CHAPTER-I

INTRODUCTION

1.1 BACKGROUND

Nepal is a landlocked country in South Asia, located between latitudes 26 o 22'N to 30 o 27'N and longitudes 80 o 04'E to 88 o 12'E, and bordered by China to the north and India to the south, east and west. With a total land area of 147,181 sq. km, the country is characterized by diverse topography, geology and climate, as well as patterns of land use. Nepal is predominantly mountainous, with elevations ranging from 64 m above sea level to 8,848 m at the peak of the world's highest mountain, Sagarmatha, within a span of 200 km. Approximately 6,000 rivers and rivulets, with a total drainage area of about 194,471 km 2, flow through Nepal, of which 76% of this drainage area is contained within Nepal(Shrestha, 1969:1).

Nepal is rich country in water resource. Together with this resource the steep topography endow this country with a great potential for the hydropower development. The theoretical hydro electricity potential of Nepal is 8300 MW. From the point of view of hydroelectric power resource, the kingdom Nepal can be broadly divided into four river basins, 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 ($170,19^{9}m^{3}$) in the country (Shrestha, 1969:1).

We get hydro electricity 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 resources. Thus creating reservoir that can be used for recreation of water supply purpose.

Hydro electricity is first originated from water resources at Roghbury in Northumberland in 1879. Lord Armstrong lit his house with electric lamp using currents from a dynamo driven by a water turbine (Benton, 1994). In Nepal "Shree Chandra Jyoti Rakish Bijuli Adda" that 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. Ministry of industry, commerce and supplies, through public corporation 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.)

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 hydro electricity is 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 that dot the Nepali hills. They are used principally for grinding corn. 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).

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For the proper development of power through strong institution, NEA was established in August 1985 (B.S. 2042) 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 institutions 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 programme 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 droven 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 world, yet hydropower plants are estimated to provide only about 2 percent of the world energy requirement.Electricity 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 Pherping (500kw) by Prime Minister Chandra Shamsher in 1911 A.D. to fulfill the energy need of ruling class. Second power plant was developed at Sundarijal (900 kw) by Judha Shamsher Rana in 1939 A.D.

Water is the most important natural resource of Nepal. There are about 6000 rivers and rivulets of which there are seven major rivers in the Kosho basin, seven major rivers in the Gandako Basin and five major rivers in the Karnali Basin which are

perennial. The total average run off is estimated at about 225 billion cubic meters with an estimated hydro electric 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 has access to electricity. The Nepalese domestic demand of electricity is dramatically increasing on average at 8 percent a year which is largest growth in the residential, commercial or industrial and agricultural sector. Despite this because of her geographic characters the prospect of hydropower development is very high (Pokheral, 2008:8).

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
Tarai	10	1	1	50
Total	**83,280**	**89**	**29,761**	**1,45,050**

Source: (N EA, 2007:42)

The theoretical, technical and economical potentiality of main river system has been estimated 83.28, 49.61 and 42.133million KW respectively. Table 3.1 has presented potentiality of major rivers.

Table 1.2

Major River and Hydro 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 potentiality	**83.29**	**49.61**	**42.133**

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

General Introduction of two selected companies

a) Chilime Hydropower Company Limited

Chilime Hydropower Plant, a peaking run-of-river type plant owned by Chilime Hydropower Company Limited is located at 133 KM north of Kathmandu at the right back of Bhotekoshi river in Rasuwa district. The plant, with the stalled capacity of 22.56MW, is delivering the power of 20MW as per power purchase agreement (PPA) with NEA since 24th Aug 2003. The plant is designed to generate 137GWh energy per annum. The generated energy from the plant is being fed to National Grid through a 38 Km long 66KV single circuit transmission line at Trisuli, Nuwakot district.

The Generated electricity from the power plant is purchased by NEA at the powerhouse and evacuated as per the PPA made on 2054/03/11. The annual deemed energy salable to NEA is 132.9GWh, excluding penalty free outage of 36 hours (720MWh) annually.

b) National Hydropower Company Limited

National Hydropower is a public sector hydropower in Nepal. The project is in Indrawati River at Sindhupalchok. The project is establish in 2054 B.S. under water recourses policy 2049.After the studying of potentiality of Indrawati River projected by project Nepal Electricity Authority (NEA) agreed to purchase 5MW from the project.

Detailed study of the project was completed in 2057 B.S. while launching third phase. During the third phase the project increase its capacity from 5 MW to 705MW. The project is situated in Jyamire V.D.C. of Sindhupalchok District. Now the project is running in profit from the fiscal year 2064/62.

1.3 STATEMENT OF PROBLEM

Nepal is rich in water resources with vast potentials for generation of the hydroelectricity, but the present exploitation is very low in comparison to its potential. The energy consumption of Nepalese people is very low among the other countries. A large proportion of people still use traditional type of energy. Among various sources of energy, hydroelectric energy is cheaper and with high

current flow. Only a small portion of rural people is deprived of access to electricity. This shows the urgency of exploiting hydropower potentially not only for enabling people to use hydropower for meeting energy needs, but also for increasing power supply to individual use.

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. Ministry of industry, commerce and supplies, through public corporation 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.

Limited domestic market is one of the major hurdles in hydropower development in Nepal. This may be attributed to the small size of the country and low level of industrialization. Nepal's potential electricity export market is India, Bangladesh and China. But Nepal has not been able to export hydropower to the market of this country. There is many problems in the energy sector of Nepal. This may be listed as heavy dependence on biomes sources, low per capita consumption of electricity, low production and slow growth in supply, insufficiency of present growth to meet future demand, vast difference in the use of electricity as between urban and rural areas. In addition, inefficiency in generation, transmission and distribution. The study attempts to see answer of the following questions.

- Do the capital budgeting best describe the investment of the hydropower companies?
- What types of contemporary steps are essential for investment improvement of Nepalese hydropower companies?
- What level of satisfaction on provided to the stakeholders by these public sector hydropower companies?
- Which company has more effective and efficient of investment?

1.4 OBJECTIVE 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 on the basis of case study o two hydropower projects of Nepal – Chilime and National Hydropower Project. In addition to this, the study has following specific objectives:-

- To examine the investment process and financial viability of hydropower projects.
- To analyze the investment climate and explore the challenges in the hydropower sector.
- To analyze the purchasing price per unit of power by Nepal Electricity Authority is the price per unit is cheap?
- To provide necessary suggestions on basis of study findings.

1.5 SIGNIFICANCE OF THE STUDY

Nepal has huge potential for hydropower development; there are many opportunities for profitable investment in the hydropower sector. Hence, the subject of this study itself magnifies its significance. The study will deal with numerous aspects of investment in hydropower projects; investment decision, financial analysis and risk analysis. In addition, the study will also analyses investment climate in Nepal to some extent, which why this would be useful to potential investors of hydropower projects. This would be equally helpful to research students and students of finance. These studies will compilation of numerous information regarding hydropower sector of Nepal so this could be significant use of anyone seeking information about hydropower sector in Nepal.

The energy consumption pattern is not same in the country. Kathmandu valley consumes the total of 50% hydro energy and its increasing demand is 20% in Kathmandu valley. Outside the valley demand of power is increasing about 10 percent. So to fulfill this situation it's necessary to study the investment situation so as to ease generation, transmission and distribution of power with cheap and minimum loss as well as institutional expansion and developmental works of energy sector.

1.6 LIMITATION OF THE STUDY

"Investment in this broadest sense means to sacrifice of current dollars for future dollars" investment is the vast topic. When investing in any project, different detailed analyses have to be made to make sure that the sacrifice of current dollars is worthwhile. There are five important facets of projects analysis.

- Market analysis
- Technical analysis
- Financial analysis
- Economic analysis
- Environment analysis

- The study covers a period 5 years from the 2002/03 to the recent fiscal year 2007/08 of CHP and NHP but main focus is on initial investment.
- The secondary data is basic input of the study and thus accuracy of conclusion derived from them highly depends upon the reliability of these data.
- Since the study is mainly concerned with CHP and NHP out of various hydropower companies in operation, the conclusion drawn from the study, and suggestion offered may not be applicable to any other private or public hydropower companies.
- Resources (time, money etc.) are limited.
- This study may not be precise as it is to fulfill the partial requirement of the MBS programme.

1.7 ORGANUZATION OF THE STUDY

The study contains five chapters in total:

Chapter I This introductory chapter includes brief background information on the investment scenario in Nepal, especially in the hydropower sector. This chapter also narrates the privatization policy of the government and its effects in hydropower sector. This chapter finally explains the objectives, significance and limitations of the study.

Chapter II This chapter deals with literature review, in other words, it focuses on the theoretical parts of the study, including conceptual reviews and review of books, article, journal and thesis. Conceptual review includes theoretical explanation of investment decision, financial terms and project evaluation and analysis techniques.

Chapter III This chapter with the name of research methodology includes sources of data, research design, population and sample and data analysis tools. The financial and statistical tools used for data analysis and explained.

Chapter IV This is the most important and extensive chapter as it include the main theme of the study. This chapter explains all the collected data, analysis them and finally based on detail analysis, conclusion are met. This chapter explains how hydropower projects are financially evaluated. In addition, this chapter also includes a comparative analysis of investment in hydropower by two public sectors and information on investment climate, opportunities and challenges in the hydropower sector in Nepal.

Chapter V This is the concluding chapter, where a brief summary of the whole study is given, conclusion of the study is explained and recommendations are given. Recommendations are based on the comparative studies of two power plants.

CHAPTER - II

REVIEW OF LITERATURE

Several works on hydropower sectors, which have been studied, are mentioned below: 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 term of outlays or benefits, are irrelevant. (Bajracharya, Ojha, Goit & Sharma 2004:255)

Many important and useful literatures are available for Nepalese water resource and hydropower sector. National and international expertise has been interested for their expertise in this sector. Some notable literatures on water resource and hydropower sector are reviewed here. An effort has been made here to literature is divided in to toe parts.

- **Conceptual Review**
- **Review of Article**
- **Review of Related Pervious Studies**

2.1 CONCEPTUAL REVIEW

2.1.1 Hydropower Development

The history of hydropower development is not so old. It can be traced back to early 19th century, when in 1831, for the first time, Michel Faraday and Joseph Henry formulated the principle of electric power generation. This section deals with the studies made on hydropower development in the context of Nepal. Studies made in the context of our countries like India is also overview to gain an insight of relevant issues, methodologies, analytical tools, etc. already employed and to explore their usefulness in the context of present study. Literature on hydropower and its development made in the context of Nepal is scattered in the form of textbook, articles, research papers, magazines, dissertations, reports, newspaper, and published and unpublished official records.(Panta,2005:167)

2.1.1.1 Power Development Prior to Plan Period

After initiation of Pherping HP in 1911 and before implementation of first five year plan in 1956, total achievement of electric sector is given below:

Table 2.1

Power Development in Nepal Prior to Plan

S.N.	Power plant	Capacity (KW)
1	Pherping Hydel Plnat	500
2	Sundarijal Hydel Plnat	640
3	Morang Hydro Electric Co.	677
4	Birgunj Electric Supply Co.	225
Total		**2,042**

Source:(Acharya ,1999:31)

Table 3.2 has shown total achievement in hydro electric generation was 2,042 KW prior to plant.

2.1.1.2 Power Development after Plan Period

Nepal has specific direction on power development after planned economic development since 1956. It was proposed to increase the generating capacity of hydro-power in different plan period. Following table 3.2 reveals the target of total plan periods power generation and achievement in different plan period.

Table: 2.2

Target and Achievement in Power Generation in Different Plan Period

Plan Period	Target in KW	Achievement KW	Resource Allocation (Rs in Millions)
Before planning	-	2,043	-
First plan (1956-61)	20,000	-	30
Second Plan (1962-65)	12,250	2,400	91
Third plan (1965-1970)	60,000	13,000	260
Fourth Plan (1970-75)	36,300	26,040	255
Fifth plan (1975-1980)	59,954	16,220	230
Sixth plan (1980-90)	1,29,923	75,371	3800
Seventh plan (1985-90)	1,06,629	1,03,055	4757.100
Eight plan	29,700	2,52,418	32034
Ninth plan	5,38,000	5,27,500	23385

Source:(Acharya ,1999:34)

2.1.1.3 Major Hydro projects installed in different plan period and installed capacity

The major hydroelectric project installed after plan period, since 1956 and their installed capacity are present in the table 1.3 below:

Table 2.3

Major Hydro projects installed din different plan period and installed capacity

Plan	Project installed	Installed capacity MW	Installed year
First plan	-	-	-
Second plan	Panauti	2.4	1965
Third plan	Trisuli	21	1967
	Pokhara	1	1967
Fourth plan	Sunkoshi	10	1972
Fifth plan	Gandaki	15	1979
Sixth plan	Kulekhani-I	60	1982
	Devghat	14	1983
	Pokhara Seti	1.5	1985
Seventh plan	Kulekhani-II	32	1986
	Marsyangdi	69	1989
Interim plan	Adhikhola	5.1	1991
Eighth plan	Jhimruk	12.3	1995
Ninth plan	Puwa khola	6.2	2000
	Khimti khola	60	2000
	Modi	14.8	2001
	Bhotekosi	36	2002
Tenth plan	Indrabati	7.5	2003
	Chilime	20	2003
	Kaligandaki-A	114	2003

Source: (Jha , 2004:62)

Power Development in Tenth Plan (2002-2007)

i. Target and Objectives of Tenth Plan:

Resources allocation of public sector is Rs. 30394.2 million in normal growth rate in which share of government sector is accounted Rs. 23795.6 million and NEA's Rs. 6598.6 million in tenth plan.

a. Targets of Tenth Plan: The long-term targets of this sector will be as follows:

a. To raise the consumption of electricity to 3.5 percent from the existing 1.4 percent of the total power consumption of the country.
b. Initiatives will be taken to export 22,000 mw electricity generated from the development of Pancheshower, Karnali and Saptgandaki multi-purpose projects.
c. Hydroelectricity projects will be constructed to generate 2,230 MW electricity, out of which 400 mw could be exported.
d. Electricity will be supplied to 63 percent people through national grid and 17 percent will be covered form alternative sources of energy.
e. Per capita electricity consumption will be raised to 180 kilowatt-hours.

b. Objectives of Tenth Plan

The following objectives have been set for the electricity sector to reduce poverty in a sustainable manner in the tenth plan.

a. To produce electricity at low cost harnessing the existing water resources.
b. To supply reliable and high quality electricity at reasonable price through the kingdom by integrating economic activity.
c. To expedite rural electrification so that it could contribute to the rural economy.
d. To develop hydroelectricity as an exportable item:

c. Quantitative Targets:

The following targets have taken for achieving the objectives of the tenth plan.

a. Hydropower projects will be constructed to supply 842 MW electricity, out of which 70 mw could be exported.
b. Additional 10 percent people will be supplied electricity through the national grid for which power will be supplied to 2,600 village

development committees through the national grid and additional 5 percent people will be supplied power through alternative source of energy.

ii. Programs of Power Sector in the Tenth Plan

a. Electricity Production and Supply:

A total of 315 mw electricity will be generated and supplied from both the public and private sector during the tenth plan to meet the domestic demand. The public sector will produce 101 megawatt and the private sector 214 megawatt. The contribution of 70 mw Marsyangdi hydropower project and another 74 mw power generated from small hydropower project (less than 10 mw capacity) during the plan period will be remarkable. (Kapali, 2007:17)

It shall be required to begin construction of some hydropower projects during the tenth plan in order to export and meet the demand of power after the completion of the tenth plan. Construction of hydropower projects with a total capacity of 1,938 mw will be begun during the tenth plan. Arun with 402 mw, upper Karnali with 300 mw and upper Tamakoshi (Rolwaling) with 250 megawatt capacity are among the major projects.

The construction of western Seti hydropower project of 750 mw capacity will also be commenced during the tenth plan. This apart, construction of a reservoir hydropower project suitable to the existing electricity system will be started during the plan period. (Kapali, 2007:18)

b. Electricity Transmission and Consolidation

Construction of a total of 430KW long transmission lines of various kilovolts will be completed during the tenth plan in order to transmit power form the hydroelectricity projects to the completed during the plan period to electricity consumption center, to export more electricity and to consolidate the system.

Of the total, 301 km transmission line will be constructed by the public sector of which the 127 km long Chameliya - Attariya 132 kv transmission line is worth mentioning. In addition to it, the construction of 140 kw Hetauda- Berdaghat, 75 km Khimti- Dhalkebar and 40 km Hetauda – Thankot 220 kv and 14 km Dumre – Damauli 132 kv transmission line will be commenced during the plan period. This apart, 129 km. transmission line will be constructed by private sector.

Besides constructing new transmission lines, some new substations will also be built and the capacity of some existing substations will be enhanced. Construction of a total of 426 MVA capacity substations of various kilovolts will be completed during the tenth plan. (Kapali, 2007:19)

b. Electricity Distribution, Extensions and Electrification

Special emphasis will be given on expanding electricity to the rural areas in the tenth plan considering the unavailability of the facility. During the plan period, 965 km long transmission and distribution lines of 33 KV, 4,977 km of 11 KV and 9,940 km of 400/230 MVA and 33/11 KV distribution substations of a total capacity of 143.5 will be constructed for this purpose.

This will facilitate additional 1,000 village development committees and 705,600 consumers. Electricity will be extended to additional 14 districts during this plan period through the national grid. It is targeted to involve cooperatives or users groups in rural electrification. (Kapali, 2007:20)

d. Surveys, Studies and Promotional Activities

Surveys and studies will be made on the hydropower projects to be completed or begun during the tenth plan and on selecting appropriate projects to supply power in the future and on exporting electricity. During the plan period emphasis will be given on the studies of reservoir projects. Surveys and studies will be commissioned on various projects with a total capacity of 13,376 mw of which 12,239 mw will be produced form the public sector and 1,137 from the private sector. (Kapali, 2007:20)

ii. Studies being Commissioned with Bilateral

Cooperation on Paneheshwor multi-purpose project (6,480 mw), Sunkoshi-Kamala Diversion (1,300 mw) and Saptakoshi multi-purpose project (3,400 mw) will be completed during this plan period. Other studies on water resources and power development and on promotiong the private sector in the development of electricity will continue during the tenth plan. (Kapali, 2007:21)

2.1.1.4 Institutions for Hydropower Development in Nepal

a. **WECS:** The secretariat gives suggestions to the concerned agencies of the government on formulation of policies and project implementation for appropriate use, control, protection, management and development of water resources and energy.

b. **Department of Electricity Development:** The department of electricity development will be basically developed as a study and promoter institution for carrying out studies on hydropower projects including multipurpose projects and attracting to and encouraging the private sector in the development of hydropower.

NPC works as a line agency of the government. NPC is responsible for the national planning and coordination of all sectors. For the water sector the WEC and its secretariat were established as a coordination and advisory body. Its ability to coordinate the numerous agencies involved in the water sector has not been effective because it does not have explicit authority. The highest authority for decision making on water related issue is the National Water Resource Development Council (NWRDC). (Upadhaya, 2003:67)

2.1.1.5 Water Resources Act 1992

This act has been enacted to address the need to make arrangements for national utilization, conservation, management of water resources in Nepal and to make timely legal arrangements for determining beneficial uses of water resources, preventing environmental and other hazardous effects thereof and also for keeping water resources free form pollution.

This act prioritizes the water use as drinking water, irrigation, other agricultural use, hydropower, industrial uses, navigation, recreational uses and other uses. This act introduces the concepts of licensing, water use associations and water quality.

2.1.1.6 Energy Consuming Sectors of Nepal

Major energy consuming sectors of Nepal are listed below:

Residential Sector

The residential sector consumes about 90 percent of total energy of Nepal in 2004/05. This sector consumes about 331 million GJ in 2004/05. Biomass resources are the major fuels used in this sector, namely the fuel wood agricultural residue and the animal waste. Recently renewable resources like biogas and electricity form micro-hydropower and solar home systems are substitutes of the conventional fuels used mainly for cooking and lighting. The commercial source of fuel is used in nominal in amount and is mainly used in the urban centers. The trend of residential sector energy consumption is presented in Annex-1. In the residential sector the energy used in mainly for different end use, mainly cooking, heating, animal feed, preparation, lighting, etc. The electric energy used in residential sector is 2729 GJ in 2004/05. (K.C., 2007:59)

Industrial Sector

The industrial sector energy consumption is about 3.47 percent of the total energy consumption in 2004/05. The energy consumption has been increasing marginally during the last few years since 1995. The industrial energy consumption has increased at the rate of 1 percent only. It is estimated that about 12.7 millions GJ of energy is consumed in the industrial sector in 2004/05. The electric energy consumption of industrial sector is 2750 GJ in the year 2004/05

The main end-use of energy in the industrial sector are process, motive power, water boiling in the boilers and lighting. (K.C., 2007:59)

Commercial Sector

Total energy consumption in commercial sector, which includes schools, hotels, restaurant government and non-government institutions etc. has increased from 2-4 million GJ in 1995 to 4.3 million GJ 2000/05 which shows an increase in 8 percent per annum. The main fuel use in commercial sector is fuel wood, kerosene and electricity. The main end use of the commercial sector is quite similar of residential sector such as cooking, heating, lighting, cooling etc.

Transport Sector Energy Consumption

The total energy consumption in the transport sector has been in the increasing trend. It has been seen that for the past few years the energy consumption growth rate in this sector is about 4 percent annually. The total energy consumption of this sector in the year 2004/05 is about 13.8 million GJ. The high speed diesel takes the highest share with 63 percent. The contribution of LPG and electricity is nominal to this sector. (K.C., 2007:60)

Agricultural Sector

The total energy consumption in the agricultural sector is about 3 million GJ in the year 2004/05. It is about 0.84 percent of the total energy consumption of the country in the same year. The main fuel used in this sector is high speed diesel and electricity. Diesel is used for water pumping (irrigation) as well as for land preparation, harvesting etc. and electricity is used for lift irrigation.

Table 2.4:

Sectoral Hydro Electric Energy Consumption Pattern in Nepal

(000 GJ)

Year / Sector	2003/04	2004/05	2005/06	2006/07
Residential	2009	2222	2435	2729
Industrial	2152	2266	2483	2750
Commercial	326	334	389	394
Transport	20	20	20	21
Agriculture	105	108	114	180
Total	5612.5	5617.33	5941.75	6474.8

Source: (K.C., 2007:61)

2.1.2 Financial Sector for Hydropower Development

2.1.2.1 Public Sector Financing

Domestic private individuals, joint venture companies(private), public companies, government's own resources(revenue) and domestic capital market constitute the major sources of local level financing.

Haggard(1994:61-62) opines that each country shall have develop a power financing model to suit its needs, to be successful in developing local capital markets, where domestic savings are mobilized to finance domestic projects,

which determines the need for international commercial involvement. He has emphasized the BOOT projects financing involves government loans, domestic development finance institutions(DFIS), commercial banks loans, capital market borrowings, supplier credits and multilateral export, credit insurance and loans. Today government grants and DFTS has the limited resources and international commercial banks have limited cross- border appetite. In addition, he suggested that international capital markets should be encouraged for financing the energy projects. He is not in favor of local financing and power development sector.(Sharma, 2004:05)

Sharma (1997:334) argues that Nepal should establish "Energy Development Bank", like Agriculture Development Bank where right to purchase share goes to Nepalese only. The government should give guarantee of minimum 10% return from such bank. However, he has not given any schemes for the development of such bank.

Local level financing in hydropower development has just begun in Nepal. In this connection, Suseli (2000:16) mentions that Puwa Khola hydropower project of 62MW capacity started generation with 25% of total cost being shared by NG and 75% by NEA. This project, for the first time, was completed under the entire supervision of Nepalese technicians. The per unit cost of power was stood Rs. 2.80 per KWh.

The total cost of Chilime Hydropower project is estimated to be RS. 2.32 crores, and out of this Rs. 80 crores (34.5%) has been financed by the employees provided fond and 51% by NEA, the remaining 14.5 percent by general people. This was also the first time that share to be issued for the general people. (Pokhrel, 2008:29)

2.1.2.2 Private Sector Financing

With the growing popularity of privatization in the world, the government of Nepal has given emphasis to private sector financing for the development of hydropower from the sixth plan; this concept was incorporated in national planning and was reinforced in the successive plans, particularly from the eighth plan.

In Nepal, Khimti Hydropower project of 60MW is the first private sector project, which was undertaken and completed by Himal Power Company and Norwegian

Company “Interkraft” under the BOOT system. The estimation was US$ 98 million of which 30% of the cost was made by promoter and remaining 70% by the loan assistance of the IFC and other international financial institutions.(Bhattarai, 2007:236)

The World Bank advocates for setting up power development fund, as it would serve as a catalyst for long term private investment in small and medium projects; it also suggest that the government should explore options for private sector financing for large hydropower projects for export purposes.

Variouis projects such as Bhotekoshi, Indrawati and Chilime hydropower project are under construction by private sector participation. Like this ‘Vidyut Bikash Bibgag’ invited the proposals of development and feasibility study of 22 hydropower projects and 28 local and foreign private investors have submitted 62 proposals. Chaina also has adopted BOT system in hydropower plants with generating capacity of less than 250 MW with a view to attract foreign investment. The Japanese trading house Marubeni Corporation and US based independent power producers also have plans to invest more than 50 power plans through Asia. However, there is no substantial basis to suggest that the private financing is the best among the financial sources.

2.1.2.3 Foreign Aid Financing

Foreign Aid I an important source of financing and it has played a vital role in the economy of most of the developing countries. In Nepal, it has also played an important role in the development of the all sectors of the economy since the over through of Rana Regime in 1951. Almost all the power projects, transmission lines, distribution lines and sub – station have been implemented under the foreign aid financing like grants and loans. From both the bilateral and multilateral sources, some cities argues that foreign aid has been beneficial to Nepal’s socio-economic development while some argue that foreign assistance following in to the country is not doing well to the country and is pushing the country in to a state of dependency (Bista, 2005:21)

Nepal has been mobilizing foreign resources since the first five year plan for the development of power; NG had covered about 15 to 25 percent of total investment

and foreign assistant about 75 to 80 percent. The major problems in foreign aid are constraint in exporting power, risk of investment, frequent changes of government policies, inadequate legal provisions, geographical complexity, lack o accessible roads and trained manpower and technology and lack of national consensus among the political parties. The commercial banks in Nepal cannot take the risk of financing this sector. Like this, it is also difficult to bear the investment by a signal donor agency and managing joint venture usually takes longer time. He estimates investment requirements in electricity for the next 30 years. Investment assuming specific costs of runoff river and storage schemes is US$ 2.2 and 1.5 million per MW respectively and based on this, the total estimated investment is US$ 9718 million, of the total cost, 23 percent (US$ 2235 million) will be contributed by external assistance. Of the external assistance, 18 percent) will be available as the bilateral assistance and the rest 82 percent (US$ 6136 million) will be in the form of multilateral loan (Shrestha 1996:23-25)

WECS (2005) estimates that total hydropower development is about Rs. 525 billion. Financial resources will need to be increased 1.5 times from the present level in order to meet the target within 30 years. Donor commitment in for hydropower is less likely to come in future, so resources will have to come from private sector and some from private/public partnership, with some multilateral backings. Rural electrification will require donor support to meet the targeted level of coverage. No estimate of additional investment in hydropower for export can be made for large multi-purpose projects until there are agreements on project schemes between Nepal and India, keen interest has been shown by private investors to develop hydropower in Nepal but there is need to sign power purchase agreement with India.

2.1.2.4 Foreign Direct Investment

Nepal and India are dependent on assistance from multilateral institutions like World Bank and ADB for the development of hydropower projects. The World Bank suspended the promised assistance both to the Sarada Sarovar Dam in India and Arun III in Nepal. The best way for hydropower projects is to arrange finance and operate by the commercial entities like Enron, such deficit with India.

There is no guarantee that foreign direct investment would benefit host countries, as it depends upon government policies of that country which ensures that FDI contributes positively to economic development where benefits are also maximized. However the given any analysis of the impact of FDI on economic growth. (Bista, 2005:21)

2.1.3 Investment

"The investment objective is to increase systematically the individual wealth, defined as assets minus liabilities. The higher the value of desired wealth the higher must received. The investor seeking higher return must be willing to face the level of risk". (Dangol, 2005:426)

"Investment as the commitment of funds to one or more assets that will be held over some future time period". Investment is concerned with the management of an investor's wealth, which is the sum of current income and present value of all income" (Dangol, 2005:426)

In this way it is clear that an investment means to trade rupee amount today for some expected future of payment of benefits, which will exceed the current outlay by an amount that will compensate the investor for the time the funds are committed, for the expected changes of prices during the period and for the uncertainty involved in expected future cash flow.

The website defines the investment and investment decision:

Investment Decisions Includes**:**

- Complete case building project management**.**
- Case-building project planning and industry analysis
- Selection of the case-building team (ideally representing all major organizations and functions impacted by the investment decision).
- Recruitment and management of a Business Case Advisory Group.
- An easily understood, comprehensive cost model, to show clearly which cost items were included, which were not, and why. The cost model also establishes clearly that alternative scenarios were compared fairly.
- A comprehensive cost analysis, showing projected investment costs under "Business as Usual" and "Proposed Investment" scenarios, across the life of

the investment. The cost model and analysis are implemented and delivered in MS Excel format, for continuing investment management and control.

A solid and complete benefits rationale, validated with your stakeholders and management. The benefits rationale is the logic that legitimizes benefits for.

And according to the website **www.cbdd.wsu.edu.com**, before making any investment, the project should be analyzed in detail. The important facets of the project analysis are:

- Market Analysis
- Technical Analysis
- Financial Analysis
- Economic Analysis
- Environmental Analysis

Market Analysis

A market consists all potential customer having wants who posses ability and willingness to engage in exchange to satisfy their wants, it deals with market power, market share, market growth. Market analysis is concerned primarily with two questions:

- What would be the aggregate demand of the proposed product/service in future?
- What would be the market share of the projects under appraisal?

Two answer the above question; the market analyst requires a wide variety of information and appropriate forecasting methods. The kind of information required is:-

- Consumption trend in the past and the present consumption level
- Past and present supply position
- Production possibilities and constraints
- Structure of competition
- Cost structure
- Elasticity of demand
- Consumer behaviors, intentions, motivations, attitudes, preferences and requirements.

- Distribution channels and marketing polices in use
- Administrative, technical, and legal constraints.

Technical Analysis

Analysis of the technical and engineering aspects of a project need to be done continually when a project is formulated. Technical analysis seeks to determine whether the prerequisites for the successful commissioning of the project have been consider and reasonably good choices have been made with respect to location, size, process, etc. the important questions raised in technical analysis for the hydropower projects are:

- Whatever the preliminary tests and studies have been done or provided for?
- Whatever the availability of human resources, power and other inputs has been established?
- Whatever the production process chosen is suitable?
- Whatever the equipments and machines chosen are appropriate?
- Whatever the auxiliary equipment and supplementary engineering works have been provided for?
- Whatever provision has been made for the treatment of effluents?
- Whatever the technology proposed to be employed is appropriate from the social point of view?

Financial Analysis

Financial analysis seeks to ascertain whatever the proposed project will be financially viable in the sense of being able to meet the burden of servicing dept and satisfying the return expectations of the shareholders. The aspects, which have to be looked in to while conducting financial appraisal of the hydropower projects, are:

- Investment outlay and cost of project
- Means of financing
- Cost of capital
- Projected profitability
- Breakeven point

- Cash flows of the projects
- Investments worth wholeness judged in terms of various criteria of merit
- Projected financial position
- Level of risk

Economic Analysis

Economic analysis, also referred to as social cost benefit analysis, is concerned with judging of project from the larger social point of view. The question ought to be answered in social cost benefit analysis are:

- What are the direct economic benefits and costs of the project measured in terms of shadow (efficiency) prices and not in terms of market prices?
- What would be the impact of the project on the distribution of income in the society?
- What is the impact on digital divided of the investment projects?
- What should be the contribution of the project towards the fulfillment of certain merit wants like self-sufficiency, employment and social order?

Environmental Analysis

In recent years, environmental concerns have assumed a great deal of significance and rightly so. Investment in the hydropower industry should give much consideration on the environmental aspects. Among the question to be asked included:

- What is the likely damage caused by the project to the environment? E.g. how aquatic life of the river would be affected?
- How installations of distribution and transmission lines affect the environment?
- What are the socio-economic effects on the people in project area?
- What is the cost of restoration measures required to insure that the damage to the environment as well as socio-economic environment is contained within acceptable limits?

2.1.4 Capital Budgeting

Investments that extend beyond a year are called capital investments and such decisions are called capital budgeting decisions: “Capital budgeting involves the entire process of planning expenditures with returns that are expected to extend beyond one year. The point capital budgeting – indeed, the point of all financial analysis – is to make decisions that will maximize the value of the firms” (Dangol,2005:912)

Is the investment worthwhile? Every individual. Capital expenditure decision needs to be thoroughly analyzed first as it has long term repercussions. This is the essence of efficient capital expenditure management. A wide range of project evaluation criterion has been suggested to judge the worthiness’ of investment projects. The important investment appraisal criterion classified into two broad categories, which are follows:-

A) Traditional or Non-discounted Method
    a) Payback Period
    b) Accounting Rate of Return
B) Discounted Cash flow or Time Adjusted Method
    a) Net Present Value
    b) Profitability Index
    c) Internal Rate of Return

A) Traditional or Non-discounted Method

This method does not consider the time value of money. It assumes that the future value of money is equal to present value. This method had been used during the early period of introduction of Capital Budgeting. The traditional method emphasis either on early return of invested amount or on the earning of the project. In other words it considers either liquidity or probability.

The following two evaluation techniques are available under this method.

a) Payback Period
b) Accounting Rate of Return

a) Payback Period

The number of years required for the proposal's cumulative cash flows to be equal to its cash outflows is known as Payback Period. It can be defined as the number of years required to cover the original cash outlay which are invested in a project. The evaluation technique of payback period is based on liquidity. The project which pays back the initial capital investment in the smallest period is given the highest rank.

$$\text{Payback Period} = \text{Minimum Year} + \frac{\text{Amount to be recovered}}{\text{Next Year CFAT}}$$

(Source: Dangol, 2005:917)

Decision Rule:

There is no any clear indication of the rule in payback period. Sometime the management set the pre-determined target period. Accept or reject of the proposal is depends upon the payback period of the project. The payback period of proposed investment is to be compared with pre-determined target period. If payback period of the proposed investment is more than the target period, the project would be rejected. On the contrary it would be accepted. R the payback period of the proposal should be less than the life of the project. If the different proposals are ranked in order of priority, the proposal with the shortest payback period will be first in priority list and it will be selected amount the different proposals.

Advantages of Payback Period

i) It is simple to understand and easy to compute.
ii) This method gives more emphasis on liquidity in deciding about the investment proposals.
iii) The term approach of payback period minimizes the possibility through obsolescence.

Disadvantages of Payback Period

i) This method does not recognize the time value of money.

ii) It recognizes only the recovery of net investment, not profit earned during the working life of the assets. Thus it considers liquidity and ignores profitability.

iii) The payback period also ignores the salvage value and total life of the projects.

Accounting Rate of Return

The accounting rate of return (ARR) method of evaluating a proposed capital expenditure is also known as average rate of return method. It is based upon accounting information rather than on cash flow. There is no unanimity regarding the definition of the rate of return. There are number of alternative methods for calculating of ARR. Under the accounting rate of return technique, the average annual expected book income is divided by the average investment in the project.

$$\text{Accounting Rate of Return} = \frac{\text{Average Rate of Return}}{\text{Average Book Investment}}$$

(Source: Dangol, 2005:918)

Decision Rule

With the help of the ARR, the financial decision maker can decide whether to accept or reject an investment proposal. According to ARR, as an acceptance or reject criterion, the actual ARR will be compared with the predetermined or a minimum required rate of return or cute off rate. A project will be qualify to be accepted if the actual ARR is higher than the minimum desires ARR. Otherwise it is liable to rejected.

Advantages of ARR

i) It is very simple to understand and easy to adopt.

ii) It considers the entire stream of income in calculating rate of return.

iii) This method is based upon accounting concept of profit. In consequence, it can be easily calculated.

Disadvantages of ARR

i) It considers only the net income and ignores net cash flow.
ii) It ignores the risk of the project.
iii) It does not recognize the time value of money.
iv) It does not consider the life of the proposal.

B) Discounted Cash flow or Time Adjusted Method

The traditional method does not consider the time value of money. The traditional method assumes that there is not any difference between present value and future value of money. The present value is equal to future value. The present value is equal to future value just in the absence of interest rate in economy.

The discounted cash flow method takes in to consideration the time value of money. It is distinguishing features of discount cash flows. Moreover this method considers all benefits and costs occurred during the life of the project.

I) Net Present Value (NPV)

The NPV method is a discounted cash flow approach to capital budgeting that discount all expected future cash flows to the present using a minimal desired rate of return. To apply the NPV method to a proposed investment proposal a manager first determines some minimum desired rate of return. The minimum rate of return is called the required rate of return, hurdle rate, discount rate or cost of capital. Then all expected cash flows from the project are discounted to the present, using this minimum desired rate. If the sum of the present values of the cash flow is zero or positive, the project is desirable and if negative it is undesirable.

This method requires the determination of three items for the project:

- Initial cash outflow
- Future net cash inflow and
- Minimum required rate of return

Net present value requires that all cash flows associated with new investment proposals be discounted in a predetermined weighted average cost of capital.

Decision rule

The decision rule for a project under is to accept the project if the NPV is positive and reject if it is negative. Zero NPV implies that the firm is in a dilemma as to accepting or rejecting the project. However, in practice, it is rate that such a project is accepted as such a situation simply implies that only the original investment has recovered. As the decision criterion this method can also be used to make a choice between mutually exclusive projects.

Advantages of NPV

i) This method recognizes the time value of money.
ii) It considers all the cash flows over the entire life span of the project.
iii) In this method, the priority is given to both profitability and risk of the project.
iv) This method also helps in satisfy the objective for maximizing the firm's value.

Disadvantages of NPV

i) This method is difficult from the view point of users.
ii) It also give wrong decision, in case, the amount of investment of mutually exclusive projects are not of equal amount.
iii) In the same way as above, it may not give correct decision with project with unequal life.
iv) It is not easy to determine an appropriate discount rate.

(Source: Dangol, 2005:925)

II) Profitability Index (PI)

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 future cash outflows and the present value of cash outlays. PI may be defined as a ratio, which is obtained by dividing the present value of future cash inflows by the present value of cash outlays.

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

(Source: Dangol, 2005:930)

Decision Rule

As aforesaid and investment proposal is accepted when the profitability index is greater than one. The decision rule is "The profitability index greater than one is accepted and less than one is rejected."

Advantages of PI

i) This method is based upon the time value of money.
ii) It considers the entire cash flows over the life span of the project.
iii) This method is consistent with the objective of maximizing the wealth of the shareholders of the company.

Disadvantages of PI

i) As to this method, it is very difficult to determine the interest rate of discount rate.
ii) This method may not provide satisfactory result in the case of two projects having different useful life.
iii) It is difficult to understand as well as computation.

III) Internal Rate of Return (IRR)

The internal rate of return is the rate which will equate the present value of cash inflows with the present value of cash outflows. It is a rate at which the net present value of the investment will be zero. This method is exclusive depends on the initial cash outlay and cash inflows of the projects. Hence, it is Internal Rate of Return. The IRR is also known as time adjusted rate of return, marginal rate of return, yield on investment and so on.

Decision Rule

If, IRR is greater than required rate of return or cost of capital or cut off rate or hurdle rate, the project should be accepted and if the IRR is lower than the

required rate of return, rejected. In case of mutually exclusive projects, preference will be given to the higher IRR.

Advantages of IRR

i) It takes in to the account the time value of money.

ii) The cash inflows over the entire life of the project are duly considered.

iii) It is not necessary to calculate cost of capital as a pre-requisite to determine internal rate of return.

iv) This method considers the profitability of the projects and help to fulfill the overall objective of maximizing shareholders wealth.

Disadvantages of IRR

i) IRR method implies that intermediate cash inflows generated by the project are – invested at the internal rate of the project that may not be convinced.

ii) The IRR criteria can be misleading when choosing between mutually exclusive projects that have substantially different in their size, time and life.

iii) Under certain case, it gives multiple rates, which can be confusing.

(Source: Dangol, 2005:934)

2.2 REVIEW OF ARTICLE

Carter, S.Macdonald N.J. & Cheng D.C.B. (1997) in their publication "Basic Finance for Market" available at **http:/www.fao.org/docrep/w4343E/w4343e07.htm** have said that the decisions on investment, which take time to mature, have to be based on the returns those investments will make unless the project is for social reasons only, if the investment is unprofitable in the long run. It is unwise to invest in it now.

A capital investment project can be distinguised rom current expenditures by two features:

- Such projects are relatively large.

- A significant period of time (more than one year) elapses between the investment outlay and the receipt of the benefits.

As a result, most medium sized and large organizations have developed special producers and methods for dealing with these decisions. A systematic approach to capital budgeting implies:

a) The formulation of the long term goal.
b) The creative search for the identification of new investment opportunities.
c) Classification of projects and recognition of economically or statistically dependent proposals.
d) The estimation and forecasting of current and future cash flows.
e) A suitable administrative framework capable of transferring the required information to the decision level.
f) The controlling of expenditures and careful monitoring of crucial aspects of projects execution.
g) A set of decision rules, which can differentiate acceptable from unacceptable alternatives, is required.

The last I crucial and this includes various methods of evaluation of investment proposals as explained in conceptual review section of this study. However, in this website, affects of inflation in decision making have been highlighted, which is worth nothing.

According to the website of **solution matrix Ltd**. a company providing business case solutions for business investments since 1994, **www.solutionmatrix.com** "Most important business decisions are investment decisions in one way or other". The company has developed an eight step business case solution for investment decision, which includes following steps:-

1) Case building project planning and industry analysis
2) An easily understood, comprehensive cost model, to show clearly which cost items were included, which were not, and why. The cost model also establishes clearly that alternative scenarios were compared fairly.

3) A solid and complete cost analysis, showing projected investment costs under “Business as Usual” and “Proposed Investment” scenarios, across the life of the investment.
4) A solid and complete benefit rationale, validated with the stakeholders and management. The benefits rationale is the logic that legitimizes benefits for the case, provides the basis for assigning value to benefits, and shows how the investment contributes to business objectives.
5) Complete cash flow statement projections showing expected cash inflows and outflows from cost benefit analysis if the investment and business as usual scenarios.
6) Financial metrics or measures to meet the purpose of the investment case, including return on investment (ROI), net present value, payback period analysis, and other summary analyses of the projections.
7) Rigorous risk and sensitivity analysis of the financial models and cash projections, including.
8) Recommendations and conclusions based on projected results. Risk and sensitivity analysis, that explain clearly what hat to be managed, what has to be watched carefully. And practical steps for maximizing return on the investment.

According to the **Water and Energy Commission Secretariat (2007),** The prevalent organizational structures at planning, policy making and coordination-level currently in operation in the water resources sector are presented hereunder gives the details of the organization involved.

- The National Development Council (NDC)
- The National Planning Commission (NPC)
- The National Water Resources Development Council (NWRDC)
- The Water and Energy Commission (WEC)
- Water and Energy Commission Secretariat (WECS)

- Ministry of Water Resources (MOWR)
- Ministry of Physical Planning and Works (MOPPW)
- Ministry of Science and Technology (MOST)
- Ministry of Forest and Soil Conservation (MOFSC)

The Water Resources Directorate has eight approved positions within three divisions:

Hydropower, Irrigation and Basin Study: The Water Resources Directorate's function is to maintain data and analyze hydropower, irrigation and basin development studies in order to provide planning advice to the Government. It provides policy and strategies for regional and bilateral programs.

1. Formulation of Water Resources Strategy of Nepal, 2002;
2. Perspective Energy Plan, Supportive Document (1994);
3. Regional and National Level Energy Resources and Consumption Profile of Nepal (1990-1996);
4. District Wise Micro hydro Inventory Study of all hilly districts (1991-1997)
5. Rapid Appraisal of Irrigation Projects (20 Projects)
6. Himalayan Sediments study on GLOF. Beside this, other achievements of WECS are:
    a. Preparation, Publication and distribution of Technical Reports in Water, Energy, Environmental, Legal and Social Sector.
    b. Provided technical input at various levels in the preparation of
        - Policy development
        - Sectoral Master Plans
        - Ranking and Inventory Studies
        - Regional Water and Power Development Initiatives
        - Water Resources Act
        - Electricity Act
        - Nepal Electricity Authority Act (Amendment)

Challenges Ahead

In addition to the responsibilities, as defined in the WEC/S mandate and acting as a Secretariat of National Water Resources Development Council (NWRDC), the Water Resources Strategy, Nepal had further mandated WECS to act as a Central Water Planning Unit of HMGN. This requires WECS for the overall coordination, integration of sub-sectoral programs, policy guidance for River Basin Planning, compliance monitoring of all the Policy, Acts and Regulations for Water Resources Development etc. Moreover, the challenge ahead for WECS is:

- The need to review the National Water Plan periodically along with the monitoring of the planned activities of NWP.

Vidyut (2008) National water plan - 2008 is the useful document reviewed here. This plan has set the objectives to generate hydropower to meet national energy requirement and to allow for export of surplus energy in hydro power sector. The pan has taken the target that per capital electricity consumption of 160 KHz by 2017 and 400 KHz By 2027. The estimated budget of overall plan is Rs 1218938 million for water sector and Rs 511362 million is allocated in hydropower structural and non structural development.

The plan has clearly stated about investment situation of different sector in hydropower development in Nepal. A present the government through re-Lending to NEA is the major source of finance in the investment of hydropower project. Private sector investment are and increasing. But at present, they contribute to only about 21 percent of total installed capacity. Most of the government sources are external (77 percent). The present resending of soft loans by Government to NEA is at 10.25%. The rate applied does not follow valuable rate lending and, because of this also NEA has been financially stressed due to the high invest rate.

2.3 REVIEW OF RELATED PREVIOUS STUDIES

K.C. (2007) has done his research on **"Investment in Hydroelectricity in Nepal".** He has shown in his research about the status of hydroelectricity in Nepal, Problem and prospects in development and its contribution to Nepalese economy. Nepal has got long experience in hydro generation and its utilization. But even after completion of 10^{th} plan development of power in Nepal is still in infancy

stage. A single large scale hydro plant has not been installed in the country. So crisis of hydro energy occurs time to time uncertainly and consumer are facing load-seeding problem. Its contribution in over all energy consumption is only 1.5 percentages.

On the other hand pattern of fuel consumption is dominated by traditional resources basically fuel-wood, which has created a serious environmental problem, deforestation and land erosion. Nation has not got sufficient hydro energy supply system in rural remote areas. There are not developed any alternative way of energy supply, rather based on traditional resources. Some alternative energy technologies are operated in these areas but they are not available everywhere in country.

Except certain urban centers life standard and development pace has not been achieved according to 21st century. Urban areas are also facing great energy crisis. So only the way to cope with this problem is development of hydro energy and its balanced distribution in rural areas, as well as remote area's of the country. The today's national interest should be in investment in hydro energy development using mostly internal resources and reducing foreign aid and loan, in energy sector. If we could mobilize the internal resources it could accelerate the speed of hydro energy development. This will help to create the indigenous technologies in hydropower development sector. Alternative resources like micro hydro and IPP production should be highly encouraged for increase INPS capacity. This is the only one way which uses the local resources and sustainable development of the hydro energy sector in Nepal.

He concludes on last that, macro indicators are affected by agro-based activities in the Nepalese economy. Nepal could not achieve modern agro-based industrialization without harnessing available water resource in the form of hydro energy. Present agro-based economy could not give any sign of rise up beyond this development path. The stagnancy of agro-based economy could not be restructured with out use of modern energy form.

Bhattari (2004) has done his research on **"Financial Resources for the Development of Hydro-power in Nepal:** a Projection up to 2030". He focus in

his study is that Status of Hydro-power Development and its consumption pattern in Nepal. Among these he has shown how investment is going on to develop this sector. Furthermore he has analyzed the role of foreign assistance to develop this sector. Based on secondary data some of his findings are as follows:

- Nepalese Hydro-electricity has passed long time since 1911, but in FY 1990/00 the total achievement was 432.26 MW and the GDP was about 1.53 for this year.
- The share of foreign loan and grand in financing investment in electricity in 37% and 22% respectively.
- Up to 2000/01, Nepal has gained 438.13 MW capacities in Hydro-power development. Among them generated capacity was 82.50% from medium, 3.71 from small and 0.90% from micro hydro projects. Rest of the power 13.01 % is produced by thermal and solar power.
- Agricultural GDP, non-agricultural GDP and tariff are found as the major determinants of electricity consumption.
- Due to debt service and lack of internal resources about 80% of hydro-electricity has been made by foreign aid.
- In terms of size, the average construction cost/MW is lowest for micro hydro-power projects Rs. 74.67 million/MW followed by Butwal Power Company (medium) Rs. 80.56 million/MW, medium hydro project (Gvt) Rs. 144.76 million/MW, medium hydro project (Pvt.) Rs. 193.13 million/MW and highest for small hydro project (Gvt.) Rs. 481.41 million/MW.

Baral (2004) did his research is "**Financing of hydropower projects in Nepal".** He analyzed the problems of financing institutions and hydropower developers and government agencies in financing hydropower projects in the context of Nepal. His research concludes that majority of the local financing institutions were interested to finance hydropower project but due to lack of experience in this new sector they want to go with small exposure. Many local financing institutions want to wait and see or learn little more before they expose themselves to hydropower.

Minority who have good clientele and quite successful in the current market has not shown to explore now avenue and are not invested to invest in hydropower now.

He recommended to financial institutions, it is necessary to Establish of power development fund to finance hydropower projects long term lenders like power development fund (PDF) and clean energy Banks (CEB) for the power project should established. The need to long term funding agencies like PDF and CEBS has been increase day by day. If we are seriously thinking of power project financing, the concept is already started but it should be expedited and the capital base and lending procedure requirement must be learnt from experienced nations.

Pandey (2004) "Hydroelectricity development in Nepal" is the useful article for review. She has shown in her research about the status of hydroelectricity in Nepal, Problem and prospects in development and its contribution to Nepalese economy. Some of her findings are:

- Hydroelectricity Project brings many environmental problems. It also affect the social and cultural condition of adjoin area of project. But actually it serves the human society by modern life style.
- Small scale Hydroelectricity project seems advantages with the view that if natural disasters occur in project run by huge investment mainly dependent in foreign loans there will be uncountable loss of property where as we do not need foreign aid to run small-scale project.
- It is necessary to improve management aspect in concern agencies to provide the quality service to people and proper operation of generating hydro energy. Use of electric energy has been unavoidable in every sector of economy.

Gurung (2003) in his research **"Water Resource In Nepal: An investment in energy prospects"** focused into the conditions of Nepalese water resources regarding to the energy sector expenditures with respect to time in the past, at present and future some of his recommendations based on this study are:

a. We should utilize the water resources at first: water and energy are most obvious factor to be developed in proper resources case. Civilization, industrialization and development are only possible when these are sufficient energy and water. By developing the energy we can maintain the income generating industries so far which in turn provide funds for investment in other resources so that all resources are supported to act as cycle.

b. Establishment of research institutions,

- Research institutions on this type of water resources based issues is prime need. Environment friendly projects in this pollution suffered world are hot cake for investors. They are waiting for favorable environment for their investment. International lending institutions are eager to provide their influences by following their funds in water resources sector in Nepal.
- Holding billion dollars in investment they can set up a sole research body where young enthusiastic researchers can get research aid to study the various sectors of water, energy environment, potential etc.
- Energy use in mining exploration and construction: Mining exploration process has needed deep drilling activities in the possible regions. Deep drilling can be easily done through electricity surplus utilization which accounts the exploration cost cheap for mining activities.
- Likewise construction activities to be performed in the established of various infrastructures in the countries regular and continuous development activities excess surplus of hydroelectricity may be the best suited energy input so as to proportionate the cost of projects and resources optimization.

Shresthacharya (2002), published a book entitled in "**Energy Economic in Nepal**". Summarizes his idea the overall energy in Nepal and economics concerns such as energy problems, issues and prospects of options, socio-economic and environmental issues, prices and policies, and status and strategy of energy types: Commercial, biomass and alternative energy.

The main objective of his study is to present an interrelationship between energy and economic development. He concludes that Nepal's indigenous energy source consists of commercial hydro-electricity and traditional fuel wood, agricultural residue and animal waste.

Dhungel (2002), in his article **"Trends and patterns of energy consumption in Nepal"** has mentioned that main sources of energies are biomass (traditional), which constitutes coal, petroleum products, hydro-electricity etc. energy consumption in Nepal is dominated by biomass, which accounted for 95%, 94.9%, 91.7%, 86.4% and remained shares if commercial energy in total energy consumption in FY 1984/85, FY 1995/96 and FY 2000/01. Either share if fuel wood, in traditional or in total energy consumption is very high and adverse in the case if electricity. Use of electricity is high in domestic sector, as well as commercial sector. High GDP cannot be accomplished without technological progress, which requires increasing se of commercial energy. Use of energy is essential for industrialization and transformation of agriculture to the other sector. More time and labor are required to collect fuel wood. As a result, there remains very little time for productive works. The use of hydropower helps to reduce deforestation that will grow agricultural production through conserving the soil, pumping, irrigation water, f drying crops, grinding grains, using tractors, threshing machine. The demand of commercial energy is positively linked with increased income of household. He emphasized that micro and small hydropower should be developed to meet rural demand for energy but medium and large-scale projects are essential to meet the demand for industrial and commercial sector.

Gyawali (2001) in his book **"Water in Nepal"** has studied the Nepalese water resources from both technical and the socio-economic viewpoint and discuss on it. He explained about the potentiality of available water resources for the economic development of Nepal. According to him the Nepalese socio-economic prosperity geared by the development of the vast water resources. According to him instead of the high capital cost oriented mega hydro power the small and the community – managed level of the micro hydro is preferable for the small developing country like Nepal. At last he suggested some very importance points that are necessary for the policy formation and implication, these are as follows:

1. Nepali hydroelectric energy must be cheap.
2. New (but cheap) hydropower generation must come on line at first.
3. Hydropower must be reliable in quantity and quality.
4. Regional balance must be maintained in developing generation capacity for both socio-political and techno-economic reasons.
5. Large-scale export potential should not be entertained without first achieving a strong domestic base.

Paudel (1996) in his research **"Hydro electricity development in Nepal"** is another useful document of review. He devoted in his study the status of hydro electricity in Nepal at present and in future. He pointed on financial problem on Hydro electricity development in Nepal.

The cost of development of hydropower is significant high due to its remoteness difficult terrain and geological condition poor communication and transportation. One of the predominant resources for the high cost of developing hydropower is mainly due to the in sufficient capability of power plants has also increased significantly due to the grant assistance projects where international competitive bidders cannot participate in the project due to the condition imposed by the donor countries.

Shrestha (1996) "Financing power development in Nepal" is reviewed here. He has emphasized in his study about problem of financing on power development. Some of his major findings are:

- Energy is a vital necessity which is directly linked with economic development. Though, Nepal is endowed with rich energy resources, but it lies among the least develop groups in terms of energy consumption.
- Still all the commercial sources of energy e.g. oil, coal gas etc expect electricity have to be imparted. They are affecting a great pressure on the balance of payment situation.

- Power is a capital intensive sector. For a country like Nepal, it is impossible to shoulder all the cost of investment. Therefore, she has been mobilizing foreign resources since the first five year plan.
- The trend of financing in power development shows that share of foreign loan is greater than the grant.

2.4 RESEARCH GAP

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 has to be continuity in rsearch. 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 Project of Nepal" therefore to complete this research work, many books, journals, articles and various published and unpublished dissertations 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 has to be fulfilled by the present research work. In this regard, here the researcher 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.

CHAPTER-III

REASERCH METHODOLOGY

Research methodology is the process of arriving at the solution of a problem through a planned and systematic dealing with the collection, analysis and interpretation of the facts and figures. In other words, research is an ongoing and ever growing activity. It is done not only to solve a problem existing in the work setting but also to add or contribute to the general body of knowledge in a particular area of interest. “Research may be defined as the objective and systematic method of finding solution to a problem i.e. systematic collection, recording, analyzing, interpretation and reporting of information about various facts of phenomenon under study.” (Wolf & Panta, 2005:04)

The objectives of this study are to analyze the investment process and its impacts. To achieve the objective of the study, the following methodology has been adopted which includes research design, sauces of data, population and sample, data analysis and research tools.

3.1 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 reached 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)

Similarly “A research design is the arrangement of condition for collection and analysis of data in a manner that aims to combine relevance to the research process with economy in procedure.”(Cellith & Jahoda, 1995:50)

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, but there is different in capacity. An intensive investigation of individual projects and a comparative investigation of the two projects have been carried out. Descriptive research design will used to explore the present situation of investigation in Hydropower in Nepal.

3.2 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 used 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, the internet. The website of NEA, IPPAN, NHP, CHP and other hydropower related sites were the source of reliable information.

In order 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 also 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.

3.3 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 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 and to be chosen; one funded by NEA and next by public sector. This narrowed down the available option.

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

Table No. 3.1

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**	**66.67**

The samples covers the 66.67% companies listed in NEPSE and as total 1.86% i.e.(2/107*100). 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 3.2

Existing, Ongoing and Proposed Hydropower projects of Nepal

Name	Capacity in MW	Name	Capacity in MW
Karnali	10,800.00	Tamur-Muwa	101.00
Pancheswor	6,480.00	Madi Ishaneshor (Storage)	86.00
Paschim Seti	750.00	Kankai (storage)	60.00
Kali Gandaki 2	660.00	Upper Modi 'A'	42.00
Budhi Gadahi	600.00	Likhu – 4	40.00
Arun 3	402.00	Kabeli 'A'	30.00
Upper Arun	335.00	Chameli	30.00
Lower Arun	308.00	Khimti II	27.00
Upper Karnali	300.00	Rahughat	27.00
Dudh Koshi	300.00	Thulo Dhunga	25.00
Langtang Khola	218.00	Budhi Ganga	20.00
Andhi Khola	180.00	Kulekhani – 3	14.00
Upper Seti	122.00	Upper Modi	14.00
Upper Marsyandi 'A'	121.00	Hewa Khola	10.00
Upper Tamakoshi	309.00		

IPP Owned Hydropower Projects

Khimti Khola(HPL)	60.00	Upper Maikhola (ENDE)	3.00
Bhotekoshi (BKPC)	36.00	Piluwa Khola (AVHP)	3.00
Chilime (CPC)	20.00	Sunkoshi Small (SHP)	2.60
Jhimruk (BPC)	12.30	Chaku Khola (APCO)	1.50
Langtang (KHP)	10.00	Thappaikhola (THP)	1.40
Indrawati (NHPC)	7.50	Madi-1 (AGPL)	1.00
Andhi Khola (BPC)	5.10	Phema Khola (KHP)	0.99
Mailung (NHPC)	5.00	Baramchi (UH)	0.99
Dharam Khola (GHP)	5.00	Tadakhola (ASP Dev.)	0.97
Lower Nyadi (BHP)	4.50	Sisne Khola (SBHP)	0.75
Lower Indrawati (SHP)	4.50	Rairang (RHPD)	0.50
Khudi Khola (KHP)	3.45	Sange Khola (SHP)	0.18
Mardi Khola (GHP)	3.10		

Source: (NEA Report, 2007:86)

Table 3.3

Existing, ongoing and Proposed Hydropower projects of Nepal

Name	Capacity in MW	Name	Capacity in MW
NEA owned Hydropower Projects			
Kali Gandaki 'A'	144.00	Khandbari	0.25
Middle Marsyangdi	70.00	Bhojpur	0.25
Marsyangdi	69.00	Jomsom	0.24
Kulekhani-1	60.00	Dhankuta	0.24
Kulekhani-2	32.00	Phidim	0.24
Trisuli	24.00	Baglung	0.20
Ganda	15.00	Doti	0.20
Modikhola	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	2.00	Chaurjhari	0.15
Seti (Pokhara)	1.08	Ramechhap	0.15
Phewa (Pokhara)	1.08	Arughat Gorkha	0.15
Tinau (Butwal)	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
Jhupra (Surkhet)	0.35	Dhading	0.03
Gamgad	0.40	Terathum	0.10
Darchula	0.30		

Source:(NEA Report, 2007:86)

20MW Chilime and 7.50MW Indrawati hydropower project both owned by the IPP and listed in NEPSE are chosen for the study.

3.4 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.

3.5 DATA GHTHERING 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 others 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 they are the resources of the opinion. Twelve questionnaires are made and distributed 13 in Chilime and 12 in National. Out of them 10 from Chilime and 8 from National gave responces on these questions.

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

3.6 RESEARCH TOOLS

The study is on financial evaluation of hydropower projects, most of the financial tools are used to analysis 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
    - Cash Payback Period
    - Discounted Cash Payback Period
    - Accounting Rate of Return (ARR)
    - Alternative Accounting Rate of Return
    - Net Present Value (NPV)
    - Internal Rate of Return (IRR)
    - Benefit Cost Ratio or Profitability Index

CHAPTER-IV

DATA PRESENTATION AND ANALYSIS

4.1 ANALYSIS OF SECONDARY DATA

During the feasibility study of potential hydropower project, financial evaluation must be done to test the financial viability of the project. Financial evaluation process can be summed up to following major steps.

- Finding out total investment outlay and cost of project.
- Finding out means of financing.
- Forecasting detail cash flow of the project.
- Testing worthiness of the investment by evaluating alternative ranking method (Capital Budgeting).
    - Cash Payback Period (CSP)
    - Discount Cash Payback Period (DCPP)
    - Accounting Rate of Return(ARR)
    - Net Present Value (NPV)
    - Internal Rate of Return (IRR)
    - Net Terminal Value (NTV)
    - Opportunity Cost Return (OCR)
    - Profitability Index (PI)
    - Perpetuity Rate of Return (PRR)

4.1.1 Total Investment Outlay and Cost of Project

First thing is to be done before investing in hydropower project is to find out total investment outlay or the cost of the project. The total project cost was estimated at NRs. 1,604,915,000 for CHP based on feasibility study of the project in 1996 price level where as the total project cost NRs. 2,477,894,521. The contracts 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 construction works.

In the same way the total project cost of the NHP is NRs. 1523706256 and the project completion id four 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.

4.1.2 Means of Financing

Both hydropower projects are already operated. They planned to finance the power plants with equity and long term debt.

Table 4.1

Project Financing

Amount in Rs.	Chilime	National
Investment Cost	**2,477,894,521**	**1,523,706,256**
Equity: NEA NEA Employees General Public Pingxing Mining Administrative Beuro Others	 48,96,00,000 23,24,99,500 25,95,000	630,000,000 720,000,000
Debt. Finance: Employee Provident Fund Citizen Investment Trust Himalayan Bank Ltd. Laxmi Bank Ltd. Nepal Bangladesh Bank NCC Bank Nepal Bank Rastriya Banijya Bank	 1,098,414887 351,924,119 202,541,185 51,315,753	 54,000,000 90,000,000 36,000,000 180,000,000 90,000,000

Source: CHP and NHP Report

4.1.3 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 finding out separately and on that basis, weighted average cost of capital needs to be calculated.

By formula,

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

For CHP

$$\frac{507,758,712}{1,942,245,660}$$

= 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 (See Annual Report of Chilime Hydropower Company Limited 2006)

For NHP,

$$\frac{76,234,591}{6,\ 93,035,924}$$

= 11%

(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 NHP is Rs.76, 234,591. (See annual Report of National Hydropower Company Ltd. 2006)

By formula,

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

According to Electricity Act, 1992 Section 12.3 hydropower projects are tax exempted from tax for 15 years. Hence tax rate is zero. Cost of debt, therefore is equal to interest rate. Cost of debt for CHP is 8% and for NHP also 8%.

By formula, Weighted Average Cost of Capital (WACC)

= Cost of Debt × weight of Debt × Weight of Equity

Weight:

Source	CHP	NHP
	Weight	Weight
Equity	0.40	0.30
Debt	0.60	0.70
Total	1.00	1.00

For CHP, WACC = (8 × .060) + (26.14 × 0.40)

= 4.80 + 10.456

= 15.256%

For NHP, WACC = (8 × 0.70) + (11 × 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 but as it would be difficult to discount at 15.256 % and 8.90 %. Hence, 15% and 9% has been used while discounting the cost and benefit for the projects.

4.1.4 Capital Budgeting Techniques

In previous section, cost of capital has been calculated. WACC for CHP and NHP were 15.256% and 8.90% respectively. Hence, for simplicity 15% and 9% discount rate has been used while applying discounted cash flow techniques.

4.1.4.1 Cash Pay Back Period

When deciding between two or more competing projects, the usual decision is accept the one with the shortest payback. 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 is: 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 it's payback period was less than the certain number of years.

The calculation of the cash payback period for CHP and NHP is tabulated in *Annex II* and following is the result of Cash Payback Period analysis:

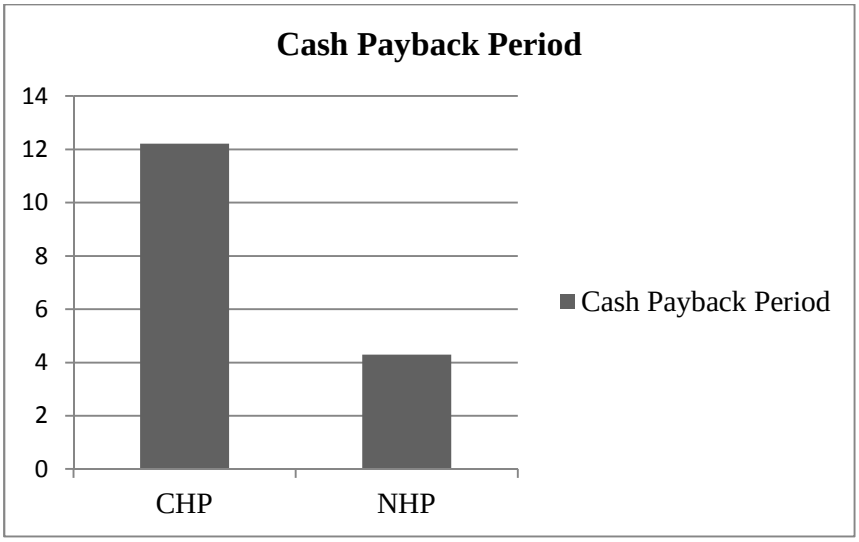
Table no 4.2

Results of Cash Payback Period

Projects	Cash Payback Period
CHP	12.21 years
NHP	4.29 years

Source: - Annex II

Figure No 4.1



Initial outlay is covered in 4.29 years for Chilime and 12.21 years for National projects. So Chilime is seems better investment compared to National as its payback period is shorter.

4.1.4.2 Discounted Cash Payback Period

This method is improved version of cash payback period method. This method keeps the advantages of Cash payback and tries to correct its drawback by taking time value of money in to account. Cash inflows 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 initial outlay is discounted cash payback period.

Since initial investment is spread over four and six years for Chilime and National, this 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 Chilime and 95 foe National. (See Annex *VI* for calculation)

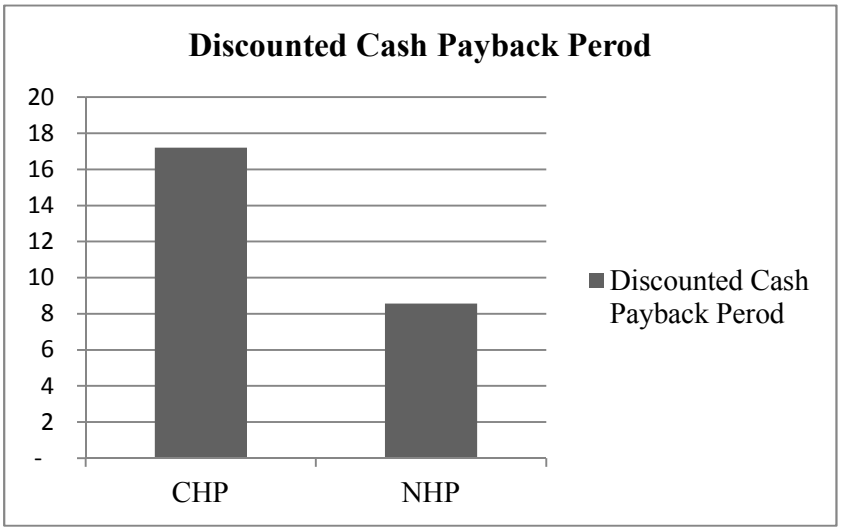
Table no. 4.3

Results of Discounted Cash Payback Period

Projects	Discounted Cash Payback Period
Chilime	17.21 yrs
National	8.56 yrs

Source: - Annex III

Figure No 4.2



Calculation of the discounted cash flows is attached in Annex *III*, cumulative present value column in the table shows the nearly of the investment over the years. Cumulative present value is nearly with net investment in 8 yrs and 17 yrs for Chilime and National respectively. Thus, net discounted cash payback period for Chilime is approximately 8056 years and for National is approximately 17.21years. If a choice has to be made between the two power plants, Chilime promises a better investment than National as its Payback period is Shorter.

4.1.4.3 Accounting Rate of Return

Alternatively, accounting rate of return is also calculated by averaging the expected cash flows over the life of a project and then dividing the average annual cash flow by the initial investment outlay. Annex *VII* shows the calculation of the ARR in this alternative method for CHP and NHP. The total life for both hydropower projects is assumed 20 years.

By formula:-

$$ARR = \frac{\text{Average Cash Flow}}{\text{Initial Investment Outlay}}$$

For CHP

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

$$\text{Average Cash Flow} = \frac{32,790,704,069}{20}$$

$$= \frac{1,639,535,203}{2,477,894,521}$$

$$= 66.17\%$$

The Average Accounting Rate of Return for CHP is 66.17%.

For NHP

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

$$\text{Average Cash Flow} = \frac{3,747,118,984}{20}$$

$$= 207,355,950$$

$$= \frac{207,355,950}{1,523,706,246}$$

$$= 13.61\%$$

Similarly the Average Accounting Rate of Return for NHP is 13.61%.

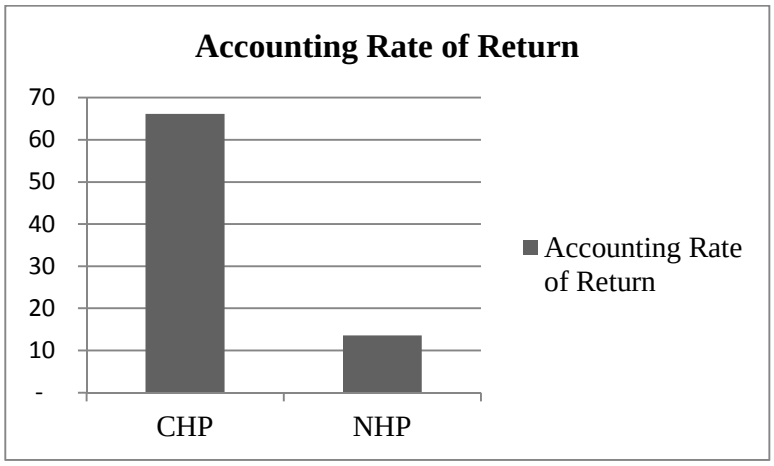
Table no. 4.4

Result Accounting Rate of Return

Projects	Alternative Accounting Rate of Return
CHP	66.17%
NHP	13.61%

Source: - Annex IV

Figure No 4.3



Even from this method, CHP looks more desirable as its rate of return is higher than that NHP.

4.1.4.4 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."

The technique is a three – stage process:-

- To calculate the present value of each element of cash expenditure in a proposal and then to add these individual present values together to provide a total present value of the expenditure.
- To calculate the present value of each element of cash income in a proposal and then, to add these individual present values together to provide a total present value of the incomes.
- To deduct the total present value of the expenditure from the total value of the incomes, to determines the Net Present Value (NPV).

If this calculation produces an NPV that is positive, the signal is accept the proposal. If, however, the NPV is negative, the signal is to reject the proposal. Note that only cash expenditures and incomes are considered, non-cash items (e.g. depreciation) are ignored.

Detailed calculation of NPV for CHP and NHP is shown in *Annex V* Total project period is assumed to be twenty years. Total cash expenditures 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 NRs. 1,599,354,005 and for NHP is NRs. 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.

Net Present Value = Total present value of cash inflows – Total present value of cash outflows

For CHP,

= 3,118,611,446 - 1,599,354,005

= 1,519,257,441

For NHP,

= 1,549,615,275 – 1,297,164,566

= 252,450,709

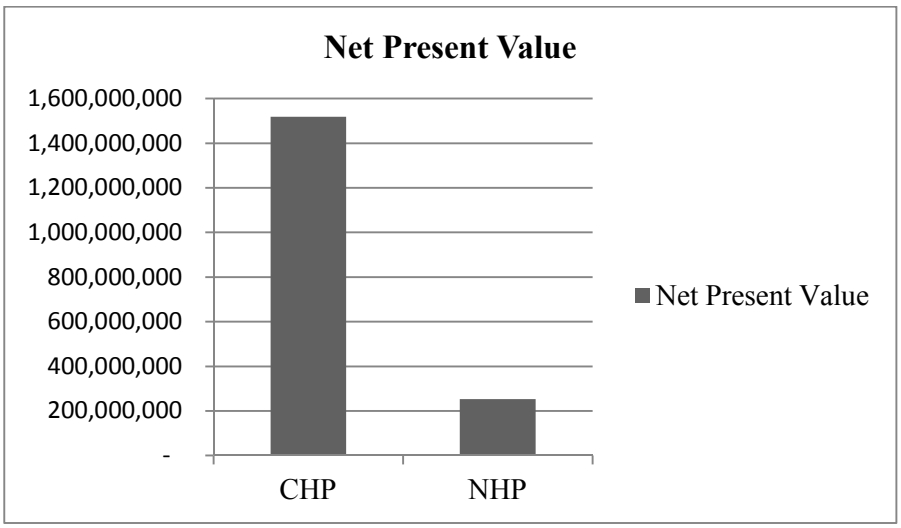
Table no. 4.5

Results of Net Present Value

Projects	**Net Present Value**
CHP	1,519,257,441
NHP	252,450,709

Source: - Annex V

Figure No 4.4



NPV of CHP and NHP are NRs. 1,519,257,441 and NRs 252,450,709 respectively. Both projects have positive NPV, so both projects are worth investing in. However, if one project is to chosen out of the two, CHP seems more desirable then NHP due to the higher NPV. If we consider the investment outlay it is true that the investment of the CHP also higher than the NHP. But proportionately CHP is the better on according to NPV method.

4.1.4.5 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, investments with higher IRR pay better.

Annex VI and *VII* show the calculation of IRR for CHP and NHP. Note that the calculation is an approximation of the Internal Rate of Return using a mathematical method called "Linear Interpolation".

In order to make this approximation, it is necessary to make two net present value calculations. One of these calculations must give an NPV, which is positive and the other calculation must give an NPV, is negative. The subsequent process of linear interpolation then uses these two NPVs (one positive and one negative) to estimate the point (or, more correctly, the interest rate) at which the NPV is exactly Zero. This point is the Internal Rate of Return.

Note that the discount factors are taken from discount tables. In *Annex IX* NPV has been calculated for the projects at 15%, 21%, 25% and 29% for CHP where the CHP is positive NPV at 25% and negative NPV at 29%. In the same way NPV is calculated for the project at 9% and 11% for NHP. It has positive NPV at 9% and negative NPV at 11%. Hence, lower and higher rate giving positive and negative NPV for projects are identified, interpolation is done using following formula:

$$\text{IRR} = \frac{\text{Lower Rate} + \text{NPV at lower Rate}}{\text{NPV at Lower Rate} - \text{NPV at Higher Rate}} \quad (\text{Higher Rate} - \text{Lower Rate})$$

For CHP,

$$= 25\% + \frac{16{,}542{,}075}{16{,}542{,}075 - (-245{,}397{,}424)} \quad (29\text{-}25)\ \%$$

$$= 25\% + \frac{16{,}542{,}075}{261{,}939{,}317} \quad (29\text{-}25)\ \%$$

$$= 25.25\%$$

For NHP,

$$= 9\% + \frac{252{,}450{,}709}{252{,}450{,}709 - (-\ 93{,}311{,}386)} \quad (11 - 9)\ \%$$

$$= 9\% + \frac{252{,}450{,}709}{345{,}762{,}095} \quad (11 - 9)\ \%$$

$$= 10.46\%$$

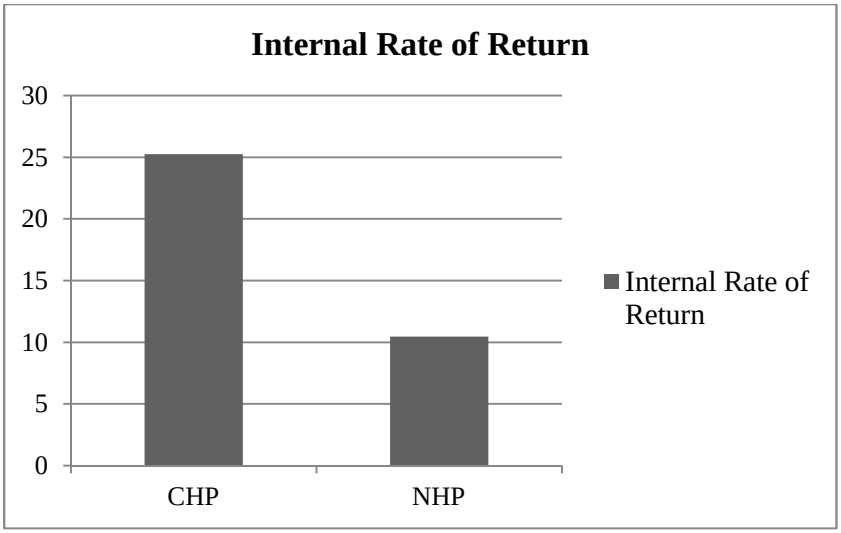
Table no. 4.6

Results of Internal Rate of Return

Projects	Internal Rate of Return
CHP	25.25%
NHP	10.46%

Source: - Annex VI and VII

Figure No 4.5



IRR for CHP is 25.25% and for NHP is 10.46%, since IRR or 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, with make both the projects acceptable for investors.

4.1.4.6 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 future cash outflows and the present value of cash outlays. PI may be defined as a ratio, which is obtained by dividing the present value of future cash inflows by the present value of cash outlays. The *Annex VIII* shows the calculation of PI for CHP and NHP.

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

For CHP,

$$= \frac{3,118,611,446}{1,599,354,005}$$

$$= \quad 1.95:1$$

For NHP,

$$= \quad \frac{1,374,994,440}{1,297,164,566}$$

$$= \quad 1.09:1$$

The decision rule of Profitability Index is :

PI > 1 : accept the project

PI < 1 : reject the project

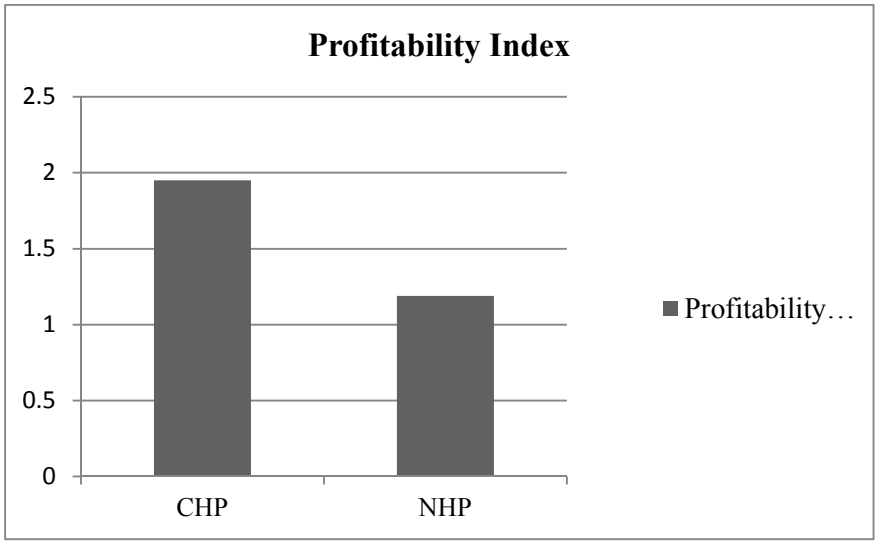
Table No. 4.7

Results of Profitability Index

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

Source: - Annex VIII

Figure No 4.6



Both projects have PI greater than one (PI > 1), so the both projects CHP and NHP are acceptable but due to higher PI CHP is preferable.

4.2 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 in to two groups- technical and administration 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 of for making of the choices according to the numbers of alternatives, where the first choices was the most important and the least choice is important. For analysis purpose, choices are assigned weight according to the number of alternatives. The total points available to each choice are converted in to percent with reference to the total point available for all choices. The choice with the percent score is ranked as the most important choice and the one the percent score is ranked as the last choices.

The following table shows the group of respondents:

Table No 4.8

Group of Respondents

Company	Group of Respondents		Sample Size
	Technical	Administration	
CHP	4	6	10
NHP	3	5	8
Total	**7**	**11**	**18**

4.2.1 Opinion towards the effectiveness of NPV and IRR in Capital Budgeting

Out of 18 respondents about the opinion towards the effectiveness the NPV and IRR in Capital Budgeting, their views as follows:

Table No 4.9

Opinion towards the effectiveness of NPV and IRR in Capital Budgeting

Respondents	NPV	IRR	Total
Technical Group	4	3	7
Administrative Group	10	1	11
Total	14	4	18
Result (%)	77.78	22.22	100

Source: (Opinion survey, ANNEX I)

4.2.2 Opinion towards "Is the project operating in full capacity all over the year?"

Respondents views as follows:

Table No 4.10

Opinion towards "Is the project operating in full capacity all over the year?"

Respondents	Yes	No	Total
Technical Group	-	7	7
Administrative Group	-	11	11
Total	-	18	18
Result (%)	-	100	100

Source: (Opinion survey, ANNEX I)

According to the employee working in these two companies they are agreed that the project is not running in the full capacity in whole year. In rainy season the

project produce the power more than the its capacity where as in dry season it operate below the capacity.

4.2.3 Opinion towards Environment affecting more in Hydropower Projects

Respondents Views are:

Table No 4.11

Opinion towards Environment affecting more in Hydropower Projects

Respondents	Political	Other	Total
Technical Group	2	5	7
Administrative Group	3	8	11
Total	5	13	18
Result (%)	27.78	72.22	100

Source: (Opinion survey, ANNEX I)

Here in this question their opinion divides in two sides. Some of their views are says that political environment influence in bitter way than the other factor and some other assumes that including political other factor also play important role.

4.2.4 Opinion towards barriers to invest in Hydropower in Nepal

Respondent's opinions as follows:

Table No 4.12

Opinion towards barriers to invest in Hydropower in Nepal

Respondents	Policy	Security	Total
Technical Group	2	5	7
Administrative Group	4	7	11
Total	6	12	18
Result (%)	33.33	66.67	100

Source: (Opinion survey, ANNEX I)

4.2.5 Opinion towards the Development of Hydropower is the Way of Prosperous Nepal

Respondent's opinions as follows:

Table No 4.13

Opinion towards the Hydropower is the Way of Prosperous Nepal

Respondents	Yes	No	Total
Technical Group	7	-	7
Administrative Group	10	1	11
Total	17	1	18
Result (%)	94.44	5.56	100

Source: (Opinion survey, ANNEX I)

Most of the respondents are agreed that only the development of hydropower, Nepal can be stand as a developed country in the world.

4.2.6 Opinion towards the preference on Public and Private Investment in Hydropower

Respondent's opinions as follows:

Table No 4.14

Opinion towards the preference on Public and Private Investment

Respondents	Public	Private	Total
Technical Group	6	1	7
Administrative Group	9	2	11
Total	15	3	18
Result (%)	83.33	16.67	100

Source: (Opinion survey, ANNEX I)

Hydropower needs large investment so it is only possible when the public make investment on this sector.

4.2.7 Opinion towards help can be expected by the Government

Respondent's opinions as follows:

Table No 4.15

Opinion towards help can be expected by the Government

Respondents	Direct Investment	Creating Investment Environment	Total
Technical Group	3	4	7
Administrative Group	4	7	11
Total	7	11	18
Result (%)	38.89	61.11	100

Source: (Opinion survey, ANNEX I)

4.3 ANALYSIS OF INVESTMENT IN HYDROPOWER SECTOR

This chapter analyses the overall investment climate in the hydropower sector in Nepal. The main focus is the opportunities and the challenges in the hydropower sector in the present context. In addition, this chapter also attempts to compare public sector in brief. The data is collected primarily from an extensive interview with the personalities of hydropower projects being studied, NEA personal and hydropower expert.

4.3.1 Opportunities of Hydropower Investment in Nepal

Market

Nepal can vary well use its hydropower potential to meet not only national but the increasing regional demand for energy as well. The power demand in Nepal is growing by approximately 10%, which shows the need to supplement the power by at least 60/70MW each year for domestic needs. The possibility of power export to India is an additional attraction for investors especially in the medium to large scale project range, India has a huge energy demand and the new Electricity Act 2003 has opened the possibility of energy market with Availability Based Tariff and Merit Order Dispatch.

Incentives

Through various acts and policies, Nepalese government has given various incentives to encourage investment in hydropower sector.

- Hydropower projects have 15 years income tax holiday.
- There are no import license fee, sales tax etc on plant and equipment including construction equipment and can be imported at 1% custom duty.
- In case of foreign currency has been invested in the project, the government shall make available necessary foreign currency at the prevailing market rate for repatriation of investment or repayment of principal or interest on loan.
- Investment promotion Measures:
- There is no double taxation with countries.
- Risk insurance is available through Multilateral Investment Guarantee Agency.
- There is transportation dispute resolution through Nepalese Arbitration Act 1999, which is based on United Nations Commission on Internal Trade Law.
- 100% foreign ownership is allowed.
- Any party (government, semi-government or private) in any country may enter in to power trade agreement.
- Parties themselves determine the agreement parameters including quantum and electricity tariff.
- Department of Electricity Development has been established as one widow incentives, assistant in importing goods, assistance in obtaining land, assistance in obtaining permits and approvals and for regulation and monitoring of projects.
- Government has guaranteed that there would be no nationalization of projects.

4.3.2 Challenges in hydropower investment in Nepal

Access roads

Hydropower projects are expensive primarily because of the fact that cost of access roads and power evacuation transmission lines are added on the hydropower project cost. Most of the hydropower project sites are in remote area construction. This along with the high voltage power evacuation system renders power from these projects comparatively expensive.

Transmission Network

Currently, some parts of Nepal are not able to get good quality and adequate power due to transmission bottleneck while some power plants are spilling energy in the absence of access to these load centered. Thus, the transmission network within Nepal needs to be strengthened and upgraded to increase to reliability of the internal power transmission network. Furthermore, enough redundancy needs to be built in to the transmission network to increase its reliability.

Geological and geotechnical Risk

Technical faults need to big losses in hydropower and there would be technical faults in geological and geotechnical design of the project.

Hydrological and Sediment Risk

This is another technical risk arising due to the design faults and faults in the soil test and other hydrological tests of the site area. Tunnels have to be built for hydropower plants and such faults might lead to leakage in the tunnels and huge financial losses for the project.

Construction and Operation Risk

Construction risk includes delays in construction due to strikes, flooding etc while operational risk include sediment accumulation, breakdown of equipment and erratic river flows.

Political and Policy Risks

Changes in government and government policies, laws and acts also threaten long term investment like hydropower.

Payment Risk

Hydropower risk projects have long life. Since hydropower contracts are long term contracts, there is always a doubt on the maintenance of the sanctity of the contract throughout the contract period by the involving parties. Payment guarantees can be requested from the government. However, this risk may still be high when the political scenario in the nation is volatile where government itself does not have any guarantee.

Currency Exchange Risks

This includes risk associated with currency conversion and repatriation facility being withdrawn and also includes risks of unexpected change in foreign exchange. Normally inflation is accounted for in cash flow forecasted of hydropower project but it cannot be accurately predicted and foreign exchange, which is based on inflation, may change unexpectedly.

Security Risks

In the country with ongoing insurgency, security risk is undoubtedly high.

Country Risk

Country risks are country specific risk. Nepal, being one of the poor economies of the world had high country risk. And the ongoing the political crises in the nation add more risk to investment in the nation.

Although different risk elements have identified, payment risk, security risk, country risk etc. can be grouped in the broad political risk.

4.4 IS ELECTRICITY PURCHASE RATE FROM CHP & 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 (GON) and NEA with multilateral and bilateral funding. The pace of development till 1995 very slow where GON and NEA were the main actors. However, promulgation of new hydropower development policy in 1992 and World Bank's deciding of canceling Arun III in 1995, created incentives for pluralism in hydropower development in Nepal. It has taken the traditional monistic path of hydropower development in which NEA and MOWR were the

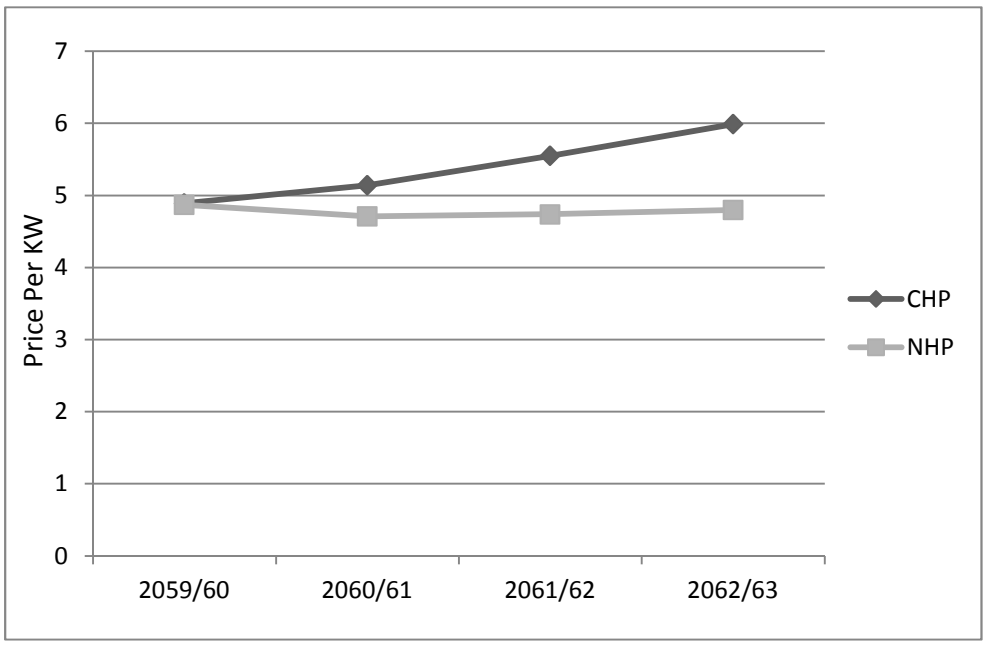
major actors. As a result, a total of 298 MW additional capacity was created in a mere 10 years from 1995 to 2005 with different modes of development compared only 249MW developed in eight and half decades till 1995. The mile stone events in the private sector efforts were perceived with the commercial operation of 60MW Khimti I and 36MW Upper Bhotekoshi in July 2000 and January 2001 respectively. The role of IPPs in the NEA power system is ever increasing and now contributes to more than one third of total available energy in the NEA system. NEA currently spends 44 percent of its revenue to pay to IPPs, majority of this is shared by foreign currency. 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 IPPs. As per the PPA between NEA and IPPs 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 announce for the first time , busy – back rate for purchasing power produced by IPPs up to 10 MW capacity having plant capacity factor above 90 percent. The rate is set at Rs 4.03 for dry season with escalation of 6% till 5^{th} year. Against the 25 to 50 years validity provided to these producers, the PPA for 1 to 10MW producers would be valid only for 15 years.

As the PPA between the IPPs and NEA is 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 @ 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. For comparison study of the cost and purchasing price conserved the given figure.

Figure 4.7

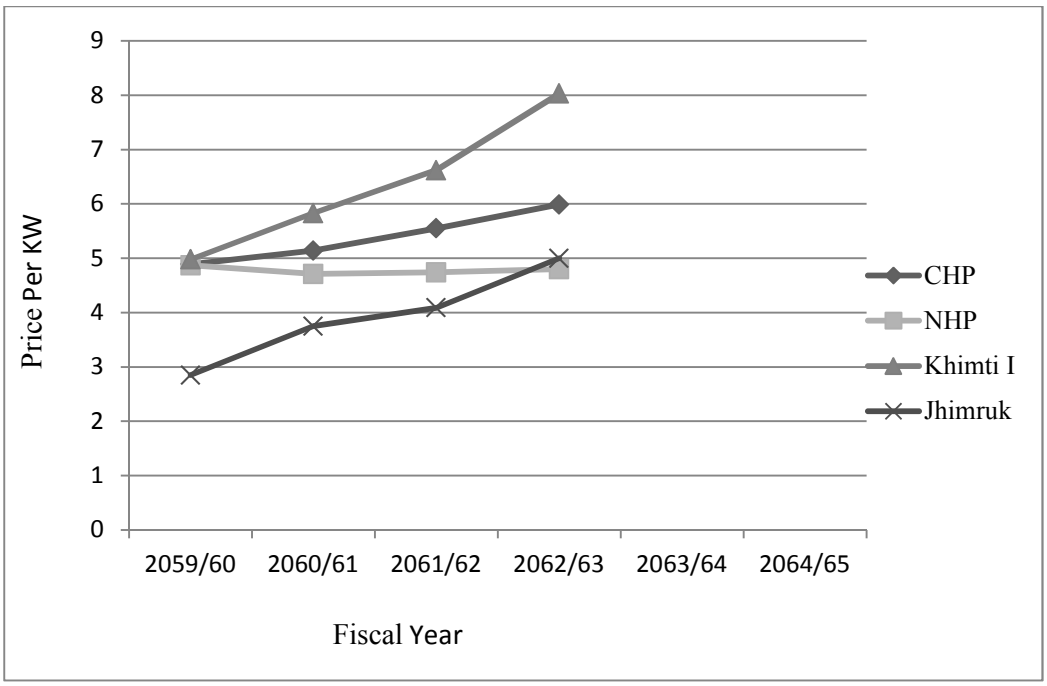
Price per unit of CHP and NHP



When we compare between the CHP and NHP on their price per KW comparatively National hydropower is cheaper than the Chilime.

Figure 4.8

Comparative price per unit with others



But when we compare among four project including the first private sector investment project Khimti I, Jhimruk is the cheapest and the Khimti the most costly project for NEA.

Conclusion:

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 invest estimated by the foreign developers, however the state never minds to check the estimate or created 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 measure as expensive as other project for NEA. Comparatively both projects are cheaper. But, it required announcing the rate of electricity to be purchase 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 to maintain same rate for the same quality of product.

4.5 MAJOR FINDINGS

4.5.1 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 2,477,894,521in 2003 and NHP is Rs 1,523,706,256. The projects taken for comparison do not have similar capacity. CHP has 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 than 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	4.29 yrs	12.21 yrs	Feasible	CHP
Discounted Cash Payback Period	8.56 yes	17.21 yrs	Feasible	CHP
Alternative Accounting Rate of Return	66.17%	13.61%	Feasible	CHP
Net Present Value	1,519,257,441	252,450,709	Feasible	CHP
Internal Rate of Return	25.25%	10.46%	Feasible	CHP
Profitability Index	1.95	1.09	Feasible	CHP

- *Cash Pay Back Period*

  The shorter payback period, more preferable the project is CHP has shorter payback period and thus is more preferable.

- *Discounted Cash Payback Period*

  The project with shorter payback period is more preferable, the project CHP is more desirable.

- *Alternative Accounting Rate of Return*

  The project is feasible if the Alternative ARR is greater than the discount rate (weighted average cost of capital) and the project with higher alternative ARR is more preferable. For both projects, ARR is higher than the weighted average cost of capital, so both projects are financially feasible investments but CHP has higher ARR and thus looks more preferable.

- *Net Present Value*

  The project is economically feasible if its net benefit at a discount rate of weighted average cost of capital is positive and the project with the greater net present value is more attractive, both project have positive NPV so both are financially viable but CHP has higher NPV. Under this method also CHP is more desirable than the NHP.

- *Internal Rate of Return*

  The IRR indicates the actual profit rate of the total investment outlay. The project is feasible if the IRR is greater than the discount rate and the project with higher IRR is more desirable. Both projects have IRR higher than their respective weighted average cost of capital, which shows both projects are feasible but CHP has greater IRR than NHP. This criterion also proves CHP is better investment.

- *Profitability Index*

  The PI describes the relationship between the present value of benefits and the present value of the costs. The project is feasible if the PI at a discount

rate of weighted average cost of capital is greater than unity. The benefit cost ratio is greater than unity for both projects, which shows the benefits from the projects are higher than their costs. Since CHP has higher PI, it is more preferable.

To conclude, all seven evaluation criterion proves that both hydropower projects are financially feasible and would prove to be profitable investments. However if a choice has to made between the two projects, all the indicate show CHP as better investment.

4.5.2 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 he 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 flowing rivers provide huge potential for hydropower.
- The power demand in the country is growing by more than 10% 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 for hydropower projects in Nepal.
- Through various Acts and polices, Nepalese government has given numerous incentives to encourage hydropower investments. For example, 15 years income tax holiday, 1% custom duty for construction equipments, 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.

In spite of 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 etc might have huge consequences sometimes even leading to complete shutdown of the plant.
- Political risks arising from changes in government police 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 percent of respondents are agreed that Npv is the best tool in capital budgeting for investment analysis.
- Both projects is not running in full capacity in all over the year. Im rainy season it produced more than capacity and in dry season it rues below the capacity.
- Political and other environment both influencing the hydropower industry bitterly. But not only political other factor playing more ie according to them 27.78 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 are agreed that the hydropower is the one and only potential through which the nation can be economically prosperous. But other thing also helps to develop.
- More than 80 percent are agreed that public is more preferable in investment rather than private because hydropower needs huge investment, then only the private sector it is very hard to invest. But it does not mean that private can not make any investment, we have very large scale power project 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.

CHAPTER-V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

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 and, position of hydro energy consumption is nominal in every consuming sector.

First Hydro plant in Nepal was installed in 1911 at Phering (500 kw). The journey of power development has passed about 9 decades. In this time period Trisuli, Sunkosi, Gandak, Kulekhani-1, Devghat, Kulekhani-II, Marsyangdi Puwa Khola, Modi Khola and Kaligandaki 'A' HPP were installed whose aggregate generation is 389.15 mw. Except that there major HPP are commissioning namely middle Marshandgi, Chameliya and Kulekhani-III of aggregate capacity 140 mw. One of the large scale projects upper Tamakoshi (309mw) 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, Jhimouk, Kimti, Bhotekoshi, Sange Khola, Indrawati, Chilime, Pliuwa Khola, Sunkosi small and Rairang, whose power generation comprises 148.283 kw. The development of power generation was on progression only after plan period since 1956. The long term vision on this sector has released only after 2000.

Share of hydroelectricity consumption in overall energy consumption is 1.5 percent. It is the total of 6673000 GJ of all energy consumption in the year 2005. The energy consumption pattern of Nepal is dominated by traditional sources. It is accounted 88 percentages in the year 2005. The major energy consuming sectors are residential sector, industrial sector, and commercial sector and transport sector. Residential sector consume highest amount of energy compare to other sector. It is 289800 GJ in the year 2005/06. To increase the consumption of electricity NEA has fixed different tariff rates and exempt to certain consuming sectors. The lowest charge per unit is fixed in irrigation i.e. about Rs. 3.50.

India is only one country of electricity trading to Nepal. Electricity trading situation is not satisfactory now. Only in the year 2003 net power export is in favor of the 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 hydro project is either public land 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 construction cost and average generation cost. In the year 1998/99 Rs. 4811.30 million national capitals is invested in hydro energy sector. The major share of investment in energy sectors comes from donors and international NGO's. Nepal has receiving international assistance from a long time in hydro resource development. Recently middle Marsyangdi hydro project (70 mw) is in construction. The estimated cost of the project is about Rs 13.65 million

5.2 CONCLUSION

While finding out financial viability of hydropower investments, following seven 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.

The two power projects being 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 same in both projects but the investment cost vary depending on the on technical and physical aspects.

In the forecasted cash flow statement used in this study, revenue of CHP is higher than NHP. And also internal rate of return of CHP is higher than NHP, which proves that CHP is less cost and more profits project compared to NHP. However, this does not lead to a general conclusion that NHP is bad project than CHP.

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 affecting to complete the project like Madhya Marsyandi Hydropower Project and newly investment like Tamakoshi 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.

Besides those facts, it is better to point out some aspects for overall development of the hydropower sectors.

- 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 sectors.
- Since most of the better hydropower projects sites are in the remote mountains location, construction of access roads to these locations has to be prioritized so that the cost of such roads are not added to hydropower cost. This could reduce the cost of energy giving it a competitive advantage if the regional power market.
- Local industry relate to hydropower should provide with tax incentives to make local products competitive with similar important equipment.

- Nepal's internal demand for electricity is principally domestic lighting use; industrial demand is at low levels resulting in low load factor in th4e 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 widow policy is highly commendable but there is still room for important so that facilities and concessions provided under Electricity Act and regulations are implemented by all ministries of the government through DOED without many hassles.
- Transmission network has to 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 conforms that hydropower investment in Nepal is sound investment opportunities in this sector. There are many incentives for hydropower investment in Nepal. Hence, in spite of some risks and challenges investors are encouraged for such investment.

5.3 RECOMMENDATION

The investment process of both hydropower projects is satisfactory but to compare CHP has better.

- The hydropower sector should follow the practices of setting financing goals for future activities and should develop major programmes to accomplish them.
- The hydropower sectors should maintained 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 programmes.
- As per hydropower policy 1992 the government of Nepal shall provide an exemptions of income tax to the project of private sector generating and distributing electricity from the hydro electric project of to the capacity of 1000KW 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.

Recommendation to CHP

CHP is one of the best projects in the country. Comparatively it has the less investment and high return among the hydropower projects in Nepal. So it could be suggest that it is too late to build another project like this model. And the government and the authority have to learn a lot of from this project.

Recommendation to NHP

The profitability position of the both companies is satisfactory. But NHP can do much to increase the net profit. The investment cost of this company was comparatively more than the CHP. And NHP can rise it’s per unit price to meet

high profit. Due to the low price of per unit it is earning comparatively less than the other. And also NHP should reduce its administrative or operational expenditure to meet the profit level of CHP. The most important thing at present is that it’s not possible to reduce its investment cost, but it should be taken in mind that the proper study before the selection of project site and investment cost can give great margin for hydropower projects.

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