

**International Cooperation in Power Generation in Nepal: A Study of  
Nalsing Gad Hydropower Project**

**A Dissertation**

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## **LETTER OF RECOMMENDATION**

I certify that Sher Bahadur Shahi prepared this dissertation entitled “International Cooperation in Power Generation: A Study of Nalsing Gad Hydropower Project”, under my supervision. I hereby recommend this dissertation for final examination by the Research Committee Master’s in International Relations and Diplomacy, Tribhuvan University, in fulfillment of the requirements for the Degree of MASTER’S IN INTERNATIONAL RELATIONS AND DIPLOMACY.

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Date: March 22, 2020

## **DECLARATION**

I hereby declare that this dissertation is my own work and that it contains no materials previously published. I have not used its materials for the award of any kind and any other degree. Where other authors' sources of information have been used, they have been acknowledged.

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**Sher Bahadur Shahi**

Date: March 22, 2020

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## ABSTRACT

Nepal has abundant potential country in water resources. There are over 6,000 rivers in Nepal. It is saying that total hydropower generation capacity of Nepal is 83,000 MW and economically 4200 MW is feasible. Due to the lack of, economic investment, willing power of leaders and technical knowledge in hydropower sector the water resources have not still utilized in power generation. Without strong commitments of foreign direct investment, the sufficient hydropower has not still produced. Especially the reservoir types Mega projects are not progress in build.

There is no proper framework for the international cooperation in hydropower generating sector in Nepal. The South Asian Association of Regional Cooperation (SAARC) Energy Center (SEC) has been trying to cooperate in SAARC countries to power generation, but some powerful countries are not interesting. The regional cooperation of hydropower generation has not launched properly. There are lots of possibilities in hydropower generation in SARRC region. Nalgad hydropower project has been launched in Nalsing Gad River of the Jajarkot district. This project is top priority in reservoir hydropower. Japan International Cooperation Agency (JICA) and Nepal Electricity Authority (NEA) have studied the feasibility study of the project. During premiership of Dr. Baburam Bhattarai Nalsing Gad hydropower development committee formed and that committee proceed process of ‘Updating Feasibility Study, Detailed Engineering Survey and Design and Environmental Impact Assessment Study of Nalsing Gad Hydropower Project.’ After four years Nalgad Hydropower Company limited displaced the Nalgad Hydropower Development committee. This company has been preparing Detailed Project Report (DPR) Recently government of Nepal exercised to cooperate with (JICA) for financial and others support. JICA has showed the positive response to propose of government of Nepal. There is possibility of cooperation of international financial and technical institution from JICA. Nalgad hydropower will contribute to provide stable energy to establishment and running industries at that area, so that it can be claimed that this project will contribute in development of multidimensional sector by internal use of energy.

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## LIST OF ABBREVIATION/ACRONYMS

ADB	Asian Development Bank
AEPC	Alternative Energy Protection Centre
DIRD	Department of International Relations and Diplomacy
DOED	Department of Electricity Development
DPR	Details Project Report
FDI	Foreign Direct Investment
FI	Foreign Investment
FY	Fiscal Year
GHG	Green House Gas
GoN	Government of Nepal
GW	Giga watt
IPCC	Intergovernmental Panel on Climate Change
IFC	International Finance Corporation
IMF	International Monetary Fund
IPPAN	Independent Power Producers Association of Nepal
INPS	Integrated Nepal Power System
JICA	Japan International Cooperation Agency
KM	Kilometer
KW	Kilo Watt
KWh	Kilo Watt hour
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MW	Megawatt
NEA	Nepal Electric Authority
NGO	Non-Government Organization
NHCL	Nalgad Hydropower Company Limited
NHPDC	Nalsing Gad Hydropower Development Committee.
NPC	National Planning Commission
PPA	Power Purchasing Agreement

SAARC	South Asian Association of Regional Cooperation
SEC	SAARC Energy Centre
UNFCCC	United Nations Framework Convention on Climate Change Conference
USA	United States of America
WBG	World Bank Group

# CHAPTER-I

## INTRODUCTION

### 1.1 Background of the Study

The consumption of energy is very much essential to fulfill different needs that occur in daily life of human beings. Energy Consumption magnifies the facilities by maintaining surrounding environmental status, producing goods, services, new researches, making easier by transportation goods and people. It also helps in construction of physical infrastructure for the social and economic development. And consume energy for different purposes such as households, industrial, transportation, communication, manufacturing etc. In present context, there will not be any imagination without energy and its consumption. Energy consumption sectors are: mainly Residential, Commercial, Transportation, Industrial, etc.

1. Residential sector: Heating, cooling and lightening to home and buildings.  
Energy is also consumed to operate residential appliances and machines such as Refrigerator, Washing -machines, Iron, etc.
2. Industrial sector: For crude oil refining, steel manufacturing, cement manufacturing, good production, etc.
3. Transportation sector: Commercial transportation by trucks, planes, trains, etc. and mass -transport by buses, trains, light vehicles, etc.

In today's world energy consumption is directly related with the economy growth and prosperity of the country. High-energy consumption leads to increase the living standard of people and helps to uplift the Human Development Index too. Proper energy consumption on our requirements makes our daily life easier and prosperous.

There are several sources of energy; Electricity is also one of the major forms of energy. The different sources of energy are solar energy, Wind energy; Thermal power, Atomic energy and Hydro energy. The sun is the ultimate source of solar energy. Fast blowing wind is the source of wind energy. When nucleus of an atom collides together or separate from each other huge amount of energy is liberated which is known as atomic energy or nuclear energy. It is very expensive and risky to generate Atomic energy in Nepal. The heat generated from hot molten fluid inside the

earth surface can be used to generate electricity the energy generated from such source is known as thermal energy. In Nepal due to lack of proper resource, manpower, and technician and capital, it is very hard to generate atomic and thermal energy. Nepal has capability to generate power from solar and wind energy, but production of solar and wind energy lacks storage system in electricity produced from these sources is hard to supply to designated location.

In world, hydroelectric power plant started many decades ago. In a hydroelectric power plant, water, flowing from a higher level to lower level, travel through a metal blades of a water turbine causing the rotor of the electrical generator to spin and produced electricity (Panthi&Panthi, 2064). In 1882 AD that the first hydropower plant was built in Wisconsin, United States of America (USA). This plant made use of a fast flowing as its source. Some year later dams were constructed to create artificial water storage area at the most convenient locations (Adhikari, 2006).

United States of America (USA) has generated largest amount of electric hydropower energy in whole and Canada is the second largest producer country. USA contributes 8-12 percent of whole hydropower generation in the world (Thapa, 2068).

In case of Nepal, first hydropower plant was established at Pharping (500-kilo watts (KW) in 1911 AD, 29 years after the world's first hydropower plant established, during Rana Prime Minister Chandra Shumsher Rana's time to meet the energy requirement of the members of the ruling class (Adhikari, 2006). Sundarijal hydropower established as a second hydropower with capacity 900 Kilo Watts (KW) as a supplementary of Pharping hydropower for use of Rana rulers and their relatives. The electricity generated from Sundarijal hydropower used only for Kathmandu valley (Thapa, 2068)

During the time of 1991 B.S and 2007B.S, in Nepal industries and trade began to increase, as a result in 2007 B.S the Morang hydroelectric supply company appeared. It started, by way of establishment of hydropower plant on Chisang Khola along with diesel / thermal power plant, to distributed the electricity inn general public (Shresth, 2017). Similarly, in 2005 B.S, electricity distribution by Birgunj electricity supply company energy generated by diesel power plant in Birgunj

City. Soon after Shree Bageswri Electric Work (P) LTD, Nepalgunj and Dharan electric company established (Shrestha, 2017).

The decade of 1960 was an important landmark for hydropower development in Nepal. During that period diesel power plant with costly fuel dependency was reduced in 62.2% to almost 0.14%. Altogether 32 major rivers of Nepal and their catchment area were studied; Karnali basin hydroelectric development study was completed by United Nations fund, etc. (Shrestha, 2017).

Nepal has developed hydropower development policy in 2058 to view the internal consumption and export possibility of hydropower in the context of the overall development of the country, an investment friendly, clear, simple and transparent policy is necessary to enhance the development process of hydropower (Hydropower Development policy, 2058). Policy guided to appropriate incentive provision and process, that tried to attract national and foreign investment in hydropower development of Nepal (Hydropower development policy, 2058).

Despite saying that, it was not so easy as the country like Nepal, low income per capita, to invest large amount of money to generate power purposing for prosperity by selling it (Dixit, 2004, pp.287-288). Government may be rich by the royalty of selling generated electric hydropower, but it is not sure to create new economic opportunities for whole public (Dixit, 2004).

Power generation using hydro resources offers sustainable, zero energy input cost, zero greenhouse gas emission, low operating and maintenance cost alternative to fossil fuel based power generation. Currently near alternative to fossil fuel based power generation. Currently, nearly 17% of the world's total power generation is based on hydro resources and its share to renewable power generation is 70 % (Energy Procedia, 2016). Although hydropower is produced in 150 countries; Nepal's economically feasible hydropower generation capacity is one of the highest. However, this huge hydropower potential is still untapped. By harnessing the hydro resources Nepal can meet its domestic demand, create a surplus for export and generate employment for its citizens.



As multipurpose and reservoir projects are different from conventional run of the river and daily peaking power plant in view of construction technology, coverage and financial investment. Due to the loan pattern and current situation, multipurpose and reservoir projects developments is essential for long run various government agencies are involved in the sector, however the policy does not emphasis on collaboration and coordination mechanism among them. For the fast and sustainable development of hydropower, a single window policy and effective coordination between all the agencies are necessary.

However, Nepal has not used full financial resources and technical knowledge to explore the full potential capacity of hydropower project. The generated hydropower energy can be supply southern part, especially Tibet, northern part of India and Bangladesh. This possible market of electricity attracts the investment capital in hydropower generation with proper coordination. China India and other international country and institutions are the potential investor to hydropower generations in Nepal.

The major energy resource base in Nepal consists of biomass, hydroelectricity, petroleum products, natural gas, and coal. The country does not have its own reserves of gas or oil. Country has huge potential of hydropower, but less than two percent of the potential 83,000 MW of hydropower is currently harnessed. 42,000MW is feasible with no environmental hazards. First hydropower was built in 1911. In Nepal, current generation is around 1300 MW. 78% of people have access to grid-connected energy, however, 82% of the population use solid fuels such as coal, dung and wood as cooking energy (NEA, 2020).

Peak load is 1,160 MW as on July 2019. Per capita energy consumption 245 kWh and expected to be 1500 kWh in next 5 years. Economic Growth is expected to reach 6.5 per cent in FY 2018/19. Last year Nepal spent almost 20 billion importing electricity from India, on top of the Rs 90 billion in petroleum. Nepal's economic and social development is being hampered by its inadequate energy supply

There are some bilateral agreements, signed as treaties and contract with hydropower development agreement and exchange of power between Nepal and India. However, this has not been materialized properly. Because of the asymmetry in

conflict of interest of both countries, has played the role of unwillingness to enforcing the agreements. The largest populated area of India is Bihar and Uttrakhand, extending around Ganges plain. The problem of drinking water and irrigation in this region are main issue and challenges for Indian government, so India kept high priority in drinking water and irrigation rather hydropower electricity import from Nepal, because it has other alternative resources, thermal, atomic chemicals and fossil oil to generate energy. On the other hand, Nepal has dual policy to power generation. Sometime before Nepal advocate to power export undermine to internal power consumptions, but now days Nepalese citizens attract to hydropower generation for internal consumption. These two internal interests of two countries are dragging to enforcing power development policy in delay directions and only formal role-plays in surface. But now days Bangladesh is interested to import energy from Nepal and some agreements are doing to power supply with in Nepal and Bangladesh as well as India bilaterally and tersely with cooperating to concerning.

In this context of Nepal, the hydropower generation by the Nalsing Gad/ Nalgad project has identified by surveyed “Under the National Master Plan study on storage-type Hydroelectric Power development in Nepal on 1999 AD to 2001 AD by Japan International Cooperation Association (JICA). This survey categorized the Nalsing Gad in P1 or first potential priority in power generation among the 93 potentially reservoir surveyed project of Nepal. (JICA). The feasibility study of Nalsing Gad storage hydropower project has completed by Nepal Electric Authority in 2012 AD. Now, recently this project undergoing “Updating Feasibility Study, Detailed Engineering Survey and Design and Environmental Impact Assessment Study of Nalsing Gad Hydropower Project” detail survey study under the contract coordination with a joint venture of SMEC International Pvt. Ltd., Australia and MWH International INC, USA in association with UDAYA consultancy Pvt. Ltd, Nepal. Installed power capacity is predicted approach 410 Mega Watts storage type hydropower project (Inception Report of Nalsing Gad, 2016) and updates detailed study report is 417 MW (Final Feasibility Study Report, 2020).

Naumure, Uttarganga, Pancheswr, Karnnali Chisapani are other government concerned important storage-type multipurpose hydropower projects, are under study. Budhi Gandaki reservoir hydropower project has already completed its detail survey

and it is waiting sake under construction policy. The contract for construction between the Chinese company and government of Nepal has been cancelled(MOEWRI, 2011).

## **1.2 Statement of Problems**

Nepal is one of the richest countries in the world to have potentials for hydroelectricity. The abundant water resources, Steep River slopes and large and deep valleys appropriate for reservoirs are the main specialties for hydroelectricity generation. Harnessing water resources for hydropower generation has long been acknowledged as an important conduit for the accelerated growth of the Nepalese economy. Moreover, it is supposed to be an important resort for reducing the widening trade deficit and thereby supporting the favorable balance of payment. Being hydropower one of the major potential water resources to give a boost to an accelerated industrial progress, its importance is equally recognized to facilitate overall socio-economic status of the country. Therefore, the development of hydropower sector has multifaceted impacts on the overall progress of the country

Nepal can compare the different cooperation models to apply here considering economic as well as national strategic need for energy security. Countries having small population, economically weak, low rate of power consuming, land locked and minimum infrastructure development condition cannot compete them easily. The policy of power selling to our neighbors and earning royalty for prosperity of Nepal might be blind, light and one-sided approach.

In order to get rid of power shortage in national grid and regional balance of national grid, the government of Nepal has set the priority to develop at least a storage hydropower project in each province. As an effort, the government has given high priority to develop Nalsing Gad Hydropower project (storage 417 MW) in Karnali Province through Nalgad Hydropower Company.

As the construction of hydropower project requires a sizable fund to construct access road, install sophisticated machines and construct various complex structures, transportation of building materials, transmission wires and equipment, an international cooperation in terms of support for finance, access to power market, technical support is essential. Hence, the proposed study will seek the different

modalities of international cooperation for development of Nalsing Gad Hydropower Project. This highly prioritized storage-type project first of all identified by Japan International Cooperation Association (JICA) and feasibility study was completed by Nepal Electricity Authority (NEA) in 2012 and funded by government of Nepal. Presently undergoing, “Updating Feasibility Study, Detailed Engineering Survey and Design and Environmental Impact Assessment Study of Nalsing Gad Hydropower Project”, detailed survey and design of the project is underway in contract with the joint venture of SMEC international P (Ltd). Australia, MHW International INC, USA in association with Udaya Consultancy Pvt. Ltd. The feasibility study of the project has established its generation capacity of 410 MW and nowadays finding out latest study is 417 MW. The cooperation of international organization in power generation to this project is compulsory in technically and financially. The public private partnership model may also be one of the implementation models.

Main problem in power generation is conflict between interest and reality. Our interest is focusing on energy selling, especially in Indian markets and via India to Bangladesh to earn currency, while India has internally vested interested to irrigation and drinking water for his large population through same water resources. On the other hand, we never homework to uses of the energy for refining minerals (iron uranium, copper etc.), cement factory, bricks industry, Train services, trolley bus services and domestic household consumption in Nepal, while we are paying billions rupees in fuel import. This problem delays the power generation and cooperation to it.

### **1.3 Research Questions**

The proposed study shall answer the following research questions:

- What is the importance of international cooperation to hydropower generation in Nepal?
- What are the roles of national and international institutions in hydropower generation sector of Nepal?
- How will be Nalsingh Gad/Nalgad hydropower project contributed to hydropower generation in Nepal?

#### **1.4 Objectives of the study**

The main purpose of the international cooperation in development sector is to gain mutual benefits from increasing economic as well as socio-political status of the countries. The hydropower sector is considered one of the potential development sectors, which need external cooperation for national prosperity. Hence, present study will set following objectives.

- To explore the importance of international cooperation to hydropower generation in Nepal.
- To explain the roles of national and international institutions in hydropower generation sector in Nepal.
- To analyze the contribution of Nalsing Gad/Nalgad Company in hydropower generation in Nepal.

#### **1.5 Significance of the study**

Nepal has not harnessed its hydropower capacity yet. It has potentiality to gain development and reach to developed nation.

Nepal can take benefits, by cooperating with China and India as well other neighbors, by development of hydropower. Nepal has already signed Power Trade Agreement with India and has special arrangement for cross border transmission lines. In the same line Nepal and China has also in the process of exchange of electricity by making special arrangement like power trade. The hydropower policy in Nepal has opened the way to private sectors to generate hydropower through licensing. Some international companies from India, China, Norway and other countries has acquired license to develop hydropower in Nepal. Some Indian and Chinese government owned company has made hydropower generation agreement with GON. Some of the agreements are not still implementation properly and some agreements are on the process of the implementation.

As the hydropower is the major economic driver, Nepal has given higher priority in this sector in its periodic development plans and national policies. However, exploitation of water resources for hydropower generation to the required

extent through its own resources is not possible. The hydropower policy is open to international cooperation in this sector. The cooperation may either be the form of direct finance or technical assistance to GON or may be an agent to generate it through licensing, and consulting services. Hence, this research paper will mainly focus on possibilities of cooperation of Nepal with its immediate neighbors and other organizations, institutions and countries in hydropower generation. Moreover, the study shall seek the possibilities of contributions of Nalsing Gad Storage hydropower project development in making international cooperation.

This paper will be useful to the students of the international relations and diplomacy, development economists. This will also be useful for policy makers to formulate policy by prioritizing domestic uses rather than exporting it to achieve the overall benefits from exploitation of hydropower. This study will, further, help to understand the independency on fuel import, which has increased the large budget deficit in trade and is subsequently weakening the prosperity of Nepal.

### **1.6 Limitations**

- This study was based on qualitative and quantitative approach. The primary and secondary data will be used in the study.
- This study mainly focused on the role of international cooperation in power generation especially in hydropower in Nepal.
- This research paper had followed analytical and descriptive method of research.
- There was time and financial constraints to study research. Due to time and resources, Nalsing Gad hydropower project has been only chosen to analyze the outcomes of the study.

### **1.7 Organization of study:**

- The first chapter consists of introductory part that include the background, statement of problems, research questions, objectives, significant, limitation and organization of the study.
- The second chapter consists review of the related literature with reviewing the important of pervious literatures finding and supplementary of new research.
- The third chapter consists conceptual framework and research Methodology of this paper.
- The chapter four consists of Analysis of International Cooperation in Power Generation in Nepal: A Study of Nalsingh Gad Project.
- The chapter five consists findings and conclusion of the research about research problem of study with studies project and findings.

## **CHAPTER-II**

### **LITERATURE REVIEW**

Trilochan Upreti on his book entitled “International Watercourses Law and Its application in South Asia” has explained that the South Asia region has no any regional framework for trans-boundary water resources sharing. The water treaties and agreements are concluded on the basis of political manipulation rather than collective negotiation on substantive issues. The double standard practiced by the major riparian country, India, has barred the rest of the riparian countries to come in to single regional framework (Upreti, 2006). This book provides series of cases and examples of how the principle of equitable utilization of International watercourse is the best framework for riparian states to resolve their water disputes and ensure benefit sharing. The Principle of equity as part of the doctrine of equitable utilization is also an important contribution of this book to this research topic. Further, the discussion on the problems and prospectus of Nepal-India water sharing and the critical analysis of India’s unilateral river linking project without any consultation with its lower and upper riparian countries Bangladesh and Nepal, makes the book highly relevant for reference.

Surya Nath Upadhyaya has analyzed in detail the various aspects of the Cooperation in power generation and agreements regarding water resources between Nepal and India. In the considered opinion of the author Nepal has failed miserably to benefit from South Asian regional cooperation and especially from Nepal-India bilateral agreements (Upadhyaya, 2012)

The paper reviewed on the first international conference in energy and power, ICEP 2016, 14-16 December, at RMIT University of Melbourne, Australia presented that “Power generation using hydro resources offers sustainable, zero energy input cost, zero greenhouse gas emission, low operating and maintenance cost alternative to fossil fuel based power generation. Currently near currently, nearly 17% of the world’s total power generation is based on hydro resources and its share to renewable power generation is 70%. Paper further stated that although hydropower is produced in 150 countries; Nepal’s economically feasible hydropower generation capacity is one of the highest. However, this huge hydropower potential is still untapped. By



harnessing the hydro resources Nepal can meet its domestic demand, create a surplus for export and generate employment for its citizens.

Bikash Thapa has stated his view about hydroelectricity in Nepal. He argued that there are possibilities of production of hydropower in more than fifty districts of hill regions in Nepal. If at the rate of five to ten MW electricity produced in each district, the economic and social development of Nepal is possible herself. But Nepal has been suffering from lack of clear policy, national agreement with common view, lack of implementation of laws, problems of priority of project, government's investment policy etc. (Thapa, 2068.p.viii). On the other hand, the construction of electricity projects runs not only in limited single institution and state mechanism. In the context of Nepal political influence of ruling and opposition parties is delayed power generation. When any investor shows the interest to production power in this sector, there are several hurdles starts to creation during construction (Thapa,2068,p.viii). For illustration the West Seti hydro electricity project took sixteen years' time to decision by the government. Due to lack of believable environment of investment, the international investor and institutions uninterested to invest in this project and it also create the negative message to international market of invest (Thapa,2068).

Thapa further mentioned that, hydropower projects are more expensive to its infrastructure so it is main challenges in the context of Nepal to investment. The government by applying the policy of no investment in electricity herself but strategy of hand over to private sectors creates the recent situation. For example: During the tenth national planning state handed over 214MW.Hydropower to generate energy to private sector is about 314MW.If we assume Chilime as private sector only less than 40MW electricity produced. This shows also problem in private sector (Thapa, 2068, p.viii).

Dr. Shastra Dutta Pant has analyzed about "Water politics of Nepal's Fresh Water. According to him, in more than a century long period of hydropower development and fifty-eight years of development planning efforts, less than twenty percent population have access of electricity in Nepal Even those who have access to live with huge power cuts every day. This is ironic considering the huge potential hydropower development in the country (Pant, 2012, p. 81). Over six thousand

perennial falling rivulets can have tapped from several places for small to large hydropower generation, irrigation and drinking water purposes. There is ample possibility of exporting of hydropower and water to both irrigation and drinking purposes (Pant, 2012, p.81). Nepal having sufficient natural resources to produce and supply electricity not only to India but also to the entire SAARC (South Asian Association of Regional Cooperation) region, it suffers due to heavy load shedding up twenty-two hours per day (Pant, 2012, p.81).

Ajaya Dixit evaluated the indirect impact of only royalty gaining by power generation through other countries or sectors, explicitly with following example: IN 1966 AD “Itypu” hydropower project installed capacity of 12600 MW project was signed in agreement between Paraguay and Brazil.(Dixit,2004, p.287). To developed the project, it was conceptualized that the hydropower generated through those rivers following between two countries had conditioned that Brazil used whole generated hydropower energy while Paraguay received only royalty, but it was not achievement full as predicted of prosperity by only earning royalty(Dixit, 2004,p.287).

Prem Kumar Malakar described the important of the Upper-Karnali in” New Conceptual Frame Work on Electricity Trading Management 2005” that the geographical structure of the project provided as a form of fate by nature. This project is cheapest, infrastructures for its development are developed and its natural structure is attractive to develop the hydropower project (Malakar, 2005, p.47). Since 1962 AD this project was studied and became able to implementation in power developed phase in 1996 AD. Nepal Electric Authority (NEA) have expend large amount of asset and time. But the license of power generation of NEA was cancelled by the government without any effective logic (Malakar, 2005, p.47).

Gopal Siwakoti, “Chintan” has explained, in ‘Critical Appraisal in the book Nepal-Bharat and China treaty’, that by followed the opportunity of the transitional period of existing political instability Upper Karnali and Arun-3rd also have hand over the Indian company (Siwakoti,2066, p. 179). All of the best project, Upper Karnali installation capacity more than 300 MW has decided to hand over to the Indian GMR and Sutlej company without discussed, inquiry and approved by the parliament of Nepal (Siwakoti,2066).

In the journal *Economic Review*, Deepak Adhikari concluded that the hydropower potential of Nepal is huge and sustainable in power generation development. This hydropower energy became the key to make Nepal's economic growth scenario brighter gaining deep inroads in to the national goal and priority of poverty reduction. (Adhikari,2016, p.85).Hydropower station have a long life and many existing stations have been in operation for more than half a century and are still operating efficiently. (Adhikari,2016,p.85)

Dr. Harriman Shrestha described, in his paper "Facts and Figures about Hydropower Development in Nepal" that, the lack of strong development power for the sake of the country is again, evidenced in priority selection of a strong project acutely needed for supply in the dry season (Shrestha, 2017, p.3).

World Bank presented on the report 2017 AD that while hydropower development offers great opportunities; it also comes with complex challenges and risks that vary significantly by the type, place, and scale of projects. Factors such as resettlement of communities, flooding of large areas of land, and significant changes to river ecosystems must be carefully considered and mitigated (World Bank, 2017, pp.2-5).

Michael Toman, lead economist in World Bank, described about international cooperation in advancing energy technologies for deep decarbonisation. He told that climate change cannot be arrested without fundamental changes in the global energy system. Such a transformation will not be possible without major advances in a variety of low-carbon energy technologies (Toman, p.315).

The program, "Towards a Sustainable Energy future for All", World Bank directed the "Direction for World Bank Groups in energy Sector "and The World Bank Groups (WBG) is confirm committed to the responsible development of hydropower project. Despite its potential, nearly/5th of potential hydropower research in developing world are yet to realized, including more than 90% in Sub-Saharan south Africa and about 70% in South Asia.

For many countries, hydropower is now the largest source of affordable renewable energy. The WBG will engage in hydropower projects of all sizes and types-run of the river, pumped storage and reservoir-including of-grid projects

meeting decentralized rural needs. In many cases reservoir projects will be multipurpose incorporating integrated water resource management.

Reservoir hydropower can also pave the way for the later introduction of other forms of renewable energy, due to its unique ability to instantly come on-line to offset variability elsewhere in the system, as well as the potential for the pumped storage to store, for example, wind power during periods of surplus.

Regional hydropower projects can service and expand markets and facilitate the formation of interconnected system and power pools, bringing down costs for all. Improved water resources management and multiple use of water for power generation, water supply, irrigation navigation, fisheries and environmental flows can have a transformative development impact (Direction for the World Bank Group's energy sector, 2013, p.22).

Bista (2011) "On economics of Nepal" illustrates the advantages of development of hydroelectricity in Nepal. According to Bista "In order to find alternative energy sources and production, the world has a different picture. Nepal under the monopoly of Nepal Electricity Authority is preparing to exploit available hydro potentials through different modalities (Community based small hydro, private sector, joint venture etc.) This is advocated a best option to the country in comparison with nuclear energy and fossil fuel based plants. Non-economic factors and Indian vested interest have disturbed this path. However, developed countries like USA, Japan etc. have been depending on nuclear energy and further new clean energy technological innovation.

Nalgad Hydropower Company Limited "Updated Feasibility Study Final Report "gives clear insight on the contribution of Nalgad Hydropower project in hydropower generation sector of Nepal (Final report, 2019). According to report, the power generation from the Nalgad Hydropower Project is planned to the integrated national Power System (INPS) of Nepal via a proposed new 400KV Hub switchyard at Kohalpur. There is no existing power transmission system infrastructure that can be used to transfer any of this Nalgad Hydropower generation to Kohalpur. The surveyed transmission line route from Dalli to Kohalpur is 112KM in length. Approximately 13 KM would pass through the Royal Bardiya National Park. Since routing of the line

through a national park is undesirable, the consultant has been verbally advised that the NEA is considering an alternative termination point north of the park, by creating a hub switchyard near Maintada, about 12 KM east of Chhinchu. This would shorten the line required for power evacuation from Nalgad by about 40 KM and would seem to be a better alternative.

Robert Gilpin on his book, "Global Political Economy (IPE) Understanding the International Economic Order" stated that in the mid-1980s a revolution in international economic affairs has occurred as Multinational Corporations firms (MNCs) and Foreign Direct Investment (FDI) began to have a profound impact on almost every aspects of the world economy(Gilpin,2001) Writer stressed the importance of multinational corporations to lead the way in internationalization of both services and manufacturing goods. He considered three major perspectives on international political economy (IPE) - Liberalism, Marxism and Nationalism mainly focused on realist or state-centric approach to analyze the international political economy, where he believed that nation -state is dominant actor in both domestic and international economic affairs. World economic order changed after the end of cold war. Market oriented economy, led by United States and his allies' cooperation, is boost up. The third world countries and some of the pervious Russian allies has also slowly attracted towards the participating in market-oriented economy. After 1990 foreign direct investment has increased. The decreasing cost of transportation helped to more and more goods are becoming tradable and international competition has greatly increased with expansion of high volume of trade. After 1990 large amount of foreign investment has invested in service sector especially in high-tech industries such as automobiles and information- tech sector. This raises the new issues in international commerce to protection of intellectual property right and market access for service industries.(Gilpin, 2001) Those two factors increased trade and financial flows created the importance of Multinational Corporations.

The computer based computing system and information technological development newly drastically changes in growth of economic globalization, which impacts in the again aspects of economic, political and social affairs with vigorously comparing with the traditional economy development by the production of steam power, oil and electric power. According to the Hilbert Gilpin, he clarified that those

changing many aspects of economic affairs, by the applied of computing system and information technological economy, significantly shifted the industrialized countries rapidly from manufacturing to services sector (financial, software, retailing). The economist Ricardo's the law of diminishes returns accounted the distribution of the national income and theory of comparative advantage to explain the trade pattern. He exemplified that "why the Great Britain exported textiles and imported port from Portugal"?

According to the Ricardo and his classical economists shared a number of basic assumption and they gave the idea that every things value is created by labor and belief that the three basic factor of production (labor, land and capital) could not move across the national boundaries(Gilpin, 2001).

If we compare in the case of Nepal the labor forces are mostly unemployment and they are exporting outside the other countries- Middle East, Gulf countries, South Korea, Japan and some European country. Our hydropower sector needed to create value by operating hydropower projects by using labor forces in our own country. It is difficult to do working without the strong commitments and policy formation of government. If we compare the human resources in other part with Karnali province in Nepal, the large portion of Karnali Province's labor forces are, more unskillful, unemployment and they annually, outsourcing especially in India with low rent of labor cost. Karnali province is remote and more lack of by infrastructure development and other sector of developments. Geographical structure and political division makes it more difficult to development to this region. The revenue of this region is very minimal both in external and internal sector. This province has no any big projects are running to construct. Even though hydropower, tourism, livestock and herbal are important possibilities to developing in this area.

Nalgad hydropower project is now finally stage of evaluating detail project survey report. Report has seen feasible to developing the reservoir hydropower project in Jajarkot district of Karnali province. Surrounding area of this project is Rukum Paschim, Jumla, Dailekh Surkhet and Salyan districts. The labor forces of this area is mostly outsourcing in India, Middle East and Gulf countries. Remittance is the main base of economy. Traditional agriculture system and livestock system both are almost going to ending limit. If we develop this projects some labor forces can be employed

and will decrease some portion of poverty. This project is a high valued costly project. Consultant services, technological equipment supply and some economic investment are expected by international cooperation to generate power in this project while simple human resources and some parts of economic share can be invested by local people, financial institutions and local raw materials as a capital of project. To implement this method government must have necessary long strategic key feature of all policy to development of the project.

According to Sylvia Ostry Multinational Corporation is a key feature of the globalization of the world economy. It is also believing that Multinational Corporation (MNCs) determining international political and economic affairs by their corporate activities with freely from their home economy. This statement is not true but actually they are creature of home economy. Multinational firms expand firstly by their direct investment to other economy with services, manufacturing and commodities enhance controlling their market and production over other economy

According to the Benjamin Gomes-Casseres, Multinational Corporation expand overseas by allies, mergers, and similar ventures with corporate strategy to establish their permanent position over other economy. Robert Gilpin with assistance of Jean M, Gilpin stated, the view of mainstream economist and MNCs, that market signal gives the behavior of firms rather than the nationality of the market and where it is operating is less important either they are internationally or domestically. The writer further stressed that MNCs are not merely substitutes for trade; indeed, they attempt. To expand their power and control over foreign economies, it is clear that multinational firms desire not only to immediate profits, but also to change and influence the rules and regimes governing trade and international competition in order to improve their long term position. In the business view of MNC interest in corporation has been expanded to firms internationally.

The John Dunning and the eclectic theory of MNCs developed by him emphasizes technology as a factor in MNCs development. Rapidly development in communication and transportation sector made possible to management and organize the services and the production system in large global scale. The technological advancement reduces the cost of transaction and the other sector cost in production for internationalization. The Marxist criticism about MNCs and Foreign Direct

Investment (FDI). According to them Foreign Direct Investment is fundamentally different pattern investment than portfolio investment. FDI is invested strategically with firms' expansion to fulfill their aim to controlling the productive power and facilities of other economies. According to the Stephen Hymer in his doctoral dissertation, his radical critiques of the MNCs. Monopoly capitalism is driven mainly by two rules, firstly it increases its firm size extend within and a cross the national boarder nesting the core and periphery layer. Secondly it divided the labor forces around the world in two scheme, where core is advanced capitalist economy and periphery is dependent and exploit less developed economy, creating two classes' boss and peasant/worker.

In 1994 Kenichi Ohmae analyzed in his book "the boarder less world" about the Global Firms and The Borderless Global Economy. He argues that international corporate alliances have undermine the significance of national foundries and created transnational link. The rapid pace of technological change, the huge cost invests in technological innovation, high risk of research failure, large scale of economy necessity to the firms need to foreign partner which makes easy to protect their access of market, share technology and other resources. Thus international cooperation plays the role to maintain the problem in not having exact demarcation line in the border to working the firms' doubtless situations.

In the context of Nepal, it is least developing country and surrounded by emerging two giant Asian Economy, India and China with land locked boarder. Power generation and consumption rate of our country is very low. Power based industrial development situation is in minimum number. Our large amount of capital has been paying for oil import from Indian and other countries. There are no other alternates to replace this import deficit without hydropower generation and implementation to domestic uses in Nepal. Even though more possibilities are available in hydropower generation from reservoir types, consistently energy forming, projects but we are not self-dependent financial, technological and consulting sector. Only cooperating international institutions can solve this weakness and states enhance to power generation. For example, Kulekhani reservoir hydropower project has been constructed under the cooperation of Japan.



Similarly, the Nalgad reservoir hydropower project, capacity of 417 Mega Watt (MW) is nearly the stage of completing the "Updating Feasibility Study, Detailed Engineering Survey and Design and Environmental Impact Assessments" cooperation with A joint venture of SMEC international private limited, Australia and MHW international INC., USA in associate with UDAYA consultancy Pvt. ltd., Nepal. After the Budhi Ganndaki hydropower project, Nalgad hydropower is also ready to construction phase has detailed survey design report. Survey reports clarify that the technical, consulting and financial supports in power generation are compulsory to cooperate.

For Budhi Gandaki Reservoir Hydropower Project, the” Report of Committee which had organized to prepare the framework of investment “has reported the requirement direction and polices to invest in reservoir Hydropower projects. According to report in context of Nepal, only run of river types’ production unable to address the drastic difference between demand and supply and also the thermal power plant is not reliable by both view of ecofriendly and high production cost of energy (Final report, 2074, p. 9). If we do not generate the consisting power by reservoir hydropower, our compulsion to import electricity from India to fulfill the requirement of Nepal is increasing in coming days. Thus for stability of electric power system reservoir based hydropower projects are necessary to build. The reservoir hydropower projects provide the extra opportunities of irrigation, fishery, water transportation, control of flood and tourism with electricity production. The reservoir collects the water in rainy season and control the flood disaster. The storage flood water provides economic value by multipurpose utilizing to it. Government of Nepal also has targeted the importance of semi-reservoir hydropower projects of reservoir capacitance of 40%-50%. The reservoir based energy productions not only for internal consumption they can also targets to import other countries.

In the perspective of Marxism: The historical import of technology (Force of Production) and the relation of the production (relation between owners and workers) determine the production of goods, its value, surplus value and competitive markets. The accumulation of surplus value for owners introduces the capitalism. The surplus value is obtained by the worker's unpaid labor (here unpaid labor means extra time of working). So the constant capital (Technology, investment) is accumulated by

surmounting surplus value by exploitation of workers and interest of invested loan. Thus the domination of one nation over other nation by expanding capital investments, through MNCs, INGOs and other institution extends their imperialism in international arena.

In the book of international relations, published by Goldstein Lenin's theory of imperialism argued that European Capitalist were investing in colonies where they could earn big profit and then using part of these to buy off working class at home (Goldstein,2008). According to Lenin: Imperialism is the highest stage of capitalism. The industrialized states exploit poor countries and buy off their own working class with the profit in globally. Through this globalization of class relation world accumulation concentrates surplus towards the rich parts of the world and away from the poor one(Goldstein, 2008).

In the perspective of dependency theory: dependency as situation in which accumulation of capital cannot sustain itself internally and must have borrow capital to running economic production activities. The debt reduces the accumulation of surplus rich nations need to loan out their money just as poor who need to borrow. Thus rich nations –north and poor nations- south deepen the gap among them.

In the perspective of Realism its mean is focusing on securities with power politics, conflict and war. Power politics is concerned over political economy and political economy activities are running through loan subsidies and technical support through multinational companies, IMF, INGOs and IGOs by mutually cooperating for long term.

An international regime is necessary to setting rules, norms and procedure for actors to focus on the issues as arm control, international trade with their mutual participation. The domestic state's rules and regulations are diluted by higher stakeholder states with different legal treaties and contract award first. International investor has been investing loan, technical support to establish industries and projects with consulting support and supplying equipment. They also want the legal support, which help to extend their further investment, and technical support.

The Constitution of Nepal (2015) has also reviewedand some important factors related to subjects from new constitution of Nepal (2015) are taking under

study. The sub article (3) under the articles (50) about Direct principles states that: the economic objective of the state shall be to achieve a sustainable economic development, while achieving rapid economic growth, by way of maximum mobilization of the available means and resources through participation and development of public, private and cooperatives and to develop a socialism oriented independent and prosperous economy while making national economy independent, self-reliant and progressive in order to build an exploitation free society by abolishing economic inequality through equitable distribution of the gains (Constitution Nepal, 2015, article.50(3)).

The new constitution article (51) about policies of the state explained, relating to economy, industry and commerce under sub articles 51.d. (2) that: To achieve economic prosperity by way of optimum mobilization of the available means and resources, while focusing on the role of private sector in economy. (Constitution of Nepal, 2015, article 51.d.2). Further it also states that, to protect and promote domestic industries and resources and accord priority to domestic investment based on Nepalese labor, skills and raw materials for the development of national economy. (Constitution of Nepal, 2015 article.51.d.3). Policies relating to protection promotion and use of natural resources also managed to ensure reliable supply of energy in an affordable and easy manner and make proper use of energy, for the fulfillment of the basic needs of citizens, by generating and developing renewable energy (Constitution Nepal, 2015, article.51.g.3)

Policies relating to labor and employment to guarantee social security, while ensuring the basic rights of all labor, in consonance with the concept of decent labor and to, encourage to mobilize the capital, skills, technology and experience gained from foreign employment in productive sector in the country (Constitution Nepal, 2015, articles.51.i.2&6).

The above literature review shows the international cooperation in power generation, especially in the sector of, financial closure and technical support (consulting services and equipment delivery and establishment) are possible in clean energy developments. The existing, law, rule and regulations of Nepal are amending and make easier to power generation. The huge amount of fuel imports increases the business deficit and makes intra dependency in fuel consumption. The water uses

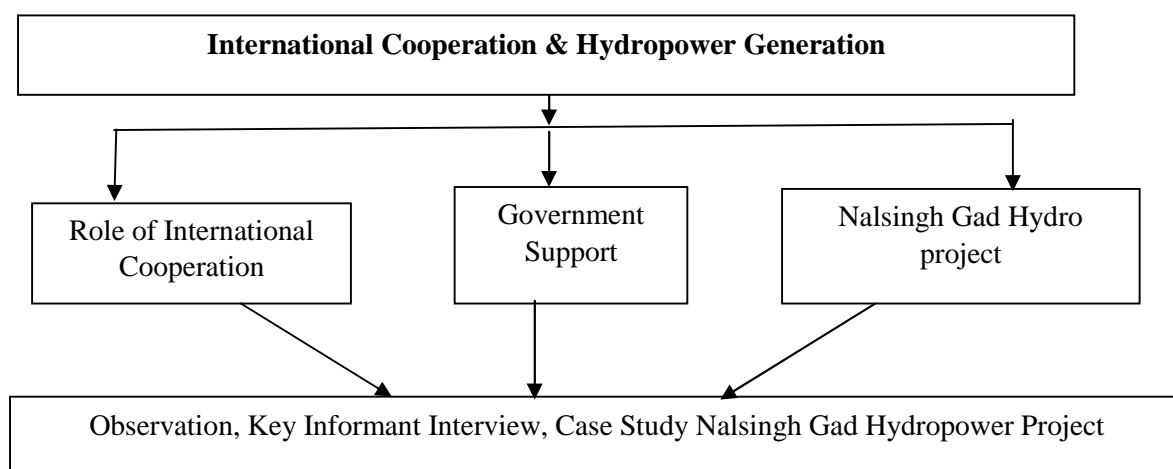
policy of our conceptual possible market India is different than our concept. India has needs the use of water in drinking and irrigation purposes for her large population in the boundary of Nepal, while we are exploring to power generation for selling in same ground with same water resources. This conflict of interest only draws backs to power generation for a long time in Nepal. On the other hand, royalty earned by power selling does not guarantee the prosperity of people. Our political assertion of socialism oriented policy can only be possible by using the energy in multidimensional purpose of internal consumption in establishment of basic industries, mineral refining and processing, domestic use of fuel and infrastructure development in electric rail, trolley bus services and recharging center, cement industry, textile, manufacturing and bricks industry. The concept in power generation policy must be focus on national demand in changing context of the world policy in political economy.

## CHAPTER- III

### 3. Conceptual framework and Research Methodology

#### 3.1 Conceptual frame work

The study is tried to define the role of international cooperation in achieving development objectives at a conceptual level. The conceptual framework of development and cooperation are thinking in the realism, liberalism and socialism perspective reflecting in the foreign aid, loan, technical support etc. Figure below Illustrates the interdependence between domestic and global goals and the enablers in context of The Study of Nalsing gad Hydropower Development. This framework is defined the role of international cooperation in development with the categories of provision, support, access and preservation. Countries cooperate to provide support in order to solve problems resulting from interdependence and globalization (e.g. global trade rules, the protection of the ozone layer). Hydropower development might not be provided in the interest of poor people in the first place. But their development-orientation can subsequently be increased. International cooperation can reshape to make them more development-friendly. For instance, trade rules can limit the use of nuclear power to support hydropower development. The example of access may be aid for trade that aims at lifting constraints on the ability of poor countries to benefit from the global trade system. The cooperation in term of preservation is also necessary to get rid of any harm from domestic development. The conceptual chart can be shown as below.



**Figure 1: Conceptual Framework for Study**

There is a close interconnection between domestic and global actions and goals to understand how international cooperation works is an integral part of development works. To explore these questions, development studies can draw on an extensive body of literature on international relations, global governance, and economic and other disciplines. The study will review key concepts from some of this literature describing patterns of international cooperation. The conceptual overview is structured according to the main categories of aggregation technology, types of contribution, governance mechanisms, the role of different stages in the policy-making process, and institutional complexity. The overview highlights patterns of international cooperation representing basic elements of the global governance framework that the implementation of a broadening development agenda needs to take into account.

### **3.1.1 International Cooperation in Hydro Power Generation in Context of Nepal**

Nepal possesses energy in the form of the hydropower and firewood; no other energy resources have been discovered in significant quantities (e.g. coal, oil, gas) hydropower offers huge potentials but thousands of population of Nepal has not still access to electricity (Upreti, 2006, p.182). Despite of abundance of water resources, only about one third of the population has got access to safe water. With respect to an international watercourse, the interest of the watercourse states sharing such watercourse is linked. One may be affected by sharing such watercourse in linked. One may be affected by the illegal use of the watercourse by the other. The protection and conservation of the watercourses is the shared interest of the states (Upadhyaya, 2012). Joint efforts are also required in the time of emergency. Therefore, the provisions of convention prescribe a general obligation to the states to cooperate in the optimal utilization and adequate protection and conservation of such watercourse. States are also required to exchange on a regular basis data relating to watercourse (Upadhyaya, 2012).

The concept of international cooperation in hydropower generation is interrelated with concept of international laws. There are several international laws related to water resources. The main international laws related to water resources are the Helsinki rules of the international Law association, 1966, the UN convention on the Law of the Non- Navigational Uses of Watercourses, UNCIW, 1997 etc.

The Governments of South Asian Region have been negotiating water resources development for the last forty years, and so far such bilateral endeavors have yielded no tangible result nor any miracle breakthrough seem likely in the foreseeable future (Upreti, 2006). If any achievements are to be made, cooperation on a regional level is the first condition; but far from this happening nothing has been done nor is anything expected, except for some bilateral treaties, and thus inaction remains the subject of sharp criticism (Upreti, 2006).

Nepal is going through a phase of economic development, a lot of water resources projects are being planned and constructed (Bhattarai & Nepal, 2017). Water resources is the most reliable natural sources of Nepal. In other word water is gift provided by nature to Nepal but it is only recognized but Nepal unable to utilizing and developing water resources (Gurung, 2019, p.5). Despite decades of work and planning only 914 megawatts (MW) of Nepal's estimated 40, 000 –plus MW potentials of economically feasible hydropower is in operation. This number will grow over the next few years with more than 3000 MW currently under development (Teplitz, 2017, p.6). The government of Nepal seems serious to develop utilization and Development of Water resources gradually several hydro projects are in pipeline or going to start now. But most of them are based on run off river. So that one huge damp based project is required for Nepal no. (Gurung, 2019, p.6). Yet even with this expected increase in hydropower availability, Nepal is still a long way from its goal of reaching “10000 MW in 10 years.” Achieving Nepal's energy and economic goals- including becoming a middle –income nation by 2030 –will require massive investments in generation, transmission and distribution (Teplitz, 2017, p.6). With a river basin approach many sectors like hydrology, climate, ecosystem, floods and droughts, erosion and sedimentation, hydropower production, irrigation and upstream and downstream linkages, among others, are considered in their totality (Bhattarai & Nepal, 2017, p.7).

## **3.2 Methodology of the study**

### **3.2.1 Research Design:**

- ) This study is based on both qualitative and quantitative research methods so that the research topic has been presented on the basis of theoretical and practical aspects.
- ) This research study has attempted to analyze international cooperation in power generation.
- ) Being a qualitative and quantitative study, it tried to find out and analyze cooperative dimension of hydropower generation in Nepal.
- ) This study is descriptive study of facts; analytical descriptive approaches.

### **3.2.2 Nature of sources of data:**

- ) The nature of sources of data is primary and secondary data. Primary data and information is obtained from questioners and interview method
- ) The secondary data and information is obtained from published books, journals, articles, magazines, newspapers, published and unpublished dissertations (thesis) of relative topics, reports of different institutions about topics and website and specially the report of the Nalgad study.

### **3.2.3 Tools and techniques of data collection:**

- ) The primary data is collected from field and interview method from key informants.
- ) Secondary data is obtained from published and unpublished literature of related topic on the basis of title and subtitle of research. Collected data is categorized, analyzed, organized and concluded
- ) This research study is attempted to analyze international cooperation in power generation in Nepal.



## CHAPTER-IV

### **4 Analysis of International Cooperation in Power Generation in Nepal: A Study of Nalsing GadHydropower Project**

#### **4.1 The Rise of / Evolution of International Cooperation in Hydropower Generation in Context of Nepal**

##### **4.1.1 Political Factors**

Prime Minister, Khadga Prasad Oli has visited, 2018 April in India and 2018 June in China, in formal state visits. During his official visit Nepalese and Chinese delegates signed in new hydropower development and supply agreement even though its implementation part is still questionable. The forming new government of Nepal after the new federal constitution 2074 declared the new policy and program through his budget orientate towards socialism according to the assertion of constitution. Government new policy priorities to develop the cross-border and Trans Himalayan Railways services, to prepared industrial and manufacturing infrastructure. For this purpose, high amount of stable energy is needed to run these projects. The high amounts stable electrical energy is only possible and economic friendly can be generate by water storage types hydropower projects by making high dam in Nepal co-operating with international organizations, financial institutions, neighboring countries, incorporate to internal invest of public and private sector. Nepal has no long and fact experience to develop high dam storage hydropower project. The skillful manpower, modern efficient technology, closure of financial investment, market and transparent policy are compulsory factors to develop the power generation. Our two neighbors India and China has good experienced to develop such high risky reservoir hydropower projects. In their country, for example Tehiri dam in India and Three Georges in China. The cooperation with these countries will be more important to runs the reservoir hydropower projects in Nepal. On the other hand, our constitution asserted the vision oriented to socialism to our society. The superiority of public must be safe by ownership their participation in states resources. So new hydropower development policy must be formed compulsory of the public responsibility and participation in development process with garneted proper share in project. Ensure the public investment either guaranteed by the government or deduct their labor cost in working as a share form. In federal structure system every seven

regions of country must be develop in proper and inclusively. So the important and stable power generating hydropower projects must be running in all province.

There was no any cooperation except few neighboring countries like former British India, China and Tibet up to early phase of Rana Period. After Europe visit of first Rana prime minister Jung Bahadur Rana “Chandra Jyoti Praksh Bijuli Adda” was established in 1968 with financial and technical support of Nepal, with the aim of supply of electricity service to ruling classes and their few influential nears and dears of rulers electrification of Nepal started Pharping Hydropower Project from 2 units of 250 KW and less than 20 KM transmission distribution line. That was the first hydropower project of South Asian Region. This project existed up to 2058 B. S. (Thapa, 2068).

#### **4.1.2 International Factors**

Different countries of the world have different demand level of energy. Developed countries like USA, Japan, France, England, China etc. have excessive demand of energy for maintaining higher standard and also for sustaining higher economic growth and economic development (Bist, 2011, p.93). In context of Nepal, while developing and constructing hydropower project in Nepal bilateral, regional and multi-national cooperation has been promoted. Nepal has been cooperating with India, China, Japan and other countries bilaterally while launching hydropower projects. The government of all member states in SAARC region are struggling to cooperate with the existing gaps in energy demand and supply in their respective countries. There is much to gain for member states in various area of policy regulation projects with success stories and knowledge dissemination from the cooperation by expanding the development hydropower to consider the international/regional level (SAARC Energy Center, 2015, p.50). The cooperation among three or more than three states also contribute to construction of hydropower projects. Nepal have signed tripartite agreements among Nepal, India and Bangladesh regarding hydropower generation. The regional cooperation among developing and least developed country is very important to much ahead on the path of economic growth (Singh, 1987, p. 13). There are huge possibilities of generating hydropower in South Asian Region (Javed, 2015, p.6).SAARC Energy Center and SAARC energy coalition have vital role for it in SAARC region. The head of the states of government at the thirteen SAARC

summit held at Dhaka on November, 2005 agreed to the recommendation of SAARC energy ministers to establish the SAARC Energy Centre (SEC), Islamabad (SAARC Energy Center, Impact Assessment & Way Forward(SAARC energy Center, 2015,p.118).

#### **4.1.3 National Factors**

According to Nepal Oil Corporation within five years, since physical year 2071/72 to 2074/75 550 billion Nepalese currencies is ousted to import fuel from India and other countries. 2.7-million kiloliter/ton fuel has imported in physical year 2074/75 at the cost of 160 billion Nepali rupees. The volume of importing in last year is increased by 20%, while the price rate of fuel is increased by 48%. According to the report of rising Nepal in the fiscal year 2018/019 Nepal imported, 566,429 kiloliter (KL) petrol (Rs. 33.6 billion), 1,714,133 KL diesel (Rs. 111.47 billion), 24932 KL kerosene oil (Rs 15.93 billion), Aviation turbine fuel 200,108 KL (12.8 billion), 429,608 tones liquefied petroleum gas (LPG) (Rs. 32.92 billion) maximally from India. Total 2016 billion rupees' fuel is imported in fiscal year 2018/019(reporter, 2020, p. 1). According to the newspaper Kathmandu post one report show that Mechi costume office has recorded that 57172 metric ton coal is imported from, India, Indonesia and Africa for cement and brick industry in the six month of 2016 (reporter, 2016, page 1) (22.53 billion). This status of import shows the fuel resources: gas, petroleum, kerosene oil, aviation fuel, and electricity also depend up on India and more than 216 billion business deficit in Nepal. Nepal is land locked country; the access of transportation is unstable and merely depends up on India. The transportation cost added high value in importing and exporting goods. The possibilities of natural gases and fossil oils are very low. And production cost is very high, so the replacement of fuel (gases and oil) is only electric energy that is recorded 157,172 tones by hydropower electricity.

The main problem of fuels import has been facing Nepal for a long time in legally and economically. The big component of business deficit is fuel import. It is necessary to find out the alternative way of fossil fuel import. The fossil fuels and gases demand and supply has created different hurdles in past and this market is unstable for internal consumption of Nepal. Even though, the rights of land locked

country to connect aboard sea is reserved by international law but it is not easy to implementation in practice. In past fuels import was ambushing as bargaining point.

Now we may have been three possibilities of power production to mitigate large amount of currency payment for fuel import and business deficit. These are clean energy (abundant amount of water resources), research and production of fossil fuel and atomic energy. The insufficient quantity of availability, high investment in research production and processing in fossil fuel is not benefit. Now days research has been oriented the discovery of heavy material Uranium and finding reports are more positive. It is good alternate of power generation and self-depend on energy consumption but it is more environmental risky, technically and financially costly in invest. International treaties and contracts are not so easy to the production of such heavy material. National law can't preserve the security of production. International cooperation is compulsory atomic power generation. Recently our position to generate atomic energy in technically, economically, environment security is not feasible. Its future is seeing bright in coming days. The nature gifted the abundant amount of water resources to generate hydropower to us as fate of life changing game. Our climatic nature is variable to raining in different seasons so that the volume water in in follow the river are varying. That varying follow of the water creates the problems consisting power generation in production. Consisting power is important power to establishment the industries, cooking facilities and railway track power supply. Even though reservoir types projects are costlier in investment, complicated in research and design the project, our economic and technical efficiency are not sufficient to explore those projects. The geography and nature of climate is suitable to product the consisting power by reservoir hydropower projects. To facilitate the problems of investment, technical support and security international cooperation with strong financial institutions and counties who are technically efficient to provide the services and equipment supplying and establishment capable to explore and construction the project is necessary.

The research report of World bank,Asian Development Bank (ADB), Norwegian government, Japan government and Indian Government Indian government have financially and technically assisted, the hydro potential of Nepal is 83,000 MW out of which the report mention only 44,000 MW for economic viability (Bist,2011,p.93). according to article 51 sub-article b(10),b (11), g (2), g (3) of

constitution of Nepal, policies of Nepal will encourage foreign capital and technological investment in infrastructure development, emphasis to obtain foreign investment, make multi-purpose development of water resources etc. (constitution of Nepal, 2015, pp.32-35). According to electricity Act 1992, there is provision of generation and development of hydroelectricity in Nepal (electricity Act, 1992). Section 7 and 9.2 of Water Resources Act 1992 mention about use of water to generate hydroelectricity. According to Foreign Investment and Technology Transfer Act, 2019 there are facilities to foreign investors in hydropower sector in Nepal. There are also provision of bilateral and multilateral cooperation in hydropower generation sector (The Foreign Investment and Technology Transfer act, 2019). Electricity rule, 2019 deals with production, transmission and distribution of electricity (Electricity Rule, 1993). Water resource Rule, 2050 deals with use of Water resources to produce hydropower (Water resource Rule, 2050).

The first plan (2013-2018) oriented to produce 18,000- 20,000 KW electricity. Second national plan (2019-2022) aim to produce 22 MW electricity (Thapa, 2068, p. 15). Third national plan (2022 -2032) aimed to produce 60 MW electricity (Third national Plan, 2022). Fourth national plan (2028-2032) aimed to produce 40.3 MW electricity. While launching fifth plan (2033-2037) the electricity capacity of Nepal was 68.346. During sixth plan large projects Kulekhani, Marsyangdi and Devighat are started (Thapa, 2068, pp15-18). At the end of seventh plan (2043 -2047) 227 MW electricity was connected and 9% of population of Nepal has access to electricity. During eight plan liberal policy had started to adopt in hydro-electricity and the all process were proceeded to enters Khimti and Bhotekhoshi project during eight plan the capacity of hydro-electricity increased up to 300 MW (Eight Plan, National planning Commission). The capacity of electricity increases up to ninth national plan was 253 MW. This plan was aimed to increase electricity up to 538MW, with in this plan. Puwakhola and Modikhola project were completed and hydropower projects in Humla and Mugu were started (ninth plan, National Planning commission) in tenth plan (2060-2064). There was aim to produce of produce of 842 MW (Eleventh Three Year Interim plan, national planning commission). During period of Twelfth plan (2067/68-2069/70) 67% of total population of Nepal received electricity service among it 58% population gained electricity from national transmission line and 9% population gained electricity from other resources (Twelfth Plan, National Planning

Commission). In thirteenth plan (2070/71-2072/73) the total connection capacity of hydroelectricity was increased to 851 MW and 74% population of Nepal had got access to electricity (Thirteenth Plan, National Planning Commission). during fourteenth plan the leakage of electricity decrease from 20 to 20.5 %, the 70% population had access in national transmission line and per person electricity consumption is 200 KW(Fourteenth Plan, National Planning Commission). The aim of fifteenth plan are to increase connection capacity of electricity up to 5,000 MW, the 99% (58 lakh 50 thousand families) population will have access of electricity. The per person electricity increased to 700 KW per hour total energy consumption the ratio of renewable energy increased from 5 to 12 (fifteenth Plan, National Planning Commission).

Hydropower Development Policy, 2058 focus on rural electrification, pursuing a strategy of bilateral or regional cooperation in the hydropower development. The hydropower potential of the country shall be utilized to maximize to meet demand of domestic sector, to focus in implementation of large storage type hydropower project, to encourage involvement of community / cooperative institutions, local bodies and private sectors in generation, transmission and distribution of hydropower in order to service throughout Nepal at a reasonable price (Hydropower Development Policy, 2058). Foreign aid policy, 2002 (2059) has replaced by Development Aid Policy 2071. The Main objectives of Foreign Aid Policy were to ensure the compatibility and convergence between foreign aided projects and national priorities, aid supported activities become an integral part of the overall development processes (Foreign aid Policy, 2002). The vision of development aid policy is to construct self-reliance economy in Nepal by means of effective mobilization of development aid and to assist Nepal to be prosperous , democratic state, contribute in development of hydroelectricity , mobilization of development aid according to high level international expression in Paris Declaration, Akra work Plan, Declaration of Busan and Male ting of Mexico ( Koirala, Chalise, Pokhrel, Neupane & Shrestha (Ed.)2070,pp.233-236) forms of foreign investment , permission for repatriation , facilitation and concession , arbitration arrangement relating to one window system etc. are major provisions under Foreign One- Window Policy ,1992 (Foreign Aid One window Policy ,1992). Rural energy policy, 2006 deals with micro and small hydropower, rural electrification institutional arrangement etc. (rural energy

policy, 2006). The Subsidy Policy for renewable energy, 2013 mentions various subsidy categories with relevant subsidy amount for all types of community /cooperative owned off-grid renewable energy technological projects. National Rural and Renewable Energy Program (NRREP) targets for different RETs including mini/microhydel (Javed, 2015). According to annual budget of fiscal year 2076/77 hydroelectricity and renewable energy will develop and expand with the aim of to supply modern energy is household and to make “sparkling /bright “Nepal by develop two large hydro and solar projects in all provinces(MoF,2019/20).

#### **4. 2Status of Foreign Aid and Foreign Direct Investment in Nepal International Cooperation of Hydropower Generation**

##### **4.2.1 Foreign Aid and Foreign Direct Investment**

Foreign aid is more important for accelerating economic development of a country. The financial needs of developing countries can partially be full filled by foreign aid. It is the transfer of capital, goods, and services from one country to another (Aryal, Subedi & Thapa, 2010, p. 260). In hydropower sector, the transferring and receiving of capitals technologies and services refers to the foreign aid. The allocation of foreign aid is rarely determined by the relative needs of developing countries. Most bilateral aid seems unrelated to development priorities being based largely on political and military consideration on the unpredictable whims and ad-hoc judgments of donor design makers. Foreign aid may be given in term of capital transfers or technical assistance and training for either civilian or military purpose. People tend to understand foreign aid as grant despite substantial amount of foreign aid is provided in the form of loan which has to be reimbursed with certain condition not given free as a grant. Most of countries have been making the use of their foreign aid accelerate to pace economic growth (Aryal, Subedi & Thapa, 2010, pp. 260-261).

Foreign Direct Investment (FDI) is any form of investment that earns interest in enterprises which function outside of the domestic territory of investor. It is said that FDI is beneficial to both the investors and the investment seeking countries (Aryal, Subedi & Thapa, 2010, p.270). Not only developing countries but also developed countries. I like Japan, USA, UK, France etc. have formulated different policies to attract FDI from other countries. FDI bring, money skills and technology

with it (Aryal, Subedi & Thapa, 2010, p.270). Some countries like China, India, USA, and Russia are using FDI as a tool to further their international relations with other countries and use them in international arena far as and when needed (Aryal, Subedi & Thapa, 2010, p.270). Different strategies like reducing obstacles increasing predictability promoting consisting fostering completion rate are needed to attract FDI and get maximum benefit from it (Aryal, Subedi & Thapa, 2010, p.270).

Foreign benefit investment is defined as the long-term investment by foreign investors in an enterprise located in an economy other than that in which the foreign direct investor is based (Aryal, Subedi & Thapa, 2010, p.270). The FDI relationship consists of a parent enterprise and a foreign affiliate which together form a Transnational Corporation (TNC) International Monetary Fund (IMF) guidelines consider an investment to be a foreign direct investment if it accounts for at least 10 percent of the foreign firm's voting stock of stakeholder (Aryal, Subedi & Thapa, 2010, p.270). However, many countries set a higher threshold because 10 percent is often not enough to establish effective management control of company or demonstrate an investor's lasting interest (Aryal, Subedi & Thapa, 2010, p.270). In context of Nepal, only national mobilization of national capital may/might not fulfill national demand of the hydropower sector. But due to vested interest and difficult terms and conditions there has been treating difficult situation to enter the foreign investment and foreign direct investment in Nepal so that the government of Nepal and concern parties have to be conscious about it and they have to try to gain sufficient foreign investment and foreign direct investment to develop hydropower sector.

**Table 1: Total inflow of foreign aid to Nepal (Rs. in millions)**

S.N.	Year	Grant	Loan	Foreign Aid	National budget	Foreign aid percent of budget
1	1950/51	1.01		1.01	24.69	4.09
2	1955/56	0.01		0.01	69.46	1.01
3	1960/61	227.50	1.0	227.50	377.20	60.31
4	1965/66	175.30	3.30	178.60	42.11	4.72
5	1970/71	270.69	32.46	303.14	769.50	41.72
6	1975/76	359.72	145.94	505.65	1913.30	26.43



7	1980/81	868.90	699.30	1562.20	4092.30	38.17
8	1990/91	1630.00	4360.00	5990.00	23594.80	25.39
9	1995/86	1120.60	2370.90	3491.50	9797.10	55.64
10	2000/01	6753.4	12044	18797.4	79835.1	23.54
11	2005/06	13827.3*	8214.3*	22.0967	12688*	26
12	2010/11	647358	413629	10608907	4080642	26
13	2015/16	792037	4163950	1955987	78239218	25
14	2016/17	456125	16642314	2120439	7311858.62	92

Source: 1 Economic Survey 1999/20, 1997/98 MOF

2. Economic Survey, 2017/18

3. Budget in Nepal, HMG/N MOE, and Revenue Adm. Training (P.T.O.) center 1982.

Note: From FY 1951-1964 estimated budget and foreign aids are taken.

\*revised.

**Table 2: Trend of foreign assistance**

S.N.	Indicators	1999/00	2004/05	2009/10	2014/15
1	Total actual foreign Assistance	17.5	23.7	49.8	55.4
2	Share of ODA in GDP (percent)	4.8	4.2	4.2	2.6
3	Share of foreign aid in total of government expenditure	26.4	23.1	19.2	12.9
4	Share of foreign assistance in development expenditure	68.8	86.5	55.1	62.5

Fig.: (MOF 2002 and 2015)

**Table 3: Share of foreign aid in development expenditure in different development plans of Nepal**

S.N.	Plan period	Development expenditure	Foreign aid	Foreign percent of development expenditure
1	1 <sup>st</sup> plan (1956-61)	382.9	382.9	100.0
2	2 <sup>nd</sup> plan (1962-65)	614.7	478.3	77.8

3	3 <sup>rd</sup> plan (1965-70)	1639.1	919.8	56.1
4	4 <sup>th</sup> plan (1970-75)	3156.9	1509.1	45.0
5	5 <sup>th</sup> plan (1975-80)	8870.6	4264.1	48.1
6	6 <sup>th</sup> plan (1980-85)	21750.0	13260.0	61.0
7	7 <sup>th</sup> plan (1980-85)	48345.4	23978.5	72.6
8	8 <sup>th</sup> plan (1992-97)	1135.191	74355.0	65.5
9	9 <sup>th</sup> plan (1997-02)	129105	72420	56.3
10	10 <sup>th</sup> plan (2002-07)	194688.0	106774	56.84
11	11 <sup>th</sup> plan Interim plan (2066-10)	235467	93548.8	53.20
12	12 <sup>th</sup> plan : MDG (2010-15) onward	N/A	125401.9	
13	13 <sup>th</sup> plan SDG (2015 onward)	N/A	189460	

Source: i) Different plans, NPC, HMG/N.

ii) Various Issues of Economic Survey, MOF, HMG/N

In context of Nepal, one of the most possible sector of investment is hydropower. The foreign investment is necessary for exportable hydroelectricity on the other hand, domestic investment is necessary for internal consumption of electricity. But state of Nepal is unable to manage this yet (Thapa, 2019). The Nepalese policies related to hydropower has been fully failed after promulgation of Electricity Development Policy, 2048. Because the distinguished companies related to hydropower which kept concern about Nepalese hydropower have not unable to invest capital for construction. Some of experts of Water resources also criticized foreign direct investment enters to develop hydroelectricity. According to former minister of Water resources of Nepal Deepak Gyanwali the center of foreign investment is not first priority for Nepal. He added that Foreign investors deny to come in Nepal for invest in hydro sector if Minister or ambassadors of Nepal request to invest in Nepal. (Gyanwali, 2009). According to Krishna Prasad Sighdhyal in context of Nepal, as in politics there was dominant/influential role in hydropower development. (Sighdhyal, 2017).

#### **4.2.2 Role of International organizations in Hydropower Generation in Nepal**

There is scope for internationalization of the issue by involving multilateral organizations, eg. The World Bank, GEF, UNDP, UN or any influential and

resourceful western government; it is noteworthy that the UK and the USA have already shown an interest (Upreti, 2006, p. 167). These institutions are capable of making a breakthrough in issues of this magnitude, in terms of economics, technology and politics (Upreti,2006,p.167).The only aim should be to achieve broader cooperation between all riparian states and to gain maximum benefits from these resources. The motives behind such external involvement should be considered to be positive regarding it not as external interference, but rather as external cooperation (Upreti, 2006, p.168). As clean source of energy the strong international support has been achieving for hydropower project and carbon trade. The decentralized production decreases the risk of energy system. (Devkota &Chaulagai, 2018, p.6).

#### **4.2.2.1 Japan International Cooperation Agency (JICA)**

The construction of all hydropower projects proposed by Japan International Cooperation Agency (JICA) in the mid-80s can increase hydropower productivity and aid socio-economic development in Nepal. If these projects are operated to their fullest potential, about 30, 000 GW hours of hydropower could be generated annually in the basin. This is about 17 times the total energy Nepal imported from India in the fiscal year 2015-16, and will lead to the possibility of exporting surplus energy (Bhattarai & Nepal, 2017, p.7).

#### **4.2.2.2 World Bank (WB)**

World Bank has been involving in hydropower generation sector of Nepal and other countries of South Asian regions. Government of Nepal performed Arun –III Agreement with World Bank. Burt Due to political conflicts of Nepal World Bank Cancelled that project. World Bank also has been showing its concern about resolution of water related disputes. For illustration World Bank has made an approach with a view to involvement in the resolution of the Ganges disputes; it was reported that Bangladesh welcomed it, but that India refused it asserting that it was a bilateral issue (Upreti, 2006).

#### **4.2.2.3 Asian Development Bank (ADB)**

Asian Development Bank will be supporting is the 630 MW Dudhkoshi Hydropower Project the reservoir-type hydro-project.

#### **4.2.2.4 Kyoto protocol.**

The earth is getting warming day to day due to human activities with industrialization by modern technology and consumption of fossil fuels. This phenomenon directly and indirectly alters the global atmosphere. In the purpose of reduce greenhouse gas emission on 11 Dec.1997Kyoto protocol has signed and ratified by 141 countries at the Kyoto city of Japan and the protocol adopted by cop-3 of United Nations Frame Work Convention on Climate Change(UNFCCC). This protocol was open for signature on 16 March1998 by the parties of UNFCCC during one year.

Philosophically Kyoto protocol seeks to reduce environmental pollutants of altering environmental freedom of citizens. The official meeting of all parties of the Kyoto protocol and observer's as the part of UNFCCC in every years is the conference of the parties. In UNFCCC one principle is agreed that developed countries have to pay billions dollars and supply technology to other countries for climate related studies and projects. Kyoto protocol came in to force on 2005 February16.

#### **4.2.2.5 Copenhagen Conference (Summit)**

United Nation's FrameWork Convention on Climate Change Conference (UNFCCC) held on 2009(Sept. 7 to Sept.18) at Copenhagen, Denmark simply named as Copenhagen summit or the conference. Even though this summit was looking as the replacement of 1997's Kyoto protocol with signed to in new treaty and alsohoped for more achievement in other sector of climate change. theoutput was limited to only simple decision recognized that climate changes to greatest challenges of the present days and this temperature should control under 2<sup>0</sup> c.But the document is not legally binding to CO<sub>2</sub>emission. (Siwakoti,2071,pp.347-348).At the fifth Magdeburg,Germany Environmental Forum held on 2008 Under the United Nations Environmental Programme(UNEP) for the establishment of infrastructure for electric vehicles. Technology roadmap will address barriers to technology transfer, cooperative actions on technologies and key economic sector, andsupport. Technology Action Programme (TAP) efforts underUNFCCC focusing on electric vehicles and clean energy(solar,wind,and hydropower).

## **4.2.3 Role of Neighboring Countries in Hydropower Generation in Nepal**

### **4.2.3.1 Bilateral Cooperation in Hydropower Generation**

#### **4.2.3.1.1 Nepal-India Bilateral Cooperation**

#### **4.2.3. 1.2 Agreements between Nepal and India related to Hydropower**

##### **4.2.3.1.2.1 Koshi Agreement (1954)**

Agreement between His Majesty's government of Nepal and the government of Nepal concerning the Koshi Project, 25 April 1954. The treaty was subsequently amended on 19 December 1966. As far back as 1779, certain British officials visited the Brahchhetra area along the Koshi river in Nepal, but nothing concrete developed in terms the taming the river(<http://nepaliwater.blogspot.kr>,2013). In the process of building the 1.1 KM barrage in Nepal, about 41 square KM of Nepalese territory was submerged in the upstream region. The Indian government offered Rs. 30 million to construct a separate canal on the eastern side for the benefit of the Nepalese in the Terai region. However, the Nepalese government used this for the construction of the Trishuli-Hydro-Electric Project located north of Kathmandu in Nuwakot district (Ibid). In November 1964, the Indian government extended an additional Rs. 40 million for the construction of Charta Canal Project as part of the Koshi Agreement to provide irrigation facilities for 66, 000 hectares of land in those two district east of the Koshi River (<http://nepaliwater.blogspot.kr>, 2013). Subsequently, the Nepalese government further increased irrigation Facilities to 41, 800 hectares of land in Morang and Sunsari districts at the cost of US\$145.5 million, with the support of the World Bank. The Indian feeling is that the Nepalese authorities on many occasions have stymied effective water cooperation for narrow political gains (<http://nepaliwater.blogspot.kr>, 2013).It was constructed between 1959 and 1963 on the Nepal side of the Indo-Nepal border for the purpose of irrigation, flood control and hydropower generation. It has 45 spurs, 500 m apart, on the eastern embankments in Nepal. The Koshi is a 729 Km long river, obtaining near Mt. Everest from the world's highest glaciers-on the Tibetan plateau and in Nepal. The Koshi enters Bihar (the northern most side of India) and finally ends at the confluence of Ganges travelling from Nepal (<http://nepaliwater.blogspot.kr>,2013).highly prone to seasonal variations in flow and sediment charge, the Koshi notorious for devastating downstream floods (Nick& Prasai, 2012,para.4).

The validity of the revised Koshi Treaty has been amended to 199 years from the previous 99 years. It is quite obvious that this amendment serves solely Nepal's interest. The amended Koshi treaty would allow Nepal even if Nepal have to follow time-consuming path to implement on Nepal's various projects in the Koshi basin to utilize the entire dry season flow of the Koshi for irrigation exclusively in Nepal in the event the government of Nepal and India failed to reach an agreement on development of Very large multipurpose projects benefiting both Nepal and India. Strangely some of Nepalese water experts still consider that it was a mistake to amend the treaty to 199 years. They even blame King Mahendra for the amendment of the validity of the treaty to 199 years. They allege that the validity of the treaty was amended under Indian pressure (Thapa, 2013).

According to article 4 of Koshi treaty, HMG shall to obtain for use in Nepal any portion up to 50 % of total hydro-electric power generated by any power house situated within 10-mile radius from the barrage site and constructed by or on behalf of the Union, as shall from time to time determine and communicate to the Union. Provide that 'HMG shall communicate to the Union any increase or decrease in the required power supply exceeding 6, 800 KW at least three months in advance if any power to be supplied to Nepal pursuant to the provisions of this sub-clause is generated in power house located in Indian territory, the Union shall construct the necessary transmission line or lines to such points at the Nepal-India border as shall be mutually agreed upon. The tariff rates for electricity to be supplied to Nepal pursuant to the provisions of this clause shall be fixed by mutual agreement (Madhuban Prakashan, 2065, pp.222-227)

According to Article 6 of Koshi treaty HMG will receive royalty in respect to power generated and utilized in the Indian Union at rates to be settled by agreement hereafter: provided that no royalty will be paid on the power sold to Nepal as per these provisions Nepal has been receiving power from Kataiya Powerhouse, which is built on the eastern canal of the Koshi barrage at Kataiya. According to Nepal Electricity Authority (NEA) Nepal received about 30 million units in the fiscal year 2005-06. Since the commissioning the Koshi / Kataiya power station for power generated and utilized in India, no royalty has been paid to Nepal according to clause 4 (ii) of the amended agreement on Koshi "HMG shall entitled to obtain use in Nepal

any portion up to 50 % of total hydro-electric power generated by any powerhouse situated within 10 mile radius from the barrage site and constructed by or on behalf of the union” (Madhuban Prakashan,2065)MG was to communicate to India any increase or decrease in the required power supply exceeding 6, 800 KW at least three months in advance, India was to construct necessary transmission line or lines to such points as the Nepal –Indian border as shall be mutually agreed upon and the tariff rates for electricity was to be fixed by manual agreement (Dixit & Basnet, 2005).Nepal pays Rs.4.00 /kwh for electricity supply received. this particular rate is a subject of discussion on meeting on power exchange between Nepal and India, when Indian delegation presses to make the tariff at “par” with the rate of Rs. 5.60 at 33 KV level Nepal gets about 1, 100 Mwah energy from two feeders in east Nepal at 132 KV (Kataiya) and 33 KV (Rajbiraj) for seven months beginning November. The issues of royalty need to be reconciled while the power received from India as part of the Koshi agreement needs to be accounted –for and clarified in Nepal’s annual electricity budgeting (Dixit & Basnet, 2005, p.23).

From the legal point of view, significant changes were made in the agreement, such as the right to divert water from the tributaries, Nepal’s involvement in the project implementation, and less beneficially, the lease for land prescribed for 199 years. Despite this, even after the revised agreement and its execution, the original intension to bring these benefits to Nepal has not fully materialized. The Chatra inundation Canal which was proposed to irrigate 66, 000 ha of land in Nepal, has in the event only led to the irrigation of 10, 000 ha. Moreover, it was felt that irrigation and flood control benefits to Nepal from the project would have been greater had the barrage site been located further upstream at Brahchhetra (Varghese, Iyer, Ahmed, Pradhan & Malla, 1994, pp.31-33).

#### **4.2.3.1.2.2 Gandak Project Agreement (1959)**

Agreement between His Majesty’s Government of Nepal and the government of India on the Gandak irrigation and Power Project, signed at Kathmandu 4, December 1959. The treaty was subsequently amended on 30 April 1964. The Gandak Project Agreement is third agreement that was constructed to bring India benefits i.e. flood control, irrigation and hydropower. On the Gandak, a barrage was constructed on a reach of river, which forms the boundary between India Nepal. The project was

to provide irrigation to a gross command area of 1, 340, 000 ha in Bihar, 500, 000 ha in Uttar Pradesh (both Indian states) and 63, 000ha in Nepal. Nonetheless, in relation to the criticism, it has also been argued that in those projects India has invested a huge amount of money, manpower and technology, and that it is therefore natural that she should accrue more benefits than Nepal (Varghese, Iyer, Ahmed, Pradhan & Malla, 1994). On the other hand, India developed several irrigation projects damming the rivers along the Nepal border without providing the requisite information; consequently, these projects have submerged large part of Nepalese territory (Pandey, 1999). From a legal standpoint, Nepal's entitled to "equitable and reasonable use" has been explicitly denied in these treaties, contrary to the principles of Article IV and V of the Helsinki Rules and Articles 5, 6 and 7 of UNCILW. For example, Nepal's share of irrigation was less than 3% of the total area watered by Koshi and the Gandak scheme (Subba, 2001). Nevertheless, from an academic and legal point of view, one sided criticism of these treaties does not facilitate future development, and due credit should be given for these agreements were carried out with sovereign consent and incorporated subsequent amendments accordingly. The India authorities closed down power production from the center halted after water supply to the canal in March earlier this year. With power production not possible in the past three months the center has been losing revenue worth Rs. 8000, 000 in a day. As per the Gandak agreement reached in 2016 B. S. the Gandak Hydel Center was established to produce 15 MW of power everyday (The Himalayan Times, 2015).

#### **4.2.3.1.2.3 Integrated Mahakali Agreement including Sarada Barrage**

Treaty between Nepal and India concerning the integrated development of Mahakali River including Sharada Barrage, Tanakpur Barrage and Pancheswr Project, 12 February 1996, signed at New Delhi. Mahakali is a principal tributary of the Ganges and border river between Nepal and India. This river is also known as Sarada in India. The Mahakali Treaty was signed on 12 February 1996 (it come in to force on 5 June 1997) between Nepal and India concerning the integrated development of the Mahakali River, including Sharada Barrage, Tanakpur Barrage and the Pancheswr multipurpose project. Of these, Sarada Barrage and Tanakpur Barrage were completed in 1920 and 1992 respectively. This Treaty absorbed the regime established by the 1920 Sarada agreement (article 1) and 1991 MOU and 1992 joint Communique for



Tanakpur Barrage (Article 2). Article 3 of Treaty endorsed the idea of constructing Pancheswr multipurpose Project (PMP) (<http://www.internationalwaterlaw.org>, p164). Hence, from a structural view point, the Mahakali River, the Sarada Agreement, the Tanakpur Agreement and the PMP. The Treaty is valid for 75 years from the date it came in to force (Article 12, Paragraph 2). In Nepal, this treaty attracted many street protests, political maneuver, and was ultimately ratified by the parliament with a two third vote (<http://www.internationalwaterlaw.org>). The Mahakali Treaty of 1996 has become almost dead since it was signed 23 years ago. It has not any yielded desired fruits and that is why many charge that it has just legitimized Indi's unilaterally constructed Tanakpur Barrage., Nepal many professionals feel that due to the increasing price of oil, India wants to capture Nepal's hydropower before she realize its strategic value Water requirement in the days to come is going to increase (<http://www.internationalwaterlaw.org>, p.164).The 1991 Tanakpur Barrage Agreement was signed in a form of Memorandum of Understanding between the two Governments. It expanded the scope of the original Sarada Project to cover the Tanakpur Hydropower Projects on the same river, work on which had already commenced in 1988. The Nepali Supreme court as it was never presented for ratification before the parliament as required for under the 1990 Constitution declared this agreement unconstitutional. The agreement secured the use of Nepali territory covering an area of 2, 9 hectars, to build a 577-meter long afflux bund to generate "the desired amount of electricity for India". According to Article 3(1) of Mahakali Treaty the project shall, as would be agreed between the parties be designed to produce the maximum total net benefit. All benefits accruing to both the parties with the development of the Project in the forms of Power, irrigation, flood control etc. shall be assessed. An official report on the Pancheswr Project, which plans to irrigate huge swathes of land and generate more than 6, 400 MW of shared hydropower, has yet to be prepared for dissemination and review, even though 23 years have passed since the signing of the Mahakali Treaty in 1997. The writers of agreement originally intended the whole project to be completed within eight years, and eight, not even a report has been filed on the construction.

#### 4.2.3.1.2.4 Other Agreements

The minister level energy meeting of Nepal and India held in Pokhara on 2 January 24, 2019 approved the proposed related to Energy Banking prepared by Nepal Electricity Corporation and Central Electricity Corporation of India jointly. According to nature of demand and supply of energy of Nepal and India led towards energy bank. That agreement assisted to solve the problem created by additional electricity during rainy season in both countries.

Surya Nath Upadhyaya analyzed that the role of India towards SAARC countries has been remaining as hegemonic. So that, in SAARC any substantive issue cannot be proceed. India has habit to present own interest and stand it is bad fact (Upadhyaya, 2012). He further writes Nepal's geographic location create obligation to work together and interdependency over each other. But India has been taking benefit of the size of population and geography and economic and military power etc. India has been taking benefit monopolistically from all of the water related treaties out agreements (Upadhyaya, 2012,). India has been creating regarding unity of Nepal wave resources. The negotiation of two parties means to receive benefit reciprocally and with equality. But unfortunately, Nepal has not been feeling Justice and equality. India has been looking only her interest (Upadhyaya, 2012). He further writes several years passed after concluded Mahakali treaty. But DPR of Mahakali treaty have not made till this date Nepal already cheated in Koshi and Gandak treaty by India. In context of Mahakali treaty, India has not showing and activities. So that, Nepal has been cheated by India while preparing Pancheswr project.

Indian has been imposing unnecessary intervention while developing water development. According to Indian viewpoint which issue is in favor of Indian interest, also in favor of Nepal. India wants to keep Nepal within umbrella of India. India has been influencing energy, water resources and other sectors (Upadhyaya, 2012, p.250). Upadhyaya further writes India has been providing high priority to water as the national security. India policy are afraid from future problems of water (Upadhyaya, 2012, p.250). According to few Indian specialists India prepared river linked Project (RLP). To fulfill need of water in future. But India keep secret this project. Nepal also not asking about this project due to Indian hegemonic behavior (Upadhyaya, 2012, pp.254-255). India want to explain water related laws according to its hegemonic

presence in south Asia (Upadhyaya, 2012). India has been launching strategy to interfere all of the possible projects related to water resources and she has strategy to permit to conduct any projects only if she will be benefited from these projects (Upadhyaya, 2012). On the other hand, India has been trying to obstruct unification of issues of water resources and electricity project. India might be prepared to perform agreement about electricity project but India do not want to conclude any agreement related to utility of water resources. In addition, water resources are linked with national security. So that India do not want to make policy and regulations related to division of water resources because India want to central over all water resources of Nepal directly and indirectly. India went to control over water by interfering internal affairs of own neighboring countries. From above facts, it is clear that India want to control over all water resources projects.

#### **4.2.3.1.2 Nepal-China Bilateral Cooperation**

China has also get opportunity to construct Budhi Gandaki and West Seti projects after second people's movement 2006. There are some comments and criticism about Chamelia hydropower project, which was estimated, to complete within 4 years but it takes 12 years for completion. On the other hand, the input was estimated Rs. 12 Crore but input was increased to 55 Crore. Similarly, some critics and commentator mentioned that the Upper Trishuli -3 A tendered owned by Chinese company Gejuwa was also problematic (Dhakal, 2019).

#### **4.2.3.1.3 Nepal-United States of America Bilateral Cooperation**

Nepal and United States of America (USA) established diplomatic relation on 1947 A. D. Us established Embassy in Kathmandu on 1959 AD.

Nepalese foreign Minister Pradeep Kumar Gyanwali met with US secretary of state, Mike Pompeo on December 19, 2019 during official visit of Nepalese Foreign Minister Pradeep Kumar Gyanwali to United States of America. During this meeting both foreign ministers talked about enforcement of Millennium Challenge Corporation, issues about making Indo- Pacific region free open and prosper, possible roles of Nepal in other global issues etc. In addition, in this meeting both foreign ministers talked about bilateral relations between Nepal and USA and cooperation,

development priorities of government of Nepal, peace process of Nepal, Development aid, trade, investment and concerning matters of regional and global issues etc.

#### **4.2.3.1.3.1 Millennium Challenge Corporation (MCC)**

The government of USA has more than forty agencies are formed to providing the foreign aid in different sectors as to support peace, development security and humanitarian relief. There are some agencies which are dependent directly with government off USA and someone agencies are independent roles. The millennium challenge corporation is one of the independent agencies formed by congress in 2004 AD. The categories to select the aid recipient countries are based developing countries, strategic related with United States and war recovering countries. US-Nepal friendly relation has been continuing since seventy years old relations without disputes to each other. Before Millennium Challenge Corporations, Nepal has obtained aid through US AID program but nowadays US has changed the aid policy in to Millennium Challenge Corporation (MCC) with new provisions. Under MCC Millennium Challenge Compact (account) program has active since 2010 AD in different level with exploring, discussions and negotiation. Now Nepal and US government have agreed to install a mega electricity transmission line and carry out maintenance on 300 Km roads on 2017 July 30. According to agreement US government will provide \$ 500 million in grants for the two projects. The assistance provided by MCC will be a record high for Nepal from a single development Partner. The Nepal government's commitment amount for the two projects is \$130 million. A total amount of \$630 million will be mobilized for the projects. Nepalese government officials believe implementation of the transmission line project will be both an opportunity and a challenge. It's an opportunity because the transmission line will help to providing the electricity distribution system and also facilitate power exports and imports medium. Maintenance of the roads enhances connectivity. Millennium Challenge Account –Nepal is an agency formed by the government to implement and manage programs financed by the MCC. MCA Nepal has announced that the energy into force (Elf) for the implementation will begin from June 30, 2020.

Received millennium challenge account is not final step of implementation. There are still someongoing misunderstanding and debates regarding the specifics of the project and the current version still might not be the final implemental

version. Due to the project location occupying cross border the US wants to ratify the project through parliament of Nepal while the government of Nepal has been delaying the process to submit the bill in parliament. According to American Ambassador Randy W. Berry Nepal asked the United States to develop an MCC compact, Nepal cannot develop hydropower without the market to pay for it. That is why MCC project focus on construction lines that will bring Nepal's power to the consumers who will pay Nepal good money for it (Berry, 2019). According to former Ambassador of USA to Nepal Alaina B Teplitz the United States Millennium Challenge Corporation (MCC) has estimated that the required investment to make this dream a reality would amount to at least \$3 billion a year, and the US was pleased this year to provide a \$ 500 million grant to Nepal to move in this direction (Teplitz, 2017, p.6). Present American Ambassador to Nepal added that it is a simple fact of geography and Economics that means India. If Nepal wants to sell power to Bangladesh, it will require an agreement with India. The reason why the MCC compact requires a cross –border transmission line agreement with India is just geography and Economics (Berry, 2019, p.6).

According to MCC's Country resident country director for Nepal Troy Kofroth a country must pass the scorecard before it can be considered by MCC's board of directors to receive MCC compact assistance. Nepal has passed the overall scorecard every year since 2012. As a result of its strong policy performance, Nepal was selected as eligible to develop a compact in December 2014. And in September 2017 Nepal signed the \$500 million MCC compact (Kofroth, 2019)

The persons who doubt on some issues also claimed that the MCC project is also part of the Indo-Pacific Strategy (IPS) of USA. They also added that MCC is also military Strategy against China and India. Some of them also claimed that MCC is project lunched by USA to counter the Silk Road project of People's Republic of China (PRC) and they argued that IPS and MCC are strategy of USA to balance the influence of China in Indo-Pacific region. According to Nepali analyst Hari Roka India has been launching "Look East Policy "by cooperating with newly industrial countries of South Asia. So that USA has been launching Indo Pacific Strategy by emphasizing India as the Center after measuring Power, capacity, competition and Economic growth in South Asian region. So that MCC is also accessory economic

program of IPS. So that MCC was not and is not Military interest without economic package (Roka, 2019, p.7). According to Chandra Shekhar Adhikari It seems that there has been discussing about Indo-Pacific Strategy from 2017 but there has been discussing about this issue from long time so that other countries also had to clear about it. By understanding that matter Australia, Japan and India has been standing with USA. The Main strategy of USA is to use places of Indo Pacific Ocean and to increase cooperation with these countries (Adhikari, 2020, p.7). There are mainly two kinds of debates raised. Firstly, the different documents issued by United States of America by US incentive laws during promulgation of Indo-pacific Strategy (IPS). Secondly while it enters in to Nepalese parliament the peoples analyze it differently. Mainly there are two kinds of debate. Firstly, it comes as political issue. Among different documents issued by America one document was issued by the Trump Administration in 2017 A. D. as “reform in Incentive Clauses”. MCC has been using as the part of Indo-Pacific strategy in different country. The annual report of US Departments of Defense published in 2019 Mentioned that the MCC of Srilanka and Mongolia are parts of IPS. While US mentioned MCC as the part of IPS Geopolitically aroused questions that are Srilanka and Mongolia parts of Indo-Pacific region or not? If US government declared the MCC was not part of Indo-Pacific Strategy then it would be cleared at that time (Adhikari, 2020, p.7). On the other hand, ten points document released by embassy of US of Nepal mentioned that there was no necessary to perform another agreement but there was mentioned that MCC is not part of IPS.

Even though in different angles disputes are arouse about ties agreement, these projects which are selected by government of Nepal are high priorities and the amount of aid is attractive. It will better to negotiate with USA if any clause of agreements is against of our sovereignty and security rather than decision making by guess. Why we are debates with IPS (Indo-Pacific Strategy) and Belt and Road Initiatives (BRI) more than our necessary. We must believe more practice rather than constructive logical statements. We must adjust our habits and behavior with times. This is time of technology and communication but no time of traditional thought and mind set expression. Our future and prosperity is depending with us. Zero sum game is for all state actors in international realm with their competitors. We must catch the opportunity when it is on the pipe line of service delivery.

#### **4.2.3.1.4 Nepal-Bangladesh Bilateral Cooperation**

Nepal and Bangladesh are two close friends of SAARC region. Nepal and Bangladesh has been continuing dialogue about bilateral cooperation about hydropower generation. The bilateral agreement about inter-state transmission line has signed between Government of Nepal and Bangladesh.

### **4.3 Role of Government Institutions of Government of Nepal in Hydropower Generation**

#### **4.3.1 Role of Government of Nepal Ministry of Energy, Water resources and Irrigation in Hydropower Generation in Nepal**

Ministry of energy is responsible for utilization and management of hydro power potential by production of energy for the expansion of industrial and economic activities. The rural and alternative energy section works under policy & Foreign Coordination Division of the Ministry of Energy.

#### **4.3.2 Role of Government of Nepal Electric Authority (NEA) in Hydropower Generation in Nepal**

The primary mission of Nepal Electricity Authority (NEA) is to generate, transmit and distribute adequate, reliable power by managing all generation, transmission, and distribution facilities in both interconnected and isolated power system in the country.

#### **4.3.3 Role of Department of Electricity Development (DOED) in Hydropower Generation in Nepal**

Department of electricity development (DOED) is responsible to develop and promote electricity sector and for implementation of overall government policies related to power/electricity sector. The major functions of the Department are to ensure transparency of regulatory framework, accommodate, promote and facilitate private sector's participation in power sector by providing "One Window" service and license to power projects. (Shresth, 2017.p.2)

#### **4.3 .4 Role of Alternative Energy Promotion Center (AEPC) in Hydropower Generation in Nepal**

Alternative energy promotion center (AEPC) was established as a national focal agency with the objective of developing and promoting rural and RETS in Nepal (SAARC Energy Center, 2015)

#### **4.4 Role of Private Sectors in Hydropower Generation in Nepal**

Private investment is not flow in unless there is proper infrastructure, because investors look for reliable electricity supply to run their manufacturing facilities, good transports network to move inputs and manufacture goods, and proper water supply.

The condition of development of hydroelectricity is very good in comparison to other sources of energy in Nepal. In more than 100 years long history of energy development there is not only participation of public sector but also private sector as well (Devkota &Chaulagai, 2018).

In context of Nepal, private sectors of Nepal have been coming frontline forcefully to develop river current based hydropower projects. Among them 2501 MW are constructing. 2581 MW are in process of fiscal management process. More than 5000 MW are in level of PPA,so that, the quota of Watershed model based project attempt to fulfilled (Thapa, 2019). The private sectors investors feeling difficulties to construct semi river basin model projects of hydropower so that they cannot construct river basin model hydropower. If state provide subsidy to private sector they can also construct river basin projects as well. So that as their nature the river basin projects are prohibited to private sectors. The private sector constructed Watershed model hydro project (Thapa, 2019).

Nearly 456 MW including Upper Tama Koshi Projects from Private sector and 200 MW electricity has been producing from public sectors. But these productions unable to maintain demand of winter season and excessive production produce than demand in summer season. So that NEA has been feeling headache about excessive amount of electricity of summer Season. NEA has been planning to manage additional electricity production by means of utilization in means (vehicles) of transportation (Thapa, 2017).



#### **4.4 .1 Role of Independent Power Producers Association of Nepal (IPPAN) in Hydropower Generation in Nepal**

Independent Power Producers Association of Nepal (IPPAN) has been preceding its activities as the representatives of the private sectors of the Nepalese energy sector. It launched two days' Hydro event management services. On January 5 to 7 2018 coordinate with Nepal government, national planning, commission and ministry of energy and ministry of environment. It has been trying to create good forum for all concern parties related to hydropower development (The Himalayan Times, 2018, January.5).

#### **4.5 Contribution of Nalsing Gad Hydropower Project in Development of Hydroelectricity Generation Sector in Nepal**

##### **4. 5.1 Present Scenario of Energy Production in Nepal**

According to Economic survey 2018/19 till mid-March of fiscal year 2018/19 77.8% of total population gained electricity (Economic Survey, 2018/019).

Till mid-march of 2018/19 total electricity production increased to 1, 142 MW. During this period the total transmission line have extended to 3908 circuit KM and distribution line have extended to 144 thousand Kilometer. Until this date the out of total connected electricity of 1.142 of which 1029.58 MW from hydropower and generated from medium and small scale hydro plant is 32 MW likewise, 561.0 MW electricity projects are owned by National Electric Authority and 522 MW projects are owned by private sectors (Economic Survey, 2018/019). Till mid-March of FY 2018/19, 1834.87 GW hours of electricity has been imported from India to Nepal to reduce load shedding. During FY 2017/18 the total electricity imported from India was 2581 GW hr. Still mid-July of FY 2018/19, the total electricity generated from Gandaki province was 481.20 MW and no electricity projects are operating in province no. 2 (Economic Survey, 2018/019).

**Table 4: Province Production of Electricity**

S.N.	Provinces	Megawatt
1	1	162.29
2	2	-
3	3	362.21
4	Gandaki	481.2
5	5	21.17
6	Karnali	7.16
7	Sudurpaschim	40.10
	Total	1074.13

Source: Nepal Electricity Authority, FY 2018/19 till mid-March FY 2018/19

At present, 6 municipalities and 37 rural municipalities from Karnali Province and 4 municipalities and 11 rural municipalities from Sudurpaschim Province do not have access to electricity, thus further investment is needed in this sector to achieve the sustainable development goal of making easy access to energy to all population by 2030 AD (Economic Survey, 2018/019).

By mid-March of FY2018/19, the electricity leakage has decline from 20.5% of FY 2017 /18 to 17.9%. The gap in demands and supply of electricity during FY 2017/18 was 357 MW while this difference has been reduced to 20 MW to 20 MW by mid-March of FY 2018/19 (Economic Survey, 2018/019). The production of hydroelectricity, which was 1074.1 MW in FY 2017/18 has increased to 1083 MW after the addition of 8.9 MW by mid-March of the current FY.

**Table 5: Hydropower projects under construction to be completed in FY 2019/20**

S.N.	Project	Capacity	District	Promoter
1	Upper Tamakoshi	456	Dolakha	Upper Tamakoshi Hydro. Pvt. Ltd.
2	Pikhuwa Khola	45	Bhojpur	Eastern Hydropower Pvt. Ltd.
3	Khanikhola	40	Dolakha	Green Life Hydro Power Pvt. Ltd.

4	Dordikhola	27	Lamjung	Himalayan Power Partner Pvt. Ltd.
5	Tadikhola	5	Nuwakot	Hiraratna Hydropower Pvt. Ltd.
6	Mistrikhola	42	Myagdi	Robust Energy Pvt. Ltd.
7	Sanjen	42.5	Rasuwa	Sanjen Hydropower Co. Ltd.
8	Lower Khola	11	Dolakha	Universal Power Company Ltd.
9	Upper Sanjen	14.8	Rasuwa	Sanjen Hydropower Com. Ltd.
10	Rasuwagadhi	111	Rasuwa	Rasuwagadhi Hydropower Com.
11	Upper Khimti	12	Ramechhap	Himalaya Energy Development
12	Junbeshi	5.2	Solukhumbu	Dovan Hydropower Pvt. Ltd
13	Lower Tadi	5	Nuwakot	Buddhabhumi Nepal Hydropower Pvt. Ltd.
14	Khoranga Khola	4.8	Terhathum	Reliable Hydropower Co. Pvt. Ltd.
15	Khanikhola	30	Dolakha	RaRa Engineering Hydropower Pvt. Ltd.
16	Upper Parajul Khola	2.2	Dailekh	RaRa Hydropower Development Com.
17	Lower Solu	82	Solukhumbu	Solu hydro Pvt. Ltd.
18	Upper Dordipower	25	Lamjung	Liberty Energy Hydropower Pvt. Ltd.
19	Rukum Gad	5	Rukum	Rapti hydro and General Construction
20	Tangchhahara Small Hydropower	24	Mustang	Tangchhahara Hydro Pvt. Ltd.
21	Singuti Khola	16	Dolakha	Singuti Hydro Energy Pvt.

				Ltd.
22	Rauwa Khola	3	Khotang	Rawa Energy Development Pvt. Ltd.
23	Solar	25	Nuwakot	NEA
Total		1007.8		

Source: Ministry of Energy, Water Irrigation, FY 2018/19.

1007.8 MW of hydroelectricity will be added from the project to be completed by FY 2019/20. Hence the end of FY 2019/20 will generate 1,264 MW of additional electricity after the completion of hydroelectricity projects including the 456 MW Tamakoshi.

A total of 30.8 MW electricity has been produced by mid-April of FY 2018/19. Out of this, 22.0 MW was generated by Bagmati Sano Hydropower located in Makawanpur and Lalitpur districts, and 8.8 MW by Rudikhola Hydropower located in Kaski district (Economic Survey, 2018/019). A total of 1264 MW electricity will be generated from altogether 42 companies including those with the investment of Nepal government from NEA and its subsidiary companies and with the investment of private sectors by the end of FY 2019/20 (Economic Survey, 2018/019). By the mid-March of FY 2018/19 103 projects has completed their construction work of electricity transmission lines of 132 KV and other KVs (Economic Survey, 2018/019).

**Table 6: Status of Hydropower Production Permissions (up to Mid-March of FY 2018/19)**

S.N.	Categories	Number	Capacity (Megawatt)	Total capacity (Megawatt)	Remarks
1	Currently operating with production permission	15	11.24	1038.07	Less than MW capacity
		76	1026.83		Less than MW capacity
2	Under construction With production	25	19.73	7780.63	More than 1 MW Capacity

	permits	278	7760.82		Less than MW capacity
3	Application for production permit	1	0.48	1519.24	More than 1 MW capacity
		29	1518.76		Less than MW capacity
4	Permits for feasibility study	17	12.88	18193.55	More than 1 MW capacity
		284	18180.67		Less than MW capacity
5	Application for feasibility study	13	9.84	1046.36	More than 1 MW capacity
		20	1836.88		Less than MW capacity
	Total	643	2957780	29577.80	

Source: Ministry of Energy Water Resources and Energy, FY 2018/19.

By mid-March of FY 2018/19 a survey license to 284 large and 17 small hydro-electricity projects has been issued to NEA and other private sector companies to generate additional electricity of 1819 MW. By mid of FY 2018/19 various types of license have been issued to projects of generating 29, 578 Mw electricity (Economic Survey, 2018/019). By mid-March of FY 2018/19 various types of license have been issued to progress of generating 29578 MW of electricity. By mid-March of FY 2018/19, power trade agreement of 5320 MW electricity has been done with 246 projects of which 70 of them will generate 1305 MW. During the same period of current FY, a total of 2515 circuit KM of 131 KV and 1, 1, 60 circuit KM of 220 KV transmission lines are under construction (Economic Survey, 2018/019).

Out of total energy consumption, the ratios of traditional, commercial and renewable energy consumption have been 68.6%, 28. 2% and 3.25 respectively till mid-March of FY 2018/19 (Economic Survey, 2018/019)

**Table 7: Sector use electricity consumption (In Giga watt hours)**

S.N.	Sectors	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
1	Household	1571.39	1679.35	1792.95	2150.21	2403.63	1731.24
2	Trade	285.42	300.25	286.48	1735.05	2074.16	1553.90
3	Industry	1251.69	1352.15	1205.69	352.37	407.59	301.50
4	Others	387.82	411.96	433.85	587.06	729.21	515.32
	Total	3496.31	3743.71	3718.97	4824.89	5814.59	4102.08

Source: FY 2018/19 till mid-March FY 2018/19.

By mid –March of FY, the total electricity consumption in all economic sector was 4, 102 GW hours whereas it was equal to 5615 GW hours during the previous FY 2017/18. By the mid-March of the current FY 2018/19, the total energy consumption in household, industrial, trading and other have been 42.6%, 38.3%, 7.4% and 11.7% respectively (Economic Survey, 2018/019).

#### **4.5.2. Nalsing /Nalgad hydropower project**

The Nalgad hydropower project undergoing “Updating Feasibility Study, Detailed Engineering Survey and Design and Environmental Impact Assessment Study of Nalsing Gad Hydropower Project” precede by Nalsing gad Hydropower Development Committee and developed Nalgad Hydropower Company limited (NHCL).Nepal Electricity Authority (NEA) carried out the feasibility study in 2012. SMEC International Private Limited (SMEC) of Australia in joint venture with MWH International Ink of USA and in association with Nepalese firm Udaya Consultancy (P) Ltd conducted a study to update the feasibility study of Nalgad Hydropower Company Limited Updated Feasibility Study.(Final Report, 2019, p.1). The Nalgad hydropower Project is located on Nalgad in Jajarkot District in the Karnali province of Nepal. Nalgad is one of the main Tributaries of Bheri River. The project is a storage project with a 210 m high RCC (Roller Competed Concrete) CFRD (Concrete Faced Rock filled Dam)dam (Final Report, 2019, p.1). The storage creates a reservoir with total storage volume of 474 MCM and a live storage of 350 MCM. The main dam contains a spillway to pass a flood up to PMF, providing a crest width of 60 m. The dam site of the project is located just downstream of the confluence of Andheri Khola, which is approximately 9.25 KM upstream from the confluence of the Nalgad and the Bheri River and the Powerhouse is located on the left bank of Nalgad and the

Bheri River approximately 500 m upstream from the suspension bridge at Dalli (Final Report, 2019, p.1)

The water way consists of 8.3 Km long concrete lined modified horseshoe head Race Tunnel of diameter 5.85, a surge shaft of diameter 16 m and 171.95 m high, a 409.5.7 m long vertical drop shaft of diameter 5.85 and 794.0 m long steel lined pressure tunnel of 4.5 m diameter. Two underground caverns for power station and transformer and GIS, housing for PowerStation and transformer and GIS, housing 4\*104.25 MW vertical Axis Peloton turbine and generator sets with an installed capacity of 417 MW, utilizing a net head of 613m (Final Report, 2019, p.1).

#### 4.5.2.1 Contribution of Nalsing Gad Hydropower Company in hydropower Generation Sector of Nepal

The design net head of the project is 635.5 m which utilize 78.4 (meter)<sup>2</sup> /s to produce 417 MW the power station comprises of 4 vertical Pelton turbines each 104.25 MW installed capacity. The installed capacity is 417 MW, annual potential energy is 3655 Gwh, Firm energy 759 is Gwh, Secondary energy is 473 MW, total energy is 1232, average annual load factor is 33.7% dry Season Energy is 683 Gwh, dry season load factor is 37.4% (Final Report, 2019, p. 4).

**Table 8: Average monthly energy production**

S.N.	Month	Peak (time duration hours/day)	Preseason (in peak time Gwh)	Wet season firm energy (in peak time Gwh)	Secondary energy (peak time wh/que.)	Energy no usable the SNPs (Not in peak time Gwh/month)
1	January	9	116.3		0.00	0.00
2	February	9	106.1		0.00	0.00
3	March	9	116.3		0.00	0.00
4	April	9	114.9		0.00	0.00
5	May	9	-		0.00	0.00
6	June	1	-	12.5	0.00	0.00
7	July	1		12.5	0.03	12.6

8	August	1		12.9	0.03	147.6
9	September	1		42.5	0.02	183.3
10	October	1		12.9	0.00	90.0
11	November	1		12.5	0.00	396
12	December	9	116.3		0.0	0.0
	Annual		682.5	76.3	0.12	473.1

Source: Nalgad Hydropower Company Ltd. final report.

A revised option of Probable construction cost (OPCC) has prepared during the preparation of the updated feasibility study to reflect the many improvements and adjustment made to the project layout and ever more detailed assessment of the construction changes and logistics. The total cost is estimated to be US\$1, 130, 680, 735 without the transmission line and US\$ 1, 256, 552, 847 with transmission line cost (Final Report, 2019, p.6)

**Table 9: Cost components of Nalgad Hydro Power Project**

S.N.	Particulars	US\$ (with transmission line)	US\$ without transmission line
1	Civil works cost including primary works and internal stile access roads	642, 224, 067	612, 224, 067
2	Hydro-mechanical works	57, 106, 780	57, 016, 780
3	Electro-mechanical work cost	116, 196, 150	116, 196, 150
4	Cost of transmission line sub-station and switchyard	95, 417, 296	
5	Allowance for unlisted items and scope contingences	88, 085, 450	78, 543, 700
6	Mark-ups (contractors insurance programs Taxes, custom, escalating)	105, 037, 070	102, 413, 094
7	Project Administration and management	182, 573, 056	164, 286, 945
	Grand Total	1, 256, 552, 847	1, 130, 680, 735

**Table 10: Financial Analysis of Nalgad Hydropower Company Limited**



S.N.		With transmission line	Without transmission line
1	Project IRR	1.94%	3.36%
2	Equity IIRR	7.31%	10.10%
3	Project NPV for government at cost equity of 7.5%	(101.29)	82.56
4	Equity NPV for government at cost equity of 7.5%	(5.31)	76.39
5	Annualized average return on equity (ROE)	1.11%	2.12%
6	Annualized average return on investment (ROI)	-0.18%	0.7%
7	Benefit cost ratio	0.69	0.79
	Analysis	Not feasible	Feasible

Source: Nalgad Hydropower Company Ltd. updated feasibility study final report.

Hydrological and Meteorological stations have been established to acquire relevant data for this study. All the Meteorological stations are equipped with participation, temperature and humidity sensors. Five Meteorological stations have been installed, all with a telemetered online data system (Final Report, 2019, p.30). Similarly, the hydrometric station located at Kalital equipped with an online water level recording system. In addition, manual water level recording has been introduced the power station site at Dalli. Table 13 presents the basic description of the station.

**Table 11: Stations maintained by the Nalgad Hydropower Project**

S.N.	Station	Lat (DD)	Long (DD)	Dev. (DD)	Parameters	States
1	Dalli	28.794	82.794	865	Water level (Manual only)	Established 09 (Gauge 19 Nov. 2016 with paper avoiding to old)
2	Kalital	28.870	82.293	1400	Water	Staff gauges relocated on 19 Nov. 2016 with

						proper traveling to old gauges
3	Pahada Mulsam	29.00	82.209	2324	Precipitation, temperature relative humidity	Manual ran rain gauge installed on 2 Nov. 2016
4	Gothgaon	28.969	82.250	2094	Precipitation, temperature relative humidity	Manual rain gauge installed on 20 Nov. 2016
5	Ramidada	28.935	82.240	1905	Precipitation, temperature relative humidity	Manual ran rain gauge installed on 23 Nov. 2016
6	Ghartigaon	28.932	82.299	1905	Precipitation, temperature relative humidity	Manual ran rain gauge installed on 21 Nov. 2016
7	Dadagaon	28.80	82.290	1682	Precipitation, temperature relative humidity	Manual ran rain gauge installed on 19 Nov. 2016 with record installed 19 July 2016

Source: Nalgad Hydropower Company Limited updated feasibility study final report.

In the feasibility study carried out by NEA, three methods were carried out to assess the long-term flows in the project area. These are a) Specific discharge method b) regional Method and 3) transposition recorded flow (Final Report, 2019, p.33). NEA had considered the data from nine different hydrological stations. In this upgraded feasibility study, data from 14 different station were analyzed to assess the discharges at the Nalgad. The detailed of the calculation is provided in the Appendix 817. Following table shows comparable characteristics of these stations.

**Table 12: Hydrological data for stations with comparable character's to Nalgad**

Station No.	River	Area (km <sup>2</sup> )	Average eleven (A)	Basic ratio with Nalgad	Avg. annual precipitation (mm)	Avg. meason (mm)	Avg. annual precipitation (mm)	Average below 3000 (km <sup>2</sup> )	Area above 5000 (km <sup>2</sup> )
115	Naugra	203	1887	2.80	1980	1620	12.4		
120	Chamelia	1175	3073	0.48	1883	1472	56.3	598	82
225	Sinja	824	2900	0.69	1000	700	21.5		
286	Jarda	816	1452	0.70	1341	1070	13.1	811	0
340	Jhimruk	683	1656	0.83	1572	1278	27.0	501	0
406.5	Modi	601	3064	0.95	3175	2580	51.6	364	54
415	Aadhikhola	476	1197	1.20	2685	2194	29.9	418	0
430	Seti	582	2786	0.98	3565	2855	49.5	355	52
488	Madi	858		0.66	3500	2800	73.9		
448	Tadi	653	1725	0.87	2196	1837	39.4	552	0
602	Sabhya	375	1586	1.52	2122	1507	245	373	0
620	Baleth	629	3346	0.90	2658	1242	53.0	254	81
650	Khimti	313	2785	1.82	1892	1534	27.3	222	4
660	Likhu	823	2957	0.69	1592	1286	52.5	576	109
Average		644	2121	1.08	2226	1784	38.0	449	35

**Table 13: Annual to monthly energy distribution factors**

S.N.	Month		ROR and ROR	Storage
1	Baishakh	(Apr-May)	5.00%	11.00%
2	Jestha	(May-Jun)	8.00%	7.50%
3	Ashad	(June-July)	11.00%	6.00%
4	Shrawan	(July-Aug)	12.00%	6.00%
5	Bhadra	(Aug-Sept)	13.00%	6.00%
6	Asar	(Sept-Oct.)	42.00%	6.00%
7	Kartik	(Oct-Nov)	10.00%	6.00%
8	Mangsir	(Nov-Dec)	8.00%	7.50%
9	Poush	(Dec-Jan)	6.00%	11.00%
10	Magh	(Jan-Feb)	5.00%	11.00%

11	Falgun	(Feb-Mar)	5.00%	11.00%
12	Chaitra	(Mar-Apr)	5.00%	11.00%

Source: Nalgad hydropower Company Ltd. updated feasibility final report.

**Table 14: Summary of Anticipated Energy Production Statistics**

S.N.	Item	Value
1	Capacity (M.N.) (Maximum output at minimum head)	417
	Annual energy (Gwh/yr.)*	
1	Dry season firm (90% reliability**)	682.5
2	Wet season firm usable, 1 hr. per day operating	76.3
3	Wet season-secondary, within 1 hr. operating***	0.1
4	Total energy	1232
	Plant factor - Firm energy	20.8%
	Plow factor - Total energy	33.7%
	Value of energy	
	Dry season firm energy at 121s/kwh	82.58
	Wet season firm energy at 0.70/s/kwh	5.54%
	Secondary energy at 0.24/s/kwh	11.35
	Total annual value (millions)	99.27
	Present value, 50 year, 10% discount rate (millions)	991.42

Source: Nalgad Hydropower Company Ltd. updated feasibility study final report.

Using the 417 MW PowerPoint output capacity at minimum head, and specifying the firm energy estimates given table below. The reduction in energy production and value of overall production is summarized in following table (Final Report, 2019, pp15-116).

**Table 15: Summary of Impact to Project value with Increasing Minimum Release**

S.N.	Leakage (m <sup>3</sup> /s)	Environmental Release (m <sup>3</sup> /s)	Firm Energy	Secondary Energy	Annual Value of	PV**** Production
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			(Gwh/yr.) (Dry/wet)	(Gwh/yr.)	Product* (Millions)	Million
1	0.1*	0.5*	682.5/76.3	481.2	99.99	989.7
2	0.1	1.0	671.7/75.1	463.6	98.16	973.3
3	02.0	646.3/72.3	445.8	94.40	936.4	
4	0.1	3.0	617.5/69.1	431.8	90.38	896.1
5	0.1	4.0	590.5/66.2	415.9	86.51	857.7

Source: Nalgad Hydropower Company Ltd. updated Feasibility Study Final Report.

To ensure that there is no need to upgrade or to construct additional 400 KV transmissions lines passing through the regions between Jajarkot and Kohalpur during the next coming 20 plus year period. Nepal Electricity Authority has stated to the Nalgad hydropower Development committee (NHPDC) (agency of Ministry of energy) that the 400KV transmission line system between Nalgad power station side and Kohalpur needs to be constructed to a double circuit, quod moose conductor design standard (Final Report, 2019, p. 119). NEA is excepting as of 10 December 2016 the development of additional hydropower projects in the wider regions, around the Nalgad hydropower project location. These future hydropower projects are stated in following table.

**Table 16: Future of large hydropower development projects in wider Jajarkot (Karnali province) area.**

S.N.	Hydropower project	Capacity in MW	Remarks
1	Upper Bheri	85	Study in progress (NEA)
2	Thuli Bheri	121	Study in progress
3	Lower Bheri	60	Study in progress
4	Bheri-1	440	Study in planned
5	Bheri-2	243	Study in planned
6	Sani Bheri (Syarpudaha)	.90	Study in planned
	Total of above	979	
7	Utter Ganga*	300	Feasibility study (NEA)
	Total capacity	1279 or 1779	

Source: Nalgad Hydropower Company Limited Updated Feasibility Study Final Report.

The following table provides the general assumptions for economic and financial evaluation of Nalgad Hydropower Company.

**Table 17: General Assumption for Economic and Financial Analysis**

S.N.	Items	Units	Value
1	Plant (Project) service Life- Civil Works Electro- Mechanical Installations	Years	35
2	Capital Cost amortization term	Years	35
3	Average Annual Forced Outage Rate Including Maintenance Outage (FOR)	%	8
4	Fixed O & M (as% of Total Capital Costs of the Project)	%	1
5	Annual royalties		
	First 15 years for energy cost % of Energy Sales	%	2
	For capacity	NRs/kW/year	200
	After 15 years For Energy Sales	%	10
6	Benefits From Sale of Capacity and Energy		
	Energy Delivered During Dry Season	NRs/kWh	12.40**
	Energy delivered during wet season	NRs/kWh	7.10**
7	Annual Discount rate	%	10
8	Annual Interest Rate	%	7.5%
	Standard Conversion Factor (SCF) - it Reflect the Price Distortions in the local Market	%	0.9

9	Duration of Peak Hours (19 Both Wet and Dry Seasons)	Hrs./day	6
10	Duration of Peak Hours (in Both Wet and Dry Sectors)	Hrs./day	18
11	Interest during contraction (IDC)	JICA (50%)	
12	Moratorium Period	ADB (20%)	0.01
13	Repayment Period Door to Door (Inc. Mora	years	2.364%
14	Escalation (inflation) (Working that Annexed)	years	7
15	Import Duties (Applied to Foreign Costs: are Conducted to Local cost)	As per the historical escalation indexes from the Nepal Rastra Bank and India Market 2018	27%
16	Local development tax (Applied to Confers to be Local Cost)	%	Civil 2.68% M: 3.99% trans mark: 2.09%
17	Cost Borrowing of Govt.	%	1
18	Cost of Capital (WACC) for Financial Analysis	%	1.5
19	Corporate Tax Year of COD- 10 <sup>th</sup> Years of Operating	%	6
	11 <sup>th</sup> Year of 11 <sup>th</sup> Years of Operating	7.5%	2.728%
	15 <sup>th</sup> years of operation - 30 <sup>th</sup> year of operating	15%	
	Carry Forward of Cases for Comparable in the Construction of Power House, Generation and Transmission of Electricity	12 years	Nepal fiscal budget FY 2075/76 FY 2018/19

Notes: \*Capacity Royalties Escalated at 5% from 2011.

\*\*Energy Benefits Escalated at 3% for 8 years of f (ii)

Source: Nalgad Hydropower Company Ltd. Updated Feasibility Study Final Report.

The capital cost figures include contingencies, taxes and duties, escalation in accordance with the inflation scenario, interest during construction. this financial analysis is therefore equivalent to a public utility writing off profit against on-going capital expenditures (Final Report, 2019, p.338).The detailed financial cost estimates for the projects are presented below in two parts. The detailed project costs with Transmission Lines and without transmission lines are presented in following table (Final Report, 2019, p.338).

**Table 18: Detailed cost estimate of Nalgad Hydropower Project with and Without Transmission Lines**

**Nalgad-Hydropower Project**

**Exchange rate US\$ = 104 NRs.**

**Opinion of Probable Construction costs (OPCC)**

**Currency: USD United States - 2018**

S.N.	Item	Description	With transmission lines	Without transmission lines
1	1	Preliminary works and access road	125, 719, 176	125, 710, 176
2	2	Civil works	486, 514, 891	486, 513, 891
3	2.1	Main dam	322, 867, 540	322, 867, 540
4	2.2	Quarry	45, 407, 726	45, 427, 726
5	2.3	Diversion Facilities	4, 170, 887	4, 170, 887
6	2.4	Diversion Tunnel excavation	1, 868, 071	1, 868, 177
7	2.5	Cofferdams	3, 334, 560	334, 560
8	2.6	Spillway, chute and Energy Dissipaters	11, 536, 961	11, 536, 461
9	2.7	Intake and low level outlets.	18, 244, 775	18, 244, 775
10	2.8	Head Race Tunnel	40, 514, 843	4, 051, 843



11	2.9	Access Tunnel to Headrace	2, 373, 805	2, 373, 805
12	2.10	Shaft	6, 610, 065	6, 610, 065
13	2.11	Pressure shaft		
14	2.12	Power house and transformer	9, 248, 016	9, 247, 016
15	2.13	Tailrace tunnel and canal	6, 354, 767	6, 354, 767
16	2.14	Access Tunnel to power station	767, 639	7, 676, 329
17	2.15	Switchyard	318, 198	318, 198
18	3	Hydro Mechanical work	57, 016, 780	57, 016, 780
19	4	Electro Mechanical works	116, 196, 150	116, 196, 150
20	5	Transmission line of Substance	95, 417, 296	0
21	6	Running Subtotal (base cost)	880, 854, 293	785436997
22	7	Allowances	88, 085, 429	78, 573, 700
23	8	Running Subtotal (Base cost)	88, 085, 429	78, 543, 700
24	9	Mark-ups	105, 037, 070	102, 413, 094
25	10	Construction Cost (Item 8 flag)	1, 073, 976, 792	166, 593, 791
26	11	Project Administration and Management	182, 576, 055	164, 286, 944
27	12	Grand Total (Item10 + Item 1)	1, 256, 552, 847	84, 801, 055
		Cost range (-25%)	942, 414, 635	888, 010, 552
		Cost range (+30%)	1, 633, 518, 701	1, 469, 884, 956

Source: Nalgad Hydropower Company Limited updated feasibility Study Final Report.

The Project under reference is the construction and operation of Nalgad hydropower project with a total installed capacity of 417 MW. The project is expected to be in operation from January 15, 2026 as shown in following table (Final Report, 2019, p.349).

**Table 19: Project Time Lines**

S.N.		English year	Nepali year
1	Year of hydropower policy	2001	2058
2	Current year	2018	2075

3	NTP expected on 15 June 2020	2020	2077
4	COD is Jan 2016 (Construction period 66 March per 5.5 years)	2026	2083
5	Operation and Maintenance Period	2026	2083
6	License termination date	2056	2113
7	Fiscal year (1 <sup>st</sup> of Shrawan (Mid July) to last day of Ashad Next year (Mid-July)		
8	Month of submission of UFSR	Aug 2018	English year
9	Expected month of commitment of Constrains	Jan - 2020	English year
10	Construction Period (months)	6-6	Month
11	Expected Month of Completion of Construction	Jan - 2016	English year
12	Commercial Operation Date for the Project	Jan - 2026	English year
13	Evaluation period (35 years from COD)	Jun 2056	English year

Source: Nalgad Hydropower Company Limited Updated Feasibility Study Final Report.

The primary requirement for the project is the land. The land is required for the reservoir area and for the construction Sites and support facilities. Expected land requirement for the project is presented in following table.

**Table 20: Land Use of the Project Affected Areas**

S.N.	Land use category	Area in ha.	Percentage
1	Forests	164.5	19.9
2	Exposed rocks	51.0	6.2
3	Grasslands	101.2	12.2
4	Hillside cultivating	304.0	36.8
5	No data	1.6	0.2
6	River/lake	97.4	11.8
7	Shrubs	31.2	3.8
8	Road etc.	76.0	9.2

	Total	826.8	100
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Source: Land and Property Inventory Survey 2014.

The international economic benefits and costs were determined between the project alternatives “with project” and “without projects”. The difference between the costs and benefit between these two alternatives are calculated to get the incremental costs and benefit (Final Report, 2019, p.350). The economic benefit from sale of energy due to operationalization of the HEP. The benefit from sale of energy shall be same under both the alternatives (Final Report, 2019, p.350).

## CHAPTER-V

### 5. Findings and Conclusion

#### 5.1 Findings

- ) Power consumption varies significantly across South Asia with the region as a whole having per capita power consumption of 707 kWh in comparison to the world average of 3125kwh. Further south Asia has 706 million people without electricity out of 1.6 billion people globally.
- ) The existing intra-regional energy trade among SAARC member states are primarily limited to electricity trade between India Bhutan and India-Nepal on hydropower generation. The concept of SAARC grid is much envisaged by policy planners of the region from many years but the passiveness of SARRC is making unsure to implementation.
- ) The Koshi / Gandak agreement signed between Nepal and India of 1950s were not inspired any large visions of 'regional cooperation'; they were essentially projects conceived by India to meet its requirements for solve its problems. These agreements are unequal and not benefit for Nepal.
- ) It has been argued that in order to take maximum benefits from Nepal's water resources, India had applied pressure and used bargaining tactics, constantly pushing Nepal to agree on the Koshi project for the period of 199 years, in exchange for trade and transit treaty renewable every 5 years, whereas the life of a water resources project is normally considered to be 50 years.
- ) The government of Nepal aimed to produce 10, 000 MW within five years and 15, 000 MW within 10 years. Government of Nepal have planned that among these electricity, 10, 000 MW will have consumed with in Nepal and additional 5, 000 MW electricity will export to other countries but this plan is not concrete base of power generation and implementation.
- ) The Alternative Energy Protection Center (AEPC) and Nepal Electricity Corporation has been working with proper cooperation to produce and supply energy in present time. According to study of NEA among 753 local bodies, 100% electrification has completed in 50 local bodies. In 222 local bodies more than 90% electrification has completed. But in 117 local body's

electrification is still less than 5%. There is no electrification in few local bodies

- ) In this fiscal year as the practice of energy exchange Nepal export electricity toward India also.
- ) In starting phase of this fiscal year the access of electricity reached up to 88 percent peoples. Among these 78 % electricity has been supplying under the Nepal Electricity Corporation (NEA) and 10 % electricity has been supplying by means of Alternative Energy Protection Center.
- ) More than 12 % Nepalese people also have not access of electricity. Government of Nepal aimed to increase access of electricity in 100 % Nepalese people within two years. The government of Nepal also has target of electrification of 40 districts fully. Karnali Province is more suffering from electrification.
- ) According to The different sources of reports the consumption of per person energy is very low in comparison to international and regional level. The per-person consumption of energy in Nepal was 191 Unit last year. The per person consumption of energy consumption in present time is 267 Unit. Government of Nepal aimed to increase the per person consumption of energy to 700 Unit within four years. The aim of government of Nepal to increase per person consumption of Energy up to double i.e. 426 Unit in last phase of this fiscal year.
- ) Government of Nepal has already approved the master plan of construction of electricity transmission line. The East west 400 KV transmission line and transmission lines based on river basins also has been constructing. With aim of export of electricity in neighboring countries Nepal has concluded agreement with India to construct New Butwal-Gorakhpur 400 KV transmission line.
- ) The traditional concepts and policy draw backing the hydropower project construction pace.
- ) There is universal principle that in preliminary phase of economic development there is necessary of foreign Aid. It can be also proved from history of developed countries presenttimes. But there are very few countries which developed successfully by depending upon foreign aid entirely.

- ) Nepalese use energy consumption per capita as an indicator of living standard. Nepal is found critical like as developing countries like African countries. However, World Development report shows comfortable situation of developed countries (US and Europe) (Bista, 2011, pp.93-94).

Though Nepal is one of the richest countries in terms of water resources, there is increasing of hydroelectricity production in country is increasing every year but Nepal still depends on India to meet the seasonal deficit of electricity.

- ) As most of the hydropower projects in the country are run of the river type their generation capacity drops to one third of their installed capacity drops the winter season.
- ) Here findings two visions for hydropower generation: some scholar advices the purpose to power export while more scholar add to internal power consumption concepts.
- ) The different international organizations World Bank (WB), Asian Development Bank (ADB), Japan International Financial Cooperation Association (JICA) etc. have been assisting by providing grant or loan and technical support to Nepal for development of hydroelectricity sector.
- ) SAARC energy center attempting to co-operate among SAARC countries in energy development sector but due to less willingness of few powerful states it is passive.
- ) Nepal had concluded more than half dozen water and hydropower related treaty with immediate neighbor India including Koshi, Gandak, Mahakali and west Seti treaties since long time without effective progress.
- ) Nepal also signed Hydropower related treaty with private sector of the China According to that hydropower related agreement between Nepal and Chinese private sector forwards foreign direct investment of Chinese Private Sector in hydropower generation of Nepal. The national pride projects and locally important hydropower prefers like Nalsing Gad Projects also can be benefited by means of international cooperation and regional cooperation.
- ) At the previous Government of K.P. Sharma Oli, The Minister of Industry, Somanath Pandey made a policy to research petroleum in Dailekh and Terai belt, iron in Butwal Area and Uranium in Mustang and Makawanpur Area

with priority and the running government also priorities this plan and a research are going to running. Possibilities of finding these materials are seen positive.

- ) Hydropower generation is compulsory to import and installed heavy equipment, skillful manpower and collect foreign investment by international cooperation with cooperating with financial institution, consulting services and power plant establishment technologies.
- ) Generating Power for internal consumption in multidimensional uses character is more beneficiary than export to other countries.
- ) Even though reservoir types hydropower projects are more expensive than run of the river types project but the power generating by reservoir is stable power which can be used in establishment the industry, house fuel, travel services and water recharge, enhance in long term reservoir types hydropower projects are important.

## **5.2 Conclusion:**

Nepal is blessed with vast natural energy resources however their fruitful utilization for the wellbeing of its growing population is lagging behind due to the economic, geographical and techno political conditions. The potential could not be achieved due to political instability, inability to attract FDIs and delay in project execution over the last decade. However now with political stability (majority government), adequate experience and FDIs , Reservoir projects being developed and cross border transmission line completed (Dhalkebar-Muzzafarpur line) already connected Nepal can utilize its huge potential in hydropower to propel its economic growth towards a Developing Country (from LDCS) and be a regional player in fulfilling the energy demand in South Asia.

The Nalsing gad hydropower project has the detailed study project report to implementation of construction reservoir project. This project is environment friendly and governments' owner public project. We don't have empirical experienced to construct high dam project. This project will be role model of consisting power generating reservoir project in Nepal. The Nepalese both skilled and unskilled manpower employed, national institution of consultancy and consulting firm, and company will be participated in joint venture with foreign advanced company. The

national man power and institution and companies efficient to their skills of empirical joint experienced which will be the base of incoming days to construct high dam project. It is the medium type's reservoir project with the base of analysis the project cost to construction, power generation capacity, and the risk of the project and will be the role model project for Nepal. This project stepping up the high morale to build the other larger reservoir projects on own efficiency in future and to helping vanishing up the huge demand of fuel import and business deficit due to its import.

The potentiality of energy generation permanent resources of Nepal is its water. The gravitational slope north to south (Himalaya to Terai) is the running flow tracks of the rivers, which is potential cause of hydro energy generation. Nepal is victimized by traditional geopolitics of petro states with in the root of Asia-Pacific region. This system has been creating uncertainty in energy security independent to us. Which tradition fluctuate the market price in volatile, high purchasing cost to buy and carrying fuels in long root. Industrial systems became weaken, large amount of unemployment youth are going to abroad search for job. Political instability has been fostering by vulnerable economic conditions. The monopoly of petro states market controlling by quota system and volatile price rate, hurdled creating by military conflict, terrorism and other bad interesting groups and states in the supplying roots makes unsure to energy security for those countries who have been depending on traditional fossil fuel supply. Their socio-economic condition has almost vulnerable.

These hurdles developed crisis in the Asia-pacific roots of fuel supply leads those countries in new geopolitics mapping position by generating clean energy produce by water, wind and solar with new technology as the renewable and clean energy form. The new research and innovation of technology and communication make easy to the energy generate by water, solar and wind alternative energy source of fossil fuel. This new position found the base of standard national energy security for them. This self-dependent policy of energy will assure the protection of national economy, improvement the venerable industrial conditions, create opportunity of employment for youth and reduce the large amounts of business deficit of fossil fuel consumption and dependency.

In Nepal hydro energy generation planning for internal consumption and export to transnational across boarder in energy markets. The hydropower generation



system: Investigation, research, management of financial closer, project construction, energy production, distribution and consumption needs a good policy and its implementation. Our capacities in these process are not sufficient. Our mere self-interest and national rule and regulations are insufficient to implement the projects without cooperation of international companies, financial institutions and other stakeholder business with rational consent and obey the international recognized rule and regulations. We are surrounded by two large socio-political economies, China and India, with differ political ideology. Our nonalignment foreign policy sometimes not effective with their power dominant interest. Our competitive markets capability is negligible with them. international cooperation, to power supply trans cross boarder through power grid, sharing technical skill and knowledge, heavy technological equipment supply and establishment them and the supply roots of construction materials, are important. The root of power supply, transmission lines in cross boarder- The social problems in the local society, environmental effect, power supply security, and the permission to cross-passes the business in third state are impossible without cooperating and consent the cross border countries.

The new technology and knowledge can obtain with consent and co-operate with stakeholders. The stakeholder countries and institutions which are capable to provide technology, technical services and financial supports, they first priorities their invest interest and bargaining with different angles -political, social, economic, sometimes religion, ethnic etc. The international and regional financial institutions are guided by their stakeholder countries national policies and they agreed the loans with lobbying with their investor. These facts also show that international cooperation is important to agree the financial institutions.

Roles of national and international institutions in power generation: The good success of power (hydro) generation depends up on the roles of national and international institutions. When the natural root of water flow is disturbed in hydropower generation then socio-economic, political, religion, and environmental effect in ecosystem are aroused and its solution must be solved with stakeholder in rational way. Sometimes local interested groups, invested NGOs, religious organization, political conflict, unnecessary demand of public share, negative convincing to the peoples has created the hurdle in projects. It delays and drawbacks the international cooperation in different sector of project. The local government and

political parties and other social organization must help to convince the concerned stakeholder with good negotiation. National Financial institutions, bank encourage to collect the local capital investment to secure their share in project. Government and political parties' disturbance with bargaining their self-interest helps to delay the project. Terrorist type's activities in project must be control and assures the security to project. The army, police, financial institutions, NGOs, local institutions, governments and its institution's inter co-operation must play the important roles in power generation. The treaties and contract rectification by government also plays the positive role in projects. The corrupted concept of employee in service, commission bargaining mediator groups, commission in local level and national parties, conflict groups, terrorism and unnecessary other hurdles and unfair rules must be controlled by the government'

Nepal has not own expertise knowledge and capability to construct reservoir types project in power generations. The detailed project feasibility study for cost estimating and project design are preparing by international consultant services either single or joint venture with local consultant. The roles of international consulting services in study may interested role with large international and regional financial institutions, funds and multinational companies who provided global political goods and services. The originate state of the firms invest their interest to long business chain with high technological equipment and repairing services in coming days in long term for their originate state.

All countries are interested to play major role in technology development and through which the effectiveness of technology cooperation engaging more countries in to long time dependency relation. They are interested in fostering the newly efficient technology but they having also interest to facilities their company to occupy the leading role in international economic competition.

The investment interested by petro state countries role is to protect their economy in future recovering the effect of shifting geopolitical position Asia-Pacific region to new geopolitics position of clean energy secured states Some international players providing their technology and skills in very last and ending time of utility.

Contribution of Nalgad hydropower in power generation in Nepal: This project is medium type's reservoir hydropower exploring in Nepal. The detailed study survey

report has been finding in final stage. The survey has jointly studied by the SMEC-Australia MHW-America with joint venture of Udaya consultancy Nepal. The maximum man power employee to survey this study are Nepalese. Our man power and consultancy has opportunity to share idea and learn knowledge from international experts and their techniques and communicative knowledge. The gaining empirical experience and expertise service Will help to further study the other projects in own capability.

- ) After completion of Nalgad/Nalsing gad hydro project, this will help to bust up the morale of Nepalese in building new reservoir projects.
- ) This project somehow fulfill the objectives mentioned in existing constitution of Nepal.
- ) This project will provide feedback to similar other projects o built in near future.
- ) The infrastructure and other contribution gained in the development of this project lead to generation on positive externalities in the society.
- ) contributes to the economic prosperity of Nepali nation in numerous such as through boosting up tourism and also increasing employment prospects for the youth population of Nepal.
- ) This project contributes to tourist trade, employment increasing, Urbanization in Mid-hill road side, deduct the deficit of fuel importing business and industrialization and furnaces energy for metal mine processing.
- ) The power generation by Nalgad hydropower project will be completed with national and transnational sector by cooperating to each other. This project will play important role and contributions to Nepal.

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