the people of the study area and its surrounding. Except agriculture, available manpower is engaged in other economic activities. Such as porter, wage Labour and services to earn their livelihood. The energy needed for the agriculture sector in the hilly and mountainous areas is for Agro processing and irrigation. For the processing, i.e. mainly grinding, husking and expelling of the local products, energy from NGSHP could be sufficient .In our country more than 80 percent of people involved in agriculture. The production of

crops will not be increased drastically because the present crop-producing practice is already an intensive one. Therefore, from these perspectives, energy from NGSHP would be sufficient for the selected villagers in the vicinity of NGSHP areas if they use for off-season irrigation for cash crops only but not for regular crops irrigation like paddy. However, to estimate such a scenario, an in-depth study has to be done. The people perception about agriculture product is presented in figure 4.19.

Among 90 respondents 9 percent cannot take any facility to raise their agricultural products. Among 91 percent, 42 percent household respondents fully used the facilities where as 40 percent use it partially. Thus, NGSHP help to raise the agriculture products of many households.

Graph 4.19: Agriculture Product Promotion due to NGSHP



Source: Field Survey, 2016.

4.2.20: Time Spending on Fuel Collection and Agriculture

Most of the females collect fuel wood instead of male in the study area. Before the project started, they used to spend around 50 day on fuel wood collection for a year. Around 7 hours on agriculture daily. Naugarh Gad hydropower helped to increase a number of consumers to enjoy more facilities now, women spend nearly 30 days to collect fuel wood for a year. The save an hour daily on household activities and utilize it in agriculture activities.

4.2.21: Concept of People

Feeling or concept refers the any kinds of response towards and things. People had either satisfaction or dissatisfaction toward electricity. What they had been feeling after NGSHP established. It was also attempted to find out that what was the feeling of people towards electricity in the study area (Table 4.20).

Among total 90 respondents highest proportion i.e. 60 (66.67%) reported that they were satisfied by electricity service. The lowest proportion i.e. only 15 (16.67%) respondents reported they were neutral and remaining 15 (16.67%) respondent reported were very satisfied. There were no non-satisfied respondents in study area of NGSHP.

In addition electricity facility is closely related with human life. It is not only necessary in day time, but also in night time. Electricity made the human life easier and comfortable. It is also able, to make the whole world as a one state. In rural area electricity is a strange thing. So 83.34 percent respondents are satisfied the way of NGSHP.

Table 4.20: Feeling of People towards NGSHP

Feeling	Number	Percentage
Very Satisfied	15	16.67
Satisfied	60	66.66
Neutral	15	16.67
Non-satisfied	0	0.00
Total	90	100

Source: Field Survey, 2016.

4.3: Major Findings

In this study the major findings are as follows:

-) Out of total 90 respondents 35 were taken from ward no 1, 30 and 25 respondents were taken from word no 7 and 8 respectively.
-) The number of people involved with respect to their age group is tabled below:
 - a. 15-25, b.26-40, c.41-60 d. above 60. In short the number of the people of the age 26-40 years is high.
-) In total the respondents have participated 46.53% female and 53.47% male.
-) Thakuri, Chhetri and Brahman are in the apex whereas Lohar is low level of the social class.
-) Out of economically active population 70% are involved in agriculture, 8.89% are involved in service similarly 5.56% , 11.11%,4.44% are involved in self owned business, foreign employment and others respectively.
-) Almost all the households pay the bill of electricity regularly.
-) People use electricity for lighting, cooking, playing radio T.V and battery charge.
-) Households use NGSHP for lighting purpose minimum 3 to maximum 10 hours.
-) Out of 25 households used for cooking purpose minimum 2 hours to maximum 5 hours.
-) Out of 21 households run business where they use electricity 5 to 17 hours per day.
-) For TV and radio playing purpose they used 2 hours to 17 hours and 2 to 6 hours for personal used.
-) Use of electricity for lighting 50 households consume per month 0-20 units.
-) Out of 20 households consume per month 20-30 units, 15 households consume 30-50 units, and 5 households consume 50-250 units per month.
-) Before installation of NGSHP firewood and kerosene are the main source of energy for lighting and cooking purpose after NGSHP it declines at 66.67% and 16.67% respectively.

-) Only 50% people used solar plant and 12.22% households had biogas before the project but after the project solar plant decrease at 33.33% and biogas increase at 22.22%.
-) Before NGSHP 80% households possessed radio but now 100% households have.
-) Only 22.22% households had TV who had solar panel now percent of TV users increase and became 88.89% and computer is now possessed by 27.78% Households.
-) Number of cell phone user's change drastically from 16.67% to 100% after NGSHP.
-) After NGSHP 7(13.46%) households children raised their study time less than one hour.11 (21.15%) households children raised one to two hours. 19(36.54%) raised two to three hours and 15 (28.85%) households children raised more than three hours.
-) In total 70 households (77.78%) says improvement their children performance at school and 20Households (22.22%) says no change in performance at school.
-) Out of 81 (90%) Households the sanitation is improved 5(5.56%) reported there no any change occurred and 4(4.44%) reported there is worse in sanitation after electricity.
-) In local area 14small industries where around 60 villagers have partially/fully involved in job.
-) After NGSHP there are 2 saw mill, 3 flour mill,3 poultry form, 2 spice mill, 1 oil expeller, 1 bakery and 2 furniture established.
-) After NGSHP plant all respondents i.e. 90(100%) reported that living standard has been changed.
-) Out of 24.44% of respondent's income neither increase nor decreased.
-) Out of total 55.56% respondents reported that their family income has partially increased.
-) Out of 11.11% respondents reported that difficult to say and 8.89% respondents reported that it is decrease.
-) Among 90 respondents 9 % cannot take any facility to rise agriculture products.

-) Among 91%,42% households respondents fully used the agriculture facilities where as 40% use it partially. Thus NGSHP help to raise the agriculture product of many households.
-) Electricity is closely related with human life therefore all respondents living standard have been changed after NGSHP.
-) Respondents has started to use audio and audio-visual materials, therefore plant has effected on social and cultural properties like changing behavior, changing clothing and thinking.
-) To build the NGSHP sustainable, repair, maintenance and operation schedule be necessary therefore there is operation schedule in powerhouse for these proper user committee is fully responsible.
-) Before electrical facility people have been using the flaming, fire hood and Kerosene at the night after electricity they are reduced such types of materials, so positive impact is found in human health. Most of the respondents are satisfied by NGSHP.

CHAPTER-V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1: Summary

This study covers the socio-economic contributions of Naugarh Gad hydropow project on education, health, employment and access on information technology of the people in Dethala VDC of Darchula district. As per objective, this study tries to access socio-economic aspect of Naugarh Gad hydro project on education, income, health, employment and information. The respondent from the study area 90 sample has been selected and To find out the average household electricity consumption and its impact on living standard of the people in project affected area.

The questionnaire has divided on five sections. First section covers household's information, second section covers NGSHP and rural electrification, third fourth and fifth section cover respectively socio-economic aspect, health and socio-economic impact and question about the project.

The result shows that there is positive impact on the education. 70 percentages of people were agreed with the increased on the performance of their children at school. Similarly, most of the people were benefited from children study habit and performance at school.

Similarly, improvements has also shown on the access on the equipment of information technology and modern electrical and electronic devices. There has also shown improvements on modern form of equipments compare with before and after the hydro energy. Almost people have Radio, TV, and many household have computer/laptop, mobile phone due to the awareness on information technology.

Similarly, the result also shown on improvement of health status by the help of hydro powerproject, Almost 40 percent of household is not suffering from any respiratory diseases and eye related infection during one year period.

And all APFs are benefited from establishment of the industries and so on change in living standard.

5.2: Conclusion

The whole conclusion of research works has been given in this paragraph.

The first chapter deals with general background, statement of the problem, objectives, significance, limitation and organization of the study. The second chapter is about literature review. The third chapter is about introduction to the study site, nature of data, sample selection, questionnaire design, method of data collection and data processing. Fourth chapter deals about the analysis and interpretation of data and the last chapter includes summary, conclusion and suggestion.

The main conclusion of the study is given below:

Naugarh Gad hydroelectric project has an upbeat impact on enhancement of education status and awareness on information technology of people live in Dethala VDC partially. People gain lighting facilities which helps to increase study more and which helps to decrease diseases by reduce indoor pollution. The acquirement and utilize of physical assets such as electric appliances has increased access to information. The verdict of impact Naugarh Gad hydroelectric project has been accomplished below.

-) The hydropower brings revolution on the information technology of Case group; almost all of house hold has Radio and TV. Number of Impact of hydroelectricity on access to information has been assessed through the ownership of a number of communication devices, radio listening and TV watching habits. General awareness of various aspects of life is sky up, even in rural lives by information technology. Information technology jumps large steps in the present decade. Rural people updated them by the revolution of information technology.
-) Naugarh Gad Small hydro has a positive impact on health of the people live in Dethala VDC as well. Number of ills households member from respiratory diseases and eye related infections such as asthma, bronchitis, eye infection,

heart diseases etc. in the past one year period are found to be less in households that are connected with NGSHP than to the households does not connected with Small Hydro.

-) Large number of people engages with some kind of business. The number of people engaged on their own business like Hardware, Computer maintenance and shell, mobile, TV, Music system is relatively high. The attraction of people on mill and shop like tea, retailer, shoe, bangle, fancy etc. is similar. Engagement of people on poultry firm, hotel and travel also high.
-) . Women of the study area are still backward. But their status is improving smoothing with time. Now they are aware of sanitation health, nutrition, child care and family planning. Their role in economic decision and overall decision about family is increasing day by day.

5.3: Recommendations

Nepal is second rich country in the world with respect to water resources, but people of rural areas have been living in dark not only at night time but also in day. People are far away from modern technology. At present, most of the urban areas which are known as facilitated also compel to remain on dark due to compulsion of load shedding. The condition becomes worse on day by day. The demand of electricity growing up and production is almost stopped. The gap between demand and supply is increasing adversely day to day.

The government should play to solve this complex problem. Many strategy and schemes can adopt by the policy maker to improve the life status of rural people. If we can emphasize on rural electrification, that uplift education as well as life standard of rural people.

-) If we give the ownership of electricity to the community rural people are very much conscious about any type of damage or loss towards the community assets. Thus this schemes not only creating real sense of ownership but it also leads to safety and security of national assets. This stops the leakage and theft of electricity which helps to reduce the problem of load shedding.

-) Plane area is very fertile for paddy and wheat but unfortunately there is no irrigation facility. People use motor to drain ground water from swallow tube well but if we can form water storage tank in community, lift the river water to fill up the reservoir and use it widely for irrigation purposes. Similar scheme can apply on kitchen garden, local pastures and farmlands have been reforested with native spices and fruit trees, therefore rural farmers are selling green vegetables to urban areas.
-) The rural electric communities are mobilizing electric contractors who are responsible for construction of new rural electrification system and joining together to develop foot trails into motorable roads using the local resource only. Thus electric material has becomes cheaper.
-) If we can join the people of VDC, INGO and local NGO as a partner and helping by providing staff development training and necessary tool and equipments for operation and maintenance then Increased rural electrification coverage, increased consumer connection rate, increased per consumer consumption, improved load factor, reduced operation and maintenance cost and improve Socio economic condition.
-) Communities are motivating their members for 100 percent consumer connection by introducing new domestic electrical appliances on installment basis, Community shops, deploying local youth unemployed people as a working group. It increases the annual income of households, it reduces average annual health care expenditure for housewives, Adult literacy rate, quality of education, women socio-economic status etc.
-) Government should emphasize the development of infrastructures in remote, hilly and mountainous districts which support the development of hydropower.
-) Detail survey and estimation should be conducted the identity and install SDSHPs which can which can be invested by foreign Donor Agencies
-) The multipurpose hydropower project should be installed to promote industries especially cottage and small scale industries and irrigation facilities.
-) Strong financial agencies should be established to facilitate the investment on the development of small hydropower project.

-) The environmental friendly, technically feasible and economically profitable hydropower plants like NGSHP should be installed.
-) Small hydropower project should be installed in rural, isolated and hilly areas.
-) Priority should be given for the development of small hydropower project because it helps to reduce regional imbalance of development, meet the local and national demand for electricity and implement, large scale project as export oriented project.
-) The private sector should be encouraged to develop hydropower specially small hydropower project like –NGSHP.
-) Electricity duty should be reduced to encourage small and cottage industries in rural areas e.g. saw mill, herbal product industry. Cold storage, cheese and ice cream factory etc.
-) Siren or any other alternative system should be keep in the project site to save people from any kind of possible dangers.
-) Participatory approach should be adopted to involve local people in the developmental activities as far as possible.
-) In every opportunity preference should be given to the local people.
-) A portion of project's revenue should be invested to launch various programs for raising the living standard of the people.
-) Local people should be also ready and conscious to help the upcoming projects and program and grab advantages.

In short it is recommended that mitigation measures must be closely monitored and upcoming hydropower project should avoid the short comings of the NGSHP. This is the lesson we must learn from the Naugarh Gad small hydropower project to develop other hydropower project to develop other small hydropower projects throughout the hilly areas of our country.

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Questionnaire: 1. Household information

Q.N	Questions	Code/answer
1.1	Name of the village	
1.2	Ward no.	1 2 3 4 5 6 7 8 9
1.3	Name of household head	
1.4	Gender	1. Male 2. Female
1.5	Age of the respondent	
1.6	Education level	
1.7	Number of household members	male female -----
1.8	Caste	1. Brahmin 2. Chhetri 3. Thakuri 4. Dalit 5. others
1.9	Religion practiced	1. Hindu 2. Buddhist 3. Christian 4. Others
1.0	Main occupation of household members	1. Agriculture 2. Services 4. Daily wage basis 5. Self owned business 6. Unemployed 7. Foreign employment 8. Other specify

2. NGSHP and rural electrification

Q.N	Question	Code/answer	Skip
2.1	Do you agree NGSHP system has played vital role in rural electrification?	1. Yes 2. No	If 1, go QN 2.2
2.2	How NGSHP helped in rural electrification?	----- -----	
2.3	How much units of electricity do you consume per month?	maximum minimum -----	

2.4	How many hours per day you do access to electricity for the following purpose? (write in complete hours) 1) Lightening 2) Cooking 3) TV/ Radio 4) For business purpose 5) For agriculture purpose 6) Personal use 7) Other specify	----- ----- ----- ----- ----- ----- -----	
2.5	How much money do you pay for electricity per month? Write in total Rs.	maximum -----	minimum -----

3. Socio-economic aspect

Q.N	Question	Code/answer		Skip
3.1	Do you think participation in the project has improved the status of the village?	1. Yes	2. No	If 1, go Q. N. 3.2
3.2	How it helped to improve the socio-economic condition of the people?	----- -----		
3.3	Have you done the productive work by using SHP system? 1. Poultry farming 2. Knitting 3. Furniture 4. Milling 5. Saw-mill 6. Dairy 7. Computer-institute 8. Other Specify	1. Yes 1. Yes 1. Yes 1. Yes 1. Yes 1. Yes 1. Yes 1. Yes	2. No 2. No 2. No 2. No 2. No 2. No 2. No 2. No	
3.4	Do you find that after involving on productive work it helped to increase your income level?	1. Yes 3. To some extent	2. No 4. Difficult to say	
3.5	Number of employed persons at the project affected area:	Before -----	After -----	

3.6	Does the project help to promote the agricultural product?	1. Yes	2. No	If 1, go Q.N. 3.7
3.7	In your opinion, how it helped?	1. Regularly 2. Sometimes 3. Irregularly		
3.8	What type of industry is installed in your village?	1. Milling 2. Furniture 3. Irrigation 4. Drinking water 5. Knitting 6. Other specify		
3.9	How many electrical instruments does your household posses before and after electrification? Write in number.	instruments before after 1. Radio ----- 2. TV ----- 3. Refrigerator ----- 4. Computer ----- 5. Cell Phone ----- 6. Chargeable battery ----- 7. Others specify -----		
3.10	Specify the annual income of the family. Total in Rs.	Before -----	After -----	
3.11	What is the status of your family income after having electrified?	1. Increased 2. Decreased 3. No change		
3.12	How much money do you spend on these energy sources? Specify total in Rs. 1. Kerosene 2. Battery 3. Candle 4. Firewood	Before ----- ----- ----- -----	After ----- ----- ----- -----	
3.13	What was the main source of energy in your family before installation of SHP?	1. Firewood 2. Bio-gas 3. Solar 4. Kerosene 5. Others		
3.14	After electrification, is your children's study hours increased?	1. Yes	2. No	If1,go Q N.3.17
3.15	How much time has been increased?	1. Up to 1 hour 2. 1 to 2 hours 3. 2 to 3 hours 4. More than 3 hours		
3.16	Has their performance at school increased?	1. Yes	2. No	
3.17	Have you seen the following changes in the			

	activities of your children due to watching TV/ using computer? 1. Talking style 2. Dress up 3. Sport 4. Reading habit 5. Dance 6. Others	1. Yes 1. Yes 1. Yes 1. Yes 1. Yes 1. Yes	2. No 2. No 2. No 2. No 2. No 2. No	
3.18	Has the project affected to drinking water supplies?	1. Yes 3. Unknown	2. No	
3.19	Is there any increase in migrated people after the project implementation?	1. Yes	2. No	If1,go Q N 3.20
3.20	How many households are migrated in the village? Write in household number.			
3.21	Has electrification improved the communication in efficient way?	1. Yes	2. No	
3.22	Have you seen any changes in following activities to household members after electrification? 1. In fashion 2. In behavior 3. In thinking 4. Others	1. Yes 1. Yes 1. Yes 1. Yes	2. No 2. No 2. No 2. No	
3.23	What is the impact of project in infrastructure development?	Positive ----- ----- -----	Negative ----- ----- -----	

4. Health and Sanitation

Q.N	Question	Code/answer	Skip
4.1	How many hours per week did you spend to collect the firewood before and after this project?	Before After ----- -- -----	
4.2	How often do you use the following sources for lightening. Write in hours per day. 1. Bio-gas 2. Solar 3. Kerosene 4. Small hydro 5. Others	----- ----- ----- ----- -----	
4.3	What is the status of sanitation in the village after electricity?	1. Improved 2. Worse 3. Same as before	
4.4	What kind of effects are seen in health conditions of family members after implementation of this project?	1. Improved 2. Worse 3. Same as before	
4.5	Does the establishment of SHP help to improve/minimize the following diseases? 1. Asthma 2. Bronchitis 3. Respiratory diseases 4. Eye infection 5. Heart diseases 6. Others	1. Yes 2. No 1. Yes 2. No 1. Yes 2. No 1. Yes 2. No 1. Yes 2. No 1. Yes 2. No	

