CHAPTER-I

INTRODUCTION

1.1 Background of the Study

As Nepal has scarce resources for huge investments for hydropower generation, rural people mostly rely on firewood for their energy needs. Most of such firewood is collected from natural forests which causes environmental degradation and its scarcity. Due to these reasons, the authorities have tightened the entry of villagers to the forest areas for collection of firewood. In such circumstances, biogas has emerged an alternative source of sustainable energy to these people. Still, a small part of rural population is using biogas for energy.

In this regards, Nepal has a vast potential for development of renewable energy resources. The potential comes from the nature of subsistence economy in the rural areas and the standard of sanitation there. Further, it is highly experienced that the life of rural women has become easier after the introduction of biogas plants in rural households. After installation of biogas plant, the compulsion of women to fetch firewood has come to an end, their time and energy have been saved and they are able to involve themselves in other economic works. In this way, alternative energy has emerged as an attractive option where one can reasonably expect that properly harnessed bio-energy can achieve the sustainable economic development of the rural livelihood with less cost and time. Similarly, from the gender point of view, it has also made the life of women easier.

Biogas plant needs improved Chulhas (ovens) which reduces the drudgery of women which is also a positive step toward better living. The biogas ovens in recent years have changed the lifestyle of people in the villages, encouraging them to come out of age-old restrictive practices as a new enlightened group (Chatterjee,2007:89).

About 80% of the 4.2 million households in Nepal use fuel wood, cattle-dung cakes and agriculture residues for cooking, and kerosene for lighting. Demand for fuel wood substantially exceeds the rate of re-growth, and this is leading to

degradation of the land and damage to vital watersheds. Cooking indoors over open fires, and lighting with kerosene, gives dangerous exposure to air pollutants and a high risk of fire, particularly for women and young children who spend much of their time indoors. In addition, women and girls have the drudgery of collecting fuel wood, which typically takes three hours each day (Rai, 2009). Livestock is the integral part of farming in Nepal and there is high potentiality of installing biogas plants in different parts of the country especially in Terai (plains) and mid hills (Shrestha, 2015).

Biogas is comparatively advantageous than other renewable energy sources like hydropower, solar, wind in rural village. Biomass continues to be the main source used for cooking and lightening particularly in rural Nepal. It improves the health condition of children and women more due to the reduction of carbon dioxide. It has wide scope in socio economic benefits for the prosperity and quality of life of rural people especially the women.

Energy is the key to development. The per capita energy consumption reflects the development situation of a country. In Nepal, feulwood is the primarily used in cooking in the rural area which has adversely affected the health condition of rural women. The potentiality of the development of biogas energy is very high in rural Nepal and it is mainly used for cooking. The smokeless energy in the household consumption has significantly reduced the workload of women and it has brought significant changes in their health condition. Though there is a huge potentiality of biogas energy development, it has to go many steps for its development. This paper highlights thepresent scenario and its historical development of biogas in Nepal. Moreover, it has deeply analyzed its effects on the rural biogas users mainly on women.

1.2 Statement of the Problem

In rural areas, almost women have heavy workload which includes fetching firewood from faraway, fetching water, cooking, feeding to children, taking their care, doing animal husbandry, collecting grass and other feeding items for them and so on. These workload starts from early sunshine to late sunset. In this way,

women are most affected in terms of workload and health problems as well. Hence, there is no doubt that the women of Nepal are burdened with a heavy drudgery. Women have extensive workload with dual responsibility for farm and household production. So, they lack time for social works and awareness generation to involve in social gathering, going literacy classes, attending meetings, and other income generating activities. Hence, the impact of lack of alternative energy sources has affected the personal growth of women in rural areas. Further, commercial sources of energy are out of reach to poor rural population. That is why it is necessary to study the impact of alternative sources of energy to the life of rural women.

In order to solve the problems created by commercial energy sources and biomass, it seems necessary to examine the scope of biogas in terms of a cost efficiency, scale and possibility of decentralization of sources. In this context my main research question is as follows:

Does biogas has positive impact on socio-economic status of rural women?

To support this main research question, I have developed following sub-questions:

1. What are the categories of energy in use and what is their proportion?
2. Is there any improvement in the reduction of economic burden after the installation of biogas in the house ?
3. Do the rural women take part in social activities after the installation of biogas in the house ?
4. What are other impacts on women after the adoption of biogas technology?

1.3 Objectives of the study

The general objective of this study is to find out the impact of biogas in the socio-economic condition for rural women. However, the following are the specific objectives:

- To find out the problems, the women were facing before the installations of biogas plants.
- To identify out the social changes on the live styles of rural women after the installations of the biogas plants in the study area.
- To assess the economic activities performed by the women after getting the facility of biogas energy.

1.4 Significance of the Study

From the last few years, biogas has been identified as an integrated energy and environmentally friendly technology for the village of Nepal. This technology provides a clean and cheap source of energy in villages, in addition to producing enriched organic manure for supplementing the use of chemical fertilizers. It also improves sanitation and hygiene and relieves women of some drudgery.

Nepal relies heavily on biomass for energy especially in the rural area. The massive use of biomass has severe consequences on the time and health of women. Over last two decades, gender issues have attained increased prominence in the debate on sustainable energy development and helping to bring critical issues of gender equality and efficiency. Thus the attention is drawn to address the gender issues in energy policy and project to equitable, efficient and sustainable outcomes in development. Gender is also appearing increasingly in the mainstream energy publications. The focus in the literature is mainly on poor rural women and wood energy. Cooking is women most important energy need in terms of time and effort. Biomass continues to be main source of cooking energy in developing countries, accounting for about one-third of all energy nearly 90 percent in some countries. Cooking is a very large share of household energy consumption, and the largest single rural energy use in low income countries. Cooking and heating with biomass and fossil fuels contribute to carbon dioxide emissions deteriorating the environment (Shakya, 2010).

Biogas provides a direct benefit, especially to rural women, as a result of the reduction of the workload when shifting from cooking on fuel wood to using

biogas. It saves approximately three hours time a day per family mainly due to the reduction on time used for collecting fuel wood, cooking and cleaning of utensils. There are a number of the environmental benefits from the promotion of biogas. A big problem for rural people especially to the housewives is indoor air pollution and smoke exposure inside the kitchen while cooking. Poor indoor air quality is one of the major risks factors for acute respiratory infections with housewives and children. Biogas reduces the smoke exposures and significantly improves the air condition inside the kitchen which ultimately improves the health condition especially eye infection, respiratory diseases, cough and headache. It has economic benefits as it reduces the direct expenses on fuel for cooking and to some extent lighting (Bajgain, 2003). Similarly, energy development was one of the objectives of the Eighth Five Year Plan (NPC, 1997: 1).

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Biogas is a Morden source of energy which has been produced from indigenous and renewable biomass resources. So, it has received a high priority for wide-scale dissemination in the country. Currently, biogas has been very popular in women in the plain and middle hill regions of the country where climate conditions are favourable (Bhattarai, 2007:9).

1.5 Limitation of the Study

The gender perspective of a study includes a study of imbalances in terms of ownership of house, female ownership of fixed assets and livestock. It also includes the economic activities of female, their level of education, their rate of participation to paid employment and social activities. All these become the prime concerns when one tend to study the socio-economic impact of social construction of gender. However, as this study is only concerned to the socio-economic impact of the biogas plant, the scope is naturally limited to the general effect on health, primary economic and social activities against and effect on household saving caused by biogas against the wider area of social construction of gender.

More than 85% of Nepali population lives in the rural areas. The major source of energy in these areas is biomass. Similarly, we can see the same trend in semi-urban areas. Due to limitation of time and financial resources it seems necessary to limit the research in SangrumbaVDC-3 of Ilam district.

The rational to select this site is that here altogether 60 households have installed biogas plants. Further, I have my own social capital there which will help me to conduct my research work smoothly. Finally, this study does not consider the scientific and chemical effects of commercial and other sources of energy as the researcher is a social scientist.

1.6 Organization of the Study

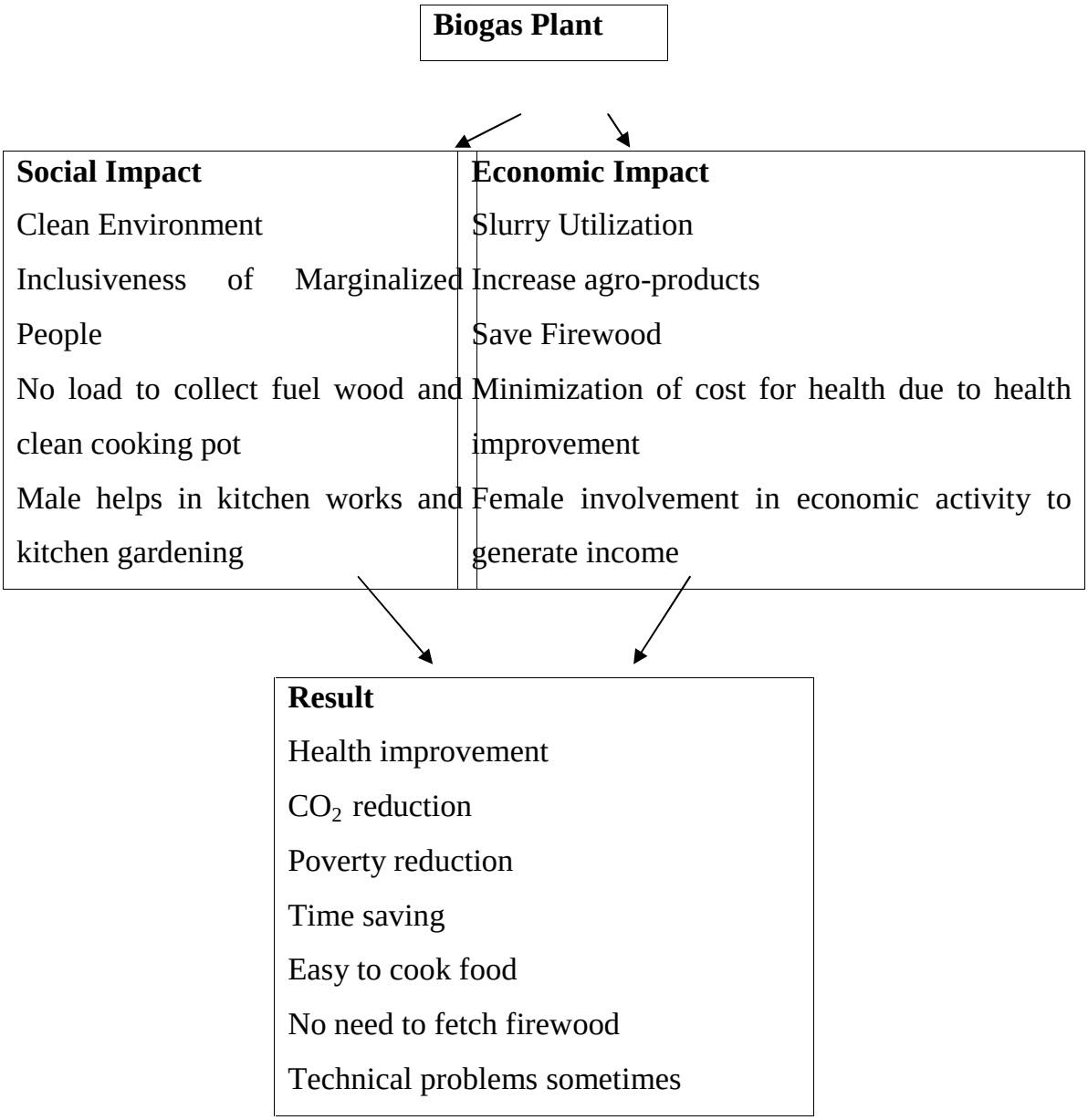
This study divided into five chapters. First chapter include about introduction, background of the study, statement of the problem, objective of the study, significance of the study, limitation of the study and organization of the study. Second chapter deals about literature review. Third chapter deals with methodology which includes nature and sources, rational for selection, research design, sampling procedure, techniques and tools of data collection and method of data collection. Fourth chapter discuss about the data presentation and analysis. Fifth chapter including conclusion and also presents the members and their needs of the study area and describes about cooperative and rural women empowerment and conclusions and recommendations.

1.7 Conceptual Framework

As the objective of the thesis is to find out the socio-economic impact of biogas to the rural women, the paper has used the concept of social construction of gender. This concept suggests that gender is a social construction and the work defined as the work of women or a work of man is a social construction and is not divided biologically. For example, kitchen works and kitchen gardening are considered a female work. Similarly, the economic activities which generate income is a male work. Hence, based on this concept the questionnaire is developed and data is collected.

Besides, the gender aspects as mentioned above this paper will also find the impact in terms of lowered workload and improved health conditions to the rural women. Similarly, biogas being a non-conventional energy source is an improved technology which sometimes the faces the technological problem. In this happening who bears the responsibilities of maintenance is also a natural question. If it is bore by male, it does not bring additional load to women. Nevertheless, this paper is focused on socio-economic impact and not the technical aspects of biogas.

Figure 1: Conceptual Framework



CHAPTER- II

LITERATURE REVIEW

Review of the previous researches is one of the most important components of a research. There are many published and unpublished work available related to biogas technology in Nepal.

2.1 Sources of Energy

Literatures have classified the sources of energy in various ways. In one definition energy is defined as a means for performing activities. For the human, energy is vital component of development. There are two types of energy sources on the earth: (a) conventional energy sources and (b) non – conventional energy sources. Conventional is obtained from a static storage, for example fossil fuel etc. These are the finite and non renewable energy. On the other hand, non – conventional is obtained from natural sources which can continuously form a current in the environment. These sources are known as renewable sources of energy. Solar energy, wind energy, geo- thermal energy and bio energy fall in to this category. Non – conventional energy sources are pro – rural, decentralized, infinite, locally available and safe when out of action (Kurian, 2004:n.p).

However, in Nepal's case Pradhan and Pradhan have classified the sources of energy in three categories. According to them energy sources may broadly be classified into three groups: "traditional (biomass), commercial (conventional) and alternative (renewable)" (Pradhan and Pradhan, 2006:168). Coal, electricity and petroleum are the commercial energy sources. By alternative sources, we mean to understand biogas, micro-hydro, solar thermal, solar photovoltaic and wind energy (Ibid). The most usual energy sources in rural Nepal are biomass from the centuries. These include bio fuel sources such as firewood, agricultural residues and animal waste (Pradhan and Pradhan, 2006:169).

Regarding the search for the non conventional energy sources Kurian further explains that there are several factors that prompted human to search them. These are the 1970s oil crisis of the world, the realization of exhaustiveness of conventional sources of energy, problems of pollution and a concern for developing appropriate energy sources for the rural population. The key concern that guided the search for the alternative energy sources were that such alternative energy sources need to be renewable, safe, local specific cheap , decentralized and appropriate. Biogas is an important sources of alternative energy (Kurian, 2004:n.p).

2.2 Workload on Rural Women

In one study some interesting results were found regarding the workload in terms of time allocation to the women. The effect is mixed in nature. In some area it has lowered down the workload and in some cases it has added the workload. However, women are able to give more time for child care, cleaning household surrounding, and taking care of patient and elderly members after installing biogas. But water fetching, mixing dung with water for biogas plant and fodder collection require more time and hence the time allocation for this has increased. While time allocation for some of the household activities; such as, forage collection, cooking, cleaning dish and other has decreased after biogas plant installation (AEPC, 2007:6)

Nevertheless, 66% women felt that they increased cooperative cohesion from family members after biogas plants installation. Similarly 66.2% expressed the view that participation in various social activities in neighbourhood has increased followed by 44.3% who said that the time to visit Family Planning Centre and Health Centre has remained same even after biogas plants installation (AEPC,2007:6)

Women in Nepal contributed to the economy in the form of household activities, income generating activities, by self employment and agricultural activities. However, the socio- economic status of women in Nepal is very low. They have the responsibility for most of the domestic blue collar jobs and much of their work

has been underestimated. However, since biogas plants have started being used, the role of women has increased dramatically (Shrestha, 2003).

Table 1 shows that time for firewood collection was saved significantly. Similarly, time was also saved from livestock caring, cooking and cleaning utensils. However, a little time for fetching water, plant feeding and fodder collection have been increased for rural women.

Table 1: Time Allocation Before and After Biogas Plants Installation

Unit: Minutes/ Day

Activities	**Time spent before Biogas Plant installation**			**Time spent after Biogas Plant**			**Time Saved after Biogas Plant**
	Terai	Hill	Both	Terai	Hill	Both	
Livestock Caring	150	140	146	137	115	129	17
Fetching Water	55	66	59	61	76	66	-7
Plant Feeding	0	1	0	25	28	26	-26
Firewood Collection /DungCake Preparation	262	324	284	169	50	127	157
Fodder Collection	84	53	73	92	49	77	-4
Cooking	143	163	150	95	81	90	60
Cleaning Utensils	55	63	58	37	31	35	23
Total							220

Source: AEPC 2015,

Similarly, the study also found that a number of women, i.e., 30.8% responded that they were able to use the saved time in other economic activities. However, majority or 69.2% could not (table 2).

Table 2: Use of Saved Time in income Generating Activities after Biogas plant Installation

Unit: Respondents in %

Income Generating Activities	Production		
	Hill	Terai	Total
Yes	80 (24.1)	77 (43.3)	157 (30.8)
No	252 (75.9)	101 (56.7)	353 (69.2)
Total	332 (100)	178 (100)	510 (100)

Source: AEPC 2015

Women in all rural regions perform a variety of roles in the role of mothers and many of these roles are of great economic significance. Women do many activities like food producing, processing and marketing. They produce and market agriculture goods and services. Most women participate and engage in wage labour, self-employed work and family labour (Tripathi et al, 2005:19-20).

2.3 Evolution of Biogas in Nepal

While writing about the socio-economic impact of biogas to the life of rural women it is also wise to look at the history of biogas development in Nepal. The history of biogas plants in Nepal date s back to late 50's. Late Father of B.R. Saubolle in St Xavier's school, Godavari, Kathmandu, initiated it as an experiment. The first biogas plant was made up of an old oil drum of 200 litre capacity. By 1974, Nepal had four biogas plants, in the households of some elites in Kathmandu. After 1975/76, the biogas program gained momentum as the government made provision of interest free loan for this purpose (Karki, et al, 1998). Having overcome several obstacles, the programme has crossed many milestones till it achieved the installation of 1, 86,073 biogas plants by July16, 2007.The technology has no doubt gained the confidence and popularity amongst rural households of Nepal (NBPG,2007:1).

In Nepalese case, the non-conventional source of energy especially biogas, however, was introduced as a programme of Agriculture Year, 1975 (Devkota, 2007: 5). After the establishment of Gobar Gas Tatha Agricultural Equipment Development Company (GGC), the momentum in the development of Biogas took place (NBPG, 2007:4).

Biogas started receiving importance as an important alternative energy source since the Seventh Five – Year Plan (1985 – 1990) of Nepal, when it was incorporated in the national development plan. Ever since, there has been progressive review of policy and revision of annual installation targets revision for promoting its expanded applications (Bhattarai, 2007:9).

In this way, biogas is becoming a prominent sector of energy output in rural Nepal. In one study it is estimated that the country has a potential of establishing 1.3 million biogas plants are being installed in the country. Of the total potential, 37 percent lies in the hill whereas the mountain virtual does not have potential of biogas plants. Terai (plain) is very much suitable for this plant, as it shares 62 percent of the total potential (Pradhan and Pradhan, 2006:168,169).

In FY 2005/06, traditional, commercial and renewable energy occupied 85.75 percent, 13.54 percent, 0.61 percent respectively of the total energy consumption in the first eight months of FY 2006/07, such ratios was 85.85 percent, 13.55 percent, and 0.6 percent respectively. This indicates that the dependency of Nepali economy on the traditional source of energy is not changed (MOF, 2007; 112).

In the first eight month of FY 2005/2006, the establishment of biogas plants increased by 66.4 percent with a total of 2330 plants compared to the 1400 plants in the corresponding period of 2004/2005. With a view to provide easy access of biogas to poor people and help produce clean and hygienic cooking gas and quality compost manure from slurry, a biogas credit unit has been established at the Alternative Energy Promotion Centre (AEPC). It channels faster and easier credits on concession to install the biogas plants and provides subsidized loan without collateral especially to rural poor and women through 112 micro finance institutions. This has positively contributed to the socio-economic condition of the rural poor and women with an access to biogas as cooking fuel. This subsidized

loan has been made available from the assistance of KFW, Germany since FY 2001/02(MOF, 2006; 155).

However, Agriculture Development Bank (ADB/N) has been the leading bank for biogas loans since the inception of the program. The ADB/N was also initially responsible for channelling the available subsidies to eligible end-users. It accomplished this through its field officer by combining the subsidy with its loans. Later on the subsidy was channelled through the central ADB/N office directly to the biogas companies. Two other commercial banks, the RBB and the NBL was also involved in providing loans to farmers for the installation of biogas systems, but their role has been as significant as the ADB/N, with branch offices in rural areas, the ADB/N was much better placed to provide loans to interested farmers (Bajgain,2005:27).

During the Eight Plan period, a total of 30,494 biogas plants were installed as against the target of 30,000 establishments in order to produce 3 percent i.e.72 megawatt energy of the total capacity of 2400 megawatt bio-gas energy on the basis of the entire existing livestock in Nepal (NPC, 1997-2002:595).

The number of biogas plants decreased by 3 percent from 2,330 in the first eight months of FY 2006/07 to 2,262 during the same period of FY 2005/06. With a view to provide easy access of biogas to poor people and help produce clean and hygienic cooking gas and quality compost manure from slurry, a biogas credit unit has been established at AECP. This unit provides prompt and easy credit service at a confessional rate of interest for the construction of biogas plants (MOF, 2007; 116).

Energy use efficiency will be improved by adopting new technology for rural energy and economic development; and negative environmental effect created by other activities will be minimized (NPC, 1997: 598). Increasingly Renewable Energy Technologies (RETs), which are also referred to as “alternative energy” options, are becoming the mainstream option for rural Nepalese access modern sources of energy. Some 45,000 new rural households are being provided services from biogas, solar PV, and micro-hydropower technologies each year at present. This is large than the number of new household in rural areas being supplied by

the national electricity grid every year, and hence is substantial from a national perspectives.

The RETs, which provide both electricity based as well non- electricity based services, have been shown to most immediately meet the needs of cleaner indoor environment, better quality lighting for education and income generating activities, alternative cooking fuels, and motive power for agricultural processing and rural industries. The major advantages of these are that they are immediately available to rural families, users are prepared to make around two thirds of the required the burden on government for their financing and proven mechanisms and supply chains exist to increase their supply to meet demands (Pandey, 2003). However, biogas is mostly used for cooking and its slurry as a bi-product is used for fertilising agriculture land.

The government of Nepal has also taken renewable energy as a means for poverty reduction. The Tenth Five Year Plan (2002 – 2007) puts emphasis on increasing energy consumption in rural households by developing and extending alternative energy sources as energy could be a powerful tool in poverty alleviation. The other consideration has been driving the concept of commercialization in rural areas by developing and promoting alternative energy technology based on resources and tools, not to mention the aim of imported commercial fuels and increasing their access to indigenous alternative sources (Bhattarai, no date: 8,9)[1].

Renewable energy technologies provide reliable and affordable energy supplies to millions of people in developing countries. Timely monitoring and evaluation is one way to enable organizations and communities who install and implement energy technology system and programs to check the efficiency and effectiveness of their work. This information can be feed back to governments and donors to improve the effectiveness of future programs (Rai, 2005).

The per capita energy consumption in Nepal is very low (14.6 GJ) and most of the energy is being used for domestic purpose. In Nepal, the sources of energy are primarily conventional. The energy consumption in 2002, by percent is 75.78

percent fuel wood, 9.23 percent petroleum product, 1.47 percent electricity, 5.74 percent animal waste, 3.75 percent agricultural residue, 3.53 percent coal and 0.48 percent renewable energy (WECS, 2003). This indicates that the dependency on forests for energy in Nepal is very high and forests are being used beyond their capacity causing deforestation and environmental degradation. Due to many constraints of technology, finance, politics and many others; the country has failed to create a favourable environment to harness the high potential of water resource and other as well.

Nepal is an agricultural country and important component of Nepalese agricultural system is livestock farming. The number of households with cattle or buffaloes in Nepal is estimated to be 2784583 and the potential biogas households is 1937006 (BSP, 2007).

By the end of 2006, a total number of 157675 plants have been installed which saves 305889 tones of feulwood per year, 4894000 liters of kerosene and produce 260005 tones of bio-compost every year (BSP, 2007).

Biogas is the mixture of gas produced by methanogenic bacteria while acting upon biodegradable materials i.e. cattle dung, human excreta and other organic wastes, in an anaerobic condition within the temperature of 26° to 35° for a certain period. It is mainly composed of 60-70 percent methane, 30-40 percent carbon dioxide and some other gases (BSP, 2003). Biogas is 20 percent lighter than air. It is colourless, odorless and smokeless gas that burns with clear blue flame similar to Liquid Petrolieum Gas (LPG). Its calorific value is about 20 MJ/m3 and 60 percent efficient in a conventional biogas stove(AEPC, 2000).

2.4 Biogas as a Simple Technology

Biogas is a simple agro-base technology and thus cheaper and easy to use in rural areas. Biogas is the mixture of gas produced by methanogenic bacteria while acting upon biodegradable materials in an anaerobic condition. Table 3 shows that it is mainly composed of 50-70 percent methane, 30-40 percent carbon dioxide, and some other gases. It is about 20 percent lighter than air. It is an odourless gas that burns with clear blue flame similar to that of LGP gas (BSP, 2007:8). Hence,

this has clear impact on cooking and cleaning habit of rural women. For example, it takes less time, it do not produce smoke and heat in the room which clearly have good effect on rural women. Similarly, the cooking pot is not dirty which easier to wash. Opposite to this, firewood produces black ash deposit in the cooking pot and thus harder to wash for rural women.

Table 3: Average Composition of Biogas

Composition	Percent
Methane (CH4)	50 - 70
Carbon Dioxide(CO2)	30 - 40
Hydrogen(H2)	5 – 10
Nitrogen(N2)	1 – 2
Water Vapour(H2O)	0.3
Hydrogen Sulphide(H2S)	Traces

Source: NBPG, 2015

The composition of biogas includes methane, carbon dioxide, hydrogen, nitrogen, water vapour and hydrogen sulphide. Methane is virtually odourless and colourless. It burns with a smokeless clear blue flame and is non-toxic (NBPG,2007:1).

The volume of gas produced from the plants of both types totally depends upon the temperature inside the digester. Higher the temperature, higher is the level of daily gas production. Temperature 30-35 degree centigrade is taken as suitable one for fermentation. Likewise ph of 7 to8 is considered as the best (ADB/N, 1996:83).

Biogas is a wet gas as it picks up water vapour from the slurry. Biogas is about 20 percent lighter than air. The main component of biogas is methane which is colourless, odourless and tasteless. But due to the presence of other gases, it gives some smell similar to that of garlic or rotten eggs (Uprety,2004).

Direct cattle-dung burning in open hearth results the loss of more than 90 percent of potential heat and soil nutrients. So the agro-technologists developed a method

of using cattle dung more scientifically through biogas plant. In this technique cattle dung is used to produce methane rich gases, an excellent fuel. It is a natural gas that can be produced by anaerobic decomposition (digestion by anaerobic bacteria) of any moist organic material .In this process animal waste is sealed from the air by a layer of water. Under these conditions organic material are decomposed by anaerobic (oxygen free) rather than aerobic (oxygen using) bacteria producing flammable gases instead of carbon dioxide. A gas produced by this method is used to generate heat for heating and cooking or electricity of lighting (Lekhak and Lekhak, 2005; 229-230).

2.5 Relevance of Biogas in Nepal

As an alternate to degrading source of firewood and semi urbanization in some areas, animal waste and human waste are being popular source of household energy in rural Nepal, and so as in Ilam. No doubt, energy is one of the basic needs for the people. Being a developing nation, different types of alternative energy have been promoted in Nepal by the NGOs, INGOs and various organizations. Nepal covers 86.71 percent traditional fuel, 12.72 percent commercial fuel, and o.56 percent renewable energy of total fuel consumption (MOF, 2005:149).

Chara Brill (1994) concluded that biogas clearly has a lot of promise in Nepal. It is a renewable relatively inexpensive decentralized energy sources. It can help to meet energy demand on rural areas while lessening the deleterious consequences of wood use in an increasing forest deficient world and alleviation problem in the supply organic fertilizers.

Impact of biogas has found in one project report on “Effect of Biogas in Social Life” by Suman Manandhar, 2056. This project report has concluded that biogas technology assure wide ranging socio-economic and environmental benefits, improves the quality of life maintain the soil fertile and give relief to the burden on the depleting forests. It has equally helped in controlling the environmental pollution.

SNV is one of the major promoter of biogas in Nepal. It counts a number of effects on Nepalese households due to introduction of biogas. According to it, a typical

biogas plant used by a six member Nepali household has the following impacts (SNV, no date):

- Reduction of workload: 2.5 hours/day
- Traditional cooking fuel saved: 2,000kg/year
- Reduction of greenhouse gasses: 4.5 tonnes/ year (As per 2005 CDN methodology)
- Significant reduction of indoor air pollution
- Improved hygiene: 70% of all households attach a toilet to their biogas plant
- Potential increase of production: up to 40 percent

As mentioned earlier, biogas is a promising technology for Nepal. It is renewable, relatively inexpensive and decentralized energy source which can help to meet energy demands in rural areas while lessening reliance on other sources for cooking fuel- especially wood and dung. Also since women are often responsible for collecting fuel wood, in some circumstances the introduction of an alternative fuel (like biogas) can have the positive effect of reducing women's workload vis-à-vis biogas in certain culture and ecological context (Britt and Kapoor, 1994).

The government data shows that about 86.8 percent of the total energy requirements in Nepal are met by traditional sources of energy that include fuel wood, crop residue, and animal dung. Fuel wood alone accounts for more than 77.3 percent (MOF, 2004:144). Nepal relies to a large extent on traditional energy resource e.g. fuel wood, cattle dung and agriculture residues. It has no proven significant deposits of fossil fuel. Traditional energy provided 87.4 percent of total energy consumption in 2003 (MOF, 2004:144). Nepal does not posses any proven significant deposits of fossil fuel in the country. More than 12 percent of the total commercial energy consumed is met through imports (MOF, 2004:144).

These figures suggest the scope of biogas as an alternative energy which has clear socio-economic impact on rural Nepal. Besides, biogas also produces slurry which is used as fertiliser to the agriculture land. However, with a simple effort to

advance the rural technology, better fertilisers can be obtained from the biogas plant which will increase the agriculture product and thus, the economic status. In one study it was found that people uses various technologies- some primitive and some slightly improved. For example, 96% of HHs have compost pits with plants, 85% of HH mix organic materials with slurry and 75% follow proper composing procedure (Table: 4). If a little effort is put on for advancement of such technology, better results and more relevance of biogas technology in rural Nepal can be proved.

Table 4: Slurry Utilization

Plants with compost pits	96%
Proper mixing of organic materials with slurry	85%
Proper composing procedure	75%

Source: BSP, 2015

In a study by APEC, various reasons were found for the installation of biogas plant by the rural population (Table 5). Same HH has experienced multiple benefits of biogas. For example, 87% of the population installed the plant due to shortage of firewood, while 88% found it easy for cooking, 81% preferred for smokeless cooking and 77% could save their time. Similarly, 52% HHs were able to improve their sanitation by attaching their toilet to the plant. Further, 29% were found to use slurry as manure. However, very few or only 8% installed it for lighting and only 22% were attracted because of subsidy.

Table 5: Reason for Installing Biogas Plant

Reason	Hill	Terai	Total
Shortage of Firewood	278(83.7)	164(92.1)	442(87)
Easy Cooking	295(88.9)	156(87.6)	451(88)
Smokeless Kitchen	272(81.9)	143(80.3)	415(81)

Improved Sanitation by Attaching Toilet	177(53.3)	88(49.4)	265(52)
Time Saving	254(76.5)	137(77)	391(77)
Slurry can be used as Manure	69(20.8)	77(43.3)	146(29)
Energy Source for Lighting	35(10.5)	5(2.8)	40(8)
Subsidy Provision	90(27.1)	24(13.5)	114(22)
Others	36(10.8)	2(1.1)	38(7)

Source: AEPC 2015

Nepal has estimated total technical potential of installing 1.3 million biogas plants of which 6, 00,000 are thought to be economically viable. By mid 2003, 0.118 million plants of varying capacities (4, 6, 8, and 10 m^3) have been installed. All hill districts are potential and Terai (plain) districts are the most potential for biogas development (Shrestha, 2007:57).

Biogas helps to reduce environmental problems, such as increasing loss of topsoil; deforestation; water shortages; flash floods; and degradation of large traces of agriculture, forest, and pasture land (ICIMOD, 1994:27). Due to its geography and low level of economic development, economic forces and the environment are closely interconnected in Nepal. (ICOMOD 1994:27) and hence relevant to preserve deforestation and enhance socio-economic status of the society.

CHAPTER- III

RESEARCH METHODOLOGY

3.1 Research design

The present study is designed in a descriptive and exploratory framework to analyze the socio-economic impacts of biogas on rural women of the area. Descriptive research design is concerned with describing the historical practices of biogas. The explorative design is used to explore the impact of installation of biogas on the socio- economic condition of women in the study area

3.2 The Universe and Sample

The case was conducted in Sangrumba VDC-3 of Ilam district. All together 30 households out of 60 households having biogas plants were taken as sample in the present study. During the field survey both male and female of different age group were chosen by random sampling technique. The respondents were chosen by purposive sampling so as to represent households from different economic classes.

3.3 Selection of the Key Informants

The researcher himself collected necessary and desired information by taking the personal interview with the household heads. Other desired inquiries to fulfil the objectives of the study area were made with the help of local well-informed people using the semi or unstructured interview method. The key informants were selected on the basis of their position and their knowledge of research topics and the interview were taken as cross checking for data obtained from questionnaire. The researcher further made cross-checking reliable by conducting one focus group discussion with 7 respondents.

3.4 Nature and Source of Data

Both primary and secondary information sources were be used for the fulfilment of the objectives of the study. The study were be basically based on field survey where as secondary sources of information were be used from the relevant sources.

3.4.1 Primary Data

This study is mainly based on primary data collection in Ward no. of SangrumbaVDC Ward No. 3 of Ilam District. Sampled households in the ward were asked to respond to a brief structured questionnaire to collect information on the socio-economic impact of biogas plant installation upon its users.

The primary information was collected during the field survey with the help of questionnaire. The questionnaire includes the various aspects of biogas plant installation with the respondents such as information on biogas, cattle numbers, saving of time and money, energy consumption habit before and after installation of biogas plant, loan and problems of biogas plant installation including health and sanitation situation.

Interview method was used to collect the quantitative information from biogas plant owner or respondent. Thus the study was primarily based on questionnaire with 30 sample informants who gave their opinion on different topic of general concern.

3.4.2 Secondary Data

This study is primarily based on primary sources of data however some secondary data are also used for background purpose. Secondary information were collected from all the materials concerning to the biogas plants such as books, journals, newspaper, published and unpublished articles and other reports etc.

3.5 Techniques and Tools of Data Collection

3.5.1 Interview Schedule

Interview schedule was designed to collect the data. The researcher took interview with households using structured questionnaire. Similarly, unstructured and open ended questions were asked to the officials and experts. This structured-unstructured mix of interview to different respondents helped this researcher to compare and cross check the results.

3.5.2 Observation

Observation method was also used to cross-check the information. The researcher visited each household selected for sampling. The condition of female of the particular area was observed and the data was recorded.

3.5.3 Focus Group Discussion

This researcher invited 7 women from different household for focus group discussion where the discussion was held with the help of a check list which comprised the similar questions so as know their group view and compare with the individual responses. Only one focus group discussion was conducted.

3.6 Data Analysis and Interpretation

As discussed above, the data was collected through various sources using various data collection techniques and tools. The data was scientifically processed, tables and charts were made and the conclusion was drawn for careful study of the facts. Descriptive analysis was used for the qualitative data. The tables were prepared according to characteristics of data such as plant owners, family size, land holding, castes education etc. Quantitative data were presented in terms of percentages and tabular form. Both qualitative and quantitative data were combined and presented to sketch out the socio-economic impact of biogas plant installation in ward no.3 of SangrumbaVDC of Ilam district.

CHAPTER-IV
SOCIO-ECONOMIC STATUS OF BIOGAS PLANT OWNERS

Nepal is a small and poor developing country. It needs to preserve the natural resources like forest, land and water. Biogas is one of the best alternative energy source to preserve the forest. Preservation of forest basically shows the good impact on socio-economic condition of a society. For example, women can save three hours a day after installation of biogas plant which is a good social impact.

This chapter describes the socio-economic condition of the biogas energy owners of Sangrumba VDC-3 of Ilam district. Here most of the residents are educated. They are very much aware with the benefits of biogas plants. The young and working aged family members from almost households are migrated for education and job within and outside the country.

Biogas is a sustainable alternative technology for economic and social development in rural area for many causes. One, inputs to operate plants are easily available and two, the technology is simple for operation and maintenance. Further, this technology gives more benefits to the rural women. As traditionally women are engaged in cooking due to social construction, rural women face health problem due to emission of smoke from biomass fuel and they lack time for child care because they spent time for fetching firewood and other daily works. The burden of workload is reduced as biogas gives smokeless cooking and also do not need firewood.

In this chapter the researcher has analysed the data collected in the field survey which include caste and ethnicity, family size, occupation, educational status, population distribution, source of light, plant's size, production, livestock, loans distributions and class distribution to show the benefits of biogas in terms of time consumption, effects on health, saving of fuel-money and women participation in social and economic works which also gives the gendered analysis of this program in the study area.

4.1 Population Distribution

Population is one of the key of any research works. It displays the result of the work. In this research study, the population of the whole VDC has been presented as below.

Table 6: Population Distribution of SangrumbaVDC in B.C 2068

Ward No.	Brahaman / Chhetri		Janajati		Dalit		Minorities		Total			
	House no.	Pop	House no.	Pop	House no.	Pop	House no.	Pop	House no.	Pop	Woman	Men
1	220	1321	36	168	2	17	87	496	345	2002	962	1040
2	143	813	36	217	13	79	99	527	291	1636	834	802
3	265	1586	13	81	14	67	58	304	350	2039	981	1058
4	15	83	46	268	4	17	198	1041	263	1409	691	718
5	152	946	10	65	3	13	49	259	214	1283	618	665
6	250	1448	31	182	1	4	78	419	360	2053	988	1065
7	116	715	64	402	1	10	44	272	225	1392	673	726
8	309	1834	56	360	9	53	197	1303	571	3550	1708	1842
9	177	1039	59	315	15	80	60	279	307	1703	820	883
Total	1647	9667	347	2058	62	340	870	4900	2926	17044	8275	8769
%	56.29	57.26	11.86	12.05	2.12	2.00	29.73	28.69	110	100		

Source: Sangrumba VDC, 2068

Table 6 shows that the total population of VDC in 2059 B.C was 17,044. The female population were 8275. The male population were 8769. This table shows that female population is less than male population. Brahaman and Chhetri have the highest population with the score of 57.26%. After that the second higher caste is Alpasankhak Lopanmukhha (Minorities) with the score of 28.69%. The third

score is 12.05% of Janjatis and Dalits have the least or 2% Dalit of VDC population.

This table shows that the total population of Ward 3is 2002. Among them Brahaman and Chhetri is 1321. After that minorities are 496, Janjatis 168 and Dalits only 17.

VDC also provided total population with no caste distribution. Table 7 shows that the total population are 18, 285 in the SangrumbaVDC with 2102 people in Ward no.1.

Table 7: Population Distribution of Sangrumba VDC of B.C 2068

Ward Number	Population
1	2102
2	1736
3	2239
4	1509
5	1383
6	2156
7	1305
8	3851
9	2003
Total	18,285

Source: SangrumbaVDC, 2068

4.2 Caste/Ethnicity

VDC source shows that the population of SangrumbaVDC is 18,285 in 2064/65. The caste and ethnicity mix of the population includes Brahaman, Chhetri , Limbu, Gurung, Rai, Tamang, Rajbanshi, Newar Satar and Meche and are mostly religiously Hindu. However few are also Buddhist.

Table 8: Caste/Ethnicity of Sampled Household

S.N.	Ethnicity	Number	Percent
1	Brahaman	21	70
2	Chhetri	8	26.7
3	Limbu	1	3.3
		30	100

Source: Field Survey, 2015

Table 8 shows that the majority of the households are Brahman households. Brahman is leading in number or 70% of sample households. Similarly, Chhetri is in second majority comprising of 26.7% of total households. Lastly, the table shows other ethnic groups like Limbus are 3.3% of the total households.

4.3 Family Size

Ward No 1 of the VDC has 2102 residents. Table 9 shows that among all 30 plant owners, 36.6 % households have 1 to 4 members. They are categorized as small size family. 43.4% household have 5 to 6 members and are categorized as medium size family. The large size family have above 7 members and comprises 20% household.

Table 9: Distribution of Households by Family Size

S.N	Family	No. of Household	Percent
1	Small(1-4 person)	11	36.6
2	Medium(5-6 person)	13	43.4
3	Large(7- above)	6	20
Total			

Source: Field Survey, 2015

4.4 Occupation Distribution

Agriculture is the backbone of the VDC. In the Sangrumba VDC , the people are involved in other occupations like government and private services and business as well. The people grow various crops like paddy, maize, wheat, mustard, jute, vegetables and fruits. The vegetable includes potato, tomato, bean, carrot, cauliflower, onion, spinach, radish, pumpkin and so on.

Table 10 shows that higher percent of biogas energy owners have agriculture as their occupation. 43.3% of the biogas energy owners are involved in agriculture and service. Similarly, 20% rely only on agriculture and 16.7% have dual occupation of agriculture and business. Other 16.7% have only private or government service as their occupation. Rest 3.3% of biogas user are involved in politics with agriculture and service as their occupation.

Table 10: Occupation Distribution of Biogas Owner Households

S.N.	Occupation	No. of Household	Percentage
1	Agriculture	6	20
2	Services	5	16.7
3	Business	-	-
4	Agriculture + service	13	43.3
5	Agriculture + Business	5	16.7
6.	Agriculture + Service + Politics	1	3.3
Total		30	100

Source: Field Survey, 2015

In the field survey the researcher found that there are mix occupation like farming and service in the same house. For example, parents are involved in farming and their sons daughters are doing government and private services**.**

Table 11: Occupation Distribution of Women Having Biogas in Household

S.N.	Occupation	No. of Household	Percentage
1	Agriculture	25	83.4
2	Services	4	13.3
3	Business	-	-
4.	Politician	1	3.3
Total		30	100

Source: Field Survey, 2015

Table 11 shows that most or 83.4% of biogas user women are involved in agriculture, 13.3% in services and 3.3% in politics.

4.5 Educational Status

Education is the key of development. Ilam is among the top of the education index in the country. As SangrumbaVDC is near of this district headquarter, naturally its education status is better. This chapter describes the educational status in Ward no. 3 of this VDC. Most of people have taken formal education in is Ward. Some also have taken informal education.

Table 12: Educational Status of Plants Owners and their Family Member

S.N.	Educational Level	No. of Person				Total	
		Male	Percentage	Female	Percentage	Number	Percentage
1	1 - 10	18	22.5	26	37.1	44	29.4
2	Above SLC	52	65	24	34.2	76	50.6
3	Literate	10	12.5	17	24.5	27	18
4	Illiterate			3	4.2	3	2
Total		80	100	70	100	150	100

Source: Field Survey, 2015

Table 12 shows that most of people are literate. 29.4% people falls under grade 1 - 10 of formal education. 50.6% have passed SLC. Similarly, 18% people are in literate and only 2% are illiterate.

This table also 37.1% female falls under 1 - 10 grade against 22.5% of the male in the same grade. Similarly, 65% male has passed SLC against 34.2% female in the same level. Only 12.5% of male and 24.5% of female are literate. No male is found illiterate but 2% female are illiterate. However, the study found that girls need not go for collecting firewood in the HHs having biogas, but it does not find any evidence that they used this time for their study.

4.6 Energy Use For Lighting Purpose

Infrastructure development like road, school, hospital and electricity are backbone of development of any society. The table 13 shows the sources of energy for light in the study area. The study found that households use electricity as a energy source for lighting and kerosene and wax candles in load shedding time.

Table 13: Type of Energy for lighting

S.N	Type of Energy	No. of Household	Percent
1	Biogas	-	-
2	Electricity	30	100
3	Solar PV Home System	-	-
4	Kerosene	All HHs in electricity load shedding time	
5	Others (candle, Emergency light)	All HHs in electricity load shedding time	
Total		30	100

Source: Field Survey, 2015

Table 13 shows that 100% of household of people use electricity for light. Same percent household's people use kerosene and other source of energy like candle

and emergency light in load shedding period. However, none of the household uses biogas or solar PV home system for lighting.

4.7 Effect on Environmental Pollution Reduction

Clean and good environment is the best for health. Environment shows the living status of any society. The biogas is one of the best alternatives for smokeless cooking which helps the users to get rid off headache and eye burning problems.

Table 14: Biogas Helps Reduce environment pollution

S. No	Reduce Environment Pollution	No. of Households	Percent
1	Reduce Effect of Firewood in Health	19	63.3
2	Reduce Deforestation + Reduce Effect of Firewood in Health	11	36.7
Total		30	100

Source: Field Survey, 2015

Table 14 shows that out of 30 sampled households 63.3% respondents reported that biogas helps to reduce bad effects of firewood in health. 36.7% also reported that it helps to reduce deforestation. Hence, the programme is successful to address the health problem of women and children which they faced before installing biogas plant due to the smoke of firewood.

4.8 Energy Source Prior to Biogas

Table 15: Energy Source for Cooking Prior to Biogas Installation

S.N.	Energy	No. of Household	Percent
1	Firewood + Kerosene + Agriculture Residue	24	80
2	Firewood + Kerosene + bio-briquettes	6	20
3	Electricity	-	-
4	LGP	-	-
Total		30	100

Source: Field Survey, 2015

Table 15 shows that 80% of household of people used to use firewood, kerosene, and agriculture residue for cooking prior to biogas installation and 20% used to use firewood, kerosene and bio-briquettes biogas installation. There is no household using LGP before installation of biogas. However, after installation of biogas some households are found to use LGP.

4.9 Experience of Using Biogas

Now-a-days biogas is very popular in the Ward 3 of SangrumbaVDC. The trend of installing biogas is increasing year after year.

Table 16: Experience of Using Biogas

S.N.	Years	No. of Household	Percent
1	1 – 5 years	14	46.7
2	5 – 10 years	8	26.7
3	10- 15 years	6	20
4	15- 20 years	2	6.6
Total		30	100

Source: Field Survey, 2015

Table 16 shows that 46.6% household's people are using biogas for 1 to 5 years. 26.7% household's people are using this for 5 to 10 years and 6.6% household's people are using this for 15 to 20 years. Hence the trend shows that this technology is being popular in years.

4.10 Plant Size

Altogether 485 biogas plants are installed in the VDC with 60 biogas plants is in ward till date.

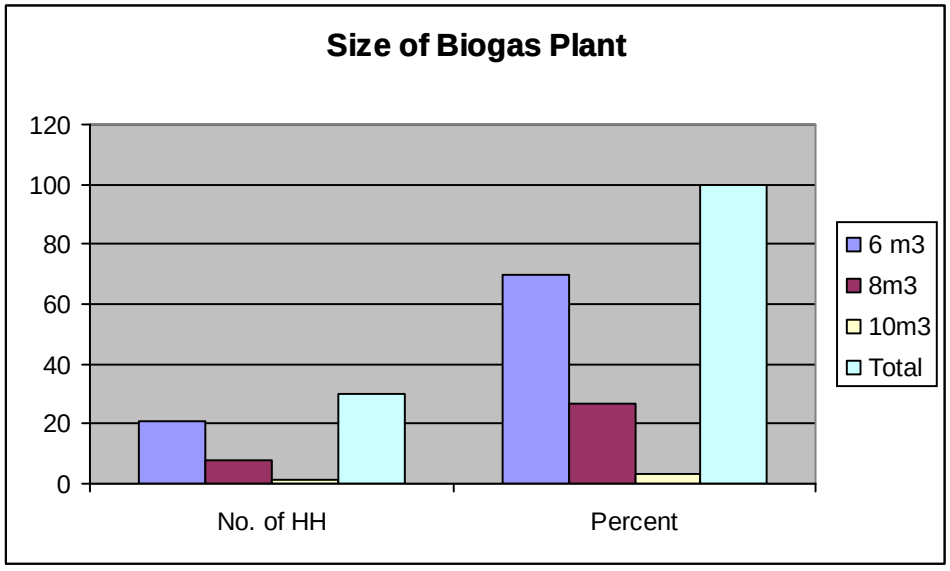
Table 17: Size of Biogas Plants

Plant Size	No. of Household	Percent
6 m^3	21	70
8m^3	8	26.7
10m^3	1	3.3
Total	30	100

Source: Field Survey, 2015

Table 17 shows that 70% households have 6m^3 plants, 26.7% have 8m^3 plants and 3.3% have 10m^3 plants. This is also shown in the following chart as well.

Chart 1: Size of Biogas Plant



4. 11 Latrine Connection in Biogas Plant

Table 18 shows that 73.3% of households did not connect latrine in their biogas plant. Some people opined that the connection of latrine is against our religion. Some people also disliked the connection due to disgusting smell. However, 26.7% households have connected latrine in their biogas plant.

Table 18: Latrine Connection in Biogas Plant

S. No	Connected latrine in biogas plant	No. of Households	Percent
1	Yes	8	26.7
2	No	22	73.3
	Total	30	100

Source: Field Survey, 2015

4.12 Livestock Distribution

Livestock is important for biogas energy. Without cattle dung, it is difficult to operate biogas plant. Buffalo and cow are the sources of cattle dung. Cattle dung is useful for biogas plant and fertilizer.

Table 19: Livestock Population

S.N.	Total no. of Livestock	No. of Households	Percentage
1.	Below 3	13	43.3
2.	4 - 6	12	40
3.	6 and above	5	16.7
Total		30	100

Source: Field Survey, 2015

Table 19 shows that 43.3% households have less than 3 cattle. Similarly 40% households have 4 to 6 and 16.7% have number more than 6 cattle. However, this

does not show that biogas programme has increased the number of cattle as a part of their economic activities. Rather, HHs installed biogas because they had cattle.

4.13 Loan for Biogas Plant Installation

Many financial institutions give loan for installing the biogas plant. Majority of the people are used to take loan from these institutions, but few are found not to take any loan and spent own money.

Table 20: Installation of Biogas Plant on Loan

S.N.	Loan	No. of Households	Percentage
1.	Loan taken	25	83.3
2.	Loan not taken	5	16.7
Total		30	100

Source: Field Survey, 2015.

Table 20 shows that 83.3% households have taken loan from financial institution and 16.7% households spent their own money for the installation of biogas plant. Similarly, table 21 shows that majority or 80% have taken loan from Agriculture Development Bank, 16% from Sahara Nepal Cooperative Bank and only 4% from Rural Development Bank.

Table 21: Sources of Loans for Biogas

S.N.	Sources of loan	No. of Households	Percentage
1.	Agriculture Development Bank	20	80
2.	Sahara Nepal co-operative Bank	4	16
3.	Rural Development Bank	1	4
Total		25	100

Source: Field Survey, 2015.

4.14 Beneficiaries

Among the beneficiaries are men, women and children. However, women are benefited directly and significantly.

Table 22: Beneficiaries

S.N.	Person	No. of Household	Percent
1	Women	15	50
2	Men + Women	7	23.3
3	Women + Children	8	26.7
Total		30	100

Source: Field Survey, 2015

Table 22 shows that women, men and children all beneficiaries of biogas energy. Altogether in 50% of HHs only women were found as beneficiaries, and in 23.3% HHs both men and women and in 26.7% HHs women and children are benefited. Hence, more benefits are found in terms of reduced workload in kitchen and farms and improvements in health of women and children.

4.15 Benefits of Biogas

People use biogas for easy cooking, saving time for good health and saving money. Some women also find it useful for getting rid of headache, eye-ache and cough problems.

Table 23: Benefits of Biogas

S.N.	Benefit	No. of Household	Percent
1	Saving Time + Smokeless Cooking + for good health	16	53.3
2	Saving Time + Good Health + Smokeless Cooking + Saving Money	14	46.7
3	Giving Lighting	-	-
Total		30	100

Source: Field Survey, 2015

Table 23 shows that 53.3% households responded that biogas plant is useful for time saving, smokeless cooking and good health. Apart from these benefits 46.7% households responded that it is useful for saving money as well. As the load to care works is bear by women, saving on fuel is an indirect economic benefit to the women themselves.

4.16 Use of Slurry in Agriculture Production

Level of production and productivity plays great role in economic development. Increase in production is the base of Gross Domestic Product (GDP) growth. Hence, increase in production increases level of employment and reduces poverty and hunger. Biogas slurry is useful for agricultural production increment.

Table 24: Use of Slurry in Agriculture production

S.N.	Production	No. of Household	Percent
1	Increase production	5	16.7
2	No improve in production	16	53.3
3	Decreased	9	30
Total		30	100

Source: Field Survey, 2015

Table 24 shows that most or 53.3% households responded that biogas slurry have not improved production. However, 16.7% responded that it increased production and 30% even felt that slurry is not a good fertilizer and reduced their agro production.

4.17 Class Distribution

Most of the households belong to lower and middle class categories. Poor class do not install plants as they have no land or livestock. Some Bramahans and Chhetries and mostly Limbu and Dalit do not have biogas plants. Most of them works as wage labour in daily base.

Table 24: Class Distribution of people Using Biogas

S.N.	Class of People	No. of Household	Percent
1	Poor	-	
2	Lower Middle Class	16	53.3
3	Middle Class	13	43.4
4	Rich	1	3.3
Total		30	100

Source: Field Survey, 2015

Table 25 shows that 53.3% households having biogas plants belong to lower middle class, 43.4% to middle class and 3.3% to rich class.

4.18 Overall Impact of Biogas on Rural Women

Study found that women are most benefited after the installation of biogas technology. But this technology also benefited men and children. This overall socio – economic impact of biogas on the rural women in Ward 3of SangrumbaVDC can be described in the following headings:

4.18.1 Workload Reduction and Time Saving

After installation of plant the workload of women for collecting firewood is reduced. Similarly, cooking time is also reduced and as the cooking utensils do not have carbon deposits as used to be in time of firewood cooking, the time for cleaning utensil is also saved significantly. Because of reduced workload, they have time to take rest, watch TV, listen radio, reading news paper, books and magazines, care child and livestock and outer activities like going temple, listening Puran , going farm etc.

4.18.2 Easy Cooking

The smokeless stove gives easy cooking to rural women. It reduces cooking time as well. It also removes the burden of collecting firewood. Women need not blow air as they used to fire the firewood. This helps women to save their body energy.

4.18.3 Health and Sanitation

Conventional fuel stove is harmful for rural women in health as it produces harmful smokes. The rural women have eye burning, cough and headache problems due to such smoke. Biogas, however, helps women to get rid of such problems as it does not produce smoke. It is widely experienced that biogas helps to improve health conditions of rural women.

4.18.4 Saving Money

It helps to save money as household need not spend for firewood. However, the installation of biogas needs a lot of money. But as this technology is long lasting, and saves time for cooking and let women time for other economic activities, it helps to save money in real sense. Similarly, if one uses it for lighting as well it also saves money of fuel and kerosene. As care work is a women's responsibility according to gender division of work, saving money is also a saving for a women to perform their careworks. Similarly, plant also demands livestock which is also a source of income for rural women.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Nepal is a least developed country where more than 80% people lives in rural areas, employed in agriculture sector and depend on conventional sources for fuel. Mostly these sources are firewood, cattle-dung cakes and agriculture residue for cooking and kerosene, fats etc. for lighting. In fact, biomass is still a main source of cooking energy which is about one-third of all energy and nearly 90 percent of household consumption in some least developed countries. It is even used for heating. However, these sources are getting scarce day by day in one hand and these causes drudgery to women and girls as in some parts of countries they spend about three hours a day to collect firewood. Biogas has risen as an alternative to address these problems as this is comparatively a low cost and simple technology which needs cattle waste as inputs and little knowledge of repair.

In economic terms biogas is developed as the alternative source of energy due to the rural subsistence economy and standard of sanitation there. It has reduced the compulsion of women to fetch firewood and saved their time and energy which let them time to involve in other economic activities and made their life easier. The improved Chulhas (ovens) reduces the drudgery of women, changes their lifestyle and encourages them to come out for income generating economic activities. It also saves women and children from the risk of fire and pollutants caused by firewood as it does not have dangerous emissions. Opposite to this biomass energy causes indoor air pollution and smoke exposure which pollutes indoor air quality and creates respiratory and eye infections, cough and headache to women and children. Thus, biogas improves the health condition of children and women.

From social construction of gender point of view women have heavy workload including fetching firewood, cooking, feeding and caring children, doing animal husbandry, collecting grass and other feeding items for them and so on. These workload starts from early sunshine to late sunset causing severe health problems as well. Biogas, in such a situation improves the condition as mentioned earlier. Besides, it has also economic benefits as it reduces the direct expenses on fuel for cooking and to some extent lighting.

5.2 Conclusion

Energy is vital component of development and thus an important sector of study. It is classified in various ways. One way of classification is classifying it into (a) conventional energy sources which is obtained from static storage like fossil fuel and (b) non – conventional energy sources which is renewable in nature like solar energy, wind energy, geo- thermal energy and bio energy. Another classification is traditional (biomass), commercial (conventional) and alternative (renewable). Coal, electricity and petroleum are the commercial energy sources; bio fuel sources such as firewood, agricultural residues and animal waste are conventional sources and biogas, micro-hydro, solar thermal, solar photovoltaic and wind energy are the alternative sources. Non – conventional or alternative energy sources are pro – rural, decentralized, infinite, locally available and safer. Hence study of bio-energy, and thus, biogas is always important.

Various studies has shown that introduction of biogas has not only lowered down but also added the workload to rural women. However, women are able to give more time for child care, cleaning household surrounding, and taking care of patient and elderly members after installing biogas. While time allocation for forage collection, cooking, cleaning dish etc. are decreased, time for other activities such as water fetching, mixing dung with water for biogas plant and fodder collection has been increased after installation of biogas. However, the role of women has increased dramatically after installation of biogas plant.

Biogas was introduced as a programme of Agriculture Year in 1975 but incorporated in development plan only from the Seventh Five – Year Plan (1985 – 1990) of Nepal. However, this has become one of the prominent sources of rural energy and more than 186,000 plants are already established till days. Hill and Terai (plain) areas are very much potential for biogas energy. However, the potential is not used significantly. Economic Survey of 2007 shows that only 0.60 percent of total energy consumed in year 2004/5 were produced from renewable sources including biogas. However, the establishment of biogas plants increased by 66.4 percent with a total of 2330 plants in the first eight month of FY 2005/2006, compared to the corresponding period of 2004/2005. Similarly, a total of 30,494 biogas plants were established in the eighth five year plan. Further, the Tenth Five Year Plan has taken the policy using alternative sources of energy as one of the means of poverty reduction in the rural areas. The increasing tendency of biogas use, however, is due to the provision of subsidy channelled through various institutions.

There are different reasons for different households to install biogas. Some of the major reasons are the shortage of firewood, easy cooking, smokeless kitchen, improved sanitation by attaching toilet to the plant, time saving, slurry use as manure, source for lighting and the provision of subsidy.

The study at SangrumbaVDC- 3 shows that most of residents are educated and aware of the benefits of biogas plants. The number of SLC pass out was found 50.6%. The working age and young members of most of the households migrated for education and job and for education in various parts of Nepal and in foreign countries. The burden of household work is reduced in many houses and female members are enjoying smokeless cooking and easy washing of utensils after installation of biogas plant.

The majority of residents installing biogas plants , i.e., 70% of total HH surveyed were Bramins. Following them 26.7% of HH were Chetries and 3.3% were Limbus. In this way, the study found that upper caste households are the major user of Biogas in Sangrumba VDC- 3. Majority of HHs were found to have small and medium family size with less than 7 members in a HH. Similarly, unlike the

general trend of other parts of Nepal, majority of HH were found to have dual occupation, e.g., 43.3% in agriculture plus public and private service and 16.7% in agriculture plus private business. However, 83.4% women were found to involve in agriculture and only 13.3% in service as their economic activities. Similarly, cent percent HHs were found to use electricity for lighting, and no houses had provisions of lighting by biogas. Instead, they were found to use kerosene in absence of electricity.

Residents were aware of some effects of biogas. For example, 63.3% were aware of positive effects on health and 36.7% also said that it reduces deforestation. Prior to installation of biogas in the house all of them were using conventional sources of energy like firewood, kerosene, agricultural residue and bio-briquettes. However, 53.3% are using biogas for more than 5 years. Some 6.6% are even using it for more than 15 years. The average plant size is 6 m3. Altogether 70% of HHs have 6m3 plants. Similarly, 26.7% HHs have attached their toilets to the system. Importantly, 50% of women were benefited from biogas plants in their house. Similarly, in 26.7% of HHs women and children and in 23.3% of HHs men and women were benefited.

Various studies has shown that introduction of biogas has not only lowered down but also added the workload to rural women. However, women are able to give more time for child care, cleaning household surrounding, and taking care of patient and elderly members after installing biogas. While time allocation for forage collection, cooking, cleaning dish etc. are decreased, time for other activities such as water fetching, mixing dung with water for biogas plant and fodder collection has been increased after installation of biogas. However, the role of women has increased dramatically after installation of biogas plant.

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potential is not used significantly. Economic Survey of 2007 shows that only 0.60 percent of total energy consumed in year 2004/5 were produced from renewable sources including biogas. However, the establishment of biogas plants increased by 66.4 percent with a total of 2330 plants in the first eight month of FY 2005/2006, compared to the corresponding period of 2004/2005. Similarly, a total of 30,494 biogas plants were established in the eighth five year plan. Further, the Tenth Five Year Plan has taken the policy using alternative sources of energy as one of the means of poverty reduction in the rural areas. The increasing tendency of biogas use, however, is due to the provision of subsidy channelled through various institutions.

The HHs are found to install plant with loans, but no HH accepted that they got subsidy. However, 16.7% of HHs did not take any loan for this purpose. Loan scheme seems to contribute to the program as 53.3% of HHs belong to lower middle class. Another contributing factor is that only few cattle are enough to input for the plant. 43.3% HHs having plant have cattle below three in number.

About the benefits the perception of the respondents are varying. For example, majority or 53.3% perceived that it saves time, gives smokeless cooking and good health. However, 46.7% perceived that it also saves money besides above benefits. However, opinions on the benefits to the agriculture are contradicting. Only 16.7% agree that the slurry increases agriculture production while 53.3% opines that it reduces production. However, 30% responded that it makes no difference to the production.

In short, the effect of biogas is general in nature. It has made the work easier within the social construction of gender, but it has no effect in the social construction itself. In other word, it has made the conventional work of women like kitchen work and baby care easier and prompt but it has not encouraged men to help in these works. After installation of biogas plant women left to go to jungle for collecting firewood or they are saving money by not buying firewood anymore. Besides, the women are also enjoying smokeless cooking which is improving their health conditions. Similarly, very few women were found to take part in income

generating economic activities. Social activities of women are mostly religious which parts of the social construction are also. However, installation of biogas has positive effects on the workload and health of women.

5.3 Recommendations

- Biogas users in Janjaties are few. Similarly, Dalit and minorities like Limbus are not benefited by biogas in the Ward. Hence, the program should focus on mainstreaming these castes in biogas use.

- Very little proportion of women are engaged in external economic activities. Hence, the program should expand its scope to the areas from easy cooking and slurry use to gender empowerment.

- Biogas program seems not active to deliver people the awareness about the lighting use of the plant. Hence, the program should disseminate the multiple use including the lighting. This will lower the cost of kerosene to the HH and also the dependency to the fossil fuel.

- Biogas programme should train women in different areas so that they can use the time saved due to installation of biogas. Some of these training may be related to external economic activities and some may be on their social empowerment so that they can make decisions on social and economic affairs in their home or in their community. The type of training may vary from one community to another.

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ANNEX 1

QUESTIONNAIRE

Socio-Economic Impact of Biogas on Rural Women

(A Case Study of Ward 3 of Sangrumba VDC in Ilam District)

Household Questionnaire No.

VDC…… Ward No……

District…….

1. Name of the head of the family:-……

2. Family Size:-

Age (Year)	Male	Female	Total	Literate	Illiterate	Occupation
0-10						
10-20						
20-30						
30-40						
40-50						
50-60						
60+						

3. What kind of energy do you have in your house for cooking ? (you can choose more)

a. electricity b. firewood c. kerosene

d. LPG e. biogas f. bio- briquettes

4. Which type of energy you use for lighting ?

a. biogas b. electricity c. kerosene d. solar PV home system e. others

5. Did you feel any effect of firewood in health ?

a. yes b. no

c. they are unknown

6. do you know about deforestation impact in environment?

a. yes b. no c. others

7. Does biogas help to reduce the environment pollution?

a. yes b. no

c. they are unknown

8. If you are using biogas what energy did you use for cooking prior to this?

a. electricity b. firewood c. kerosene

d. LPG gas e. agriculture residue

9. Is biogas costlier than other energy?

a. yes b. no c. equal

d. no idea

10. How long you have been using biogas?

a. 10 year b. 7year c. 5 year

d.2 year e……

11. Did you known the benefit of using biogas before?

a. yes b. no

12. Why did you choose to install biogas?

a. for saving time b. for smokeless cooking c. for lighting

13. What is the size of your biogas plants?

a. 6 m3 b.8m3 c. 10m3

14. Do you use human waste in biogas energy?

a. yes b. no

15. How many cattle do you have in your house?

a. one b. two c. three

d. more

16. How many cattle do you have in your house?

a. cow b. buffalo c. goat d. others

17. How much did you spend to install the biogas plants?

a. Rs.…….

18. Did you get any grant from any organization?

a. yes b. no

19. If yes, from which organization and how much?

…….....……..

20. Did you get any loan from any organization?

a. yes b. no

21. If yes, from which organization and how much?

…….....……..

22. Who are most benefited by use of biogas in your home? (you can choose more)

a. males b. females c. children

d. others

23. Is there any change of role of women in social activities because of introduction of biogas in your house?

a. positive b .negative c. equal

24. What is the change in rural women life style after using biogas ?

a. They get more time to involved in social activities .

b. It changed their economic status.

c. It helped improve educational activities.

d. other (if any)…….

25. What kind of social activities are you involved in?

a. informal education b. political activity

c. religious activities d. entrepreneurial activity

26. If you get involved in entrepreneurial activities, what kind of enterprise is it?

a. small grocery b. handicraft c. embroidery d. other……..

27. Which activities did you (women) get engaged before the installation biogas plant?

a. informal education b. political activity

c. religious activities d. others……

28. What problem do you normally face after the installation of biogas plant?

…….....……..

29. What are the benefits of using biogas for rural women? (you can choose more than one)

a. saving time b. saving money c. good health d. smokeless cooking e. giving lighting

31. Does biogas help to increase your production?

a. yes b. no c. same

32. Does biogas slurry useful for agriculture production?

a. yes b. no

33. Where do you like to classify yourself?

a. poor b. rich c. middle class

d. high class

ANNEX 2

PICTURES

Field Observation

Picture 1: A 6 m^3 biogas plant

Source: Field Survey, 2015

Picture 2: A Kitchen after installation of Biogas plant

Source: Field Survey, 2015