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Nepal as a Business Hub for Hydro Power industry

Introduction to Hydro Power Industry of Nepal

Thesis

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Thesis Abstract

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Nepal at present is suffering from the energy crisis due to the lack of enough production of electricity in the country. The main purpose of this thesis is to evaluate the present situation of electricity crisis in Nepal and provide the information to the foreign investors about the investment opportunities in hydropower sector in Nepal. The theoretical section gives the details about Nepal and electricity production scenario in Nepal. It also gives the detail about the demand and supply of electricity, investment policies in hydropower, and risks in the investment of hydropower as well as the barriers of investment in hydropower in Nepal.

Eventually, based on the theoretical overview as well as the empirical study deep analysis is done to make the conclusion of the thesis. The major problems of not being able to produce enough electricity in the country were found to be the lack of capital, lack of stable government and stable political situation. The investment policy of Nepal was found to be compatible for foreigner to invest in the country. Finally, the thesis was concluded with a finding that there are very good opportunities for investors to invest in hydropower sector in Nepal.

Key words: Hydropower, Investment model, Resource utilization, Transmission line, Sustainability, Business opportunities.

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Abbreviations

ADB:	**A**sian **D**evelopment **B**ank
Billion:	10^9 = 1000 millions
BIPPA:	**B**ilateral **I**nvestment **P**romotion and **P**rotection **A**greement
EDCF:	**E**conomic **D**evelopment **C**ooperation **F**und
EIA:	**E**nergy **I**nformation **A**dministration
FDI:	**F**oreign **D**irect **I**nvestment
GDP:	**G**ross **D**omestic **P**roduct
GIS:	**G**eographical **I**nformation **S**ystem
HMG:	**H**is **M**ajesty **G**overnment
IDA:	**I**nternational **D**evelopment **A**ssociation
IPO:	**I**nitial **P**ublic **O**ffering
IPPAN:	**I**ndependent **P**ower **P**roducers **A**ssociation **N**epal
IPPs:	**I**ndependent **P**ower **P**roducers
JBIC:	**J**apan **B**ank for **I**nternational **C**ooperation
KFW:	**K**reditanstalt **F**ÜR **W**iederaufbau (Germany)
KOICA:	**K**orea **I**nternational **C**ooperation **A**gency
kW:	**k**ilo**W**att
MW:	**M**ega**W**att
NEA:	**N**epal **E**lectricity **A**uthority
NEC:	**N**epal **E**lectricity **C**orporation
NIBL:	**N**epal **I**nvestment **B**ank **L**imited
NPR:	**N**epalese Rupee (NRP 98 = USD 1)
OECF:	**O**verseas **E**conomic **C**ooperation **F**und
OPEC:	**O**rganization of the **P**etroleum **E**xporting **C**ountries
PPA:	**P**ower **P**urchase **A**greement
PPP:	**P**ublic **P**rivate **P**artnership
PPP:	**P**urchasing **p**ower **p**arity
SEBON:	**S**ecurities **B**oard **o**f **N**epal
SFD:	**S**ecurity **F**ederal **C**orporation
UTHP:	**U**pper **T**amakoshi **H**ydro **P**ower

1. INTRODUCTION

The main objective of thesis is to introduce the reader about the potential and scope of hydropower business in Nepal. The thesis consist the relevant ideas about the hydropower industry in Nepal. It includes mainly potential of hydropower business, its development, market, promotion. This thesis could play a motivational role for attracting the internal as well as foreign investors to invest in hydropower industry in Nepal and boom this industry in short period of time. Hydropower industry could play a vital role to solve the problem of energy crisis in this region and uplift the country economy building Nepal as a wealthy Nation.

1.1 Research problem

Nepal has huge hydropower potential despite that it is unable to explore its potential capacity and the country is having electric energy crisis. It has been one of the major problems in Nepal. It is also affecting economic development of a nation since industrialization depends upon energy and electric energy can be a major source of energy for industrialization in Nepal. This thesis deals with the ideas and explore the relevant problem with suitable solution that why Nepal is lacking to optimize productivity of water resources for the production of hydropower energy and its commercialization in Nepal.

1.2 Research Limits and Boundaries

In the thesis substantial information, datasets, as well as the inclusion of tables and statistics are taken from various relevant sources by acknowledging them. There is no self-observational field study. It is not possible due to high technical expertise, time constraints and financial deficit. The analysis made in the thesis depends on previous case study. So there is always question mark for reliability

and validity. It is impossible to include all significant information because the area of study is large.

1.3 Research Methods

The thesis is mainly based on quantitative or qualitative research approach as well as it also includes empirical study. Needed substantial datasets as well as the inclusion of tables and statistics are taken from various relevant sources by acknowledging them.

2 HYDROPOWER INVESTMENT AND THEIR FINANCING FOR PROPER UTILIZATION OF RESOURCES AND PRODUCTION

Hydropower sector in Nepal require internal as well as external investment for the proper utilization of resources and its production.

2.1 Financing

Investment in broader sense means capital, labor, expertise and time spent in the hope of future benefits.

Capital investment: means funding of Hydropower projects. Hydropower projects in Nepal can be funded by internal investment and external investment.

Internal investment: The funding needed for running and improving different Hydropower projects can be collected within a country by its citizens and business institutions. The government of Nepal should create a favorable environment for internal investment. The government of Nepal should ensure people and business institutions about security of their funds. The Nepal government should play a motivational role to engage more investors within a country in the sector of hydropower business with its clear future vision, program and strong security insurance policy so that the investors have confidence to invest in this sector of business.

Internal investment can be obtained by following sources.

1. National Banks and Financial Institutions
2. Public share
3. Public Private Partnership (PPP)
4. Government Budget and policy

Here are some current facts and figures about internal investment in Hydropower business sector of Nepal.

2.1.1 National Banks and Financial Institutions current role in Hydropower investment

Investment of Banks and Financial Institutions in Hydropower is around NPR (Nepalese rupees) 17 billion (ca. 170 million USD). (Belbase Bishnu. 2013.1) Private sector investors have been increasing investment in the Hydropower sector. The private sector started to invest in the Hydropower sector from 1995. By the end of the last fiscal year (2012/13) private sector Hydropower projects were generating 230 MW which is 30 % of the total national power generation. According to the Independent Power Producers Association Nepal (IPPAN) the private sector has invested around NPR 55 billion in around 25 under construction hydropower projects. The projects are expected to be completed in four years and these will add around 300 MW of electricity to the National grid. (Belbase Bishnu. 2013. 1)

The 15 MW Hewakhola hydropower project, which is being developed by the private sector, will be completed by mid-April 2015 according to promoters. Likewise Robust Energy Private Limited is developing 42 MW Mistrikhola Hydropower project. The project`s estimated cost is around NRP 6 billion. The project is to be completed by mid-April 2017. Similarly, 20 MW Modikhola Hydropower project is expected to be completed by mid-April 2016 at the cost of around NRP 3.6 billion. A consortium of 11 banks led by Nepal Investment Bank has made loan investment in the project. These projects are examples that private sector can work in the Hydropower sector even without government involvement. Hydropower promoters despite multiple challenges have on an average invested around 30 % through their own sources and the remaining 70 % through loans from banks and financial institutions in the project. (Belbase Bishnu. 2013. 1)

According to Hydropower promoters at present, Nepalese banks and financial institutions have the ability to invest up to NRP 50 billion in Hydropower projects. According to the Nepal Rastra Bank, banks and financial institutions have invested NRP 17 billion in the Hydropower sector by the end of last fiscal year (2012/13) which ended in mid-July. Also due to the Nepal Rastra Bank`s provision requiring commercial banks to invest at least 10 % of the total loan portfolio in Hydropower and agriculture sectors. After the banks and financial institutions increased loan investment in the hydropower sector, construction of Hydropower projects has gained momentum. The government needs to provide more incentives to the private sector, which has been engaged in Hydropower development despite adverse situation in the country and encourage them. (Belbase Bishnu. 2013. 1)

2.1.2 Public Share

Public participation for the development of any business is very important. In context of Hydropower business in Nepal general public and locals should be involved in the business. The business environment should be made in such a way that people actively take part in different hydropower project with confidence and trust. For this clear policy and strong sense of security should be created by government and corporate sectors. Initial Public Offering (IPO) should be launched by companies and government in more Hydropower projects to involve local and general public. Public share could be good method to raise capital in this sector.

Some of the old and current important facts about Public Share in Hydropower sector of Nepal.

In Nepal according to the amended Securities Registration and Issuance Regulation (2008 A.D), Hydropower companies must float shares for the locals before they open the issue for general public. A company has to float a minimum of 30 percent of the share to the public and out of the 30 %, 5 % has to be set aside for the company´s staff, 10 % for the locals and remaining 15 %will be floated to the general public. (Business Age, 1)

At present there are six hydroelectric powers listed on the Nepal Stock Exchange.

These are:

1. The Arun Valley Hydropower company
2. Butwal power company
3. Chilime Hydropower company
4. National Hydropower company
5. Sanima Mai Hydropower
6. Ridi Hydropower Development Company Ltd.

Sanima and Arun Valley Hydropower companies are listed with the Securities Board of Nepal (SEBON) while the rest have applied for the same. Sanima issued primary shares worth NRP 211 million at the rate of NRP 100 per share, while Ridi Hydropower issued share worth NRP.147 million. Likewise Tamakoshi Hydropower issued primary shares worth NRP 25.416 million and while Arun Valley Hydropower issued shares worth NRP 24.3 million to the residents of the project site. (Thapa Santosh. 2014, 1)

After the outstanding IPO success of Ridi Hydropower Development Company Limited which is oversubscribed by 92 times (officially confirmed), other hydropower companies are also in the pipeline for IPO. Upper Tamakoshi Hydro Power (UTHP) has sought permission from the Securities Board of Nepal (Sebon) to float 25.42 million units of shares to public, while Barun Hydropower Company has applied for permission to issue 243,000 units of shares to the people in the project affected area which is managed by Civil Capital. Similarly, NIBL Capital Markets Ltd. has signed agreements with two hydropower companies -United Modi Hydropower Pvt. Ltd and API Power Company Ltd. to act as the issue manager and underwriter for their respective initial public offerings (IPOs). United Modi signed an agreement to issue 4,000,000 units of common stock at NRP 100 per share, according to a statement from NIBL Capital. While Api Power signed an

agreement to issue up to 2,046,240 units of common stock at NRP 100 per share. (Thapa Santosh, 2014, 1)

The Share Market expert believe that current trend of the power developers to issue public shares is creating an environment conducive for investment in the country, which again is likely to boost the capital market.

For current information readers are suggested to visit **Nepali Stock Market Blog.** Web address **www.nepalistockmarket.blogspot.fi**

2.1.3 Public Private Partnership (PPP)

The Nepalese government has encouraged the private sector and the energy consumer group to participate in Hydropower projects so as to utilize the private sector´s efficient techno-managerial skills, entrepreneurship, and financial ability. The government offered the private sector to construct new projects under a public private partnership (PPP) scheme to promote the private sector´s participation, along with the provision of the guaranteed 10 percent project share to the project affected general public. With this investment concept, Chilime Hydropower produced 22 MW power in 2003 and is undertaking 5 different larger power projects, amounting to 570 MW. This tremendous success in a short period of time as well as the efforts to empower the local people by making them direct stakeholders is one of the success measures of the PPP model in the energy sector in Nepal. (Ghimire Rabindra, 2012, 2)

2.1.4 Nepal Government role in development and investment of Hydropower in Nepal

Since Nepal is developing country the government is not so strong enough in financial condition. Therefore the development of hydropower has been slow in the past. The political turmoil is also one of the reasons for slow development. History of hydropower development in Nepal is almost 100 years long, but almost all hydropower projects were constructed after 1917.These project were financed by foreign governments, development agencies and bilateral and multilateral organizations. Before 1990, government had followed closed economic policy and there was no opportunity to private sector participation in Hydropower. Total sum of US $ 1.44 billion was invested by government of Nepal from internal and external sources which is equal to 13 percent of total development expenditure and 44 percent of foreign loan during the 35 years. Government had received financial and technical assistance from USSR, UK, India, China, Germany, Japan, South Korea and their development organization OECF, EDCF, JBIC, SFD. Besides, soft loan received from multilateral organization World Bank, ADB and IDA, OPEC, and financial institutions Kuwait Fund and KFW. (Ghimire Rabindra, 2012, 2)

During last 100 years history trend of Hydropower production is not satisfactory. Table 1 shows power production in different regime (Rana regime- 1.14 MW, Panchayat regime-226.65 MW and Multi-Party System period- 415 MW). Currently 592.4 MW projects are under construction by NEA and independent power producers in different financing model. (Ghimire Rabindra, 2012, 2)

Table 1. Hydro Electricity Production in different regime

Regime	period (AD)	Under taking of		Total (MW)
		NEA & GoN (MW)	Private sector (MW)	
Rana Regime	1911-1934	1.14		1.14
Panchyat Regime	1969-1989	226.65		226.65
Multi-Party Regime	1990 to date	240.60	174.5	415.10*
Total Installed Capacity		468.39	174.50	642.89

Source: Nepal ko jalbidhut Bikash Bigat Dekhi Bartaman Samma, 1911-2011, Nepal Electricity Authority Economic Survey 2010/2011, Ministry of Finance.

* Micro hydropower 4.43 MW and under construction of about 592.4 MW is not included.

The above table shows that Nepal has seen three regimes in its modern history. The regimes have somehow affect the development of the country which ultimately have effect in hydro electricity production. Rana regime was autocratic dynasty rule. In this regime common people were deprived of development facilities and there was economic exploitation in Rana rule. As a result of which very less only 1.14 MW hydroelectric production was done in this regime. Panchyat Regime was direct rule by king Mahendra Bikram Shah. In this regime 226.65 MW hydroelectricity production was done. At present in Nepal there is multiparty regime. The major political parties selected by the general people run the government. In this regime till now 642.89 MW hydro electricity production have been done but the result is not satisfactory. This is because of political instability, corruption, slow bureaucratic system.

To make available electricity to 100 percent population and to meet the higher rate of economic growth, demand of electricity has forecasted 1640 MW and 2363 MW

coming five and ten years respectively. (NEA: 2011). Electricity is identified as exportable product from which Nepal can earn billions of dollars. But, existing policies strategies mechanism and the working style would not be suitable to achieve the ambitious goal. (Ghimire Rabindra, 2012, 3)

Table 2. Development Budget and Investment in Hydro project by Government and NEA.

Fiscal year (f/y)	Investment in Hydropower (Rs. 10 million)	Hydro power (MW)	Hydro Expenditure to foreign loan	Hydro Expenditure to Development Expenditure	Hydro Expenditure to total Expenditure
Before 1971	0.007*	2.14			
1971-1984	973.50	123.15	2.36%**	37%**	25%**
1985-1994	1,709.70	102.50	34%	13%	9%
1995-2004	3,618.96	170.60	39%	15%	6%
2005-2010	2,800.00	70.00	44%	13%	7%
	9,102.17	468.39	44%	13%	7%

Source: Nepal ko jalbidhut Bikash Bigat Dekhi Bartaman Samma, 1911-2011, Nepal Electricity Authority Economic Survey 2010/2011, Ministry of Finance.

* Cost of Sunadarijal (1000 Kw) and panuati (640 Kw) is not included, this amount cost only Pharping project.

** Total expenditure, development expenditure are included from fiscal year 1974/75 to 1983/84

The above table indicates that there has been increase of investment in hydro power sector by the Government of Nepal. This is a positive sign for this sector. The government has realized the importance of energy for all round development of a country. Bilateral and Multilateral relationship and globalization of business in the current world has also helped in the increase of investment in this sector.

2.2 Government policy

To regulate the hydropower project and industries, government of Nepal has formulated numbers of acts, rules, regulation and policies. Out of them some important documents are:

- Water Resources Act, 1992
- Electricity Act, 1992
- Land Acquisition Act, 1977
- Environment Protection Act, 1997
- National EIA Guidelines 1993
- Manual for public Involvement in EIA process of hydropower projects
- Manual for preparing Scoping Document for EIA of Hydropower Projects
- Manual for Conducting Public Hearings in the EIA process for Hydropower Projects
- Hydropower Development Policy, 2001
- Irrigation Policy, 2003
- National Water Plan, Guidelines for the study of hydropower projects, 2003
- Hydropower License Management Guidelines

Besides this several acts and rules has been formulated. Ministry of Water Resources and Ministry of Energy, Water and Energy Commission, Department of Electricity Development, Nepal Electricity Authority has right to formulate different policy, administer the hydropower development projects and enter in to power purchase agreements. (Ghimire Rabindra, 2012, 3)

2.2.1 Hydropower Development Policy, 1992

Model and Approaches: Realizing the importance of private sector Participation in Hydropower sector Government of Nepal has issued Hydropower Development Policy, 1992. The policy opens the door to private sector for the development of the hydropower in BOOT (Build, Own, Operate and Transfer) model. The policy offered four different types of investment models.

1. Sole or joint venture of one or more private national investor.
2. Joint venture of the government and one or more national or foreign investor.
3. Hundred percent investment of one or more than one foreign investors and
4. Joint venture of the national or foreign investors.

The Government is pursuing water resource development in Nepal from three different approaches. Firstly to develop small and decentralized hydropower projects to meet the local demands in remote and isolated regions of the country. Secondly, to develop medium sized power projects to meet the national demand within the national grid including surplus for export, and to develop local capacity. Thirdly, large-scale multi-purpose projects to meet the regional demand for food, energy and control flood and water related disasters. (Ghimire Rabindra, 2012, 2)

Table 3. Royalty and Tax matter

Tax and royalty exempted provision is as follows:

Particulars	Up to 1000 KW	More than 1000 KW
Royalty	NO	Rs. 100.00 per KW per annum and 2% of the average sale per unit.
Income Tax	NO	• Generators- First 15 years 0% tax • Electricity substation, and transmits and extends the distribution lines 0% tax for first 10 years. • Income tax 10% less than other corporate income tax. • Upgrading, modernizing of project expenses tax exemption of 50%. • Import license fee sales tax free. • Foreign currency facilities.
Pricing of Electricity	Free to fix price	Price to be fixed mutual agreement with NEA.
Export	No mention	As per Government of Nepal directives.
Nationalization of Project	Foreign investment project is nationalized after 50 years.	

Source: Hydropower Development Policy, 1992, Ministry of Energy, Government of Nepal.

2.2.2 Hydropower Development Policy, 2001

Types of licenses and its period: Hydropower Development Policy, 2001 is more cleared on various aspects. It has emphasized on generation of electricity at low cost, reliable and qualitative electric service, development of rural economy, development of hydropower as an exportable commodity. Investors need to obtain different types of license in different stage of development. The study license for a maximum period of five years, the hydropower generation license for internal supply for Thirty-five years, for export oriented hydropower project for Thirty years and in the case of the captive plant producing energy of which at least 60% is utilized by any national industrial enterprise on its own up to the period the concerned industry remains in operation and if the industry does not remain in operation, up to 30 years. But for storage project, the term of the generation license is only for maximum period of five years on the basis of the construction period. (Ghimire Rabindra, 2012, 3)

Rate of royalty: Royalty need to pay on the basis of the capacity of project and energy sold in market. Royalty is negotiable for the project more than 1000 MW. The rate is as follows

Table 4. Rate of royalty for internal consumption

	Electricity Capacity	Up to 15 years		After to 15 years	
		Annual capacity Royalty/kW	Energy royalty/kWh	Annual capacity Royalty/kW	Energy Royalty/kWh
1	Up to 1 MW	Rs.100/-	1.75%	-	
2	From 1 MW - 10 MW	Rs.100/-	1.75%	Rs.1000	10%
3	From 10 MW - 100 MW	Rs.100/-	1.85%	Rs.1200	10%
4	Above 100 MW	Rs.200/-	2.00%	Rs.1500	10%
5	For captive use	Rs.1500/-	-	Rs.3000	

Source: Hydropower Development Policy, 2001, Ministry of Energy, Government of Nepal.

Table 5. Rate of royalty for export

	Electricity Capacity	Up to 15 years		After to 15 years	
		Annual capacity Royalty/kW	Energy Royalty/kWh	Annual capacity Royalty/kW	Energy Royalty/kWh
1	Run of river	Rs.400/-	7.5%	Rs.1800	12%
2	storage of river	Rs.500/-	10%	Rs.2000	10%

Source: Hydropower Development Policy, 2001, Ministry of Energy, Government of Nepal.

2.3 Financing Model in Hydro Power sector for investment by Nepal Government

Nepal requires following the portfolio theory while financing the project. Single financing model should not be appropriate for numbers of project. Diversification of sources of financing minimize the various threats emerge from the investors and lenders. Model of financing depends on nature, size and time of project completion.

Power production is heavily constrained by the availability of financial and human resource. A huge investment is deserved to carry out a project. Financial resource is set forth as the lending constraints in the power production given the high per capita energy production but the degree depends on the scale of production.

Partnership with the private sector is the best possible way to fill-out the resource constraint in the liberalized economy. Resource in the private sector needs to channelize in the productive sector of national interest. Although private sector accepts power production is a lucrative sector to invest yet only about 27 percent of the total installed capacity is carried by national and international private sector. There is a huge trend of holding license of river intended to carry out projects after the Electricity Act, 1992, but a very few gets the work done. (Ghimire Rabindra. 2012.5)

Summarizing the existing practices in Nepal and abroad, different financing model can adopt in Nepalese context. Some of them are discussed below:

2.3.1 Government and NEA subsidiaries company Funding Project

It is the duty of government to generate 10, 000 MW of electricity within 10 years period at any cost. There are different models of project and financing option, however, most reliable and unswerving model is generation of power through NEA and subsidiaries companies as a special purpose vehicle of project financing. Strategically sensitive and national importance project need to develop in this model. However, government is suffering from development fund; mega project may not be possible from this model. NEA can obtain loan from banking sector, issue power bond itself also can use its own profit from different ongoing projects. (Ghimire Rabindra. 2012.7)

2.3.2 Government and International Agency Model

Government can receive financial assistance from different developed countries (as bilateral model) and from development and financial agency like World Bank and its group, Asian Development Bank, OPEC, (as multilateral model) to build more capital intensive mega projects. Government can obtain soft loan. Power Development Fund is another source of funding. Chamelia Hydro Electricity Project (US $ 100 million, 30 MW) funded by Government of Nepal, NEA and Korean Government is an example of such model. (Ghimire Rabindra. 2012.7)

2.3.3 Public Private Partnership Model

Small projects are independently running by private sector but some huge projects associating high risk and high cost of Capital. Such type of project needs governmental support to complete the project. Nepalese private sector is seeking suitable investment sector. Resources scattered national wide need to collect and channelized in a productive sector. Financial institutions either invest or provide loan in hydro project. However, they are willing to invest higher profitable sector than hydro projects. Besides, central government, PPP model is equally suitable

with local government (District Development Committee, Municipalities and Village Development Committee). Cooperate organization charitable and NGOs and other local development organization also can participate in small block of equity capital. Non Resident Nepalese can be vital partner in hydro power sector. Chilime Hydro Electric Power project is a successful project of this model. People may utilize their remittance receive from foreign employment purchasing power equity or power bond. (Ghimire Rabindra. 2012.7)

2.3.4 Private Sector Model

Private sector includes domestic investors or joint ventures with foreign investors develop the projects. More than two dozens of projects are completed and same numbers of projects are under construction under this model. Khimiti (60 MW) projects, an undertaking of Himal Power Ltd. is a first successful private sector project jointly invested by 1 domestic company: Butwal Power Company, 3 foreign companies and loan support from 5 international agencies: Asian Development Bank(ADB), International Finance Cooperation(IFC), Eksportfinans As (Norway), Nordic Development Fund (Finland) and Norwegian Agency for Development Co-operation(NORAD). The project is running in BOOT model and ownership of the plant will be transferred from HPL to the Nepalese government after 50 years of operation. The project was started in construction works in June 1996 and was commissioned in July 2000. (Ghimire Rabindra.2012.6)

2.3.5 Foreign Direct Investment (FDI) Model

China and India are suitable and strategic partners for the power development of Nepal. There is high possibility of FDI with in Asian countries and European and American countries in some extent. China is world`s top recipient of foreign investment. In South Asian context, India also received highest amount of FDI. Nepal´s current FDI in Hydro power sector is not significant. It needs to create more conducive environment to attract FDI in greater amount. Government has right to select and award appropriate Hydro Electric project. But, there is a critic of

100 percent FDI model in Hydro power projects which may arise some difficulties in the future. Government need to assume the potential risk happening following this model and also required to think about the possible remedies to overcome such problem in time. National sovereignty and dignity are to be important than some megawatts of energy. It is the issue of discussion whether 100 percent FDI run project is better or not for Nepal. Both investors and governments need to express long term commitment in order to cooperate each other to make success the long term and huge investment venture. (Ghimire Rabindra. 2012.6)

2.4 External Investments

In developing country like Nepal foreign investment is key part for the success of the hydropower development campaign which needs to contribute 45 % of the total investment (around US $ 16 billion) for 10 years. Many Important steps have been taken to attract foreign investment in this sector in the recent year by the Government of Nepal. In the chairmanship of Prime Minister Investment Board has been formed. BIPPA agreement with India is done. Indian and Chinese government counterparts and businessmen are showing deep interest on hydro power investments. (Ghimire Rabindra. 2012.5)

All most all projects completed before 2008 were built in assistance with foreign countries, development agency and bank loan and grants. In 2010, 782 different projects amount of total NRP 36.352 billion was approved for foreign investment. Out of these 782 projects, 18 projects were energy based and total committed amount of investment is NRP 8.429 billion. But, Nepal has to make power sector more attractive and provide more facilities to the foreign investors so they will shift from service to energy sector. Nepal has several evidence and experience of foreign investment in hydro project since the sector is second priority followed to manufacturing sector. Khimti, Bhote Koshi and Indrawati hydro project (103.5 MW) received USD $ 233.6 million foreign investment. Chameliya hydro project (30 MW) is supported by KOICA. Upper Trishuli (60 MW) project is financed by China Exim Bank as a loan of US $ 120 million, Rahughat (32 MW) project is financed by

Exim bank of India amount of US $ 31 million as a soft loan. 40 percent of total cost of Kabeli (37.6 MW) project is financed by Power Development Fund of the World Bank. Upper seti Hydro Electric Project (127 MW) received loan amount of NRP 180 million from ADB. Similarly, in West Seti (750MW) Chinese government has shown keen interest to provide US $ 1.6 billion loan. Bilateral and Multilateral assistance to build hydropower projects has been in practiced in Nepal during last 40 years and from last 16 years, foreign investors and domestic private investors also involved in hydropower project. But these projects were not more than 60 MW capacities. Investors certainly take decision on the basis of the rate of return on investment and risk of projects. Investors have unlimited scope of invest in this sector but they have to be ready to face various types of risk: political risk, market interest risk, inflation risk, hydraulic risk, climate changes risk, geological risk etc. Project life of hydropower is comparatively higher than other sector and its return increase in coming years. (Ghimire Rabindra. 2012.6)

2.4.1 Know How Investment

Besides capital investment, know how investment is also very important. There should be good research of project by the government or related group before starting them. Efficient and smart world class expertise should be used. The government of Nepal should focus in producing efficient Human resource in the related field with in a country. In a country more academic and vocational knowledge and training should be provided in this field to generate skill manpower. If necessary world class, advance and latest know how, technically skill manpower should be imported in the country.

2.4.2 Time Investment

Time is essential factor. Every project and work should be smartly completed within the given time frame. The bureaucracy should work and coordinate in the right time in a right way. In the recent past years many projects have been delayed which creates bad impression for the investors within and outside of country.

2.5 Resource Utilization

Proper utilization of resources is essential to achieve the goal. The government of Nepal should utilize its resources like water, manpower, capital and diplomatic relations and policies for the hydropower production.

2.5.1 Water

Nepal land is blessed with enormous amount of inland water resource, sources of which comes from the Himalayan Range. The perennial nature of rivers and the steep gradient of the country's topography provide ideal conditions for the development of hydropower. The production of electrical power through the use of the gravitational force of falling or flowing water is suitable in Nepal and can be done in tremendous amount. Water to run the power plant is provided free by nature and is renewable source of energy with low-cost and none polluting. Government should use this core competency of the country for the economic benefits of its people and country.

2.5.2 Manpower

Nepal is a youth country. The youth force is an invaluable asset of the nation. The youth is not only a vital source of the state but also a change agent. The youths are pioneers of economic, social, political and cultural transformation and change driving force. This class remains as an important asset of the nation because of courage, innovativeness, inquisitiveness and high level of self-confidence, which is also considered to be a main source of nation building. Population of 16-40 age groups in Nepal accounts for 38.8 percent of the total population. Given that the youth is the backbone of the nation from both qualitative and quantitative perspectives, it is necessary to make overall development of the youth and include their capacity in the mainstream of national development. Government should make policy and program to attract young people in this sector of business. High

quality and technically sound manpower should be produce in this field. Government should provide quality academic education and better technical skill in this field. The government should be able to use its manpower for its benefit.

2.5.3 Capital

Proper utilization of national capital is important. Unnecessary expenditure by the government should be stop. Money should not be freeze in the banks. There should be clear policy for proper utilization of capital. More budget should be separated for infrastructure development like Hydropower.

2.5.4 Diplomatic Relation and policy

The government of Nepal should use diplomatic relation for the betterment of hydropower industry in Nepal. Beneficial agreement and treaty should be signed with other nations for the development of Hydropower. Clear and smart policy should be made to attract foreign investor in the country.

3. RESEARCH ENVIRONMENT

The research and all the significant information required for the subject of the thesis is taken from Nepal and its hydropower industry. Case study is done with the information from past and present collected from authentic sources from Nepal and its hydropower industry. Pre assumption is done on the basis of old and new facts obtain from Nepal and its hydropower industry. The following paragraphs explain the size, chronological development, the potential and current situation of hydropower industry of Nepal in details.

3.1 Introduction

In the following paragraphs there is brief introduction of Nepal, its economy, social structure and business etiquette.

Figure 1. Map of Nepal. Source: Nepal Atlas

Figure 2. Flag of Nepal**.** Source: Nepal flag

Nepal: Nepal (ˈ/nɛˈpɔːl/ officially the **Federal Democratic Republic of Nepal** is a landlocked sovereign nation located in South Asia. With an area of 147,181 square kilometers (56,827 sq mi) and a population of approximately 27 million. Nepal is the world's 93rd largest country by land mass and the 41st most populous country. It is located in the Himalayas and bordered to the north by the People's Republic of China, and to the south, east, and west by the Republic of India. Specifically, the Indian states of Uttarakhand, Uttar Pradesh, Bihar, West Bengal, and Sikkim border Nepal, while across the Himalayas lies the Tibetan Autonomous Region. Nepal is separated from Bangladesh by the narrow Indian Siliguri Corridor. **Kathmandu** is the nation's capital and largest metropolis. (Nepal in figure, 1)

Some of the important facts and figures of Nepal:

Capital and largest city: Kathmandu

Official languages: Nepali

Demonyms: Nepali, Nepalese, Gurkhas

Government: Federal Parliamentary Republic

Legislature: Constituent Assembly

Unification: Kingdom declared: 25th September 1768; State declared: 15 January 2007; Republic declared: 28 May 2008.

Area: Total 147,181km^2 . 56,827 sq mi; Water (%): 2.8

Population: 26,494,504 (2011 census); Density: 180/km^2 ; 518/sq mi

GDP (PPP): Total: $ 62.384 billion; Per Capita: $ 2,310 (2013 estimate)

GDP (nominal): Total: $19.921 billion; Per Capita: $743 (estimated 2012)

Gini (2010): 32.8 (medium)

HDI (2013): -0.540 (medium) 145th

Currency: Nepalese rupee (NPR)

Time zone: NPT (UTC+ 5:45)

Drive on the: Left

Calling –code: +977

ISO3166 Code: NP

Internet TLD: .n (Nepal in figures, 1)

3.1.1 Social Structure

As Nepal being a very broad diversified home land of several ethnical groups it has common social family structure. In general living in joint family system at a home, respecting and following own socio-traditional conducts generation to generation. Showing physical affection openly in public is restricted; gents and ladies socialize separately both before and after marriage with family gatherings. Normally marriage is arranged by parents with help of marriage consular called Lahmi. Among new generations love marriage is also popular now a day. They have right to choose their mate and decide their own future bright. There is no way to say that Nepalese society remained untouched by global changes, mainly in major cities and towns of young generation hugely influenced by information technology of world and adopted several fascinating ways. (NepalLink.1. Business and travel guide.)

3.1.2 Religious beliefs

Nepal is multi religious country in the world so different ethnic groups live with their own way of religious practice, lifestyle, language, culture and tradition with ever peace of harmony in society. About 80% of total populations are Hindu religion follower lives in the all over Nepal's east to west up to Maha Bharat range in north, about 10% Buddhist religion people among live bellow of Himalayan region to mid hill, valleys and in towns together 4% Muslim religious people and rest of other religious people live in different parts of the country. In Hindu community every ritual ceremony handled by priest (pundit), by Lama (monk) in Buddhism community as well by Mullah in Muslim community. (Nepal Link.1. Business and travel guide.)

3.1.3 Economy

Nepal is among the poorest and least developed countries in the world, with about one-quarter of its population living below the poverty line. Agriculture is the mainstay of the economy, providing a livelihood for three-fourths of the population

and accounting for a little over one-third of GDP. Industrial activity mainly involves the processing of agricultural products, including pulses, jute, sugarcane, tobacco, and grain. Nepal has considerable scope for exploiting its potential in hydropower, with an estimated 42,000 MW of feasible capacity, but political instability hampers foreign investment. Additional challenges to Nepal's growth include its landlocked geographic location, civil strife and labor unrest, and its susceptibility to natural disaster.

3.1.4 Business etiquette

It is definitely useful for business to make friends with influential businessman, politicians and bureaucrats. Not much gets done without the help of contacts with influential people. Generous wining and dining tactics are one of the ways to get such people to listen to you. There are many middlemen who might offer their services to get government work done in less than half the normal time. Make sure to run a check on them through your network before making any decisions. Saturday is the official holiday and Sunday is a half-working day. Business hours are from 9 am to 5pm and Nepali people are quite laid back and prefer not to work on weekends. It is always good to show up on time for a meeting, but don't be surprised if your partner or client is late by 15 minutes or more. (@illo's Expat Nepal, 1)

It is polite to greet people by saying "namaste". You have to press your palms together in front of your chest and either nods your head or bow down slightly. Always greet the elderly with a namaste. If you are meeting prospective business partners, you can shake hands and use English greetings. Supervisors may be addressed as 'sir' or 'madam'. "Ji" can be added to the end of a name to show respect: "Nancy-ji". This can be used for elders and professors or government officials. In the workplace, once relationships have been built the family references may also be used in place of names: "didi" for older sister, "bahini", and younger sister, "dai", older brother and "bai", younger brother. If a name is not known then

these names can be used respectfully to ask a question. Most Nepalese will expect you to directly ask "What is your name?" and will give you a name that they prefer to be called. This should be followed. Personal relationships are very important and therefore much time is spent on establishing these over endless cups of ’chai’ (tea). Questions about family, work, life experiences are good ways to establish these relationships. It’s best to allow time for small talk before getting down to business discussions. Most decisions are made by management without much input from staff. The top down approach is quite prevalent though there are exceptions to the rule. When meeting a client or a business partner, smart casual dress would be appropriate. (@illo‘s Expat Nepal, 1)

3.2 Hydropower in Nepal

Nepal land is blessed with enormous amount of Water, sources of which comes from the mighty Himalayan Range. Hydropower is the major source of Electricity in this country. World's 20% of electricity is by Hydropower. In contrary, 96% of electricity in Nepal is by Hydropower - That says a lot of Nature Power of Nepal. Hydropower electricity is environment friendly - no pollution in air or in land, and, is also the most efficient method of all. Yet, despite the vast amount of source, not all sources have been used in Nepal. Many small to large scale private-run and Government owned companies operate their hydropower projects throughout Nepal. Nepal has the capacity to produce up to Eighty Five Thousand Megawatts of Electricity - 85,000 megawatts. Today, country produces less than 50 % of that capacity. Hydropower business is a great way for Nepal to progress - It has the potential to uplift poverty, provide electricity to every household and even allow Nepal to sell electricity to other countries. Popularity of Hydropower comes closer to becoming Nepal's third most important business for earning foreign-revenue and every year, lots of foreign companies visit Nepal for project studies. (Nepal Vista. 1 .Hydropower in Nepal. Article.)

4 SCENARIOS OF HYDROPOWER DEVELOPMENT IN NEPAL FROM PAST TO PRESENT

Nepal, the Himalayan country in South Asia between China and India bestowed with 2.27% of the world water resources , 818,500 Hectare of total water surface area, about 6,000 rivers including rivulets and tributaries totaling about 45,000 Km in length. Thus Nepal land is blessed with enormous amount of inland water resource, sources of which comes from the mighty Himalayan Range. Hydropower is the major source of electricity in this country. The perennial nature of rivers and the steep gradient of the country's topography provide ideal conditions for the development of hydropower.

4.1 Hydropower potential of Nepal

Nepal has a huge hydropower potential. Some half century ago, water resources expert Dr. Hari Man Shrestha conducted an academic research for his PhD degree in Russia, which revealed that theoretically Nepal could generate 83,000 megawatts hydropower, of which 42,000 megawatts was economically and technically feasible. This estimate was made at a time when very little river water discharge data was generated by very few measuring stations. Dr. Shrestha also used average runoff discharge that includes the flood water as well as making the study to be only a very high level approximation. That however could have been considered the only possible way to estimate the hydropower potential where not much measuring stations were available during that time. (Arjun Bahadur KC.2013, 1)

4.1.1 Recent research on hydropower potential of Nepal

A recent study conducted by the team of Institute of Engineering, Tribhuwan University Nepal and led by Prof. Narendra Man Shakya has shown that Nepal has a total potential to generate 53,000 megawatts of hydropower in Nepal. This team's estimate was based on the latest water discharge data available with the

department of Hydrology and Meteorology, using Geographic Information System (GIS). Unlike Dr. Hari Man Shrestha `s study, this team estimated the hydropower potential excluding the flood water from the discharge data making this study more reliable. The estimate of potential entirely depends on what types of models are used and what kinds of assumptions are made while developing various scenarios. This study however, does not tell the maximum generating potential in terms of electrical energy Gigawatt hours (GWh) based on wet as well as dry season flow duration. (ArjunBahadur KC.2013, 1)

4.1.2 Current situation of Hydropower in Nepal

The present situation is that Nepal has developed only approximately 600 MW of hydropower. Therefore, bulk of the economically feasible generation has not been realized yet. The hydropower development in Nepal began with the development of 500 (Kw) Pharping power plants in 1911 build with aid from UK. The most recent significant power plant commissioned is the 144- MW kali Gandaki “A” Hydroelectric plant. Until 1990, hydropower development was under the domain of government utility, Nepal Electricity Authority (NEA) only. However, with the enactment of new hydropower development policy 1992, the sector was opened to the private sector also. First private company to undertake Hydropower project was Bhote Koshi Power Company Limited. There are numbers of projects already built by the private developers. Private power producer contribute 148 MW of power to the “Integrated Nepal Power System.” In Nepal approximately 50 percent of the population has access to electricity, and only 5 percent of the rural population has access to electricity from the National grid. Even residents in Nepal`s capital city of Kathmandu experience outages several times a day for up to 16 hours during the dry season. These electricity shortages have led to a heavy reliance on biomass burning for energy in rural Nepal, which has negative health and environmental impacts, particularly for women and children .One third of the generated electricity is used by industries such as manufacturing plants. The electricity power demand is growing by 28 percent every year. Over 100 Hydropower projects are proposed in Nepal as of 2001. (Arjun Bahadur KC.2013, 2)

Nepal Government encourages Hydropower by providing advantage for Business. License must be obtained from Nepal Electricity Authority. There is no royalty to be paid for power generation up to 1000 Kilowatts. Tax and custom duty for machinery and equipment are also exempted for private companies generating that much of electricity. The business scope of Hydropower energy in Nepal is very bright. It will not only solve the country`s energy, economic and social problems but also generate revenue for the country and investors by exporting electricity to neighboring countries. According to the U.S Energy Information Administration (EIA), between 2008 and 2035, China and India `s share of world energy consumption will jump from 21 percent to 31 percent therefore both countries have expressed interest in developing hydropower projects in Nepal to address this projected growth in demand. (Arjun Bahadur KC.2013, 2)

4.1.3 Chronological Development of Hydropower in Nepal

Nepal is rich in hydro-resources, with one of the highest per capita hydropower potentials in the world. The estimated theoretical power potential is approximately 83,000 MW. However, the economically feasible potential has been evaluated at approximately 43,000 MW. After the establishment of the first hydropower plant (500 MW) in 1911, the second hydropower plant (640 KW) was established at Sundarijal in 1936. Similarly the Morang Hydropower Company, established in 1939, built 677 KW Sikarbas Hydroplant at Chisang Khola in 1942 though this Plant was destroyed by landslide in the 1960s. The development of hydropower was institutionalized after the initiation of the development planning process. The First Five-year Plan (1956-61) targeted to add 20 MW of hydropower. However, the target was unmet. During the Second Three-year Plan (1962-65), some progress was achieved. Till 1962, the Electricity Department of HMG was responsible for the generation, transmission and distribution of electricity. In 1962, Nepal Electricity Corporation (NEC) was established and was given the responsibility of transmission and distribution of the electricity. The Electricity Department was responsible for the task of electricity generation. After a long gap since the establishment of the Chisang Hydroplant, the hydropower generation capacity of the country expanded with the construction of the Panauti Hydroplant

(2400 KW) in 1965 and the Trishuli Hydro plant (21000 KW) in 1967. A series of hydropower projects then followed. The Eastern Electricity Corporation was established in 1974. In 1977, Small Hydropower Development Board was established. (Adhikari Deepak, 2006, 71)

Institutional restructuring took place again in 1985, when the merging of the Electricity Department, Nepal Electricity Corporation and all the development boards (except the Marshyangdi Hydropower Development Board) resulted in the creation of Nepal Electricity Authority (NEA). Since this arrangement, the NEA has been responsible for the generation, transmission and distribution of electricity. Other public sector institutions involved in the hydropower sector include Water and Energy Commission and its Secretariat constituted in 1976, the policymaking body established in 1981, and the Department of Electricity Development. Of late, the private sector is also emerging as an important player in the hydropower development. Independent Power Producers (IPPs) have been the ongoing institutional innovations in the power sector of Nepal, with the IPPs signing power purchase agreements (PPA) with the NEA to sell electricity. At present, the total hydropower generation has reached 556.8 MW or just 0.7 % of the potential. Of the total energy consumption in Nepal, traditional energy like fuel-wood, agriculture residues and animal dung comprises 88 percent and commercial energy like petroleum, hydropower and solar energy constitutes 12%. Hydropower accounts for 75 % of the commercial energy supply in Nepal. The hydropower plants have mainly catered to the electricity needs in the urban and semi-urban areas. The highest growth of hydropower took place during 2001-2005 wherein 195.3 MW (35.1 % of the total) was produced followed by the decades of 1981-90 and 1991-2000 decades which saw the production of 180.3 MW (32.4 percent of the total) and 125.9 MW (22.6 % of the total) respectively. The period since 1981 produced 501.5 MW (90.1 % of the total), implying that only 55.3 MW (9.9 % of the total) was produced during the entire period of 1911-1980. (Adhikari Deepak, 2006, 71)

4.2 Nepal Electricity Authority (NEA)

Nepal Electricity Authority (NEA) was created on August 16, 1985 (Bhadra 1, 2042) under the Nepal Electricity Authority Act. 1984, through the merger of the Department of Electricity of Ministry of Water Resources, Nepal Electricity Corporation and related Development Boards. To remedy the inherent weakness associated with these fragmented electricity organizations with overlapping and duplication of works, merger of this individual organization became necessary to achieve efficiency and reliable service. (NEA, 1)

4.2.1 Objectives

The primary objective of NEA is to generate, transmit and distribute adequate, reliable and affordable power by planning, constructing, operating and maintaining all generation, transmission and distribution facilities in Nepal's power system both interconnected and isolated. (NEA, 1)

4.2.2 Responsibilities

In addition to achieving above primary objective, NEA's major responsibilities are:

1. To recommend to Government of Nepal, long and short- term plans and policies in the power sector.
2. To recommend, determine and realize tariff structure for electricity consumption with prior approval of Government of Nepal.
3. To arrange for training and study so as to produce skilled manpower in generation, transmission, distribution and other sectors.

4.2.3 Board of Directors

Management of NEA is entrusted to a Board of Directors which is constituted as follows

1. Secretary, Ministry of Energy Government of Nepal: Chairman
2. Secretary, Minister of Finance Government of Nepal: Member
3. One prominent person from commerce, industry or financial sector: Member
4. One prominent person from consumers group :Member
5. Two prominent persons with experience in power sector from outside government : Member
6. Managing Director NEA: Member Secretary

The Managing Director acts as member secretary as well as chief executive officer. (NEA, 1)

All the current and relevant happenings and information about the hydropower sector of Nepal can be obtained from Nepal Electricity Authority web page. The web page address is www.nea.org.np

4.3 Present energy Scenario in Nepal

Nepal's economic and social development is being hampered by its inadequate energy supply. The country does not have its own reserves of gas, coal or oil. Although it's most significant energy resource is water, less than 1% of the potential 83,000 MW of hydropower is currently harnessed. Firewood is the predominant energy carrier, constituting more than 70% of consumption. However, its use is inefficient, and poses a threat to the country's forests. At the same time, the indoor pollution caused by open hearths in homes presents a hazard to health. Electricity is generally only available in urban areas. Biomass is the major source of energy, particularly in rural Nepal. Biomass fuels consist of both woody and non-woody biomass. The former come from trees and shrubs, the latter from crop

residues and other vegetation. Fuel wood from forest and tree resources, charcoal mainly from woody biomass, residues from different agricultural crops and animal dung are the major biomass-based energy resources. Coal, petroleum products and electricity are the commercial sources of energy that are utilized in Nepal. However, the country spends a huge amount of its foreign exchange reserves for the importation of fossil fuel. In addition, transportation problems arising from the geographical structure of the country tend to bar people living in remote areas from using petroleum products. The Nepal Electricity Authority (NEA), the government-linked monopoly electricity supplier, serves only 15% of the country's total population. For this small fraction of customers, reliable electricity access is less than 8 h per day, with rotational blackouts accounting for the remaining 16 h. (Energy Situation in Nepal. Article.1)

In December 2008 the Nepal Government declared a "national energy crisis" and one year later the World Bank argued that "Nepal is experiencing an energy crisis of unprecedented severity, caused by years of under-investment and sharp growth in electricity demand". Nepal ranks among the lowest in the world in terms of net electricity generated per capita and energy intensity; and two-thirds of households live at least a 5-18 days walk from the nearest village connected to the electricity grid. The annual electricity generation on the grid system in 2009-2010 was about 3,690 GWh, of which about 57% was generated by power plants owned by the Nepal Electricity Authority (NEA), 26% by IPPs, and the remaining 17% was imported from the Indian grid. Hydropower utilization is currently less than one per cent of the proven potential. The total installed hydroelectric generation capacity is 586 MW (NEA 2002). This power has been made available to 878100 consumers through 1962 km of transmission and distribution lines. The national grid represents the overall hydroelectric industry of Nepal as it accounts for almost 98 per cent of the capacity and 99 per cent of the energy supplied. Apart from national grid, both the public and private sectors and independent power producers manage isolated supply systems. At present there are 35 small/mini hydroelectric plants in operation in remote areas of the country. (Energy Situation in Nepal. Article.1)

4.3.1 Nepal energy use per capita

For that indicator, The World Bank provides data for Nepal from 1971 to 2011. The average value for Nepal during that period was 331.44 kg of oil equivalent with a minimum of 309.81 kg of oil equivalent in 1971 and a maximum of 382.64 kg of oil equivalent in 2011.

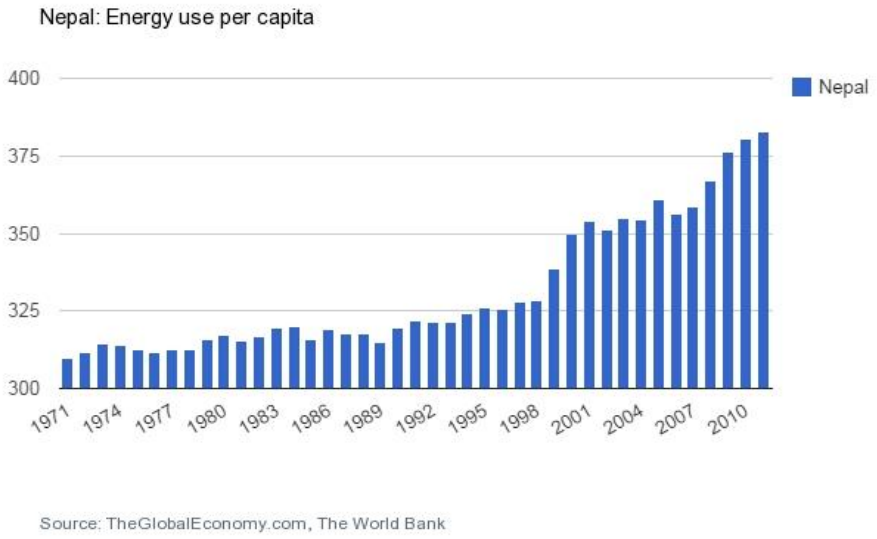


Figure 3. Nepal Energy use per Capita. Source: The GlobalEconomy.com. The World Bank

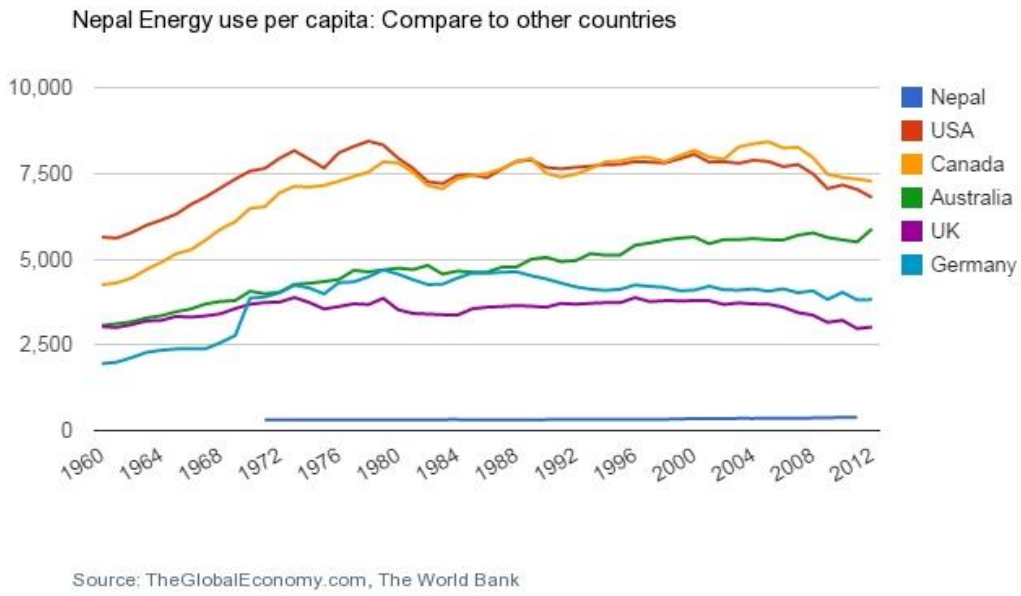


Figure 4. Nepal Energy use per Capita: Compare to other countries: Source TheGlobalEconomy.com. The World Bank

*__Word Bank Definition:__ Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircrafts engaged in international transportation.

A generalized view of different types of energy consumed in Nepal by different sectors and in different geographical regions of Nepal can be shown by following charts. The following charts are taken from the year 2003/2004 which almost represent existing trend till now in Nepal.

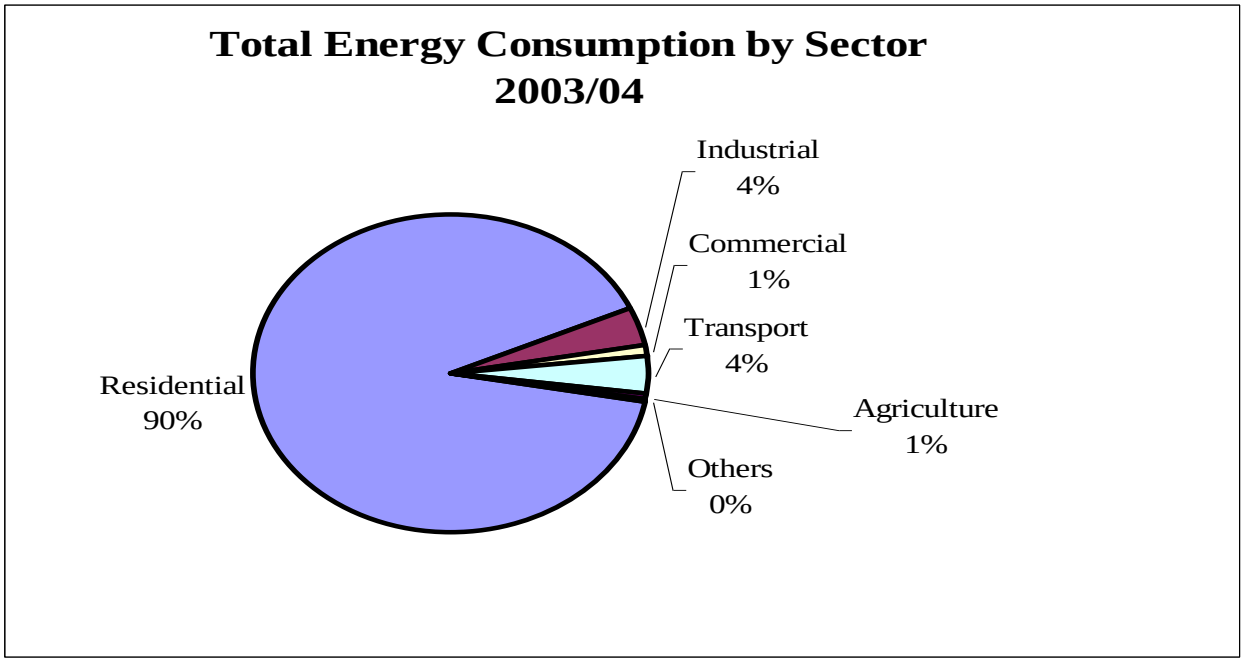


Figure 5. Total Energy Consumption by Sector 2003/4. Source: Nepal Energy Department

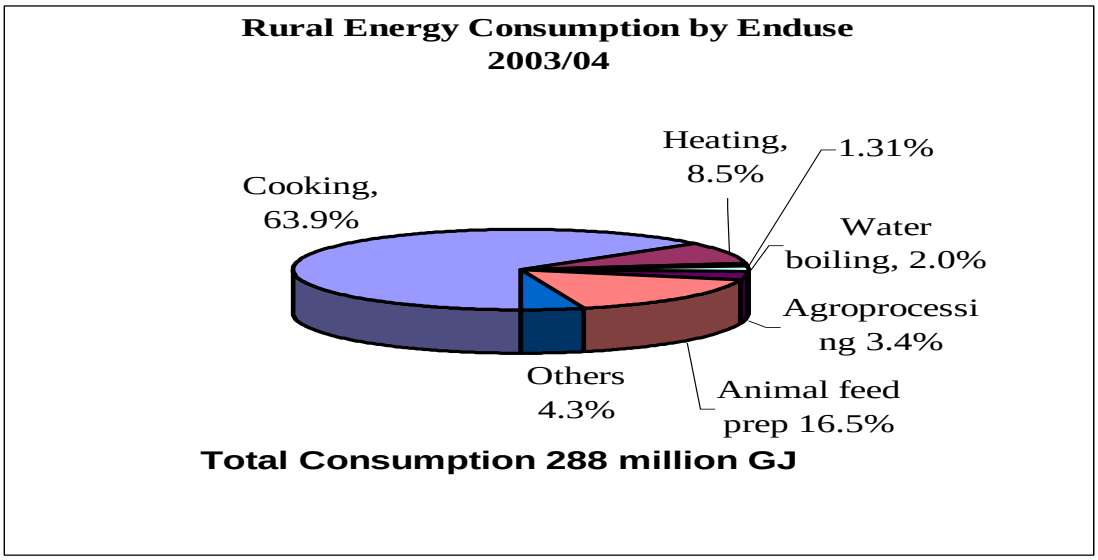


Figure 6. Rural Energy Consumption by Endues. Source: Nepal Energy Department

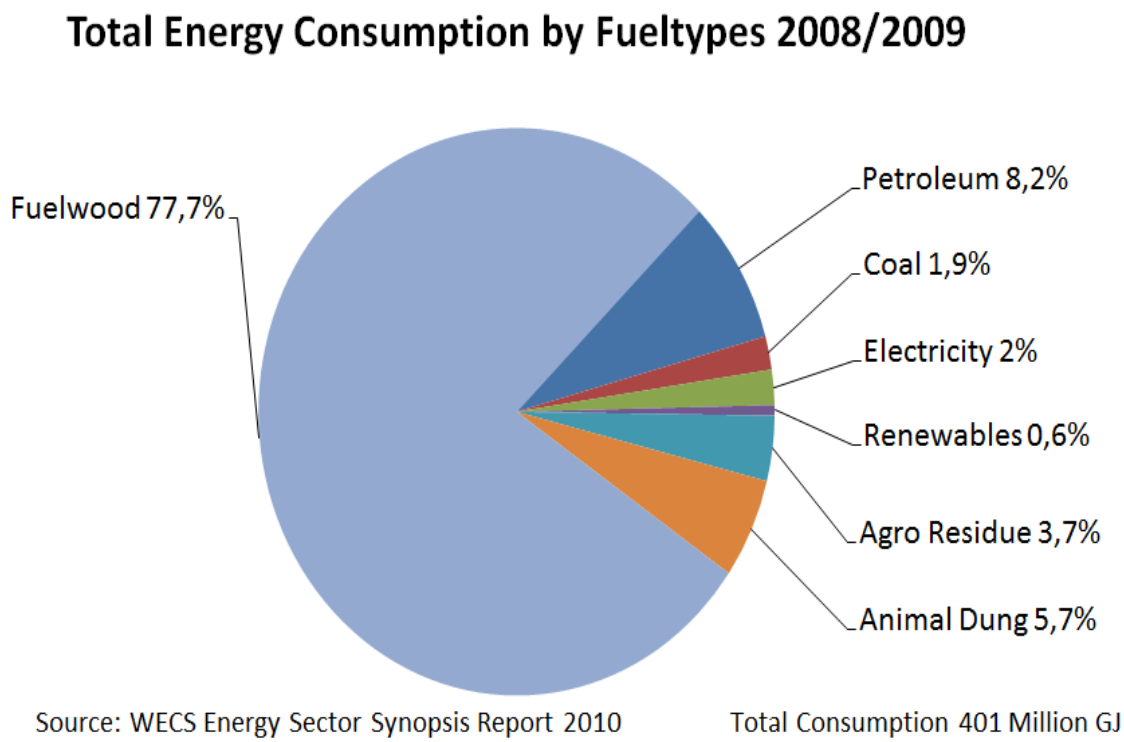


Figure 7. Total Energy Consumption by Fuel types 2008/2009.

4.3.2 Hydro Energy Scenario of Nepal

The current scenario of energy in Nepal is pathetic as the demand- supply gap is extremely wide due to multiple reasons which hindered the development and execution of power projects. The major hurdles came due to paralyzed policies, government's poor vision of energy economics and the decade long Maoist insurgency. The current demand stands at 1178.30 MW peak hour demand but the installed capacity is only 1100 MW as of fiscal year 2012-13. According to the NEA the demand for electricity is increasing at the rate of 10% with the need of additional 100 MW in the national grid each year. The energy deficit is the main cause of power cuts (termed popularly "LOAD SHEDDING" among the mass). Power cuts in wet season are an average of 3-4 hours daily and during dry season; it shoots to 12-16 hours daily. Consumers and industries are severely

affected. Even service oriented industries have to cut their office hours to maintain uniformity with the market. Manufacturing units are compelled to go for diesel/fossil fuel plants to operate industries pushing the operational costs of finished products by a whopping 25% to 40%. Majority of industries have been shut down and instead started trading of basic and FMCG products. It has made the entire national economy import oriented. (Mandel Avdesh.2013)

NEA (Nepal Electricity Authority) is a Government of Nepal undertaking responsible for the distribution of electricity and controlling all other derivatives of electricity to the consumers (both commercial and industrial). NEA and Nepal Government operate both Hydro and Thermal power projects. NEA trades and distributes the electricity in Nepal through its grids. There are many private sectors players in the Hydro power. These are called Independent Power Producers (IPP). (Mandel Avdesh.2013)

IPP are private sector operating energy projects (both Hydro and Thermal). Private projects go through the same stages clearances as Government projects. Private projects ink PPA (Power Purchase Agreement) with NEA to sell their energy. If private projects want to sell their energy to a third country then it can sign agreement with the respective country. All the private projects must sell their energy to the NEA only as NEA is the only organization in Nepal to trade and distribute electricity. But if a private company wants to develop a project for own industrial purpose then they can develop and have to pay royalty and hand over the energy project after 25 years of operation to the Government of Nepal. Water is a national resource so it is necessary to pay royalty to the Government. A private project can be hold up to 25 years by the company and then hand over to the Nepal government. The current PPA rate for Wet Energy is NRP 6 ($ 0.06) per KWh $ for Dry Energy NRP 4.80 ($ 0.048) per KWh. Due to supply gap, a big share of electricity is imported from India especially during the dry season. (Mandel Avdesh.2013)

Here are some data and figures which shows current Hydro Energy Scenario of Nepal:

Table 6. Peak Hour Demand and Available Energy (2005-2010)

Year	Peak Demand (MW)	Change in Peak Demand	Available Energy (GWh)	Change in Available Energy
2005	557.53		2642.75	
2006	603.28	+8.21%	2780.92	+5.23%
2007	648.39	+7.48%	3051.82	+9.74%
2008	721.73	+11.31%	3185.95	+4.40%
2009	812.50	+12.5%	3130.79	-1.73%
2010	885.28	+8.96%	3711.77	18.56%

* If 10% CARG pre –assumption consumption of energy is considered, the peak demand for the year FY 2012-13 is 1178.30 MW Source: Nepal electricity Authority

Table 7. Hydro Energy Available for past 6 years (2005-2009)

Year	NEA Hydro (GWh)	Change in NEA Hydro
2005	1522.90	
2006	1568.55	3.00%
2007	1747.42	11.40%
2008	1793.14	2.62%
2009	1839.53	2.59%

Source: Nepal electricity Authority

Table 8. Energy Purchase by NEA from IPP and India (2005-2010)

Year	IPP (GWh)	Change in IPP	Indian Import (GWh)	Change in Indian Import
2005	864.795		241.389	
2006	930.04	+ 7.54%	266.23	+10.29%
2007	962.26	+3.46%	328.83	+23.51%
2008	958.42	-0.40%	425.22	+29.31%
2009	925.74	-3.53%	356.46	-16.17%
2010	951.43	+2.78%	638.68	+79.17%

Source: Nepal Electricity Authority

4.3.3 Energy Purchased by NEA from IPP and India

The growth in IPP from 2005 to 2010 is only 2 % Compound Annual Growth Rate (CARG). There are several hundreds of private projects in pipeline but due to lack of investment and proper planning, promoters have not been able to deliver projects and hence there is huge deficit of power in Nepal. Whereas, imports from India have increased significantly to 21.50% CARG and huge forex is invested just to pay the electricity tariff. (NEA)

* Considering tariff at (Indian currency) IRP 4 ($ 0.067) per kWh then just IRP 2555.72 million ($ 42.58 million) have been emptied from the forex in 2010 to pay the electricity bills to India. Nepal's forex reserves is Indian currency as 72 % of trade is with India. (NEA)

4.3.4 List of Hydro projects in Nepal:

Table 9. Operational major Hydropower project

S.N	Hydro project Installed	Capacity (kW)	S.N	Hydro project Installed	Capacity (kW)
1.	Kali Gandaki "A"	144000	7.	Gandaki	15000
2.	Middle Marsyandi	70000	8.	Modi khola	14800
3.	Marsyandi	69000	9.	Devighat	14100
4.	Kulekhani No. 1	60000	10.	Sunkosi	10050
5.	Kulekhani No.2	32000	11.	Puwa Khola	6200
6.	Trisuli	24000			
				Total	**459150**

Source: Nepal Electricity Authority

Table 10. Grid Connected Small Hydro projects

S.N Hydro project	Installed Capacity (kW)	S.N Hydro project	Installed Capacity (kW)
1. Chatara	3,200	9. Khandbari**	250
2. Panauti	2,400	10. Phidim	240
3. Tatopani (Myagdi)	2,000	11. Jomsom**	240
4. Seti (Pokhara)	1,500	12. Baglung	200
5. Phewa (Pokhara)	1,000	13. Surnaiyagad (Baitadi)	200
6. Tinau (Butwal)	1,024	14. Doti	200
7. Sundarijal	640	15. Ramechhap	150
8. Pharping***	500	16. Terhathum**	100
		Total	**13844**

Source: Nepal Electricity Authority

Table 11. Isolated Hydropower projects

S.N Hydro project	Installed Capacity (kW)	S.N Hydro project	Installed Capacity (kW)
1. Heldung (Humla)	500	13. Chaurjhari (Rukum)**	150
2. Kalikot	500	14. Aarughat (Gorkha)	150
3. Accham	400	15. Taplejung**	125
4. Jhupra (Surkhet)***	345	16. Okhaldhunga**	125
5. Darchula 1 and 2**	300	17. Rupalgad (Dadeldhura)	100
6. Bhojpur**	250	18. Syangya***	80
7. Dhankuta***	240	19. Manang	80
8. Jumla**	200	20. Gorkhe (Ilam)***	64
9. Syarpudaha (Rukum)**	200	21. Helambu	50
10. Bajura	200	22. Chame	45
11. Bajhang**	200	23. Dhading	32
12. Dolpa	200		
		Total	**4536**

Source: Nepal Electricity Authority

Table 12. Private Sector Hydro Projects

A. Independent Power Producers (IPPs) connected to INPs

S.N	Hydro projects	Installed Capacity (kW)	S.N	Hydro projects	Installed Capacity (kW)
1.	Khimtikhola (HPL)	60,000	13.	Chaku Khola (APCo)	1,500
2.	Bhotekoshi (BKPC)	36,000	14.	Patikhola (KHP)	966
3.	Chilime (CPC)	22,000	15.	Pheme Khola (KHP)	995
4.	Jhimruk (BPC)	12,000	16.	Upper Hadi Khola	991
5.	Indrawati 3 (NHPC)	7,500	17.	Baramchi (UH)	980
6.	Andhikhola (BPC)	5,100	18.	Seti- 2	979
7.	Khudikhola (khudi HP)	3,450	19.	Sisne Khola (GBHP)	750
8.	Mardi Khola	3,100	20.	Rairang (RHPD)	500
9.	Piluwa Khola (AVHP)	3,000	21.	Salinadi (KSHPS)	232
10.	Sunkoshi Small (SHP)	2,500	22.	Sange Khole (SHP)	183
11.	Ridi Khola	2,400			
12.	Thoppal Khola (THP)	1,650			
				Total	**166806**

Source: Nepal Electricity Authority

Table 13. Major Hydro Power Projects under Construction

S.N	Hydro Projects	Installed Capacity (kW)
1	Upper Tamakoshi	456,000
2	Chamelia	30,000
3	Kulekhani- 3	14,000
4	Gamgadhi	400
Total		**500,400**

Source: Nepal Electricity Authority

Table 14. Independent Power Producers (IPPs)

S.N	Hydro Projects	Installed Capacity (kW)
1	Lower Modi-1	9,900
2	Sipring Khola	9,658
3	Ankhu Khola-1	8,400
4	Siuri Khola (NGPL)	4,950
5	Lower Indrawati (SHP)	4,500
6	Mai Khola	4,455
7	Hewa Khola	4,455
8	Lower Piluwa	990
Total		**47,308**

Source: Nepal Electricity Authority

Table 15. Hydro Power Projects with PPA Concluded

Private Sector Hydro Projects

S.N	Hydro projects	Installed Capacity (kW)	S.N	Hydro projects	Installed Capacity (kW)
1.	Upper Madi	19,008	16	Jumdi Khola	1,750
2.	Lower Balephi	18,514	17	Theule Khola	1,500
3.	Mai Khola	15,600	18	Jhyadi Khola	998
4.	Namarjun Madi	11,880	19	Dorkhu khola	990
5.	Madkyu Khola	9,968	20	Seti Khola	465
6.	Lower Sunkoshi-III	9,900	**PPA Concluded for Capacity Upgradation**		
7.	Nau Gad Khola	8,500	1.	Baramchi Khola	3,178
8.	Upper Mailun A	5,000	2	Hewa Khola	2,055
9.	Tadi khola	5,000	3.	Chaku Khola	1,500
10.	Radhi Khola	4,400	4.	Jiri Khola	1,210
11.	Charanawati Khola	3,520	5.	Bhairab Kunda	1,150
12.	Middle Gaddigad	2,970	6.	Belkhu Khola	198
13.	Upper Hugdi Khola	2,599	7.	Narayani Shankar Biomass	100
14.	Pikhuwa Khola	2,475			
15.	Middle Chaku	1,800		**Total**	**136,228**

Source: Nepal Electricity Authority'

Table 16. Hydropower Projects under Termination Process

Under Termination Proccess					
S.N	**Hydro projects**	**Installed Capacity (kW)**	**S.N**	**Hydro projects**	**Installed Capacity (kW)**
1.	Upper Modi Khola	14,000	3.	Daram Khola	5,000
2.	Langtang Khola	10,000	4.	Lower Nyadi	4,500
Total					**33,500**

Source: Nepal Electricity Authority

Table 17. Hydro Power Projects Planned and Proposed

Major Hydro Project

S.N	Hydro Projects	(kW)	S.N	Hydro projects	(kW)
1.	Budhi Gandaki	600,000	6.	Upper Modi ”A”	42,000
2.	Nalsyagu Gad (Storage)	400,400	7.	Upper Trisuli 3 ”B”	37,000
3.	Upper Seti (Storage)	128,000	8.	Rahughat Khola	27,000
4.	Seti Trishuli (Storage)	128,000			
5.	Upper Trisuli 3 ”A”	60,000		**Total**	**1,422,000**

Source: Nepal Electricity Authority

4.3.5 Transmission Lines

In Nepal Transmission and System Operation Business Group is entrusted with the key responsibilities of generation and transmission system planning, system operation, operation and maintenance of national grid and trading of power. It is headed by a General Manager. The System Planning Department carries out load forecasting, generation expansion planning and transmission system planning of the power system of Nepal while System Operation Department performs the operation planning and real time system operation. Similarly, Grid Operation Department carries out overall operation and maintenance of national gird and Power Trade Department executes the trading of power with Independent Power Producers and also carries out the business activities of power exchange and trading of power with India. (Nepal Electricity Authority)

To use the generated electricity, the national wise grid system is helpful because it carries the power from one corner of the country to the other corner of the country that needs it. The capacity of transmission lines vary according to the purpose of the lines. The 132 kV national and the regional transmission lines are the major transmission lines, along with the 220 V normal household distribution lines. Some of them are single circuited whereas some are double circuited. One of the most important and the most ambitious trans-country transmission grid between Nepal and India is the double circuited inter country transmission grid which is currently being developed and, according to the news on BBC Nepali Service of 2011 December 5, is planned to be completed in 2013 with a transmission capacity of 3000 MW. The grid is connected to both the energy thirst countries, and, hence, the agreed supply cannot be assured to meet their demand and deficiency. In addition to the national and inter-country transmission grid, there is the transmission grid of 66kV for the electricity distribution in a certain region. Under the government’s millennium goal and poverty reduction plan, government is continually elaborating the projects of rural electrifications as 132kV transmission lines. (Adhikari Dwarikar.2011, 9)

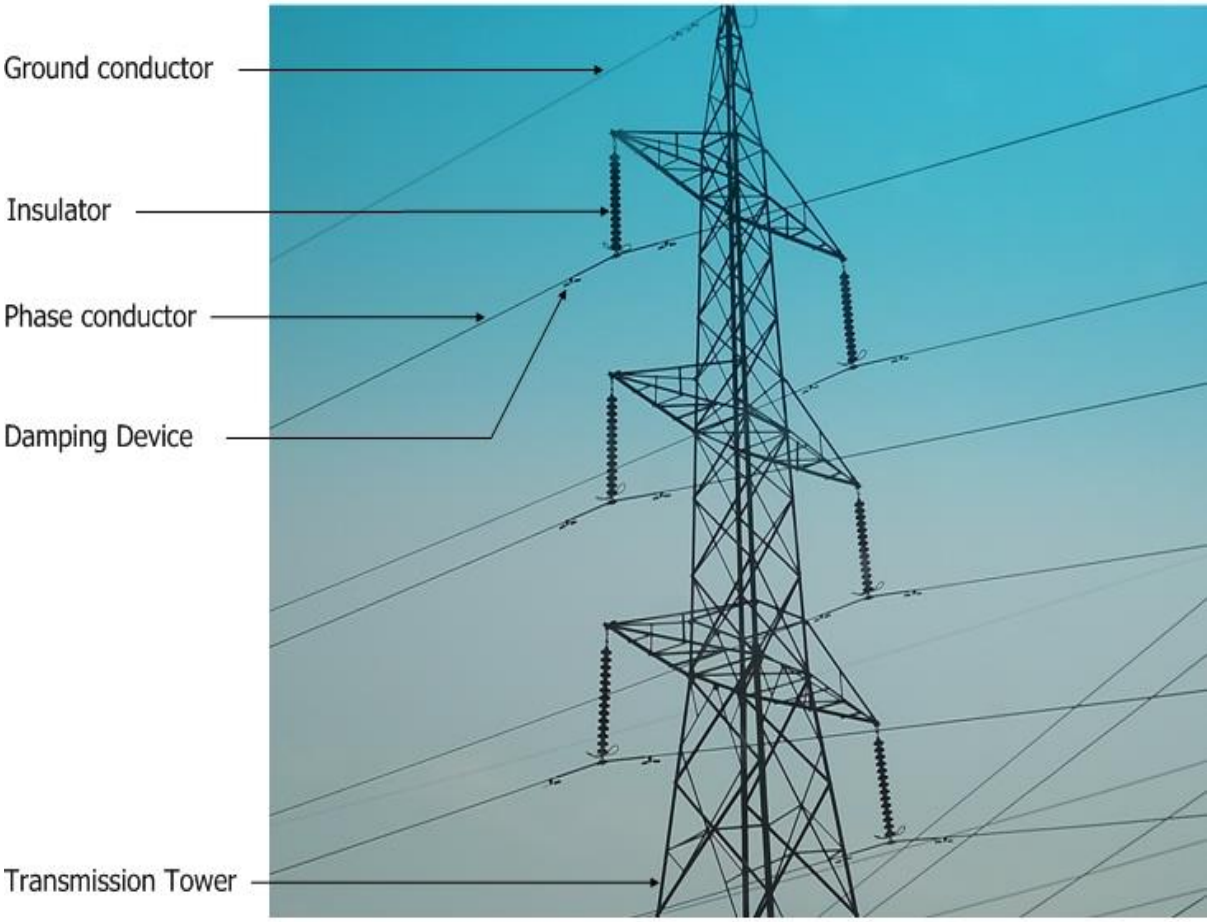


Fig - A : Transmission line with tower and other accessories

Figure 8. Transmission line with tower and other accessories. Source: Nepal Electricity Authority

Major Lines – Existing-

Table 18. 132 kV Transmission Lines

S.N	Transmission Lines	Length (KM.)	Type of CKts.	S. N	Transmission Lines	Length (KM.)	Type of CKts.
1.	Anarmani-Duhabi	85.0	Single	2.	Hetauda-Gandak P/S	154.0	Single
3.	Kusha-Katiya (India)	19.0	Single	4	Bharatpur – Pokhara	97.0	Single
5.	Duhabi- Hetauda	282.0	Double	6.	Bardaghat-Butwal	43.0	Double
7.	Hetauda – KL2 P/S	8.0	Single	8.	Butwal – KGA P/S	58.0	Double
9.	Bharatpur-Marsyangdi P/S	25.0	Single	10	KGA P/S –Le khnath	48.0	Single
11.	Marsyangdi P/S –Suichatar	84.0	Single	12	Pokhara-Modikhola P/S	37.0	Single
13.	Suichatar -KL2 P/S	34.0	Single	14	Butwal- Tanakpur P/S	407.0	Single
15.	Suichatar – New Bhaktapur	26.9	Single	16	Pathalaiya – New Parwanipur	17.0	Double
17.	New Bhaktapur – Lamosangu	48.0	Double	18	Marsyangdi-M. Marsyangdi	44.0	Single
19.	Lamosangu – Khimti P/S	46.0	Single				
					Total	**1562.9**	

Source: Nepal Electricity Authority

Table 19. 66 kV Transmission Lines

1.	Chilime P/S –Devighat P/S	43.56	Single	2.	Suichatar – New Patan	4.0	Double
3.	Trisuli P/S – Balaju	29.0	Double	4.	Teku – K3 (Underground)	3.5	Single core
5.	Debighat P/S – Balaju	30.0	Single	6.	Suichatar – K3	6.9	Single
7.	Debighat P/S – New Chabel	33.0	Single	8.	New Patan – New Baneshwor	2.8	Single
9.	Balaju-Laincahur	2.3	Single	10	Bhaktapur – New Chabel	12.0	Single
11	Balaju – KL1 P/S	36.0	Double	12	New Baneshwor – Sunkoshi P/S	61.0	Single
13	KL 1 P/S Birgunj	72.0	Double	14	Debighat Trisuli	4.56	Single
15	Suichatar – Teku	4.1	Single	16	ndrawati-Panchkhal	10.0	Single
					Total	**354.72**	

Source: Nepal electricity Authority

Table 20. Under Construction transmission lines

I. 220 kV Transmission lines			**ii. 132 kV Transmission lines**		
1. Khimti-Dhalkebar	75	Single	1. Thankot-Chapagaon	28.5	Double
2. Hetauda-Bharatpur	72	Double	2. Chameliya-Attariya	129	Single

Source: Nepal Electricity Authority

Table 21. NEA Joint Venture under Public Private Partnership Program

400 kV Transmission Lines	**Length (KM.)**	**Type of CKts.**
1. kV Dhalkebar-Muzzaffarpur Cross Border Line	45.00	Double

Source: Nepal Electricity Authority

Table 22. Planned and Proposed Transmission line

S.N	**Transmission Lines**	**Length (KM.)**	**Type of CKts.**	**S. N**	**Transmission Lines**	**Length (KM.)**	**Type of CKts.**
1.	220 kV New Marsyangdi-Matatirtha	85	Double	8.	132 kV Hetauda-Kulekhani-IISiuchatar second circuit	44	D/C Tower
2.	132 kV Sangati-Lamosangu	40	Double	9.	220 kV New HetaudaDhalkebar-Duhabi	283	Double
3.	132 kV Kabeli-Damak	90	Double	10.	220 kV New Hetauda-Matatirtha	45	Double
4.	132 kV Middle Marshyangdi - Dumre-Marshyandi	44	Double	11.	220 kV Bardaghat-New Butwal	30	Double
5.	132 kV Dumree-Damauli	18	Single	12.	220 kV Trishuli-Thankot	54	Double
6.	132 kV Butwal-Kohalpur Second circuit	208	D/C Tower	13.	132 kV Kohalpur-Attariya second circuit	200	D/C Tower
7.	220 kV Bharatpur-Bardghat	73	Double		**Total**	**1214**	

Source: Nepal Electricity Authority.

Table 23: Transmission Lines NEA Joint Venture under Public Private Partnership Program

1.	400 kV Duhabi-Purnia Cross Border Line*	22 Double	3.	66 kV Sanjen-Chilime	12 Double
2.	400 kV New Butwal- Gorakhpur Cross Border Line*	25 Double		**Total**	**59**

Source: Nepal Electricity Authority

Table 24. Transmission Line Sub-Station

Existing			**Planned & Proposed**		
S.N	**Capacity**	**Unit MVA**	**S.N**	**Capacity**	**Unit MVA**
1.	132/11 kV	186.00	1.	132/33 kV Syangja	15.00
2.	132/66 kV	248.40	2.	132/33 kV Anbukhaireni	15.00
3	66/11 kV	485.20	3.	132/33 kV Damak	30.00
4.	132/33 kV	470.50	4.	132/11kV Chapali	30.00
5.	66/33 kV	25.00	5.	132/33 kV Kusum	30.00
	Total	**1415.10**	6.	132/33 kV Matatirtha	32.00
			7.	132 kV Hapure	30.00
	Under Construction		8.	132 KV Hetauda	30.00
1.	132/11 kV Matatirtha	22.50	9.	(Kamane) 132 KV Pathlaiya	22.50
				Total	**234.5**
				Planned & Proposed	
			1.	New Butwal Switching Station	
			2.	New Bharatpur Switching Station	
			3.	Pathlaiya Switching Station	

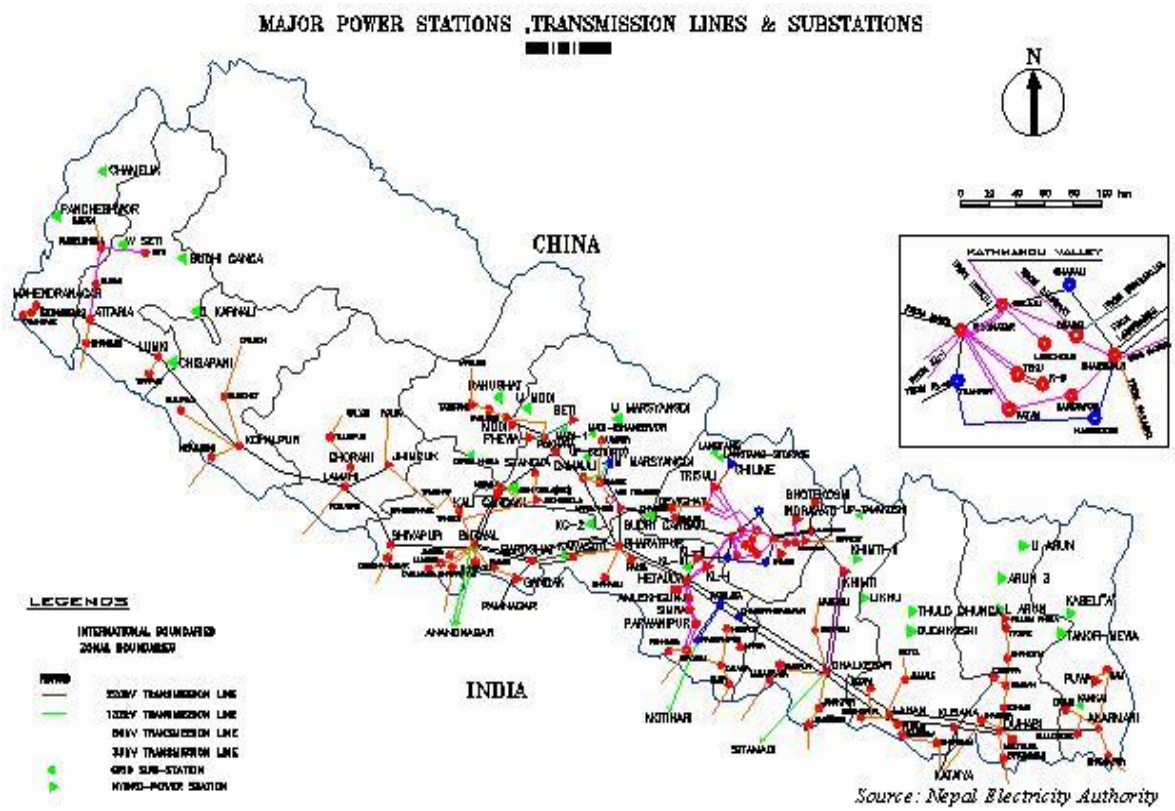
Source: Nepal Electricity Authority.

Table 25. Overall Scenario of Power Projects in Nepal

Sectors	**Capacity (kW)**
Total Major Hydro Grid Connected	472994
Total Small Hydro Isolated	4536
Total Hydro NEA	477530
Total hydro IPP	158315
Total Hydro -Nepal	635845
Total thermal (NEA)	53410
Total Solar (NEA)	100
Total Installed Capacity (including Private and Others)	**689355**

Note: * Line length within Nepal portion. ** Leased to the Private Sector. *** Not in Normal Operation. Source: Nepal Electricity Authority.
Source: Nepal Electricity Authority

Picture which shows major power stations, transmission lines and substations across Nepal



Nepal.

Figure 9. Major power stations, Transmission lines and Sub stations of Nepal Source: Nepal Electricity Authority.

4.4 Marketing and Promotion

Marketing and promotion is important for hydropower industry of Nepal. Nepal is rich in natural resources the most potent sector of all the resource is clean water and the concomitant electricity generated from its adequate water resources. As most of the water flows through the densely populated southern region, the importance of hydroelectricity and clean water will be immense in the future. In the past 100 year's hydropower production history of Nepal, only 634 MW of energy has been produced. But this figure cannot be referenced to determine the future because with Indian market opening in 2003 and Nepal opening in 1990, interest in hydropower has grown tremendously over the years. The total hydropower potential of Nepal stands at around 83000 MW. From more than 6000 rivers and rivulets of Nepal, around one million GW hour of electricity can be generated. This potential is adequate enough to meet the total domestic and part of regional energy demands for many years. More importantly, there exists a robust potential of consuming this generated electricity for the next 3 decade. (Er. Gyanendra lal Pradhan, 1)

Hydropower is not only about energy production for productive sectors but also a powerful means of brining in socio-economic transformation and development of villages, hydropower leads to development activities in villages mostly as hydropower plants need to be constructed in the villages. The poor- the target group can benefit from this because the socio-economic benefits from a hydropower project to the rural populace are extensive. Hydropower is a big resource and ace sector for Nepal because of its adequate water potential. In the coming 10-30 years, the demand for clean water will increase considerably along with the tremendous increase in power demand both at the domestic front and regional market.

Target Market: Hydropower industry of Nepal has good business scope. It has a huge market potential with in country and around regional market. All the countries around Nepal are having energy crises and the energy demand is increasing day by day. India and China can be its important market. The land lock geography of

Nepal also helps the export of electricity to other nations. Nepal Government should make better strategic plan to use its existing potential to the best. Local and international entrepreneurs should be motivated and taken into confidence. Small scale hydropower should be encouraged. Local people participation is essential. Promoting hydropower is important. There should be bilateral and multilateral talks in a high government level among the nations. Governments of different countries should work with a clear vision and trust for mutual benefits.

4.5 International Interest

Among the International community, Nepal is of regional strategic interest due to its squeezed geographical position between two emerging superpowers: China and India. Today Nepal is the midst of a new found drive to harness its water resources to meet the exploding energy demands of its powerful neighbors. The Nepal government is looking for investors and financiers for several large dam projects above 300 MW, including Arun III, Upper Karnali, Budhi Gandaki and the 750 MW West Seti project. The projects, if built will generate electricity for export to India and China. The world`s largest funders are supportive to this trend. For example The World Bank approved financed the most recent was a $ 46 million commitment to Kabeli Energy Limited to build a $ 108 million hydroelectricity power station in Nepal. The Asian Development Bank seems inclined to foot a large part of the more than US $ 1 billion price tag of the West Seti project.

Nepal Government has given emphasized on foreign investment and did various decisions. In the chairmanship of Prime Minister Investment Board has been formed. BIPPA agreement with India is already done. Indian and Chinese government counterparts and businessmen are showing deep interest on hydropower investment. All most all projects completed before 2008 were built in assistance with foreign countries, development agency and foreign bank loan and grants. In 2010, 782 different projects amount of total NRP 36.352 billion was approved for foreign investment. Out of these 782 projects 18 projects were energy based and total committed amount of investment is NRP. 8.429 billion. But, Nepal Government should make power sector more attractive and provided more

facilities to the foreign investors so that they will shift from service sector to energy sector.

Nepal has several evidence and experience of foreign investment in hydro project since the sector is second priority followed to manufacturing sector. Khimti Bhote Koshi and Indrawati hydro projects (103.5 MW) received USD $ 23.6 million foreign investment. Chameliya hydro project (30 MW) is supported by KOICA, Upper Trishuli (60 MW) project is financed by China Exim Bank as a loan of US $ 120 million, Rahughat (32 MW) project is financed by Exim bank of India amount of US $ 31 million as soft loan. 40 % of total cost of Kabeli (37. 6 MW) project is financed by Power Development Fund of the World Bank. Upper Seti (750 MW) Chinese government has shown keen interest to provide US $ 1.6 billion loan. Bilateral and Multilateral assistance to build hydropower project has been in practiced in Nepal during last 40 years and from last 16 years, foreign investors and domestic private investors also involved in hydropower project. But these projects were not more than 60 MW capacities. (Ghimire Rabindra, 2012, 4)

India and Nepal have several important power projects agreements. Recently in 2014 there has been an important agreement between India and Nepal that Indian infrastructure giant GMR construct a 900- megawatt hydropower project of Nepal´s Karnali River that is forecast to generate electricity from 2021 onwards. According to GMR, 12 percent of the power generated by the US $ 1.5 billion Karnali project will be given to Kathmandu free of cost, with the remainder exported to India and possibly Bangladesh. The deal will provide Nepal with a 27 percent share of the equity, with GMR agreeing to transfer complete ownership of the project to Kathmandu 25 years after the plant beings generating electricity. This agreement has opened doors for future plans to utilize Nepal´s resources for the benefit of its people. Indian´s new Prime Minister Narendra Modi has sought to deepen energy ties between the two neighbors, securing a commitment to fast- track the Karnali project during his visit to Kathmandu in August 2014. Although New Delhi has traditionally exerted huge influence in Nepal, Beijing has recently intensified its engagement with the Himalayan nation, pumping billions of dollars in to infrastructure projects ranging from roads to hydropower plants.

4.6 Hydropower and local Environment

Comparing the environment impacts of different size dams, the larger the project, the greater the negative impact on wildlife, communities and ecology. The vast majority of the negative impacts on hydropower projects are those inflicted upon environment. In the construction and development process, acquiring buildings materials and carrying out construction are associated with greenhouse gas emissions. Additionally, dam construction alters river flow and obstructs fish migration. Therefore, during the planning and proposal process, mitigation measures such as fish ladders and pumps to control sediment displacement must be considered.

Small and medium projects typically use less intrusive construction measures than large scale dams, such as low diversion wires. A thorough environmental assessment of the 60 MW Middle Marsyandi identified several major issues with this type of dam construction, including ; changes; soil erosion; sedimentation; land instability; loss of fish; diversity; loss of terrestrial vegetation; and increased in noise pollution during construction and operation. The Middle Marsyandi also resulted in negative impacts on the health and sanitation of the community from the increased exposure to an outside workforce. (Willams and Porter, 2006)

Additional health outcomes included the degradation of air quality, water quality and soil waste. Despite these negative health and environmental outcomes, there are positive health impacts inherent in replacing traditional fuels with hydroelectricity. Indoor air pollution in Nepal far exceeds optimal levels resulting in around 7,500 premature deaths annually. Greater access to hydroelectricity provided by constructing small and medium scale dams would combat the negative health and environmental outcomes associated with burning fuels for energy.

4.7 Sustainability Analysis of Nepalese Hydropower Projects

Sustainability simply means the ability of a project to maintain its projected operations, targeted services and benefits during its projected life time. Sustainability Analysis is defined as ‘‘the identification and analysis of degree of presence or absence of the factors that are likely to impact, either positively or negatively on the prospects of sustained delivery of project benefits’’. Social, environmental and economic aspects of new and existing hydropower projects are the three pillars of sustainability analysis. The union of any two aspects will create either bearable, equitable or viable situation, but the intersection of all the aspects will create a sustainable situation and ensure social, environmental harmony at its best and, if not, they will at least mitigate or compensate and on same run maximize the positive outcome.(Adhikari Dwarikar.2011,10)

Sustainability of Nepalese Hydropower projects in Nepal mainly concern with following factors those are likely to impact, either positively or negatively on the prospects of sustained delivery of projects benefits. These are: Government Stability; National and Regional Energy Policies; Policies inconsistencies; Planning Deficiencies; Licensing Anomalies; Strategic assessments; Attention to Climate concerns in Energy focused Projects; Evaluation of Alternative Energy options; Dam safety; Environment impact Assessment; Water quality; Sediment transport and erosion; Downstream hydrology and flooding; Rare and Endangered Flora and Fauna; Passage of fishes; Health issues; Environment management of existing hydro projects; Managing social aspects; Outcome for new development; Strategies to achieve proposed outcomes; Institutional frameworks; Identification of cost and benefits; Allocation of benefits.

4.8 Obstacles

Nepal faces many obstacles in commercializing its hydropower potential. This is because of the poor policy of the government as well as the 1950 bilateral treaty between India and Nepal. Without India's consent and cooperation, Nepal cannot develop its hydropower. India and Bangladesh are two major markets for hydropower. However, Nepal does not have direct access to their markets. Although development of 40,000 MWs of hydropower plants in Nepal is said to be feasible from an engineering/economic perspective, from a financing through Nepalese banks perspective, it is impossible. Loans from international banks are needed to finance hydropower projects in Nepal as local banks do not have capacity to support large projects. However, most international banks have not yet been interested as many Nepalese projects are not yet considered “bankable” from a project finance perspective. There are many challenges to financing hydropower projects as the financing requires the project itself to be free of risk from a legal and contractual viewpoint, thus making it worthy of being used as collateral on its own right. The only way forward is for the government to change its policies significantly to ensure the bankability of projects currently being developed by many independent power producers. A tumultuous political environment in Nepal presents an obstacle to developing hydroelectric projects.

The existing hydropower projects are expensive due to heavy reliance on bilateral and multilateral financing agencies, costly foreign consultants and contractors, limited manufacturing capability of power generation, transmission, and distribution-related equipment, inefficient management and high cost of preparatory works as well as unfavorable geological condition.

Social Acceptability: One obstacle to hydropower project implementation in the past has been community objection and dam-related protest. The rationale behind developing micro-hydro schemes with active community involvement is to facilitate project completion while increasing capacity and other development benefits. Proposals for large-scale hydropower projects have often evoked public protest in Nepal, particularly in communities where projects will be located. Therefore,

community perceptions of different hydroelectric options are important to consider when evaluating the feasibility of different policies. Proposals involving India-Nepal collaboration for dam building have been met with particularly strong protest. Besides this some of the major challenges are political risk, market interest risk, inflation risk, climate change risk, geological risk, high corruption rate, slow bureaucracy, unavailability of technology and technical manpower.

4.9 Opportunities and Solutions

Nepal is most attractive Hydropower investment destination. The lucrative investment opportunities lie in the small, beautiful and strategic country Nepal. With an estimate hydropower potential of 300,000 megawatts that translate into a US $ 600 billion potential market capitalization, (Acharya Sujit, 2013, 1). Nepal is the hidden gem that investors will find sooner or later. As the world progresses and as billions of people are anointed into the ranks of new consumers, the need for more energy is going to increase.

From an investor´s eye, this ever increasing demand means the existence of a significant long term business opportunity that yields lucrative returns. This is especially true in context of Asia, which now accounts for 52 percent of the entire World´s GDP and is about to become the hub of consumerism with its massive population. China and India are poised to lead this consumer drive with an estimated 1 billion people entering the middle class by the year 2022 (Acharya Sujit, 2013, 1) This colossal influx into the pool of consumers along with the current huge infrastructural expansion drive means that the explicit demand for energy in these two countries is about to skyrocket. In investor´s jargon, it is termed as a risk averse yet high yielding sector worthy to be explored and exploited.

Land locked in a short 200 kilometer width- span between both China as its northern neighbor and India as its Southern neighbor, its location is highly strategic but it is the excellent age-old relations it maintains so well with both these neighbors that puts into play the whole dynamic of investment in energy.

Big energy potential, big markets and proximity to them reveal the presence of a big investment opportunity. But to translate the opportunity into reality, other ingredients are also required to be added into the mixture. Some of these key ingredients include the fundamentals of a country e.g. its offer of political stability, safety and sector specific policies that make investments attractive.

Nepal has always been a country that has excelled in maintaining a wide range of international relations which is evident by the strong and growing presence of its various foreign missions. Many of the world's countries have also set up their dedicated diplomatic missions in Nepal signaling the importance these countries see in maintaining such bilateral ties. But the political climate of the country in the last decade was unstable due to an internal conflict waged by the Maoists of Nepal against the state. Around four years ago, this era of conflict was paused with the signing of a comprehensive peace agreement between the two parties. Nepal then entered into a transition phase where the key task of all the parties involved was to bring the peace process to a logical conclusion and draft a new constitution that would include all the voices in the country. Recently on April 15th, 2012 the task of bringing the peace process to a logical conclusion was finally achieved, thereby permanently concluding the paused conflict. And the other task of drafting a new constitution is also on the verge of conclusion. With such positive developments occurring in the political landscape, Nepal is now poised to become an emerging market with unprecedented growth potential.

It is the early investors entering the energy market that can avail the "first mover's advantage" -just as done by two Chinese companies i.e. the Chinese Three Gorges Company which is investing US$ 1.8 billion in a 750 MW hydropower project and Hydro china Corporation which is investing US $ 300 million in a 150 MW hydropower project and two Indian companies i.e. SJVNL and GMR each investing more than a billion US dollars in larger scale hydropower projects. There are several similar or larger deals investors can find due to the largely prevalent untapped potential.

Nepal policies: Over the years, various governments of Nepal have slowly but surely progressed the investment polices to make it more palatable to foreign

investors. They have specifically worked on the hydropower policies to make it an attractive destination for investors to place their bets in Asia when considering making hydropower investments. As a result, internal rate of returns of above 16% and return on equity above 45% can easily be achieved by many of the potential hydropower plants. The private sector continually advocates the government to make better policies and ensure transparency of rules and regulations in order to create a level playing ground for all stakeholders.

The hydropower sector of Nepal is very well structured with the Ministry of Energy serving as the key nodal agency. Under it, the autonomous Nepal Electricity Authority (NEA) looks after the entire country's generation tariffs, transmission and distribution systems, whereas the Department of Electricity Development (DOED) oversees the hydropower licensing regime. Prospective hydropower developers can themselves identify a hydropower site and apply for the survey license with the DOED. Power purchase agreements to sell the power generated from projects can be signed with the NEA. A developer of a hydropower project also needs to attain certain environmental and forest clearances and procure the required land prior to initiating project construction – and again there are properly documented set procedures in place at various ministries to systematically conclude these tasks. Besides this Nepal government is taking essential step to control corruption in a country. Media is also playing important part to stop corruption; corrupt people are exposed in a society. Through different media the importance of hydropower sector to Nepal is promoted among the general Nepalese people so now the people are positively concern in it with positive attitude. There is also progress in the academic and technical sector with the establishment of Institutions with provides sound knowledge and produce skill manpower.

4.10 Suggestions

For the implementation of plan and achieving the targets relating to the hydropower, development of cost effective small and medium-sized projects to meet domestic demand at affordable price, encouragement of private sectors investment in hydropower development and power distribution on competitive basis, acceleration of rural electrification attracting investment from community and private entrepreneurs, improvement in the integration of social and environment mechanism into power development process, encouragement of the power-based industries and transportation systems to create market for existing surplus energy and future energy growth are extremely important.

Besides, facilitating the flow of funds from domestic financial sector to the hydropower sector and the institutional set-up for the power export, promoting hydropower research and development (R&D) center to assist in preparation of national power system and improve NEA as a commercially viable entity remain the other challenges. Political stability is important in the country to attract foreign investors.

Corruption and commission should be minimized. Foreign counterpart should feel friendly environment while working in the country. Government should sign agreement and treaty with other nations for mutual benefit for the utilization of resources in a way that it should not affect the Sovereignty of Nepal. There should not be extreme politics in the sector of hydropower.

Red tape should be clearly understandable. Promotion of hydropower sector with in a country should be done to engage more people with moral and economical support. Country should produce technically sound manpower with in a country.

5. CONCLUSION

In a conclusion there is a brief description what information a reader can get and learn from this thesis. The reader can know information about reliability and validity that deals with the authenticity of thesis and evaluation of usefulness.

5.1 What can be learned?

This thesis is based on economic prospective of hydropower industry of Nepal. Thus reader can be able to know about the information related to economic prospective of hydropower industry in Nepal. There are also some materials which help reader to know about Nepal, its economy and business culture. This thesis provide clear idea about the size of hydropower industry in Nepal; its chronological development from past to present time; current energy scenario of Nepal; different financial model used to construct hydropower in Nepal; different source to raise investment in hydropower sector; proper utilization of prevailing resources for benefits of Nepal and its people; potential of Hydropower energy in Nepal and its sustainable and profitable market; profitable business opportunities for internal as well as external investors.

5.2 Reliability and validity

In the thesis substantial information, datasets, as well as the inclusion of tables and statistics are taken from various relevant sources by acknowledging them. There is no self-observational field study. It is not possible due to high technical expertise, time constraints and financial deficit. The analysis made in the thesis depends on previous case study. Some data and information are taken from Nepal electricity Authority which is authentic source. In some cases past information is considered for the general view point since there are no big changes. Some information is different in different places this is because of different people opinion. So there is always question mark for reliability and validity. It is impossible to include all significant information because the area of study is large.

5.3 Evaluation of Usefulness

This thesis is certainly useful in the respective field. It shares important information about hydropower industry of Nepal in economic prospective. Reader can acquire valuable and current information in the hydropower business sector of Nepal. The thesis can play as a motivational tool to attract investors in this sector. It also promotes the hydropower sector of Nepal.

5.4 Feasibility of suggestions

The suggestions if implemented effectively then to achieve satisfactory target is not impossible. The political parties of Nepal should make stable political scenario in Nepal to fascinate foreign investors in Nepal. The constitution of Nepal should be made sooner to gain the international trust. Clear and effective policies should be made to promote hydropower. In the recent years many old policies are replaced by new policies which implies positive mark. In a recent years control over corruption activities is in the fast track. Media is also playing pivotal role to control corruption. Situation is that culprits are scared of being expose.

5.5 Future research

There are many things to explore about the improvement of hydropower sector in Nepal. The area of research is vast. There is always change in the scenario of the subject in accordance with time. It is recommended to do future research in marketing of hydropower sector of Nepal. Research on the effect of hydropower in social and economic life of Nepalese people. Research to spot suitable place for the construction of hydropower with in the country. Research on cost effective policies to gain better revenue.

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