Socio-Economic Impact of Surma Devi Small Hydropower Project A Case Study of Bajhang District

Submitted to the Central Department of Economics
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In
Economics

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LETTER OF RECOMMENDATION

This thesis entitled **Surma Devi Small Hydropower Project Bajhang District** has been prepared by Mr. Khagendra Prasad Joshi under my supervision. I hereby recommend this thesis for examination by the Thesis Committee as a partial fulfillment of the requirements for the Degree of **Master of Arts** in **Economics**.

Date: 2068/02/29

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APPROVAL SHEET

We certify that this thesis entitled **Surma Devi Small Hydropower Project Bajhang District** submitted by Mr. Khagendra Prasad Joshi to the Central Department of Economics, Faculty of Humanities and Social Sciences, Tribhuvan University, in partial fulfillment of the requirements for the Degree of Master of Arts In Economics has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the master degree.

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This research report is prepared as a thesis in the partial fulfillment of the requirement for the master's degree in economics. The basis objective of the study is to identify the socio- economic impact of the Surma Devi small Hydor-power project (SDSHP) of Bajhang district.

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June 15, 2011 Khagendra Prasad Joshi

ABSTRACT

In general, this study attempts to appraise the importance of electricity in the development of Nepal. This research, however, focuses on the significance of the small hydropower project in the context of our county. Obviously, Nepal lacks capital, infrastructure, and technology to install large hydropower projects. In such a case. It is rather wise and practical to install small hydropower. Projects to fulfill our demand for electricity. For it can be installed with small amount of capital. So, we can encourage the private sector to invest on it. Likewise, it does not demand as sophisticated technology as the large projects do. Moreover, it is free of hazardous environmental impacts. In all, it, unlike the big projects, has more positive impacts than negative ones. So, the small hydropower projects can play a key role in the overall development of Nepal. The present study has attempted to bring these aspects of the small hydropower projects into the limelight through the study of impacts of Surma Devi Small Hydropower project in the overall sectors of the study area, Daudi Chaur VDC Bajheng. Nepal has immense endowment of water resources. Theoretical and technical potentialities of hydropower are estimated to be 83,290 MW and 45,520 MW respectively, However, economically viable capacity is accounted to be 42,133 MW . It is expected that electrification will create various opportunities of development activities in the rural areas. Neither are traditional sources in the position to meet the requirements of energy nor are they sustainable.

The hydropower plant of Zurich of Switzerland built in 1882 is the first hydropower plant in the world . In the context of Nepal, Pharping Hydro plant (500KW) is the first hydropower plant . Nowadays, the demand for electricity is increasing by more than 10 percent . Up to the end of FY 2008 there are 58 hydropower projects. They have contributed total

675.959 including 144.083MW by private sector in accordance with Power purchasing Agreement (PPA). Out of the total hydropower, 545.785MW has been linked in the national grid and rest has been generated by small hydropower plants, and distributed locally. The total number of electricity consumers has reached 13, 92, 055.00 up to FY 2007/2008 .The Surma Devi small hydropower is a run-off-river type project with 200KW capacity, The construction work of this project started in 2043 and completed in 2045 The project has been installed Japanese Grants . It has brought about various impacts on socio-economic aspects of people residing in the surrounding areas of the project. The project has benefited 66 households of the study area. Out of the total households, the land of 23 households has been occupied by the project. The socio- cultural norms and values have changed due to the concentration of socio-cultural norms and values have changed due to the concentration of large number of people from diverse backgrounds, The level of awareness in people has significantly increased. The project has created abundant opportunities for knowledge and skill. So, their economic status has become better than before . PAFS include the ethnic groups such ass Chhetir , Kami, Damai , Sarki the study area , however , is dominated by the Chhetri community.

In conclusion , installation of small hydropower project like SDHP is relevant/ significant from various angles in the present context of Nepal, eg. to fulfill the national demand of electricity, protect environment, uplift living standard of rural people, enhance economic activities in the rural areas and reduce regional imbalance of development.

ABBREVIATION

ADBN	- Agricultural Development Bank Nepal
AEPC	- Alternative Energy Promotion Center
BSP	- Biogas Support Programme
CBS	- Central Bureaus of Statistics
CCO	- Canadian Cooperation Office
CDM	- Clean Development Mechanism
FY	- Fiscal Year
GGC	- Gobar Gas Company
HA	- Hectare
HHs	- Households
Hr	- Hour
IEDC	- Integrated Energy Development Company
Kgs.	- Kilogram
Ltrs	- Liters
Rs.	- Rupees
SNV	- Netherlands Developments Organization
Sq Km	- Square Kilometer
VDC	- Village Development Committee

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CHAPTER I

INTRODUCTION

1.1 Background

Nepal is a landlocked mountainous country, which is sandwiched between India and China; it is 1,127 km far form 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 in shape and its average length from east to west is 885 km and the breath from north to South is 193 km.

Nepal is divided on the various bases such as ecologically (Mountain, Hill and Terai) river's basis (Kosi, Gandaki, and Karnali) administratively 5 development region 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 people 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 Nepalese economy facing 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 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 at infant state. However, more or less, all sectors such as agriculture, industry, trade, and

commerce and commutation. Social services and tourism are developing smoothly.

Energy is the basis need for all the 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 basis pre-requisite for socio economic development of a nation.

The trend of energy consumption is predominated by traditional sources particularly fuel wood. Over utilization of forest creates serious environmental problem. Fossil fuels (petroleum and coal) are imported. It needs a large amount of foreign currency. Nepalese economy however is facing problems like trade deficit debt trap, and unfavorable balance of payment on one hand. People's per capita income US$ 400 (World Bank, 2010) and purchasing power is very low. In the other hand, the use of solar energy is negligible and wind energy is still as survey stage.

But the water resource is immensely available in Nepal and hydropower is clean renewable, pollution free, reliable and easily available. It is the best alternative among all the available energy in the context of our country.

Nepal is the first richest country in water resources in Asia and the second richest in the world. Nepal has about 6,300 large and Small River hurling from the Himalayas and high mountains towards the plain and Terai. The total length of those large and small rivers is about 45,000 km.

The perennial nature of Nepalese rivers and the steep gradient of the country's topography provide ideal conditions for the development of some of the world's largest hydropower projects in Nepal, The total hydropower potential of these rivers is estimated about 83,290 MW of and which 45,520 MW (54.69 percent) and 42,133 MW 50.59 percent) are technically and economically feasible from 93 and 66 sites respectively. The country's theoretical potentiality occupies 2.27 percent of world's potentiality of hydropower. However, Nepal has generated 615.959 MW hydroelectricity up to the end of up to 2008/09. It is 0.67 percent and 1.33 percent of the theoretical and economic potentialities respectively. Out of the total installed power, 463.136 MW and 152.713 MW power have been installed from public and private sectors respectively. Total installed capacity has reached 615.959 MW including thermal power (NEA, A annual report, 2006/07).

The demand of electric power has increased by more than 11.12 percent in FY 2008/09 whereas the overall energy supply had increase by 8.60 percent in comparison to FY 2007/08. It is suppressed due to the limited supply, industries trade and commerce services, transportation, communication and other infrastructures are expanding rapidly. In this way, there is a large gap between demand and supply of electric power because its demand exceeds supply. So there is high and continuous requirement of installation of hydroelectricity projects.

There are four scales of hydropower projects in Nepal i.e. mega, large medium and small. The aim of installation of mega and large medium and small hydropower project 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 policy plays important role for tourism development agro-based industries, irrigation and 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 cannot be supplied through the national grid and where infrastructures have not been developed adequately.

Likewise, such projects are technically as well as economically feasible at rural area. It is also preferred in those areas where the small and cottage industries can not run due to the lack of sufficient energy. Similarly, micro hydropower projects are installed in the 130 backward areas as the alternative of other energies.

Hydroelectricity was first originated form water resources at Rothberg of Northumberland in 1879. Lord Armstrong lighted his house with electric lamp by using current from a dynamo driven by a water turbine. The first hydropower station in Europe for supplying electricity to the public was bolt at Zurich, Switzerland in 1882. It was based as the principle of kinetic energy.

In the context of Nepal, Pharping Hydro plant (500 KW) in 1911 is supplying electricity in Kathmandu. Then 24 years letter second hydropower project Sundarijal (900 KW) was generated in 1935 A.D. Now its capacity is 640 KW. The development of hydropower went ahead in progressive path smoothly. Only 2077 KW power was installed from hydropower at the starting date of economic plan in 1956 AD. Every plan has been making plans and implementing this programmes about the development of hydropower in Nepal. Unfortunately first five

year plan did not achieve the goal of power installations only preliminary works were completed. But other plans more or less achieved the goal of hydropower development. Even in holiday plan period (Since 1990/1992) we achieved 71000 KW power due to the completion of some projects. Out of five hydropower projects including a major project. Sixty–eight hydropower projects have been installed up to FY 2007/08 Out of them 8 projects are considered as the large scale project.

Government of Nepal (HMG/S) brought out new liberal policy about the development of hydropower to encourage private sector (foreign as well as local investor, by the implementation of water resources Act 1992. Especially Nepal has adopted this liberal policy to attract private investment for the development of small hydropower projects. Nepal electricity authority has announced its policy to purchase the power generated by its private developers/investors of small hydropower projects up to 5 MW capacity. In order to support the capital requirement for the installation of hydropower project

The government has established a power development fund (PDF) support the private investors. Similarly, domestic commercial banks have been also autonomously investing on hydropower project is priority sector investment. This policy has been encouraged the private investors to install small hydropower projects to much the growing national demand for energy in the country.

At present the effort of the government and Nepal Electricity Authority (NEA) is not adequate to harness the vast power generation potentiality of the country and meet the growing demand in the short run. Electricity act – 1992 has facilitated wide business opportunities to local and foreign investors for developing hydropower projects. In this regard, the

government has already granted permission to independent power producers to develop hydropower project.

1.2 Statement of Problem

Nepalese economy is based on traditional agriculture. In addition to agriculture other sectors of economy such as industry, trade and commerce, transportation, communication and tourism are to developed yet due to their inadequate electric power and financial resources. The absences of infrastructures like road and transmission line. Hydropower development can not be achieved more over infrastructures are required for proper exploitation of other available resources in the country. In short, economic development has not got proper acceleration due to insufficiency of electricity.

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 important the petroleum products. Nepal has limited sources of foreign exchange. As a result Nepal has been facing the problem of debt trap trade deficit and unfavourable balance of payment.

The demand of petroleum product is growing day-by-day and sometimes we have to face the crisis in their supply in the international price too market as well as wind energy is still of the state of research and survey. Likewise, the price of petrol is Rs 97.50 per liter; diesel Rs 73 Kerosene Rs 69 (June 2011) The solar energy has to been adequately utilized.

Similarly, biogas cannot be produced all over the country especially in the cold hilly as well as mountains regions.

All scale of hydropower projects is viable in Nepal. Large dam and reservoirs are needed for large scale hydropower projects life and marine life of the concerned area and its surroundings similarly huge capital investment is required to install large scale hydropower project. For this government should take foreign debt or invite foreign investor to invest. In both cases foreign exports and technicians would be used consequently. The generation cost of large project should found comparatively higher than that of small project. Despite the generation cost of large scale project should be owner than the small one in accordance with the principle of economics in reality. The result is found just opposite. That's why the large capacity of electricity and ultimately, it has got to bear extra load of debt.

On the other hand, micro-hydropower can fulfill the demand of electricity can fulfill the demand of electricity is backward and isolated areas, where disadvantaged groups and marginalized people live. Indeed micro hydropower projects have not been installed in adequate number is targeted areas yet.

The marginalized people are living in remote rural areas which lack balance of regional development. To some extant, the development cannot be promoted in rural areas in the absence of the electricity.

1.3 Objectives of the Study

The objectives of this study are divided in two part viz. general objectives and specific objectives.

1.3.1 General Objectives

- To high light the importance of electricity in economic development.
- To state the potentiality and present status of hydropower in Nepal.

1.3.2 Specific Objectives of this Study

- To examine the socio-economic impacts of Surma Devi Small hydropower project on the targeted area.
- To suggest the sustainable development of small hydropower project in Nepal.
- To find out the average household electricity consumption and its impact on living standard of the people in project affected area.

1.4 Significance of the Study

The development of all sector of an economy depend on energy the utilization of energy especially electricity is centered in urban area and most of the rural areas have been passed by the existing energy development schemes in Nepal, Generally sources of energy are divided into broad two part viz. traditional and commercial. Out of the total energy consumption, the traditional resources contributed 86 percent to 90 percent and commercial resources contributed 1.4 to 2.0 during the ninth plan and in the tenth plan, domestic contribute 95.92 percent and commercial contribution is 0.44 percent. 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.

Electricity can significantly diversify rural activities. The electricity can raise the living standard of people advantage of electricity are:

- Electricity makes human life easier by providing domestic as well as non domestic facilities creates employment opportunities. In the presence of electricity, electronic devices may be available. They improved both quality and quaintly of communication and education.

- Electricity helps to discover, develop, expand, promote new techniques and technologies in various sectors.

- Electricity helps to develop infrastructures which are preconditions for the economic development. Development of electricity and infrastructure has correlation with each other.

- Improve in extra curricular activities which help to raise the living standard of the people.

- Electricity helps to improve overall sectors of the economy.

As electricity is significant in the development so the researcher has conduced a research on a small hydropower project. This research will be helpful and resourceful in the following ways.

- Possibly this is a first research about small hydropower project, especially for far west region of Nepal. However many research of middle and large hydropower projects have been already done.

- This project is contributing to the electrification of hilly and mountainous districts Bajhang. However their hydropower project is also inoperation in Bajhang district now.

- Outcomes from this research many be helpful to other individuals and institutions to implement programs effectively in such type of project.
- Research will help to know externalities (cost and benefit) for other project and programs and to implement such type of new project.
- Socio economic impacts of this project inform us the role of project in the socio-economic up-liftment of a community.
- Finding of this research may be valuable information to those persons institutions that are interested about people of the related area.

In short, the importance of small hydro projects is increasing in every aspect of the society. Therefore the study which attempts to identify the socio economic impacts of this Surma Devi small hydropower project is significant at present.

1.5 Methodology

This research is based upon quantitative data as well as qualitative, so this research is descriptive type of research because it is a fact finding investigation with adequate interpretation in the context of social research. It is more specific than exploratory study as it aims to identify the various socio-economic characteristic of the community. The project site is located in rural area Daulichaur-1 Bajhang. It is just ten km. far from district headquarter.

1.5.1 Primary Information

Primary information was collected from the field survey. For this purpose the following tools have been applied in this research.

Observation:

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

Interview:

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.

Questionnaire:

A questionnaire was developed prior to project visit. The questionnaire was developed in such way that it covers 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. The project has occupied land of total 66 household who are considered as directly project affected families and they were selected to full up questionnaire.

1.5.2 Secondary information

Secondary information has been collected form different sources of governmental and non government organization 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.

1.5.3 Method 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 diagrams sub-divided or component bar diagrams and multiple bar diagrams have been used to analyze the primary as well as secondary data. Sub divided or component bar diagram and multiple bar diagrams have been also used to analyze primary as well as secondary data in this study.

1.6 Limitation of the Study

This research has been conducted for academic degree this study is focused on the socio-economic impacts of the hydropower project in the development of Nepal. Surma Devi small hydropower project. SDSHP has been taken as a case study. The study primarily focuses the characteristics of the communities and social impacts caused by SDSHP at the local area.

The generalization derived from this study may not be equally applicable to other sector. Due to the financial, temporal and other constraints the field survey was conducted in a single season. Likewise, only PAFs were

the respondents of this research. Some limited aspects of the study area is analyzed here the study area is limited to Daulichaur VDC and Chainpur. Information of other VDCs attached with Daulichaur has been connected in this study. Besides this study it is tries to include statistics up to FY 2008/09.

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 scale hydropower project have been conducted to identify various types of impacts created by the development of hydropower project. Many publications, reports these dissertations articles on journals newspapers which are related to the hydropower are reviewed in the thesis. Those literatures which are closely related to this research have been reviewed as follows.

Pokhrel P.L. (2003) in his article, "Videshi Laganimathika Prashnaharu", has mentioned that HMG proper policy and long –term plan of hydropower development are essential to fulfill national needs and to export. If national capacity and technology would inadequate then HMG should to offer foreign investors to develop hydropower. Khimti (60 MW) is the first project invested by foreign companies under the electricity Act – 1992. the mention that foreign companies are investing on hydropower generation by imposing their own terms and condition.

That has led to be very expensive cost being the second richest country of the world with respect to water resources applying PPA, NEA pays 42 percent of its total revenue annually for 15 percent of its existing total capacity (Khimti 60 MW and Bhotekoshi 36 MW) that have invested by foreigners. Comparing statistically, it has been shown that per KW and per unit cost of some projects that are launched by Nepalese private companies are cheaper that those projects that are lunched by foreigners

(completely and partially). He has suggested that HMG (NG) should think over foreign investment for Nepal's hydropower development on the time to provide electricity at cheap rate, control environmental degradation encourage local investment and skill and to enhance the employment opportunity.

Thapa B. (2004) "Dobbar Vikas" says that development of hydropower has been doubled in twelve years of restoration of democracy in comparison to thirty years of Panchayat. Statistically, existing capacity of hydropower is more than 600 MW now. It was only 281 MW capacities before twelve years. Per capita energy consumption reached around 60 Kw per year now. However, it was less than 20 KW at that time. Total number of customers as reached 970,000 from 290,000 during that period. Now NEA became capable not only to Solve the problem of load shedding but also to export. New liberal hydropower policy facilitated investors in the various cases then private sector has been attracted and it become has developed the local industries which create the employment opportunity. Likewise, it helped to raise the value of goods and services and performed the integrated energy system of Nepal and positive impact on overall economy. National capital. Skills, knowledge technicians and technologies have become capable to apply small hydropower plants after came of the new policy private sector has generated about 145 MW electricity in Nepal in this period.

Thapa B. B. and Pradhan B.B.(1995) say that hydropower is 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 earning from large power project, agricultural, industrial

products and other modern manufacturing output to be stimulated by power supply. Small and micro hydropotontial 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 are 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.

Jha, H.B. (1995) "Sustainable development of small Hydropower in Nepal" says that one of the major reasons for poverty and backwardness of the Nepalese economy is power deficit. Shortage of power creates a problem in the development of agricultural industrial, trade and other sectors of the economy. With a view of meet the power shortage, there is need to generate power from not only the medium or mega projects but also small scale hydropower projects. The small hydropower projects might contribute significantly by providing electricity in isolated pocket area as well as to the grid since the electrification is related to productivity. Small hydropower might help to increasing 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 it provide supporting services such as agriculture extension input supply. Marketing services credit facility etc and development of capability of the farmers.

Bastola S.N. (1990) "Water resources development on highly Himalayan Rivers" says that geographical and geological condition of the country has been rise to such a river system in our country. It surveys that some of the cheapest hydropower station can be developed in the country. 15 million Kilo Watt hydropower potentiality of our country is so much greater compared to our consumption. It can be exhaustible for our economic uplift. We must look for market, external input for isolated hill area, medium size projects to meet national needs in relation to entry, irrigation water supplies and large scale projects primarily for export and securing navigation facilities from lower riparian to ease the difficulties by Nepal's landlocked status. River are not only the ornaments of eth country but also diamonds if they are properly utilized by involving a long term plan for its development. Fifth development plan has (NPC, 1970) scouted to distribute the benefits of economic and social development High priority has been given in bringing rural electrification to the hilly regions economic activities are not sufficient over there. However, there are rivulets whose capacities range from 1 to 200 KW.

Dahal M. K. and Mund H. (1996) "Social economy and National development: Lessons from Nepalese experience" published by NEFAS is another valuable and marvelous publication in this regard also. This publication includes five major areas of social economy and national development in the content of Nepal. These are out ward oriented economical nationalism, local development people's participation. Self help organization and cottage and small scale industries. In this article. Out ward oriented economic nationalism Madan Kuamr 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 estimated commercial potential of water resources 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 is Nepal's most valuable asset and it is commercially unexploited yet. 50 percent of the theoretical hydropower potentiality is estimated to have commercial feasibility. Only 12.5 percent of the total population lies had access to electricity with 253 MW installed capacity which is 0.3 percent of total theoretical potential. Nepalese prospect for hydro resources development is further jeopardized by the lack of national consensus on harnessing water resources and its utilization on the basis of constitutional provision.

Sharma N. K. (2003) "Economics of Nepal' is another important publication. This publication includes overall macro economic aspects and their scenes of Nepalese economy he explains about utilization of water sources and its role in economic development. He mention about hydropower potentiality. He explain 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 installment 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 with in 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.

Dahal, M. K. and Gurugharana K. K. (1998) "Environment and sustainable development" published by NEFAS is also an important publication, which is related with environment and sustainable development. These both aspects are inexorably interlinked with each other. They explain that the vicious circle of poverty and environmental degradation is reinforced. The growth of population, the people use traditional as well as commercial energies, biomass energy accounted for 95 percent of total energy consumption (75.6 percent from fuel wood and the rest from agro residue and dung cakes) the forest alone fulfills 96 percent of the total energy rural households need.

In addition to over exploitation of forest resource, there is simultaneously the problem of under utilization of many potential renewable natural

resources and energy sources. Similarly negligible shores of potentialities of solar, wind biogas have been utilized. On the one hand there is underutilization of the available natural resources. On the other hand the demand for energy is raising. The people depend on biomass for the energy they need. It is aggravating the environmental degradation. They conclude that generation of hydropower, as a renewable energy. Is significantly required to sustain the development and to protest the environment in the context of Nepal.

Paudyal, S.(1999) "Pattern of energy consumption and its impact on economic development of Nepal", has analyzed the energy scenario of 1990s. in average shares of traditional and commercial energy consumption seem more than 90 percent and les than 10 percent respectively.

Either share of fuel wood, in traditional or in total energy consumption, its very high and adverse in the case of electricity. Use of electricity is high in domestic sector, although its use is increasing rapidly in industrial as well as commercial sector. High GDP can not be accomplished without technological progress, which requires increasing use of commercial energy. Use of energy is essential for industrialization and transformation of agriculture to the other sector, more time and about are required to collect fuel wood as a result there remains very little time for productive works. The use of hydropower helps to reduce deforestation that will grow agricultural production through conserving the soil pumping, irrigation water. Dryings crops grinding grevims using factor, threshing machine this demand of commercial energy is positively linked with increased income of household. He emphasized that micro and small hydropower should be developed to meet rural demand for energy but

medium and large scale projects are essential to met the demand for industrial and commercial sector.

Dhungel K. R. (2002) "Trends and Patterns of Energy Consumption in Nepal" mentioned that main sources of energies are biomass (traditional which constitutes fuel wood agriculture waste, animal dung etc. and commercial sources which constitutes coal petroleum products, hydro electricity etc energy consumption in Nepal is dominated by biomass, which accounted for 95percent, 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 FY2000/01 respectively. Average growth rate of biomass and commercial energy consumption during the FY 1984/85. FY 2000/01 were 2.4 percent and 10 percent respectively. Combining both an average growth rate was more than 3percent 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 1.0 percentrespectively. Income electricity for electro products consumption and electricity were 1.75 percent and 1.4 percent respectively.

Average growth rate of biomass and commercial energy consumption during the FY 1984/85 FY 2000/01 were 2.4 percent and 10percent respectively combining both an average growth rate was more than 3percent per annum during this period. The trend of energy consumption in Nepal during the 1984/85 FY 1995/96 also shares that biomass was growing by 2.2percent per annum. Similarly commercial energy

consumption was growing by more than 5percent 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 and 27.2 percent 12.7 percent and 10percent respectively. Income elasticity of electro products consumption and electricity were 1.75 percent and 1.14 percent respectively, the found that elasticity coefficients are greater that 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 S. (2004), in his article "Hydropower: The Harbinger of Hope" says 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.

Shrestha, R. (1995), in his article "Privatization of Power sector in Nepal," has mentioned that efforts of privatization in power development started in United States of American and United Kingdom since 1980s. Nepal is in its initial stage of privatization of the power sector after it brought out new and liberal Water Resources Policy-1992, Hydropower Development policy-1992, and Electricity Act - 1992. Private sector initiatives and market-oriented behaviour are expected to improve the power sector and its performance and efficiency. The number of hydropower project installed by private sector is increasing day by day. Rural people cannot afford high electricity tariff unless the government provides subsidies. Significant portion of cash flows out of the country as debt services and dividends that create the problem of deficit balance of payment and less attention towards environmental impacts are major demerits pointed out by Shrestha. On the other, power sector creates more employment opportunity, improvement of socio-economic condition of people, promotion of skill, encouragement to the investor, consciousness, control of environmental degradation, deforestation and desertification, increase in government revenue, and assistance to the national economy are some merits of privatization of power sector.

Hora P. (1994), in her thesis "Role of Micro-Hydropower in the Rural Electrification of Nepal", explains that among the alternative energies more popular and available, continuously renewable, non-polluting, efficient, widely distributed and based on simple as well as flexible energy source is micro-Hydropower (MHP) in Nepal. It is technically feasible as well as economically viable and the most appropriate technology for Nepal indeed, micro-Hydropower projects are not sufficient to meet the national demand of electricity on one hand. We have no economic resource, technology and skilled manpower to install large-scale hydropower project on the other hand. Small-scale hydropower projects can play very important role in such context. This technology provides access to electricity and other mechanical forms of energy for agro processing. Further more, it is also capable of providing rural electrification to a limited scale.

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

A study of Small Hydropower Projects: Problems and Prospects" (1987), published by East Consult and IDS, includes the problems associated

with small hydropower projects and prospects for future development. The study shows that the lack of proper planning and technical deficiencies, lack of rational design framework, ad-hoc site selection procedure, lack of proper classification of project, hypothetical data base and absence of quality are major constraints in the development of SHPs. The study shows that economic analysis has not been used as basis for project selection and implementation. The economic utilization of capacity and people's involvement in the pricing for small hydropower projects, are not fully exercised due to the scattered family characteristics in the hilly and mountainous areas. The study has shown that there is great disparity in costs among projects with similar capacities installed under similar conditions. This study also points out the involved management and organization flows. Having huge feasibility in Nepal, small hydropower installation is the most appropriate technique, which can provide both electricity and agro-processing services to the dispersed settlement in the hilly region. This traditional technology is indigenously and economically very attractive. The study recommends that the long term strategy is required to develop hydro energy resources.

Upadhyaya, R.P. (2051a B.S.) "Jalsrotko Barema Sunna-bujna parne Kuraharu" is an important article, about water resources of Nepal. He mentions 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 rives n 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.

Upadhyaya R.P (2051b BS), "Jalvidhyuat Utpadanko Vaikalpik Upaya" is an important article in this regard. He explains in this article that source of small rivers is reducing day by day due to the environmental degradation. Nepal's large-scale hydropower projects are costly in comparison to India and China. Besides this, there are other causes as well. So, Nepal neither can export due to the high generation cost nor can its people consume (because their purchasing power is declining. Nepal is facing the problems of debt trap. If Nepal generates large-scale projects (either by taking foreign loan or by bringing foreign investors), that may be expensive one hand and Nepal should bear large burden of foreign debt on the other hand. So, installation of cheap and small scale projects which are possible to install by using local resources to fulfill annual national demand of electricity and participation in decision making are alternative measures for development of small scale hydropower projects instead of large scale hydropower project at present context. He also recommends that we should know the relationship of water resources with other sectors to develop all of them simultaneously.

Gurung, S.B. (2000), in his thesis "Impact of Modikhola Hydroelectricity Project in Parbat District," reveals that the total water provides nearly 25 percent of the world's energy. It is estimated that 73,000 TWH can be

generated where as today; the world has produced 3,207 TWH of hydroelectricity. Asia consists of 28 percent of the world's hydropower potentiality. High run off potentiality of several rivers and mountainous topology support to raise hydropower development in the context of our country. The study analyzes potentiality and historical perspective of hydropower development in Nepal. Major rivers and small rivers contribute 87 percent and 13 percent in theoretical hydropower potentiality of Nepal respectively. Total technically feasible hydropower potentially is 45,520 MW from 93 project sits of different river basins. He also analyzes the sustainable development of small hydropower projects in Nepal. He recommends that we should develop the small hydropower projects in the present context of Nepal.

Paudel, N. (1996), in his thesis "Hydroelectricity Development in Nepal" has studied about the development of hydroelectricity during different plan periods and major projects. Harnessing our water resources is cashier to say than to do as the wide topographical variation has created hitch in our development efforts. However, this variation can be turned into nature's gift and ultimately can pave the steps for economic prosperity. Proper utilization of the water resources is essential for generating electricity and reducing the import of expensive petroleum products. Hydropower projects seem to have brought some changes in attitude, behavior, habit, and consciousness of the local people. It has mainly contributed to transportation, market and communication facilities. The physical characteristics and rivers naturally affect Nepal's hydropower development activities and human interaction. He concludes that small hydropower plants, which may be the only means of rural electrification in the country, are viable at present.

Acharya, K. (1983), in her thesis "Hydroelectricity Development in Nepal and its contribution to Nepalese Economy," mentions the contribution of hydroelectricity to Nepalese economy. It plays significant role by developing various fields such as agriculture, industries, transportation, social services etc. Water resource is the Nepal's greatest asset but unfortunately very insignificant portion has been harnessed to this date. She says that there is unequal distribution of electricity in different development regions. Nepal is facing many problems with respect to hydropower development. These are: lack of capital, skilled manpower, technical know-how, sufficient market and economic status of people as well as country.

Upadhyaya, G.S. (1975), in his thesis "electric power and its role for Economic Development of Nepal", says that electricity is a substitute of oil and fuel wood. Electric power installation was started since 1911 A.D. in Nepal but motion of development activities was very slow. If we develop hydropower, it can be used in various sectors such as ropeway, trolley streetlights, industries, domestic usage and so on. It plays significant role to reduce unemployment and poverty in the country. We can produce more goods having high quality at low cost by using electricity. We can earn more foreign exchange by selling electric power. Definitely, it will help to regain favorable trade balance and balance of payment. Development of electricity really brings economic revolution in the country. Increasing demand of electricity is encouraging to develop hydropower.

Pokharel, B.M. (1998), in his thesis "The study of Hydroelectricity in Nepal: A case study of Socio-economic Impact of Jhimruk Hydro Project, Pyuthan", has mentioned that energy is important for economic development. Without it, he 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 leas 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 quantative method is used the study find the every kind of socio economic and environment effect in the study area as well as surrounding area.

Shrestha B.R. (2000), in his thesis "Role of Hydro-electricity in Economic development", mention that the development of the hydroelectricity is possible due to the enormous water resources as well as favorable topographic and climatic condition. Hydroelectricity ahs tremendous advantages for the people, and it helps to develop energy sector of economy. Electricity is one of the infrastructures of upgrading the socio-economic condition of nation. The proper utilization of electric

power accelerates the motion of national development. Our experience shows that the developed countries like Japan. UK, USA, China, France etc. achieved advancement in time through electric power. At present, the stock of non-renewable resources like petroleum products, coal, natural, gas, fuel wood etc. is decreasing. The hydroelectricity has become economically attractive because it is renewable and environment friendly. He has discussed the role of hydroelectricity in various economic as well as non-economic sectors. Industries, agriculture, transportation, social services and other sectors can be promoted by the utilization of electricity. He ahs also discussed but the development during the plan periods.

"Final Evaluation of Private Rural Electrification Project (367-0162)" (1994, is a report prepared by a research team of Ranjitkar, under the USAID of Nepal. This report is based on the study of evaluation of three private plants as the private Rural Electrification Projects which are: (1) Purang-25 KW (Muktinath VDC of Mustang), (2 Silkes-100KW (Parche VDC of Kaski) and (3) Seem - 16 KW (Morabang VDC of Rukum). The study shows that the installation of micro-hydropower plants has brought technical revolution in the rural areas where people had not been exposed to modern technology. Micro-hydropower plants give them opportunities to utilize modern technology to improve their living standard. These plants also help them to link their subsistence village life to the modem market through value - added goods produced by micro enterprises e.g. milling cottage industries and so on developed in the course of time. After the establishment of pored plants in villages, there are good changes that micro enterprises will flourish. The study has found that the expected benefits from the projects are firewood and kerosene savings; improvement in education, agricultural productivity, health, and women's

working time etc. right sized micro-hydropower plants are economically replicable and sustainable because such plants are within the managerial capacity of the rural people. The team recommends that the micro-hydropower projects should not only be financially and economically viable but should be also on appropriate scale depending upon the needs of villagers' transparency and participation in the decision making, managerial as well as technical back-up support.

Bhadra B. (2005) in his article Hydropower development in Nepal-problem and prospects", defined about the condition of hydro electricity in Nepal. He emphyecise that The use of electricity and fuels have been found to be accelerating thought 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 greeting 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 neighbouring 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 beneficiated 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.

CHAPTER III

STATUS OF HYDROPOWER IN NEPAL

3.1 Introduction

The main sources of water are sea, rivers, artesian well, lake and rainfall. But Nepal has not access to sea. Nepal's mountainous topography coupled with the favorable hydrology, dense and perennial rivers-network provide good condition and prospect for development of hydropower plants of any capacity ranging from micro to mega projects.

Hydro-energy has become economically attractive because it is renewable as well as environment friendly. The energy generated from water resources covers about 25 percent of the world's energy. It is estimated that 73,000 TWh could be provided. Asia holds 28 percent of world's total potentiality. There are abut 6,300 large and small rivers in Nepal and total length of all these rivers is 45,000 km. Mostly, hydropower potentiality has been broadly categorized in three ways: (i) Theoretically, (ii) Technically and (iii) Economically.

3.2 Potentiality of Hydropower in Nepal

3.2.1 Theoretical Potentiality

Theoretical potentiality of hydropower is estimated on the basis of hydrological and topographical conditions of a given territory. The theoretical hydropower potentiality is divided into three categories: rivers (I with catchments area equal to or greater than 1,000 sq.km. as major rivers: (ii) with catchments area from 300 to 1,000 sq. km. as small rivers and (iii) the rest (less than 300 sq. km.) rivulet/streams. Theoretical potentiality of hydropower of our major rivers like Saptakoshi, Saptagandaki, Karnali and Mahakali, and other southern rivers is shown in the table below.

Table 3.1

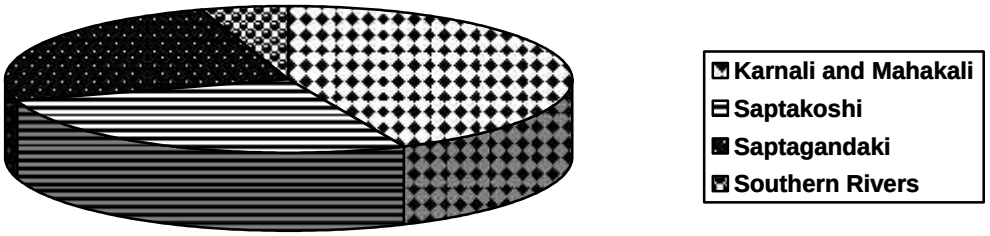
River Basinwise Theoretical Hydropower Potentiality in Nepal

S.N.	River	Major Rivers		Small Rivers		Total	Potential of Basin slope
	Basin	MW	percent	MW	percent	Potential (MW)	
1	Saptakoshi	18,750	22.51	36,000	4.32	22,350	33,400
2.	Saptagandaki	17,950	21.55	2,700	3.24	20,650	29,000
3.	Karnali and Mahakali	32,680	39.23	3,500	4.20	36,180	56,500
4.	Other Southern Rivers	3,070	3.69	1,040	1.25	4,110	8,500
	Total	72,450	86.9	10,840	13.01	83,290	127,400

Source: WECS, "Perspective Energy Plan," Supporting Document No. 2, MOWR, HMG/N, Kathmandu, 1995.

Nepal's total theoretical hydropower potentiality is 83,290 MW. The theoretical hydropower potentiality of major river courses and small river courses are 86.99 percent and 13.01 percent respectively. The Karnai and Mahakali have the highest theoretical hydropower potentiality (43.44 percent). Then come Saptakoshi (26.83 percent) and Saptagandaki (24.79 percent). Lastly, Southern rivers, which originate from Mahabharat range, have the lowest (4.93percent) theoretical hydropower potentiality.

Graph 3.1
Theoretical Potentiality of Hydropower in Box



Source: Table 3.1

3.2.2 Technical Potentiality

Technical Potentiality of Hydropower is assumed on the basis of technically viable and possible sites to generate electricity. To generate hydropower, technically feasible sites are limited in number. So, total technical potentiality of hydropower generation in limited in comparison to theoretical potentiality. The total number of technically feasible hydropower sites is 93.

Table 3.2

Basinwise Technical Potentiality of Hydropower in Nepal

S.N.	River Basin	No. Identified Sites	Technical Capacity	percent of Theoretical Potential
1.	Sapta Koshi	53	11,400	13.69
2.	Sapta Gandaki	13	6,660	8.00
3.	Karnali and Mahakali	18	26,570	31.90
4.	Other Southern Rives	9	890	1.07
	Total	93	45,520	54.66

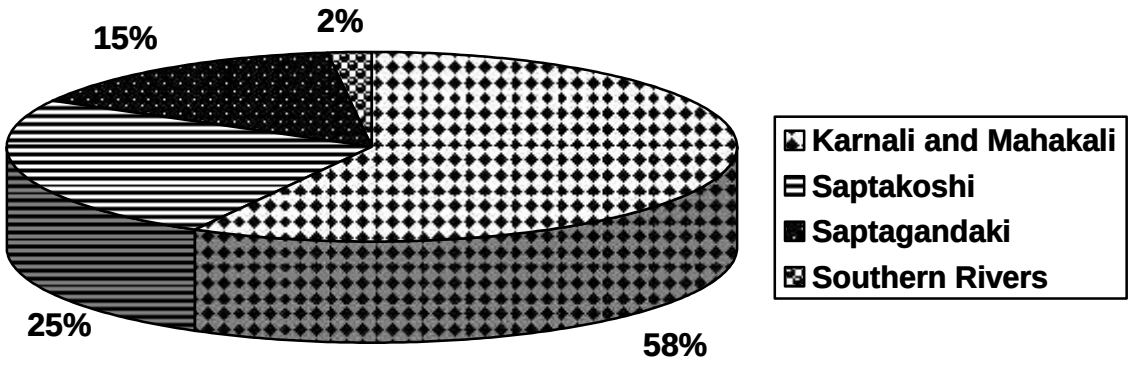
Source: WECS, "Perspective Energy Plan." Supporting Document No. 2, MOWR, HMG/N, Kathmandu, 1995.

The above table shows that the total technical potentiality is 45,520 MW, which is 54.66 percent of theoretical potentiality of hydropower in Nepal. Saptakoshi consists of the highest number of technically feasible sites. it

consists of 53 sites (57 percent) out of total 93. Karnali holds the second highest position. it consists of 18 sites including Mahakali (19 percent). Then, Sapta Gandaki and rest southern rivers have 13 sites (14 percent) and 9 sties (10percent) respectively.

Figure 3.2

Technical Potentiality of Hydropower in Box



Source: Table 3.2

3.2.3 Economic Potentiality

Economic potentiality of hydropower is assumed on the basis of economically viable or feasible sites to generate hydropower. Economic potentiality of hydropower is limited in comparison to technical and theoretical potentiality. Only 51 percent of total theoretical potentiality is economically viable. Likewise, only 66 sites are economically viable.

Table 3.3

Basinwise Economic Potentiality of Hydropower in Nepal

S.N.	River Basin	No. of Identified Sites	Total Capacity	Theoretical Potential (In percent)

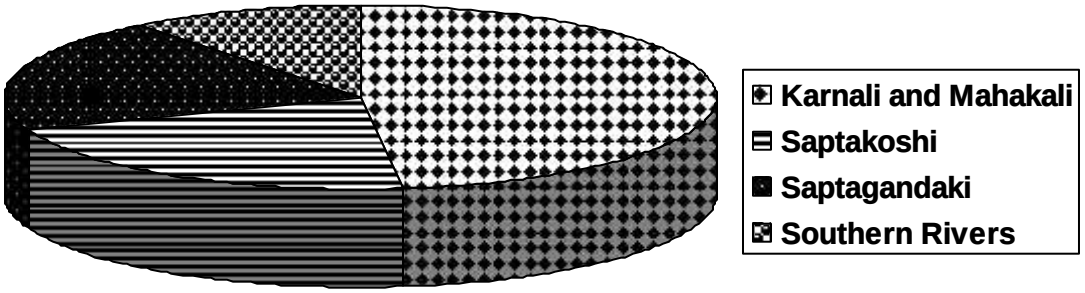
1	Sapta Koshi	40	10,860	13.04
2.	Sapta Gandaki	12	5,270	6.33
3.	Karnali and Mahakali	9	25,125	30.17
4.	Other Southern Rivers	5	878	1.03
	Total	66	42,133	50.59

Source: WECS, "Perspective energy Plan", Supporting Document No. 2, MOWR, HMG/N, Kathmandu, 1995.

Economically viable total hydropower is 42, 133 MW. Karnali and Mahakali rivers have the highest capacity (25,125 MW) of total economic potentiality. It contributes 59.63 percent. Then Sapta Koshi and Sapta Gandaki are in second and third positions respectively with respect to economic potentiality. Forty-four sites have been identified (out of total 66 sties) in Sapta Koshi which occupy 60.60 percent of all sites. In the case of numbers of economically potential identified sites, Sapta Koshi (12 sites) and Karnali and Mahakali (9 sites) are in second and third position respectively.

Figure 3.3

Economic Potentiality of Hydropower in Box



Source: Table 3.3

3.3 Present status of Hydropower in Nepal

All 75 Districts of the kingdom have access to electricity. 615.057 MW electricity has been generated in NEA (Including private and others) up to the end of FY 2006/07 (NEA). Out of total population, the contribution of hydropower is 90.66 percent (5520.201 MW from 68 projects), diesel 9.32 percent (56.756 MW from total 5 stations) and solar 0.02 percent (100 KW from 2 stations). Out of 58 hydropower projects, 10 projects are considered as major projects (installed by public sectors) whose contribution is equal to 389.150 MW. Under the power purchase agreement (ppa), 8 projects have been installed by private sectors. Their contribution is equal to 144.083 MW. 9 small projects are connected to the national grid. Their contribution is equal to 12.552 MW. 545.78 MW has been linked with the national grid and rest 6.416 MW has been generated by their small hydropower plants, and distributed locally.

Pharping (500 KW), Khandbari (250 KW), Gorkhe (64 KW) and Syangja (80 KW) small hydro plants are not in operation now. Total 11 small hydro plants (Phidim, Jomson, Jumla, Darchula (I and II), Taplejung, Terhathum, Bhojpur, Chaurjhari, Syarpudaha, Bajhang and Okhaldhunga) have been leased to the private sector for operation isolating from the national gird. Salleri (400 KW) and Amche (600 KW) small hydropower projects have been installed by institutions like SCENCO and KBC respectively with the participation of private sectors isolating from the national gird. Middle Marsyangdi (700 MW) and Rairang (0.5 MW) are under construction with the effort of private sector as per PPA.

For the electricity transmission, there are 1,132 KM single and 412 KM double circuit of 132 KV lines 231 KM single and 161 KM double circuit of 66 KV lines respectively, and 3 KM and 22 KM bar circuit of joint (66 KV and 132 KV) lines were in operation by the end of FY 2002/03. 132 KV transmission lines such as Butwal-Sunauli (23 KM), Sattalpati-Musikot (50 KM), Buipa-Okhaldhuna (29 KM), Chhinchu-Rukam Jajarkot (70 KM), Ghorahi- Holery (45 KM)

The total use of available electric energy, within the NEA system, was 3051.82 GWh. It increased by 9.74 percent (270 GWh) during the upto FY 2006/07. This comprised of 1747.42 GWh, from hydro generation, and 13.31 GWh from thermal plans to NEA, 962.26GWh form private generators and 328.83 GWh imported form India in accordance with Power Exchange Agreement (PEA between Nepal and India). Total sale of electricity is 2258.14 GWh, which is increase by 11.10 percent over last year's sales figure. Internal sales increased to 2179.89 GWh but exports to India decreased to 138.903 GWh, a fall by 27.75 percent. The total number of electricity consumers reached 13,92,055.00 up to FY

2006/07. The per annum increase rate is 8.78 percent. The sector-wise consumption in FY 2006/07 reveals that the domestic category accounted for 96 percent, industrial category only 1.90 percent, commercial 0.51 percent and non commercial 1 percent of the total number of customers. Out of the total sales, domestic, industrial commercial and non-commercial sales were 40.36 percent, 38.46 percent, 6.37 percent and 3.48 percent respectively, and their contribution on total revenue is accounted for 40.51 percent, 35.97 percent, 8.66 percent and 6.27 percent correspondingly.

Indeed, the development of hydropower is rapid. The involvement of private sector in hydropower development is very meaningful and encouraging. At the end of FY 2006/07, the private sector has contributed 31.53 percent of total generated hydropower. Besides, the generation cost of hydropower. Besides, the generation cost of hydropower lunched by private sector is comparatively lower than that of public projects.

CHAPTER IV

ROLE OF HYDROPOWER IN THE ECONOMIC DEVELOPMENT OF NEPAL

4.1 Introduction

Geographically, Nepal is a mountainous country with immense endowment of natural resources. It, however, is still a poor country due to the lack of their proper exploitation of available resources. Every sector of economic development is influenced by electricity. Nepal has extreme potentiality of development of hydropower due to enormous water resources and favourable topography. The hydropower is the yardstick of the modern development because of its tremendous advantages. Sadly, we have a severe problem of the underutilization of the available resources. The adequate supply of electric power is considered as the basic impetus for raid economic development and growth of each and every country. So, hydropower is an essential as well as highly valuable asset of the nation. Besides, it is also a basic need for socio-economic development. In the highly industrialized countries, electricity has become virtually lifeblood of social economic structures.

Nepal's economic prospect lies in its water resources, which flow pricelessly from Nepal to India. It is assumed that the present estimated commercial potential of water resources in Nepal, if harnessed properly through bilateral, regional and international cooperation, the benefit would accrue, not only to Nepal but also to the SAARC region as whole.

Every country's development depends on the development of agriculture, industry, transportation and communication, trade and commerce, tourism and social service sector. More or less, in all these sectors, electric power

is required either for domestic use such as lighting, heating and cooking, or for commercial use such as operating machines and equipment, or for laboratory use and so on. Hydropower plays significant role in the overall development of a nation.

Hydropower, which is reliable and highly potential, has not been exploited more than 1 percent out of the total theoretical potentiality yet. Forest resource, one of the major sources of energy, has dwindled over time due to its continuous exploitation for domestic and commercial uses. WECS (1994-95) has estimated that forest and shrub land occupy 4,520.94 thousand hectare. The depletion rate of forest is 2 percent per annum. This indicates that deforestation, due to various causes, is a current problem. Deforestation, desertification and environmental degradation disturb eco-system, and, ultimately affect the development. Hydropower can play significant role to substitute fuel wood, and help to control environmental degradation.

As a commercial source, petroleum products are imported. It needs a large amount of foreign currencies. Our foreign trade shows that import is greater than export. The demand for energy is increasing day by day along with growing population and developmental activities within the country. Increase in the volume of imported petroleum product within economy is normal in the absence of its substitutable energies. But the circumstance has made us dependent on development economies. Nepalese economy has been suffering from trade deficit and unfavourable balance of payment. If we become able to replace petroleum product by electricity, only then saving can be invested for development activities. Electricity, therefore, is an accelerator of economic development. In the Nepalese context, electricity may be an ideal substitute for fuel wood and petroleum products.

Electricity is essential for domestic, commercial, industrial, agricultural, social service, transportation, communication, trade and commerce. It is both essential output as well as input in our practical life. The sector wise role of electricity in economy development has been discussed below.

4.2 Role of Electricity in Agricultural Sector

Out of total population of Nepal, 86.06 percent live in rural area (CBS Pocket book, 2006/07). Eighty percent people are involved in agriculture. The Nepalese economy is based on agriculture. Agriculture has contributed 29 percent in GDP and its growth rate is 3.7 percent per annum whereas growth rate of non agricultural sector is 3.3 percent per annum. Combining both, GDP growth rat is 3.6 percent per annum.

Agriculture plays crucial role in Nepalese economy. Mostly, the agriculture products are used in our daily life in the form of food grains and semi processed agricultural products. Sufficient agricultural products help to meet food requirement of increasing population. Moreover, the agricultural products, which remain after fulfilling the national need, can be exported. This sector has been providing raw material for many industries as well.

Our system of cultivation is still traditional even in the 21st century (CBS Pocket book, 2006/07). Out agriculture depends on monsoon. Only about 20 percent land has been provided with irrigation facility out of total cultivatable land. As a result, the productivity rate is very low. To improve the productivity great, we need to apply scientific methods and technologies. It is only possible in the presence of sufficient electricity for lifting the underground water for irrigation, and using modern equipments.

Electricity is a basic component for the development of the agriculture. It is essential to run agro-based industries, improve and store seeds, chemical fertilizer, increase productivity, and promote the agricultural sector, electricity is a basic component. Traditional agriculture can be transformed into modern and agro-industrial sector only by using electricity. Electronic media can play significant role in the development of agricultural sector. Agriculture program, broadcasted by radio and TV, are very effective and helpful to the farmers. They can get knowledge about newly innovated farming technology through these media. Further, electronic media help to disseminate information and knowledge, which are related to the economic development, new technologies and methods.

In short, the use of electricity helps to save time, labor, and money in agriculture sector, and it will ultimately contribute to national GDP and NI.

4.3 Role of Electricity in Industrial Sector

The economic development of any country depends not only on the availability of natural resources but also on the extent of its rational utilization. Nepalese economy can grow strong by developing all level of industries based on available resources within the country. Unfortunately, the important sectors like agriculture, industry, trade and commerce are still in the infant stage of development.

Advanced economies like USA, UK and Japan developed with the help of the industrial development. This exemplary lesson signifies that the development of industries pushes up the economy by creating demand, opportunity, expanding market, increasing supply, consumption, innovation, utilization of available resources properly, encouraging the entrepreneur and so on.

Electricity is the prime mover of industrial development. It is an essential element for all scale industries such as small and cottage, medium, large and heavy scales. Infrastructure is foundation of economic development. Industries and infrastructures are positively related to each other.

Hydropower is the most important factor that can render grate contribution to establish all scale industries. Shares of total electricity consumption in industrial sector were 38.72 percent and 36.85 percent (provisional figure) by the end of FY 2004/05 and FY 2006/07 respectively. This fact indicates that the role of electricity in industrial sector is highly significant in the context of developed as well as developing countries like Nepal.

4.4 Role of Electricity in Transportation

Infrastructures are essential for economic development. Transportation is very important in the process of economic development of each and every nation. National unity, security, homogeneity etc. cannot be ensured without linking the various parts of the country by adequate network of transportation.

Particularly, petroleum is used as a fuel for transportation. More than 70 percent of total imported petroleum products are used in transportation only. But, coal and petroleum have not been discovered in our country yet. Large amount of foreign currencies go out from our economy for importing petroleum products. That amount can be used in developmental activities if we manage to find a suitable alternative of these expensive petroleum products. Use of hydroelectricity reduces the transportation cost. Transportation cost of ropeway is cheaper than that of roadway by 17 paisa per kg. by using electricity, various means of transportation like electric railway, trolley bus, ropeway, and cable car can be operated

(NEA Annaual Report, 2006/07). These means of transportation are assumed to be very effective, efficient and suitable to save the environment from population. In fact the import of petroleum products for transpiration is likely to be uncertain and expensive. In Nepal, transportation sector so far consumes very little amount of available electric power. Out of total consumption of electricity in this sector 5.86 percent and 6.56 percent had been consumed in FY 2004/05 and FY 2006/07 respectively. The generation of electric power in a large amount raises possibility of expanding it to transportation.

4.5 Role of electricity in Trade and Commerce

Trade and commerce is mirror of an economy. Advanced economy develops favorable trade and commerce. Expanding trade and commerce also shows the development of an economy. The adequate facility of electricity promotes external as well as internal trade.

First of all, electricity is required to run industries. Second, if people have facility of electricity, they can use and demands electrical and electronic goods like iron, fridge, washing machine, radio, TV and computer etc. These gods are useless in the absence of electricity. Electricity is very essential to produce electronic and electrical goods.

Electricity facilitates the mechanism of trade and commerce. For instance, electricity is essential to advertise trade and commerce through electronic media. Computer as the most effective and efficient device to prepare account about trade and commerce.

Now-a-days, the use of electricity is increasing everywhere. Even in rural area, rural electrification is enhancing market, demand and supply. Small and cottage industries like grinding mills, paper factory,

and raw-material processing factories have been established. Those small industries are really promoting trade and transaction in the rural areas. We can encourage, develop, expand and promote our trade and commerce to the favourable direction by generating hydropower. It helps to maintain and improve trade balance in the context of international trade.

4.6 Role of Electricity in Tourism

Nepal is a beautiful country. Beautiful natural sceneries, multicultural society, important historical place, bio-diversity, favourable environment climatic mix-up, and many other characteristics have identified Nepal and a beautiful country in the world. All these features attract tourist to visit Nepal every year. In Nepalese context, tourism plays important role in economic development. We need foreign currencies to import commodities from other countries. It has played a significant role in the balance of payment (BOP) of Nepalese economy.

Nepal has not been able to earn foreign currencies in large amount by exporting goods and services in the international market. Our economy is suffering from trade deficit in the international trade. Earnings from truism and remittance help to reduce trade deficit. Nepal ahs not still earned large amount of remittance due to the lack of supply of skilled and qualified manpower. So, tourism is an important and reliable source of foreign currencies.

We can get so many advantages from tourism. Firstly, our country will be recognized in the world. Flow of tourists helps to promote domestic agricultural products, cottage industries and industrial products. The foreign currencies earned form this sector can be used to promote economic activities.

Nepal has a great prospect to develop tourism in rural areas. Not only the established tourist destinations like Pokhara, Chitwan, Ilam, Mt. Everest, Saipal Himal, Khaptad National Park, Surma Sarobar, Mt. Makalu, but also the rural areas have been benefited by electricity. These rural areas can be turned into tourist destinations.

To develop this sector, we should conserve and promote all types of heritages. Similarly, electricity is essential to provide many facilities in these tourist destinations. Entrepreneurs will be encouraged to invest in this sector, if electricity is available. For it enhances facilities in hotels and guesthouses. Electronic media and information technologies help to provide and exchange information, which are essential to the tourists.

We can turn those places into tourist destinations, where electricity is available therefore; electricity is a major component to develop this sector.

4.7 Role of Electricity in Social Service

Social services are related with the welfare of people. The main purpose of social service is to provide social welfare by mobilizing available resources to the communities as far as possible. Social service can be provided effectively and easily with the help of electric power.

Electricity helps to add more families in the institutions and organizations like school, campus, hospital, administrative offices, NGOs, INGOs, consultancies, agencies etc. Electricity helps to operate advanced technologies, techniques and tools, which increase both quality and quantity of social services.

The structure of socio – economic dimension of Nepal is the least developed one. So, the development of hydropower can play vital roe lot

uplift the socio – economic condition. We can expand the social services in rural areas in the presence of electricity. Rural people can get many advantages. Their capacity, skill and knowledge will increase. Their participation in various activities will increase. In short, their living standard will be improved with the help of electric power. Besides, it helps to reduce imbalances as well. Therefore, hydropower helps to maximize social welfare through social services.

CHAPTER V

SOCIO - ECONOMIC CHARACTERISTICS OF SURMA DEVI SMALL HYDROPOWER PROJECT

5.1 Introduction

Surma Devi Small hydropower project lies in Bhajang district, one of the mountainous districts of Seti zone in far western development region. The district covers the totals area of 3.48 sq. km. Its total population and number of households were 159,203 and 30,766 respectively. Share of the district population of Seti Zone, Far-western Development region and whole Nepal were 7.54 percent, 3.64 percent. Bajhang district falls within the group of the best district on the basis of 39 indicators of development mentioned by ICIMOD. In order all, the district's position is 59th (20 best of the 25 districts) out of 75 districts out of four major indicators. This district holds the bad position in two indicators such as poverty and deprivation and women empowerment similarly. It holds intermediate position in two indicators such as natural resource endowment and socio-economic infrastructures development index.

Bajhang District has immense endowment of water resource of Seti river and its tributaries rivals and rivulets besides other natural resources. District has more than 2000 MW hydropower potentiality. However, a large number of people are still living in darkness in Bajhang.

On the one hand a very attractive project like Western Seti Hydropower Project is the dreams of country and on the other hand other small projects are not initiated in this district.

In Bajhang, electricity has been not supplied through national gird. Around 2500 households have access to electricity including solar system up to the last December 2007, which account a small part of total households of the district.

The Surma Devi small hydropower project with 200 KW capacity is installed by using the water of Bauli Gad which is situated in the north that is also a tributary of Seti River. It is an important and popular project in far western development region. Although it is small in power. Surma Devi small hydropower is only a single existing hydropower project in Bajhang. The electricity has been sold to NEA according to PPA. This project is playing very important role for rural electrification in Bajhang.

The project constitutes a 12 m long diversion weir with 3.25 m long side intake freefall weir and trash rack 50 m long open power canal, 60m, 4 m × 3.5 m × 2.5 m sized defour, desanding basin 2.487 m long surface steel penstock pipe alignment semi surface power house having two turbo impulse turbine of 200 kw capacity of each and 50m long open tailrace cannel.

Location and Accessibility

The structures of SDSHP is located in a community land and forest at Daulichaur, Every part of the project lies in the public land and community forest. This project is situated between the latitude of (29˚22’ N to 30˚34’ N and) the longitude of 80˚46' E to 86˚34’ E). it is about 47.5km far from Tamail Bazar (up to where bus reaches regularly) Bajhang in the Jayaprithavi highway 8 km North west from the district headquarter chainpur, 290 km from the near city Dhangadi, Kailali and too much far from capital city Kathmandu. Bajhang Distrcit also lies above 3000 feet from sea level.

Until now the road is not available to reach the project site under the segment of Jayaprithivi highway. No any vehicles are available for transportation. Chainpur is the nearest market of surrounding. Which is developed Junctin for all kinds of products and materials. Besides this Tamail and Bhande market are also recently developed for local product.

5.3 Socio - Economic Characteristics

5.3.1 Population Distribution of the Study Area by Caste Group and Sex

The total of 430 population and 66 households are recorded in the study area at ward No. 3 Chainpur VDC Bajnang also. Out of the total population the share of male and female are 50:48 percent and 49.52 percent respectively five caste groups such as Braman Chhetri, Kami, Damai, Sharki are found in the study area. Out of the total caste group chettri house holds are in the highest while other caste groups have the least number of households. Out of the total households number of Chettri Bramin, Kami, Dami, Sharki are 42,12,4,4, and 2 respectively in the study area similarly out of the total population those caste group consist 74.44 percent 13.54 percent 6.44 percent 2.33 percent, 3.25 percent correspondingly total number of house holds population and sex ratio of the overall study area have been presented in the following table.

Table 5.1

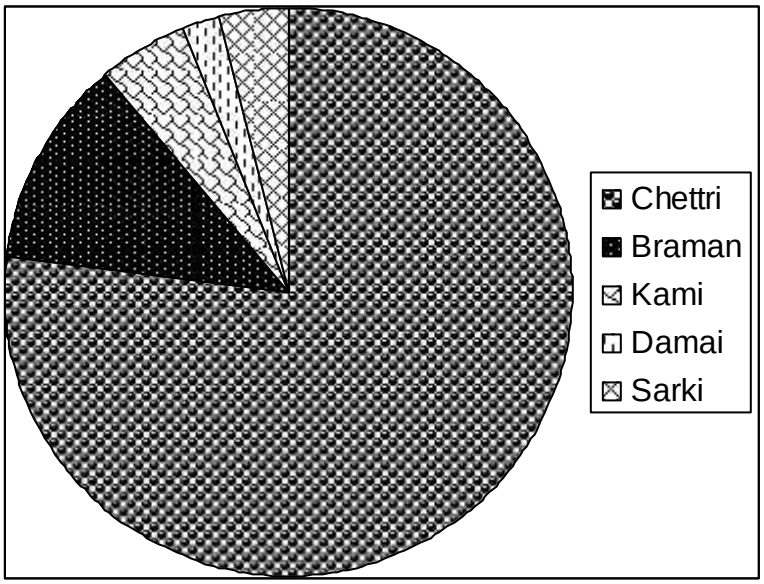
Demographic Study of Project Area

S.N.	Caste Group	Sex Male	Female	Total	Percent	No. of HHs
1.	Chhetri	160	160	320	74.44	44
2.	Brahman	28	32	60	13.54	12
3.	Kami	13	13	26	6.44	4
4.	Damai	5	5	10	2.33	4
5.	Sarki	8	6	14	3.25	2
Total		214	216	430	100.00	66

Source: Field Survey 2008.

Figure 5.1

Demographic Study of Project Area



5.3.2 Population Distribution of PAEs by Caste Group and Sex.

Those households whose eland have been occupied by the project is categorized under project affected families (PAFs). Out of the total 66 households of the study area, direct impact of the implementation of this

project is on 25 families where the total PAFs population is 161, the male consists 51.20 percent and female occupies 48.80 percent. Brahman, Chhetri Kami and Sarki are the dominant four caste group of PAFs. Chhetri are found in majority among PAFs, Household and Population of PAFs is Chhetri, 12 and 96, Brahman 7 and 40, Kami 3 and 15, Sarki 1 and 5 respectively.

5.3.3 Religion in the Study Area

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..

5.3.4 Literary Status of the Study Area

Literacy is one of the most significant indicators to measure people's living standard. Out of total population 45.40 percent people are literate in the study area. Literate male and female are 60 percent and 40 percent respectively. By caste group literacy rate is different. Literacy rate of Chhetri, Braman, Kami, Damai and Sarki are 55.30 percent, 89.60 percent. 20.25 percent. 16.15 percent 8.60 percent respectively. It is found that the literacy rate of male is higher than female in every caste group.

Table 5.2

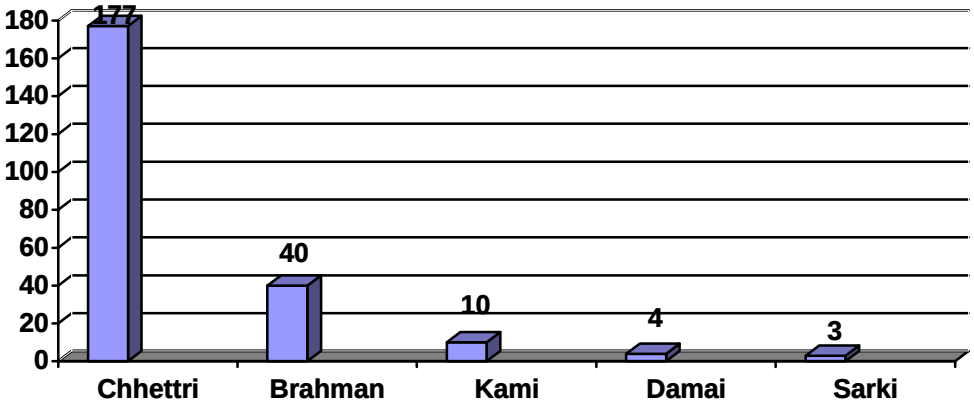
Literacy status of the study area by caste group and sex

S.N.	Caste Group	Total population	No. of Literate people		
			Male	Female	Total
1.	Chhetri	320	102	75	177
2.	Brahman	60	30	10	40
3.	Kami	26	10	-	10
4.	Damai	10	2	2	4
5.	Sarki	14	3	-	3
Total		430	147	87	224

. Source: Field Survey, 2008

Figure 5.2

Literary status of the study area by caste group



5.3.6 Educational Status of the PAFs

The literacy rate of the PAFs is 73 percent in aggregate out of others the literacy rate of male and female are 58.82 percent and 41.18 percent respectively in aggregate. The literacy rate of male is higher than female in the whole PAFs and every caste group also. There is only one primary school in the study area. The nearest lower secondary , higher secondary and campus are situated at Chainur 7 Bhaupur, Bajhang. One hour away form the study area. The total number of 60 Chhettry),20 (Brahmin); 9 (Kami) 9 (Damai) and 2(Sarki) people from total PAFs have found the primary school. Lower secondary and higher secondary level respectively. Out of them the share of male and female in primary and lower secondary level is equal. How every the share of male is higher then female in the case of secondary as well as higher levels.

Number of female is found higher than male in primary as well as lower secondary level in Chhetri and Brahman communities of PAFs out of the whole PAFs. Only one male and one female are involved in teaching profession.

5.3.7 Occupational Status of the Study Area

Agricultural and animal husbandry is main occupation (78.89 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. 298 people (including 144 people of PAFs) are involved in agriculture as well as other occupation. Among the total population of the study area. 16.71 percent people are involved in foreign employment likewise.7.67 percent economically active people of PAFs are involved in foreign employment. Agriculture foreign employment business wage labour and porter are also secondary occupation of limited people in PAFs and the study area.

Porter, agriculture business wage labour and foreign employment are secondary occupations for 12.42 percent. 11.74 percent, 5.37 percent 4.70 percent and 1.01 percent of the study area and 8.33 percent, 9.02 percent, 4.17 percent 4.17 percent and 0.0 percent of PAFs respectively.

Table 5.7

Main as well as Secondary Occupation of the Study area of PAFs

Occupation		Agri.	Service	Foreign Employment			Business	Wage labour
				India	Other	Total		
Primary	Number of people at the study area (in percent)	249 (78.89)	18	22	-	22	12	8
	Number of people at the PAF (in percent)	129 (73.69)	9	15	-	15	10	5
Secondary	Number of the study area in percent	35 (11.74)	-	3	-	3	15	14
	Number of people at the PAF (in percent)	13	-	-	-	-	6	6

Source: Field Survey 2008.

5.3.8 Settlement

All people were living in house made by mud and stone with stone roofs (Kachchhi) 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.

5.3.9 Health and Sanitation

5.3.9.1 Drinking Water

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. Before the project started 15.5 and 3 PAFs used to drink water of pipe. Tap and well sources respectively. Quality of piped water has improved. At the completion of the project, 18.4 and 11 PAFs are drinking water of pipe. Tap and well sources respectively. The number of users of piped water is increasing.

5.3.9.2 Use of Toilet

Sanitation is one of the indicators of living standard of the people. Before the project start there were only 5 *Kachchi* toilets in all PAFs.They improved their habit and started to use toilet. But due to their poor economic condition, they haven't built modern toilets yet. The use of Kachchi toilet has increased by 46.67 percent and reached from 5 to 20. After the completion of the project only one PAFs has made Pakki (Modern) toilet.

5.3.9.3 General Treatment

Before the project start, people of the PAFs used to follow domestic as well as traditional approaches like, witch-doctor (*Dhami Jaharki*) 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 are, diarrhea, Cold-cough, dysentery etc., Health post was only one the health institution for medical treatment of all PAFs before the project start. Nowadays, health centre and private clinics are available there for medical treatment.

5.3.10 Land Holding

Most of the land plots of PAFs are cultivatabled. Out of some plots of land are situated in the bay of Bauli Gad river where the project is situated. The project has occupied nearly 50 ropani of land it was providing 25 PAFs by providing compensation PAFs total holding land was 936 ropani before the project started. However, they have only 908 ropani land at the completion of the project.

The land is classified into three categories such as Khet, Bari and Pakho Bari (Non - Cultivatable land) The Total area of all PAFs was 544 Ropani (58.12percent) before the projected started, however, it is 523 Ropani in their hand at the completion of the project. Irrigatable and non-irrigatable khet were 401 Ropani (73.71percent) and 153 Ropani (26.29percent) before the project started respectively. However, it is 382 Ropani (73.07percent) and 141 Ropnai (25.96 percent) at the completion of the project respectively. Similarly, the total area of Bari and Pakho bari were 312 Ropnai (33.33 percent) and 80 Ropnai (8.55 percent) in over all PAFs hand before the project started. However, they have only 310 Ropani (34.14 percent) and 75 Ropani (8.26 percent) in their hand at eh completion of the project. 21 Ropani Khet and 2 Ropani Bari and 5 Ropani Pakha Bari have decreased land distribution by Caste group is shown in table. Bari is called that part of land where we could plagued the land and Pakho Bari is that kind of land where in half of land is covered by grass half the land is cultivated.

Table 5.8

Land Hold in of PAFs by Caste Group and its Kinds

(*in Ropani***)**

S.N.	Caste Group	No of HH	Kinds of Land (khet)					
			Irrigatable	Non-irrigatable	Total	Bari	Pakho Bari	Ground total
1.	Cheetri	17	228	106	334	146	56	636
2	Brahman	3	79	10	89	39	11	139
3	Kami	2	84	27	111	22	7	140
4	Sarki	1	10	-	10	5	6	21
Total		23	401	143	544	312	80	936
					(58.12)	(33.33)	(8.55)	(100)

5.3.11 Irrigation

Rivulet - canal is the main source of irrigation. Large area of cultivatable land is available in the study area but there is shortage of irrigation. There is possibility of Canal of Bauligad for irrigation in the study area. Bauli Gad is using for irrigation in a Deual Bagar (Jaula) now.

5.3.12 Agricultural Production

Agricultural products are major sources of food for PAFs. Irrigation is one of the major problems for farming system in the study area, PAFs grow food crops such as Paddy, Maize, millet, etc. cash crops like vegetable production also starting now. Total PAFs used to produce 981 muri paddy 354 muri maize and 154 muri paddy millet before the project started. However, they produce 673, muri paddy, 343 muri, mazi 15 muri wheat and 154 muri millet after the completion of the project. Before the project. Average production of paddy, maize millet was 1.20 1.13 and 0.5 muri per Ropani however it is 1.27, 1.21 and 0.5 muri per Ropnai after the completion of the project. The productivity of cereal crops has decreased due to the decrease in the cultivated land at the completion of the project.

Table 5.9

Agricultural production of PAFs (BP and AP

Cereal Crops	Total Production		Average prod.		Ave. Prod. of each Pafs	
	BP	AP	BP	AP	BP	AP
Paddy	981	673	1.20	1.27	29.61	29.26
Maize	354	343	1.13	1.21	15.39	14.91
Wheat	-	15	-	-	-	0.65
Millet	154	154	0.5	0.5	6.69	6.69

Source: Field Survey, 2008.

BP = Before project started

AP = After project started

5.3.13 Market for Agricultural Products, use of Chemical Fertilizer ad improved seeds

The oldest and nearest market of the study area is chainpur bazaar, Chainpur VDC Bajhang and Tamail, Bhande Jhota, Malumela are recently developed local markets, almost all the agricultural products of such area had been purchased by employed manpower of the project during the construction period of the project.

The local people adopt traditional farming system. However, chemical fertilizer is popular for farming. They usually purchase it from Chainur Bazar before the project started but now they have started to purchase form other local market.

People have started to use improved seeds referred by JT and JTA. Before the project started the lack of improved seeds, chemical fertilizer, pesticides advice of technicians were main the problems smoothly. The farmer cannot get chemical fertilizer on time. Lack of application of modern farming system is also another cause of backwardness of the agriculture sector of the study area.

5.3.14 Food sufficiency/Inefficiency in The PAFs

Generally, agricultural products are for local consumption. Out of total PAFs, agricultural product of 13 PAFs were not sufficient for themselves for a year before the project started. However, agricultural products of PAFs are not sufficient for themselves for 6-9 and 9-12 months of a year respectively after the completion of the project. In other words 9 PAFs food product is insufficient for a year. Food product of 6 PAFs was just sufficient for a year before the completion of the project, however, 8 PAFs have become capable after the completion of the project.

Before the project started 4 PAFs were able to save their agricultural production. However, 5 PAFs are able to save their agricultural production of a year after the completion of the project. We conclude that food production of PAFs has improved after the completion of the project.

5.3.14.1 Additional Sources to fulfill food inefficiency

Wage - labor porter sale of cattle, business and services are sources to fulfill food deficit of some poor families. Wage labor, portor and sale of cattle were major sources to fulfill food deficit before the project started however sale of cattle and foreign employment became major sources after the completion of the project. It indicates that major sources to fulfill food deficit of PAFs are changing.

5.3.15 Source of Income

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

5.3.16 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.

5.3.17 Status of Livestock

Livestock husbandry is also source of in come of PAFs and the study area. People keep cow, buffalo for milk and dung and bullock for plough. They keep goat chicken duck for meat people also sell them for income.

5.3.18 Electricity

5.3.18.1 Electrocution in the Study area and PAFs.

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 total households are benefited from electricity. And also all PAFs are benefited from electricity now.

Almost all the household ay 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 PAFs 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.

SDSHP has been providing free electricity facility for of PAFs that are near by the circuit line along the penstock alignment of the project.

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. electricity is still rising in the study area.

5.3.18.2 Energy sources and user household

People of the study area use fuel wood for cooking and kerosene and electricity for light. Electricity is used to play radio and T.V. use of kerosene

has been significantly replaced by electricity in the study area. Those house hold, which have no access to electricity is still use kerosene for light.

5.3.18.3 Fuel wood consumption by PAFs

People of the study area and PAFs used public forest and their own forest before the project started. They however are using ministry forest and their own forest for various purposes after the completion of the project.

Before the project started total PAFs used to consume approximately 645 quintal fuel wood over a year, price of fuel wood was Rs. 110 per quintal before the project started. Total PAFs used to consume fuel wood equivalent to Rs. 70,950 and average consumption of PAFs was equivalent to Rs. 3,080. After the completion of the project those PAFs consume 580 quintal (equivalent to Rs 92,800) and average consumption is equivalent to Rs. 4,035 (25.22 qw.) over a year. Real consumption of fuel wood of PAFs has decreased but monetary volume increased due to price rise (from Rs 110 to Rs. 160 per bundal).

The price of wood is raise because the community has got money by working in the project and the value of money is going high actually they know the value of . money and the society change in monetary field. or the forest is going save by different community so that the wood which they used was not salient to use or they cant got wood easily from the

Table 5.10
Kind of used forest and consumed fuel wood by PAFs

Kinds f Forest	Quantity of consumed fuel wood by PAFs		Monetary Value of Fuel Wood			
	Total in Quintal	Average in Quintal	Price per quintal	Total price	Average Price	
Public and Private forest	645	28.04	116	70,950	3080	BP
Community and private forest	580	25.22	160	92.800	4,035	AP

Source: Field Survey, 2008.

5.3.18.4 Use of electrical/electronic goods

PAFs use various kinds of electronic good such as radio Tape, T.V. iron, emergency light etc. for which electricity, cell and acid battery as energy were used. Only 10 radio/Tape were there in overall PAFs before completion the project whereas total number of radio, T.V. tape recorder emergency light, iron in overall PAFs are 21, 5, 2 and 5 respectively now. Rice will, oil mills, saw mill also established now. But before the completion of the project there were not only mill. For these mill and other thing electricity is key fuel.

5.3.19 Women and Children

5.3.19.1 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 40 day on fuel wood collection for a year. Around 7 hours on agriculture daily. Surma Devi small 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.

5.3.19.2 Maritual and reproductive status of PAFs.

Totals number of married couple was 39 before project started in overall PAFs. It has reached 72 couple now.

Average marriage age of male and female were 20 years and 18 years respectively before the completion of the project, however these are 24 years and 19 years now.

Generally, the first delivery age (first baby born) has increased now from 19 to 20 years. The child gap was 2.52 years before the project started which is 3 years now. Similarly the fertility rate of per mother (below 49

years) was 5 children before the project started. However, it has decreased to 4 now. Total number of women (above 49 years) of all PAFs has reached from 12 to 17 now.

Table 5.11

Marital Status and Reproductive Status of PAFs

	BP	AP
Total Married	39	72
Average married age of male	20	24
Average married age of female	18	19
Mother's Ave. Age of first delivery birth	19	20
Average no. of child by > 49 years (female)	5	4

Source: Field Survey, 2008.

5.3.19.3 Female education of PAFs

Total number of female (above 14 years) of PAFs was 58 before the project started. However this number has reached 82 now out of such number of literate female was 5 only before 35 after completion of the project. The number female of primary (0-5) lower and secondary (5-10 class) lower and secondary (5-10 class) and collage level were 4, 1, 0 and zero respectively

before the project started. Now 25, 5, 3,and 1 respectively How ever their number is increased now, there was no female to take any kind of training and skill before the project started but 6 female of total PAFs have taken varius kinds of training now.

Table 5.12

Female education of PAFs

	Total female > 14 years	Illiterate	Literate 1-5 class	5-10	Collage
BP	58	53	4	1	-
Ap	82	52	24	5	1

Source: Field Survey, 2008.

5.3.19.4 Women Empowerment (participation on Employment, political Leadership, Decision, Making and other sector.)

Women's participation on Employment politics and decision making indicates the Women's empowerment and their status in its society. In all women's of PAFs and its study area are backward in this context. Only one women is involved in teaching profession. Neither have they gone aboard to study or Job nor have they actively involved in politics. In general the role of women of PAFs in economic decision and over all decision over their family was just 15 to 20 percent before the project started as well as after completion of the project.

5.3.19.5 Health and Awareness

People of the PAFs adopt domestic approach for treatment. Until now they used traditional treatment. But in ratio before and after the completion of the project the trend to go to hospital is raising day by day.

The pregnant females of 18 PAFs used to deliver their children in house and rest of the females reached at hospital. This ratio of going to hospital

also increasing now. Some families take help of health activities from health institution.

5.3.20 Employment

5.3.2.1 Involvement of people in Agriculture

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.

5.3.20.2 Involvement of PAFs in the Areas except Agriculture (15-60 aged Group)

120 people (58 and 62 female) of all PAFs are of 15-60 age group. Out of them 24 people (20 male and 4 female) are employed for full time and 35 (28 male and 7 female) are employed for part time, in various sectors of employment except agriculture such as services. Wage labour, business foreign employment and portor employed male is higher than female in each and every full time Job. Females of PAFs are not participated in foreign employment. The main purpose of part time employment of the people is to earn extra income. Most of the businessmen and service holders stay outside the district.

5.3.21 Market Price of Goods and Services in the study area

Wage and market prices have increased at high rate after the completion of the project in comparison to before the project started. Beside some freely available natural goods became economic goods e.g. There was no economic value (pricelessly available) of sand pebble etc. before the project started but since the initiation of the construction, their market prices got determined Rs.20 and Rs.30 per Tin respectively. Other locally available materials for construction such as stone, wood have become more expensive after the completion of the project than they were before the completion of the project)

Similarly wage rate of different kinds of Labour have increased after the completion of the project viz. From Rs.50 to Rs.200, Rs.100 to Rs.300 and Rs.75 to 250 per head of unskilled- semi skilled, skilled labour or manpower respectively. In the same way price of local product have also increased. Now market prices of paddy, rice, maize, wheat and millet have increased from Rs.500 to 1700, from Rs.900 to Rs.2500 from Rs.300 to Rs.1800 from Rs.1500 per muri respectively. Price of oil, ghee, milk have also increased now. In the same way price of meat items and fish such as mutton, chicken, buff and fish have increased from, Rs.80 to Rs.250 from Rs.30 to 125 from Rs.20 to Rs.80 and from Rs.50 to 150 per kg respectively.

In aggregate the wage rate has increased by approximately 100 percent to more than 200 percent after the completion of the project. Now, market price of construction materials have increased by more than 90 percent in comparison to before the project started. Similarly market prices of food crops and meat items have increased by more than 35 percent in

aggregate. It is clear that wage rate, market price of local as well as imported products have increased.

Table:13

Market wage Rate of labour and construction materials. (in Rs.)

Wage per head				Price of Construction Material				
Skilled		Semi Skilled	Unskilled	Sand/ Tin	Pebble/Tin	Stone/Pile	Wood/Fs	Cement
BP	100	75	50	-	-	500	50	500
AP	300	250	200	50	80	3000	400	1800

Source: Field Survey, 2008.

Table 5.14

Market price of foods (in Rs.)

Price of various kinds of food								
	Paddy/ Muri	Rice / muri	Maize/ Muri	Wheat / Muri	Millet / Muri	Oil/ Ltr.	Ghee / kg	Milk / ltr.
BP	500	900	300	700	300	60	100	10
AP	1700	2500	1800	2500	1500	180	200	40

Source: Field Survey, 2008.

Table 5.15

Market Price of Foods (Meat and Fish (In Rs.)

Price of meat and fish (Per kg)				
	Mutton	Chicken	Buff.	Fish
BP	60	30	20	50
AP	250	125	80	150

Source: Field Survey, 2008.

Environment effect of Surmadevi small hydropower project

The environment is dry in the study area. Before the project stocked the environment is going decrease like jungle, and water resources of that the environment is being dray and muddy. it is because of the cause of destroying jungle by cutting wood and other materials. The land is sliding every years because of the lacks of jungle they have not knowledge about the save environment and jungle. But after the project started it given the different opportunity to do some works and knowledge . Today's they have radio. T.V. and such kind of information's technology where thing gain the knowledge, about to save environment, today the PAFs community and other society are working for saving environment and control to destroy the jungle. These reason is context the land slid and soil erosion and make environment green.

5.3.22 Accessibility

The Daulichaur VDC is the study area. There is no any kind of transportation available between segments to the study area without foot. There is no any kind of educational institutions. There is only one primary school. But the nearest VDC Chainpur is developed area where High School College, health institution, banks, agriculture center, and HMG offices are settled. NGOs are situated at there main market is also Chainpur for local people. Road has reached at Tamail Bagar. There is not gravel road in the whole district. The bus stop is at the Tamail Bagar near the headquarter, Chainpur. The airport is located at Rithapata VDC near Chainpur V.D.C. Just 30 minute for on foot from the study area.

CHAPTER VI

IMPACT OF SURMA DEVI SMALL HYDROPOWER PROJECT

6.1 Introduction

It has been known that every hydropower project has positive and negative impacts on social, cultural and economic aspects of the concerned area and its surroundings, environmental impacts of small hydropower are limited. Surma Devi small hydropower project has influenced various aspects of physical and social economic aspects of human being in the project site. Chainpur VDC ward No. 1 and its surroundings. It has as well as indirect and positive as well as negative impacts. It has following socio-economic impacts.

6.2 Impact on infrastructural development

Project has positive impact on the development of infrastructures. Telephone service available at Chainpur 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.

6.3 Impact on Heath and sanitation.

People are conscious of their health and sanitation. They started to visit clinics and hospitals instead consulting with witch doctor (Dhami, Jotish, Jhankri). Mothers have learnt how to take care their child. Most of the people made Pakki toilet. Quality of drinking water has improved but all households have net access of clean drinking water. During the construction period local people were benefited from the medicines and health service from the project site. However, it has been stopped after operation.

6.4 Impact on Education

People are aware of the importance of education for women because of the use of T.V and other educational institution. Now girl go to school in a large number. But as far as higher education is concerned. Local people (male as well as female) are still backward. Some people have started to send their children to boarding school. Some women have taken skill oriented training.

6.5 Impact of Employment

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 7 local people with permanent job and 7 people with seasonal job. Similarly, more than 500 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 inaccordacne with their desire, skill and capacity.

6.6 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

6.7 Impact on Population

The project has influenced the individuals due to the construction activities and land occupying. 209 (51.30 percent male and 45.70 percent

female) of total 23 PAFs are directly influenced due to the occupying land by the project. Most of the households of Chainpur-1 and consumers of community forest of Ritapata-5) have been directly influenced by the project. But the people of site's surroundings are also influenced indirectly. Due to the construction of the project number of households in Chainpur and Rithapata ahs increased. No. life style of the people has become well than before.

6.8 Impact on Land Holding.

About 70 percent of land is community land which is used by the hydropower and 30 percent land is public land. 50 ropani land was effected by lockage of water. 15 PAFs obtained compensation in cash for their lost land. Most of the share of the land are Khet (63 percent) then Pakho Bari (27 percent) and Bari (10 percent). Share of Dhami's land s more than 50 percent of the total lsot land. The land owned by joint families is lost more than the individually owned land. Some PAFs bought cultivatable land by investing cash compensation. So, only 50 Ropnai of all the PAFs has decreased in aggregate due to the project. Now, Hence the project affected landholding of the PAFs negatively.

6.9 Impact on Agricultural Products and Its Market

The total agricultural projects have not decreased by large amount because some PAFs bought land by spending composition. In aggregate production of paddy and maize of PAFs has decreased by 18 muri and 35 muri respectively. But millet has neither decreased nor increased because its farming land is in same area. Some family has started wheat farming. Farming of off season vegetable.

Local market of local product at Chainpur bazaar is developed. Throughout the projects construction period the producers sold their products form their own house. That's why has project ahs positive impact on local product and this market.

6.10 Impact on Livestock

Livestock of all PAFs have increased by 11.45 percent. People known the advantage of livestock husbandry. They earned large amount of money by selling livestock amount of money by selling livestock during construction period of the project. The people were attracted to livestock husbandry due to the rise of price of cattle. In short the project impact is positive in livestock husbandry.

6.11 Impact on Market Price

Some nature gifted goods e.g. gifted goods e.g. stone sand and pebble etc. become economic goods, due to the project. Now wage rate of different kinds of labour has increased by more than 90 percent in comparison before complection the project. Market price of construction materials has increased by 100 percent and market price of food crops and meat have increased by around 50 percent. In conclusion market price of commodities have increased heaving due to the installation of the project. It means that market is being expanded.

6.12 Impact on Income Sources

Traditional income sources have improved. Now, people have started vegetable farming and increased livestock husbandry. Business has been expanding day by day. The project has provided employment opportunity

to the wage labor time to time. Service and foreign employment as the sources of income have attracted the people. Hence, the income of the people, themselves, consume most of the agricultural production. So that average agricultural cash income is limited, wage labor porter, service and foreign employment are sources of cash income of the local people.

6.13 Impact on Expenditure Pattern

The average expenditure has increased by 49.23 percent now in comparison to before the completion of the project. People's total spending has increased due to the rise in market price of commodity high consumption growth of child, increase population etc. now, people spend the largest amount of money on clothing and on education and health. Festival, food, social activities successively. Expenditure pattern of the people have changed.

6.14 Impact on Electrification and Consumption of Energy

In comparison before the completion of the project, number of electrified households of the study areas and PAFs has increased by 40 percent 9 (HHs) and 42 percent (5 HHs) respectively. Electricity user households have increased. Braman Chettri electricity user household have increased but other group are still far way from this facility. Now there is no problem of load shedding.

Total PAFs have 2/2 TV and decks now. Electricity has substituted the cell and acid battery in electrified households. As an industrial use of electricity numbers of rice/flour mill, oil mill and saw mill, operated by electric power in the electrified area of Bajhang have increased by 42.65 percent 20 percent and 30 percent respectively. In comparison before the

completion of the project. Electricity ahs substituted the dies for this purpose at the electrified access areas of Bajhang.

Some people become experts in wiring and repairing the electric line consumption of Kerosene and battery has decreased heavily by more tan 90 percent in the project areas. Public forest has become community forest. Total consumption of fuel wood of PAFs has decreased by 10 percent however, price of fuel wood has increase by 45percent per quintal.

6.15 Role of Compensation

The composition is used to fulfill various needs of PAFs. 17.39 percent PAFs used their compensation to purchase land (Khet) which is better for productive quality than their lost land. Some PAFs have became free form debt-load. Some PAFs invested their compensation on business. Indeed project become very fruitful for those PAFs who obtained large amount of compensation. Inversely, the project became bad for those PAFs who obtained little amount of compensation instead of their lands.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

7.1 Summary

Energy is a basic requirement for development. The development of all the productive sector of an economy depends on development of the energy sector. In general there are two types of energy sources viz. traditional and commercial. Electrification creates various opportunities of development activities in rural area. Traditional source of energy are not sufficient to meet the energy demanded. The use of fossil fuel is also costly and it negatively pressurizes on the balance of payment in the economy. Over pressure on forest creates various problems.

This study attempts to appicaise the importance of electricity in economic development. It also discusses about hydropower potentiality and its present status in Nepal and impacts of SDSHP on socio-economic condition of people in the area around the project.

Nepal has great potentiality of hydropower. The theoretical potentiality of hydropower is estimated to be 83.290 mw on the basis of hydrology and topography the technical hydropower potential is accounted 45,520 MW and the economically exploitable capacity of the kingdom, however, is 42,133 MW.

The hydropower development in Nepal has long history starting from the local water mill known as Ghatta. The firs hydropower plant was Pharping hydro project (500 kw) which was built in 1911 A.D. The government has been lunching the development programmes in

accordance with economic plan. Every plan has given to priority to hydropower development for national development.

Before introducing of the development plans, only 2,07 KW hydropower was generated in Nepal. Then first five year plan failed to generate power, 2,400 kw: 13000 kw 16.040 kw 16220 kw, 77.577 kw, 90,172 kw, 25,500 kw and 274,514 kw hydropower were generated during the second three year. Third forth, fifth, sixth, seventh. Eight Ninth and Tenth five year plans period from large as well as small scale projects respectively.

Surma Devi small hydropower 200 kw have been completed which are installed by Japanese grants. 69 hydro projects exist up to the end of FY 2006/07 and have contributed total 615.849 MW hydropower including 153.113 mw of total capacity by private sector in accordance with PPA (power purchase agreement). Kaligandaki 'A' (144 mw) is the largest hydropower project among all hydropower projects. Out of the total hydropower 615.959 mw has been linked in the national grid and rest (6.416 mw) is generated by small hydropower plants and distributed locally.

During the FY 2006/07 the electricity energy available for the use within the NEA system accounted to 3081.5 (GWH) (increased by 9.74percent) and total sale was 2258.14 (GWH) (increased by 11.10percent) over last year's sales figure. The total number of electricity consumers in upto FY 200607 reached 1392055 (increased by 8.97 percent). Consumption of domestic category is accounted 96 percent of total consumption. The Surma Devi small hydropower project is run off river type of project with 200 kw capacity located in Bajhang district of set zone it is middle power project of the far western development region. This project was imitated in 1987 and completed 1989. The project is installed by Japanese grant. It

has influenced various aspects of socio-economic aspects of human being residing in the surrounding areas of the project. The project has used the mitigation measures to reduce negative impacts on environment, physical biological, and socio-economic aspects.

The study area lies in the Daulichaur VDC ward No. 1, Bajhang district. The study area is situated in hilly area. The adverse impact on aquatic life has resulted mainly from the lack of water in the stream.

The SDSHP has directly as well as indirectly influenced 560 people of 75 house-holds and consumers of community forest of 40 families (PAFs), who lost land, have been benefited by the project. PAFs consist of 161 people: Four caste group such as Dhami, Kami, Dami, Braman, But additional three caste group are also in the study area. Hindu religion are only in practice 63.64 percent people are literate in the study.

The agriculture and livestock husbandry are the main occupation of the area. The average land holding area was 40 Ropani per PAF. Before the project started and has become 35 Ropani per PAF after the completion of the project. Joint family have more land than other. Their main sources of irrigation is canals derived from rivulets. The main agricultural product are paddy, maize and millet. In addition to Chainpur the local market for agricultural product out of total 20 PAFs were able to save their food before the project started and after the completion of the project only 10 PAFs are able to save, only 7 PAFs are able to subsistence level for food after the completion of the project when it was 13 PAFs before the started of this project. Most of the PAFs drink piped water. All PAFs not use toilet until now people used to believe in withc doctor until now although there are district Hospital and many private clinic.

Agriculture and livestock husbandry wage labors serive, foreign employment business are major soruces of income. People spend money on clothes, health and education, social activities, festival and food stuff etc. now expenditure on education has highly increased. The electricity was extended due to the effort of the project in the study area. 82.80 percent of total PAFs and 70-36 percent of household of the whole study area are getting electricity facility after completion of the project. Every caste group are getting electricity facility up to now. Besides domestic uses. E.g. operating rice mill, oil. Mill saw mill etc people use community forests all PAFs consume 580 quintal fuel wood now. Per PAFs consumption of fuel wood is equivalent to Rs. 4,035.

The fertility rate is 5 children per women now, women are backward in overall indicators of women empowerment. Now, the role of women in economic and over all decisions about their own families are 48 percent and 32 percent respectively. People are aware of child-care and women's health now more people have started to go to health institution for check up.

The project has provided permanent as well as temporary job opportunities to the people of surrounding areas. Some freely available natural goods have become economic goods, wage rate, market price of imported construction materials and local products have increased.

7.2 Conclusion

The demand for electricity is higher in comparison to the generated capacity. During this decade, hydropower projects are being installed rapidly within our country. 1,749 to 859 GWH power has been generated

from 58 larges as well as small scale projects up too the end of FY 2006/07. Out of the total investment, the contribution of the private sector emerges to be significant due to the liberal as well as privatization policies of Nepal Government.

The Surma Devi small hydropower project (200 kw) is supplying electric power through its own capacity. Besides its impact can be noticed in the Bajhang district, particularly.

The study area is dominated by Chhetri and Brahman about various impacts on the life style of local people of the project area and its surrounding.

The socio-cultural norms and values have changed due to the concentration of large influx of people from divers place background. The level of awareness has increased in people. Opportunity knowledge, skill etc. are available in the area and their economic status has become better than before people are attracted towards service foreign employment and business instead of traditional occupations such as agriculture livestock husbandry etc.

Nobody has been forced to migrate due to the project despite the project has occupied about 50 ropani Land. Some PAFs purchased better cultivatable land by using compensation. Some PAFs used compensation to pay debt invest on business and so on. 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.

The consumption of the electricity is very low in the study area. There is a need to increase the consumption of the electricity. Out of the total population, 20 percent people are still living in darkness. In conclusion the installation of small hydropower projects like SDSHP is rather than significant from various angles in the present context of Nepal.

As for the impacts of SDSHP environment are concerned, they are almost ignorable. Likewise it does not effect the human settlement as much as the large projects do. Obviously it helps to raise the living standard of people living in the surroundings area of the project. It helps to fulfill the demand of electricity in the rural area.

7.3 Recommendations and Suggestions

1. Government should emphasize the development of infrastructures in remote, hilly and mountainous districts which support the development of hydropower.

2. Detail survey and estimation should be conducted the identity and install SDSHPs which can which can be invested by foreign Donor Agencies

3. The multipurpose hydropower project should be installed to promote industries especially cottage and small scale industries and irrigation facilities.

4. Strong financial agencies should be established to facilitate the investment on the development of small hydropower project.

5. The environmental friendly, technically feasible and economically profitable hydropower plants like SDSHP should be installed.

6. Small hydropower project should be installed in rural, isolated and hilly areas.

7. 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.

8. The private sector should be encouraged to develop hydropower specially small hydropower project like – SDSHP.

9. efficient plants and equipments like that SDSHP should be sued in hydropower project, which many help to generate high power at low cost.

10. 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.

11. Siren or any other alternative system should be keep in the project site to save people from any kind of possible dangers.

12. Participatory approach should be adopted to involve local people in the developmental activities as far as possible.

13. In every opportunity preference should be given to the local people.

14. A portion of project's revenue should be invested to launch various programs for raising the living standard of the people.

15. The compensation should be paid on time through the easy procedure for PAFs.

16. Income generation programs should be launched by project in the study area.

17. Local people should be also ready and conscious to help the up coming 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 SDSHP. This is the lesson we must learn from the Surma Devi small hydropower project to develop other hydropower project to develop other small hydropower projects throughout the hilly areas of our country.

REFERENCES

Acharya, K. (1983). *Hydroelectricity development in Nepal & its contribution to Nepalese economy*, M. A. Thesis Submitted at CEDECON, T.U., Kirtipur.

Annual Report (2006). *A Year in Review FY 2004/05 NEA,* Kathmandu: Durbar Marg.

Annual Report (2007). *A Year in review FY 2003/04 NEA.* Kathmandu: Durbar Marg.

Bastola, S.N. (1990) *Water resources development on mighty himalayan rivers,* Kathmandu : Lalita Printers (P.) Ltd.

Bhadra B.(2005) *Hydropower development in Nepal, problem & prospect* an article published in Madan Dahal ed. Nepalese economic textbook of M.A.

Bonton, W. (1991). *Encyclopedia britannica*. Chicago: University of Chicago.

CBS (Central Bureau of Statistical) (2006). CBS.

CBS. (Central Bureau of Statistics) (2002). Population Pocket Book. *2001: (national report).* Kathmandu: Central Bureau of Statistics.

Dahal, M. K. & Gurugharana K. K. (1998). *Environment & sustainable development: Issues in Nepalese perspective*. Kathmandu: NEFAS.

Dhaungel, K. R. (2002, July Sep.). Trends & patterns of energy consumption in Nepal, *The Economic Journal of Nepal,* 25 (3).

Dhital. K. (2005). *Hydropower development in Nepal*. In Madan Dahal (Ed.) Nepalese economic textbook of M.A.

Dhungel, K. R. (2002 July). Trends & patterns of Energy consumption in Nepal *The Economic Journal of Nepal* 25 (3).

Ghimire, H.K. (2003). "Small scale hydropower a means of rural electrification remote hilly areas of Nepal". *A seminar paper presented in Hydro- Africa -2003 International,* SHRED, NEA.

Gurung, S.B. (2000). *Impact of modikhola hydroelectricity project in Parbat district* M.A. Thesis submitted at department of geography. T.U. Kirtipur.

Hora, P. (1994). *Role of micro hydropower in the rural electrification of Nepal*, M.A. thesis submitted at department of geography. T.U. Kirtipur.

Jha, H. B. (1995). *Sustainable development of small hydropower in Nepal,* CETS, Lalitpur.

Magar, D.P. (2005 Feb.). *A study of Socio-Economic Impact of Hydropower Project*. Thesis Submitted at CEDECON. T.U. Kirtipur.

Paudel, N. (1996). *Hydroelectricity development in Nepal*, M.A. thesis submitted at department of geography, T.U. Kirtipur.

Paudyal, S. (1999). "Pattern of energy consumption & its impact on economic development of Nepal", *the economic journal of Nepal.* 22 (4) CEDECON, T.U. Kirtipur.

Phuyal. S. (2004, Feb.), Hydropower: *the haribinger of hope", the Kathmandu post daily*.

Pokharel B.M. (1998). *The study of hydroelectricity in Nepal: A case study of socio-economic impact of Jhimruk hydro project, Pyuthan*, M.A. Thesis submitted at department of geography. T.U. Kirtipur.

Pokhrel, P.L. (2003). *Videshi lagaanimathika prashnaharu*. Nepal Forth-Nightly Dec. 1-15, 2003.

Sharma, N.K. (2003). *Economics of Nepal.* Kathmandu : Pairabi Prakasan.

Shrestha A.K. (1991). *Hydropower in Nepal: issues & concerns of development.* Kathmandu.

Shrestha B. R (2000). *Role of hydropower electricity in economic development*. M.A. Thesis Submitted a central Department of Geography. T.U. Kiritpur.

Shrestha B.K. (2000).*Role of hydroelectricity in economic development*, M.A. Thesis submitted at department of geography. T.U. Kirtipur.

Shrestha, A.K. (1991). *Hydropower in Nepal: issues & concerns of development*. Kathmandu, Nepal.

Shrestha, R. (1995). Privatization of Power sector in Nepal". *Vidhyat bulletin*, August 18, 1995, NEA.. Kathmandu : Durbar Marg.

Thapa, B. (2004). *Dobbar Vikas*, Kantipur Daily. Feb-19, 2004.

Thapa, B.B. & Pradhan B.B. (1995). *Water resources development Nepalese perspective*. IIDS. Kathmandu, Nepal.

Upadhyaya, G.S. (1975). *Electric power & its role for economic development of Nepal*. M.A. Thesis Submitted CEDECON, T.U. Kirtipur.

Upadhyaya, R.P. (2051a). "Nepalko barema sunnabujna parne kuraharu". *Yug sambad saptahik.* Tuesday, Jestha, 3, 2051.

Upadhyaya, R.P. (2051b). Jalvidhyut utpadanko vaikalpik upaya". *yug sambacd saptahik.* Tuesday, Jestha 10, 2051.

Appendix – 1

Questionnaire

The study of socio-economic impact of SDSHP (only for project afflicted families PAFs)

1) General Information:

a) Name of Respondent

b) Zone : Seti District: Bajhang VDC: Daulichour

Word No: 7 Village: Tole:

Block No.:

c) Total population of the family

Male……Female……..

d) Family's information.

Table: 1

S.N.	Name	Relation with Head of HH	Sex	Age	Education	Occupation	
						Main	Secondary
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

r) Spoken language ----------mother tongue.

No. speaker of mother tongue----------male----------female

f) Religion ----------major religious festival ----------

i) Status of house and land, house only land only/both.

i. House: Pakki/Kachchi

ii. Shed/cell: No. Kind:

2. Health and sanitation

Source of Drinking Water	BP	AP
	Piped/well/tape	Piped/well/tape
Quality of drinking water	Better/good/bad unknown	Better/god/bad unknown
Kind of Toilet	Open/kachchi/pakki	Open/kachchi/pakki
Institution to treat	Domestic/witch doctor health post/center activist.	Domestic/witch doctor health post/center activist.

3. Land Holding

Table 3

In Ropani

Kind	Irrigation		Non-irrigation		Worked by	
	BP	AP	BP	AP	Own family	Next family
Khet						
Bari						
Pakho bari						
Grand Total						
AP H.H.						

4) Agriculture and animal husbandry

a) Source of Irrigation: BP ……..AP…….

B) Production of cereal and cash crops.

Table 4

	crop	Production per Ropani		Total Production	
		BP	AP	BP	AP
cereal	Paddy				
	Maize				
	Wheat				
	Millet				
cash	Oil seed				
	Other				

Status of livestock

D. market for vegetable, food and cash crops, chemical fertilizer and use of advanced, improved seed.

Table 6

Crop and Vegetable	Market		Chemical fertilizer		Advanced seed		Problem	
	BP	AP	BP	AP	BP	AP	BP	AP
Food crop								
Cash crop								
Vegetable								

5. Sufficiency of agricultural production (BP and AP)

a) If you save your production, what and how much do you save? How do you utilize it?

b) If agricultural production is insufficient for your family to now months to fulfill of a year and what are the source it? Sources to fulfill insufficiently of food pension/ labor wage/ service/ portering.

6. Annual income and expenditure of your family?

Table 7

Source of income	Bp	AP	Remark	Expenditure	BP	AP	Remarks
Agriculture				Pattern			
Business				Clothing			
Services				Health/education			
Pension/interst							
Industry				Festival			
Other				Miscellaneous			

7. Human resource management

a) How many time period of a year is required for agriculture?

For paddy farming . . . to for maize farming . . . to . . . . for. Wheat / oil seed farming . . . to . . . other farming . . . to . . .

b) What do you do in the rest ment's of a year?

c) Except agriculture, what sorts of work do your family member (15-59 years)? If do and why and where?

d) Is your family's youths migrated for employment? If migrated, where and how much they earn monthly/annually?

c) Female-education of PAFs

	Total female (>14years)	Illiterate	Literate and 1-5 class	5-10 class	College	Trained/skilled
BP						
AP						

d) Women- Empowerment (Participation on Employment, political Leadership, Decision Making and other sectors).

Table (In female No.)

	BP	AP
Job-holder		
Engage on Business		
Actively Participated on Politics		
Live in abroad for study of employment		
Leading of organization/institution/group		
Decision about whole family (percent)		
Economic-decision (percent)		

c) Health and Consciousness

Table

	BP	AP
Institution general treating	House/health inst.	House/Health Inst.
Check up for pregnant women and child	House/health inst.	House/Health Inst.
Place for delivery	House/Health Inst. or activist	House/Health Inst. or activist
Knowing about family-health	No/Little/enough	No/Little/enough
Knowing about Radio/TV-news/programme	No/Little/Enough	No/Little/Enough

1) Schooling – age children of your family (6-15 years)

	BP	AP	Remarks
No. of children who go to school			
Daily time to study in home			
Own Sanitation done by themselves	No/some time/mostly	NO/Some time/mostly	

If, they do not go to school, what do they do? Why?

8. Source of Fuel, Kind of Stove and Forest

Fuel	BP	Solar	Bio-Gas	Kerosene	Electricity	Other
	AP	Solar	Bio-Gas	Kerosene	Electricity	Other
Stove	BP	Traditional	Bio Stove	Bio Stove	Heater	Other
	AP	Traditional	Bio Stove	Bio Stove	Heater	Other
Forest	BP	Public	Community	Lease-hold	Private	Other
	AP	Public	Community	Lease-hold	Private	Other

9) Electricity

a) For what purposes do you use electricity? Domestic use: Lighting/ Heating/Cooking Commercial Use Industrial Use

b) Electronic Goods and use of fuel

Electronic Good	Bp	Ap	Use of fuel	BP	AP
Radio/Tape					
TV/Deck					
Emergency Light					
Iron/Fan					
Charger/Fridge					

10) Miscellaneous

a) What did you get advantages and disadvantages during the construction period as well as after the completion of the SDSHP.

b) Did your family-member employ in the project's construction? From what, how much did you earn?

c) What are the good and bad aspects of this project?

d) What sort of project/projects is fruitful of your family?

e) What did the projects employees behave you?

f) Are your ready to help any this type of project?

g) Finally, have you any comment?

APPENDIX – II

Check list

1. a) Name of respondent:……..sex:……Age:…….. occupation …….

b) address Zone: ……District: ……..VDC:…….Ward No.

village:……..Tole:…….Block No……

2. What are the differences between before and project (no---- no. of electrified HH, lightness, use, load shading/regularity of power supply, kind of line no. of operator / technician, monthly duty).

3. How did the electric power substitute to the other fuels such as fuel wood, kerosene, solar, bio-gas, acid battery, cell battery (inpercent).

4. What did the project affect on environment?

5. What and how did the project assist on construction of infrastructures?

6. How did the project impact on social value, norms, culture etc?

7. What things were innovated due to the project?

8. What are the possibilities of new economic activities in local area after the project?

9. What were the advantages during the construction period of the project to the local people?

10. What are the advantages and disadvantages of the project?

11. What were/are the main problems of the study area before the project started/after the completion of the project?

12. How many people of the local area got/getting employment in the project?

13. What did the project affect community forest?

14. What kind of projects and programmes, which may advantageous, are needed to implement in this area?

15. What are the available facilities, which supports socio-economic aspects, medium of transportation and required time to reach those destinations?

Destination	Located Place		Transportation Time		Medium of Transportation	
	BP	AP	BP	AP	BP	AP
District Headquarter						
District court						
HMG's Offices						
Primary School						
High-school Collage						
Health Institution						
Banks						
Co-operative						
Agriculture Service Center						
NGO						
Market						
Road Access						
Phone Facility						
Airport						
Grinding mill						

16. Market rate observation of Goods and services in the study area

a) Wage-rate and price of construction Materials.

Wage-rate per head)			Price of Construction Materials							
Skilled	Semi-skilled	Unskilled	Sand/tin	Pebble/tin	Stone/pile	Cement/bage	Wood/F3	Zinc/Bundle	Iron/kg	Iron Rod/kg

b) Market price of foods

Price of Various Kinds of Food									
	Paddy/Muri	Rice/ muri	Maize / Muri	What / muri	Millet / muri	Oil / Ltr.	Ghee / kg	Milk / Ltr.	Curd / Ltr.
BP									
AP									

c) Market Price of meat items (*per kg.)*

	Price of Meat and Fish				
	Mutton	Pork	Chicken	Buff	Fish
BP					
AP					

17. Compensation

(in Rs.)

Compensation for	No. of Households	Total Amount
Land Purchase		
Land Lease		
Others		
Grand Total		

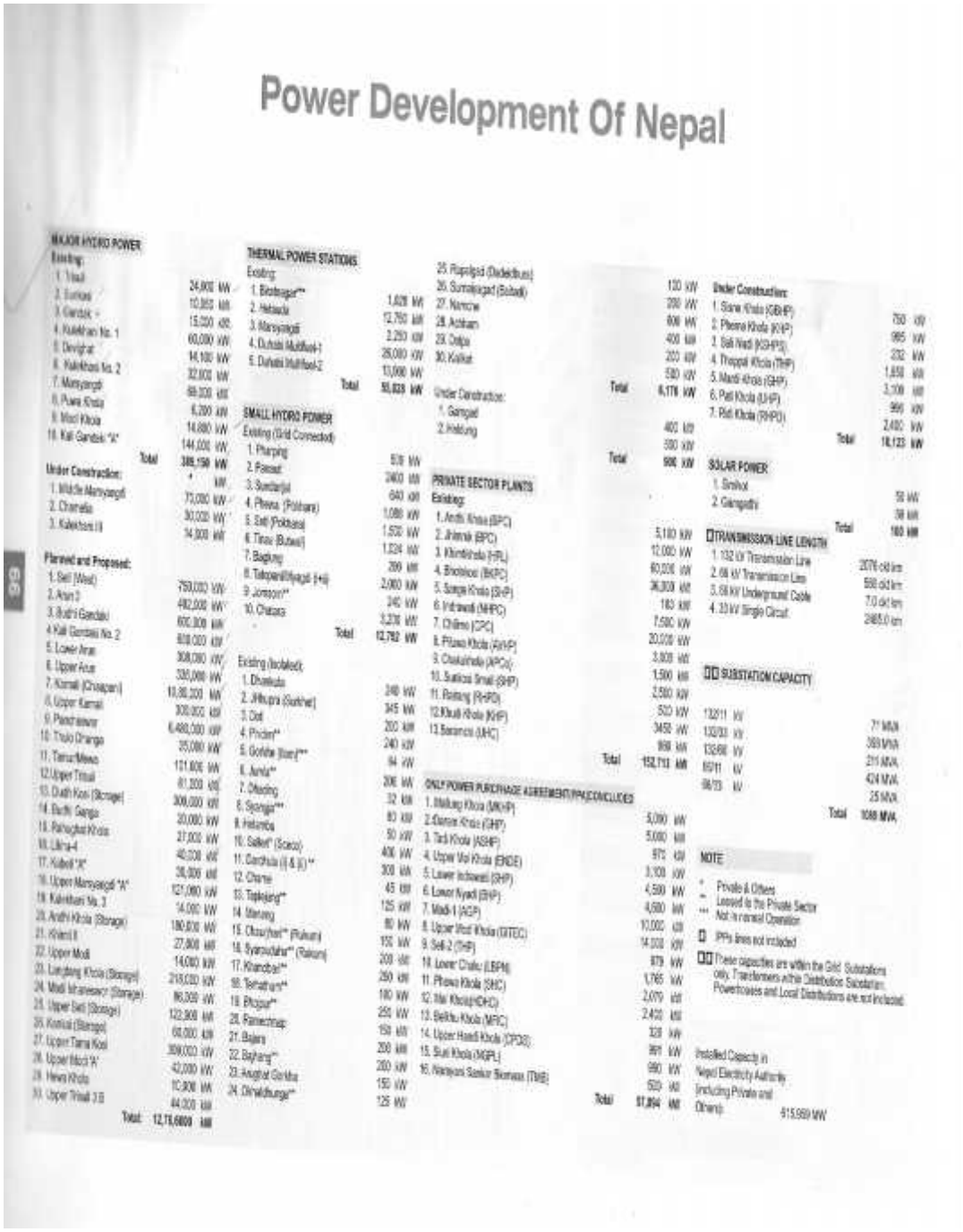
18. Miscellaneous

	BP	AP	Remark
No. of shop			
Transportation cost (in Rs.)			
Kind of Road			
Tourist Travelling (in No.)			
Knowledge about Hydropower			
Sales of milk items and vegetable			

19. Finally, have you any comment?

Thank You.

Power Development Of Nepal



MAJOR HYDRO POWER

Existing:

1. Trisuli	24,000	kW
2. Sunkosi	10,050	kW
3. Gandak +	15,000	kW
4. Kulekhani No. 1	60,000	kW
5. Devighat	14,100	kW
6. Kulekhani No. 2	32,000	kW
7. Marsyangdi	69,000	kW
8. Puwa Khola	6,200	kW
9. Modi Khola	14,800	kW
10. Kali Gandaki "A"	144,000	kW
Total	**389,150**	**kW**

Under Construction:

1. Middle Marsyangdi	*	kW
2. Chameliya	70,000	kW
3. Kulekhani III	30,000	kW
	14,000	kW

Planned and Proposed:

1. Seti (West)	750,000	kW
2. Arun 3	402,000	kW
3. Budhi Gandaki	600,000	kW
4. Kali Gandaki No. 2	600,000	kW
5. Lower Arun	308,000	kW
6. Upper Arun	335,000	kW
7. Karnali (Chisapani)	10,80,000	kW
8. Upper Karnali	300,000	kW
9. Pancheswar	6,480,000	kW
10. Tinau Dharga	35,000	kW
11. Tamur Mewa	121,600	kW
12. Upper Trisuli	81,000	kW
13. Dudh Kosi (Storage)	300,000	kW
14. Barhi Ganga	30,000	kW
15. Rahughat Khola	27,000	kW
16. Likhu-4	40,000	kW
17. Kabeli "A"	36,000	kW
18. Upper Marsyangdi "A"	121,000	kW
19. Kulekhani No. 3	14,000	kW
20. Andhi Khola (Storage)	180,000	kW
21. Khimti II	27,000	kW
22. Upper Modi	14,000	kW
23. Lumdung Khola (Storage)	219,000	kW
24. Modi Mahaseowr (Storage)	90,000	kW
25. Upper Seti (Storage)	122,000	kW
26. Kankai (Storage)	60,000	kW
27. Upper Tama Kosi	309,000	kW
28. Upper Modi "A"	42,000	kW
29. Hewa Khola	10,000	kW
30. Upper Trisuli 3 B	44,000	kW
Total:	**12,76,6000**	**kW**

THERMAL POWER STATIONS

Existing:

1. Biratnagar**	1,628	MW
2. Hetauda	12,750	MW
3. Marsyangdi	2,250	KW
4. Duhabi Multifuel-I	25,000	KW
5. Duhabi Multifuel-2	13,000	KW
Total	**55,628**	**kW**

SMALL HYDRO POWER

Existing (Grid Connected):

1. Pharping	500	kW
2. Fewtal	2400	kW
3. Sundarijal	640	kW
4. Phewa (Pokhara)	1,088	kW
5. Sett (Pokhara)	1,500	kW
6. Tinau (Butwal)	1,024	kW
7. Baglung	200	kW
8. Tatopani(Myagdi (+ii)	2,000	kW
9. Jomsom**	240	kW
10. Chatara	3,230	kW
Total	**12,782**	**kW**

Existing (Isolated):

1. Dhankuta	240	kW
2. Jiltkupra (Surkhet)	345	kW
3. Dott	200	kW
4. Phidim**	240	kW
5. Gorkha (Barp)**	64	kW
6. Jumla**	300	kW
7. Dhading	32	kW
8. Syangja**	60	kW
9. Helambu	50	kW
10. Salleri* (Solcu)	400	kW
11. Darchula (I & II) **	300	kW
12. Chame	45	kW
13. Taplejung**	125	kW
14. Manang	80	kW
15. Okhaldhunga** (Rukum)	155	kW
16. Syanzudahar** (Rakum)	200	kW
17. Khandbari**	250	kW
18. Terhathum**	180	kW
19. Bhojpur**	250	kW
20. Ramechhap	150	kW
21. Bajara	200	kW
22. Bajhang**	200	kW
23. Arughat Gorkha	150	kW
24. Okhaldhunga**	125	kW
25. Rupaligad (Dadeldhura)	130	kW
26. Sumalaigad (Baitadi)	200	kW
27. Namche	600	kW
28. Arghara	400	kW
29. Dolpa	200	kW
30. Kalikot	580	kW
Total	**6,178**	**kW**

Under Construction:

1. Gamgad	400	kW
2. Khotang	500	kW
Total	**900**	**kW**

PRIVATE SECTOR PLANTS

Existing:

1. Andhi Khola (BPC)	5,100	kW
2. Jhimruk (BPC)	12,000	kW
3. Khimtikola (HRL)	60,000	kW
4. Bhotekosi (BKPC)	36,000	kW
5. Sunga Khola (SHP)	180	kW
6. Indrawati (NHPC)	7,500	kW
7. Chilime (CPC)	20,000	kW
8. Phawa Khola (KVHP)	3,000	kW
9. Chaukhidale (APCo)	1,500	kW
10. Sunkosi Small (SHP)	2,500	kW
11. Pokhara (PHPD)	500	kW
12. Khudi Khola (KHP)	3450	kW
13. Baramchi (UHC)	998	kW
Total	**152,713**	**kW**

ONLY POWER PURCHASE AGREEMENT(PPA)[EXCLUDES

1. Malekhu Khola (MKHP)	5,000	kW
2. Daram Khola (DHP)	5,000	kW
3. Tadi Khola (ASHP)	970	KW
4. Upper Mai Khola (ENGE)	3,100	KW
5. Lower Indrawati (SHP)	4,500	KW
6. Lower Nyadi (SHP)	4,500	KW
7. Madi-1 (AGP)	10,000	KW
8. Upper Mod Khola (UMEC)	14,000	KW
9. Sali-2 (THP)	879	KW
10. Lower Chaku (LEPA)	1,765	KW
11. Phawa Khola (SHC)	2,079	KW
12. Ilai Khola(HDHC)	2,400	KW
13. Belkhu Khola (MFC)	328	KW
14. Upper Hadi Khola (CPSS)	991	KW
15. Suri Khola (MGPL)	990	KW
16. Nirajara Sankar Biomass (THE)	520	KW
Total	**57,894**	**KW**

Under Construction:

1. Sisne Khola (GBHP)	750	KW
2. Phewa Khola (KHP)	995	KW
3. Sali Nadi (KSHPS)	232	KW
4. Thoppal Khola (THP)	1,650	KW
5. Mardi Khola (SHP)	3,100	KW
6. Patl Khola (UHP)	996	KW
7. Rivi Khola (RHPD)	2,400	KW
Total	**10,123**	**kW**

SOLAR POWER

1. Simikot	50	kW
2. Gamgadhi	50	kW
Total	**100**	**kW**

TRANSMISSION LINE LENGTH

1. 132 kV Transmission Line	2076 ckt km
2. 66 kV Transmission Line	566 ckt km
3. 66 kV Underground Cable	7.0 ckt km
4. 33 kV Single Circuit	2465.0 km

SUBSTATION CAPACITY

132/11	kV	71 MVA
132/33	kV	369 MVA
132/66	kV	210 MVA
66/11	kV	424 MVA
66/33	kV	25 MVA
Total		**1099 MVA**

NOTE

* Private & Others
** Leased to the Private Sector
*** Not in normal Operation

□ IPPs lines not included

□□ These capacities are within the Grid Substations only. Transformers at the Distribution Substation, Powerhouses and Local Distributions are not included.

Installed Capacity in Nepal Electricity Authority (including Private and Others) 515.989 MW

Power Development Of Nepal

MAJOR HYDRO POWER

Existing:

1. Trisuli	24,000 kW
2. Sunkosi	10,050 kW
3. Gandak	15,000 kW
4. Kulekhani No. 1	60,000 kW
5. Devighat	14,100 kW
6. Kulekhani No. 2	32,000 kW
7. Marsyangdi	69,000 kW
8. Puwa Khola	6,200 kW
9. Modi Khola	14,800 kW
10. Kali Gandaki "A"	144,000 kW
Total	**389,150 kW**

Under Construction:

	* kW
1. Middle Marsyangdi	70,000 kW
2. Chameliya	30,000 kW
3. Kulekhani III	14,300 kW

Planned and Proposed:

1. Seti (West)	750,000 kW
2. Arun 3	402,000 kW
3. Budhi Gandaki	600,000 kW
4. Kali Gandaki No. 2	660,000 kW
5. Lower Arun	336,000 kW
6. Upper Arun	335,000 kW
7. Karnali (Chisapani)	10,80,000 kW
8. Upper Karnali	300,000 kW
9. Pancheswar	6,480,000 kW
10. Thulo Dhunga	25,000 kW
11. Tamur/Mewa	101,000 kW
12. Upper Trisuli	61,000 kW
13. Dudh Kosi (Storage)	300,000 kW
14. Budhi Ganga	25,000 kW
15. Rahughat Khola	27,000 kW
16. Likhu-4	40,000 kW
17. Kabeli "A"	30,000 kW
18. Upper Marsyangdi "A"	121,000 kW
19. Kulekhani No. 3	14,000 kW
20. Andhi Khola (Storage)	180,000 kW
21. Khimti II	27,000 kW
22. Upper Modi	14,000 kW
23. Langtang Khola (Storage)	218,000 kW
24. Madi Ishaneswor (Storage)	85,000 kW
25. Upper Seti (Storage)	122,000 kW
26. Kankai (Storage)	60,000 kW
27. Upper Tama Koshi	306,000 kW
28. Upper Modi "A"	42,000 kW
29. Hewa Khola	10,000 kW
30. Upper Trisuli 3 B	44,000 kW
Total:	**12,78,6000 kW**

THERMAL POWER STATIONS

Existing:

1. Biratnagar**	1,026 kW
2. Hetauda	12,750 kW
3. Marsyangdi	2,250 kW
4. Duhabi Multifuel-1	26,000 kW
5. Duhabi Multifuel-2	13,000 kW
Total	**55,026 kW**

SMALL HYDRO POWER

Existing (Grid Connected):

1. Pharping	500 kW
2. Panauti	2400 kW
3. Sundarijal	640 kW
4. Phewa (Pokhara)	1,000 kW
5. Seti (Pokhara)	1,500 kW
6. Tinau (Butwal)	1,024 kW
7. Baglung	200 kW
8. Tatopani/Myagdi (I+II)	2,000 kW
9. Jomsom**	240 kW
10. Chatara	3,200 kW
Total	**13,792 kW**

Existing (Isolated):

1. Dhankuta	240 kW
2. Jhupra (Surkhet)	345 kW
3. Doti	200 kW
4. Phidim**	240 kW
5. Gorkhe (Ilam)**	64 kW
6. Jumla**	200 kW
7. [illegible]	32 kW
8. Syangja**	60 kW
9. Helambu	50 kW
10. Salleri* (Solu)	430 kW
11. Darchula (I & II)**	300 kW
12. Chame	45 kW
13. Taplejung**	125 kW
14. Manang	80 kW
15. Chaurjhari** (Rukum)	150 kW
16. Syarpudaha** (Rukum)	200 kW
17. Khandbari**	250 kW
18. Terhathum**	100 kW
19. Bhojpur**	250 kW
20. Ramechhap	150 kW
21. Bajura	200 kW
22. Bajhang**	200 kW
23. Arughat Gorkha	150 kW
24. Okhaldhunga**	125 kW
25. Rupalgad (Dadeldhura)	100 kW
26. Surnaiyagad (Baitadi)	200 kW
27. Namche	600 kW
28. Achham	400 kW
29. Dolpa	200 kW
30. Kalikot	500 kW
Total	**6,176 kW**

Under Construction:

1. Gamgad	400 kW
2. Heldung	500 kW
Total	**990 kW**

PRIVATE SECTOR PLANTS

Existing:

1. Andhi Khola (BPC)	5,100 kW
2. Jhimruk (BPC)	12,000 kW
3. Khimti Khola (HPL)	60,000 kW
4. Bhotekosi (BKPC)	36,000 kW
5. Syange Khola (SHP)	183 kW
6. Indrawati (NHPC)	7,500 kW
7. Chilime (CPC)	20,000 kW
8. Piluwa Khola (AVHP)	3,000 kW
9. Chaku Khola (APCo)	1,500 kW
10. Sunkoshi Small (SHP)	2,500 kW
11. Rairang (RHPD)	500 kW
12. Khudi Khola (KHP)	3450 kW
13. Baramchi (UHC)	990 kW
Total	**152,793 kW**

ONLY POWER PURCHASE AGREEMENT(PPA)CONCLUDED

1. Mailung Khola (MKHP)	5,000 kW
2. Daram Khola (GHP)	5,000 kW
3. Tadi Khola (ASHP)	373 kW
4. Upper Mai Khola (ENCE)	3,100 kW
5. Lower Indrawati (SHP)	4,500 kW
6. Lower Nyadi (BHP)	4,500 kW
7. Madi-1 (ACP)	10,000 kW
8. Upper Modi Khola (SITEC)	14,000 kW
9. Seti-2 (THP)	979 kW
10. Lower Chaku (LBPM)	1,796 kW
11. Phawa Khola (SHC)	2,679 kW
12. Mai Khola (HDHC)	2,400 kW
13. Belkhu Khola (MFIC)	322 kW
14. Upper Hadi Khola (CPCS)	981 kW
15. Siuri Khola (NGPL)	990 kW
16. Narayani Sankar Biomass (TMB)	500 kW
Total	**57,084 kW**

Under Construction:

1. Sisne Khola (GSHP)	750 kW
2. Pheme Khola (KHP)	995 kW
3. Seti Nadi (KSHPS)	232 kW
4. Thoppal Khola (THP)	1,650 kW
5. Mardi Khola (GHP)	3,100 kW
6. Pati Khola (UHP)	996 kW
7. Bijl Khola (BHPS)	2,400 kW
Total	**10,123 kW**

SOLAR POWER

1. Simikot	50 kW
2. Gamgadhi	50 kW
Total	**100 kW**

☐ TRANSMISSION LINE LENGTH

1. 132 kV Transmission Line	2078 ckt km
2. 66 kV Transmission Line	565 ckt km
3. 66 kV Underground Cable	7.0 ckt km
4. 33 kV Single Circuit	2465.0 km

☐☐ SUBSTATION CAPACITY

132/11 kV	71 MVA
132/33 kV	358 MVA
132/66 kV	311 MVA
66/11 kV	424 MVA
66/33 kV	25 MVA
Total	**1189 MVA**

NOTE

* Private & Others
** Leased to the Private Sector
*** Not in normal Operation
☐ IPPs lines not included
☐☐ These capacities are within the Grid Substations only. Transformers within Distribution Substation, Powerhouses and Local Distributions are not included.

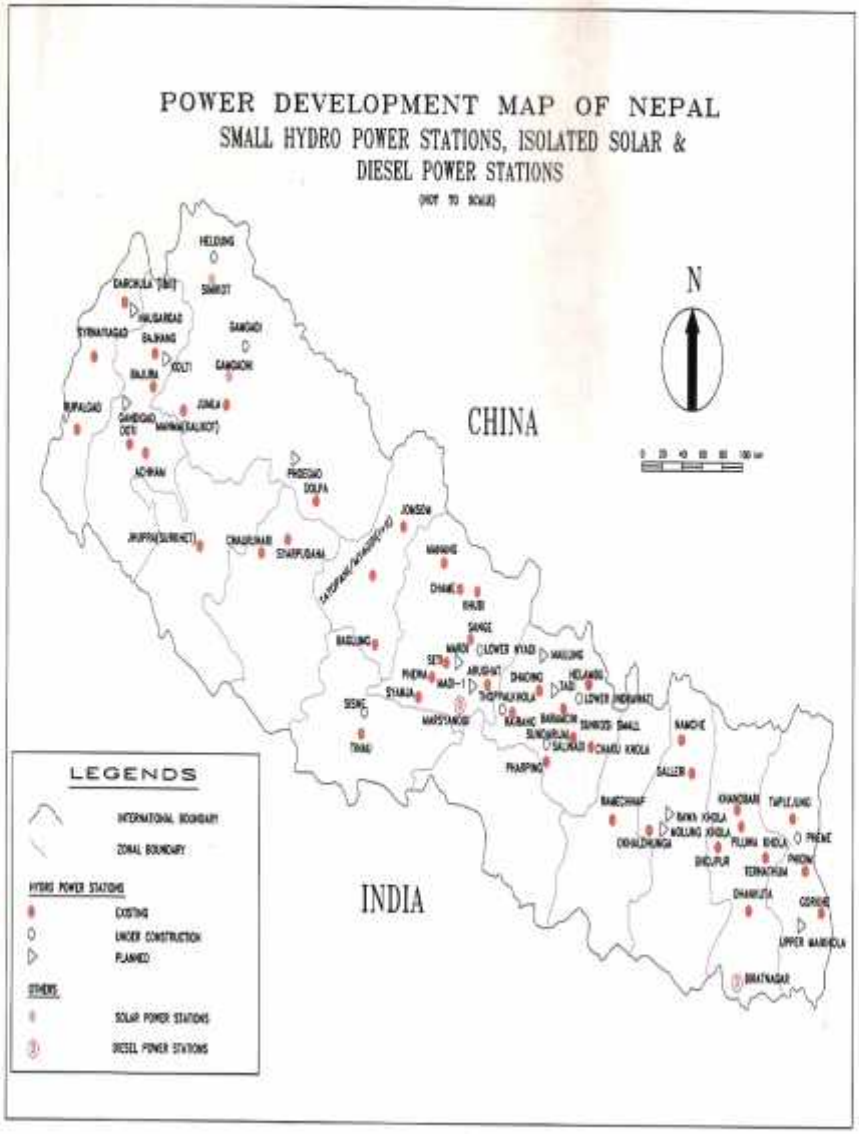
Installed Capacity in Nepal Electricity Authority (including Private and Others): 615,959 kW

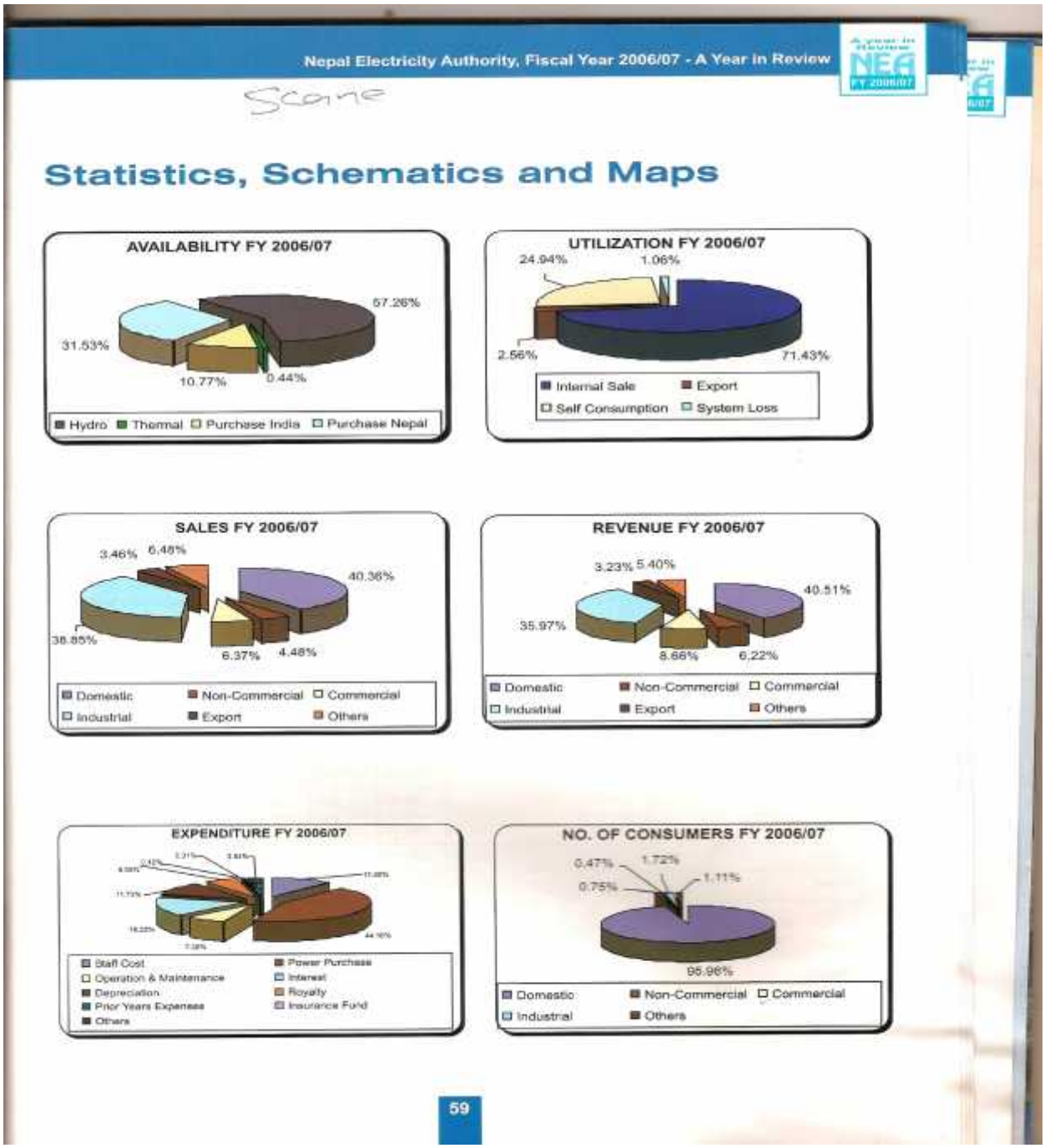
Scale

POWER DEVELOPMENT MAP OF NEPAL

SMALL HYDRO POWER STATIONS, ISOLATED SOLAR & DIESEL POWER STATIONS

(NOT TO SCALE)





Altken et al (1990) claim that there has been generally lack of industrialization associated with the rural electrification in Nepal. It will facilitate social mobilization and local instutionalization. There is no end-use diversification policy do to absence of conscious effort so most projects have failed tracing back the opportunities of employment. To conserve energy, the electricity use is to be promoted. In rural parts, the electricity supply and demand can be managed this. The increased in

hydro- electricity power will promote small industries transportation and communication, lift irrigation lightener/ space heating, emerging tensile industries cooking and electric transportation systems. On the other hand, the fuel cost is high and that can be cudweed with the development in hydro electricity because at present, fuels are used every where such as the use of it in cooking, transportation and other fields can easily be radical if electricity replaces the position. The examples of ropeways and trolleys prove it better. Besides these the electricity can be used for institutional hurdles, i. e. wimps, goods etc needed for institution that can reduce the cost of fuel utilizing electricity. So, might be this is the only ultimate solution for government of Nepal to integrate economy with development.

The current position of hydro- power in Nepal, regarding development and utilization is very pitiable However, thorough the formation and adoption of good policy, with equal priority in all parts of motion, and good co- ordination with the neighboring countries , Nepal can soon take a great leap by the development of Hydro power and preserving the use of other fuel with the adjustment in electricity cost preventing the corruption in the relatedfied, indeed loading realty to the environmental preservation.