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Selling Renewable Energy in Nepal

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Selling Renewable Energy in Nepal

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Selling Renewable Energy in Nepal

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This study has been conducted for the CONNECT Project of Laurea University of Applied Sciences. The main research question addressed in the thesis is whether Finnish companies should start a renewable energy business in Nepal. This process involved investigating the current renewable energy business and markets in Nepal. The main objective of this research is to support the growth and speed up the internationalization of Finnish small and medium enterprises of renewable energy to developing countries.

The purpose of the study is to examine the opportunity for market entry, the demand for renewable energy and the networking between different energy related organizations in Nepal. The energy crisis is increasing day by day in Nepal and there is great interest in alternative energy resources. Nepal has many natural resources with higher theoretical energy potential, but there are very few economically feasible sources. This study covers the micro and macro environment analysis.

The method used in this thesis is qualitative research, which includes personal interviews with four energy business-related organizations. Some common questions relating to the availability of resources, economic and environmental competitive, social acceptance, and the organization itself were prepared separately and sent to each respective organization via email. The format of the questionnaire included questions that can help provide answers and suggestions, which can support the entry of new companies in the Nepalese market.

The finding of this study is that it could be feasible to provide renewable energy services in remote areas because the Government of Nepal is providing subsidy in this area. Nepal is going to celebrate Investment Year 2012/13, which could provide many opportunities such as tax exemption for new businesses planning to invest in Nepal, especially in the energy or tourism sectors. Likewise, this research establishes that of all renewable energy resources the most used resource is Biogas. Finnish companies can concentrate on these resources. This research also investigates the extents of wasted energy in Nepal.

Key words, energy crisis, renewable energy, energy audit, load shedding

Table of Content

1	Introduction	7
1.1	Background of the thesis	7
1.2	Objectives of the thesis	7
1.3	Research questions of the thesis.....	7
1.4	Key definitions in the thesis	8
1.5	The structure of the thesis.....	8
2	The Business operating environment in Nepal.....	8
2.1	Political factors	8
2.1.1	Politics.....	8
2.1.2	Political stability	9
2.1.3	Interim constitution of Nepal 2007 (Division of power)	10
2.1.4	Constitution making process.....	11
2.1.5	Important international relationship.....	12
2.1.6	Taxation policy.....	12
2.1.7	Corruption	13
2.1.8	Environmental policies	14
2.1.9	Bureaucracy	14
2.1.10	Lobbying.....	15
2.1.11	Role of NGOs	15
2.1.12	Past and existing contacts between Nepal and Finland government.....	15
2.2	Economic factors	16
2.2.1	Economic stability.....	16
2.2.2	Economic structure.....	16
2.3	Social factors	17
2.3.1	Population demographics	18
2.3.2	Nepalese culture in general	20
2.3.3	Business culture in Nepal	21
2.3.4	Hofstede's dimension of culture.....	21
2.3.5	Human rights	22
2.3.6	Public health	22
2.4	Technological factors	23
2.4.1	Level of new innovation and discoveries.....	23
2.5	Environmental factor	24
2.5.1	Geography	24
2.5.2	Procedure to open a new business in Nepal	25
2.5.3	Foreign investment and technology transfer act 1992.....	25
2.5.4	Employment and job securities in Nepal	26

2.5.5	The regulation of health and safety in Nepal	26
2.5.6	Welfare arrangement	26
2.5.7	The regulation of competition	27
2.5.8	The regulation of trade and restrictions	27
3	Energy markets in Nepal.....	28
3.1	The general energy situation in Nepal	28
3.2	Nepal electricity authority (NEA)	29
3.3	Investment and investor in energy	29
3.4	Energy crisis	30
4	Renewable energy market in Nepal	35
4.1	Current situation and outlook of renewable energy market	35
4.1.1	Renewable energy consumption	36
4.1.2	Sectoral renewable energy consumption by fuel type	37
4.1.2.1	Residential sector	37
4.1.2.2	Industrial sector	38
4.1.2.3	Transport sector	39
4.1.2.4	Commercial sector	39
4.1.2.5	Agricultural sector	40
4.2	Challenges, constrains in market entry and technology.....	40
4.2.1	Barriers/challenges for renewable energy.....	40
4.2.1.1	Policy and regulatory barriers.....	40
4.2.1.2	Institutional barriers.....	41
4.2.1.3	Financial barriers.....	41
4.2.1.4	Technical barriers	41
4.2.1.5	Information and awareness barriers	41
4.2.1.6	Systemic, decentralization and governance.....	41
4.2.1.7	Social, cultural and gender barriers	42
4.3	Critical constraints	42
4.4	Major issues.....	42
4.5	Financing of renewable energy projects	42
4.6	Impact of current energy crisis among the industries in Nepal	46
4.7	Energy policy	47
4.7.1	National electricity crisis resolution action Plan 2008.....	47
4.7.2	Rural energy policy 2006	48
4.8	Government authorities and supporting institutions in Nepal.....	48
4.8.1	Ministry of energy (MoEng).....	48
4.8.2	Department of energy development (DoED):.....	48

4.8.3	Nepal electricity authority (NEA).....	48
4.8.4	Water and energy commission secretariat (WECS).....	49
4.8.5	Electricity tariff fixation commission (ETFC).....	49
4.8.6	Ministry of environment (MoEnv).....	49
4.8.7	Alternative energy promotion centre (AEPC).....	49
4.8.8	Local institutions and communities in renewable energy technology.....	50
4.8.9	Independent power producers association of Nepal (IPPAN).....	50
4.8.10	Other industry associations.....	50
4.9	Companies and renewable energy organizations in Nepal.....	50
4.9.1	Center for renewable energy (CRE).....	50
4.9.2	Kathmandu university (KU).....	50
4.9.3	Innovative energy and environment Nepal (IEEN).....	51
4.9.4	Solar electric manufacturers association Nepal (SEMAN).....	51
4.9.5	Renewable energy test station (RETS).....	51
4.9.6	Rural energy development program (REDP).....	51
4.9.7	Clean energy Nepal (CEN).....	51
5	Renewable energy (RE).....	51
5.1	Hydropower.....	52
5.2	Biomass energy.....	53
5.2.1	National biomass energy support program (BESP).....	54
5.2.2	Nepal biogas project.....	54
5.3	Solar energy.....	54
5.4	Wind energy.....	56
5.5	Waste to energy.....	56
5.6	Geothermal energy.....	57
6	Interview research methodology.....	57
6.1	Aims, target groups and content of interview.....	57
6.2	Interview results.....	57
7	Conclusion.....	58
7.1	Summary.....	58
7.2	Limitation.....	59
7.3	Future research.....	59
	References.....	60
	Figures.....	65
	Tables.....	66
	Appendices.....	67

1 Introduction

1.1 Background of the thesis

This study has been done for the CONNECT Project of Laurea University of Applied Sciences and the main purpose of this project is to support the growth and speed up the internationalization of Finnish SMEs of renewable energy companies to developing countries. Trade in renewable energy in developing countries is the main objective of this thesis, where Nepal has been selected as a case study. This study examines the availability and the market for renewable energy resources in Nepal. Though Nepal has abundant sources of water to produce hydropower, its maximum potential has not yet been harnessed due to the lack of technical expertise. For this reason, it faces energy crises on annual basis. A huge amount of energy is needed to power the increased urbanization and meet the increased living standard of people. However, the limited availability of energy is not sufficient to meet this demand. Thus the country has to confront the heavy load shedding throughout the whole year. To overcome this energy crisis the Nepalese Government is promoting renewable energy sources all over the country. However, the production of renewable energy is still very expensive compared to fossil fuels. Therefore, the government has provided subsidies in biomass and solar energy in rural areas to promote renewable energy

1.2 Objectives of the thesis

The objectives of thesis are to identify opportunities for market entry into renewable energy market in Nepal, promote networking between renewable energy related organizations, and determine the demand for renewable energy resources. The other objectives of the thesis are to predict the suitable time of entry, determine geographical suitability and to analyze the competition in this market.

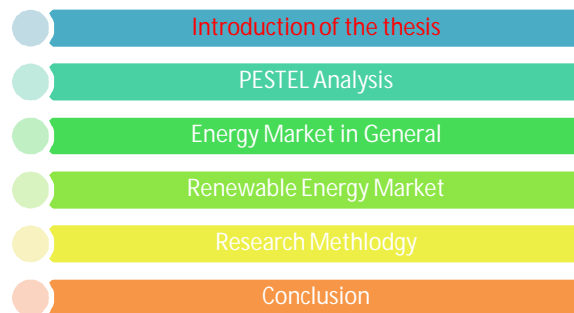
1.3 Research questions of the thesis

By the end of this research, the following questions will have been addressed. The questions are, what kinds of policies have been embraced by the Nepalese Government to promote renewable energy business in Nepal and what are the procedures to start a new renewable business in Nepal? Who are the main buyers and competitors? What kinds of subsidy, tax reduction and support the Nepal Government has provided? How much is the demand of the renewable energy in Nepal and what are the suitable available resources of renewable energy?

1.4 Key definitions in the thesis

Renewable energy refers to energy whose sources will never finished, and which can be regenerated naturally from water, sun, wind. Comparing to non-renewable energy, renewable energy does not harm the environment. They are known as environmental friendly. Energy generated from non-renewable energy like fossil fuels produce the harmful gases which have caused many of the environmental problems, such as ozone depletion and global warming, that have to be faced these days. Biomass energy is considered a major indoor polluter. (Edu Green 2007). The demand for renewable energy resources including biomass, hydro, solar, wind, and waste to energy, and geothermal energy, are increasing and these resources could meet the global demand of energy. Renewable energy technologies are the fastest growing technologies in the world.

1.5 The structure of the thesis



In the first chapter, the introduction and objectives of the thesis have been described. In the second chapter, PESTEL analysis of Nepal has been done. In the third chapter, the general situation of electricity, demand and supply of electricity, impacts of load shedding in Nepal have been analyzed. In the fourth chapter, demand of renewable energy market, suitable renewable energy resources, subsidy for renewable energy business have finalized. In the fifth chapter, interview has been conducted with different personnel related to RE business. In the final chapter, the conclusion, recommendation of the thesis has been written.

2 The Business operating environment in Nepal

2.1 Political factors

2.1.1 Politics

According to ancient history, Nepal was divided into different kingdoms; King Prithivi Narayan Shah had unified Nepal in one rope in 1768. In 1959, new constitution was promulgated, first general election was held, and Nepali congress party won with the majority, but in 1962, King Mahendra suspended parliament and took all the power in his hand. In 1996, Maoists launched a group of armed rebellions from remote himalayan foothills to overthrow the monarchy. 2001, June - King Birendra and his whole family were killed and Prince Gyanendra became king. 2005, Feb - the last King of Nepal, Gyanendra took absolute power again to crush the Maoists. Maoist did not stop the campaigning against the monarchy. Due to this civil war, 12,000 people were died and 100,000 people were displaced according to UN Report. Finally, in April 2006, King Gyanendra had to give the power to the public under the public pressure after that the parliamentary government was discussing to stop the civil war. A peace deal was agreed in November, although the Maoists continued to press for the abolition of the monarchy. Parliament agreed to the condition in December 2007, the Maoists emerged as the largest parliamentary party after elections in April 2008 and Nepal became a republic in May 2008. Mr. Yadav became the first president of republican Nepal in July 2008. The Maoist-led coalition government has disintegrated in May 2009 and succeeded by another coalition. (Nepal country profile 2012). Mr. Baburam Bhattarai has been a Prime Minister of Nepal since August 2011.

2.1.2 Political stability

Different parties and individual have given their own view for Political stability in Nepal. Foreign Ministry spokesperson Ma Zhaoxu of china said in one newspaper that China values the friendship and cooperation between the two countries in accordance with the Five Principles of Peaceful Coexistence. (Beijing promotes stability in Nepal 2011)

According to one press release on 23 Feb 2011, Nepal launched its National Action Plan (NAP) internationally on the Implementation of the United Nation Security Council Resolutions (UNSCRs) 1325 and 1820, at a special side event on the margin of the 55th Commission on the Status of Women in the New York on 17 February 2011 in Kathmandu. The NAP aims for participation and leadership of women at all levels of decision-making, conflict transformation and peace processes including taking measures to address specific needs of women and girls in the design and implementation of all relief and recovery programs thereby creating sustainable peace and just society. (Permanent Mission of Nepal to the United Nations New York, 23 February 2011) Nepal Peace Trust Fund (NPTF) was signed on Joint Financing Arrangement (JFA) 2010 with the aim of harmonizing the donor support in Nepalese peace process. The JFA signing held between Government of Nepal and representatives of Denmark, Finland, Germany, Norway, Switzerland, United Kingdom and European commission. (NPTF-Signing the joint financing Arrangement 2010)

Ministry of peace and reconstruction of Nepal's main motive is to provide effective assistance to build a beautiful, peaceful and new Nepal through lasting and sustainable peace building. Office of the High Commissioner on Human Rights in Nepal (OHCHR-Nepal) is starting implementation of its "Peace through Justice" project funded by the UN Peace Fund for Nepal (UNPFN), delivers focused rapid-disbursing support through UN agencies to support the peace process. (UN peace project kicks off in Nepal 2009) The Emergency Peace Support Project was approved by the World Bank's Board of Executive Directors and it will help to support the government fulfill the commitments made under the Comprehensive Peace Agreement and the subsequent 23-Point Agreement. The Grant was US\$50 million. (Emergency Peace Support Project 2008) Livelihoods Recovery for Peace project (LRP) of United Nations Development Program (UNDP) has been running for the peace establishment in Nepal. (Livelihoods Recovery for Peace Project 2012)

2.1.3 Interim constitution of Nepal 2007 (Division of power)

The Interim constitution of Nepal 2007 is currently at practice until a new constitution will be promulgated. The provision of constitutional monarch provided by the constitution was replaced with ceremonial President through third amendment in May 28, 2008. Likewise, country was declared to be federal democratic through the first amendment to the constitution in April 13, 2007. (Constitutional History of Nepal) Following are the key provisions of the constitution.

The President of Nepal is the ceremonial head of the state and government with the responsibility to protect the constitution, the Legislature Parliament elects it, and either through political consensus or majority votes for the period constitution is declared. President has the power to declare the state of emergency, make an appointment of chief of army staff and heads of constitutional organs and address the session of parliament, but all on the recommendation of the Council of Ministers. (Constitutional History of Nepal)

Executive power includes Prime Minister of Nepal who has elected by the Legislature Parliament through political consensus or majority votes. The Council of Minister including member who are not members of parliament but on the recommendation of prime minister who is responsible for issuing general directives, controlling and regulating the administration of Nepal and all executive functions. (Constitutional History of Nepal)

Legislative power of Nepal has 601 members among 601 members, 240 are elected through FPTP (First Past the Post), 335 members elected through PR (*proportional representation*) and 26 members nominated by the Council of Ministers. Key responsibilities of the parliament are to elect the President, vice President and Prime Minister, enact laws, pass budget and national programs and policy, check and balance the government and judiciary, conduct legislative

hearing for the post of constitutional organs and judges of Supreme Court and pass impeachment motion against prime minister and other constitutional heads in case of need. (Constitutional History of Nepal)

The Constitution provides three tiers of Court, which include the Supreme Court of the Kingdom of Nepal, the Court of Appeal and the District Courts. Supreme Court is the Apex Court. All courts and judicial institutions except the constitutional assembly court are under the Supreme Court. There is no distinction between Criminal and Civil court except some basic procedures. In addition to these regular courts, there is provision in the constitution to establish special types of courts or tribunals for hearing special types of cases by the law. According to these provisions, there are four Revenue Tribunals, Administrative Court, Labor Court, Debt Recovery tribunal and Debt recovery Appeal Tribunal but special court are functioning under the respective laws. These institutions are under the judicial control of the Supreme Court. (Judiciary in Nepal)

Interim Constitution provides for five constitutional bodies that are Public Service Commission, Election Commission, Auditor General, and Commission for the Investigation of Abuse of Authority and National Human Rights Commission. (Constitutional History of Nepal)

2.1.4 Constitution making process

Constitutional Assembly (CA) member were supposed to make a new constitution within two years since the CA was first elected in 2008. Nevertheless, a new constitution was not drafted in the scheduled time so the date was extended until May 2011. Once again, the deadline was expired on 31st august, 2011 and the extension was made based on five-point agreement within the political parties. The raising questions of how much is expected from the assembly. The CA member Sapana Malla said; "We are not only writing a new constitution, but also changing the government system from monarchy to the republic, from Hindu state to secular state, integrating the army and holding peace negotiations." (The wait continues for a new constitution in Nepal 2011). Unfortunately, CA member has to extend the time for a new constitution again, and they have decided to make the first integrated draft of the Constitution between February 13 and 27, 2012 and complete it by May 21 and 27, 2012. (Nepal Assessment 2012)

Different leaders have different opinions about the new constitution making process. The former House of Representative Daman Nath Dhungana said that the peace process is heading toward conflict and the political leaders are debating only and could not make any decision. (Spotlight news magazine 14 Jan 2012) Senior leader of the Nepali Congress Sher Bahadur Deuba suggested that fresh elections would be conducted if the constitution were not drafted by May 27. (The Himalayan times 5 February 2012)

2.1.5 Important international relationship

Government of Nepal is encouraging foreign investments by providing attractive incentives and facilities within a liberal and "open policy". (Nepal-Foreign Investment Opportunities) Nepal has established an Institute of Foreign Affairs (IFA) as a wing of the Ministry of Foreign Affairs (MOFA) with the intention of maintaining the relation with all countries as well as to maintain a positive and impressive image of the nation in the international arena such as the UN (United Nations), other international bodies and regional organizations like SAARC (South Asian Association for Regional Cooperation). It handles foreign policy related issues, focuses on policy research, training and dissemination of information through seminars and publications as its principal areas of operation. Nepal has just declared the fiscal year 2012-2013 as the "Nepal Investment year" with the aim to bring big investment in the country during this period in the major areas of agriculture, tourism, energy, infrastructure and medical and educational institutions with a view to achieve a double digit economic growth within the Nepal Investment Year. (Institute of Foreign Affairs) Currently, around 300 billion rupees (US\$3.55 billion) are invested annually in the country from both the government and the private sector, and now the target is additional 350 billion rupees annually to achieve the double digit growth. (Nepal to declare 2012-2013 as a year to increase international investment 2011)

There is one agreement between the Government of the Republic of Finland and the Government of Nepal on the Promotion and Protection of Investments. (Ministry of Industry) likewise, Nepal is beneficiary of preferential trade treatment with the European Union under the Everything but Arms (EBA) Regulation, which was adopted by the EU council in Feb 2001. (Charlotta 2006)

2.1.6 Taxation policy

Foreign investments are eligible to receive the following incentives and facilities. Income received from exports is free from income tax and Income tax is exempt for a period of 5 years from the date of commercial production in the case of production-oriented industry, energy based industry, agro industry, forestry industry. (Nepal-Foreign Investment Opportunities 2011) If the industries established in remote, under developed and less developed areas, other than cigarette, and alcohol industries, are entitled to an additional tax exemption of 50%, 20% and 10%; and in respect of excise duty, 25%, 15% and 10%, respectively. They are entitled to deduct one-third of the value of the fixed assets investment as depreciation allowed under the income tax law. (Nepal-Foreign Investment Opportunities 2011)

Industries that invest in modern plant, machinery and equipment that control environmental pollution are entitled to deduct 50 percent of the investment so made as deductible expenses in

computing taxable income. 10% of the gross profit is allowed as a deduction against net income because of expenses connected with technology or product development and skill enhancement and Dividends declared from investments made in the industry are exempt from income tax. 5% of the gross income would be allowed as a deduction in computing net income on account of donation made for the improvement of schools, colleges, universities, private hospitals, religious places and other social welfare activities, expenses on advertisement. (Nepal-Foreign Investment Opportunities 2011)

Industries that provide direct employment to 1000 persons or more will be entitled to an additional 2-year exemption from income tax. Interest income earned by a non-resident on a foreign loan will be taxed at a concessionary rate of 15 percent. Similarly, royalties, technical and management fees earned by a non-resident person will be taxed at 15 percent. (Nepal-Foreign Investment Opportunities 2011) In order to avoid the double taxation on incomes of foreign investors, the Government will take necessary action to conclude agreements for the avoidance of double taxation with the countries of the concerned foreign investors. (Nepal-Foreign Investment Opportunities 2011)

2.1.7 Corruption

According to Transparency International Today (TI), Nepal is ranked 154th with a score of 2.2. It was ranked 146th last year. The index had scored 183 countries and territories from zero (highly corrupt) to 10 (very clean) based on perceived levels of public sector corruption. Two thirds of the ranked countries have scored less than five. Nepal is the second most corrupted countries in south Asia. Chairperson of TI Nepal Bishnu Bahadur KC issued a statement in Nepal's daily English newspapers The Himalayan Times that the cause of rampant corruption in public sectors has been attributed to the government's lethargic performance to control the financial crime in political transition. It reflects the lack of will power and commitment on the part of the government and political parties to maintain good governance and that anti-graft bodies failed in their job. (Nepal second most corrupt country in south Asia 2011)

Table 1. Corruption perception index

FULL TABLE AND RANKINGS

The Corruption Perceptions Index ranks countries/territories based on how corrupt their public sector is perceived to be. A country/territory's score indicates the perceived level of public sector corruption on a scale of 0 - 10, where 0 means that a country is perceived as highly corrupt and 10 means that a country is perceived as very clean. A country's rank indicates its position relative to the other countries/territories included in the index.

SEARCH TABLE

RANK	COUNTRY	SCORE	REGION RANK	REGION	SOURCES	CONFIDENCE RANGE
154	Nepal	2.2	29	Asia Pacific	6	2.1 - 2.4

(Source: Corruption perception index 2011)

2.1.8 Environmental policies

Environmental protection act 1997 of Nepal has been made for the protection of the environment by maintaining clean and healthy environment by minimizing adverse impacts likely to be caused from environmental degradation on human beings, wildlife, plants, nature and physical objects. To protect the environment with proper use and management of natural resources, taking into consideration that sustainable development could be achieved from the inseparable inter-relationship between the economic development and environment protection. (Nepal-Environment Protection Act 1997) To protect the environment before starting any business following steps should follow. Initial and repost of initial environment examination or environmental impact assessment to be made. Submission of the proposal for approval and power to grant approval to implement proposals. Report should complied with monitoring and evaluation reports, environmental examination and maintenance should be updated. There is environment protection act 1996 and environment protection rule 1997 (First amendment in 1999) which controlled haphazard of waste disposal. Before starting any industry permanent pollution control certificate should be taken. After that, complaints may be lodged in case anyone causes pollution or emits waste and notice to be issued control pollution or not to emit waste.

2.1.9 Bureaucracy

Nepalese Bureaucracy has faced different challenging phases and still become less effective and powerful. If we see the history of Nepalese Bureaucracy, we can see different NGOs, human

rights, social welfare were established only after the multiparty system in Nepal. After that, Nepalese Bureaucracy has started to work as a civil servant by providing different services. (Sapkota 1997)

2.1.10 Lobbying

Advocacy Forum mission is to do research, advocacy and lobbying related to human rights and its major role is to mobilize the national and international opinion to respond to the human rights situation in Nepal. Nepal has also been campaigning for the establishment of the Truth and Reconciliation Commission, Disappearance Commission and the Ratification of various international treaties safeguarding the rights of people. (Advocacy Forum Nepal)

2.1.11 Role of NGOs

All the NGOs (Non-Governmental Organizations) and INGO (International Non-Governmental Organization) plays a very crucial role for the development of Nepal. Some of the NGOs and INGOs are working for the peace building, public health, community development, child protection, biodiversity, climate change, renewable energy, rural development, gender equality, education, health, child labor, trafficking, human rights and many more. (Association of International NGOs in Nepal)

2.1.12 Past and existing contacts between Nepal and Finland government

Nepal and Finland government have very peaceful relationship. Because of this, Nepal has Finnish embassy in Kathmandu with the mission of promoting peace, democracy, equality, human rights, sustainable development and the principle of rule of law in the country and trade, tourism and cultural exchange between two counties. Finland has provided a lot of support for the development cooperation between two countries that can help to reduce poverty, enhance the peace process, root democracy into the society, improve human rights and promote environmentally sustainable development. Finland's support to Nepal in 2010 was approximately EUR 12.5 million, and the amount of aid is planned to be increased. Finnish aid goes to the education, water and sanitation, forestry and environment. Likewise, through Inter-institutional development cooperation aid goes for strengthen the capacity of state institutions such as ministries, departments and universities in cooperation with Finnish state institutions or civil service departments. They are working for local cooperation, for example, for the conflict prevention and peace building projects. There are many Finnish NGOs working in Nepal, which are funded by Finnish Ministry of Foreign Affairs. According to this Ministry in 2011, they are funding more than 50 NGO projects that are implemented by 20 Finnish NGOs in Nepal. If we

combined the fund from the Finnish government support and the organizations, the budget is altogether more than EUR 5 million. (Embassy of Finland Kathmandu)

2.2 Economic factors

2.2.1 Economic stability

The success and the failure of the business are also depending upon the economic situation of the country. Income level, price, savings and availability of credit affect the economic situation of the country. The purchasing power of Nepalese people is very low due to political instability, higher inflation rate and unemployment. (Basnet 200) Despite these matters, nowadays remittance income is playing a vital role for the foreign currency earnings and the favorable impact on balance of payment situation also to reduce the number of people in the country below the poverty line and ultimately to the economic growth of the nation. The share of remittances in total current account receipts had increased from 38.2 % in 2004/05 to 56.7 % in 2008/09. (Remittance in Nepal 2011) From this, we can say that Nepal has enabled to maintain a very comfortable level of foreign exchange reserves and increase people's living standard. Nepal is one of the poorest and underdeveloped countries in the world. One-quarter of its population living below the poverty line depends on Agriculture based on monsoon for their income and employment, and Industrial activity mainly involves the processing of agricultural products, including pulses, jute, sugarcane, tobacco, and grain. (Youth for Christ Nepal 2011) Nepal has a capacity of producing energy with an estimated 42,000 MW, but because of political instability, lack of technology and investment, it could not be able to do effectively.

2.2.2 Economic structure

Table 2 shows the economic growth rate, import, export, total expenditure, current expenditure, principal repayment and revenue collection of Nepal.

Table 2. Economic structure

S.N	Headings	Sub-headings	Units
1	Labour Force		18 million
2	Labour Force by occupation (2010 est.)		
		Agriculture	75%
		Industry	7%
		Services	18%
3	Unemployment rate (2008 est.)		46%
4	Population below poverty line (2011)		30.90%
5	Household Income or consumption by percentage share (2011)		
		Lowest	10%:3.2%
		Highest	10%:29.5%
6	Distribution of family income- Gini Index (2008)		47.2
7	GDP (Purchasing power parity 2011)		\$37.74 billion
8	GDP (Official exchange rate 2011)		\$18.3 billion
9	GDP-real growth rate (2011)		3.50%
10	GDP-percapita (2011)		\$1,300
11	GDP-composition by sector (2010 est.)		
		Agriculture	34.90%
		Industry	15%
		Services	50.10%
12	Investment (gross fixed 2011)		3% of GDP
13	Budget (FY 2011)		
		Revenue	\$3.9 billion
		Expenditure	\$5.3 billion
14	Taxes and other revenues (FY 2011)		21.3% of GDP
15	Inflation rate (Consumer prices 2011 est.)		7.80%
16	Current account balance (2010 est.)		\$437.9 million
17	Exports (clothing, pulses, carpets, textiles, juice, pashmina, jute goods 2011)		\$896 million
18	Exports-partners (2011)		
		India	66.40%
		USA	6.80%
		Germany	4.80%
		Bangladesh	5.40%
19	Imports (petroleum products, machinery and equipment, gold, electrical goods, medicine 2011 est.)		\$5.4 billion
20	Imports - partners (2010)		
		India	65.20%
		China	11.50%
21	Exchange rates: Nepalese rupees (NPR) per US dollar		
		2011	Npr 83.31
		2010	Npr 73.15
		2009	Npr 77.44
		2008	Npr 65.21
		2007	Npr 70.35

(Source: The world Fact Book 2012)

2.3 Social factors

It has included various elements such as, class, structure, beliefs, values, social institutions, accepted patterns of behavior, customs of people and their expectations. (Basnet 2008) Before going to establish any business in any country, everyone has to analyze the socio-cultural

environment for developing its policy and strategy. Socio-cultural environment influences the demand and supply of goods and services. Buying habits of peoples are determined by these trends. Nowadays, there is lack of opportunities for youth, political instability, educational purpose because of these reasons peoples are leaving the country and this trend of seeking better life style is increasing sharply. If we observe social life structure of the rural areas, the father heads all families. We still believe to stay in a joint family. However, the globalization affects the world slowly so do in Nepal as well which made many changes day by day in Nepalese society, for example, infrastructural developments like new buildings, apartment systems, shopping malls, modern public education, fashions etc. Most of the Nepalese especially young generations are affected with the western trends; they speak English language and dressed in western style clothes. Besides this, people are becoming more conscious for their health. Therefore, many people in Nepal allocate time for physical fitness such as yoga, aerobics and gym.

2.3.1 Population demographics

Population of Nepal at glance (Preliminary Result of National Population Census 2011) Nepal has divided into 5-development region. Those are eastern development region (EDR), central development region (CDR), western development region (WDR), mid-western development region (MWDR) and far-western development region (FWDR).



Figure 1. Map of Nepal: Administrative division

Table 3. Population

S.N.	Area	Population 2001			Population, 2011			Decadal Change (%)
		Total	Male	Female	Total	Male	Female	
	Nepal	23,151,423	11,563,921	11,587,502	26,620,809	12,927,431	13,693,378	14.99
1	Mountain	1,687,859	837,060	850,799	1,795,354	871,391	923,963	6.37
2	Hill	10,251,111	5,016,802	5,234,309	11,475,001	5,487,695	5,987,306	11.94
3	Tarai	11,212,453	5,710,059	5,502,394	13,350,454	6,568,345	6,782,109	19.07
1	Urban	3,227,879	1,664,362	1,563,517	4,525,787	2,311,649	2,214,138	40.21
2	Rural	19,923,544	9,899,559	10,023,985	22,095,022	10,615,782	11,479,240	10.90
1	EDR	5,344,476	2,670,622	2,673,854	5,834,182	2,805,905	3,028,277	9.16
2	CDR	8,031,629	4,109,059	3,922,570	9,713,702	4,868,132	4,845,570	20.94
3	WDR	4,571,013	2,198,170	2,372,843	4,945,190	2,305,995	2,639,195	8.19
4	MWDR	3,012,975	1,500,526	1,512,449	3,584,386	1,730,159	1,854,227	18.97
5	FWDR	2,191,330	1,085,544	1,105,786	2,543,349	1,217,240	1,326,109	16.06

(Source: Preliminary Results of National Population Census 2011)

Table 4. Living standard

Summary statistics of literacy and education			
(Percent)			
	Nepal Living Standards Survey		
	1995/96	2003/04	2010/11
Literacy rate of population 6 years and above	37.8	50.6	60.9
Adult literacy rate, both sexes (15 years and above)	35.6	48.0	56.5
Males	53.5	64.5	71.6
Females	19.4	33.8	44.5
School ever attended, both sexes (15 years and above)	33.9	45.8	54.6
Males	50.2	61.2	69.6
Females	19.1	32.6	42.9
Mean years of schooling	7.0	7.5	8.1
Net enrollment* at primary school, both sexes	57	72	68.8
Males	67.0	77.9	67.2
Females	46.0	66.9	70.2
Net enrollment* at lower secondary school, both sexes	19.0	29.0	26.7
Males	23.0	31.1	26.9
Females	14.0	26.4	26.5
Net enrollment* at secondary school, both sexes	9.0	15.1	15.0
Males	13.0	16.8	15.7
Females	6.0	13.4	14.2
Attendance in private school, both sex	7.5	16.7	26.8

* Net attendance rate for NLSS-III.

(Source: Nepal Living Standard Survey 2010/2011)

Table 3 shows the total population of 2011 divided into geographical region wise, five development region wise and urban/rural wise. Likewise, table 4 shows the literacy rate of population above 6 years in Nepal was 50.6% in 2003/2004 and it is increased by 10.3% in 2010/2011. The level of distribution of family income of Nepal is 47.2 (GINI INDEX 2008)

2.3.2 Nepalese culture in general

There are many official language in Nepal. They are Nepali 47.8%, Maithali 12.1%, Bhojpuri 7.1%, tharu 5.8%, Tamang 5.1%, Newar 3.6%, Magar 3.3% and current days English language is also acceptable in some offices and organizations. According to the census 2011, the major religion of Nepal are Hindu 80.6%, Buddhist 10.7%, Muslim 4.2%, Kirat 3.6% and other 0.9%. The major ethnic groups are Chettri 15.5%, Bramhan 12.5%, Magar 7%, Tharu 6.6%, Tamang 5.5%, Newar 5.4%, Muslim 4.2%, Kami 3.9%, Yadhav 3.9% and other 32.7%.

Nepalese have a vast cultural diversity and different ethnic groups and religions. People are open minded, kind hearted or easy going. They use their right hand to eat food and left hand to wash after having long toilets. They do not share food from a same plate because people think if lips touches the food vessels or water glasses, it is called "Jutho" that means it is polluted for others. Pointing out finger at people is considered bad - it means wait and I will have something against you. If you have to point at someone, use your upturned hand or lift your chin and say over there. A shake of the head back and forth usually means "yes"; and a nodding of the head up and down tends to mean "no". (Nepal Culture, Customs & Etiquette 2011)

Both Male friends and both female friends are walking by holding hands. This is very common in Nepal and a sign of a good friendship. Kissing, hugging in public places is not acceptable for Nepalese people. (Culture Crossing 2011)

Nepalese have many temples, church, and Buddhist stupa. In many Hindu temples, foreigners are not allowed to enter or to take a picture without the permission. People cannot enter into the temple or Nepalese homes with the shoes.

Being on time is not valued for the most part. This is generally the case in business and social settings. "Nepali time" means people will run late to everything. Public buses do not run on time and traffic is unpredictable. It is usual to delays at all levels from getting a bus, taxi, plane and/or getting a room in a hotel. (Nepal Culture, Customs & Etiquette 2011)

Women from the rural areas, they are housewives while in urban areas, women are working but with the least salaries and lower opportunities. (Culture Crossing 2011)

Nepalese use to pressed two palms together at around chest level and saying, "Namaste", that means, "I salute the god/goddesses in you". Handshakes are common after the initial Namaste for those familiar with western customs. They use right hands for the hand shaking but most of the married women do not feel comfortable to do hand shake especially with men. (Culture Crossing 2011)

2.3.3 Business culture in Nepal

The Formal attire in Nepalese business culture is coat & tie, or the Nepali dress code "Kurta Surwal" with Nepali hat for office besides this business suit for modern people who live in the city. (Culture Crossing 2011)

In all the meetings or every time when people meet they used to greeting by saying "Namaste" with pressing two palm together at the neutral chest level, with a slight bowing of the head. After that, meeting can be start by asking the health of a colleague and his/her family. To the elder people used to address by 'sir' or 'madam' or "Ji" can be added to the end of a name to show respect: for example "Matti-ji". In the workplace, once relationships have been built the family references may also be used in place of names: "didi" - older sister, "bahini" - younger sister, "dai" - older brother, "bai" - younger brother. (Culture Crossing 2011)

In every meeting, it will start by talking the Personal relationships with a cup of Nepali tea. After having this session, the meeting's real agenda will start. Nepalese management follows the top down approach for the decision making process (Culture Crossing 2011)

2.3.4 Hofstede's dimension of culture

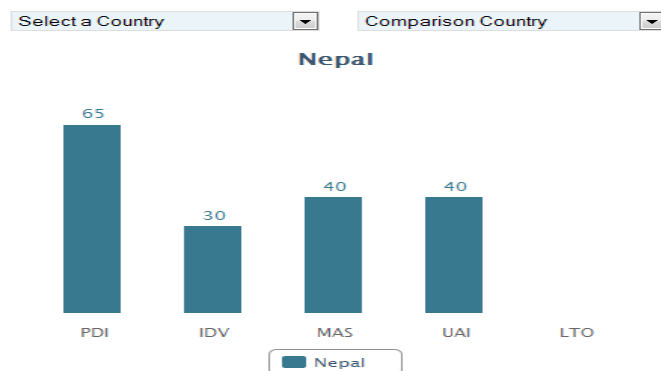


Figure 2. Geert Hofstede dimensions

According to figure 2, the culture of Nepal is measured in four different dimensions; they are power distance index, individualism versus collectivism, masculinity versus femininity and uncertainty avoidance.

Nepalese has higher power distance index. Most of the Nepalese are still living with joint family, and all the decision are taken by the head of the family. They will control all the activities of the family. Also in the cases of offices, top-level boss will take the decision and no one have any objection with that decision.

Nepal has collectivism culture because not only the close family but also the societies where we born, grown up are integrated into strong, cohesive in-groups which continue protecting us in exchange for unquestioning loyalty. The society is male dominating that is why masculinity is higher than femininity because there is maximal distinction between men and women's activities. There is a lack of education for women. Nepalese people are accepting uncertainty because they believe in religion and peaceful relationship with everybody; they have a high tolerance for differences in behavior.

2.3.5 Human rights

Nepalese Human Rights called the National Human Rights Commission Nepal (NHRC), which was established in 2000 under the Human Rights Act 1997, and later on in 2007, it was becoming a constitutional body of Nepal. The main goal of NHRC is to contribute for the protection of human rights, to maintain the peace in the country, to give justice for the victim by implementing the national laws and international human rights instruments. (National Human Rights Commission Strategic Plan 2008-2010)

2.3.6 Public health

Nepal does not eradicate all the communicable diseases; there are still many communicable diseases, which caused the death of many rural people. Despite of this, there has been remarkable improvement in health indicators such as Infant Mortality Rate, Maternal Mortality Ratio and Total Fertility Rate. There is one law regarding Nepalese People Health in the constitution of 2007. The foundation called Nepal public Health has been established with the objectives of giving support to the existing or new community based public health training institutions, prioritize public health action and research areas and facilitate pilot interventions in collaboration with national and international partnerships with special emphasis to building communities' capacity. (Nepal Public Health Foundation 2011)

2.4 Technological factors

Ministry of science and technology was established in 1996 to function science and technology for the development of the nation by creating an environment for the development of science and technology. Under the ministry, the national Science and technology council and the Royal Nepal Academy of Science and Technology (RONAST) has founded in 1976 and 1982 A.D. respectively. (Ministry of Science and Technology 2011) The Nepalese government is allocated Nepalese rupees 386033000 for research and development of science and technology in Fiscal year 2011/2012. (Three years Expenditure prediction point no 332)

2.4.1 Level of new innovation and discoveries

The construction of the Information Technology Park has completed with an objective to produce the skilled workers to develop the computer software.

Government web portal of Nepal through the development and expansion of internet facility in various ministries, secretariats and departments has been created. The National Information Technology Center (NITC) was established in 2002 in line with IT policy 2000. It is working to manage the e-gate pass for the ministry offices, optical fiber connection within different ministries and departments, E-government implementation for creating transparent interaction between government and citizens(G2C), government and business organizations(G2B) and different government organizations(G2G) in Nepal. (National Information Technology Center Nepal)

Nepalese are able to make biogas from the cow dung through the construction of household-scale "digesters" that use bacteria to break down the dung in airless conditions, producing a clean and smokeless gas. (Nepal Renewable Energy) Nepal has a history of more than 50 years biogas technology development, and Father B.R. Saubolle started this technology in Nepal by demonstrating biogas plant at St. Xavier School in 1955. It took more than 20 years to accept this technology by the government and as a result, The Biogas Support Program (BSP) has founded in 1999.

National Forensic science laboratory has established for processing of physical evidence on search of truth. (National Forensic Science Laboratory) "B.P. Koirala memorial planetarium, observatory and science museum development board" was established in 1992 in order to establish Planet aria, Observatories and Science Museums in Nepal & conduct research activities in the area of Astronomy, Astrophysics and Cosmology. (Ministry of Science and Technology)

E-village program was started with the motive of teaching learning has been carried out through computer at primary, lower secondary and higher secondary levels of the school, Audio and video services are on use to engage students in the learning process. (Panta 2011)

Biodiversity Center, Atomic center and space technology center will be established for the effective implementation of biodiversity and atomic policy. (Nepal's Budget Speech 2011/2012) To reduce the poverty through biotechnology with its use where it can be applied and the key substitute for the development of the country as well as environment protection and public welfare. (Biotechnology Policy 2006)

2.5 Environmental factor

2.5.1 Geography

Nepal is in south Asia between India and China. The geographic coordinate is 28 00 N, 84 00 E and the lowest point start from 70m (Kanchan Kalan) to highest point Mount Everest 8,850m. Area of Nepal is 140,800 sq km among which 136,800 sq km is covered by land and 4,000 sq km by water. It is one of the landlocked countries. The climates is varies from cool summers and severe winters in north to subtropical summers and mild winters in south Terrain. Natural resources are quartz, water, timber, hydropower, and scenic beauty, small deposits of lignite, copper, cobalt and iron. (Geography and Map of Nepal)

Natural hazards are severe thunderstorms, flooding, landslides, drought, and famine depending on the timing, intensity, and duration of the summer monsoons. An environmental current issue in Nepal is deforestation (overuse of wood for fuel and lack of alternatives), contaminated water (with human and animal wastes, agricultural runoff, and industrial effluents), wildlife conservation, vehicular emissions. There is some Environmental international agreements about Biodiversity, Climate Change, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection, Tropical Timber 83, Tropical Timber 94, Wetlands signed, but not ratified. (Geography and Map of Nepal)

Nepal has only 59km railway track and 13,223 km highways (paved 4,073km and unpaved 9,150km). There are 46 airports (2004) among them over 3,047 m there is 1, 914 to 1,523 m there are 7, and 1,524 to 2,437 m there is 1 airport. Likewise, less than 914 m there are 29, 914 to 1,523 m there are 7 and 1,524 to 2,437 m there is 1 airport with unpaved. (Geography and Map of Nepal)

2.5.2 Procedure to open a new business in Nepal

Table 5 shows the processing day to open the new business in Nepal. Normally, it will take 29 days to complete all the process. Details can be seen in the table below:

Table 5. Starting a business

Starting a Business ¹			
DB 2012 RANK	100	DB 2011 RANK	95
CHANGE IN RANK	+5	View details »	View methodology »
		Compare all economies »	
Indicator	Nepal	South Asia	OECD
Procedures (number)	7	7	5
Time (days)	29	23	12
Cost (% of income per capita)	37.4	21.6	4.7
Paid-in Min. Capital (% of income per capita)	0.0	19.1	14.1

No.	Procedure	Time to Complete	Associated Costs
1	Verify the uniqueness of the proposed company name	1 day	NPR 5
2	A professional verifies and certifies the memorandum and articles of association	5 days	NPR 10,000 depending on the professional's charges
3	Buy a stamp to be attached to registration form	1 day	NPR 5
4	File documents with the Company Registrar's Office, Department of Industry	15 days	NPR 4,500
5	Make a company rubber stamp	1 day	NPR 275
6	Register for VAT and income Tax with the Inland Revenue Office, the Ministry of Finance	5 days	no charge
7	Enroll the employees in the Provident Fund	1 day	no charge

(Source: Doing business 2012)

2.5.3 Foreign investment and technology transfer act 1992

According to this act, to transfer the foreign investment and technology, permission of the department should be required. After that, an application must be filled then only the department will make process to take permission. This act has been described provisions related to Visa of foreign national. They will provide a non-tourist visa for up to six months, and their dependent family will get business visa if the investment is more than 100 thousand US dollar. It has been written about the settlement of disputes between a foreign investor and national

investor. If there will be any dispute, which cannot be solved by mutual understanding then the case will be settled by arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL).

2.5.4 Employment and job securities in Nepal

Following things are necessary while hiring any employee. The general manager shall classify the posts of the workers and employees of the establishment according to the nature of the production process, service or work of the establishment and should notify the Labor Office. While appointing any employee, appointment letter describing the nature of appointment should give and the priority should give to Nepalese citizen.

Child labor is completely prohibitive and except in prescribed circumstances, minors and women may ordinarily be employed for the period from 6 am to 6 p.m. The calculation of the service period of any worker or employee should do in an establishment period during which a worker or employee remains on paid leave. In a contract some important points should mention such as whether a permanent or temporary job, employees facilities, retirement etc.

2.5.5 The regulation of health and safety in Nepal

The company should do every employee's health and safety arrangements. For example, regular medical checkup including eyes, insurance, separate modern toilets for male and female workers or employees in easily accessible places. If any worker or employee dies or becomes unable to work for more than 48 hours after sustaining injury because of any accident, or for any other reason, the concerned establishment shall notify the Labor Office within three days.

2.5.6 Welfare arrangement

Every company has to arrange welfare fund, compensation money, bonus, provident fund, medical benefits, annual leave (sick, public holiday, maternity, unpaid) for their employees. In every establishment employing, 50 or more women workers and employees, the company should arrange for a healthful nursery for their babies and arrange rest rooms equipped with the minimum necessary facilities and canteen.

2.5.7 The regulation of competition

Nepal has very little legislation about competition. It has recently become a member of the World Trade Organization (WTO). Being a member of WTO, a free trading regime of South Asian countries are offering. Under such circumstances, a Competition Law is necessary to the country. The government had targeted to formulate a Competition Law with the support of United Nations Development Program (UNDP). (Competition policy and Law in Nepal)

"The Constitution of the kingdom of Nepal, 1990" mentions protecting and promote the national enterprises (private or public). About the black marketing, "The Black Marketing and Certain other Social Offenses and Punishment Act, 1975" help to control black marketing, profiteering, hoarding, adulteration and certain other social offences like creating artificial scarcity, fraudulent sale, and sale of drug and maintaining the health, convenience and economic well-being of the public. (Competition policy and Law in Nepal)

"The Industrial Enterprises Act, 1992" will help to make the industrial sector competitive by giving guidelines about the liberal, open and competitive, economic policies to all the enterprises. "The Consumer Protection Act, 1997" supports to maintain the health of consumers, offering facilities and economic benefits, maintaining the quality of goods and services, controlling the inflation caused by monopoly and unfair trade practices, making arrangements establish institutions for facilitating consumer complaints and redressing grievances. (Competition policy and Law in Nepal)

Every country in the world wants to increase its domestic business. If the business opportunity were provided to domestic suppliers /contractors, it would help to increase domestic economy because they use local inputs (raw material, labor, technology, managements) in the production process. Therefore, this system will reduce the possibility of red tape and corruption that will provide predictable market access for the products of foreign origin. If this kind of transparency occurs, it encourages international competition for procurement. The transparency decision-making process is helping to reform the economy of developing countries because it is important to the pursuit of sound macroeconomic policies and stabilization measures. (Competition policy and Law in Nepal 2004)

2.5.8 The regulation of trade and restrictions

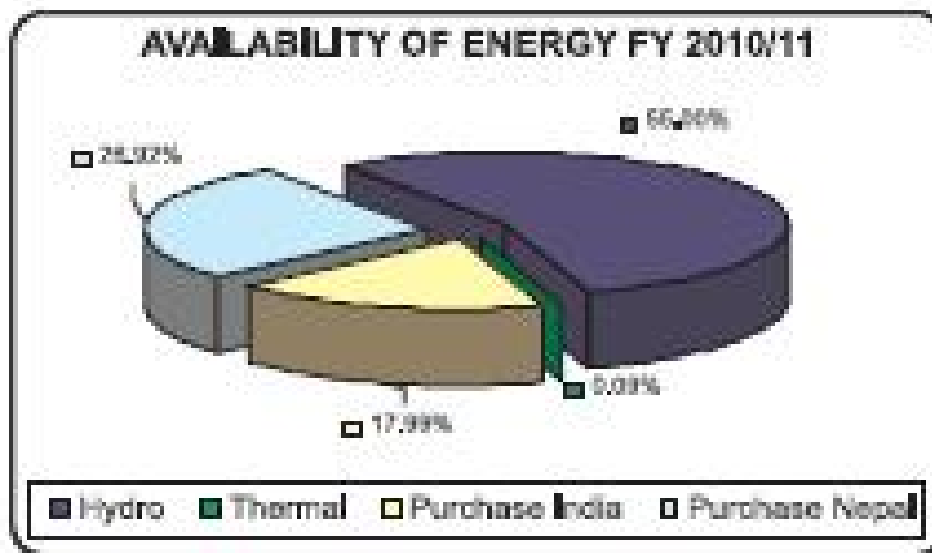
Nepal Government has free trade Agreement between European Union (EU), North America free trade Agreement (NAFTA), South Asian Association for Regional Cooperation (SAARC) and Multi-Fiber Agreement quotas. This agreement took place at the end of 2004. Besides this, Nepal

became the 147th member of WTO in April 2004 that supports to get more opportunities in export and import. (Trade Policy and Integration 2004)

3 Energy markets in Nepal

3.1 The general energy situation in Nepal

Nepal is one of the richest countries for the water resources. It has high hills and more than 6,000 rivers (approx. 2800 miles in total length) which provide many opportunities for large and small hydropower development. Because of technical, financial, geographical situation, it is unable to harness its potential. Social and economic developments of the country are dependent on enough energy supply. It is estimated to have theoretical hydro potential of 83,000 MW, of which 42,000 MW is economically feasible. (Policy DB 2011) Four hydropower plants, with a total installed capacity of 353.4 MW, are under construction. Till to the present date, the total installed capacity of the Integrated Power System are 400 MW, with hydro-plants of 75 MW or smaller contributing about 85% in the total system capacity mix and 23% (156 MW) of the current capacity are contributed by the private sector. The main transmission infrastructure operates at 132 kV and also there is a plan to upgrade it to 220KV in the future, and runs parallel to the Indian border in the south of the country. (Policy DB 2011)



(Source: Nepal electricity authority annual report 2011)

Figure 3. Availability of energy

Figure 3 shows the availability of energy in Fiscal year 2010/2011. The highest proportion of energy was produced from hydropower in Nepal after that energy produced by private energy companies, energy produced from Nepal is not enough that is why energy purchased from India too. The availability of thermal energy is very less in proportion.

3.2 Nepal electricity authority (NEA)

NEA is the main responsible body to distribute electricity within whole Nepal. Its main responsibilities are to recommend Government of Nepal, long and short- term plans, and policies in the power sector, likewise to determine and realize tariff structure for electricity consumption with prior approval of Government of Nepal and to arrange for training and study to produce skilled workers in the generation, transmission, distribution and other sectors. There are many Independent Power Producers (IPPs) who generate electricity and sells it to NEA under the Power Purchase Agreement. NEA is the only buyer of energy in Nepal and is responsible for energy exchanges with India. (Nepal electricity authority) NEA has made different Act and Regulations regarding electricity supply.

Electricity access Half of the House Hold (HH) in the whole country can only enjoy the electricity. (Annual Progress report 2009-2010) According to the report made by Government of Nepal for "Scaling Up renewable energy Program, Investment Plan for Nepal 2011", we could observe that 33% of HH still depend largely on kerosene for lighting, but almost all (99.7%) HH in the urban areas of Kathmandu valley have access to electricity. Altogether only 18% of Nepal's population has electricity.

Nepal has five development regions among them; the Western development region has the highest proportion of HH using electricity (63%), while the Mid-western development region has the lowest (34%). Besides this, the HH from the Mountain region has the least proportion of using electricity (41%). The proportion of HH using electricity in the Hills (56%) and Terai (59%) is slightly higher.

NEA has a generation operation and maintenance business group that is responsible for the daily operation and maintenance for the hydropower and thermal power station, which is owned by NEA. (Nepal electricity authority annual report 2011)

3.3 Investment and investor in energy

Kulekhani III Hydroelectric Project estimated cost is NRs. 2.43 billion which is jointly financed by GON (Government of Nepal) an NEA and deadline of the project is on July 2012. In this project M/S Sino Hydro Corporation, China has the contract for the construction of civil work of the

Project along with M/S Jheijiang Jinlin, Electromechanical Company; China got the contract for Electromechanical, Hydro-mechanical and Transmission Line. (Nepal electricity authority annual report 2011)

Chameliya Hydroelectric Project estimated cost is 100 million US\$ jointly financed by GON, NEA and Korean Government and the deadline of this project is December 2012. Korea Hydro & Nuclear Power Co. Ltd, (KHNP); Hwachon Plant Construction Co. Ltd. (HWACHON) Korea; Sean Engineering and Construction Co. Ltd. (SEAN) Korea and Nepal Hydro & Electric Ltd., (NHE) Nepal have got the contract for the construction of Electro-Mechanical, Hydro-Mechanical 132kV Transmission Line works of the project. (Nepal electricity authority annual report 2011)

Upper Trishuli 3A Hydroelectric Project Estimated cost is 125.775 Million US\$, and China Exim Bank have committed to provide concessional loan of 120 Million US\$ and the estimated deadline of this project is in 2014. Contract for the major construction work (Civil, electro-mechanical, hydro-mechanical works) was signed on 28 May 2010 with China Gezhouba Group Co. Ltd. Rahughat Hydroelectric Project estimated cost is US\$ 67 million, out of which US\$ 31 million is funded by the Export-Import Bank (EXIM Bank) of India. (Nepal electricity authority annual report 2011)

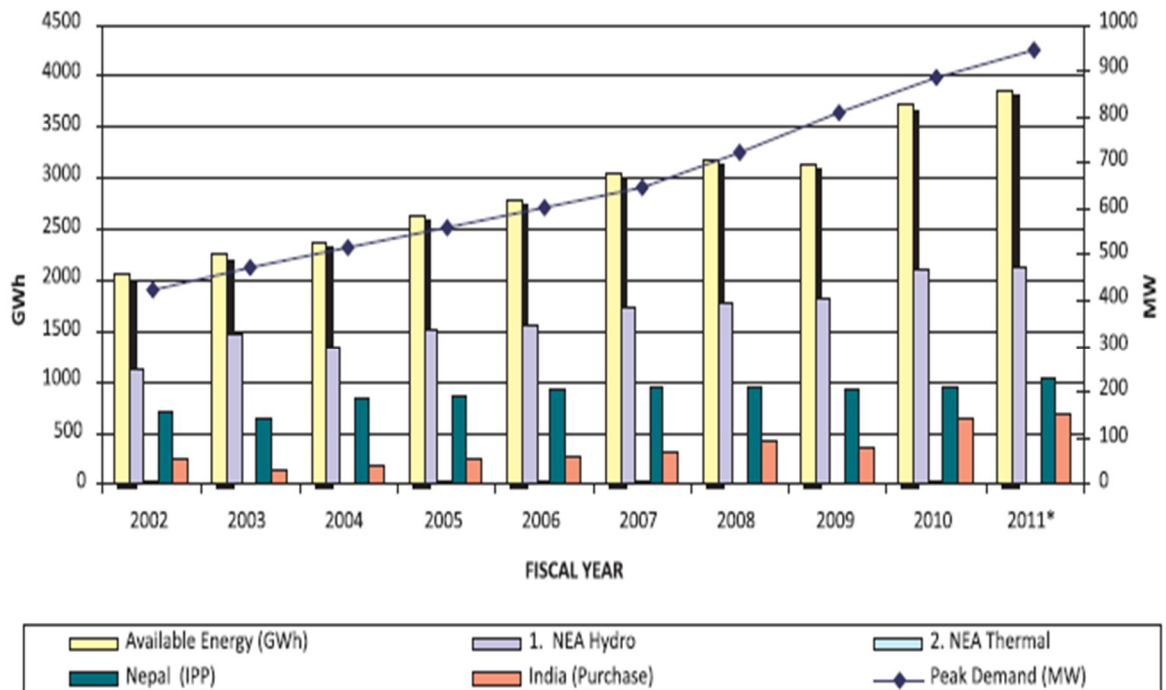
3.4 Energy crisis

Nowadays Nepal is facing a huge crisis of power supply. Load shedding (Power cut system) is increasing day by day. During the wintertime, Nepalese has to live 14hrs or more without electricity in a day because of the lack of water in the reservoirs. From hydropower, 706 MW power is generated which is insufficient to meet growing demand.

There is no any electricity conservation act in Nepal. If Nepal government can apply Energy Audit system in every sector, it will help to keep the focus on variations, which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, and identify energy conservation technologies, retrofit for energy conservation equipment. In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified period. (Energy Tech Consultants Pvt. Ltd) Its primary objective is to reduce energy consumption per unit of product output or to lower operating costs. (Energy Audit: cost-effective solutions for the industry in the era of the energy Crisis part 1)

According to Bishma Pandit, Rural Energy Advisor (was Energy efficiency consultant ESPS program) has written one article in the daily English language news paper on the Himalayan times on 1st December 2010, "Implementations of Energy audit options are incredibly important to save the energy within facility. Nepal, we had been using technologies that were designed before 1980 when energy was not a major component of production. Now energy is prominent components within any business. Government should remove custom duty for energy efficient technologies/renewable technologies. Business community needs to realize their carbon footprint and cost of production with these technologies with international bench marks while we have been taking about WTO and other open market economy."

The Integrated Nepal Power System (INPS) has a total installed capacity of 706 MW of which 652 MW (92%) is generated from hydro resources. The annual electricity generation on the grid system in 2009-2010 was about 3,690 GWh, of which power plants owned by the Nepal Electricity Authority (NEA), 26% by IPPs, generated about 57% and the remaining 17% was imported from the Indian grid. (Investment Plan for Nepal 2011)



(Source: Nepal electricity authority annual report 2011)

Figure 4. Total energy available and peak demand

Table 6. Total energy available and peak demand

Particulars	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Peak Demand (MW)	426	470.33	515.24	557.53	603.28	648.39	721.73	812.50	885.28	946.10
Available Energy (GWh)	2066.45	2261.13	2380.89	2642.75	2780.92	3051.82	3185.95	3130.79	3711.77	3858.37
1. NEA Hydro	1113.13	1478.04	1345.46	1522.9	1568.55	1747.42	1793.14	1839.53	2108.65	2122.08
2. NEA Thermal	17.01	4.4	9.92	13.669	16.1	13.31	9.17	9.06	13.01	3.40
3. Purchase (Total)	936.31	778.69	1025.519	1106.184	1196.27	1291.09	1383.64	1282.20	1590.11	1732.89
India (Purchase)	238.29	149.88	186.675	241.389	266.23	328.83	425.22	356.46	638.68	694.05
Nepal (IPP)	698.02	628.81	838.844	864.795	930.04	962.26	958.42	925.74	951.43	1038.84

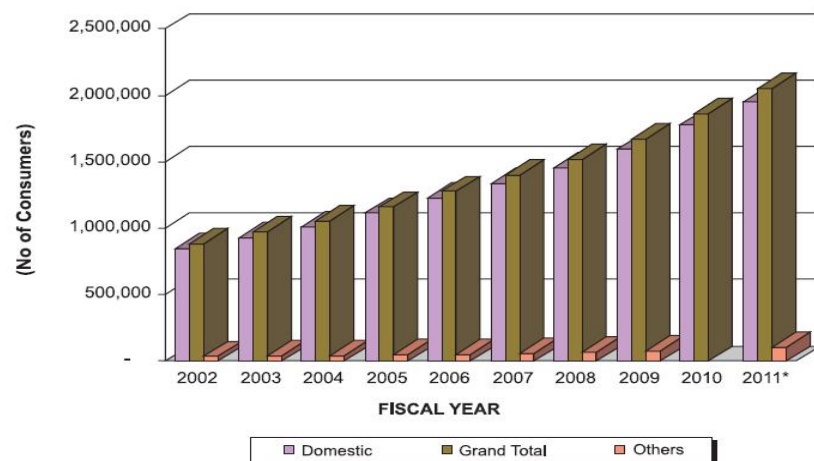
Note :- Peak demand is for all areas covered by integrated system including supply to India

* Provisional figures; Subject to final audit

(Source: Nepal electricity authority annual report 2011)

Table 6 shows that rapid urbanization and the increasing new industries are the reasons for high demand of electricity nowadays. According to the NEA, the peak demand in 2010 was 885 MW, which was an increase of 9% over the previous year. The annual energy demand was 4,367 GWh resulting in a shortfall of some 676 GWh, resulting in load shedding of 12-14 hours per day. The peak demand met by NEA rose steadily from 603 MW in 2006 to 946 MW in 2011 (with the excess over installed capacity supplemented by purchases from India), indicating a compound annual growth rate (CAGR) of 9.4%. Likewise, the total available energy increased from 2,781 GWh to 3,858 GWh at a CAGR of 6.8% during the same period.

Growth of Consumers



(Source: Nepal electricity authority annual report 2011)

Figure 4. Growth of consumer

Table 7. Growth of consumer

Particulars	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Domestic	848,540	930,554	1,010,719	1,113,740	1,227,295	1,339,253	1,450,254	1,595,015	1,775,571	1,948,968
Non-Commercial	8,629	9,722	9,865	9,950	10,010	10,215	10,556	10,518	10,952	12,805
Commercial	3,898	5,317	5,454	6,000	6,170	6,000	6,052	7,305	8,919	10,938
Industrial	18,789	19,833	21,374	22,500	23,020	24,089	25,548	28,559	29,410	33,155
Water Supply	251	305	352	370	380	414	434	584	609	725
Irrigation	1,353	1,721	2,557	3,400	6,450	13,183	18,614	22,335	32,089	39,470
Street Light	1,048	1,229	1,437	1,500	1,550	1,608	1,961	2,339	2,214	2,310
Temporary Supply	172	138	150	155	165	210	300	403	522	607
Transport	49	48	48	50	54	39	38	42	41	41
Temple	1,800	1,738	1,959	2,150	2,290	2,628	2,746	2,911	2,941	3,218
Community Sales	1	1	15	35	58	169	375	594	795	1,018
Total (Internal Sales)	884,530	970,606	1,053,930	1,159,850	1,277,442	1,397,808	1,516,878	1,670,605	1,864,063	2,053,255
Bulk Supply (India)	5	5	5	5	5	5	5	5	4	4
Grand Total	884,535	970,611	1,053,935	1,159,855	1,277,447	1,397,813	1,516,883	1,670,610	1,864,067	2,053,259

(Source: Nepal electricity authority annual report 2011)

Table 7 and figure 4 shows that the consumer of power system has been increased by 10.6%, which are about 1,854,275 customers from the previous year. The total number of consumers increased at a compound annual growth rate (CAGR) 10.0% from 1.28 million in 2006 to 2.05 million in 2011, of which 95% comprise domestic connections.

Table 8. Electricity Sales

Category	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Domestic	552.22	612.37	670.78	758.19	805.72	893.27	931.35	908.67	1108.87	1170.77
Non-Commercial	78.22	80.74	83.01	100.54	95.29	100.52	109.93	98.89	103.47	108.58
Commercial	90.43	92.74	108.12	109.31	120.30	141.69	154.38	146.29	187.12	206.21
Industrial	596.68	629.51	689.80	764.00	785.55	849.13	901.09	845.68	960.43	1043.32
Water Supply & Irrigation	29.28	29.98	31.67	49.98	45.50	47.96	46.86	48.14	55.98	55.01
Street Light	39.52	45.80	55.20	54.86	63.24	66.90	70.26	67.51	65.58	66.12
Temporary Supply	0.28	0.35	0.25	0.39	0.87	1.26	0.70	1.04	1.00	0.97
Transport	5.64	5.53	5.47	5.80	5.65	6.31	5.88	5.22	5.42	5.36
Temple	2.48	2.81	4.11	4.58	4.77	4.78	5.12	4.76	3.64	3.39
Community Sales	5.72	4.74	5.58	6.03	9.18	15.51	24.65	32.01	34.95	45.42
Total (Internal Sales)	1400.46	1504.57	1654.00	1853.69	1936.07	2127.33	2250.22	2158.21	2526.46	2705.15
Bulk Supply (India)	133.86	192.25	141.23	110.70	96.55	76.87	60.10	46.38	75.07	29.59
Grand Total	1534.32	1696.82	1795.23	1964.39	2032.62	2204.20	2310.32	2204.59	2601.53	2734.74

Note : * Provisional figures; subject to final audit.

(Source: Nepal electricity authority annual report 2011)

According to the table 8, Electricity sales by NEA increased from 2,033 GWh in 2006 to 2,735 GWh in 2011 at a CAGR of 6.1%. In terms of composition, the domestic sector accounted for 43% of the total consumption in 2011, followed by the industrial sector at 38%. Consumption of electricity by other sectors is very much smaller than domestic sectors. Such as, commercial (7.5%), non-commercial (4.0%), street lighting (2.4%), water supply & irrigation (2.0%), community sales (1.7%), and bulk supply to India (1.1%), with negligible amounts consumed by transport and temples.

Table 9. Nepal power system load forecast

Fiscal Year	Energy (GWh)	System Peak Load (MW)
2010-11	4,430.70	967.10
2011-12	4,851.30	1,056.90
2012-13	5,349.60	1,163.20
2013-14	5,859.90	1,271.70
2014-15	6,403.80	1,387.20
2015-16	6,984.10	1,510.00
2016-17	7,603.70	1,640.80
2017-18	8,218.80	1,770.20
2018-19	8,870.20	1,906.90
2019-20	9,562.90	2,052.00
2020-21	10,300.10	2,206.00
2021-22	11,053.60	2,363.00
2022-23	11,929.10	2,545.40
2023-24	12,870.20	2,741.10
2024-25	13,882.40	2,951.10
2025-26	14,971.20	3,176.70
2026-27	16,142.70	3,418.90
2027-28	17,403.60	3,679.10

(Source: Annual Report of NEA 2011)

The table 9 shows the energy demand forecast from 2010 to 2028. Likewise, table 9 is the energy demand forecast table from 2010-11 to 2027-28. The electricity demand is forecast to reach about 3,679 MW in the financial year 2027-28, (medium growth scenario) which is an increase of 2,800 MW. (NEA Annual Report, 2011) To Meet the future demand of electricity, it will be the biggest challenge for Nepal. Despite lots of challenges, Nepal is getting lots of support from different international organizations. Recently, The World Bank has approved one project, which is called Nepal-India Electricity Transmission and Trade Project. The main objective of this project is to establish cross-border transmission capacity between India and Nepal of about 1000 MW to facilitate electricity trade between the two countries, and to increase the supply of

electricity in Nepal by the sustainable import of at least 100 MW. (Nepal-India Electricity Transmission and Trade 2011) This project will help to reduce load shedding in Nepal in future.

4 Renewable energy market in Nepal

Nepal is currently facing a power shortage. The 706 MW is not enough to meet the peak demand of electricity. That is why NEA has to cut off the power for a certain hour in a day. Because of increasing urbanization, Nepalese people have a habit to live with the electricity. People are using generator, electricity inverter for the supplement of electricity. In this context, Renewable Energy will be the best solution for Nepal. It can provide reliable and cost effective energy service to thousands and thousands of rural areas.

GoN (Government of Nepal) has a goal of increasing the share of renewable from less than 1% to 10% of the total energy supply and increase access to electricity through alternative energy sources from 10% to 30% within the next 20 years. Complementing these goals, the GoN envisages investments of USD 1,076 million in RE by 2020, which will include support for hydropower, solar PV and biogas technologies. (SREP Investment plan 2011)

4.1 Current situation and outlook of renewable energy market

Nepal's energy resources are currently classified into three categories namely the traditional, commercial and alternative. Traditional energy resources are wood from forests and tree resources, agricultural residues coming from agricultural crops and animal dung in the dry form and biomass energy via biomaterials. Coal, grid electricity and petroleum products are considered as commercial energy resources. Biogas, solar power, wind and micro level hydropower are categorized into the alternative energy resources in Nepal. Such resources are considered as the supplement of conventional energy resources. 87% energy consumption was derived from traditional resources, 12% from commercial sources and less than 1% from the alternative sources. (Energy sector synopsis report 2010)

4.1.1 Renewable energy consumption

Table 10. Total energy consumption by various fuel types

Total Energy Consumption by Various Fueltypes and Years (Unit in 000 GJ)

Category	Fueltype	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Traditional	Agr residue	12732.1	13025.7	13326.6	13634.9	13963.5	14006.6	14370.9	14359.5	14684.7
	Animal dung	19491.8	19901.1	20319.0	20745.7	21181.4	21626.2	22080.3	22544.0	23017.4
	Fuelwood	258635.6	269157.7	274960.2	280888.3	286960.0	292460.4	298325.4	304721.2	311167.3
Traditional Total		290859.4	302084.6	308605.8	315269.0	322104.9	328093.2	334776.6	341624.7	348869.5
Commercial	ATF	2283.4	1716.3	1911.2	2316.4	2417.1	2327.0	2306.9	2493.5	2493.4
	Coal	7446.3	6481.0	5721.3	7292.4	6459.3	10364.0	6158.4	8243.0	7751.5
	Electricity	4612.1	5065.8	5433.5	5974.5	6673.2	6969.9	7658.4	8100.8	8137.2
	Fueloil	588.1	577.8	553.6	421.4	-27.7	1.2	52.8	27.2	0.0
	Gasoline	1984.1	2118.9	2259.1	2276.1	2533.6	2712.3	3413.0	3377.2	4158.4
	HSDiesel	12367.5	10856.8	11378.0	11368.7	11910.6	11163.9	11632.6	11481.6	17693.1
	Kerosene	11472.0	14017.8	12641.0	11270.6	8658.6	8217.9	7174.0	5628.1	2541.4
	LDiesel	133.7	94.4	23.9	23.1	3.4	11.4	7.0	12.0	14.8
	LPG	1974.6	2400.8	2761.3	3256.8	3820.7	3988.7	4607.0	4768.3	5702.6
Other Petroleum	482.1	522.2	588.3	662.7	746.7	841.2	947.7	124.6	409.9	
Commercial Total		43343.9	43851.9	43271.3	44862.7	43195.4	46597.3	43957.8	44256.4	48902.3
Renewable	Biogas	1179.2	1350.1	1526.5	1650.3	1847.5	2027.2	2222.1	2384.2	2593.1
	Microhydro	38.1	41.7	47.2	52.8	56.9	65.1	90.2	112.7	136.0
	Solar	0.3	0.9	1.7	2.2	2.7	2.9	3.1	4.1	5.6
Renewable Total		1217.5	1392.8	1575.5	1705.3	1907.2	2095.2	2315.4	2501.0	2734.6
Grand Total		335420.9	347329.3	353452.5	361837.0	367207.4	376785.8	381049.9	388382.1	400506.4

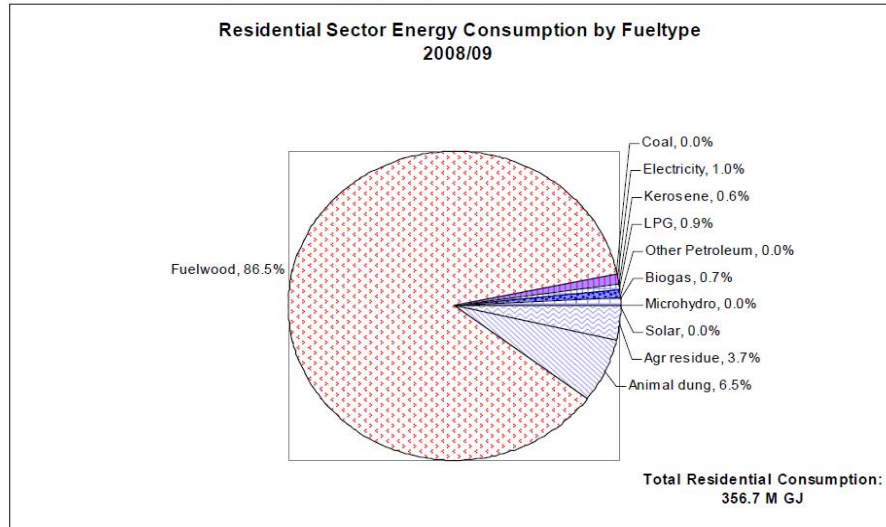
(Source: Energy Sector Synopsis Report 2010)

According to table 10, total energy consumption in 2008/2009 was 400506400 among them the used portion of renewable energy was 27346000.

4.1.2 Sectoral renewable energy consumption by fuel type

4.1.2.1 Residential sector

Presents the share of different fuels used in the residential sector

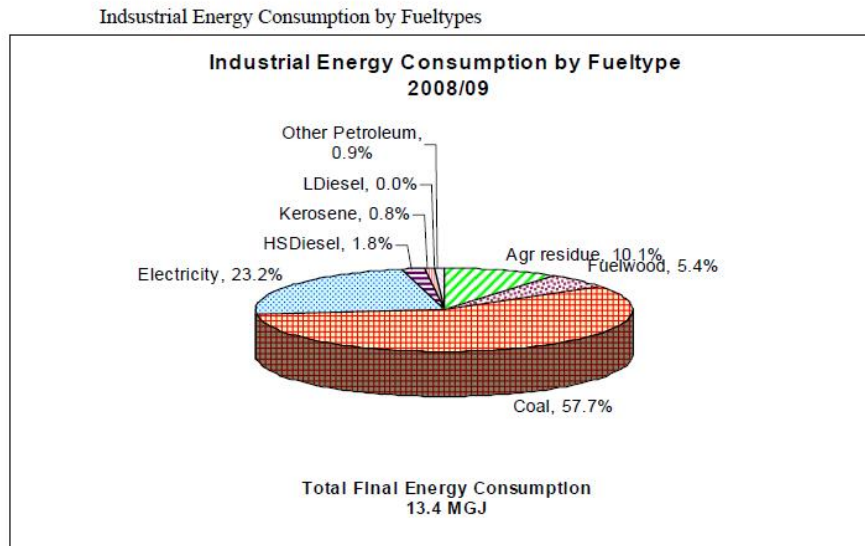


(Source: Energy sector synopsis report 2010)

Figure 5. Residential sector

The residential sector consumed almost 89% of the total energy consumption of Nepal in 2008/09. Figure five shows that Biomass resources are the major fuels used in this sector, namely fuel-wood, agricultural residue and the animal Waste. Recently renewable sources like biogas and electricity from micro-hydro and solar home Systems are used as substitutes for cooking and lighting. Only 1% of alternative energy resources are used, but the annual growth rate of solar is high with more than 200% followed by biogas and electricity from micro-hydro with 15% and 32% respectively. (Energy Sector Synopsis Report Print Final 2010)

4.1.2.2 Industrial sector



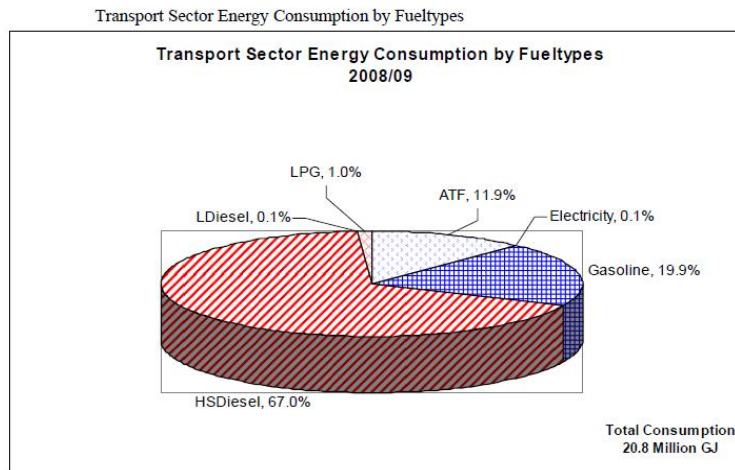
(Source: Energy sector synopsis report 2010)

Figure 6. Industrial energy consumption

Figure 6 shows that total Energy consumption in this sector is about 13.4 million GJ, which is 3.3% of the total energy demand. Although total energy consumption has been increased than last years, it has increased only by about 0.4% annually since last eight years. The main end uses in the industrial sector are process heating, motive power, boiling in the boilers and lighting. This sector is heavily dominated by energy from coal, and other sectors are power motive (31%), process heating (30%) and lighting (2%). (Energy sector synopsis report 2010)

Many traditional and small-scale industries are being closed due to insufficient electricity because only one fourth of total industrial energy was covered with electricity. Besides this, Biomass resources (fuel wood and agricultural residue) are still being used in the industrial sector for ignition of fire as well as for heating purposes used with coal. Biomass still supplies about 15% of the industrial energy requirement. (Energy sector synopsis report 2010)

4.1.2.3 Transport sector

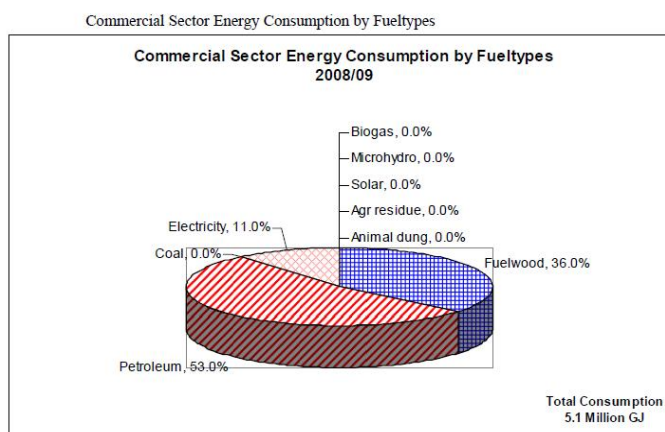


(Source: Energy sector synopsis report 2010)

Figure 7. Transport sector energy consumption

As increasing trend of consuming energy, figure 7 shows that this sector is the second largest energy-consuming sector with about 20.8 million GJ (5.2%) in the year 2008/09. The annual growth rate of this sector is about 8.9 % annually. Transport sector can be divided into five categories; they are the Road transport, Railway transport, Trolley transport, Ropeway transport and Aviation transport. Road heavily dominates energy consumption by sub sector of this transport sector because it consumes about 86.5% of the total sectoral consumption, whereas Aviation subsector consumes about 13.4%. Consumption in Railway, Trolleybus, and Ropeway sub sector is minimal even less than 0.5%. (Energy sector synopsis report 2010)

4.1.2.4 Commercial sector



(Source: Energy sector synopsis report 2010)

Figure 8. Commercial sector energy consumption

As shown in the figure 8, his sector consumed 5.2 million GJ only in 2008/2009; it is one of the badly affected economic sectors during the last decades because its annual growth rate is only 3% since 2000/01. LPG and Kerosene are contributing about 53% of the sector to meet the demand. Then fuel wood stands for supplying about 36% of the sectoral energy consumption. Electricity is the third largest sources of energy (11%) in the sector. (Energy sector synopsis report 2010)

4.1.2.5 Agricultural sector

Table 11. Agricultural sector energy consumption

Agricultural Sector Energy Consumption by Fueltypes		
Fueltype	Consumption (000 GJ)	Percent
Electricity	173.7	4.8%
HSDiesel	3469.0	95.1%
LDiesel	3.7	0.1%
	3646.4	100.0%

(Source: Energy sector synopsis report 2010)

According to the table 11, this sector uses only two types of energy sources that are electricity and Diesel. It consumed only 1% of total energy demand, which was 3.6 million GJ in the year 208/2009. Around 95% of the total agricultural energy comes from petroleum products specially the diesel fuel. Only 5% is derived from electricity. Electricity consumption in this sector is increasing by about 8% annually since 2000/01 whereas light diesel oil is increasing by about 11% annually. Comparing to petroleum, electricity is increasing rapidly. (Energy sector synopsis report 2010)

4.2 Challenges, constrains in market entry and technology

4.2.1 Barriers/challenges for renewable energy

4.2.1.1 Policy and regulatory barriers

Rural (Renewable) Energy Act, Rural/Renewable Energy Central Co-ordination Commission Regulation and Central Rural Energy Fund Regulation are the policy barriers in Nepal. Feed in Tariff Act, Alternative Energy Promotion Centre (AEPC) Act and Nepal's 20 Years Perspective Plan (2011-2030) are at different stages of development which might take some more time to get into parliament because of the current political situation in Nepal. (Situation analysis 2011) Another challenge is a new constitution as Nepal's Parliament has extended its tenure to

implement the new constitution again for another six months to prepare a new constitution and implement them in time. (Six-month calendar for constitution writing 2011)

4.2.1.2 Institutional barriers

Some institutional barriers are weak networking between energy companies, distributors, finance institutes; inadequate cooperation between different RE projects in Nepal are the main institutional barriers. (Situation analysis program 2011)

4.2.1.3 Financial barriers

There are some key barriers related to financing of RE scheme in Nepal. They are high costs of renewable energy systems, high dependency on donor funds, limited knowledge of available financing schemes, limited knowledge within micro finance institutes about market opportunities in the RE sector. To develop loan-products for the renewable energy sector, risk aversion of finance institutes, insufficient capital within micro-finance institutes to finance renewable energy applications, limited knowledge about the role of carbon financing to support a sustainable financial environment and limited availability of credit to user groups are also the key financial barriers. (Situation analysis 2011)

4.2.1.4 Technical barriers

Lack of detailed information on the potential sites and feasibility of RE (Renewable Energy) systems, limited experience with the technical, economic and environmental aspects of renewable energy, inadequate knowledge on the installation, management, operation and maintenance of large renewable systems are the technical barriers. The other technical barriers are insufficient capacities both in the knowledge and in human resource for manufacturers, installers and maintenance technicians for promotion of large solar systems beyond 100 watts, and particularly use of photovoltaic energy to generate heat. (Situation analysis 2011)

4.2.1.5 Information and awareness barriers

There is a lack of enough information about RE system. Most of people from a rural area are still unaware about the most feasible option at the local situation.

4.2.1.6 Systemic, decentralization and governance

Decision making process in Nepal is mostly center driven. There is a top-down approach and it may create conflict between the local bodies and stakeholders. In RE development program,

center level stakeholders operate all programs, but there is a need of the power of local level to sustain the programs. In the case of Nepalese people from a rural area, still they are not fully capable of mobilizing the resources and establishing such system on their own. On the front of decentralization, it has been seen that centre level institutions, which have decisive powers, tend to retain their administrative and financial power to control and only delegate implementation responsibilities at the district or lower level. (Situation analysis 2011)

4.2.1.7 Social, cultural and gender barriers

Nepalese people are very rich in cultural. One community culture is different from others. Many rural and urban areas have their own cultural and social values. Therefore, before implementing any kind of program, these barriers have to be taken into account.

4.3 Critical constraints

Due to shortage of fund subsidy stopped by government from March 2011, people were not able to use the renewable energy system. There is no independent regulatory mechanism as well as limited coordination among energy related sectors. Nepalese people are still using traditional energy resources, which are dominating energy supply side. Another critical constraint is inadequate infrastructure and transportation facilities.

4.4 Major issues

Various factors such as the wide geographical variability, lower literacy rate among the users and high cost factor are some of the major issues associated with the promotion of sustainable energy in the country. (National Energy situation report 2005)

4.5 Financing of renewable energy projects

Nepal as a developing country gets many financial aid for different sectors by Nepal government, national and international organizations. Alternative energy promotion center (AEPC) is the government body to promote, support the Renewable energy sector in Nepal. Winrock International-Nepal is also the organization, which has promoted and integrated renewable energy systems in rural communities, made improvements to and recommendations on the policy framework and investment programs for renewable energy, introduced renewable energy options for livelihood and poverty alleviation initiatives, and built the capacity of NGOs, industry associations, private project developers, and government agencies. (Environment Forestry Energy & Ecosystem Services) It has promoted the clean energy services for poor

households through access to microfinance in Nepal. They help the lower income people to install the biogas, solar home systems, smoke hoods, and improved cooking stoves by providing microfinance. Likewise, scaling up renewable energy program will support investments to scale-up renewable energy generation in the Nepal.

The Asian Development Bank (ADB) and World Bank are also working with Government of Nepal to give the financial support in the energy sector. ADB plays a vital role in Asia Solar Energy Forum to exchange the knowledge between the Nepal sector agencies and international utilities, governments, and the private sector since 2010. (Program for Scaling Up Renewable Energy in Nepal 2011)

Table 12. Donor wise approved budget

Donorwise Approved Budget for NFY 2068/69 (2011/2012)
Alternative Energy Promotion Centre
Ministry of Environment

(Figure in Thousands)

SN	Programme/Project	Approved Budget									Remark
		GoN	Donor							G. Total	
			Danida	Norway	Germany-KfW	World Bank-IDA	EC	UNDP	Total		
1	Alternative Energy Promotion Centre	64,235	190,000	100,000	10,000	0	0	0	300,000	364,235	The donors budget include budget for the technical Component
2	Biogas Production Programme	112,238	0	0	27,160	274,942	0	0	302,102	414,340	World Bank budget includes the GPOBA and CDM
3	Micro hydro and Alternative Energy Programme*	676,225	208,465	226,710	385,400	0	0	0	820,575	1,496,800	The donors budget include the subsidy
4	Community Micro Hydro Rural Electrification Programme (PDF)	2,530	0	0	0	310,620	0	0	310,620	313,150	
5	Renewable Energy for Rural Livelihood (REERL) Programmes	0	0	0	0	0	0	38700	38,700	38,700	
6	Renewable Energy Project	3,730	0	0	0	0	20,000	0	20,000	23,730	
7	Biofuel Programme	12,400	0	0	0	0	0	0	-	12,400	
8	Enhanced Rural Energy Service Programme- Kabeli Transmission Project	0	0	0	0	10,000	0	0	10,000	10,000	This is World bank new Project in the areas covered by Kabeli transmission line from Jhapa to Taplehung Districts
	Total	871,358	398,465	326,710	422,560	595,562	20,000	38,700	1,801,997	2,673,355	
	Total in %	32.6%	14.9%	12.2%	15.8%	22.3%	0.7%	1.4%	67.4%	100%	

*The GoN Budget in SN 3. includes the budget for 15,000 SHSs (NRs. 120 Million) , 900 KW Micro/Mini hydro (NRs. 126 Million) and NRs. 140 Million for additional financial support to Micro/Mini Hydro Power Projects

(Source: Alternative energy promotion center 2011/2012)

Table 12 shows the donor wise approved budget for fiscal year 2011/2012 in Alternative Energy sector. Danida, Norway, Germany, World Bank, UNDP, EC and Government of Nepal are the major donors for renewable energy resources in Nepal.

Table 13. Donor wise disbursed Percentage

Country	Disbursed%	Remaining %
Denmark	78	22
Norway	100	0
Nepal	56	44
KfW	40	60
DFID	100	0

(Source: Donor wise budget 2011/2012)

Danida, Norad, KfW and Government of Nepal continued their support in providing subsidy fund through REF. Table 13 shows that donation provided by Norway gives donation to Alternative Energy promotion Center and Micro hydro and Alternative Energy Programs. Likewise, Germany donates to Biogas production program. In March 2011 Department for International Development, United Kingdom (DFID/UK) joined ESAP program for providing financial support to around 34,000 SHSs with total financial support of 2 million pounds sterling.

Government of Nepal plans to invest of USD 1,076 million in RE by 2020, which will go to support for hydropower, solar PV and biogas technologies. (Scaling up Renewable Energy Program 2011, 9 pt 33)

Table 14. Proposed scaling up renewable energy program

Proposed SREP Programs

Sector	Small Hydropower – SREP \$20M	Mini and Micro Energy – SREP \$20 M
Modalities	Structured Financing Facility: \$20M for credit/risk coverage to domestic financial institutions/SHP, including Technical Assistance	Central RE Fund (under AEPC): \$20 M for revolving credit/grant facility including Technical Assistance
Targets	50 MW new SHP capacity, selected from immediate pipeline of 100 MW	Biogas: \$10.0 M for 160,000 biogas systems Mini- and micro-hydro: \$5.0 M for 30 MW Solar Home Systems: \$5.0 M for 500,000 systems

(Source: Scaling up renewable energy program 2011)

The overall program targets set by government have been used as the basis in preparing this Investment Plan, which covers the period October 2012 to September 2017. Scaling up renewable energy program financing will be used to install 50 MW of small hydropower, 30 MW of Mini and Micro hydropower, 500,000 solar home systems, and 160,000 biogas plants according to the table 14.

Table 15. Financing Plan

Financing Plan, USD '000

Investment	GoN	SREP Initial Allocation	RREP	Other	Private Sector Equity	Total	% of Total
Small hydro power		20,000		58,750	33,750	112,500	22
Mini & micro hydro	20,000	5,000	60,401	21,265	26,667	133,333	26
Solar home systems	18,750	5,000	56,395	19,855	25,000	125,000	24
Biogas	20,000	10,000	56,703	19,963	26,667	133,333	26
Other RETs	1,500		6,500		2,000	10,000	2
Total	60,250	40,000	180,000	119,833	114,083	514,167	100

(Source: Scaling up renewable energy program 2011)

Table 15 shows the investment of different organization to the RE Sector in Nepal. GON is investing 60,250 USD, Rural Renewable Energy Program (RREP) 180,000 USD, SREP program 40,000 USD, private sector and other for Nepal 114,083 USD.

Table 16. Channeling of scaling up renewable energy program funds

Channelling of SREP Funds

	Program	SREP Financing	Lead MDB
Component I: Small hydropower Development	SHP	\$10m	IFC
	SHP	\$10m	ADB (private sector arm)
Component II: Mini and Micro Initiatives: Off grid Electricity	Solar PV	\$5m	ADB
	Mini/micro hydro	\$5m	ADB
Component III: Mini and Micro Initiatives: Cooking	Biogas	\$10m	WB

(Source: Scaling up renewable energy program 2011)

The proposed lead MDB (multilateral development bank) to channel scaling up renewable energy program funds for financing the programs in Nepal through three components is shown in the Table 16.

Table 17. Government support for rural and renewable energy development

Government Support for Rural and Renewable Energy Development

Period	Activity
Sixth Plan 1980 - 85	GoN subsidy of NPR 2.67 million to micro hydro entrepreneurs through the Agricultural Development Bank of Nepal
Seventh Plan 1985 - 1990	GoN made specific reference to the RET sector as a means of providing benefits to its rural population and conserving forest resources
Eighth Plan 1992 - 97	GoN provided NPR 330 million in the form of subsidies for the development of micro hydro, biogas, solar, biomass and wind energy projects
Ninth Plan 1997 - 2002	Total outlay of NPR 5,548 million, with NPR 776 million (14%) from GoN and balance leveraged with private sector and donor funding
Tenth Plan 2002 - 2007	Total estimated investment NPR 4,587 million, with GoN contributing NPR 550 million
Three Year Interim Plan 2007 -2010	Total investment NPR 4,957 million, of which about 80% is in the form of subsidy from GoN and donors;
Current Three Year Plan 2010 - 2013	Estimated investment of NPR 7,107 million, of which the GoN will contribute NPR 1,350 million in the form of subsidy.

(Source: Scaling up renewable energy program 2011)

The current Three Year Plan sets an ambitious target of providing electricity to an additional 7% of the rural population through RETs (Renewable energy technology). Expenditure on RETs over the past decade has been around NPR 12 billion, and the current expenditure is close to NPR 3 billion annually.

4.6 Impact of current energy crisis among the industries in Nepal

Nepalese one of the most popular online newspaper "ekantipur.com" published some articles about current energy crisis in Nepal. This crisis hits Nepalese industries badly as a result of these industries forces to cut off their productions or increase the production cost. According to this article, the eastern region of Nepal needs around 200 MW of electricity out of which industry needs 150 MW but only 65 MW can consume by industry.

Likewise, load shedding has forced the country's largest industrial base to decline their production by 60 percent. Rushi Unnithan, executive director of Jagdamba Steels one of the steels production factory said, "Our factory used to produce 1,280 tons of iron rod daily, which now has come down to only 500 tones,".

According to Ashok Temani, president of the Birgunj Chambers of Commerce and Industry (BCCI), five iron factories have shut down their operation. "There is no environment to run industries," said Temani. "The government is only busy collecting revenue." Due to the energy

crisis, nine cement factories and seven iron factories is struggling to run under their normal production schedule. The cement factories having daily production capacity of 15,000 sacks have been producing just 3,000-5,000 sacks for the last few weeks. Mahendra Agrawal, sales manager of Jagdamba Cement, said his company is struggling to supply cement as per the market demand.

BCCI has urged the government to import additional 12 MW power from India by repairing Birgunj-Raxaul transmission line. "The repairing of the transmission line will cost only Rs 400,000," said the president of BCCI. Industrialists have also demanded to bring into operation the 14-MW diesel plant in Hetauda. Arun Mahato, head of Birgunj Power Distribution Centre of Nepal Electricity Authority, said NEA has held talks with Bihar Electricity Board to restart the Birgunj-Raxaul transmission line. According to Mahato, import of the 12-MW electricity from Raxaul could bring down power shortage in Birgunj by three hours a day.

4.7 Energy policy

There is not any typical national energy strategy in Nepal, but there are some energy related policies in Nepal that can be found in 5-year plans. Both the 10th five-year plan (2002/03 - 2006/07) and the 3-year interim plan (2007/08 - 2009/10) defined about the electricity sector. These plans, plus the Hydropower Development Policy (2001), the Renewable Energy Perspective Plan (2000-2020), the Perspective Energy Plan (1991-2017), the Water Resources Act (1992), and the Electricity Act (1992) is the main policy, planning, and legislative documents guiding the energy sector in Nepal.

4.7.1 National electricity crisis resolution action Plan 2008

Nepal government has decided 38-point Electricity Crisis Resolution Action Plan in Poush 2065 (2009) that provides for immediate, short-term and long-term programs. Immediate programs include determining a Power Purchase Agreement at a flat rate for power plants up to 25 MW, 7 years of income tax holiday for such plants, and waiver of the provision for performing an Environmental Impact Assessment (EIA) for power projects expected to achieve implementation by Chaitra 2068 (2011). The Plan also described importing more power from India, build 200 MW of thermal power plants, encourage power generation through captive plants by subsidizing the additional cost involved in producing power from oil, and strengthen and add transmission capacity. These plans also encourage solar and wind power through various concessions and facilities. (The Renewable Energy and Energy Efficiency partnership 2011)

4.7.2 Rural energy policy 2006

This policy targets to use the improved biomass technologies, solar home systems (10 Wp and above) and white-LED and photovoltaic-based solar lights replacing kerosene lamps (renewable energy) to meet the needs of energy in a rural area. The program of using small solar systems based on small photovoltaic and white-LED as an immediate and intermediate solution will be more affordable to the poor people in Nepal. (The Renewable Energy and Energy Efficiency partnership 2011)

4.8 Government authorities and supporting institutions in Nepal

The principal institutions responsible for policymaking and program implementation in the renewable energy sector are listed below:

4.8.1 Ministry of energy (MoEng)

It was established in 2009 through a reorganization of the former Ministry of Water Resources. MoEng's role includes planning to develop energy resources to accelerate the social and economic development of the country, policy development, energy conservation, energy research, promotion of multipurpose electricity projects, promotion of private parties in electricity development, bilateral and multilateral agreements for energy/electricity, tax related matters and coordination of institutions related to the sector. (Investment plan for Nepal 2011, 11)

4.8.2 Department of energy development (DoED):

A department under the MoEng, it is primarily responsible to ensure enforcement of the regulatory framework; accommodates, promote and facilitate private sector participation in the power sector by providing a 'One Window' service; and issue licenses for power projects. (Investment plan for Nepal 2011, 11)

4.8.3 Nepal electricity authority (NEA)

Set up in 1985 through a merger of related government bodies, NEA is a vertically integrated state-owned firm under the MoEng responsible for generation, transmission and distribution of electricity. NEA recommends long and short-term plans, policies, and tariffs for the power sector. NEA is the only domestic off-taker of power and all domestic IPPs require a PPA from NEA to sell power to the grid. (Investment plan for Nepal 2011, 11)

4.8.4 Water and energy commission secretariat (WECS)

WECS was established to develop water and energy resources in an integrated and accelerated manner in the country in 1981. (Investment plan for Nepal 2011, 11)

4.8.5 Electricity tariff fixation commission (ETFC)

Cabinet has reconstituted set up for the regulation of retail tariffs, ETFC recently. (Investment plan for Nepal 2011, 11)

4.8.6 Ministry of environment (MoEnv)

Set up as a separate entity in 2009 following reorganization, some of the main objectives of MoEnv include promotion of sustainable development through environmental protection, conservation, coordination of adaptation programs to minimize the negative impacts of climate change. The MoEnv is also responsible for policy and plan formulations and coordination of the RE sector. (Investment plan for Nepal 2011, 11)

4.8.7 Alternative energy promotion centre (AEPC)

Established in 1996, its role is to promote the use of RETs and the efficient use of energy, reduce environment impacts, develop commercially viable alternative energy technologies and raise the living standard of the people, particularly in rural areas. AEPC is a semi-autonomous government body under the MoEnv, which was formed under Clause 3 of the Development Board Act 2013 BS. It is currently operating under the mandate given by the Alternative Energy Promotion Development Board Formation Order (Fifth Amendment) 2063. Its governing board includes government, private sector, non-governmental organizations (NGOs) and financial institutions. To implement its mandate, the AEPC typically works partners including government agencies, donors, private sector and civil society⁴⁰. (Investment plan for Nepal 2011, 12)

The process to expand the mandate of the AEPC and the establishment of the Alternative Energy Promotion Board (AEPB) through the promulgation of an Act has begun. The AEPB would be an autonomous agency with powers to raise grant and loan funds locally and internationally to develop RE, maintain a separate fund, provide support to local bodies, NGOs and CBOs and promote PPPs in RE development. The AEPB will need organizational strengthening to implement its expanded mandate.

4.8.8 Local institutions and communities in renewable energy technology

Several industry associations that include the Nepal Micro Hydro Development Association, the Solar Electrical Manufacturers Association of Nepal, and the Nepal Biogas Promotion Association support the mini and micro energy sector. Two NGOs, the Biogas Sector Partnership-Nepal (BSP-N) and the Centre for Rural Technology-Nepal also support renewable energy technology programs. The Association of District Development Committees of Nepal (ADDCN) and Association of Village Development Committee in Nepal (NAVIN) is important players actively engaged in advocacy, networking, and policy guidance in the renewable energy sector. (Investment plan for Nepal 2011,12)

4.8.9 Independent power producers association of Nepal (IPPAN)

IPPAN is a non-profit, non-governmental organization established to encourage private sector participation in hydropower development in the country in 2001. IPPAN serves as a link between the private sector and government of Nepal agencies and helps in the exchange of technology, expertise, knowledge, financial and management information among the IPPs in the country. (Investment plan for Nepal 2011, 12)

4.8.10 Other industry associations

The Federation of Nepalese Chamber of Commerce and Industries (FNCCI), and Confederation of Nepalese Industries (CNI) serve as umbrella organizations with a mandate extending beyond renewable energy technology. (Investment plan for Nepal 2011, 12)

4.9 Companies and renewable energy organizations in Nepal

4.9.1 Center for renewable energy (CRE)

It is a non-governmental and not profit making organization, which was established in 1992 with the objectives to become the national information bank for renewable energy and appropriate technology, conducting awareness program and research on these fields.

4.9.2 Kathmandu university (KU)

KU has Bio- Based and Green Energy Laboratory where research can be done for the bio energy. Research is focused on gasified engine system, energy generation from solid waste, Biomass cooking stove, solar energy utilization, bio-diesel production, refinement and utilization of fuelling I.C engines.

4.9.3 Innovative energy and environment Nepal (IEEN)

This is a non-governmental organization, which is established with one of the motives to conduct scientific and participatory research and studies in relation to existing or new innovative technologies in the fields of renewable energy and environment.

4.9.4 Solar electric manufacturers association Nepal (SEMAN)

It is an umbrella organization of Nepalese solar photovoltaic system manufacturing companies.

4.9.5 Renewable energy test station (RETS)

It is established with the mutual collaboration of Nepal Academy of Science and Technology (NAST), Alternative Energy Promotion Centre (AEPC), Energy Sector Assistance Program (ESAP), Nepal Bureau of Standards and Metrology (NBSM) and Solar Electric Manufacturers Association of Nepal (SEMAN). Its main objective is to provide technical assistance, international trend in use of renewable energy system, measurement of quality control of renewable energy products. (Renewable energy test station)

4.9.6 Rural energy development program (REDP)

The REDP is a joint program of the government of Nepal, the UNDP and the World Bank, and has covered 55 districts.

4.9.7 Clean energy Nepal (CEN)

CEN are a non-profit group conducting research based public education and advocacy campaigns to promote sustainable energy use and environmental conservation, particularly in the Kathmandu Valley.

5 Renewable energy (RE)

Nowadays people are very conscious about the environmental problem globally. The use of traditional or non-renewable energy resources caused negative effects on the lives of the people side by side it is neither sustainable nor desirable from the environmental aspects. To produce the Non-renewable energy, coal and crude oil have been used which produce harmful gases in the atmosphere caused global warming, ozone depletion. The reasons why Nepal government has given high priority for these sectors are it is less expensive to provide access for rural area and it provides cleaner, safer and more convenient energy to people. Therefore, Renewable energy is

becoming very popular, environmental friendly with no negative impact on green house gases (GHG) and very important in today's world. It helps to protect the domestic economy by producing energy from the natural resources like sun, wind with no cost that cause less emission and can reduce chemical, radioactive and thermal pollution. It is considered as environmental friendly energy resources. In the context of Nepal, Biogas, solar, mini hydro, waste energy are suitable in a rural area while Nepal government is also supporting this technology for rural area.

Table 18. End use status of renewable energy

End Use Status of Renewable Energy Technology			
Technology	End use status	Advantage	Remarks
Micro-hydro	Lighting Enterprise	Access to clean energy Enterprise development	
Solar home systems	Lighting Enterprise	Access to clean energy Enterprise development Access to information	Under the owner's control
Biogas	Cooking Lighting	More comfortable fuel for cooking compared to fuel wood	Women are more benefited
Solar dryer, cooker, water heater	Cooking Water heating Drying Enterprise	Clean energy Save commercial energy/fuel wood	
Briquettes	Cooking Enterprise	Clean energy Save commercial energy/fuel wood	Women are more benefited
Improved cooking stove	Cooking Enterprise	Minimize indoor pollution Save fuel wood	Women are more benefited
Wind energy	Lighting Water pumping	Clean energy	Not very popular
Geothermal	Religious purpose Enterprise	Free energy Village/Rural Tourism Improve health	Can be mobilize for income generation
Solar water pumping system	Household Agriculture	Access to drinking water Drip Irrigation	Needs more investment

(Source: Energy sector synopsis report Nepal 2010)

Table 18 shows the most used renewable resources in Nepal. They are micro-hydro, solar home systems, solar dryer, cooker, water heater, biogas, briquettes, improved cooking stove, wind energy, solar water pumping system.

5.1 Hydropower

Nepal has more than 6000 rivers with the theoretical hydropower potential of 83,000 MW among these 42,000 is practically possible. Nepal Electricity is the only responsible organization to generate and distribution of electricity within whole Nepal while the department of electricity takes all the responsibility to provide the license for survey, generation, transmission and distribution to the other organization. Government of Nepal promotes small hydropower projects

via independent power producers because it is one of the strategies to solve the current energy crisis in Nepal. In fact, GON provide different subsidy scheme for the hydropower projects such as 50% for the hydropower projects up to 3 MW to be constructed in the initiation by community educational institutions, forest users' groups, community organizations and other local organizations. 75% subsidy provide to projects below 1 MW if constructed by the cooperatives at Village Development Committee (VDC) level. Apart from this, government provides "additional financial support delivery modality 2010" to provide additional financial support to micro/mini-hydropower projects in 13 very remote districts and other villages classified as very remote as the households have difficulties in contributing 50% of the project cost.

Nepal has developed 24 Small Hydropower (SHP) projects (range 1-10 MW) totaling 64.6 MW in capacity. Of this, Independent Power Producers (IPPs) account for 47.3 MW and the rest are NEA owned. IPPs are presently developing 18 SHP projects totaling 77.7 MW. NEA has also issued Power Purchase Agreements (PPAs) to 29 IPP projects with a total capacity of 103.4 MW, which are yet to achieve financial closure. Project developers with PPAs who have failed to develop the projects have been given 90 days notice to achieve financial closure, failing which the PPA may be revoked along with the termination of the generation license. (Investment Plan for Nepal 2011)The government could reissue the licenses to new developers on a competitive basis to develop projects. The Government of Nepal has announced that projects over 10 MW will be awarded based on competitive bidding. Potential developers can still identify sites and apply for survey licenses on a first come first serve basis for projects up to 10 MW. (Investment Plan for Nepal 2011) The Government of Nepal is considering a PHP scheme, which aims to assist District Development Councils (DDCs) to develop SHP by utilizing the royalty payments received from SHPs in operation. The Department for Electricity Development (DoED) is to assist DDCs develop the plants. PHP is expected to contribute about 180 MW during the 2011-16 plan periods.

5.2 Biomass energy

Biomass energy especially biogas is suitable and famous in a rural area of Nepal. It is derived from different forms solid, liquid or gas from the forestry, agriculture and other sectors like cattle dung. It could be wood fuels, agro fuels and others mixtures of plant and animal materials available on a renewable basis. Traditional energy system of Nepal includes only the solid biomass fuels, which derived from plants and animals. Nepal government and different national and international organizations are working together to improved the current situation of biomass system. Different projects have been running in a rural area. Alternative Energy Promotion Center's (AEPCC) a Government institution established on November 3, 1996 under the then Ministry of Science and Technology with the objective of developing and promoting

renewable/alternative energy technologies in Nepal. This program is the first project to operate under the clean development mechanism. BSP is already certified by ISO 9001-2000. Due to this program around 9000 people is employed directly or indirectly. People can also get biogas loan from 264 micro finance institutes in Nepal.

5.2.1 National biomass energy support program (BESP)

This program has been done by the Centre for Rural Technology (CRT/N), one of the implementing partners, which were executed by Alternative Energy Promotion Center (AEPC) of the Government of Nepal with support from Energy Sector Assistance Program (ESAP) of DANIDA. (Improved Cook Stove Development: A Case from Nepal) CRT/N has been promoting Improved Cooking Stove since 1991 for household and institutions in the hilly region of Nepal. Presently ESAP's BEC is working in 1,012 VDCs of 52 mid hill districts, 240 VDCs of 12 Terai districts and 38 VDCs of 4 high hill districts with the total coverage of 68 districts. This fiscal year BEC has spent NPR 93.1 million out of budget NPR 81.9 million.

5.2.2 Nepal biogas project

Nepal has signed an emission reductions purchase agreement (ERPA) for the Nepal Biogas Project with the World Bank. This is the first greenhouse gas emission (GHG) reductions project in Nepal under the Clean Development Mechanism (CDM) of the Kyoto Protocol. Alternative Energy Promotion Centre (AEPC) will sell a total of one million tons of greenhouse gas emission reductions to the World Bank managed Community Development Carbon Fund (CDCF). (Reducing Emissions While Providing Community Benefits 2011) Due to this project, Local communities of Nepal have also benefited from the jobs created to support the biogas facilities. Besides this, this project promotes to use the biogas because biogas units will be sold at a non-commercial price to poor households.

5.3 Solar energy

Nepal is one of the most favorable countries by nature for the solar energy and receives ample radiation too. It varies from 3.6-6.2 KWh/m²/day. People from a rural area of Nepal cannot afford the diesel generators operations cost for electricity, in mountains and cold high altitudes on Nepal biogas technology has not been work properly because it is difficult to collect roving herds of cattle. Likewise, Small Hydro turbines need specific topographical conditions that are only found near a small percentage of users' dwellings. (Energy Sector Snyopsis Report Nepal July 2010) There is only one solution for it, solar electricity generating systems because it is easy to install and operation but we cannot say this technology has not any limitations and problems but these can overcome with proper planning.

The country has 300 sunny days per annum and thus is very rich in solar power potential. Using PV module of 12% efficiency, total energy generated will be $0.12 * 4.5 * 147,181 * 10^6 = 80,000 \text{GWh/day} = 17.7 \text{ TW}$ (assuming peak sun to be 4.5 hours). This energy generated is more than the energy required for fulfilling the whole energy demand of the world. The total estimated world energy demand at present is about 13 TW. If we use just 0.01% of the total area of Nepal, we can generate solar electricity of 8 GWh/day that is 2920 GWh/year (which is more than the energy generated by NEA in the year 2003 amounting 2261 GWh/year). (Energy sector synopsis report Nepal 2010)

As per the report of the Alternative Energy Promotion Centre (AEPC), 2008 under the Solar & Wind Energy Resource Assessment in Nepal (SWERA), the commercial potential of solar power for grid connection is 2,100 MW. With National average sunshine hours of 6.8/day, and solar insolation intensities of about 4.7 kWh/m²/day, there is a huge potential for Solar Water Heaters (SWH), Solar Dryers (SD), and Solar Cookers (SC). SWH have been fully commercialized, and by 2009 more than 185,000 SWH had been installed. SD and SC are still in the phase of commercialization. (The renewable energy and energy efficiency partnership 2011)

Nepal Telecommunications Corporation (NTC) was the first organization to use solar electricity in Damauli in 1974. Since then NTC has become one of the significant users of solar electricity amounting to more than 1000 KWp generating about 47000 kWh/day of electrical energy at more than 3000 locations, without national grid supplied electricity. PV is powering 75% of all the Public Call Offices (PCO) in NTC. In addition, 5 MWp of photovoltaic power is currently being used in various public and private sectors like telecommunication, utility supply, stand-alone, water supply, and aviation. Later on, the trend of SHS installation has been increasing because of the subsidy policy implemented by AEPC/ESAP. This technology is used in Mustang as solar pumps (3.2 KWp) and solar PV driven mills (1.2 KWp and 1.6 KWp) for grinding wheat and millet. (Energy sector synopsis report 2010)

Dhaubadi, in remote Nepal has become Asia's first 'renewable energy village' with the installation of mini wind-solar hybrid power system with the financial and technical support from ADB in collaboration with the Centre for Renewable Energy (CRE). ADB has chosen Nepal as the first pilot country for its small wind power initiative instead of choosing hydropower project and sponsored for "alternative approaches to meeting Nepal's energy needs."

Project for Solar Powered Street Lighting: NEA is going to held one pilot project within Kathmandu Valley. They are going to promote solar lightening in the streets in urban areas by Installing solar powered and solar wind hybrid powered street lighting systems. It includes to purchase, replacement or installation and setting up a system. Around 1000 existing street lamps

will be replaced by solar energy, which will reduce peak demand by 0.2 MW and save about 700 MWh per year. The procurement of consulting services is in the final stage. (Nepal electricity authority annual report 2011)

5.4 Wind energy

Wind Energy could not get much attention comparing to other renewable energy resources in Nepal. Nepal had been started to collect data about wind speed in 1967 but after the establishment of AEPC in 1996 practical research and development has taken place. There are many challenges for wind energy projects in Nepal. One of them is rugged geography with no infrastructure developments. Its countrywide potential has not been assessed, but the theoretical potential has been estimated at over 3,000 MW, with approximately 448 MW. Extreme wind speeds of 46.76 m/s have been recorded, with 238 kW/m² of energy density. There are 40 wind measurement stations installed all over the country run under the Department of Hydrology and Meteorology; however, presently only 29 stations are properly running. (Wind energy potential assessment in Nepal 2009)

In Nepal, the wind velocities in low altitude valleys are lower in magnitude than those in the High altitude valleys and mountain ridges. This is evident from data observed in Kathmandu (low values) and Kaligandaki valleys (high values). The lower plains and hills generally include the southern plains (Terai), Kathmandu Valley and areas generally below 3000 m altitude with the basic wind velocity of 47 m/s is adopted. Likewise, the second zone lies above 3000 m where the basic wind velocity of 55 m/s has been adopted. (Wind energy potential assessment in Nepal 2009)

This could be a good alternative energy for the country like Nepal, where people have to suffer from daily power cut off. The preliminary studies by the Alternative Energy Promotion Center (APEC) show that 3000 megawatts wind energy can be generate in Nepal, which could be a perfect solution of the electricity crisis, and it can be a cheaper renewable option as well because wind turbines can be built by using local raw materials in Nepal. It has a capacity of producing wind energy than solar energy but also current public and private investments remain below 40 kilowatts, with no individual turbine larger than 10 kilowatts in capacity.

5.5 Waste to energy

Government of Nepal, ministry of local development has some act regarding to waste management and Solid waste management and resources mobilization center and National waste

management council has been established under this ministry. Different foreign organization had tried to study on the status of SWM. Deutsche Gesellschaft Fuer Technische Zusammenarbeit (GTZ) commissioned a study on the status of SWM. In 1976, the first German Expert, Dr. Ing. O. Tabasaran from the University of Stuttgart recommended major reorganization in the present waste management system by the establishment of an autonomous agency in charge of SWM in Kathmandu, Lalitpur and Bhaktapur municipalities. Currently, GON and Germany agreed jointly to develop a waste disposal system in the Kathmandu Valley. (Solid waste management and resource mobilization 2011)

5.6 Geothermal energy

Geothermal energy is a natural energy comes from the earth. It has been used for the space heating and bathing, but it is used for generating electricity in today world. Nepal does not have proper use of geothermal energy but further investigation and development is continued. AEPC mention in its website to conduct feasibility studies and will promote for this energy project. As of 2004, 32 hot water spring sites, with temperatures exceeding 50°C had been identified in Nepal, which is used for the therapeutic purpose, and it was figure it out that 2.1 MW energy can be produce by geothermal energy.

6 Interview research methodology

6.1 Aims, target groups and content of interview

The aim of the interview research methodology is to get some more information that we cannot find from other research. Mr. Dirghayu Shrestha an electrical engineer in Nepal Electricity Authority, Mr. Bibek Baral an associate professor of Kathmandu University, Mr. Santosh Pokharel a researcher/member of Innovative Energy and Environment Nepal (NGO) and Mr. Krishna Chandra Poudel an information and communication officer of Alternative Energy Promotion Center are the four target persons for the interview. Interview questions were prepared separately to each target groups. Some common questions related to Availability of recourses, Economically Competitive, Environmentally Competitive and Socially Acceptance were asked to each group. Likewise, some questions related to their organization, renewable energy business has also been prepared and sent them via email.

6.2 Interview results

According to the interview, Hydropower, biogas and waste to energy are the most available resources. In the present situation of the energy crisis in Nepal, this renewable energy could play

a vital role to minimize the load shedding in Nepal but It is difficult because these technologies are mostly being used only for household purpose. That is why people would not be interested to install these technologies if they do not get subsidy and if they cannot get any economic benefits using such technologies but the people of the city area are hugely using Solar PV and Solar thermal System without subsidy. Bio- Gas, hydropower, solar, waste to energy and wind energy are more environment friendly as compare to other source of energy. If we compare to other resources, Micro Hydro, solar directly replaces the use of Kerosene and diesel. On the other side, Biogas replaces firewood, managed household waste and also less installation cost, and easily available materials in local level. The investment is secure in Micro hydro because in a rural area the grid is not connected and the people are not getting electricity. From Micro hydro, electricity could be sold to the people and return the investment.

Kathmandu University can offer feasibility analysis of certain renewable energy systems, business model development (public private partnership) for the systems, operation and maintenance support, etc. KU can have direct collaboration with foreign institutions and companies. Associate Professor from KU said that the majority of the solid waste in the cities is organic, so biogas system can be one of the areas. Energy generation from incineration of solid waste also can another possibility. He recommends visiting the representatives of the companies in Nepal to discuss and evaluate the environment for investment and forming a partnership with the local business communities and technological institutes like ours. Next, the companies can carry out detailed feasibility studies and figure out the investment areas.

7 Conclusion

7.1 Summary

Nepal is going to celebrate "Investment Year 2012/13" with the aim to attract many investors to invest into many sectors such as agriculture, energy, tourism. This is the right time to all the investors and companies to enter into Nepalese market. Government of Nepal is encouraging foreign investments by providing attractive incentives and facilities within a liberal and "open policy".

Energy Crisis is one of the main problems in Nepal. The demand of electricity is high and increasing day by day but the supply of electricity is not enough to supply in whole Nepal. Because of this matter, Nepalese people are facing the power cut system everyday for example; especially in wintertime, there will be no electricity for 14-15hrs per day. Geographical

structure of Nepal is also another problem for electricity. Being the richest country in water resources, Nepal has 83,000 MW potential of theoretical hydropower but because of technical, financial, geographical situation, 42,000 MW is economically feasible. NEA is responsible to generate and distribution of electricity in Nepal. Now, NEA is promoting the individual power producers to produce energy and sell it to them. This is one of the good opportunities for Finnish companies to invest on small hydropower and sell it to NEA.

The solution of energy crisis in Nepal could be the utilization of Renewable Energy Resources. Among many resources, if we target the remote area, Biogas is the most suitable RE resources for each family because we can get enough resources what we need for the Biogas system. Most of the families have cattle at their home and we can use animal dung to produce biogas. Many national, international organization and government will provide subsidy to those companies/organization, which are working for remote area.

Energy from waste could also be suitable for big cities or village of Nepal because the resources for waste to energy are available in large-scale but proper waste management system is needed. Many foreign organizations had tried to study the status of solid waste management but that was not sufficient. If we can reorganization the present waste management system in the big cities for example Kathmandu, Bhaktapur, Lalitpur, we can get enough resource for waste energy and there is a big possibility to have a monopoly business in this sector in Nepal.

Solar energy resource (Photovoltaic) is little bit expensive resource to afford though, Nepal is one of the most favorable countries by nature for the solar energy and receives 3.6-6.2 KWh/m² of solar power per day. It is suitable for mountains and cold high altitudes where other resources cannot work properly. NEA is going to held one pilot project where all the streets lights of Kathmandu Valley are going to replace with solar energy. In this case, Finnish Renewable Energy SMEs have chances to get collaboration or contract of that project.

7.2 Limitation

Geographical, economical, underdeveloped infrastructure, traditional technologies are the limitation for Nepal.

7.3 Future research

Unorganized waste management system can create environmental and public health problem in Nepal that is why more research is needed on the proper solid waste management system in the big cities of Nepal. There is a big possibility to get plenty of energy if we could succeed to segregate all the waste in those cities.

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Figures

Figure 1. Map of Nepal: Administrative division.....	18
Figure 2. Geert Hofstede dimensions.....	21
Figure 3. Availability of energy.....	28
Figure 4. Growth of consumer.....	32
Figure 5. Residential sector.....	37
Figure 6. Industrial energy consumption	38
Figure 7. Transport sector energy consumption.....	39
Figure 8. Commercial sector energy consumption.....	39

Tables

Table 1. Corruption perception index.....	14
Table 2. Economic structure	17
Table 3. Population.....	19
Table 4. Living standard.....	19
Table 5. Starting a business.....	25
Table 6. Total energy available and peak demand	32
Table 7. Growth of consumer.....	33
Table 8. Electricity Sales	33
Table 9. Nepal power system load forecast.....	34
Table 10. Total energy consumption by various fuel types	36
Table 11. Agricultural sector energy consumption	40
Table 12. Donor wise approved budget	43
Table 13. Donor wise disbursed Percentage	44
Table 14. Proposed scaling up renewable energy program.....	44
Table 15. Financing Plan	45
Table 16. Channeling of scaling up renewable energy program funds	45
Table 17. Government support for rural and renewable energy development	46
Table 18. End use status of renewable energy	52

Appendices

Appendix 1 Interview with AEPC (Alternative Energy promotion Center)

1. Availability of resources

a. Which is the most feasible renewable energy in Nepal based on the availability of resources?

Nepal has huge potential of RE resources. Among them biogas seems more feasible. As a developing country the people of more than 80 are based on agricultural activities. On the other side, biogas is feasible from plain land to 2100 mtr.

But other RE is not less feasible. Please find the detail:

S.N.	Technologies	Total Potentiality	Remarks
1	Mini/micro Hydro	80 MW	Possible in 55 districts of Nepal
2	Biogas	1.1 million plants	At existing livestock population
3	Solar	1,830 MW	In 4.5 kWh/m ² /day radiation if 2% area is taken as suitable
4	Improved Cooking Stove (ICS)	31,89,721	Considering 75% eligible households as of total household of 2001 census
5	Improved Water Mill (IWM)	25,000	
6	Wind	3,000 MW	Considering 10% of area with more than 300 m ² WPD
7	Bio-fuel	11,00,000 tons	

2. Economically Competitive

a. Can renewable energy sources compete with fossil fuels such as diesel and petrol in terms of price at present situation?

Not exactly, most of them need higher investment at present. But if you see in long duration they can. Because we need not to pay for the resources and transportation, but only the installation cost.

b. Which renewable energy is most likely to compete with fossil fuels in terms of price?

Not now

c. At this present situation, are there any renewable energy sources that could compete with fossil fuels with small government subsidies?

The production of biofuel (biodiesel) from *Jatropha Curcas* is showing some rays of hope even though it is in study phase

d. Is the government subsidy sufficient for renewable energy sources to compete with fossil fuels -diesel, petrol or natural gas?

No. I can't say it is enough. The government of Nepal is providing subsidy as per the Subsidy Policy of 2066 Bs. It is being reviewed soon. (You can accessed this subsidy in http://www.aepc.gov.np/index.php?option=com_content&view=category&layout=blog&id=88&Itemid=117)

e. Are there any possibilities that renewable energy could economically be competitive with small government subsidies in future?

3. Environmentally Competitive

a. Which renewable energy source is more environmental friendly compared to fossil fuels?

All RE sources are environment friendly. But if we compare Micro Hydro directly replaces the use of Kerosene and diesel. On the other side, Solar also replaces both. Biogas replaces firewood. So there three technologies replace fossil fuels.

4. Social acceptance

a. Which renewable energy source is more likely to be accepted by people in Nepal?

1. Biogas, Because of less installation cost, and easily available materials in local level. As you know Nepal have agriculture based economy, most of the people of rural area have one or more cattle.

2. Improved Cooking Stove is also very popular because of less firewood consuming nature and very low installation cost. But this technology cannot fully replace the consumption of firewood but can reduce only.

5. What is the major alternative energy sources encompassed in the priorities of AEPC Nepal?

As a national focal agency of renewable energy, AEPC has a mandate to promote Mini/micro hydro, Biogas, Sola Energy, Improved Water Mill, Improved Cooking Stove, Bio-briquette, Gasified, Wind energy, Biofuel.... Gasified, Wind energy, Biofuel are in piloting phase. So AEPC works for all, and cannot divide the priority. But it depends on the popularity, geographical area and the nature of RETs.

6. What could be the suitable alternative energy sources for Nepal based on the availability of the resources and the cost?

Biogas, Solar and micro hydro

7. Could alternative energy sustain without government subsidies in future?

It is difficult because these technologies are mostly being used only for household purpose. So the people cannot get direct and immediate impact. So people would not be interested to install these technologies if they do not get subsidy and if they cannot get any economic benefits using such technologies.

But the people of city area are hugely using Solar PV and Solar thermal System without subsidy.

8. Is there any possibility to produce energy from the waste in Nepal? Especially in the major cities?

Researchers are ongoing. People already have piloted this system in their house hold in small scale. So there are some possibilities.

9. Is there any possibility for Finnish companies to work under AEPC? What are the procedures?

AEPC works collaborating with the various partners like ministries and its departments, non-governmental organizations, private sector, civil society and community/users groups for the development and promotion of RETs in the country.

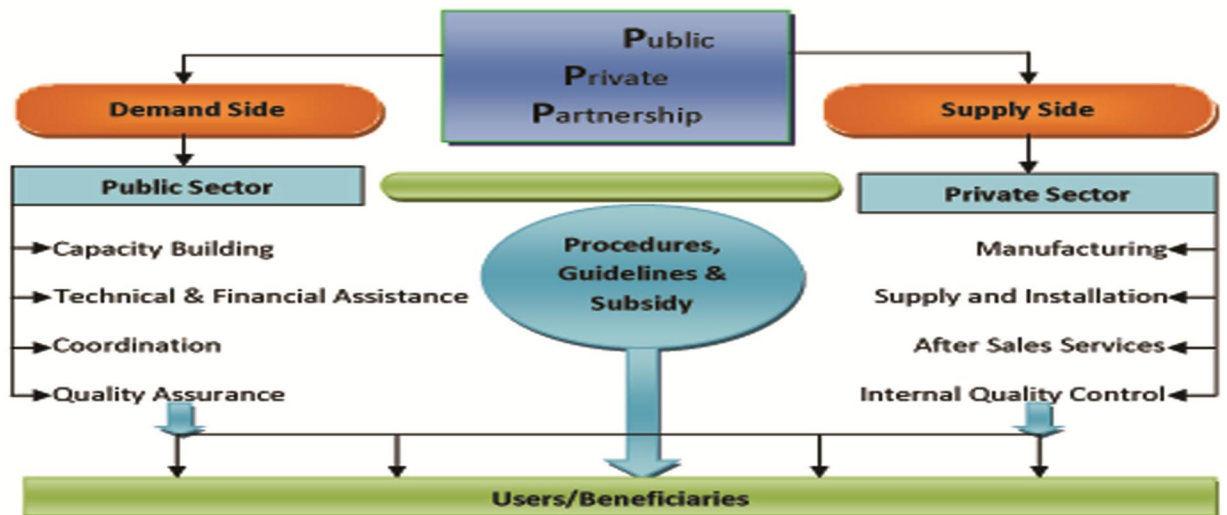
AEPC follows the Public Private Partnership (PPP) Model and Demand Based Approach (DBA). Public sector works for the issues like capacity building, technical and financial assistance, coordination, quality assurance etc and private sector works for manufacturing, supply and installation after sales services.

Capacity development of local government bodies have been emphasized by operational zing District and Environment Unit/Section (DEEU/S) in all the 75 districts of the country for demand collection, implementation, monitoring and supervision of RETs and programs. Besides programs have regional and district level partners working as outreach for collecting demands, implimentation and monitoring. Pre-qualified (PQ) companies are involved in manufacturing, supply, installation and after sals services. So, as the rule of the GoN, all technologies have Pre-qualified companies. The examination process occurs once a year with some criteria such as services provided in past, the team, registration in VAT and TAX etc. (You can see the list of such companies in:

http://www.aepc.gov.np/index.php?option=com_content&view=category&layout=blog&id=121&Itemid=303)

There are separate PQ companies for different RETs and the subsidy is chanallize only through such companies. But the people can work with any companies for installing RET with out getting subsidy.

The overall program implementation modality can be seen as below.



Appendix 2 Interview with IEEN (Innovative Energy and Environmental Nepal)

1. What are the visions of IEEN to promote renewable energy in Nepal?
 2. Are there any current projects handled by IEEN in the sector of renewable energy in Nepal?
 3. From your point of view, which could be the best option for alternative energy source for Nepal on the basis of availability of resources, cost effectiveness and environmental impacts?
-
1. Being a non-profit organization, prominent visions of IEEN are to find out the domestic renewable energy resources to assist the rural communities of Nepal, to aware rural communities about renewable energy resources and to conduct researches in the sector of clean and renewable energy resources.
 2. There are some current projects handled by IEEN in the sector of renewable energy in Nepal. IEEN has provided necessary technical assistances and linkages to install bio-gas plants in two big hotels in Chitwan. There is an ongoing project work to study about the feasibility analysis of standalone PV system in Nepal. Similarly, IEEN is conducting a research work to explore the technical and economic feasibility of PV in telecommunication service.
 3. Considering the availability of resources, cost effectiveness and environmental impacts, Biogas could be the best option for alternative energy source for Nepal.

Appendix 3 Interview with NEA (Nepal Electricity Authority)

- Availability of resources
- Which is the most feasible renewable energy in Nepal based on the availability of resources?
 - => Water is the most feasible renewable energy in Nepal.
- Economically Competitive
- Can renewable energy sources compete with fossil fuels such as diesel and petrol in terms of price at present situation?
 - =>Yes, renewable energy sources can compete with fossil fuels because Nepal has very high potential in water resource. Also, there is a possibility of wind, Biogas and solar energy in many parts of Nepal, whereas we do not have our own fossil fuels.
- Which renewable energy is most likely to compete with fossil fuels in terms of price?
 - =>The energy from hydro is most likely to compete with fossil fuels in terms of price.
- At this present situation, are there any renewable energy sources that could compete with fossil fuels with small government subsidies?
 - =>Solar, Bio and wind energy sources could compete with fossil fuels if there is a small government subsidy.
- Is the government subsidy sufficient for renewable energy sources to compete with fossil fuels -diesel, petrol or natural gas?
 - =>If government subsidies, Foreign Investment and private sectors together involve in renewable energy sources, it can compete with fossil fuels.
- Are there any possibilities that renewable energy could economically be competitive with small government subsidies in future?
 - => There is lot of possibilities of renewal energy in Nepal in future, if there are more government subsidies in this sector. In hydro generation, initial investment is very high, that our country only cannot afford we need a foreign investment from donor countries. In the present crisis in Nepal, this renewable energy could play vital role to minimize the load shedding in Nepal.
- Environmentally Competitive
- Which renewable energy source is more environmental friendly compared to fossil fuels?
 - =>Bio- Gas and wind energy is the more environment friendly as compare to other source of energy. In Biogas household waste is managed properly, that makes the environment clean and healthy. Nepal is facing difficulties in dumping sites and waste management.
- Social acceptance

- Which renewable energy source is more likely to be accepted by people in Nepal?

=> Solar and Biogas is more likely to be accepted by people of Nepal because government has provided more subsidies in it.

- At present situation, can micro hydro secure the investment?

=>The investment is secure in Micro hydro because in rural area the grid is not connected and the people are not getting electricity. From Micro hydro we can sell electricity to the people and return our investment.

- Are there any challenges faced by NEA to manage grid for micro hydro?

=>NEA is facing difficulties to manage the grid to Micro hydro because the micro hydro is located in rural areas. Due to geographical difficulties and high investment in transmission line the grid cannot be connected to all the rural area of Nepal.

- What are the benefits of micro hydro over other renewable sources such as Bioenergy, wind and solar in Nepal?

=>Water is available easily, everywhere throughout the year in Nepal whereas for the other sources of energy we have to depend upon sun light, wind and waste which is not available every time and place. So micro hydro has more benefits than other renewal sources of energy.

Appendix 4 Interview with KU (Kathmandu University)

10. Availability of resources

- b. Which is the most feasible renewable energy in Nepal based on the availability of resources?

Possibly hydropower, followed by biomass (waste and sustainable forestry).

11. Economically Competitive

- f. Can renewable energy sources compete with fossil fuels such as diesel and petrol in terms of price at present situation?

For electric power generation renewable energy sources including hydropower and biomass system is far cheaper than fossil fuel based systems. For transportation, biofuels (biodiesel and bioethanol) is still competitive. However, currently the supplies of those biofuels are very limited.

- g. Which renewable energy is most likely to compete with fossil fuels in terms of price?

Undoubtly, hydropower. However, proper biomass systems can be competitive as well.

- h. At this present situation, are there any renewable energy sources that could compete with fossil fuels with small government subsidies?

Hydropower. Also there are plenty of opportunities in Biomass based gasifier systems which can compete with fossil fuels with small government subsidies.

- i. Is the government subsidy sufficient for renewable energy sources to compete with fossil fuels - diesel, petrol or natural gas?

It is difficult to say. However, there have been lots of success stories in the area of biogas systems and improved biomass based cooking stoves. Also, micro hydro and solar photovoltaic systems are also coming up in rural areas after government subsidies, which have been successfully implemented by the local communities.

- j. Are there any possibilities that renewable energy could economically be competitive with small government subsidies in future?

Yes. There are good chances, depending upon the type and scale of the system.

12. Environmentally Competitive

- b. Which renewable energy source is more environmental friendly compared to fossil fuels?

Micro hydropower, Biomass (agriculture waste, forestry residue and sustainable forest resources), and solar.

13. Social acceptance

- b. Which renewable energy source is more likely to be accepted by people in Nepal?

All of the above mentioned renewable resources.

14. What are main focus areas of KU Bio Based Research Center concerning energy production from biomass?

KU Bio Based Research Lab is currently focused on development of cheap gasifier based systems as well as more efficient biogas digesters that can generate biogas from household and other organic waste as well as household wastewater. Focus has also been on improved cook stoves with electricity generation (SCORE) with foreign collaborations.

15. What could be the possible benefits of Bioenergy compared to other renewable energy sources like wind, solar in Nepal?

Nepal has biomass in abundance. If proper technologies are available, it will still be one of the major energy sources in the years to come, especially for household cooking as well as electric power generation because of being low cost and sufficient supply. Regarding solar energy, it is still expensive, has to dependent totally on imported technologies and can generate power only on small scale. Wind has failed to attract sufficient interest due to the uncertain and unreliable annual wind flow pattern.

16. Can Bioenergy compete with wind and solar in terms of price?

Yes. Very well.

17. What kind of Support can get from this institute to the Finnish RE Companies?

The support we can offer is feasibility analysis of certain renewable energy systems, business model development (public private partnership) for the systems, operation and maintenance support, etc.

18. Is there any possibility of collaboration? If yes then how?

KU can have direct collaboration with foreign institutions and companies. The collaboration can be done after some discussions and negotiations.

19. Is there any possibility to produce energy from the waste in Nepal? Especially in the major cities?

Yes there are plenty of opportunities. The majority of the solid waste in the cities is organic, so biogas system can be one of the areas. Energy generation from incineration of solid waste also can another possibility.

20. Would you like to give some suggestion or recommendation to these companies?

The companies can do preliminary studies on the possible resources and business models. For this I would like to recommend a visit of the representatives of the companies to Nepal to at least discuss and evaluate the environment for investment. Next, the companies can carry out detailed feasibility studies and figure out the investment areas. I would certainly recommend forming partnership with the local business communities and technological institutes like ours.