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Diploma Thesis

Hydropower Projects in Nepal: Finance and Risk Mitigation

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Hydropower Projects In Nepal: Finance and Risk Mitigation

Objectives of thesis

The objective of this study is to try to explore the investment scenario in the hydropower sector and test the financial viability on the basis of case study to hydropower financing in Nepal. The study is made on this topic to find out the ongoing development of Hydropower projects in Nepal and to find out the proper way of evaluating and suggesting the planned and proposed hydropower projects. The study is also undertaken to analyze the problems of financing institution and hydropower developers and government agencies in financing hydropower projects in the context of Nepal. The specific objectives of the study are as follows:

- To study the investment process and financial viability and risk mitigation of hydropower projects.
- To analyze the investment climate and explore the challenges in the hydropower sector.
- To analyze the project evaluation criteria and the problems of the private developer in arranging finance and risk mitigation for their hydropower projects.
- To find out the major problems of financing in a hydropower projects in developing countries like Nepal along with risk mitigation techniques.
- To provide necessary suggestions on basis of study findings.

Methodology

All the data required for this study were accumulated through primary and secondary basis. Secondary data were collected from the Chilime Hydropower Company, National Hydropower Company, Nepal Electricity Authority and other instaurations related or working in the sector of hydropower. And primary data were collected from the two power companies which are taken for this study. Those persons who are working in these company are the resources of the opinion. Twelve questionnaires are made and distributed, 13 in Chilime and 12 in National Hydropower. Out of them 10 from Chilime and 8 from National Hydropower gave responses on these questions.

In questionnaire interview they were clearly divided two groups for response, one is technical group and another is administration group. From both company, eleven responses from administration group and seven responses from technical group. Respondents were managers, accountants, engineers and general staffs.

The proposed extent of the thesis

xxx

Keywords

Hydropower, Financing, Investment, Nepal, Risk

Recommended information sources

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Declaration

I declare that I have worked on my diploma thesis titled "Hydropower Projects in Nepal: Finance and Risk Mitigation" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 29th March 2018 _____

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Hydropower Projects in Nepal: Finance and Risk Mitigation

Abstract

The objective of this study is to explore the investment scenarios in the hydropower sector and recognize the viability of hydropower project financing in Nepal. It is conducted with the aim of understanding the ongoing development of Hydropower projects in Nepal and to find out the proper way to evaluate the planned & proposed hydropower projects. The study is also undertaken to analyze the problems of financial institutions, hydropower developers and government agencies in hydropower projects funding in the context of Nepal. This research was conducted as a case study comparing two hydropower projects, namely, Chilime Hydropower Company and National Hydropower Company along with a critical anlysis of the investment scenario and Government Policies & Acts influencing this sector.

The hydropower companies chosen for this study, have different Capital Structure and Funding, yet both projects are economically feasible. Capital Budgeting tools used in this study have concluded that due to immense potential and favourable government policies such as tax exemption, hydropower projects, small or big in size, have positive financial outcomes. The major risk factor to any of the hydropower projects comes from political instability, state of basic infrastructure and monopoly buyer situation. The study further concludes that hydropower projects are capital-intensive with a longer payback period, so the best strategy for hydropower development is public-private partnership, filling the gap between economic and financial viability.

Keywords: Hydropower, Financing, Investment, Nepal, Risk, Government Policies, Capital Budgeting

Projekty vodních elektráren v Nepálu: Finance a Zmírnění rizik

Abstrakt

Cílem této studie je posoudit investiční scénáře v rámci sektoru vodních elektráren a zhodnotit udržitelnost financování vodně-elektrárenských projektů v Nepálu. Studie je provedena se záměrem porozumět stávajícímu rozvoji těchto projektů v Nepálu a nalézt vhodný způsob vyhodnocování plánovaných a navrhovaných vodně-elektrárenských projektů. Dalším předmětem studie je analýza problémů finančních institucí, developerů vodních elektráren a vládních agentur při financování projektů vodních elektráren v kontextu Nepálu. Tento výzkum byl veden jako případová studie porovnávající dva projekty, jmenovitě Chilime Hydropower Company a National Hydropower Company současně s kritickou analýzou investičních záměrů a vladníchpolitik a nařízení ovlivňujících tento sektor.

Dvě společnosti vybrané pro tuto studii mají odlišnou kapitálvou struktury i financování, přesto jsou oba projekty ekonomicky realizovatelné. Pomocí nástorjů kapitálového rozpočtování použitých v této studii bylo zjištěto, že projekty vodních lektráren, bez ohledu na velikost, mají pozitivní finanční výsledky, díky nesmírnému potencionáu a příznivé vládní politice v podobě daňových výhod. Hlávním rizikovým faktorem pro jakýkoliv projekt vodní elektrárny je politická nestablita, stav infrastruktury a monopolní postavení kupujícíího. Dalším závěrem této studie je, že pro projekty vodních elektráren, které jsou kapitálově náročné s delší periodou návratnosti je nejlpeší strategií spolupráce mezi soukromý a veřejným sektorem, která vyplní mezeru mezi finanční a ekonomickou udržitelnotí.

Klíčová slova: Vodní elektrátrny, Financování, Investování, Nepál, Riziko, Vládní politika, Kapitálové eozpočtování

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List of Abbreviations

ACOR	Average Capital Output Ratio
ADB	Asian Development Bank
AIW	Asian International Water
BIMSTEC	Bay of Bengal Initiative for Multi Sectoral Technical and Economic Cooperation
BOOT	Build Own Operate and Transfer
BOT	Build Operate and Transfer
CBS	Central Bureau of Statistics
CHP	Chilime Hydropower Company Pvt. Ltd
DANNIDA	Danish Development Assistance
DOED	Department of Electricity Development
FAO	Food and Agricultural Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GJ	Giga Joule
GOVN	Government of Nepal
INPS	Interconnected Power System of Nepal
IPPAN	Independent Power Producers Association, Nepal
IPPs	Independent Power Producer
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
KDF	Kuwait Development Fund
KOE	Kilo Oil Equivalent
KW	Kilowatt
KWh	Kilowatt Hour
LPG	Liquid Petroleum Gas
MHP	Middle Hydropower Projects
MOF	Ministry of Finance
MOWR	Ministry of Water Resources
MW	Megawatt

NEA	Nepal Electricity Authority
NOC	Nepal Oil Corporation
NORAD	Norwegian Agency for Development Cooperation
NPC	Nepal Planning Commission
NPV	Net Present Value
NRs	Nepalese Rupees
PBP	Pay Back Period
PDF	Power Development Fund
PPA	Power Purchase Agreement
PTC	Power Trading Corporation
UNDP	United Nations Development Project
WACC	Weighted Average Cost of Capital
WB	World Bank
WECS	Water and Energy Commission Secretariat

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1 Introduction

1.1 Background of the Study

Nepal is a rich country in water resources. Together with this resource, the steep topography endows this country with a great potential for hydropower development. The theoretical hydroelectricity potential of Nepal is 83000 MW. From the point of view of hydroelectric power resource, Nepal can be broadly divided into four river basins, namely, Sapta Koshi in the west, Sapta Gandaki in the center, Karnali and Mahakali in the far western. Which all together comprise about 80 percent of the total run off (170.199m3) in the country. (Shrestha, 1969:1)

Hydroelectricity is obtained from water resources. The electricity is produced from generators that are driven by hydraulic turbines. To ensure the requisite head of water, the turbine are replaced at power house which may be at some distance from the water resource. Hydroelectricity is originated from Northumberland in 1879 which was first generated in the water from Rogbury. Lord Armstrong lit his house with electric lamp using current from a dynamo driven by water turbine. (Benton, 1994). In Nepal "Shree Chandra Jyoti Rakish Bijuli Adda" commissioned and established the Pharping hydro plant of 500 kw capacities. But, the initiations were taken place only after the first five years' plan in 1956. (NEA, 2001:23)

Energy in Nepal is derived from biomass resources, imported fossil fuel resources, hydropower and renewable energy resources (solar, micro-hydro and biogas). Ministry of water resources is primarily responsible for the hydropower development in Nepal. Ministry of industry, commerce and supplies, through public corporation like Nepal oil corporation is responsible for the supply of fossil fuels. The ministry of science and technology is taking leading role in the promotion of alternate energy primarily the renewable energy sources through alternative energy promotion center. Ministry of forestry and soil conservation looks after the forest sector which is the major source of energy in Nepal. (Energy Sector Synopsis Report, June 2006)

The Nepalese economy is broadly characterized by traditional agricultural sector. The energy sources of Nepal are in experimental stage. The traditional sources are main sources in Energy supply in Nepal. It is a well-known fact that energy development drives the helms of civilization. Water resources have been occupying a very important phase from the beginning of human civilization because of the ancient cultures had developed near the banks

of rivers, seas, lakes, etc. Power in the form of hydroelectricity in basic energy input for industrialization of the country, which is in developing stage in Nepal. One hopeful phenomenon in this regard is the prevalence of small traditional hydro turbines called "Ghatts" in the hilly parts of the country. They are principally used for grinding corn using water to spin the turbines. Ways have been found to improve these turbines and penstocks so that the hydro energy can be more flexible used for motive power as well as electricity. (ADB/N 1987)

Energy in Nepal is derived from biomass resources, imported fossil fuel resources, hydropower and renewable energy resources (solar, micro-hydro and biogas). Ministry of industry, commerce and supplies, through public corporations like the Nepal oil corporation is responsible for the supply of fossil fuels. The ministry of science and technology is taking leading role in the promotion of alternate energy primarily the renewable energy sources through alternative energy promotion center. Ministry of forestry and soil conservation looks after the forest sector, which is the major source of energy in Nepal. (Energy Sector Synopsis Report, June 2006)

For the proper development of power through strong institution, NEA was established in August 1985 as the largest public enterprises responsible for the generation, transportation and distribution of power with proper management under the "NEA ACT 2041" merging the fragmented institution, primarily the electricity development (ED) and the Nepal Electricity Corporation. Its establishment and consolidation has provided an appropriate institution framework for the substantial development program expansion of envisaged for power sub sector. (Shrestha, 1991:11)

1.2 Hydropower Development in Nepal

Hydropower is derived from generators turned by the force of falling water. Most other electric energy is obtained from generators drove by steam produced either by a nuclear reactor or by burning fashil fuel namely coal, gas and oil. In the initial stage, hydropower plants played a vital role in the world, yet hydropower plants are estimated to provide only about 2 percent of the world energy requirement. Electricy is a commercial source of energy. Among the indigenous sources of non-commercial energy; hydro, solar power, solar house system and micro hydro power plants are generating electricity. The thermal plants including multi-fuel plants I and II of conventional type also generate a small amount of electricity. The generation of thermal power will be closed down when hydro-electricity can meet the

demand of electricity in the country. The thermal plants have been established to meet the peak demand for power, so hydropower is the dominant source of electricity in Nepal. (Bhattarai, 2004:69)

The first power plant in Nepal was established at Pharping by Prime Minister Chandra Shumsher in 1991 A.D. to fulfill the energy need of the ruling class. Second power plant was developed at Sundarijal of 900 kw capacity by Juddha Shumsher Rana in 1939 A.D.

Water is the most important natural resource of Npeal. There are about 6000 rivers and rivulets of which there are seven major rivers in the Koshi Basin, seven major rivers in the Gandaki Basin and five major rivers in the Karnali Basin which are perinnial. The total average run off is estimated at about 225 billion cubic meters with an estimated hyrdro potential of 83 thousand megawatt of which some 44 thousand megawatt can be economically harnessed. So far 1.5 percent of the available economic potential has been exploited and only 15 percent of the population of Nepal has access to electricity. The Nepalese domestic demand of electricity is dramatically increasing on average of 8 percent per year which is largest growth in the residential, commercial or industrial and agricultural sector. (Pokheral, 2008:8)

1.3 Evolution of Hydropower Financing in Nepal

In the past, only the government of Nepal was involved in developing hydro projects in the country, but after 1990 the involvement of private sector in hydropower development has changed the scenario of the hydropower development. So far, 6-7 projects amounting around 30% of total power is developed by private sector. The present government policies are also favorable for the private sector to develop electricity and sell to the government. Therefore, the potential of booming the private sector investment in hydropower development can be seen. At present, 40-50 companies have taken the license to develop such projects. The private companies are in various stages of development, mostly are under study but a few are already executed. One of the major problems of the private companies is to arrange the funding for the projects. Hydropower projects are capital incentive in nature compared to some of the other sectors and gestation period is also more. The capital required seems to be available in the country's money market with the commercial banks and financial institutions. Somehow till date, only one or two projects have managed to get small portion of their financing from the local money market. There seems to be some problems in mobilizing the capital capital available in the market towards hydropower sector.

In the early stage, all the public-sector hydropower projects including Micro and Mini were funded by the Government either from its own resources or from the funds provided by the donors. The capital outlay made can be considered as a non-recoverable grant for the project implementation. The main constraint on the public sector is a lack of continuous funding for implementation. The public sector hydropower construction program has received substantial assistance both from the multinational and bilateral donor agencies. The assistance has been in the form of grant aid or soft loan. The Asian Development Band (ADB), United Nations Capital Development Fund (UNCDF), Organization of Petroleum Exporting Countries (OPEC), Swiss Corporation. NORAD has assisted about half of the total public sector power projects through financial assistance. More than 80% of the private small hydropower projets are funded by the ADB/N. Rest of the projects are funded through other commercial banks and donor agencies. The Government of Nepal first time announced a policy to subsidize in 1985 for construction of small hydro projects on the cost of equipment for electricity generation, transmission and distribution for the private rural electrification project through ADB/N. Nepal has followed a planned economic development model from 1956 in the form of a 5-year development plan. Recently the 10th year plan is running. However, the specific policy in energy development was mentioned only from the fifth-year plan (1975-80) that was probably triggered by the first world energy crisis in the early seventies. A major policy instrument adopted in the Hydropower sector is Hydropower Development policy 1992; to facilitate rapid exploitation of power sector is the provision of national or foreign private sector investment. In this regard investment for the projects can be made, in any of the following ways:

- Construction of feasible and economical projects by Nepal Electricity Authority itself.
- Sole or joint venture of one or more private national investors.
- Joint venture of the government and one or more national or foreign investors.
- 100 percent investment of one or more foreign investors.
- Joint venture of national and foreign investors.

Table 1.1: Hydropower Potential in the River Basins of Nepal

River Basins	Theoretical Potential	Identified Sites (No.)	Established Potential Capacity (MW)	Potential Energy Output (GHz)
Mahakali	13,000	2	2,250	10,000
Karnali	23,170	11	8,840	40,000
Gandaki	20,650	13	6,200	30,000

Koshi	22,350	53	11,840	62,000
Southern	4,100	9	630	3,000
Terai	10	1	1	50
Total	**83,280**	**89**	**29,761**	**1,45,050**

Source: (NEA, 2007:42)

The theoretical, technical and economical potentiality of main river system has been established 83.28, 49.61 and 42.133 million KW respectively. Table 1.2 has presented potentially of major rivers.

Table 1.2: Major River and Hydropower Potentiality (in million KW)

River Basin	Theoretical Potential	Technical Potential	Economic Potential
Saptakoshi	22.35	11.40	10.860
Sapta Gandaki	20.65	6.66	5.270
Karnali Mahakali	36.17	25.57	25.125
Southern Rivers	4.11	0.98	0.878
Country's total potential	**83.29**	**49.61**	**42.133**

Source: Energy synopsis report WECS, (1992/93)

1.4 Statement of the Problem

Nepal is known as a rich country in hydro resources. There are more than 600 rivers having potential of 83000 MW. The government of Nepal has given high priority to the sector. On the other hand, most of the Nepalese cannot have opportunity to use electricity and they are living with traditional lamps with kerosene. Similarly, Nepal is a poor country and their people have very low per capita income in the world. There is low salary in comparison with other South Asian countries. Construction of hydroelectricity uses labor and technician mostly from the country itself. Moreover Nepal is capable of producing hydropower equipment and materials. But the price of electricity is very high among the south Asian Countries.

Almost all of the hydropower projects in Nepal have been assisted by bilateral and multilateral sources. Most of the hydropower projects have been financed mainly through grants from neighboring and friendly countries to Nepal. The study and implementation of the energy projects have been financed through bilateral assistance of USAID, PINNIDA, SNV/Netherlands, DANIDA, and UNDP. Nepal to some extent has own technical and financial resources to produce electricity. But very few attempts have been made to develop hydroelectricity by Nepalese company and businessman independently. This is an interesting issue of hydropower financing in Nepal.

Moreover, in present situation, commercial banks are investing their huge cash in Treasury bill in very low return due to the lack of favorable opportunity. They are paying high interest for the loan than the interest earned in Treasury bill by the financing Institutions. Rather investors and financial institutions are not willing to invest in the hydropower project. Next interesting issue is that Nepal has started hydropower in 1912 A.D. During the 100 year period, Nepal has produced only 556 MW hydropower, which is less than 1% of its potential capacity. The government of Nepal, has got financial support from the financing agencies and has been given high emphasis to this sector. But the pace of development is very slow in comparison with India, China and other neighbouring countries. Nepal is located between two big countries China and India. They are developed countries and suffering from shortage of electricity. Nepal is rich in hydropower potential and also has the potential of exporting this resource. In view, of this situation, the research is directed towards the following research issues:

- Why has Nepal not been able to export and sell electricity?
- What type of problem is there to sell electricity?
- What type of problems are being faced by hydropower developers, Financing institution and the government agencies in the context of hydropower development?
- Why banking and financing institutions are not attracted to the hydropower sector in Nepal?
- Why financing in a hydropower in a developing country like Nepal facing many risks? And what are the adequate tools to mitigate such risks?

1.5 Objectives of the Study

The objective of this study is to try to explore the investment scenario in the hydropower sector and test the financial viability based on case study to hydropower financing in Nepal. The study is made on this topic to find out the ongoing development of Hydropower projects in Nepal and to find out the proper way of evaluating and suggesting the planned and proposed hydropower projects. The study is also undertaken to analyze the problems of financing institution and hydropower developers and government agencies in financing hydropower projects in the context of Nepal. The specific objectives of the study are as follows:

- To study the investment process and financial viability and risk mitigation of hydropower projects.

- To analyze the investment climate and explore the challenges in the hydropower sector.
- To analyze the project evaluation criteria and the problems of the private developer in arranging finance and risk mitigation for their hydropower projects.
- To find out the major problems of financing in a hydropower projects in developing countries like Nepal along with risk mitigation techniques.
- To provide necessary suggestions on basis of study findings.

1.6 Research Questions

The aim of this research is to find the different impact on hydropower financing in Nepal. The relevant research question for this study are:

- Does the capital budgeting practice best describe the financing and risk mitigation of hydropower companies?
- What types of contemporary steps are essential for the financing and risk mitigation improvement of Nepalese hydropower companies?
- What level of satisfaction on provided to the stakeholders by these public-sector hydropower companies?
- What are the major risk factors associated with the hydropower projects financing and how to mitigate such risks?

1.7 Significance of the Study

Hydropower is economic, nonpolluting and environmentally benign source of energy. Out of 83000 MW potential, only 50 percent is technically feasible but still is a substantial amount. Till date the harnessed capacity is only 556 MW and 125 MW still under construction. So 99% of the potential is still to be harnessed. In the line of this fact, research, analysis and development of hydropower is very essential from the view of economic development of the nation and uplift the overall economic condition of Nepal.

The industrialization process in Nepal is very slow. Despite various attractive policies of government in respect of industrialization, new investment made on industrial sector is not satisfactory. On the other hand, in developing country like Nepal, development of hydropower industries and projects is very essential for supply of electricity required for establishment and operation of industries in Nepal. Financing and Banking sector of Nepal is increasing rapidly. Financing the hydropower projects is a great opportunity for the financial sector of Nepal to invest. The lack of proper research and data in this sector has

made it difficult for investors to enter this area with confidence. The study will try to point out the problems in this field that will enable the developer, financing institution and the government for planning in the future to move ahead in the field. It certainly helps the Policy maker of the government for formulating the amendment of hydropower policy and program in the future. The study aim at providing the status and fact in the hydropower field focusing the private investment in the hydropower in Nepal which will enable the financing institutions and hydropower developers to choose the least cost and high return projects.

Similarly, the study will find out the problems and provide suggestions and recommendations for improvements in the field of planning to distribution of electricity. It helps to attract private hydropower developers, which enables rapid hydropower development in the country. Hence, the study will be beneficial to the government as well for formulating the best strategy and policy; to the investor for section of least coast and high return project; to the financer; and to the students and researches for providing actual data and valid information for their study.

1.8 Limitations of the Study

This study is limited to certain boundaries for which future new research might be required in the future to add upon the research findings from this study.

The scope of the study is limited to the financing and hydropower organization selected through the judgement sampling by the researcher method. The research is based on the information and data available from the various websites including the Nepal Electricity Authority, Ministry of Water Resource, Economic Survey and the Journal, Magazine, Reports of Nepal Hydropower Association and responses given by the respondents. The study is limited and focused on the present status on August 2004 to 2006 and has covered 2001 to 2006 data available from the Financing Institutions and Hydropower Companies. This study does not reflect the Hydropower Development and financing problem in the world and neighboring countries so that it is entirely based on the context of Nepal but it has included some of the information related beyond our country Nepal. The accuracy and reliability of the conclusion of data depends upon the published data, official records of the organization and data provided by the respondents. Due to the various constrains only ten hydropower developers and ten financing institutions were approached during the study including one Consulting Firm.

2 Objectives and Methodology

The objective of this study is to analyze the project evaluation criteria, the problems of the private developer in arranging finance for their Hydro Project and investment process and its impact. To achieve the objective of the study, the following methodology has been adopted which includes research design, sources of data, population and sample, data analysis and research tools.

2.1 Research Design

Research design is the plan, structure and strategy of investigation conceived so as to obtain answer to research question and to control variances. The plan is the overall scheme on program of research. It includes an outline of what the investigator will do from writing the hypothesis and their operational implication to the final analysis of data. The structure of the research is more specific. It is the outline, the scheme, and the paradigm of the operation of the variables. Strategy we use here, in also more specific that plan. In other words, strategy implies how the research objectives will be researched and how the problems encountered in the research will be tackled. "A research design is the arrangement of condition for collection and analysis of data in a proper manner that aims to combine relevance to the research purpose economy in procedure." (Kerlinger, 1986:23)

The research design thus is a stepwise plan or strategy toward reaching a conclusion from the research work. Among numerous types of research design, a combination of descriptive and case study research design has been applied in this research. For case study, two power projects, one funded by private sector and next by public utility, with a difference in capacity. An intensive investigation of individual projects and a comparative investigation of the two projects have been carried out. Descriptive research design will be used to explore the present situation of investigation in Hydropower in Nepal.

2.2 Sources of Data

Since this research is a case study research of the two hydropower projects, most of the data are collected from the two projects being studied. Data used in this study are secondary in nature. The use of secondary data is much extensive which are collected through the record factors of the both company. Secondary data have been collected from the published and unpublished official record of the Chilime Hydropower Company and National Hydropower

Company's annual report, annual report of NEA, hydropower related publication and above all data collected from the internet. The website of NEA, IPPAN, NHP, CHP and other hydropower related websites were the sources of reliable information.

To explore the investment climate in Nepal, especially in the hydropower sector and to collect expert opinion in hydropower investment, interviews have been carried out with different well known personalities. And, the papers presented in the seminars on related hydropower issues are also considered through the internet.

All the background information on present status of hydropower development in Nepal has been collected from various sources like annual report of NEA, hydropower related other institutions. There have been various seminars on hydropower related issues relevant to this study and some of paper presented in those seminars, the internet made this crucial and important information accessible and optimum advantage of this accessibility has been taken.

2.3 Population and Sample

Currently there are 107 feasible hydropower projects in Nepal, which are listed in tables 3.1 and 3.2 in the next pages. However, 29 of the hydropower projects are at present only planned and proposed. There are ten major hydropower plants and forty small hydropower plants built and operated by the NEA. By the year end 2007, independent power producers and fourteen other are under construction and preliminary work in progress have built eleven small and large hydropower projects.

The large number of hydropower projects provides many choices for case study of hydropower projects. However, the intention of the research was also carry out a comparative analysis on investment by public sector. Hence, two power projects are chosen; one funded by NEA and next by private sector. This narrowed down the available option.

Both companies are listed in NEPSE. There are three companies listed in NEPSE. And the samples are taken in the judgmental basis which are:

Table 2.1: Power projects Listed in NEPSE and Sample Taken

S.N	Power Companies	Sample
1	Chilime Hydropower Company	1
2	National Hydropower Company	1
3	Butwal Power Company	-
Total	**3**	**2**

Source: *NEPSE*

The samples covers the 66.67% companies listed in NEPSE. Thus, on judgmental sampling basis, Chilime Hydropower Project and the National Hydropower Project were decided upon as two case study project for this research paper.

Besides the companies listed in NEPSE, other hydropower projects are as follows:

Table 2.2: Planned and Proposed Hydropower Projects in Nepal

Name	**Capacity in MW**	**Name**	**Capacity in MW**
Karnali	10,800	Tamur-Muwa	101
Pancheshwor	6,480	Madi Ishaneshor	6
Paschim Seti	750	Kankai	60
Kali Gandaki 2	660	Upper Modi 'A'	42
Budhi Gandaki	600	Likhu – 4	40
Arun 3	402	Kabeli 'A'	30
Upper Arun	335	Chameli	30
Lower Arun	308	Khimti II	27
Upper Karnali	300	Rahughat	27
Dudh Khola	300	Thulo Dhunga	25
Langtang Khola	218	Budhi Gandaki	20
Andhi Khola	180	Kulekhani – 3	14
Upper Seti	122	Upper Modi	14
Upper Marsyandi 'A'	121	Hewa Khola	10
Upper Tamakoshi	309		

Source: *NEA Report, 2007:86*

Table 2.3: Existing, ongoing and Proposed Hydropower projects of Nepal

Name	**Capacity in MW**	**Name**	**Capacity in MW**
NEA owned Hydropower Projects			
Kali Gandaki 'A'	144	Khundbari	0.25
Middle Marsyangdi	70	Bhojpur	0.25
Marsyangdi	69	Jomsom	0.25
Kulekhani-I	60	Dhankuta	0.24
Kulekhani-2	32	Phidim	0.24
Trisuli	24	Baglung	0.20
Ganda	15	Doti	0.20
Modi Khola	14.80	Jumla	0.20
Devighat	14.10	Syarpudha	0.20
Sunkoshi	10.05	Bajura	0.20
Puwa Khola	6.20	Bhajhang	0.20
Chatara	3.20	Baitadi	0.20
Panauti	2.40	Dolpa	0.20
Tatopani/Myagdi	2	Chaurijhari	0.15

Seti	1.08	Ramechhap	0.15
Phewa	1.08	Arughat Gorkha	0.15
Tinau	1.02	Taplejung	0.15
Sundarijal	0.64	Okhaldhunga	0.13
Namche	0.60	Rupalgad	0.10
Pharping	0.50	Syangia	0.08
Kalikot	0.50	Manang	0.08
Heldung	0.50	Gorkhe (Illam)	0.06
Salleri	0.40	Helambu	0.05
Achham	0.40	Chameli	0.05
Jhurpa	0.35	Dhading	0.03
Gamgad	0.40	Terathum	0.10
Darchula	0.30		

Name	**Capacity in MW**	**Name**	**Capacity in MW**
IPP Owned Hydropower Projects			
Khimti Khola	60	Upper Maikhola	3
Bhotekoshi	36	Piluwa Khola	3
Chilime	20	Sunkoshi Small	2.60
Jhimruk	12.30	Chaku Khola	1.50
Langtang	10	Thappaikhola	1.40
Indrawati	7.50	Madi-1	1
Andhi Khola	5.10	Phema Khola	0.99
Mailung	5	Baramchi	0.99
Dharam Khola	5	Tadakhola	0.97
Lower Nyadi	4.50	Sisne Khola	0.75
Lower Indrawati	4.50	Rairang	0.50
Khudi Khola	3.45	Sange Khola	0.18
Mardi Khola	3.10		

Source: *NEA Report, 2007:86*

2.4 Data Analysis

The main objective of this study is to find out how investment decision is made and how financial viability of hydropower is tested. In financial terms, this is called capital decision. Hence various capital budgeting techniques have been used to find out financial viability of the hydropower projects. In addition, sensitivity analysis was carried out for both hydropower projects being studied in order to test the robustness of the investment. This research also has specific objectives of comparative analysis of two public investments and identifying opportunities and challenges in the present hydropower scenario in the country.

2.5 Data Gathering Process

All the data required for this study were accumulated through primary and secondary basis. Secondary data were collected from the Chilime Hydropower Company, National Hydropower Company, Nepal Electricity Authority and other instaurations related or working in the sector of hydropower. And primary data were collected from the two power companies which are taken for this study. Those persons who are working in these company are the resources of the opinion. Twelve questionnaires are made and distributed, 13 in Chilime and 12 in National Hydropower. Out of them 10 from Chilime and 8 from National Hydropower gave responses on these questions.

In questionnaire interview they were clearly divided two groups for response, one is technical group and another is administration group. From both company, eleven responses from administration group and seven responses from technical group. Respondents were managers, accountants, engineers and general staffs.

2.5.1 Sources of Primary Data

The primary data were collected from structured questionnaire and the personal interview method mostly. Two separate structured questionnaires were designed, one for the Hydropower Developer and another for Local Financing Institution to collect the required information and data in the field of hydropower financing. A common and general guideline was developed to interview with professional and experts.

- **Data Collection from Hydropower Developers:**

These questionnaires were prepared for various personnel of hydropower project developers who were officer level in their organization. As there were lots of people in the developers list. On the basis of judgement sampling, 10 developers and their representatives were selected to get the information on the developers problem in arranging fund from the Local Financial Institutions. The people contacted were key personnel who had participated in the hurdle.

- **Data Collection from Local Financing Institutions (LFI):**

The second types of structured questionnaire were given to the representatives of the LFIs who were all senior level employees. Ten respondents who were selected on the researcher judgement basis, contacted to fill up the questionnaire. It was very difficult to fill up the questionnaire as they were policy level people and extremely busy. Therefore researcher

filled up the questionnaire on the basis of their verbal answer. It is expected that the information and date given by them were accurate.

- **Data Collection through Interview with the Experts:**

Thirty persons were contacted in the field of financing and development of hydropower project in Nepal. Twenty-one numbers of people have given very useful information regarding the financing but nine of them were not useful. Nine person's interviews were useful to understand the market situation, economics of hydropower industry and other general information in Nepalese hydropower industry.

2.5.2 Sources of Secondary Data

The secondary information was collected through available books and other published materials in the hydropower of Nepal. But main materials of study were reports, preceding of the seminars and workshops, web page surfing and the articles related to financing of the hydropower. The main sources are Internet, NEA Library, Nepal Hydropower Association (NHA), and Alternative Energy Promotion Center, United States Development Fund-Energy development literature. Published materials –profile of banks, bulletins of Nepal, Rastra Bank, year report of Agriculture Development Bank, Nepal Industrial Development Corporation.

2.6 Data Processing Technique

The collected data, which were obtained from different sources, were not in appropriate form to analyze. Therefore, all the data collected were separated and categorized as per their relevancy and compiled in appropriate forms. All the data were not relevant and appropriate for the study. The data were described by presenting in the light of theoretical basis using different tools and techniques of financing of hydropower project. Similarly the collected data were presented and arranged in tabulated form, percentage, ratio, graphs, table are presented. Collected data are tabulated in suitable table format.

2.7 Research Tools

The study is on financial evaluation of hydropower projects, most of the financial tools are used to analyze as needed. And the statistical tool hypothesis has also been used to test if there is significant difference between the net cash flow of the two projects.

The financial tools are used for analysis data in this study are as follows:

1. Weighted Average cost of capital
2. Cash flow statement
3. Capital Budgeting Technique
    a. Cash Payback Period
    b. Discounted Cash Payback Period
    c. Accounting Rate of Return (ARR)
    d. Alternative Accounting Rate of Return
    e. Net Present Value (NPV)
    f. Internal Rate of Return (IRR)
    g. Benefit Cost Ratio or Profitability Index

2.8 Data Analysis Plan

The overall research has been analyzed majorly on the basis of primary data collected through the set of questionnaire. The filled questionnaire have been tried to analyze in depth and the opinions of questionnaire are tried to quantify according to the objective requirements and its possibilities.

The obtained data have been tabulated, analyzed presented and interpreted by using averages percentage and other statistical tools as per the requirement. Per these purposes, computer software programs have been used. This study has followed descriptive method of analysis. Collected data have been tabulated and analyzed under before after framework. Findings from qualitative information have also been presented.

3 Literature Review

In this chapter, the first section covers literature review of previous research work and articles and presents the reviews looking at the concept and summary of the outcomes of various research studies carried out to evaluate the welfare gain achieved from the installation of hydropower project in Nepal financing and risk mitigation by the users. The review of the literature concerns about the theoretical aspects, past research studies and articles from different sources like journals, articles in Nepalese as well as international context concerning different sectors are included to identify the broader aspects of cost and benefits of hydropower project in Nepal financing and risk mitigation. In the second section the conceptual framework will be developed which help to design the study of the cost and benefit aspects of hydropower projects in Nepal financing and risk mitigation.

3.1 Literature Review

The review of literature is a fundamental part of planning of the study. The main purpose of literature review is to find out what works have been done in the research problem and what have been done in the research problem and what must be done in the field of the research study being undertaken. Every search requires a clear idea on the problem of study and its solution, which emerges from the review of literature. “Scientific research must be based on post knowledge. The previous studies cannot be ignored because they provide the foundation of the present study”.

This chapter reviews the available literature relating to Nepal electricity authority and view expressed by various scholars and researches on the profitability and financial performance of public enterprises. So far as analysis of financial performance in the context of Nepalese enterprises is concerned, some studies have been undertaken by the management experts and students describing the financial performance of public enterprises. Power plays significant role in the sustainable development of an economy that drives society towards the path of modernization. Nepal being one of the rich countries in hydropower sector, many important literatures are available in this field.

EAST Consult (1990) has attempted to evaluate the socio-economic impact of micro-hydro schemes on rural communities of Nepal. This study is more concentrated in issue of mill ownership and management. The study is based on the information collected from seven sites, which were visited by research team and were studied. The study examines the

technical performance such as mechanical agro-processing and electricity, its impact on the mill owners and their customers, user's perception of milling activities, prospects for electrification and impact of electrification on both owners and their customers.

PPL and NEA (1991) have presented a master plan of small hydropower in Nepal prepared under the scope of Nepal German technical cooperation with the financial and technical support of GIT. The study aims at a systematic identification of optimum small hydropower potential to match the electricity demand of the rural communities in the hill and mountains and to rant the identified projects. The target area in this study falls in the Eastern Development Region of Nepal. This report analyses the socio-economic and technical background of each site. The report also discusses about energy usage pattern, electricity supply, expenditure on electricity, electric appliances, advantages and disadvantage of electricity etc. It also describes about energy market situation in Nepal. According to this study, the traditional energy sources as fuel wood and agro-residue are mainly used for domestic purpose. Fuel wood is virtually a "Fire" good and a common resource in targeted area. The energy usage pattern in mountain district shows cooperatively higher energy consumption level due to higher energy requirement, and relatively lower commercial energy consumption is concentrated mainly in the urban areas. The reports show that each household on an average, pay the bill of NF's 73 for the use of electricity which would have been higher if the supply were regular. Nearly ninety-four percent of the total households having access to electricity revealed that its supply was irregular and it is supplied only for eleven hours a day. In addition to this the report shows that about forty-six percent of the total households are willing to pay thirteen percent and wish to pay as high as thirty-seven percent of the cost which shows the expenditure that the households in the are willing to pay against the usage of prospective electricity.

Shrestha (1996) on the topic "Financing power development in Nepal: a case study of NEA" points out that the power is a capital-intensive sector for country like Nepal but there was no clear-cut policy for its development and its financing existed prior to the era of planned development. It was started in a planned way with the introduction of first five-year plan (1956-61). Power is a capital-intensive sector, for country like Nepal, it is impossible to shoulder all the cost of investment. Therefore, Nepal has been mobilizing foreign resources since the first Five Year Plan. The trend of financing in power development shows that the Nepalese government only covers about 15 to 25 percent of the total investment whereas 75 to 85 percent of investment is covered by foreign aid. The share of international loan is

greater that the grant. The study also says that the main issues of financing in power development in Nepal are the shortage of capital, dependency on foreign aid, constraints in exporting power, risk of investment etc. frequent changes in the government policies and inadequate legal provision, geographical complexity, lack of trained manpower and modern technology are other constraints. According to the study, observing the power deficiency problem, it can be said that there is market within the county. But while analyzing the country's market with respect to the economically feasible power potentiality and with the large-scale projects, the scarcity of the sizeable market is in front.

Investment analysis decisions require information relating to initial investment costs, terminal cash flows, annual revenues, annual operating expenses and tax rate. All these cash flows should be the incremental due to the project in consideration. The cash flows, which do not affect the present cash flows either in the tern of outlays or benefits, are irrelevant. (Bajracharya, Ojha, Goit & Sharma 2004:255)

Ghimire (2006) in his paper presentation in USA presents that the lack of access to electricity in the rural areas has been considered as one of the major hindrance to rural development in Nepal. From the point of social justice and equitable development of the country, and to bring forth changes in areas such as education, access to information and to curtail adverse environmental effects there is not alternative to supply of electric energy.

Government of Nepal has adopted liberal policy to attract private investment on small hydropower development to facilitate electricity generation, no arrangements of waivers of license for up to 3 MW and waivers of detailed Environment Impact Assessment (EIA) for up to 50 MW (Budget Speech, 2009/10). Similarly, waivers on Environment impact license are provided or the construction of extension line under the action plan of national energy crisis mitigation. Power purchase agreement up to 25 MW has been fixed for the private sector participation in power generation.

The below table shows the status of total energy available in Nepal:

Table 3.1: Total Energy Available

Particulars	**2013**	**2014**	**2015**	**2016**
Available Energy	4687.09	4687.09	5005.7	5100.11
NEA Hydro	2273.11	2288.23	2365.64	2168.49
NEA Thermal	18.85	9.65	1.24	0.07
Purchas (Total)	1966.12	2389.21	2638.82	2931.55
India (Purchase)	790.14	1318.75	1369.89	1758.41
Nepal (IPP)	1175.98	1070.47	1268.93	1173.14

Source: *(Statistical pocket book of Nepal, 2016)*

3.2 Theoretical Framework

3.2.1 Financial Analysis

Financial analysis is designed to determine the relative strengths and weakness of a company, whether the company is financially sound and profitable relative to other companies in its industry and whether its position is improving or deteriorating over time. Investors need such information to estimate future cash flows from the company and to evaluate the riskiness of these flows. Managers need to be aware of their company's financial position to detect potential problems and to strengthen weakness. (Weston & Brigham, 1987:259)

Financial analysis is the key tool for financial decision and starting point for making plan before using sophisticated forecasting and budgeting procedures. The value of this approach is the quantitative relation that can be used to diagnose strengths and weakness in a company's performance. Financial performance is the main indicator of the success or failure of a company and the focus of financial statements and significant relationship that exists between them. (Khan & Jain, 1994:4.1)

Financial performance analysis involves the use of various financial statements. The financial statements contain summarized information of a company's financial affairs, organized systematically by the top management. These statements are used by investors and financial analysis to examine the company's performance to make investment decision. (Panday, 1999:29.30)

3.2.2 Financial Statements

The financial statements contain summarized information organized systematically of the firm's financial affairs. Preparations of the financial statements are used by investors and financial analysts to examine the firm's performance to make investment decisions. Financial statement discloses financial information relating to any business concern during a financial year, which is presented in the form of income statement and balance sheet usually prepared at the end of each financial year.

Financial statement reports what has actually happened to earnings and dividend over the past few years. Financial statements are prepared from the accounting records maintained by the enterprises. The basic objective of financial statements is to assist in decision making.

- Income Statement

The income statement presents a summary of revenues and expenses of a firm for the specific period, the period could be month, quarter, six months or a year depending on the time period for which revenues and expenses are summarized.

It reveals the financial position of the hydropower projects, cost and profit associated in any fiscal years. It measures the net profit or loss of any project during any fiscal year. The profit measures the strength of the project and loss indicates the weakness of the project During the preliminary phase the project occurs the loss due to high operational, set up, overhead expenses and after some years of establishment cost are minimized and profit goes up.

The major terms included in the income statements are sales revenue, other income, in credit sided and all the expenses are recorded in the debit side. If expenses exceed revenue, the project incurred loss and if revenue exceeds the expenses, the project incurred profit which will affect the balance sheet of any project.

- Balance Sheet

The balance sheet or statement of financial position portrays the financial structure of the company in terms of its economic resources and respective interests or claims on such researches. A balance sheet shows the financial position of a company by detailing. The sources of fund and the utilization of these funds properly classified and arranged in a specific manner. It communicates information about the assets and liabilities and owner, equity of company as on a specific date usually at the end of each financial year.

3.2.3 Tools of financial statement analysis

Analysis and interpretation of financial statement can be done through various techniques for analyzing comparative financial statement fund flow; ratio analysis and test of hypothesis are widely used.

3.2.3.1 Comparative Financial Statement

Comparative financial statements are statements of the financial position of a business so designed as to provide time prospective to the consideration of various elements of financial positions of embodied in such statements. The focus of the financial analysis is on key figures contained in the financial statements and significant relationship that exists between them. (Khan & Jain 1992)

Financial analysis may be of two types viz. vertical analysis and horizontal analysis. Financial statement like a balance sheet or profit and loss account, of a certain period of the business at a point of time is known as vertical analysis. It is also known as state analysis.
In horizontal analysis, a series of statement relating to number of years are reviewed and analyzed. It is also known as dynamic analysis because it measures the change position or trend of the business over several years. This study is based on horizontal analysis. The balance sheets and income statement which is alone are prepared in a comparative form because they are most important statements of financial position.

3.2.3.2 Comparative Balance Sheet

Balance sheet is the statement prepared at the end of each financial year to reflect the position of assets, liabilities and capital. Increase and decrease in various assets and liabilities as well as proprieties equity or capital brought, about by the conduct of a business can be absorbed by a comparison of the balance sheet at the beginning and end of the period, such observation after yield considerable information which is valuable in forming an opinion regarding the progress of the enterprises and to facilitate comparison, a single device known as the comparative balance sheet may be used.
Comparative balance sheet is the tool of financial statement analysis. Balance sheet of at least two years are compared and the changes between data are indicated in absolute amount as well as in percentage increase or decrease. Thus, it may be defined as the study of the same item, group of items and computed two or more balance sheet of the same business enterprises on different dates and the study of the same item, group of items and computed two or more balance sheet of the same business enter dates and the study of the defined of proportion computed from these figure on ten different dates. Main advantage of this analysis is that it describes of nature of business enterprises and of the enterprises as a whole.

3.2.3.3 Comparative Income Statement

The income statement is the summary of revenue and expenses showing net income or loss of any firms. Profit and loss account or income statement shows the profitability of a firm. The statement helps in deriving meaningful conclusion as it is very easy to ascertain the change in sales volume, administrative expenses, selling and distribution expenses, cost of sales etc. (Jain & Narang, 1998:12)

Comparative income statement shows the operating result for number of accounting periods so that changes in absolute data from one period to another period may be stated in terms of absolute change or in terms of percentage. It contains the same column as the comparative balance sheet and provides the same type of information, the amount balance, increase and decrease in money amounts and the percent of increase or decrease. It is the tool of financial statement analysis which compares at least two years' figures in terms of rupees and percentage.

3.2.3.4 Ratio Analysis

Powerful and most widely used tool of financial analysis is ratio analysis. A financial analysis is the relationship between two accounting figures, expressed mathematically or the tern ratio refers to the numerical or quantitative relationship between two items/variables. This type of relationship can be expressed as percentage, fraction and proportion of numbers. Ratio analysis is defined as the systematic use of ratio to interpret the financial statements so that the strengths and weakness of a firm as well as its historical performance and current financial condition can be determined. (Khan & JIN, 2003;80)

Ration analysis is a powerful tool of financial analysis. A ratio is defined as "the indicated quotient of two mathematical expressions" and as the relationship between two or more things. In financial analysis, a ratio is used as a benchmark for evaluating the financial position and performance of a firm. The absolute accounting figures reported in the financial statements do not provide a meaningful understanding of the performance and financial position of a firm. (Pandey, 1999:19)

Hydropower Project financing is one of the most secured project for investment project in Nepal. Despite of this project financing is not being invested in Nepal easily. Hydropower financing is concerned with the arrangement of funds for establishment, operation and maintenance of Hydropower projects. For Hydropower projects only Equity capital is not sufficient for construction. Hence, Debt Finance is required to meet the budgeted fund required for various activities. Financing is concerned with the planning and controlling of firm's financial resources at least to meet the cost of capital required for the project. Since, Hydropower project needs huge amount of funds to implement the projects, financing and development banks, Citizenship Investment Fund, Employee Provident Fund and commercial Banks are the source of financing for such project.

Power may be generated using various technologies and resources. Among them the power generated by using the water is termed as hydropower. Water is used to drive the mechanical equipment. The mechanical equipment relates to generator, which produces electricity and controlled by the other equipment then distributed to the consumer. The hydropower is only one power, which uses chipset source of water energy. In Nepal, more than 90% of electrical power has been produced by hydropower that we use for our household and commercial purpose. Hydropower is the only renewable energy technology, which is presently commercially viable on a large scale. It has four major advantages: it is renewable, it produces negligible amount of greenhouse gases, it is the least costly way of storing large amount of electricity, and it can easily adjust the amount of electricity produced to the amount demanded by consumers. Hydropower accounts for about 17% of global generation capacity, and about 20% of the energy produced each year.

- Financing

Financing is the process of accumulation and utilization of money for the betterment of projects. Collection of funds for the investment project is cost intensive. Hence least cost of capital is the great concern of the financing. Nowadays financing is regarded as the debt management that is most for the investment project to earn high rate of return on capital. Under the financing, generally there are three functions: Investment decision, financing decision and Dividend decision. Hence the financing decision cannot be successful until investment project is profitable project. In this study financing function will be studied to carry out the thesis works.

- Projects

Projects constitute the various terms. It is a scheme, which has fixed time, budget and objective and estimated outcomes. Every activity and works is done for the achievement of outcomes in the future. Hydropower Projects also aim to achieve predetermined objectives and outcomes i.e. generation/sales of electricity for which investment is done in initial year until gestation period. Project may be formulated after the fixation of policy and program. Hence project is the means to achieve desired objectives.

3.3 General Aspects of Hydropower Financing

The construction and financing of Hydro power project has traditionally been the domain of the public sector. However, private investment in and ownership of power generation

utilities have increased continuously in recent years. This is a consequence of a general liberalization of the power market in many countries.

Another factor in this development has been that funding from government and international agencies has become gradually more difficult to secure, making loans and equity capital from the private sector increasingly important in the financing of both thermal and hydro power projects. Compared to thermal power development, there are few examples of private sector development of hydropower projects. There are three important reasons for this:

1. The risk associated with investment in hydropower projects is often regarded as being higher than the risk of developing thermal power projects.
2. Hydropower projects requires large amount of fund.
3. The economic life of a hydropower project is often far longer than the repayment period for the loan.

Hydropower projects, i.e. those with a maximum output of less than 10 MW, often have additional features that make them less profitable and thus more difficult to finance than larger projects. Several of the cost components involved in developing hydropower project does not change proportionally with project size. For a large project the feasibility study normally accounts for 1-2% of total costs, while for a small project it may well amount to 50% of the cost. As the expected revenue of the project is small, there is little capacity to absorb unforeseen expenses. Consequently, the economic feasibility of a small project is very cost-sensitive and the risk is higher than for larger projects. Tight cost control is necessary to succeed. Experienced engineers who can quickly identify a sound project should perform feasibility and design studies, Equipment should be “off-the-shelf” standard solution. The relatively small investment involved in each hydropower project makes limited-recourse project financing difficult. This report discusses the most important financing alternatives and their implications for the developer and the ledger, and the distribution of risk between them. The report also attempts to identify possible ways of improving financing conditions for hydropower project.

3.3.1 Key Players

The parties involved will vary depending on how the project is financed. A large hydropower utility may design, construct and finance a new hydropower project with a minimum of involvement from other parties. In most cases however, the project will involve several

parties: developer, ledger, shareholders and contractors. This section provides a general discussion of the parties involved and their interests in the power project.

- Sponsor

The sponsor is the government agency or utility that is promoting a project. A private company that requires power may be the sponsor, but it may not want to build or own the plant. For large hydropower projects, the sponsor will normally be the national government or a government agency that wishes to improve the power-supply situation and to control the development of the power sector. For hydropower projects the role of the sponsor is often less important. The project may be a part of a national or regional electrification program with a government sponsor. However, in many cases the owners of the water rights develop the hydro projects.

- Developer

The developer is the most important participant in the development project. They must secure the necessary permission for the development, sign contracts with consultants, contractors and equipment suppliers, arrange a power purchase agreement (PPA) and secure the necessary financial resources for the development.

- Lenders

Normally a bank or other investment institution will provide most the financial resources needed, often in the order of 60-80%. The lenders may be agencies established for the specific purpose to facilitate investment in the national infrastructure, e.g. the World Bank. They will provide financing at more favorable terms than that can be obtained on the private market. Private agencies such as commercial banks and insurance companies can also provide funding for hydropower projects. However, as their main concern is to earn money, their interest rates will be higher and loan payback period is shorter. To obtain a loan the developer must convince the lenders of the project's economic feasibility and provide security for the lender's involvement.

- Investors

In most projects, bank loans will provide the largest proportion of the financial resources required. However, the last 20-30% of the financing, the equity capital, must be provided from other sources. This capital is poorly secured and has the lowest claim on the project's assets and cash flow. In return for taking this risk, the investors will expect to have strong influence on the project, high anticipated profits or other special benefits. The project may

be organized as a shareholder's company with the investors receiving shares in return for the equity they provide. Possible investors include:

1. Power utilities that wish to influence or control electricity supply in an area.
2. Industries wish to have access to power production utilities.
3. Local industry or local government agencies that provide venture capital to promote electrification in their area.
4. Financial institutions that are interested in long-term investments.

- Power Purchaser

The power purchaser will normally be a national or regional power utility or distribution company. It is also possible that the power will be sold directly to an end user, or to a power broker. The agreement between the developer and the user is spelled out in detail in the Power Purchase Agreement (PPA). It describes the amount of power to be supplied, prices and the price regulation agreement, and plenty clauses that come into effect if the conditions are not fulfilled. The PPA is extremely important for project development It is the lenders main security that shows the project will be able to pay its debts. Without it, limited-resource project financing is impossible.

- Contractor

The traditional approach to hydropower project construction has been to let separate contracts for the individual elements of the project. The developer will also need and engineering firm to plan and describe the project, and to control the project. As several parties are involved, it may be difficult to apportion the responsibility for cost overruns or delays. An alternative is to use a single contractor and sign a turnkey contract. The responsibility for completion normally lies then with the contractor, to whom the risk, or a large portion of it, is transferred. Financiers may insist on a turnkey contract to avoid the risk associated with project construction and performance. The contractor will demand a higher contract price in return for assuming the risk.

3.3.2 Financial Market

- Equity Finance

Investment for the project is done through the share capital for construction of the project is known as equity financing. Government policy allows a debt equity ratio of 50:50; however, the lending institution advocates a debt equity ratio closer to 70:30 as a prudent measure for lending.

- Debt Finance

Collection of money for construction of the project through the debt is known as debt financing. In raising debt for financing the power project, the cost of funds should be the lowest so that the ultimate cost of electricity will be cheaper for the consumers. The decision of the project promoter to go for equity or debt finance depends upon various factors such as government guidelines for power projects, incentives available and returns on equity as also the cost of debt equity.

- Domestic Capital Market

Debentures (convertible and non-convertible)/bonds are issued by government and public limited companies to increase the resources for power sector in the capital market. Presently, internal rates are deregulated and credit rating is mandatory if the maturity of instrument exceeds maturity periods. The area of project financing in the Nepalese context, is mainly limited to term lending institutions like finance company, commercial bank and development banks. The concept of loan syndication amongst the Financial Institutions is slowly starting in Nepal in these days. This also helps in sharing of risk among the Financial Institutions apart from saving on efforts and cost because of appraisal done by the lead institution.

- International Financial Markets

Due to limited domestic finance available for power projects, the need to tap international markets becomes inevitable which is characterized by long tenure of maturities and availability of various modes of finances. Nepal has yet to use international markets for financing hydro project.

- Multilateral Institutions

Institutions like World Bank, International Monetary fund (IMF), Asian Development Bank and Commonwealth Development Corporation (CDC) have traditionally been financing infrastructure in developing countries. The financing comes with restrictive covenants, affordable cost, and long tenure of usually more than 7 years and in an assured manner. The co-financing facility extended by some of the multilateral institutions is gaining popularity. In many of these loans, sovereign guarantee is required.

- Syndicated Loans

The specific features of syndicated loans are that they are available for medium to longer period; specific to the requirements of the borrowers to suit their projects and availability of floating rate of interest. Most of the investors are Asian/European banks, Financial Institutions, Insurance Companies and pension funds.

3.3.3 Financing Strategies for Hydropower Projects

This section considers the main financing alternatives for hydro projects, and discusses the implication for the developer and the lender. Thereafter the essential factors that must be considered when selecting the financing strategies are considered. The focus is on private market development, but a discussion of government incentives for promoting hydropower development is included. Financing alternatives and conditions will be discussed to optimum financial strategies.

3.3.4 Financing Alternatives

Financing can be a major problem in many hydro projects. In many cases, the developers neither have sufficient funds for self-financing, nor sufficient assets to provide security for a bank loan. In this situation, the developer can try to finance the project by securing loans against the anticipated cash flow of the project. However, this will require a series of complex contractual arrangements that are expensive to set up.

- Use of In-House Fund

The developers accumulated reserves may be used to finance a project. This may involve company in-house funds or personal reserves. As hydropower projects involves relatively large up front investments, the use of in-house funds as the sole source of finance is only possible for the smallest hydropower projects.

- Ordinary Bank Loans on Balance Sheet Financing

A bank loan supplies most the required capital (60-80%). Loans are secured against assets or property owned by the developer. Bank loans are relatively simple to arrange if the developer can provide sufficient security for the banks involvement. As the lenders interests as well secured the need for a tight network of contracts to control risk can be relaxed, making the financing structure more flexible. This reduces the time and cost involved in arranging the loan. In addition, god security for the lender will normally result in lower annual borrowing costs. However, this route is normally closed to a developer with limited financial resources.

- Co-development with a Financially Strong Partner

The project is developed as a joint venture with a financially strong partner. A strong partner may provide equity capital and offer security for bank loans (assets/property). In addition to their risk-sharing potential, the partners may also be selected based on their ability to provide expertise important for the project (engineering, finance and power market). A typical

example of co-development might be a farmer who owns a waterfall. A power utility in the area may agree to finance, develop and operate a hydropower project at the site. In return for this, the farmer may be allocated several shares in the project, a royalty payment or electricity supply.

- Limited Resource Project Financing

The principal difference between balance sheet financing and limited resource project financing is the way in which the bank loans are secured. In limited resource project financing, the future cash flow from the project are the lenders main security. These are two important reasons for using limited resource project financing. The developer may not have sufficient assets to secure a bank loan, or the developer may not wish to hear all the project risk involved in the development. As the lenders cannot rely on the liquidation value of the project (or sponsor) as a means of securing repayment, they will "take security". This involves exercising tight control over most aspects of the project development.

  - Charge over the physical assets
  - Assignment of the project contracts
  - Contract undertakings
  - Shareholder Undertakings
  - Insurance
  - Bonding

All aspects of the project will be arranged to control the risk for the lenders, who will wish to see evidence of the projects economic viability. They will require an independent technical report by a credible consultant. They will scrutinize important agreements such as power purchase agreement, the operating and agreement, and shareholder's agreement. The lenders will require contractors, suppliers and operators that have a strong record of accomplishment in their field.

Whenever possible the risk is transferred to third parties. A contractor working on a turnkey fixed price basis can be used to minimize the completion risk. A long-term Power Purchase Agreement mitigates the market risk. The lenders will even ensure that they have the right to step in and operate the project in the case that it is not paying its debts. Limited recourse project financing involves a series of complex contractual agreement. The initial arrangement costs are relatively high, which makes financing difficult for projects with a capital cost have less than US$ 5- 10 millions.

- Leasing

Leasing the assets is an alternative to ownership. A lease can be defined as: A contractual relationship in which the owner of the asset or property (the Leaser) grants to a firm or person (the lessee) the use of the property's services for a specified period. In 1980, the annual volume of the leasing industry was around 40 billion US dollars. In general, the types of leases available in the market today can be classified as either operating lease or financial lease. An operating lease is written for a short period of time, from a few months to a few years. The leaser assumes most of the responsibilities of ownership including maintenance, service, and insurance. The operational lease is not a long term financial commitment and is unlikely to be used for financing equipment in hydropower projects. A typical example is the rental of an office copying machine. A financial lease (capital lease) is a long-term contract by which the lessee agrees to pay a series of payments that in sum will exceed the purchase price of the asset, and provide the leaser with a profit. The lessee takes on the fundamental ownership responsibilities such as maintenance, insurance, property taxes. Normally the agreement is not cancelable by either party, but may provide clauses that allow canceling should certain circumstances occur. Upon termination, the asset is returned to the leaser. Leasing is most suitable for high volume standard equipment, and is rarely used to finance hydropower equipment.

- Build Own Operate (BOO)

In BOO project the owner of the water rights grant the development right to an independent developer. The developer controls the design, construction and operation of the plant. In return, he pays a fee to the right owner. In many cases, there is an agreement that the project will transfer back to the owner after a period – Build Own Operate Transfer (BOOT).

- Payback Using Electricity of Other Goods

As an alternative to paying the debt in cash, the lender may accept payback in electricity or other goods, for example, a company with high power consumption may agree to finance a hydropower project. In return, it receives electric power from the developer.

- Suppliers Credit

Suppliers are often willing to provide financing for their equipment. The purchase price is often closely linked with the financing terms. The conditions are subject to negotiation and a competitive situation can significantly improve the terms available.

3.3.5 Factors Affecting the Financing Strategy

Securing financing may be a major obstacle in developing a hydro project, and the efforts involved should not be underestimated. In this section, several questions affecting the choice of financial strategy are discussed. The principal question for the developer is should the project be financed using in house funds, by co-development with a financially strong partner, by ordinary bank loans secured against the developer's other assets or property, or by limited-resource project financing? The financing strategy will affect the developer in several ways. Risk, revenue and control over the project are all closely related to the financial arrangements. The developer's financial resources are the first thing to consider. A financially strong developer can use in house funds or ordinary bank loans. This gives a large degree of control over the project, which may be an important consideration, particularly if the project is a part of the developer's core activity.

However, it also means trying up financial resources for a long time. With fewer financial resources, the developer must look for other routine of financing. The size of the debt component is important when considering limited resource project financing of hydro projects. The high arrangement costs make small projects unattractive to project lenders. However, limited resource project finance ought to be available for projects in the upper segment of hydro, i.e. 5-10 MW.

Co-development with a financially strong partner may be the only option for financing a hydro project. At an early stage, the developer should consider possible partner for co-development. It may be worth approaching companies that are already involved in the operation of hydropower. Such companies are well qualified to judge the feasibility of the project and will already possess much of the expertise necessary for developing the project in house. Management of the of the project risks is another important consideration. In general, a high level of debt means a high cash flow risk. Debt service has first claim on project earnings. The developer will receive revenue only if there is a surplus after interest and repayments. The size of the financial obligation is important if the project is a failure. If the project fails, the developer in the case of in house funding or ordinary bank loans carries all the losses. Using the same methods as in limited resources project financing can mitigate much of the risk. However, the developer should consider the consequences if the project is a failure. In project finance, the cash flow risks are higher, but the involvement is limited. In non-resource project, the involvement is limited to the equity. In a limited resource project the developer has accepted additional undertakings, but the involvement is still limited. The

developer will have to pay a price for reducing the risk. The arrangement costs are high and third parties accepting a risk will require a premium. The developer's desire to control the project is also affected by the financial arrangements. With a high degree of equity control of the project will remain with the developer. With much unsecured debt, the financiers will control the project until it has been repaid. If control over the project development is important to the developer, he must also accept a larger financial involvement.

3.3.6 Financing Conditions

Financing conditions depend on the individual project, the financing institution, and the general conditions in the bank market. For this reason, any discussion of financing terms must be rather general. In general, 50% to 80% of the total cost can be provided as debt. The level of debt that is acceptable to the lender depends on how the loan is secured a large debt component means increasing the lenders risk. In turn, this results in a higher interest rate. An ordinary loan is characterized by three components:

- The Interest Rate
- The Loan Life
- The Grace Period

Normally the interest rate floats and varies with changes in some benchmark loan rate. Mitchell and Macke Ron indicate that personal bank loans in UK may be made at 2-4% over the base rate, while "On-Balance Sheet" loans will be made at 0.5-5% above the base rate plus an up-front fee. Limited-resource project finance will entail a banking fee of approximately 1% of the total banking capital cost and an interest rate at least 1-2% above the base rate. Development institutions may provide loans with repayment spread over 10-20 years. Loans in commercial banks have a typical repayment time of 10 years, with 13-15 years as maximum. For limited-resource arrangements several additional elements must be considered:

- Initial arrangement fee: The financiers will require an up-front fee for covering the arrangement expenses of financing.
- Undertakings: The lenders may restrict the payment of dividends to shareholders. This is done to provide a buffer against unforeseen problems and may amount to half a year of debt service. Payment of dividends may also be cancelled in case the project is performing badly.

- Conditions precedent: Several conditions must be met before the loan can be drawn. Normally this requires that all contracts be to the bank's satisfaction that all permits are in place, the existence of a favorable review from an independent technical consultant, all insurances in place.
- Fees to external experts: The financiers will require all fees to external legal and technical advisors to be paid by developer.

3.3.7 Key Points in Successful Financing

Obtaining financing is a critical activity in developing a hydro project. Financing Renewable Energy Projects (1993) lists the following key points for successful financing:

- Consider the Need for External Advice

The developer should seek professional advice at an early stage to determine how to arrange the financing. Key advisors are financial, legal and technical advisors. Consulting with the professional people, decisions should be made for least cost of financing.

- Verification of Available Resources

Lenders will wish to see evidence of the water flow available for power production. Reliable assessment of the water flow may be difficult, at hydro projects. It is suggested that flow gauging should start as early as possible, at a location close to the likely intake site. The developer should have at least 12 months of flow data. Correlating them with long term stream flow or rainfall data from nearby gauging stations should extend the flow measurements.

- Careful Structuring of the Contractual Arrangements

The developer and his advisors should analyze the project risks and develop a plan for apportioning these risks. The principal agreements that the developer should focus on are:

  - Engineering, procurement and construction agreement
  - Power purchase agreement
  - Operating and maintenance agreement
  - Site agreements
  - Shareholders agreements

- Early Attention to Planning and Consents

A checklist of all the permits necessary for the development must be drawn up, and a plan developed as to how these permits and consents will be obtained.

- Approach to Lending Institutions

If the decision is made to utilize project finance, the developer in conjunction with his financial advisor should carefully select which lending institutions to approach. The local branch or the bank will not usually be equipped to deal with project financing other than small transactions. It is important to contact the specialist energy or financing group at head office. The best time to approach the lenders to request a formal commitment is when the contractual arrangements have been substantially negotiated (but not finalized) and the major development milestones have been met.

- Information Memorandum

The information memorandum is a business plan that gives the prospective lender a full picture of the project. It is an essential document that should be carefully and thoroughly prepared, as it is the principal means of attracting the lenders interest in the project. An information memorandum should include the following:

  - Project Summary
  - Overview of financial plan, sources and uses of funds
  - Term sheet that describes the financial package as the developer expects the loan to be Structured
  - Description of development plan
  - Description of the principal contracting parties
  - Summary of major project contracts
  - Summary of principal licenses and permits
  - Summary of risks
  - Financing evaluation which describes projected cash flow and project debt repayment for several scenarios.

Independent Power Producers continued to play an important role in the power hydropower sector contributing to almost 21% of the total installed capacity with addition in the system of the 7.5 MW Indrawati III Hydropower Project. The continued interest shown by the private sector investor in the generation sector is encouraging but presently limited to small plants not exceeding 10 MW.

Table 3.2: Financing of the Private Projects (In Millions)

Name of Project	Year	Project Cost (USD)	Foreign Part	Local Part	Cost Per MW (USD)
Andhi Khola, 5.1 MW	1990	3	3	0	0.42
Jimruk, 12 MW	1993	10.7	10.7	0	0.89
Khimti, 60 MW	2001	133	127	5	2.22

Chilime HEP, 20 MW	2003	31.6	0	31.6	1.58
Piluwa, 3 MW	2003	4.03	0	4.03	1.43

Source: *Nepal Electricity Authority – Library*

Table 3.3: Comparison of Hydropower Cost

Country	Cost per KW (USD)
China	1502
India	2061
Nepal	4346
Papua New Guinea	1925
Mynman	2719
Srilanka	4451
Bhutan	1000

Source: *Nepal Electricity Authority – Library*

Table 2.3 shows that Nepal has high Project cost per Kilowatt and Bhutan has the least cost among the countries compared. The reason behind the high cost may be the dependence on foreign investment, foreign equipment and technology and interest cost of debt. But slowly Nepal has started to produce hydroelectricity in low cost by the private sector like Chilime and Piluwakhola Hydropower Project.

3.4 Hydropower Sector Organization

The main institutions in the power sector include the Ministry of Water Resources (MWR), the Department of Electricity Development (DOED), the Nepal Electricity Authority (NEA), and the Electricity Tariff Commission. The National Planning Commission (NPC) and the Water and Energy Commission Secretariats (WECS) have a major input in power sector policy and planning and review the progress of major development projects. After 1990 Economic liberalization and policy of private sector involvement in hydropower sector in Nepal, The Ministry of Finance and other relevant ministries are involved in discussions in the project approval process. Department of electricity development and NEA are the two authorities involve with the private sector issues mainly, the first one is the HMG/N body to issue license and other government policies and second one to sign PPA and purchase electricity and pay for it.

3.5 Hydropower Potential in Nepal

The geographical constitution of Nepal, with great variations in altitude from the High Himalayas to the lowlands of the Terai over a relatively narrow width combined with abundant snowmelt and monsoon water offers tremendous energy potential for generating hydropower. A small country like Nepal accommodates some of the significant tributaries of the mighty Ganges. The major river basins of Nepal are Koshi, Gandaki, Karnali and Mahakali.

The average annual precipitation is about 1500mm, 80% of which occurs during the monsoon season (June-September). The gross theoretical hydro potential of Nepal's rivers, based on average flows has been estimated at 83,000 MW as shown in the Table 2.4 below. Potential sites are expected to generate 51% of this theoretical potential on economically feasible terms. Water is one of Nepal's chief resources. There are numerous small lakes and over 6,000 small and big rivers. In the upper and middle reaches, the rivers typically flow in narrow valleys with sharp falls, which provide excellent opportunities for run-of-river type hydroelectric power development. In contrast the valley configurations in the lower reaches before the river debouche onto the southern plains provide favorable conditions for storage type development. The total available surface runoff is 224 billion and the rechargeable groundwater potential, 12 billion. The rivers of Nepal contribute up to 45 percent of the total run off the Ganges River. The snow-fed Karnali, Gandaki and Koshi are Nepal's major river basins; with 71 percent of the total catchments in Nepal, they collectively contribute 71 percent of the total runoff in the country. The Babai, West Rapti, Bagmati, Kamala and Karnali rivers originating in the lower Himalayas are also important rivers contributing 18 percent of the total runoff. In addition, there are numberous small rivers and rivulets suitable for small hydro development.

Table 3.4: Hydropower Projects Identified for Development & Planned Proposed

Projects	Capacity (KW)
Seti- West	750000
Arun III	402000
Budhi Gandaki	600000
Kali Gandaki II	660000
Lower Arun	308000
Upper Arun	335000
Karnali (Chisapani)	1080000
Upper Karnali	300000
Pancheswor	6480000

Thulo Dhunga	25000
Tamur-Mewa	101000
Upper Trishuli	60000
Dudh Koshi (Storage Type)	300000
Budhi Ganga	20000
Rahughat Khola	27000
Likhu-4	40000
Kabeli "A"	40000
Upper Marsyangdi "A"	121000
Upper Trishuli 3B	44000
Andhi Khola (Storage Type)	180000
Khimti II	27000
Hewa Khola	10000
Langtang Khola (Storage Type)	218000
Madi Ishaneswor (Storage)	86000
Upper Seti (Storage)	122000
Kankai (Storage)	60000
Upper Tamakoshi	309000
Upper Modi "A"	42000
Total (KW)	**22567000**

Source: NEA Bi-Annually Paper–VIDYUT-2064

Nepal's reliance on its water resources, particularly for hydropower is basic and will continue far into the future. Nepal wishes to expeditiously harness and properly manage and share this resource to meet the ever-growing need for various uses of water and clean energy both in the country and in the sub-continent to achieve economic prosperity and a better quality of life for the people.

3.6 Comparison between Hydropower and other Sources of Energy

We look briefly at the various energy options, and see how they compare with hydropower. Whether we like it or not, across the world there will still be a dependence on fossil fuels because of the scale of future energy requirements, and because there is a tendency particularly today with the increasing participation of private developers for the 'easier' option. In comparison with hydro, thermal plants take less time to design, obtain approval, build, and recover investment. But once build they have higher operating costs, typically shorter operating lives (about 25 years) and they are of course major sources of air, water and soil pollution and greenhouse gas emissions.

In parts of the Asian region where there is still a strong dependence on thermal power generation, air quality problems are evidenced clearly by frequent smog, and damage to crops caused by acid rain. Nuclear power is still considered an additional option in some

countries, but past accidents at Three Mile Island in the USA, and Chernobyl in the former USSR- the latter having had both local and very widespread catastrophic effects also gave signals to the world about the potential dangers which can be associated with this technology, and while some countries have quite a high dependence on nuclear power, such as France, for example, there is also quite a widespread public rejection of it, with many countries having a moratorium on future nuclear development. Therefore, the renewable sources of power, while they clearly face economic disadvantages compared with fossil fuel based plants, have a great many advantage to offer our planet, and they should not be in competition with each other, but should be regarded as complimentary.

Some other renewable sources in addition to hydropower can be promising for the future, especially wind and solar power. A significant potential has been identified for both in some regions, but today they are still major shortcomings: first, even if major efforts were made to develop them, they could not produce the large amount of power which will be necessary for future decades, or to offer the same level of service. As they are both intermittent sources, it must be remembered that they require some sort of back up supply and in many cases these may have adverse environmental impacts, which must be taken into account.

After hydro, wind power is probably the renewable source with the greatest potential according to UNDP up to 50000 TWh/year. Quite a few countries have invested in wind power developments, for example Spain, Morocco, Germany, Denmark, USA and Australia. But apart from the problem of intermittent supply, another point, which should be acknowledged, is that wind power is not without its environmental impacts and if implemented on a large scale, it would certainly face some opposition from the green NGOs. Finally, in comparing the various options, coming back to the point that hydropower, particularly when developed with a storage reservoir, is the only source of power, which can offer additional benefits, such as irrigation, water supply, flood control, fisheries development, and recreational facilities.

The Upper Karnali Hydroelectric Project in Nepal with an installed capacity of 300 MW and generating annually 1,874 GWh will cost about US $486.6 million (at 2001) price and will have an annual operating cost of only US $5.5 million. An alternative combination of combined cycle and gas turbine thermal power plants of 388 MW will cost only US $273.1 million while its annual operating cost including fuel will be US $ 139.3 million to generate the same amount of energy as the hydropower project. The Karnali (Chisapani) Multipurpose Project with an installed capacity of 10,884 MW and generating 21,496 GWh (including re

regulating power plant) will cost about US $ 5,836 million (at 2001) price and will have an annual operating cost of US $58.4 million. An alternative combination of coal fired and gas tubine thermal power plant of 13,300 MW will cost about US $8,939.5 million while its annual operating cost including fuel will be US $1,288.7 million to generate the same amount of energy as the hydropower project. The above two cases clearls that hydropower projects are not expensive besides its numerous advantages over thermal if the size of the plant become larger.

3.6.1 Advantages of Hydropower

The following are the advantage of hydropower over other sources of Energy**:**

- Non-Polluting: It is a non-polluting source of energy with high conversation efficiency and does not contribute to Green House Effect whereas to generate billion units by thermal generation; one million ton of carbon dioxide is released into the atmosphere. Conversion efficiency of Thermal plant is also about 40% against 85% of Hydro which means that for every one million units actually generated, 1.5 million are being wasted and thrown into atmosphere.
- Multi-Purpose: Storage type Hydro projects provide addition benefits of flood control, irrigation, drinking and industrial water, navigation and tourism. The low temperature water from the reservoir is provided to a super Thermal Plant downstream for meeting its requirements.
- Cheap Power: As compared with other sources, generation cost of hydropower is quite less. It becomes cheaper with passage of time. With the passage of time the present-day cost of generation is $1/666 as compared to $1/20 with thermal station set up during the same time. With the passage of time the cost of generation of project will remain almost same whereas that of the old thermal plant will go on increasing.
- Longer Life: As compared to life of 25 years of Thermal plant the envisaged life of hydro plant is 35 years. But in actual the life of hydro plant is much more and with minimum renovations, the life of hydro plant can be enhanced considerably.
- Reliable Source: As the hydro plants can be started/synchronized and raised from no load to full load in minutes, as they can pick up and drop load as per requirement of system and as their forced outages are rare and as they require minimum minute. The hydropower can be well described as reliable source of energy. The plant availability in case of hydro plant is generally of the order of 85% and as compared to thermal we can

avail the same benefits and results if we set up hydro plants of capacity of 66% the thermal capacity. Due to above facts, hydro plants contribute substantially to overall system stability and reliability and results into optimum operation of system.

- Overall Development: As hydro plants are located in difficult area their setting up improves the Road Rail link communication; they provide employment and gear up the economy of that region.

3.6.2 Challenges and Issues on the Domestic

Around 40 percent of the population has access to some form of electricity, the major of energy consumption being in the urban areas. In a steep terrain country like Nepal with dispersed villages in the hills and mountains, electrification is very costly. This situation poses challenges in managing the financial resources to expand the electrification network.
The electricity tariff in Nepal is high and is beyond the affordable capacity of many of the consumers. The reasons are manifold. The basic infrastructure is not well developed often includes infrastructures such as long approach roads transmission lines and so on. The majority of equipment and materials also have to be imported, which requires foreign currency and transportation overland for a long distance from the port. The major share of the financing for the projects is from external loans and investments which are to be paid back in foreign currency escalate the tariff further. The challenges lie in developing cheap and reliable hydropower projects so as to keep the tariff within the reach of everyone. Nepal Government is, therefore, undertaking power sector reform measures with a view to bring about improvements to remedy the situation.
It is encouraging to note that the private sector is gradually entering the power market. The local banking sector's interest in forming consortiums with private developers and in the case of Piluwa Indrawati, small Sunkoshi and Khudi projects also heralds a new dawn on the horizon despite present security situation. The main challenge to the private sector is the transfer of technical know-how and easy access to the international markets for financing mechanisms. The domestic demand over the forecast periods of 25 years is relatively small, limiting many developments. The challenge lies in the ability to establish several energy intensive industries and transport system within the country for creating a greater demand for hydroelectricity, which will lead to a higher energy growth rate than the load forecast. A break-through along this line will provide ample opportunities for development of this clean and renewable energy.

Nepal's own resources both in the public and private sector cannot meet the financial investment needed for hydropower development. A large investment is requiring from foreign development agencies and private sector entrepreneurs. Although significant foreign investment has been attracted in recent years, much remains to be invested for meeting both internal demand and the significant potential for the export of power.

3.6.3 Potential for Cost/Efficiency Improvement

There is a significant potential in Nepal for cost and efficiency improvement in hydropower harnessing. The major features of such an improvement are:

- There is a need for increased use of local financial resources in project development project development for domestic power needs through indigenous resources will reduce the vulnerability of foreign exchange risk to a large extent.
- Project selection based on screening and ranking with sufficient alternatives would make the project more efficient. In the past, some projects in Nepal had to be selected due to lack of sufficient alternatives. At present a number of projects have been studied to feasibility level, which provides sufficient alternatives.
- Enhanced use of domestic manpower and manufacturing base for planning design and construction of hydropower projects will not only increase the manpower skills but will also reduce the cost that Nepal has currently being spending in obtaining such services from outside. Now Nepal has more than 600 engineers that have multiple skills and vast experience in such activities. Local construction and manufacturing skills have been considerably improved after the successful completion of several medium sized projects in recent years in the public and private sectors. This capability needs to be effectively utilized for future project development on a wider scale.
- Transmission line development particularly along the north – south corridor will enhance the attractiveness of hydropower schemes, which are located mainly in the remote north of the country. In this regard, NEA has studied six north-south corridors, of which the Shivapur-Tamghas-Modi and the Damak-Phidim-Hille corridors are studied at feasibility level.
- Project development of higher capacity will have benefits of economy of scale is a sufficiently competitive institutional environment can be fostered.
- In the changed scenario, system planning criteria for domestic power projects must be reviewed.

- Optimization of power plants capacity with the export potential to be considered future power purchase/sale agreements should make provisions for the domestic market as well as for the export market.

In this context, three categories of interconnections will be coming up in near future: (1) IPP selling power to NEA using NEA grid, (2) IPP directly signing PPA with Power Trade Corporation, India (PTC) wheeling power through NEA grid and (3) IPP's dedicated transmission lines for export to India. Domestic hydropower projects with potential for export of power at present the generation expansion plan is prepared for domestic power requirement only, with the recent agreement of high voltage interconnection with India, the export potential from the domestic projects should also be considered for optimizing the plant capacity.

River Valley Development: As per the tenth five-year plan strategies, river basin development approach should be under taken which will optimize the cost of development of infrastructure (Access road, transmission lines and communication) Project development and construction costs. This approach will help in reducing the tariff of such hydropower projects and hence enhance their visibility.

In addition, this strategy will help in fulfilling the local communities economic/social necessities of drinking water, irrigation, communication, tourism, health and education.

3.7 Scenario of Financing of Hydropower Projects

By the year 2050 A.D. the world population is expected to increase by 50 percent, from 6 to 9 billion. About 7 billion will live in developing countries. Everyone in the world is entitled to development, as a basic human right, and there is no possibility for development with adequate electricity supply. After clean air and water, a reliable and constant electricity supply is probably the most fundamental requirement for a reasonable standard of living today. It is critical because of its role in education (light, radio and television) and for the food processing industry and for health services. Today, as we move further and further into the age of information technology, and begin to become a "Digital Society", a reliable electricity supply has become crucial for most functions of modern society.

According to the World Energy Council, an additional 400 million people born over the next 20 years will be added to this figure. These will be mostly in rural areas of developing countries; parts of the world with the greatest amount of unexploited hydro potential.

To provide energy accessibility to all these people, almost 100 million people would have to gain access to modern energy services each year for the next 20 years. This contrasts with the 40 million people per year who were supplied with commercial energy between 1970 and 1990, and the 30 million per year since then. This means that efforts must be tripled. While annual per capita consumption of electricity is more than 26,000 KWh/year in Norway, nearly 14,000 KWh in the USA, and nearly 18,000 KWh in Canada. It is less than 100 KWh in many African nations and 47 KWh in Nepal. We know very well that even the development of all available hydro potential would still be insufficient to meet the needs of many countries. But clearly, great efforts should be made to maximize the use of hydro, together with other renewable resources, to minimize the use of alternative energy sources, which will be detrimental to the environment. The potential of renewable energy resources appears to be very significant and it would be prudent to try to develop all of them. Hydropower is still producing about 20 percent of the worlds electricity, and the share is likely to remain at about this level. The total technically feasible potential is more than 14300 TWh/year, and the total economically feasible potential is estimated at 8100 TWh/year (of which about 2600 TWh/year is already developed) leaving about 5500 TWh/year for possible implementation. There is about 700 GW of hydro capacity in operation and about 108 GW of hydro capacity under construction in at least 80 countries. In many cases, the hydro plants are developed as part of multipurpose water resources developments and so they are providing the additional benefits of irrigation, water supply, flood control, improved navigation and recreation. Hydro provides at least 50 percent of national electricity in 60 countries, and more than 90 percent in 24 countries, and virtually all the electricity in 12 countries.

3.8 Hydropower Financing & Risk Mitigation

Financing of any project/work involves getting the money and investing it in the implementation of it. Largely, this holds true if such project is being implemented as a government project or grand funded project This aspect can be deemed to be project financing in a wider sense.

Hydropower has the specificity to be a capital-intensive technology with long lead times for development and construction (and on top of this each project has to be tailor made for its specific location, leading to additional complexity). All these parameters have an impact on how hydro power plant projects are financed.

First hydropower has a very capital intensive cost structure. Each electrical energy generation available (solar panels, wind turbine, diesel generators, hydropower) has its specific cost structure: some energy sources will need an important initial investment (referred to as Capital Expenditure CAPEX) but relatively low operating costs (as it is generally the case for hydro but also other renewables like wind or solar), for some others the investment will not be as big but operating costs (called OPEX, and which include fuel costs, if any, Operation and Maintenance costs – O&M – as well as replacement costs) might be very high (diesel generators, who have to pay for their fuel). A good comparison of capital intensity is the specific investment cost – a diesel generator will cost $600 to $1000 per installed kilowatt of capacity, whilst a hydro plant may cost $1500 to $4000 per kilowatt. For instance, in Nepal, the Upper Trishuli 3A project (now under construction) has a capacity of 90 MW for an investment of $132 million, or $1,467/ KW. On the other hand, whilst a hydro power plant wont consume any fuel, a 1 MW diesel engine will consume 250 to 300 liters of diesel per hour – at any cost in excess of $1 per liter in most countries, especially in rural areas.

Before the promulgation of Hydropower Development Policy, 1992 hydropower projects were implemented as public sector project. Main sources of funding for the purpose were grant and soft loan. Grant funding from donor community tended to be expensive as donors attached various strings to the grant. Similarly, the impact of soft loan was always hard due to foreign exchange risk inherent in the depreciation of local currency.

Whereas, private sector would fund implementation of hydropower project with owner's own equity supplemented by debt from financial intermediaries (FIs). The public private partnership modality has also been used for the implementation of hydropower projects. Various types of public private partnership range from assets creation by the private sector under a concession granted by the government to management of public assets.

- Financial Engineering

Especially with a hydropower project, financing it is a matter of financial engineering, supplementing civil, electric and mechanical engineering, which comprise an integral part. Financing it is a little more than "have money and will spend" and the core issue is accountability; with regards to generating return on investment and with regard to debt servicing. Financing involves sourcing fund, investing it prudently with assurance of recovery. Successful financing depends on risk management and on how the security is perfected.

- Financing Scenarios

Theoretically it is also possible to implement a hydropower project with full equity financing which depends on availability of own money or grant for using as equity. Hydropower being capital intensive, coupled with a long gestation period, full equity financing of it is rather rare. Because the equity holder will be exposed to the full risk of the project. However, this modality of financing is not preferable for ability to leverage with high "debt to equity" ratio results in higher rate of return on equity compared to rate of return on the project. Equity can also be raised from public as ordinary equity or preferred equity. These instruments enable a developer in extending the ability to leverage bigger loan.

Equally rare is full debt financing which is possible where the borrower can provide full collateral covering the loan amount or third party guarantee (surety) is available. It is possible to secure full debt financing if the borrower enjoys high credit rating. Primarily the lender or the surety is exposed to the full risk of such financing. It is rare for a financial intermediary to provide debt without any security (unsecured debt). Fund can also be mobilized for hydropower financing by issuing bond and or debenture.

The middle path is a mix of equity and debt; the proponent putting in some equity and borrowing the rest. The proponent will be required to provide repayment guarantee for debt in the form of collateral and/or third party guarantee. However, as hydropower is capital intensive, it may not be possible and/or desirable to provide collateral/guarantee. The way out is to go for "project finance".

- Mechanism and Mechanics of Perfecting Security

Success of project finance depends on arrangements during construction period, post commissioning (debt servicing period). The arrangement is also necessary to provide robust and sturdy safety net and proper documentation. Therefore, following factors must be considered in loaning money on project finance basis for a hydropower project:

1. Expenditure – watertight arrangement during construction purpose:

- Assign all contracts/agreements, inter alia, related to construction, supply, transportation, erection/installation, consultancies (design, engineering, supervision, etc) to the lenders so that the lender(s) is/can continue to complete implementation and operation of the project, in the case of default by the borrower, by being able to step in the shoes of the borrower or have someone do so on the lender's behalf.
- Ensure that the borrower company's equity holders inject their equity during the implementation of the project.

- Ensure that both debt and equity for the project is injected into a dedicated bank account, on which the lender has first lien, and outflows from this account is closely monitored by the lender.
- Ensure that proper contractual arrangements are made such that (a) cost overrun and (b) time overrun is effectively avoided. (Time overrun tends to be more expensive due to additional interest during construction, loss of revenue and even penalty to NEA for delayed delivery of electricity)
- Ensure that there are no gaps and cracks between various contracts/agreements which could become reason for increase in the total project cost.
- Payments for the implementation should to be closely supervised by FIs.
- Ensure that the borrower company has or can access necessary contingency fund to complete the project even if the project cost goes up due to unforeseen reasons.

2. Revenue – watertight arrangement for commercial operation; debt service period

- Assign PPA to the lender(s) with the Nepal Electricity Authority consent
- Ensure that the revenue stream received from NEA is directed to a bank account specified by the lender. NEA will have to be approached to for their concurrence.
- Designate such a bank account as an "escrow account" in which the lender shall have first lien. The borrower is to be allowed to open accounts in banks only with concurrence of the lenders.
- Allow the developer to withdraw money from such account without any hindrance only to the extent necessary to operate the project plant and to maintain the plant in top condition pursuant to "prudent operating practices".
- Money to be automatically transferred to the lenders for their debt service (both principal and interest thereon) on specified dates.
- Allow the developer to withdraw money from the account for the distribution of dividend to its shareholders, to the extent permissible based on fund balance in the escrow account after leaving an amount necessary to meet on debt service obligation in the immediate future.

3. Robust and sturdy safety-net

- Ensure that all necessary insurance policies are put in place to cover all exposures to all possible risks (e.g. CAR, EAR, TAR, ALOP, increase in cost due to devaluation, contractors' equipment, third party liability, comprehensive workman's compensation,

professional liability and so on so forth). The words of the proposed insurance policies to be finalized in consultation with the lender.

- Ensure that the lender is mentioned in such insurance policies as the co-insured, to provide for the eventualities emanating from default by the borrower.
- Ensure that the project's cost estimate has adequately budgeted for the payment of insurance premium.

4. Documentation

- Execute loan agreement between the lender and the borrower to sign off on the arrangements agreed and put in place as listed above.
- Include following in the loan documentation as collateral:
  - Project's all tangible assets
  - Project's all intangible assets; inclusive of all licenses, contracts, agreements necessary for the implementation and operation of the project.
- Have such agreement "registered" wherein all tangible and intangible (various contracts, agreements, license, etc) assets are mortgaged against the loan enabling the lender to foreclose without having to resort to court of law.

- Risk Management

Management of risk involves identification of various risks associated with a project and assessment thereof. However, the most important step lies in arranging measures to mitigate such risks including an effective insurance program. Simply put, risk management entails shifting and/or sharing risks. Let us look at certain important risks from the perspective mentioned here.

- Foreign Exchange Risk

There are mainly two ways a developer could be exposed to foreign exchange risk. A developer can borrow locally or from foreign institution and the conditions regarding security will be same. However, the borrower's exposure to certain risk will be different. Foreign exchange risk is inherent in foreign loan due to fact that foreign currency tends to be relatively strong compared to Nepali currency. This risk materializes with devaluation if revenue is denominated in local currency while having to service the loan denominated in foreign currency. This risk can be mitigated by (a) either having the loan denominated in local currency or (b) rate of revenue denominated in foreign currency.

Similarly, this risk may also be manifest in rising cost of imports. Now a day insurance coverage could be arranged against cost escalation due to declining value the local currency.

A foreign investor is also exposed to this risk if the currency of the host country is weak and is subject to devaluation vis-à-vis his own currency. Foreign investors have insisted on denominating the revenue stream in hard currency to avoid being exposed to this risk.

- Repatriation Risk

Another risk associated with foreign loan is "repatriation risk". This becomes of greater concern to a lender whether it will be able to repatriate the proceeds of debt servicing. Generally, governments of developing countries, in their quest to attract foreign investment, have enacted legislation guaranteeing repatriation. If such a guarantee is not available, either the lender will not make a loan or will make it subject to exorbitant rates of interest. In Nepal, repatriation is guaranteed by Foreign Investment & Technology Transfer Act, 1992 and Electricity Act, 1992 for hydropower projects.

- Sovereign Risk (Country Risk)

A foreign entrepreneur investing in Nepal is exposed to risks such as those associated with the governments creditworthiness, the possibility of expropriation and nationalization, changes in the local political environment, and enforceability of contracts. These types of risk are known as sovereign or country risk. Multilateral Investment Guarantee Association (MIGA), a member of the World Bank Group does provide insure against such risk at a fee. However, the availability of such insurance is limited only to foreign investors.

- Interest Rate Risk

It is now time we also touched upon the concept of interest rate risk. Lenders offer two kinds of interest rates: (a) floating rate and (b) fixed rate. Floating rate entails changes in the interest rate during the term of the loan, thereby introducing an element of uncertainty or risk fro the borrower. Banks prefer floating rate as they need to be able to adapt to changes in financial market as well as to cover their own exposure to the vagaries of changing interest rates (including bank rate). For a developer fixed rate is the best way to mitigate this risk. However, banks tend to add a margin to the then prevalent rate to cushion their own risk if they are asked to offer fixed interest rate.

- Inflation Risk

The real value of a unit of nominal currency tends to depreciate over time with inflation. This phenomenon is universal – irrespective of strong or weak economy of the host country. Even hard currency is subject to this risk. Escalation in the rate of tariff is the only answer, as it is not possible to hold down the inflation at any cost.

- Legislative Change Risk

This is regarding the risk of changes in the country's laws that (a) increases rates and taxes or other expenses and liabilities (b) reduces revenue of the project or (c) reduces the value of the assets. Such changes impact the viability of a project adversely. Generally, an entrepreneur must take such risk. However, it can also be mitigated by passing the impact through to the utility provided that the utility is amenable to such pass through.

- Market Risk

It is common knowledge amongst engineering community that energy requires guaranteed market due to the constraint regarding, primarily, storage and transmission. A simple way to mitigate this risk is to sign a long-term Power Purchase Agreement (PPA) with the utility.

- Revenue Risk

A developer can have a long term PPA but such a PPA also may not ensure plant load factor at a specific level if the utility accepts delivery of the energy at its pleasure, mainly in the case of a run of the river type of project. This means there may not be a guaranteed stream of revenue to the project for it to meet its financial obligation regarding (a) operation, maintenance and repairs, (b) debt servicing (c) and assuring a reasonable return on investment to the investors. "Take or pay" type of PPA mitigates this risk which entails the energy off taker accepting dispatch of all contract energy and if unable to accept as such then paying for all contract energy even if it is not able to dispatch full quantum of such energy.

However, with respect to both market risks and revenue risks, it needs to be noted that people are not only setting up merchant plants but the electric energy is also being traded in the spot market in Western countries.

- Payment Risk

This risk emanates from the lack of creditworthiness on the part of the utility, buyer of the energy. In many developing countries, state-owned utilities do not have established credit histories and suffer from records of poor management, over-employment, high leakage (technical or otherwise), etc.

Developers are known to ask the government to issue counter guarantee to cover for the payment risk. This basically entails a government sanding surety to ensure that the utility pays its dues to the developer in time and in the case of the utility's failure to meet its obligations the government is required to promptly make payments to mitigate the delinquency of the utility. Now a days multilateral funding agencies like the World Bank take a dim view of a government issuing counter guarantee. Having a letter of credit put in

place by the utility with the IPP as the beneficiary is another way of mitigating this risk for short term.

- Construction Risks

Time and cost overrun risks is one group of construction risk of which time overrun risk results in loss of revenue as well while it also raises total amount of interest during construction of the debt financing and may even attract penalty for late delivery of energy. Other construction risks are force majeure risk, socioeconomic/environmental risk, geological risk, performance risk, design risk, etc. One can arrange insurance coverage against such risk like contractors all risk (CAR), transportation all risk (TAR), erection all risk (EAR), professional liability, etc. including "advance loss of profit insurance" which can be complemented by signing a "fixed price" turnkey contract and incorporating a clause for imposition of liquidated damages on the contractor for delayed substantial completion or commissioning of the plant.

An investor also does face risk due to gaps and cracks between various contracts if there is more than one contract for the implementation of a project. This can be mitigated by signing engineering, procurement and construction (EPC) contract.

- Hydrological Risk

The "take or pay" nature of the PPA guarantees the fact that all energy produced by a plant, depending on the availability of water, irrespective of whether the season is dry or wet shall be turned into cash. However, if there is no water to generate energy due to the change in the level of precipitation climatic reason or change in the hydrology of the catchment area then these projects are on their own. This risk emanates from the fact that seasonal rainfall patterns affect the amount of water available to a hydropower plant and generation may fall below contract levels in any season, thus threatening the revenue stream of such projects. Obviously, a dry year will be an unmitigated disaster for a hydropower plant. The most effective way to mitigate hydrologic risk is to gather hydrological data for a reasonable number of years in the past and design the project accordingly after having selected a project with better hydrological potential as well as information.

3.9 Review of Related Acts/Plans

3.9.1 Hydropower Development Policy, 1992

Regarding different models of investors participation for the hydropower development in Nepal, the government of Nepal has formulated the hydropower development policy 1992.

In this policy, the Government of Nepal has declared as investment may be made for the projects relating to generation, transmission and distribution of hydroelectricity as follows:

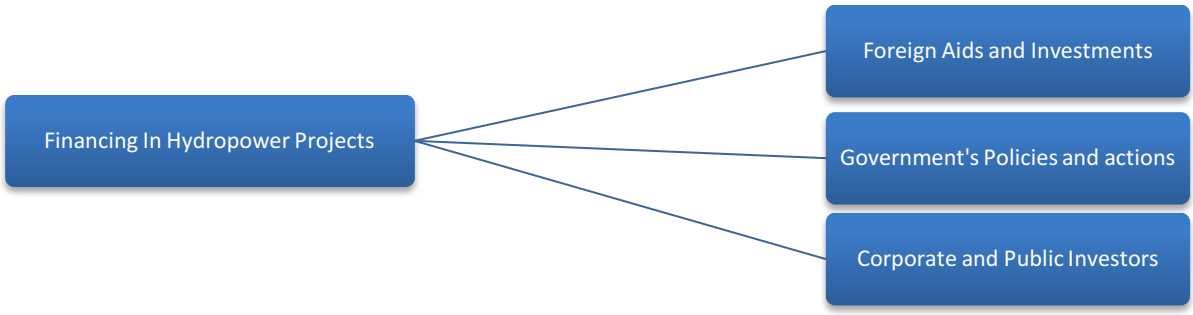
- Sole or joint venture of one or more private national investors
- Joint investors
- Joint venture of the government and one or more national or foreign investors
- Hundred percent investments of one or more than one foreign investors
- Joint venture of the national or foreign investors

Hydropower development policy 1992 has made a provision of exemption of income tax to the newly established hydropower companies for certain years to inspire and facilitate them in the field of hydropower generation. In this regard, the provisions made by the hydropower development policy 1992 are as follows:

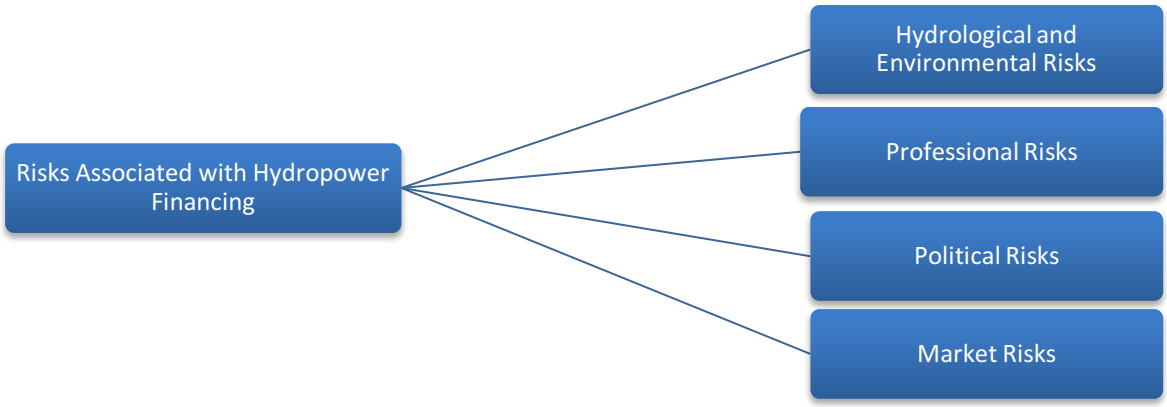
- An exemption of income tax shall be given to the projects of private sector generation and distributing electricity from the hydroelectric project up to the capacity of 1000 KW.
- Hydroelectric project, constructed under to investment of private sector, producing more than 1000 KW shall be granted exemption from income tax for a period of fifteen years starting from the date of its commercial production.
- Any private entrepreneur, who constructs electric substation, and transmits by extending distribution lines be granted exemption from income tax for a period of ten years.
- If the private companies take on contract for purpose of operation, maintenance and management of the hydroelectric plant or transmission and distribution lines under the ownership of Nepal government, such companies shall be granted exemption from income tax for a period of 5 years.
- The income tax shall be less than ten percent of the corporate income tax which the government imposes from time to time.
- If the investor reinvests in the hydroelectric project to diversify the project or to expand its established capacity by twenty five percent or more, or to modernize the technology or to develop the subsidiary industry, such investor may deduct an amount of fifty percent of the new additional fixed asset, from the taxable income of such hydroelectric projects. Such deduction may be at a time or from time within three years.

3.10 Research Variables

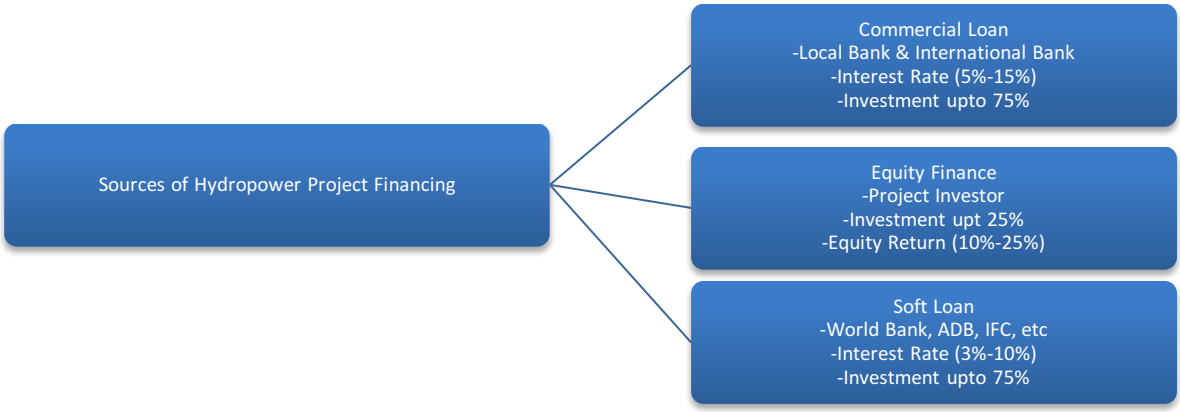
Dependent Variables **Independent Variables**



Financing in hydropower is a capital-intensive project and requires high initial investment cost. Government's policies and actions, foreign aids and investments, corporate and public investors etc. may help to increase the investment in hydropower projects.



Hydrological & environmental risk, inflation risk, interest rate risk, political risk, market risk, foreign exchange risk etc are the risks which directly affects the hydropower financing.



Since hydropower project financing is capital intensive projects so it would be fulfilled by either loan financing or equity financing. Loan financing portion generally concerned with

commercial and soft loans whereas equity financing portion mainly concerned with project investors.

3.11 Research Gaps

The purpose of this study is to draw some ideas concerning to the investment in hydropower sector in Nepal and to see what new contribution can be made and to receive some ideas knowledge and suggestion in relation to the area of investment in hydropower projects. In this context, the previous studies can't be ignored because they provide the foundation to the present study. In other words, there must be continuity in research. This continuity in research is ensured by linking the present study with the past research studies. It is clear that the reference of new research can't be found on the exact topics, i.e. "investment in Hydropower Projects of Nepal" therefore to complete this research work, many books, journals, articles and various published and unpublished dissertation and the field opinion are followed as guideline to make the research easier and smooth through these reference materials. The researcher can find out the gapping from the past research that must be fulfilled by the present research work. In this regard, this research is going to analyze the different procedure of investment of the selected hydropower projects.

"Investment in Hydropower Project of Nepal" is a new topic for the research work. It is expected that the uncovered areas of this research work will be studied. The gapping between old and new research work will be focused and filled up based on the given objectives and the limitation in this research.

4 Practical Part

4.1 Analysis of Secondary Data

The secondary data, which were collected through published materials of the hydropower association, commercial bank, banker association, Nepal Rastra Bank and finance company. But main materials will be the reports paper presentation and the articles related to financing of the hydropower. The main sources are internet NEA library, Nepal Hydro power association (NHA) and alternative energy promotion center. Published materials profiles of banks, bulletins of local financial institution (LFT) i.e Nepal Rastra Bank, Agricultural Development Bank, Nepal Industrial Development Corporation, brochures, company profiles, newsletters, website of various companies. All the information and data collected through the sources are analyzed and presened as following.

4.1.1 Resent Trend of Hydro Power Financing in Nepal

The credit to start up a private sector hydropower development goes to the effort put by a volunteer of united mission to Nepal (UMN), Mr. Odd Hofton. He is the first one to put effort in showing the example in developing electricity in private sector by developing 1 MW in early seventies, 5.1 MW Ahdikhola HEP in 1990 and then on his initiative 12 MW Jhimruk in 1993 was also developed by Butwal Power company Ltd, he established. These examples set were very successful in showing examples. It proved that cheap electricity could be developed and even distributed by private company. In these projects, training of manpower and organization experiences development were the main achievements besides these projects introduced electricity to the many remote places by those times. After 1996-97 when the private sector was encouraged to develop hydroelectricity, many companies came in the picture to take license of developing hydropower projects. Khimti I and Bhotekoshi are the two projects, which are the medium size project developed by the private sector attracting foreign investment. After these projects, a few local investor developed projects like Indrawati III, Piluwa and Chilime by using mostly local finance. A few projects that are completed by private developers are already in the national gril; main projects developed by private sector are given in the table 4.1 below.

Table 4.1: Power Projects Developed by Private Developers (In Million)

Name of Project	Year	Project Cost (USD)	Foreign Part	Local Part	Debt Portion (%)	Equity Portion (%)	Cost Per MW (USD)
Andhikhola 5.1 MW	1990	3	3	0	0	3	0.42
Jhimruk 12 MW	1993	10.7	10.7	0	0	10.7	0.89
Khimti, 60 MW	2001	140	135	5	69	31	2.33
Bhotekoshi 36 MW	2001	99	33	66	70	30	2.75
Chilime HEP 20 MW	2003	31.6	0	31.6	60	40	1.58
Piluwa HEP 3 MW	2003	4.03	0	4.03	70	30	1.43

Source: *Field Interview by Researcher*

Comparing the financing aspect of the projects developed by NEA and private sectors, it can be concluded that most of the projects developed by NEA in the past were developed to fulfill the objectives of providing electricity by the state to the people. Whereas, the projects developed by the private sector now are for business purpose and profit oriented.

- Financing Structure

Almost all small and medium size projects developed by NEA were developed from the foreign and soft loan from the foreign banks and developing institution. On the other hand, the financing arrangement for the private developer is the main problem the bigger projects used the foreign equity holders and foreign banks but the small projects used local funds.

- Generation Cost

The projects developed by NEA are relatively costly. There could be several reasons for it but main are the donation driven procurement inefficiently in project management, fully relied in the foreign resources, financial leakage in construction phase. The private developer fully utilized the local resources and the other problems like leakage are minimum with private developers.

4.1.2 Financing Pattern of Hydropower Projects in Nepal

When Hydropower pricing is being considered, its financial aspects also needs to be considered. The ultimate reason to build a hydropower project is to sell its output that has to be marketable and its price has to be competitive and affordable. In order to achieve that objectives, appropriate financing to build the project has to be arranged. Previously, construction of hydropower projects were thought to be in the domain of the government, as the supply of electricity was thought to be their responsibility. Therefore, hydropower projects were used to be financed by the government through its revenue or grant, aid or soft

credit from foreign donors. There was no consideration at all for any return on the investment made by the government on building such hydropower project and its output was priced just to cover operating expense. It was thought of as a public edifice built by public sector with public money for public benefit. Now the concept is changing mainly due to the constraint of financing resources with the government and demand of other sectors, particularly social sectors on the government's limited resources.

The hydroelectricity being a capital intensive and long term investment with a number of foreseeable and hidden risks. It is difficult decision to invest in such a huge sector. Initially the MOWR (HMS/N) started the development of hydropower projects in Nepal. Later a fully owned government organization, The Nepal Electricity Authority was formed to handle the total responsibility of generation, transmission and distribution of electricity. During its functioning NEA developed a number of small and medium size project. A few representative projects are given in the table 4.2 below. Almost all of these projects are developed by the major finance from foreign grant money or soft loan from international financing institutions. These projects were developed under donor driven condition at the time of acute shortage of electricity in the country; therefore, in these projects the local component put by HMG/N is nominal. Generation cost per MW in these projects is also very high.

Table 4.2: Financing of the Existing Hydropower Projects (In Million)

Name of Project	Year	Project Cost (USD)	Foreign Part	Local Part	Cost Per MW (USD)
Kulekhani I 60 MW	1982	68	56.5	11.5	2.19
Kulekhani II 32 MW	1987	48	40.8	7.2	1.5
Marsyangdi 69 MW	1988	241.5	0	0	3.5
Modi Khola 14.8 MW	2000	32	9.5	22.5	2.16
Kaligandaki 'A' 144 MW	2002	296.6	247.75	48.85	2.06
Piluwa Khola 6.2 MW	2000	15.7	0	15.7	2.53

Source: *Nepal Electricity Authority – Library*

Comparing the per Megawatt cost of construction project with NEA and private power producer. It is observed that the project construction cost from the private sector is less than the project developed by NEA government sector. Hence, Nepal has to encourage private sector to develop such project that reduces the consumer cost per kilowatt-hour. Comparison of electricity tariff in South Asian Region, Figure 2.3 shows the average prices for all six countries in the region based on international fuel prices at August 2001. It also shows that

the range from lowest price to highest is relatively high, ranging from 4.22 US cent/kwh in Bhutan to 6.40 US cent/kwh, a difference of more than 50 percent. Nepal which initially thought would be one of the cheapest countries in the region, in fact falls roughly in the middle, with average prices equaling 5.90 US cent/kwh.

4.1.3 Total Investment Outlay and Cost of Project

Total investment outlay is the first thing to be done before investing in a project (cost of the project). The total project cost was estimated at NRs. 1,604,915,000 (15million USD) for CHP based on feasibility study of the project in 1996 price level where as the total project cost NRs 2,477,894,521 (23million USD). The contract were made with different construction companies and forms for both companies. Different work items are varied and some additional works were also executed during the course of the construction works.
In the same way, the total project cost of the NHP is NRs. 1,523,706,256 (14million USD) and the project completion time of 4 years. The capacity of CHP is nearly three times greater than NHP. Above data are based on project completion report, prepared by CHP and NHP.

4.1.4 Means of Financing

Both hydropower projects are already operational. They have used equity and long term debt to finance the power plants.

4.1.5 Cost of Capital

Since both projects CHP and NHP have equity as well as debt capital, cost of equity and cost of debt have to be calculated separately on that basis, weighted average cost of capital needs to be calculated.

By Formula,

$$\text{Cost of Equity} = \frac{\text{Earning after Tax}}{\text{Equity}}$$

For CHP,

$$\text{Cost of Equity} = \frac{507758712}{1942245660}$$

$$= 26.14\%$$

According to Electricity Act, 1992, Section 12.3, hydropower projects are tax exempted for 15 years. Hence EAT is equal to Net Cash flow. Net cash flow of CHP is Rs. 507,758,712. (As per the Annual Report of Chilime Hydopower Company Limited 2006). As currency does not affect the calculation of ratio, Nepalese Rupee (Rs) is used in calculation.

For NHP,

$$\text{Cost of Equity} = \frac{76234591}{693035924}$$

$$= 11\%$$

Net cash flow of NHP is Rs. 76,234,591 (As per the Annual Report of National Hydropower Company Limited 2006)

By Formula,

Cost of Debt= Interest Rate (1-Tas Rate)

As tax is exempt for 15 years for these companies, tax rate is 0%. Cost of debt is therefore equal to the interest rate. So, cost of debt is 8% for both the companies.

By Formula,

Weighted Average Cost of Capital (WACC) = Cost of Debt x Weight of Equity

Table 4.3: Weight of Equity and Debt financing

Source	**CHP**	**NHP**
Equity	0.40	0.30
Debt	0.60	0.70

Source: *Annual Report NHP and CHP*

For CHP, WACC = (8 x 0.60) + (26.14 x 0.40)

= 4.80 + 10.456

=15.256 %

For NHP, WACC = (8 x 0.70) + (11 x 0.30)

= 5.60 + 3.30

=8.9 %

WACC for Chilime and National is 15.256 % and 8.90 % respectively. Normally, cash flows are discounted at the cost of capital, so the figures are rounded off to 15 % and 9 % for ease of calculation and simplicity.

4.1.6 Capital Budgeting Techniques

In previous section, cost of capital has been calculated along with WACC for CHP and NHP that were 15% and 9% respectively.

4.1.6.1 Cash Pay Back Period

When deciding between two or more competing projects, the usual decision is to accept the one with the shortest payback period. Payback is often used as a 'first screening'. By this, it means that when a capital investment project is being considered, the first question is to ask: How long will it take to pay back its cost? The investors might have a target payback, and so they would reject a capital project unless its payback period was less than the certain number of years.

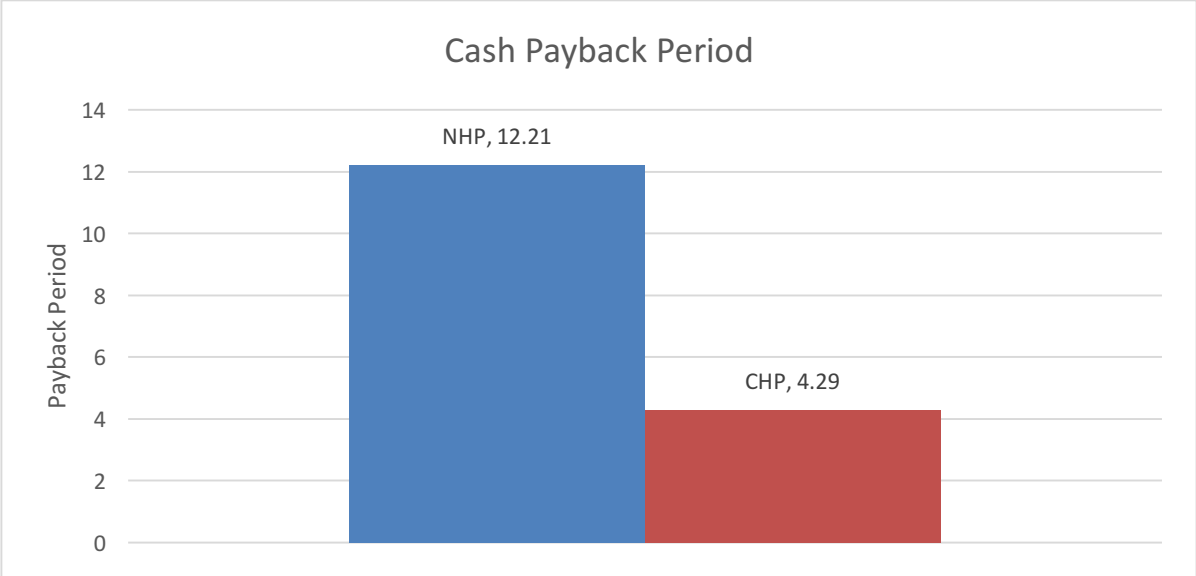
The cash payback period for CHP and NHP is extracted from the Annual Report of CHP and NHP and following is the result of Cash Payback Period analysis:

Table 4.4: Result of Cash Payback Period

Project	**Cash Payback Period**
NHP	12.21 years
CHP	4.29 years

Source: *Annual Report NHP and CHP*

Figure 4.1: Cash Payback Period



Initial outlay is covered in 4.29 years for CHP and 12.21 years for NHP. So, CHP seems to be a better investment with regards to payback period being shorter.

4.1.6.2 Discounted Cash Payback Period

This is an improved version of cash payback period. This method keeps the advantage of cash payback period and tries to correct its drawback by taking time value of money into account. Cash inflow over the years are discounted at the cost of capital until it equals to the present value of initial outlay. Number of years required to equal the initial outlay is discounted cash payback period.

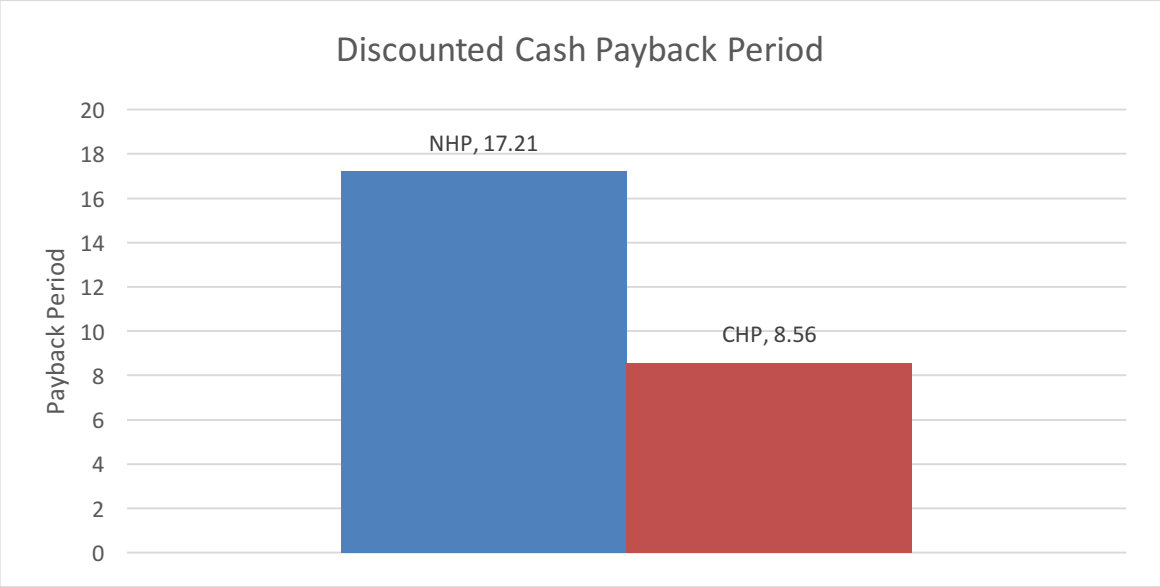
Since initial investment is spread over four and six years for CHP and NHP, the initial investment is also discounted and present value of total investment is calculated. Therefore, net cash inflows over the years are discounted at 15% for CHP and 9% for NHP.

Table 4.5Results of Discounted Cash Payback Period

Project	**Discounted Cash Payback Period**
NHP	17.21 years
CHP	8.56 years

Source: *Annual Report NHP and CHP*

Figure 4.2: Cash Payback Period



Cumulative present value is nearly equal with the net investment in 8 years and 17 years for CHP and NHP respectively. Thus, net discounted cash payback is the same. If a choice must be made between the two power plants, CHP promises a better investment than NHP as its payback period is shorter.

4.1.6.3 Accounting Rate of Return

Alternatively, accounting rate of return is also calculated by averaging the expected cash flow over the life of a project an then dividing the average annual cash flow by the initial investment outlay. The total life for both hydropower projects is assumed 20 years.

By formula,

$$ARR = \frac{\text{Average Cash Flow}}{\text{Equity}}$$

For CHP,

Initial Investment Outlay = Rs. 2,477,894,521

$$\text{Average Cash Flow} = \frac{32790704160}{20} = 1639535208$$

$$ARR = \frac{1639535208}{2477894521}$$

$$= 66.17\%$$

The average accounting rate of return for CHP is 66.17%

For NHP,

Initial Investment Outlay = Rs. 1,523,706,246

$$\text{Average Cash Flow} = \frac{3747118984}{20} = 207355950$$

$$ARR = \frac{207355950}{1523706246}$$

$$= 13.61\%$$

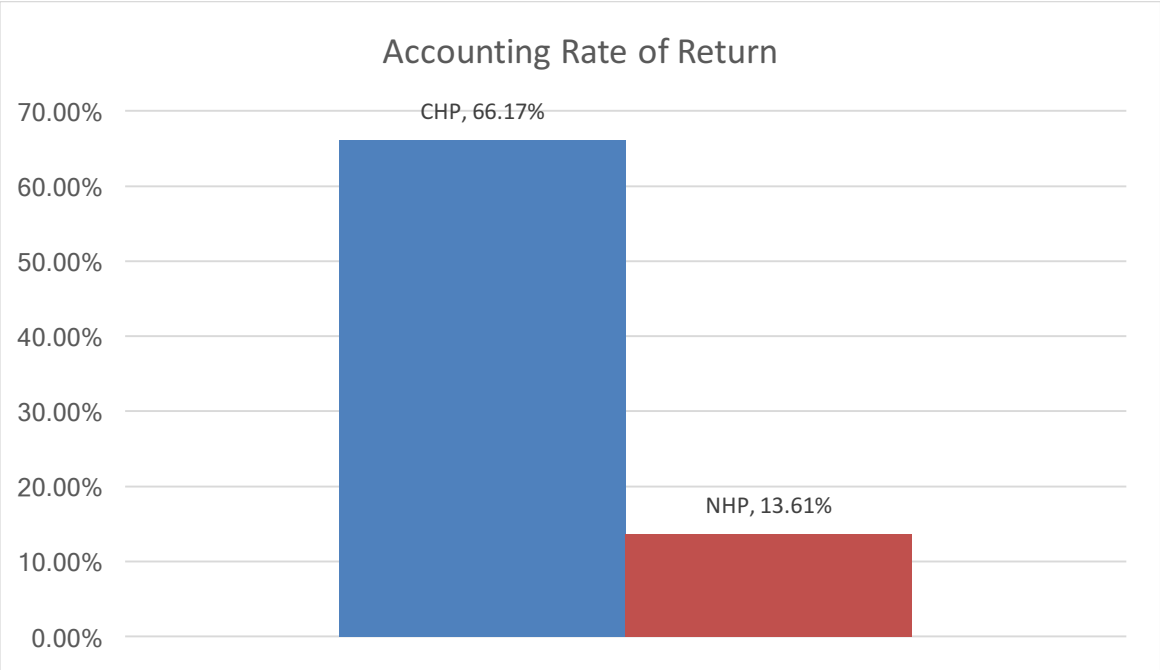
The average accounting rate of return for NHP is 13.61%

Table 4.6: Results of Accounting Rate of Return

Project	**Accounting Rate of Return**
CHP	66.17%
NHP	13.61%

Source: *Annual Report NHP and CHP*

Figure 4.3: Accounting Rate of Return



From this analysis, CHP looks more desirable as its rate of return is higher than NHP.

4.1.6.4 Net Present Value

Net present value is one of the three methods of capital investment appraisal, which can conveniently be grouped together as the "Discounted Method".

A positive NPV is the signal is accept the proposal. If however, the NPV is negative, the signal is to reject the project. Note that only cash expenditure and income are considered, non- cash items (eg. Depreciation) are ignored.

Total project period is assumed to be twenty years. Total cash expenditure occurs in contraction period which are discounted by 15% and 9% which is approximate weighted average cost of capital for both projects, likewise, cash inflows of twenty years project period are also discounted at the same rate. Total present value of investment cost of CHP is RS. 1,599,354,005 and for NHP is RS. 1,297,164,566. Net present value of cash inflows is deducted from net present value of total investment cost. The different should not be considered due to the different capacity level of these projects.

By formula,

NPV = Total present value of cash inflows – Total present value of cash outflows

For CHP,

= 3118611446 – 1599354005

= 1519257441

= 14.5 million USD

For NHP,

= 1549615275 – 1297164566

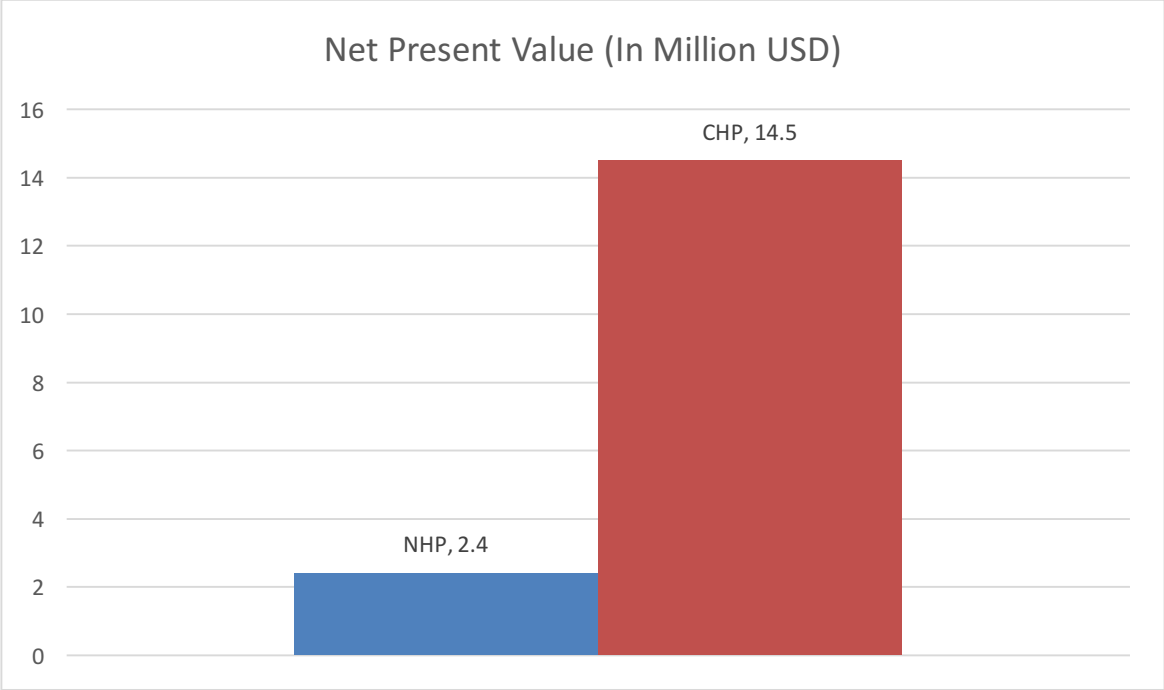
= 252450709

= 2.4 million USD

Table 4.7: Result of Net Present Value

Project	**Accounting Rate of Return**
NHP	2.4 million USD
CHP	14.5 million USD

Figure 4.4: Net Present Value



NPV of CHP and NHP are USD 14.5 million and USD 2.4 million respectively. Both projects have positive NPV, so both projects are worth investing in. However, if one project is to be chosen out of the two, CHP seems more desirable than NHP due to the higher NPV. If we consider the investment outlay, it is true that the investment of the CHP is also higher than NPV. But proportionately CHP is the better one according to NPV method.

4.1.6.5 Internal Rate of Return (IRR)

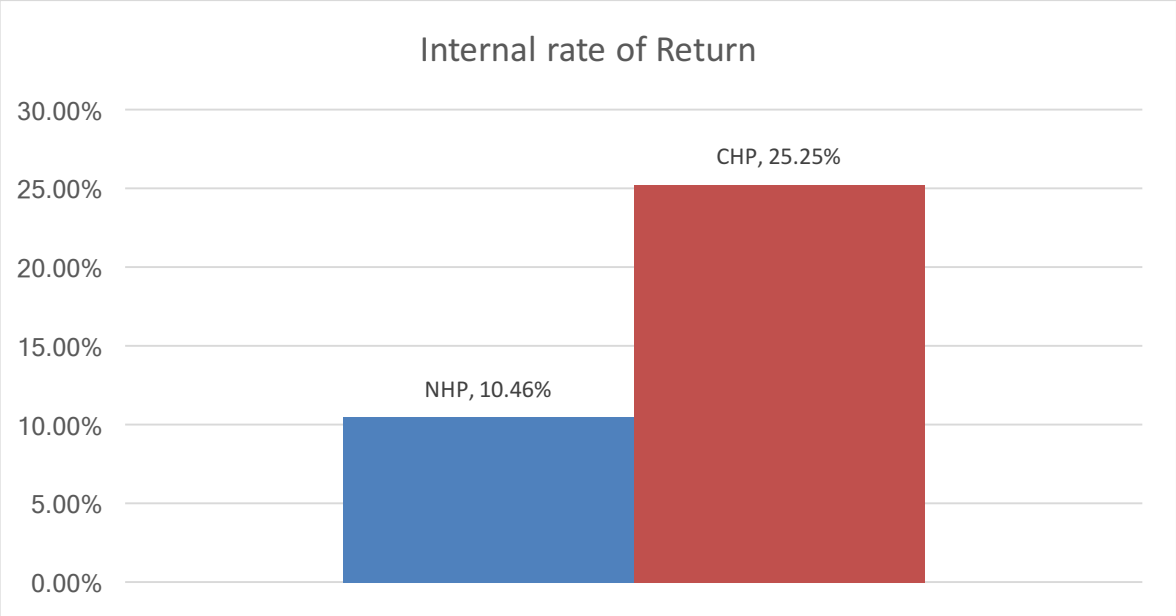
One way to compare investment is to calculate an Internal Rate of Return for each one. The internal rate of return for a project Is the discount rate that makes the present value of the project's income stream total to zero. The internal rate of return is a measure of the worth of an investment. If the risks are equal, investment with higher IRR pay better. The calculations for IRR has been done on the annual report of NHP and CHP which are 25.25% for CHP and 10.46% for NHP.

Table 4.8: Results of Internal Rate of Return

Project	**Internal Rate of Return**
NHP	10.46%
CHP	25.25%

Source: *Annual Report NHP and CHP*

Figure 4.5: Internal Rate of Return



IRR for CHP is 25.5% and for NHP is 10.46%. Since IRR for CHP is higher, the project CHP looks more desirable compared to NHP from this method of investment appraisal. Both the projects, however, have higher internal rate of return than the weighted average cost of capital, which makes both the projects acceptable for investors.

4.1.6.6 Profitability Index

The profitability index (PI) is a time adjusted capital budgeting technique. It is similar to the NPV approach. The PI approach measures the present value of return per rupee invested, while the NPV is based on the difference between the present value of the future cash inflows and the present value of cash outlays.

By Formula,

$$PI = \frac{\text{Present value of cash inflow}}{\text{Present value of cash outflow}}$$

For CHP,

$$= \frac{3118611446}{1599354005}$$

$$= 1.95:1$$

For NHP,

$$= \frac{1374994440}{1297164566}$$

$$= 1.09:1$$

The decision rule of Profitability Index is:

PI > 1 : accept the project

PI <1 : reject the project

Table 4.9: Results of Profitability Index

Project	**Profitability Index**
NHP	1.09:1
CHP	1.95:1

Source: *Annual Report NHP and CHP*

Both projects have PI greater than one, so both the projects CHP and NHP are acceptable but due to higher PI of CHP, it is preferable.

4.2 Discussion

4.2.1 Analysis of Primary Data

To know the effectiveness of the investment, an empirical analysis has been conducted. It is assumed that it helps to find different aspects of investment. To achieve the expected information about investment, questionnaire has developed and responses are collected from the respondents. Out of 25 questionnaires distributed, 18 are received from respondents. Respondents are classified into two groups – technical and administrative of the power companies. The responses received from various respondents have been arranged, tabulated, and analyzed in order to facilitate the descriptive analysis of the study.

Some of the questionnaires are in descriptive nature and some of them are asked either for a yes or no response or for making of the choices according to the number of alternatives, where the first choices were the most important. For analysis purpose, choices are assigned weight according to the number of alternatives. The total points available to each choice are converted into percent with reference to the total points available for all choices. The choice with the percent score is ranked as the most important choice.

1. **The rate of return of projects in terms of payback period, Interest rate of retrun and gestation period.**

Table 4.10: Rate of return in terms of payback period, interest rate of return and gestation period

Respondent	Payback Period (Yrs)	Internal Rate of Return (%)	Gestation Period (Yrs)
1	4	30	2.5
2	5	25	2
3	8	27	3
4	9	22.5	3
5	10	25	2
6	6	20	3
7	5	30	4
8	5	25	4
9	6	26	4
10	8	28	3.5
Average	**6.6**	**25.85**	**3.1**

The above table shows that gestation period depend on the construction schedule which is to an extend is site specific and very much dependent in the site conditions but the project management skill of management team can control the construction schedule. Payback period of the small scale project is not very high. It in fact depends on the investment and

return scheme. Internal rate of return of hydropower projects are found to be higher compared to other general investment opportunities.

2. The financing structure of project, in debt/equity ratio

Table 4.11: The financing structure of project, in debt/equity ratio

Total Respondent	80:20	70:30	60:40	50:50
10	3	6	0	0

The above table 4.11 shows that 6 respondents like to have 70:30 debt equity ratio and three respondents want a 20% equity and 80% debt. At present, the main problem of the developers is arranging equity, therefore, developer always like to have high debt equity ratio. On the other hand, in project financing, the lenders always like to have smaller ratio.

3. Planning to raise fund for hydropower project

Table 4.12: Planning to raise fund for hydropower project

Total Respondent	International financing Institution (IFI)	Local financing Institution (LFI)	Both
10	2	5	3

Out of ten, five respondents of the developers want to finance the project from LFIs but due to equity problem, two developers want to go to foreign market to find the possible partners for collection of fund easily with low interest rate and a longer term. Three of them want financing from both institutions as they think it is easy to arrange a deal with bank with local bank and looking for longer term payment.

4. Planned to raise fund from IFIs

Table 4.13: Planned to raise fund from IFIs

Total Respondent	Lower Interest rate	Can arrange Large amount from Lender	Easy to Arrange Fund	Not Possible to Arrange fund from LFI
10	4	2	2	2

It is found that four developers wanted fund from IFI due to lower interest rate. Two in each option want to have international financing institution to finance their project due to large amount they can lend, easy to arrange fund and not possible to get money from local

financing institution respectively. Many think that with IFIs, fund is available from the single lender at lower interest rate. Equal respondents tried foreign market once they fail to arrange fund from LFIs.

5. Main benefits of raising fund from LFIs

Table 4.14: Main benefits of raising fund from LFIs

Total Respondent	Easy to convince the Lender	No Currency Risk	Easy to Monitor	Easy to arrange the collateral
10	4	3	2	1

Four of the developers want local fund because it has no currency risk, three of them think that it is easy to convince LFIs and arrange guarantee or collateral. Two out of ten respondents think that it is easy to monitor the loan if we finance the project from local financing institution and one respondent wants LFI because it is easy to arrange collateral from them.

6. The problems of raising fund from LFIs

Table 4.15: The problems of raising fund from LFIs

Total Respondent	High Interest Rate	Not possible to Collect big amount	Less Payback Period	Problem of Margin and collateral
10	4	3	2	0

The above table shows that the main problem of LFIs is the lack of large core capital to lend larger sum to a single borrower in high interest rate, coordination of the banks in consortium is equally burning. Due to the problem of adequate long term deposits, the LFIs have problem of payback. Three of them respond that they have problem of collecting big amount from a single bank.

4.3 Electricity Purchase Rate from CHP and NHP is Expensive to NEA

The history of hydropower development in Nepalese consists of two distinct periods. During the period till 1995, most of the power plants were constructed by the Government of Nepal and NEA with multilateral and bilateral funding. The pace of development till 1995 was very slow where GON and NEA were the main actors. However, promulgation of new

hydropower development policy in 1992 and World Bank's deciding the cancellation of Arun III in 1995, created incentives for pluralism in hydropower development in Nepal. It has taken the traditional monistic math of hydropower development in which NEA and MOWR were the major actors. As a result, a total of 298 MW additional capacity was created in a mere 10 years from 1995 to 2005 with different modes of development compared to only 249 MW developed in eight and half decades till 1995. The milestone event in the private sector efforts were perceived with the commercial operation of 60 MW Khimti I and 36 MW Upper Bhotekoshi in July 2000 and January 2001 respectively. The role of IPPs and NEA power system is ever increasing and now contributes to mare than one third of total available energy in the NEA system. NEA currently 44% of its revenue to pay to IPPs majority of this is shared by foreign loan. This obligation means major portion of US$ outflow annually, from foreign exchange reserve.

A Power Purchase Agreement (PPA) is required to be made between NEA and IPP. As per the PPA between NEA and IPP in Nepal, National Hydropower project (Indrawati) is partially in foreign currency and the remaining in local currency. Khimti I and Bhotekoshi are paid fully in foreign currency. However, the rate varies with different IPPs, in July 1998, the government announced for the first time, busy-back rate for purchasing power produced by IPPs up to 10 MW capacity having plant capacity factor above 90%. The rate is set at Rs 4.03 (0.039 US$) for dry season with escalation of 6% till 5th year. Against the 25 to 50 years validity provided to these producers, the PPA for 1 to 10 MW producers would be valid only for 15 years.

As the PPA between the IPPs and NEA is different for different for different projects, it would be interesting to compare the electricity tariff rates bringing all the same footing. For this purpose comparison is made in local currency assuming an annual devaluation of local currency at 3 percent per annum. The period conserved for comparison is from 2003 to 2018, in consideration of maximum limit of escalation for 20 years in Bhotekoshi and Indrawati. When price between the CHP and NHP on their price per KW, comparative National hydropower is cheaper than Chilime. But, when we compare among four projects including Khimti I and Jhimruk, Khimti I being the first private sector investment project, Jhimruk is the cheapest and Khimti the most costly project for NEA.

The power purchase rate of NEA varies with different IPPs. The existing PPA rate has given excessively high advantage to foreign developers compared to national developers, furthermore, the state required to guarantee certain rate of return in the investment estimated

by foreign developers, however the state never minds to check the estimate or create some regulatory mechanism of development. It is not rational to give different rate for the same type of product

Here, CHP and NHP energy rate cannot be measured as expensive as other project for NEA. Comparatively both projects are cheaper. But, it required announcing the rate of electricity to be purchased from IPPs publicly for project of different size ranging from micro – small-medium to large one. Purchase rate is required to be fixed for the peaking. It would maintain same rate for the same quality of product.

4.4 Major Findings

4.4.1 Findings from Secondary Data

While investing in hydropower projects, total cost of the projects are estimated and means of financing are decided upon, if capital structure include debt and equity capital, weighted average cost of capital is calculated. The cost and benefits of the projects are then set up as cash flows over the entire project period and then discounted to their present values at a discount rate which is the weighted average cost of capital. Finally, net cash flows are calculated and financial evaluation is done using capital budgeting techniques.

Theoretically, there are altogether seven capital budgeting techniques to evaluate the financial acceptability of the capital investment. From the feasibility study and project completion reports of CHP and NHP, it is found that both projects have used only one capital budgeting method – the internal rate of return. However, in this study all seven capital budgeting techniques have been used to evaluate the financial viability of the projects.

Major findings of this study are as follows:

- Total Investment Cost:

Total construction cost of CHP is Rs. 2,477,894,521 (23.7 million USD) and NHP is Rs. 1,523,706,246 (14.6 million USD). The projects taken for comparison do not have similar capacity. CHP is nearly three times greater than NHP on capacity but construction cost of the project CHP is not so higher than NHP. It is nearly one half time larger investments in CHP and NHP.

- Weighted Average Cost of Capital:

Both power projects are funded with equity and debt capital. However, NHP would be funded with 70% debt and 30% equity capital while CHP is funded with 60% debt and 30% equity capital. The weighted average cost of capital is 15.256% for CHP and 8.90% for NHP.

- Capital Budgeting Techniques:

The results of capital budgeting techniques applied for financial evaluation is tabulated below:

Table 4.16: Results of Financial Evaluation of CHP and NHP

Techniques	CHP	NHP	Decision	Comparative Choice
Cash Payback Period	4.29yrs	12.21yrs	Feasible	CHP
Discounted Cash Payback Period	8.56yrs	17.21yrs	Feasible	CHP
Alternative Accounting Rate of Return	66.17%	13.61%	Feasible	CHP
Net Present Value	14.5 million USD	2.4 million USD	Feasible	CHP
Internal Rate of Return	25.25%	10.46%	Feasible	CHP
Profitability Indes	1.95	1.09	Feasible	CHP

All seven criterion proves that both hydropower projects are financially feasible and would prove to be profitable investment. However, if a choice has to be made between the two projects, all the analysis indicates to CHP as better investment.

4.4.2 Findings from Primary Data

The investment cost of hydropower projects depend more on the technical aspects than on the investors. However, in public sector there is equal risk bearing capacity. NEA bearing the state-owned utility has the responsibility of fulfilling growing energy demand of the nation and is thus bound to compromise on lower profit and the greater risks.

There are following major incentives and opportunities identified in the hydropower sector in Nepal.

- Nepal is second richest country in water resources in the world. Numerous fast flowng rivers provide huge potential for hydropower.
- The power demand in the country is growing by more than 10 percent each year. In addition, the new electricity act of 2003 has opened the possibility of power export to India, which if materializes, will expose a huge potential of hydropower projects in Nepal.

- Through various Acts and policies, Nepalese government has given numerous incentives to encourage hydropower investment. For example, 15 years income tax holiday, 1% custom duty for construction equipment, repatriation of investment in foreign currency, one – window policy from DOED, guarantee of no nationalization of private projects, electricity tariff based on negotiation, 100% foreign ownership allowed, etc.

Despite opportunities and incentives, hydropower industry is exposed to various risk and challenges, which are listed below:

- Poor infrastructure such as access roads lead to higher costs for hydropower projects which results in loss of competitive advantage and transmission bottlenecks from barriers in uniform distribution of energy through the nation.
- Technical risks which arise due to design fault or due to errors in geological surveys might have huge consequences sometimes even leading to complete shutdown of the plant.
- Political risks arising from changes in government policies and laws also threaten the investors especially in the present volatile political situation.
- Construction and operational risk resulting from delay in construction due to natural causes like flooding, landslides or due to human made obstacles also impose certain risk for the investors.
- Payment risk is high in long term investments like hydropower projects, where there is doubt on the maintenance of the sanctity of the contract, throughout the contract period by the involved parties due to any reason.
- Security risk is undoubtedly the highest risk in the present context of the unstable political scenario and ongoing political crisis.
- NPV is the best tool of capital budgeting to analyze and compare investment. More than 77% of respondents are agreed that NPV is the best tool in capital budgeting for investment analysis.
- Both projects is not running in full capacity all over the year. In rainy season, it produced more than capacity and in dry season it rues below the capacity.
- Political and other environment are both influencing the hydropower industry bitterly. As per the respondents, 22.78 percent argued that political environment affecting more but rest of the respondents argued other.
- Policy and security both plays the vital role but in present scenario security is the main barrier to invest in hydropower.

- All agreed that the hydropower is the only and only potential through which the nation can be economically prosperous.
- More than 80% agreed that public is preferable in investment rather than private because hydropower needs huge investment. But it does not mean that private sector cannot invest as there have been large scale hydropower projects invested by private sectors.
- Creating investing environment is the main expectation from the government of hydropower investors and government also should invest in large investment, because only the government and private sector can jointly invest in large power project.

It is not clear that export of hydropower from Nepal to India, as base load supply, is commercially feasible. Nepal's independent power producers (IPP) prices are not among the cheapest electricity prices compared with other IPPs in the region. They are in the mid-range of prices. If the necessary transmission charges were added to Nepal's IPPs, most IPPs would not be competitive as exporters to the Indian base load market. However, there are some specific IPPs in Nepal that may have a competitive pricing advantage in the Indian market. It has been told that some of the new larger scale plants many offer significantly lower prices. If this is true, then the older, earlier IPPs would apparently not be competitive for exporting to India at present PPA prices, but future large-scale plants might be competitive. In addition, the volumes available from individual plants, appear to be uneconomic to export from Nepal on a plant by plant basis. It appears reasonable for Nepal to consider exporting larger blocks of hydropower through some mechanism that aggregates the exportable volume, and to sell this as mid and peaking power.

Bhutan's hydroelectricity is not significantly cheaper than Nepal' if capital subsidies provided by India are considered. Bhutan has lower generation prices, with an average price of 4.07 cents per kwh. This is lower than Nepal's average of 5.8 cents per kwh. However, Bhutan's plants were both developed using loans and equity provided by the Indian government. The return on capital for both debt and equity for the Bhutan projects in significantly below the private costs of capital in both India and Nepal. We calculated an adjusted price for the Bhutan projects using the same equity and lending rates that we found in the Indian private sectors projects. The result is 5.51 cents per kwh.

Both Sri Lanka and Nepal may benefit from wholesale electricity trade with India. In both cases, it would appear to be economically advantageous for Nepal to be able to buy Indian wholesale electricity. In Nepal's case, it may be economically advantageous to sell mid merit and peaking power to the Indian grid. There has been strong debate over the role of private

generation in South Asian over the past several years. These conclusions provide important information relevant to the debate on the role of independent power producers.

4.5 Analysis of Primary Data

The primary data were collected from the personal interview and structured questionnaire method. Two type of separate questionnaire were designed for hydropower developer and financing institution. In order to collected the detail information in the field of financing of hydropower projects and the researchers has carried out the interview with experts and professional in the financing of hydropower projects to collect the opinion and views. Analysis of data and information collected through the questionnaire and interview has been analyzed as under.

4.5.1 Analysis of Interview with the Experts and Professionals

Opinion survey was done through personal interview with professional and experts of the hydropower developers and financing institutions. The results of this interview have been tabulated under the financing and opinion of the individual were included in the recommendation. The detail about the interview is in the following tables. Thirty persons were interviewed in the field of financing hydropower developer and businessman in Nepal. Among them twenty were hydropower developers and ten were financers of the various institutions. Twenty-one of them have given very useful information regarding the financing but nine of the interview were useful to understand the market situation economics of hydropower industry and other general information in Nepalese hydropower industry. The information and data observed during the interview are listed in the following tables.

Table 4.17: Opinion Survey/Interview with Experts and Professional

Discussion Topics	Respondent	Response in %
Government Policy	Officer level of Bank and financial institution	Favorable – 60% Unknown – 10% Unfavorable – 30%
Financer Attitude	Chief Executive Officer	Positive – 90% Negative – 10%
General Concept	Assistant level employee	Known – 70% Unknown – 30%

Present Status	Scholars and Officers	Unfavorable – 80% Favorable – 10% Worst – 10%
Future Aspects	Businessman	Bright – 50% Unattractive – 30% Neutral – 20%
Foreign Financing	NGOs and INGO and other supporting institutions Employee	Attractive but a lot of improvement to be made
Current Problems	Businessman	Insurgency situation and negligence of Government employee
Improvement to be made	Business	Policy and legislation amendment, improvement of present insurgency situation and improvement on service provide by the government employee

Among the thirty persons in the field of financing and development of hydropower project in Nepal, many people have given very useful information regarding the financing. They provided not only the precise information and experience in the field of financing but also some of the information about the market situation, economic situation of hydropower industry and other general information in Nepalese hydropower industry. Regarding the government policy and legislation on hydropower sector in Nepal, the respondent was optimistic and they found it favorable policy for which financers and investors should attempt to grab the opportunity. Local financing institutions are interested to provide loan with some collateral, as there is high risk of time of payback. The general view and concept of financing in hydropower sector was also found satisfactory. Most of the respondents were aware of the fact and opportunity of hydropower sector in Nepal. Regarding the concern about the financing through foreign investor or government were found to be attractive but needs to improve on providing governmental services to them. The intellectual and experts were asked about the current problems in the country for the investment in the hydropower sector, the respondent that the situation might be improved.

4.5.2 Analysis of Responses of Hydro Power Developers

The structured questionnaire was asked to ten persons of different organization among them 50% were hydropower project owner and 50% senior employee of the organization. The organization were selected on the judgmental basis of researcher among thirty hydropower developer of Nepal. The response was summarized and tabulated as under.

4.5.3 Analysis of Responses of Local Financial Institutions

Seven structured questionnaire were asked to ten persons of different organization five of respondents were commercial banks, two respondents were development banks and three were other financing institution. Questionnaires were asked to senior employee of the organization. The organizations were selected on the judgmental basis of researcher among thirty hydropower developer of Nepal. The response was summarized and tabulated as under. The response given by the local financing institutions for questions are given below:

1. Problem of financing of hydropower projects in Nepal

a. Problem in sale of electricity

It is observed that Nepal's electricity is expensive. The generation cost was very high and then huge loss in transmission and distribution, which again added to electricity tariff thus Nepalese electricity, is one of the expensive in the region. Due to the high tariff of electricity and low per capita income, it is very difficult to increase the domestic consumption of electricity substantially to the existing customers, it is because the substitution of electricity in cooking is not economically feasible in large scale. The expansion of electricity is needed but the current statistics show that approximately 85% of the load is domestic load, long transmission and huge distribution cost, which make the domestic expansion not economically viable to NEA. This limits the expansion of domestic market.

The analysis showed the Nepal's average tariff to the consumers was almost double of that of India. Main reason was the Nepal's tariffs are not subsidized while those of India are heavily subsidized. As a result, Nepal's electricity utility is a profit-making organization generating even some internal funds for investment in power system expansion while almost all of India's electricity utilities are running of the total electricity consumption. The largest consumer, industry with about 34% of the total electricity consumption, is heavily charged. It again highlighted the urgent necessity for tariff reform in India. Unless this reform takes place, no substantial investment will come forward in power sector and hence, Nepal's hydroelectricity is too expensive to be exported to India. In addition, the volumes available

from individual from individual plants appear to be uneconomic to export from Nepal on a plant by plant basis. It appeared reasonable for Nepal to consider exporting larger blocks of hydropower through some mechanism that aggregates the exportable volume, and to sell this as mid and peaking power.

b. Socio-political problem of the country

Nepal has been facing a lot of socio-political problems since 1990 when multiparty system is introduced in the country. Though the country is opened for the liberalized polices and fronts for the investment to rest of the world. But due to the frequent changes in government and so the policies the objectives are not fulfilled. Due to the political instability, the investors had no favorable atmosphere for investment in Nepal. In last 7-8 years, a lot of violence, killing and destruction by moist have created a havoc situation in the country, which has a severe negative effect in the direction of investment in infrastructure project. The timing when this research was carried out the situation of Nepal is least preferred for the investment in the long-term project like hydropower projects. Everybody seemed to be waiting a peace and security to reestablish.

c. Problem of genuine developers

When hydropower generation was opened to private parties in around 1996-97, a whim has started to capture more and more license for development of hydropower projects. The people, who were having some knowledge that this industry has future, were the ones to opt for it. In the first phase, people who had some know low of hydropower and its future were the one to take license who had some knowledge only but no other resources. They had even lacked resources for the pre-feasibility of the project. They just were having vision that one day the license will lay the golden ages. The researcher has found that a few had already made their dream come true and some in the process. In the second phase, some of the people politically affiliated captured few license, the politician having money to an extent but not know how. They opted the license give good impression to their voters that they are going to develop electricity to their voters but not sure when this is going to happen.

In the third phase, some entrepreneurs or businessmen who can arrange resources came to be seen. Bu then, most of the economically viable projects are booked and they left with the project far from the motor able road and national grid, which made the project difficult to construct and less attractive in economic terms. Thus, only few so-called developers who has captured license were capable for developing projects. These developers who had

struggled to arrange finance and to construct the projects to make the project successful, are the one who are genuine developers.

d. Equity arrangements is the main problem of the developers

Hydropower generation projects are capital intensive, need all the capital at the beginning or during construction, take long to pay back and is full of risk. The capital requirement in the hydropower project is to an extent is site specific also, because according to the site condition the construction cost of the same amount of energy may substantially cost more. On an average, the generation cost on current price level is Nrs. 100-120 million (about 1 million USD) per MW. Since the hydropower projects are constructed under the concept of project finance in which the equity put by the developer is in real sense the guarantee for the lender, that the project is going to be there and will generate the revenue as it has been planned. Therefore, the first phase of financing of hydropower project from the beginning i.e from the time of feasibility study, detail design, power purchase agreement and all the works for the financial closure. In the non-recourse financing like project financing the lenders always want the borrower should put as many as possible. The current investment portion is minimum 30-70 of equity debt. The arrangement of 30% equity is the major problem for the developer.

e. Unstable government policies

As discussed above in overall country scenario, the government are short lived so as their policies. Due to the short sightedness of the government, long-term development vision of any sector cannot come forth. It happened to be the same to the hydropower sector; different development policies and strategies have been tried in this sector. Due to the lack of detail analysis and experiences, the policies and regulation made by the government changes from time to time. This kind of frequent changes in the policies loses confidence of the investor in hydropower industry.

2. Lack of co-ordination between government departments and ministries

The development of the hydropower project involves several government ministries and departments. There is no dear-cut co-ordination between the different ministries even the level of information flow and integrated approach to support one main policy. The ministry of water resource (MOWR) come with the developer friendly policy but the ministry of finance (MOF), Department of taxation, customs, Nepal Rastra Bank (NRB) and ministry of environment (MOE) remained adamant to their general rules which does not solve the problems. Therefore, if a sector is given apriority in development all the concerned ministries

and department should sit together and work a single window policy for that sector so that there will not be a problem at the time of execution in the long term.

3. Less priority of local financing institution towards the hydropower development sector

When it comes to the financing of the hydropower sector, it needs to involve the developers and LFIs. Developing a new sector like hydro is not the burden of developers only; the LFIs also should work hard to develop this sector for the future investment opportunities. The current situation of high liquidity in the economy is due to lack of proper investment opportunities, the LFIs are continuously decreasing the interest rates on the deposits. Therefore, the LFIs should also come forward to help the genuine developers and work together to make the win situation for both. The current lending policies of the LFIs are one sided, the developers are accepting the conditions of the lenders but one-sided policies cannot last long.

4. Lack of consortium financing

After studying the capital composition of local commercial and developing banks except few commercial banks, rest have very limited core capital. Most of the money available with the commercial banks is the short-term deposit from public. Therefore, there is the mismatch in cash flow of the banks. On the other hand, even if the core capital is available with the bank, the bank does not want to expose heavily to one industry and to one project or borrower, there needs to be balance of portfolio of lending. Nepal Rastra Bank (NRB) has also made the guideline in the exposure limit to a single borrower. All these factors lead to the need of consortium financing to the hydropower projects. The consortium concept itself is not matured in the Nepalese finance industry. There is a great need to take initiatives by banks to flourish the concept of consortium financing. The formation of consortium and its management should be the task of banks rather than that of developers, which is in the current practice. Since the lead partner charges the fee to manage the consortium, it should do the administration, management work and also arrange the consultancy of technical experts for monitoring of project progress.

5. Issue of Personal Guarantee in project Financing Concepts

It is found that LFIs have reservation in practicing the project-financing concept; this is the situation of lack of confidence on the developer's facts and figures. LFIs doubt on the first place on project costing and secondly on the objectivity of the equity developer put in 14, the result of which lender asks the personal guarantee of promoter's board members. But,

the future of developing and lending will be only successful if the rules of the project financing are honor from both the parties.

6. Lack of an Independent Body for technical consultancies in Hydropower project

There is great need of an independent team of consultants which comprises of the technical experts available in country as the center of excellence which can impart practical input or to the point advice to the developers and lenders as a when they required. This independent body should work on fee basis and should provide the consultancy with some accountability. This body at the beginning should start from the grant fund available with donor or government to provide the cheaper consultancy to lender to understand the developer technical proposal. This mechanism will help lenders to make quick decision on lending. As time of construction of the project is the prime factor, the delay is deciding or reimbursing fund by banks will be very critical to the developer.

7. Lack of co-ordination with INGOs and NGOs to the real developers

It is found that a reasonably large sum of money to spend in the country by different INGOs and NGOs in hydro and alternative energy sector. Some of them are specially spending time and money to develop hydropower sector but most of the activities carried away by these organizations are in repetitive in nature or same and mostly in the micro hydropower sector. There is acute need to channel these funds in developing the small hydropower projects, especially in investigation, financing large amount of money if the project became infeasible at end of study then the investment is a waste. Therefore, this job of detail feasibility should be done from the government fund or grant so that there is fair judgements of the parameters of the project. It is very difficult in the developing industry like hydro in Nepal for the entrepreneurs to risk their capital without the return. MOWR should co-ordinate the activities and the project study should be carried away in a genuine manner. The argument here is that feasible projects should be available for the developer without any confusion so that they will put their money in the project (but the developers must verify the fact before developing it). At present the developers are asked to find the site, do the study and develop it. Once developer put large money in the study and investigation there could be a tendency to make the project feasible by force, which later create a spiral effect of problems to all the stakeholders.

8. Regulation for Licensing of the project

Currently the project development licenses are issued in two phases. First phase is the feasibility study license, which is only for the investigation and study. In the second phase,

a project construction or the development license. The construction license is subjected with condition that, the developer should carry away the PPA and financial closure with 12-18 month time, otherwise the license is withdrawn in principle but this is not done in real practice. Since license is the ultimate authorization to the developer to develop the nation's hydro resource, the license issuing authority should be very serious in investigating the seriousness and resource base of the license holder. Stricter regulation for the issuance and monitoring the developers is of utmost importance to find out the real developers. Currently a person or group of people have captured several licenses with minimum pain and behave like a mini nation to sell the rivers and water resources of a nation to Nepalese or foreign buyer. Trading of the developing license should be strictly banned by regulation or else it can create the problem of gaining license just to sell them for a profit.

9. Objectives evidence of equity

One of the problems raised by LFIs about the developer is the issue of the equity they supposed to put in the project. The main concern is that many of the developers inflate the cost they spent in bringing the project to the stage, to borrow money from the lender. The prices of the asset, e.g. land, building and administrative expenses are inflated to match the equity part. Many a times the lender doubt the costs, this create a situation of lack of confidence on the part of the lenders. Secondly, the equity portion should be raised first and shown on the tangible form to gain the confidence of the lenders. This in fact helps developers to get a cheaper loan; this is because the lender will reduce the risk premium as they get confidence on the developers.

10. Real costing of project components by developer

It has been learnt from some of the lenders and from developers that due to the problem of equity arrangement or with bad intention on the developers are that they inflate the cost of the components of the project in such a way that they will cover the project expenses with the portion of the loan. Some time they save some money from the debt and use it to some other business also. This culture and some evidences have warned the lenders not to believe the developers on face value. There have been cases of such practice in the past. The hydropower industry is in the developing stage as in the past, government has developed the hydropower project on grant and soft loan. In such project, the financing and economies were not the primary concerns as these projects were built on the priority of supplying electricity to the public. Now a couple of projects are developed for the commercial purpose considering all the costs and benefits. As the industry is still in infant stage, most of the

lenders had expressed their opinion to wait and see the performance before making any decision to enter the industry.

11. Full and comprehensive insurance coverage for the entire project

Financing a hydropower project is very heavily dependent on prudent management of risk. This involves identification of various risks associated with a project and assessment thereof. However, the most important step lies in arranging measures to mitigate such risks, including an effective insurance program. Insurance is available to every sector, and even in the hydropower, insurance cushions some risk of the project. The cost of insurance is sometimes the problem for smaller project with limited financing. Since the hydropower projects are full of risks, so insurance is a must. The full coverage increases confidence level of the lenders.

12. Long term financing banks: clean energy bank concept

Since the main objective of the commercial bank is to invest in short term projects, in the present situation there is a lot of liquidity in the economy. Due to insufficient investment opportunities in the financing market in the short term, the interest rate is decreasing but there is scarcity of fund in the long-term projects like hydropower. In such a situation, a long-term financing bank (like clean energy bank) which will finance exclusively to renewable energy sector, primarily hydropower could be very helpful. The capital for such bank could be arranged from domestic and foreign money market. One such bank is already proposed to the NRB for its approval. Similar banks will be the best institutions to finance the power project; there is the need for such institutions rather than forming consortium which is a lengthy and costlier option.

13. Establishment of power development fund

World Bank has already approved a fund (US$ 17 million) to help Nepalese hydropower sectors development. A fund in the name of power development fund is planned to provide the revolving credit to finance the hydropower projects. The concept is to lend the long-term loan to the developers in the suitable terms. The fund will provide up to 60% loan to project of size up to 10 MW and up to 40% for the project sized more than 10 MW. This fund will be of great help for the developer but amount in the fund is of primary concerns of the developers. Recently, government has appointed Nepal Bangladesh Bank as administrator for management and operation of the fund.

14. Government equity participation

One of the main problem of the developer is the arrangement of the equity portion, as the private hydropower generation in Nepal is in its infant stage, therefore, the government should encourage the sector. In order to establish the confidence of the other investor, government should also participate as a minor partner in the genuine developers project. This involvement of government will help to attract more entrepreneurs. This investment is required only in the beginning after certain time when the hydropower development industry gets established it will atrtract investors on its own.

15. Hydropower developing companies

Presently, the private developers need to register their companies as Pvt. Ltd as per the companies act in Nepal, a private limited company cannot have more than 50 shareholders. As discussed, hydropower project needs large und, the equity portion itself needs more than 50 people. The companies should be registered as limited so that there should not be the restriction on the number of shareholders. The transmission and distribution of electricity is under NEA. Therefore, there has been some concern that whether NEA will buy electricity and pay on time the price of electricity as per PPA. This concern of the developers and lenders cannot be ruled out. In order to have an option of NEA, there should be other companies in the market who would distribute electricity and collect revenue directly from consumers. For this, there are two options available. One, the power producer should be given license to distribute power on its own or there should be other companies available who will distribute power and will be in position to purchase the license to distribute power but it is yet to get approval from concerned authority. The alternative of NEA will be better for the developer for price negotiation as well as it is not possible with NEA. In order to materialize the concept, the power wheeling facilities is a must, as it is difficult to transit the power by the private parties in the present situation. In the present situation, NEA is the only institution with power transmission lines. As the infrastructure cost of the transmission lines very high, which prohibit for any new companies to invest in it. But if government allows the transmission to be used by the private developer to transmit electricity from the point of generation to the point of consumption with appropriate fee this system is known as power wheeling facility. If NEA and government agree on this, then the private producer can sell their electricity directly to the bulk users like high power consuming industries. This facility of wheeling will give an option to the producers to find their own customers and NEA also will not have the obligation to buy electricity from private producer.

16. Hydropower developer's fear to lose control and the high return foreseen

The power purchase rate of NEA is attractive for the developers and the conditions of the PPA are in favor of the developer. It is a normal tendency to design slightly higher capacity of plant components and equipment to make higher flow in the wet season to generate more energy. Therefore, the internal rate of return of the project range from 20% to 30%. Due to the high return, developers try to capture more and more of the holding of the project in one hand but are not in the position to put more money. Therefore, the financial closure take time. The other aspect related to this is that, the promoters do not want to lose control of the project, which is only possible if they have majority of equity of the project.

17. Capital market and public issue

The Nepalese capital market is in very early stage; only few commercial banks are trading in the secondary market as well as the primary market. The capital market has lost its image due to the investor in the industrial sector had suffered a great loss in the past. Due to the poor response of the investor in capital market, the hydropower development companies are not very keen to raise money from the capital market. The first company which is issuing public share in hydropower sector is National Hydropower Company.

4.5.4 Risk and its Mitigation of financing in Hydropower Projects

The idea that no worthwhile profit will be gained without a substantial amount of input is a well-known concept when it comes to investment. Still, small investors are aware of the risks they are taking and should know which opportunities exist to mitigate such risks. The table below groups the main risks that investments in renewable energies are exposed to:

Risk	Description/examples	Mitigation
Hydrological and Environmental Risks	Landslides, flood, ESIA/permits; Adverse climate (lack of rain) socio cultural/community conflict.	Detailed analysis and research; Different rate in dry and wet season by the government Building infrastructure and providing benefits such as employment
Professional Risks	Cost/time overrun during construction Design failure or inability to reach designed	Turnkey or CPE contracts, active monitoring, time based contract with builder with penalty, insurance

	output/performance during operation	Guarantee from contractor
Political Risks	Risk of confiscation, expropriation and nationalization; Changed regulation on tax holidays; Political unrest; Strikes	Isolating project from political influence; Designing the project with political risk and volatility to have a proactive approach rather than reactive to instability
Market Risk	Reliability of buyer; Change in prices	Signing PPA agreement with guarantee for stability until a given number of years to at least reap some benefits from the investment

There are several risks to be dealt with but they can be mitigated however with careful analysis and planning. Rushing into a project of this magnitude should be analyzing the risks is not possible and will most likely result in difficulty in operation and failure of the project. However, there are risks involved, so there is a need to be informed and prepared when they occur. As there is high risk, the return is also higher. The entrepreneurship lies in taking risk and being able to manage it. If an investor can do so then there is ample opportunity to invest in the hydropower sectors of the world.

5 Results and Discussion

5.1 Summary

Nepal is located between two populous countries China and India. Every energy consumption process in Nepal is dominated by traditional fuel resources while being one of most potential country to produce hydroelectricity. The country has huge potential and should be heading towards providing energy to the increasingly crowded cities of India and China.

First Hydropower project in Nepal was installed in 1911 at Phering (500 kw). The journey of power development has passed about 9 decades. In this time Trisuli, Sunkoshi, Gandaki, Kulekhani-1, Devghat, Kulekhani II, Marsyangdi Puwa Khola, Modi Khola and Kaligandaki 'A' HPP have been installed whose aggregate generation is 389.15 MW. Other projects commissioned have an aggregate capacity of 140 MW. One of the large-scale projects, Upper Tamakoshi (306 MW) is being planned and proposed. Contribution of thermal power generation is accounted 55.028 kw. Isolated and interconnected system of small hydro power existing in the country is generating 18.968 kw power. The major HPP under private sector are Andhikhola, Jhimruk, Kimti, Bhotekoshi, Sange Khola, Indrawati, Chilime, Piluwa Khola, Sunkoshi Small and Rairang, whose power generation is 148.283 Kw. The development of power generation was on progression only after plan period since 1956. The long-term vision on this sector was released only after 2000.

Share of hydroelectricity consumption in overall energy consumption is 1.5 percent. It is the total of 6673000 GJ of energy consumption in the year 2005. The energy consumption pattern of Nepal is dominated by traditional sources. It is accounted 88 percentage in the year 2005. The major energy consumption sector are residential sector, industrial sector, commercial sector and transport sector. Residential sector consumes highest amount of energy. It was 289800 GJ in the year 2005/6. To increase the consumption of electricity NEA has fixed different tariff rates and exempt to certain consuming sectors. The lowest rate per unit is fixed in irrigation i.e. Rs 3.50 (0.034 USD).

India is the only country with electricity trading to Nepal. Electricity trading situation is not satisfactory now. Only in the year 12003 net power export is in favor or Nepal.

There is different electricity supply system existing in the country. There are two sub systems under the electric supply system in Nepal. They are INPS and IPPS. There are also some isolated systems supplying electricity independently in the remote areas.

Investment pattern in hydropower project in Nepal is either public, private or joint venture. Prior to 1990 only public sector was in financing in power development. But after the initiation of liberalization policy private sector started to invest in this sector. Before investing in hydro projects, it is necessary to observe the viability of fund and construction cost of project. Later it affects the per unit generation cost. Average construction cost and average generation unit cost of small hydro power plant is higher than other plant. But in usual, the medium HPP are cost effective both in average consumption cost and average generation cost. In the year 1998/99, Rs 4811.30 million (46 million USD) national capital was invested in hydropower sector. The major share of investment in energy sector comes from donors and international NGO's. Nepal has also received international assistance from a long time in hydro resource development. Recently middle Marsyangdi hydropower project (70 MW) has started construction. The estimated cost of the project is about Rs 13.65 million (1.3 million USD).

5.2 Conclusion

While finding out financial viability of hydropower investments, following steps are followed:

- Finding out total investment cost of the project
- Finding out means of financing
- Finding out the Weighted average cost of capital
- Applying capital budgeting techniques, especially the net present value method and internal rate of return method
- Strategically planning along with understanding risk and have a proactive approach to its mitigation

The two-power project that was studied, CHP and NHP are both financially feasible projects. All the capital budgeting techniques applied while evaluating the projects proved positive. The investment process is found to be similar in both project but the investment cost varies depending on the technical and physical aspects.

In the forecasted cash flow statement used in this study, revenue of CHP is higher than NHP. Also, internal rate of return of CHP is higher than NHP which proves that CHP is less cost and more profit project compared to NHP. However, this does not lead to a general conclusion that NHP is a bad project. It is still a very good investment, which, according to

this study, is most of the hydropower projects that have been carefully analyzed and designed.

One of the biggest risks in hydropower investment is the technical risk, arising due to the fault in design, hydrological estimation and the geological surveys. This risk may prove fatal leading the investor to bankruptcy. In the present context, the political and the security risk threaten hydropower investment in Nepal the most. The ongoing political crisis has affected to complete the project like Madhya Marsyangdi. In addition, present political instability has imposed questions on the sanctity of the contracts and payment guarantees of the government. Changes in law like the Electricity Ordinance and Electricity Regulatory Commission Ordinance under discussion also impose another threat.

Risk mitigation is of peculiar importance for hydropower projects that have inherently high front-end risks. During the first years of studies and construction, a lot of money must be spent without any revenue. Delays and cost overruns during this period are therefore critical and it has often been observed that Independent Power Producers tend to have higher revenues than public operators in the first years after commissioning to fulfill private sector requirements on return.

Besides these facts, below is a list of some aspects for overall development of the hydropower sector:

- Nepal's economic growth is closely linked with the development of its water resources, primarily with the harnessing of its vast hydropower potential for national and regional benefit. Nepal introduced economic liberalization a decade ago, realizing that this goal can be met only through active participation of the private sector.
- Since most of the better hydropower project sites are in the remote mountains, construction of access roads to these locations must be the priority so that hydropower developers don't have to deal with the added cost of construction of roads. This could reduce the cost of energy giving it a competitive advantage in the regional power market.
- Local industry related to hydropower should provide with tax incentives to make local products competitive and provide cheaper alternative to imported goods.
- Nepal's internal demand for electricity is principally domestic lighting use; industrial demand is at low levels resulting in low load factor in the power system. Hence, power consuming industries need to be developed within the country and the power trading with our neighboring countries need to be pursued actively.

- The single window policy is highly commendable but there is still room for important so that facilities and concessions provided under Electricity Act and regulations and implemented by all ministries of the government through DOED without many hassles.
- Transmission network must be improved so that energy is not wasted and is easily distributed to the load centers in the nation and beyond. In the context of New Electricity Act in India 2003, which increased the possibility of power export to India, transmission corridors need to be built in to India such that power can be traded in large volumes, furthermore, this opportunity of power trading with India should be utilized even with the current generation facilities.
- The ratification of power trade agreement with India should be expedited and new market in south Asia should be studied to explore further possibilities in the region. Before that power laws should be fine-tuned.
- The fact that both hydropower projects being studied and financially viable and profitable confirms that hydropower investment in Nepal is sound investment opportunities in this sector. There are many incentives for hydropower investment in Nepal. Hence, despite some risks and challenges investors are encouraged for such investment.
- A well-conducted risk analysis can help identifying the project-specific risks, and most of the time, some measures can be taken to counteract them. Governments or some institutions can for example offer credit or political guarantees to the project developers and some insurance can be taken to cover some specific events.
- Finally, good project supervision especially during construction, and an efficient procurement process for the equipment, construction services, etc., also help make a project more competitive. It must be reminded that each risk is usually borne by one of the partners and comes with a price since some provision needs to be made.

5.3 Recommendations

By analyzing CHP and NHP projects and related documents, reports and policies regarding hydropower in Nepal, following recommendation can be made from this study:

- The hydropower sector should follow the practices of setting financial goals for future activities and should develop major programs to accomplish them.

- The hydropower sectors should maintain a separate human resource department to make sure that there is an effective system of handling grievances of employees and conduction of management development and training programs.
- As per hydropower policy 1992, the government of Nepal shall provide exemption of income tax to the project of private sector generating and distributing electricity from the hydroelectric project with the capacity of more than 1000 KW, for a period of 15 years starting from the date of its commercial production. So, the hydropower companies are suggested to invest in the new hydropower projects utilizing such benefits to meet the present crisis of electricity in the country.
- Government should formulate plans and policies to attract private as well as public investors for growth of hydropower companies creating investment friendly environment and focusing on their security in the hydropower development while shielding them from political risks.
- Since having capital intensive nature and is counterbalanced by a very long lifetime, which unfortunately is not always a feature sought by private equity. In this context, Public Private Partnership can help filling the gap between economic and financial viability.

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