CHAPTER – I

INTRODUCTION

1.1 General Background

This study is designed to assess the Socio Economic Status of Bio Gas Users: A Case study of Tanahunsur Village Development Committee of Tanahun District. It also examines the background characteristics of biogas users, operational status of biogas plant and impact of biogas plant on women's way of life of the topic.

Nepal is one of the poorest and least developed country in the world with lowest per-capita income $1 per day. Nepal is a small country with an area of 1, 47,181 sq. inhabited by 2, 31, 514, 23 people (Population Census 2001). The land area can be roughly divided into three physiographic regions like: the hills, the mountains and the plains. Out of total population 86 percent live in rural areas as well as 14 percent live in urban areas. (Census, 2001)

The economy of Nepal is primarily based on agriculture and other sectors of the economy are quite small. National account data shows that at factor cost, the share of agriculture in the total GDP was 32.35 percent (MOF/GON, 2009), Most of the rural population has the tradition of raising cattle as an integral part of their farm people are depended mainly on firewood for their energy requirement. They use it for cooking, space heating and other purposes.

The low level of economic development is reflected in the lesser range of energy consumption. Per – capita energy consumption in Nepal is 336kg of oil equivalent (kgoE) (BSP bulletin, December 2004.). Energy consumption pattern is divided into three parts by their sources, namely traditional, commercial and renewable. Large proportion of energy consumption is met by traditional energy resources with increasing pressure on forest resources leading to environmental imbalances to rise with increasing pressure of population growth. Nations demand for fuel is increasing at an alarming rate. About (86-90%) total energy demand is met by firewood, animal dung and Agriculture residue NPC, 2002: The Tenth Plan, (2002-07).

Nepalese rural economy, predominated by subsistence agriculture is based on combination of crop production and animal husbandry. The average size of small – scale farm is about 0.96 hectors per holding.

Animal husbandry makes up a vital part of agricultural production system of Nepal. It has always been complementary to the crop production in the traditional agriculture system in Nepal. In rural area, average farmer hold cattle and buffaloes for dairy products. Dung is used to make compost for the field and usually under condition of resource stress, as a raw material for fuel. The number of cattle and buffaloes is also increasing along with households. Nepal produces about 41.4 million MT of livestock manure per year. It is estimated that about 8, 1000 MT of dry dung cake, alternate to firewood which is equivalent to 20,000 MT of oil. If we compare the electricity with energy generated from existing biogas plants, it would approximately reach 30 MW. The

estimated biogas potential of Nepal is sufficient to operate 1.9 millions of biogas plants. (BSP – N 2006).

The low level of economic development is also reflected in the level of energy consumption. Per capita energy consumption in Nepal is 15GJ.There is a great disparity in the energy consumption pattern of the people as there is a disparity in the income, consumption, attitudes, aspiration and life styles. When divided energy into three parts by there sources namely traditional, commercial and renewable, traditional energy occupied - 87.8 percent, commercial energy - 11.5 percent, and the renewable energy - 0.4 percent of the total energy consumption in FY2008/2009 (MoF 2009).The signifies that a large proportion of energy consumption is met by traditional energy sources with increasing pressure on forest recourses leading to environment imbalances to rise. The source of energy in balance of the country can be shown as follows; fuel wood -89.2 percent, Agriculture residues - 4.2 percent, Animal waste - 6.6 percent, Petroleum product - 64.2 percent, Electricity - 18.3 percent and coal - 17.5 percent and others are renewable (MoF, 2009).

Bio – gas as an alternative energy, so it is essential in these days. There are so many alternative energy such as hydro power, solar power, wind energy, biogas and so on. Thus, biogas remains the best alternative source of energy that stands technically, socially, economically, biologically and environmentally feasible. The cost of wind and solar power are expensive for the rural people than biogas.

The biogas technology to be the simple convenient and reliable then other sources of energy. It helps to reduce firewood and kerosene consumption, conserving

environmental, reduce sanitation problem, reducing work load to women, children and also increase agriculture production. So, bio-gas energy is more useful in the context of Nepal. This is also feasible and cheap then other energy. Policy of HMG/N is to promote biogas technology. In Nepal, 1, 23,395 family size bio-gas plants have been installed in the end of 2004. Bio-gas programmed has been run in 65 districts of Nepal. The bio-gas plants are located in Nepal are, 57 percent Terai, 37 percent Hills, and 6 percent in Mountain regions (Bio-gas Nepal, 2004; Published by BSP).

This technology increasingly accepted by all ethnic groups in both the hills and the Terai. There is not any significant social barrier to the technology especially when cow, buffalo dung is used as slurry. Since, combustion of biogas does not produce toxic fumes and carbon residues on the bottom of pots and pans, health conscious rural people (especially women) favor this technology. The plant owner in the Tarai reported that the level of gas production decreased by about 25 percent during winter. It may go beyond 50 percent in Hills. (Impact study of Bio-gas installation in Nepal, Agricultural Development Bank).

This study is important not only for rural area of country but also the resource management in the nation as a whole. It also helps to formulating policies and strategies in the field of bio-gas technology.

1.2. Introduction to Biogas

Bio gas from manure, vegetable waste and algae, considered for the Isle of Man. Biogas can be substituted for natural gas or prepare as fuel for boilers and electrical generations, Biogas systems convert animal dung into methane gas, which is flammable and can be used as a domestic fuel for cooking and lighting – slurry is used for organic fertilizer.

1.2.1 Uses and Benefits of biogas plant installation

The chief purposes behind the installation of biogas plants are cooking and lighting. It is used in cooking stoves in the kitchen. It burns with a clear blue and smokeless flame. The utensils remain neat and clean and cooking environment becomes healthier. It requires lesser time for cooking than that of firewood.

Biogas can be used for lighting purpose too. However, due to low efficiency in its use for lighting is less recommended. It can also be used as a fuel in internal combustion engines. Such engines can be used in small cottage industries where there is no electricity supply.

Digested slurry produced after the digestion has rich nutrients and possessed good fertilizing quality. So, it can be used in substitution of chemical fertilizer. The use of chemical fertilizer for increasing productivity highly affects on the less fertility of land and environmental degradation.

1.3 Historical development of Biogas in world and its potentiality in Nepal

Biogas technology has been gaining popularity now a day as a good alternative source of domestic energy, the origin and development of such popular biogas was used for heating both water in Persia during the 6th century. Marco polo mentions the use of covered sewage tanks. It probably goes back 2000-3000 yrs ago in ancient Chinese literature. In 1808, H. Davy made experiments with strawy manure in a retort in a vacuum and collected biogas. He wasn't interested in the gas but rather rotten or not rotten manure. However, He determined that methane was present in the gases produced during the anaerobic digestion of cattle manure (CES, 2001).

Jan Baptita van Helment first determined in the 17th century that flammable gases could evolve from decaying organic matter. An Italian National count Alessandro Volta concluded in 1776 that there was direct correlation between the amounts of decaying organic matter and amount of inflammable gas produced. He wrote to a friend about combustible air. He wrote that submerged plant materials in the ponds and lakes continuously give off such gas later Volta's gas was shown to identical with methane gas.

It took over hundred years to use the gas for man kind: The plant for methane generation was set up in 1900 in leper asylum in India. Another plant was installed in Indonesia in 1914. Interest in biogas rose very high at the time of beginning of 2nd world war. By 1950, about 1000 biogas plants were built by French German converted their some 90,000 automobiles to run on biogas to save petroleum fuel during the world. The energy crises followed after the was drew attention of many countries towards biogas (Karmachrya: 1992).

The first bio-gas plant was constructed in Nepal by B.R. Saubolle, a school teacher in 1995 at St. Xavier's school, Godavari. In 1968, Khadi and village Industries commission (KVIC). India built a plant for an exhibition in Katmandu. The agriculture department of HMG/N launched bio-gas plants construction programmes in a systematic way. During fiscal year 1975/76, which was declared as the "Agriculture year" by His Majesty's Government of Nepal (HMG/N) The Agriculture Development Bank (ADB/N) provided free of interest credit to install 196 plants against a target of 250 of the "drum type" bio-gas plants (New ERA 1985:7).

The development and dissemination of biogas technology in Nepal was initiated in an organized way after the establishment of Gobar Gas Tatha Krishi Yantra Vikash (P.) Ltd. (Gobar Gas Company – in short) in 1977 with three main shareholders, the Agriculture Development Bank (ADB/N). The fuel corporation of Nepal (FCN) and united Mission to Nepal (UMN). In 1974, Development & consorting services (DCS) built four floating drum plants of KVIC design. Ever since its establishment the Gobar Gas Company has been solely responsible for promoting and installing Gobar gas plants all over Nepal. However, the result of the programmer of the company in the initial years was not so encouraging in comparison to its national potentials.

Research on various design of biogas plants such as floating steel dome design, concrete fixed dome design, breasted tunnel design plastic bag bio-digester. Ferro cement gas holder, brick mortar dome and mud dome were tested and experimental at Butwal. Fixed dome design a Chinese modification plant was introduced in Nepal in 1980. After several modifications, fixed dome design, which is more popular in Nepal?

During the period of 1981 to 1986, GGC developed and tested various designs of biogas plants such as floating drum design, fixed dome design, tunnel design. Plastic bag design bio-digester and so on. Similarly, various types of biogas appliances such as gas pipes, mixture machines gas taps, stokes, lamps, water drains, gas meters, agitators, manometers etc were developed modified and tested. Slurry coming from the plant was applied to various croup, e.g. vegetable and cereals. It was also used for feeding fish and animals. However, most of the research on the subject was limited to experiments and papers.

Research was also conducted in the application of gas for running engines for agro-processing, pumping water for irrigation generating electricity especially on community basis until 1986, GGC (Gobar Gas Company), installed 60 such plants. But most of them could not continue functioning due to some special problems.

In 1992 BSP was introduced at different stages for massive dissemination of the technology in the country. In 1995, Nepal Biogas promotion group (NBPG) was established as an umbrella organization of all the construction companies.

For the promotion and extension of the program. In 1996, His Majesty's Government of Nepal (HMG/N) setup Alternative energy promotion centre (AEPC) under the Ministry of science and Technology (MOST). The role of AEPC is as the networking at the central level policy making (GGC profile 2001 i 1, 2).

Biogas plant installation is increasing over the years with the government initiation. Government has promoted credit facilities to the people in the provision of land

ownership certificated through ADB/N. Government are supporting to various organization and agencies for its development.

As the forest resource is decreasing, threatening the environmental problem, government is being aware to develop the biogas installation activities, including national planning process. Biogas installation program was in corporate in the seventh plan (1986-90) period and the emphasis has been continued even in the tenth plan (2002 – 2007). In this course, HMG/N has made strategies for the further development of biogas. Privatization Policy is becoming the key efforts to the government to increase biogas plants in the country (WECS: 1994/95). Subsidy policy is one of the major's strategies for biogas energy development.

Table 1.1: Subsidy Rate for Biogas Plants

Plant size	**Terai Districts**	**Hill districts**	**Remote Hill Districts**
4 & 6 cubic meter	Rs 6,500	Rs 9,000	Rs 12,000
8 & 10 cubic meter	Rs 6000	Rs 9,000	Rs 12,000

Source: Biogas support program, 2008

A total of 18 districts are categorized as Low Penetration Districts (LPDs) for now. These districtys receive extra Rs. 500/- subsidy per plant. These districts are Achham, Dailekh, Okhaldhunga, Rukum, Baglung, Baitadi, Dadheldhura, Doti, Panchthar, Rolpa, Salyan, Taplejung, Dhanusha, Mahottari, Parsa, Rautahat, Saptari and Siraha.

The potential for biogas generation is based on the number of cattle and buffaloes. In Nepal, house hold with animals are 27, 84,585 and the potential biogas household is 19, 37,015, regarding the potentiality of Biogas is higher in Terai then hill, remote hill and mountain (Final report on the bio-gas support programmer, phase III, 2005).

1.4 Statement of the problem:

Despite of higher technological advancement in the field of energy generation, many developing countries are facing the energy related problems such as rising prices of fossil fuels, depleting forest resources including environmental degradation etc. and Nepal is no exception of this.

Energy is a basic requirement of human life for the betterment of human development process. Energy is needed in all major spheres of life which are directly connected with man's survival and progress such as in cooking; lighting and heating etc. firewood, animal dung, agricultural residue and solar energy are used by the household and also in agriculture sector in rural areas of Nepal. Almost all Nepalese people are highly dependent on firewood for energy, which has resulted into degradation of forest resources.

In the Nepalese context, solar, water and wind energy have not been fully exploited. High consumption of fuel wood as a traditional source of energy leading to deforestation results into natural disaster such as soil erosion, flood, landslides and desertification etc. Firewood only has been the most common and traditional source of energy for Nepal that represents about three fourth of total energy consumption which is mainly consume in rural Nepal.

The forest alone is not capable of sustaining the increasing demand of energy for growing population. Although there is huge potentiality of hydropower, only less than 1 % has been exploited. Other alternative source of energy such as solar power, and wind energy is negligible in use because of high cost of installation.

For the collection of firewood, rural women and children spend more time as well as on cooking and washing utensils. Smoke produced form firewood in poorly ventilated room with traditional stove creates smoke borne diseases such as respiratory problem including long-term asthma, headache and eye burning etc.

In Nepal, considerable amount of domestic energy requirement is met by the direct burning of dung. Such practice of using cattle dung as a source of energy has grave consequence on agricultural productivity. Not putting the manure back on the agricultural land as fertilizer deprives the soil of valuable nutrients and materials which drastically reduces crop production and results into food shortages. Dung obtained from cows, buffaloes and other animals can be better utilized if converted into biogas. Biogas is a reliable alternative source of energy, which replaces other expensive and pollutive energy resources. It plays crucial role for the conservation of forest and environment, reduction of fossil fuels and self sufficient in energy production.

In view of the situation, presented above, this study has been undertaken to provide feedback to the concerned authorities on promoting the use of biogas so as to reduce the rate of deforestation to improve the health situation of rural women and children and use the time required in collecting fuel woods on income generating activities.This study has

been carried in the specific context of Tanahusur VDC of Tanahu district but its finding can be taken as valid for other VDCs of the district as well and VDCs of other districts.

1.5 Objectives of the Study

The basic objective of this study is to assess the socio-economic status of Bio Gas Users and the impact of biogas use on women's health and income in Tanahunsur VDC of Tanahun District. In order to fulfill this, the study has set specific objectives as follows.

1. To find the socio-economic characteristics of the biogas users.
2. To analyze the operational status of the biogas plants; and
3. To asses the impact of the use of biogas on women's health, saving of time income, etc.

1.6 Significance of the Study

Biogas plant installation is an appropriate alternative and renewable source of energy in rural areas. It has gained momentum nowadays in the absence of adequate development of energy sources such as hydropower, solar power and wind energy which require more capital for installation and operation.

Biogas technology simply reduces the workload of women and children in family for collecting firewood and washing utensils. Time and money saved after the installation of biogas plant, can be utilized on income generating activities. Biogas technology also helps to improve the health and sanitation of rural people and creates smokeless and healthy environment in the kitchen. Biogas also reduces the prevalence of insects in higher rate than that of earlier due to the neat and clean environment.

Biogas directly helps to reduce the rate of forest depletion. The consumption of firewood is curtailed after the installation of biogas plant. Reduction in the rate of forest depletion ultimately reduces the range of natural disasters such as flood, landslide, soil erosion and desertification.

Above mentioned benefits reveal the importance of bio-gas plant installation in rural areas.

In Nepal, hydropower has great potentiality but it is untapped due to lack of capital and trained man power. Likewise, wind power and solar energy including other renewable sources of energy require large amount of capital for installation and operation. Among other renewable source of energy biogas is the most appropriate, renewable and reliable sources of energy in Nepal where large majority of the people are living in rural areas and have the tradition of rearing cattle and buffaloes and an integral part of their farming. Biogas has both positive and negative impacts on its uses. Except the increase in the prevalence of mosquitoes, biogas has several positive impacts upon its users.

In view of the above, the study holds a special significance in the context of promotion of bio-gas plant in Nepal. The study by finding out who the users are, what is the status of bio-gas plants and what problems the bio-gas users are facing would provide valuable basis for undertaking appropriate measures by the concerned authorities in promoting the use of bio gas in rural areas. This would encourage households to continue using bio-gas plant and also induce non-user household to install biogas plants.

1.7 Limitations of the Study

This study has attempted to analyze the socio-economic status of biogas users in Tanahunsur VDC of Tanahun District. However, it has following limitations:

I. This study is primarily based on socio-economic characteristics of the biogas users in Tanahunsur VDC of Tanahun District.

II. This study deals with the operational status biogas plant installation in Tanahunsur VDC only.

III. This study considers only impact of the use of bio-gas on women.

IV. All the data mentioned in this study based on primary as well as secondary data. Primary data have been collected from the household survey questionnaire, interview method and observation method. Secondary data have been collected from the secondary sources such as books, booklets, journal, Newspaper, PDDP unpublished thesis and official data etc.

1.8 Organization of the Study

The study in total consists of six chapters. The first chapter of the study includes introduction, brief history of biogas and its potentiality in Nepal. Statement of the problem, objectives, significance and limitation of the study. In the second chapter, literature review is presented. The third chapter include methodology, where research design, nature and sources of data techniques of data collection, selection of the study area, brief introduction of the study area, sample size, and method of data analysis are

given. Impact of Biogas energy on women of the respondents is given in chapter four. Whereas, chapter five discusses the installation, operational status and impact. Summary, conclusions and recommendations are given in chapter six.

CHAPTER: II
LITERATURE REVIEW

There are some books, booklets, bulletin published in the subject bio-gas plant. Most of them are published by foreign writers but only the few books are published by the Nepalese writers. The books of Nepalese writer are not enough for only regarding the bio-gas plant. Among the several books, bulletin is published by both foreign and Nepalese writer. The literature review will be collect from selected number of books and related fields.

(BSP 2005) Biogas is the mixture of gas produced by methanogenic bacteria while acting upon hide gradable materials in an anaerobic condition. It is mainly compassed of 60-70 percent methane, 30-40 percent carbon dioxide, and some other gases. It burns with clear blue flame similar to that of LPG.

Biogas is the mixture of gas produced by methanogenic bacteria while acting upon hide gradable materials in an anaerobic condition. It is mainly compassed of 50-70 percent methane, 30-40 percent carbon dioxide, and some other gases. It about 20 Percent lighter than air. It is an odorless gas that burns with clear blue flame similar to that of LPG gas (BSP 2007).

According to the final report of bio-gas use survey 2007/2008. A Bio-gas user household saves 990kg of firewood & 6 liter of kerosene oil per year. The gas production was insufficient of in the winter as reported by majority of the respondents one third of the household are attached their latrines to the bio-gas plants. Above half of the respondents used the slurry in the cultivated land and other uses in gardens. The decrease

in occurrence of disease was the positive benefit of bio-gas plant installation. However negative part of installation was increased prevalence of mosquito and some even reported occurrence of typhoid. Most of the household were in the value of male. The major problem in the bio-gas plant in the value problems, high rate of interests, high cost and non-availability of spares, increased prevalence of mosquito.

BSP Year Book (2008) focus that BSP has been the first CDM project in Nepal with registration of two CDM Project in December 2005 of 19,396 Plants Constructed under BSP Phase – IV, have been registered with and approved by the CDM Executive Board. An Emission Reduction Purchase Agreement (ERPA) for the two Projects has been signed with the Word Bank for trading of the Emission Reductions from the two projects for first Seven Years Starting 2004/2005 as the first crediting years 2004/2005 has been completed and payment has been made too.

Winrock International Nepal, in partnership with Eco Securities Limited, developed a Project Design Document for Biogas Support Program (BSP/SNV) to develop sustainable Financing through the Clean Development Mechanism (CDM). The reductions in Greenhouse Gas (GHG) emissions by household biogas digesters as a result of substituting firewood, agriculture residue, burning of dung cakes or kerosene, and capturing methane which is naturally released in the atmosphere are being translated to' carbon credits' through this project. BSP has already installed more than 110,000 biogas plants and targets to install an additional 200,000 by 2009. It was estimated that each biogas plant can generate carbon credit of around 5 ton CO2equivalent per year.

(GGC profile 2001:7)Biogas is a wet gas as it picks up water vapor from the slurry. Biogas is about 20 percent lighter than air. The main component of biogas is methane

which is colorless odorless and tests less. But due to the presence of other gases, it gives some smell similar to that of garlic of rotten eggs.

Biogas is about 20 percent lighter than air. It is colorless and odorless gas that burns with clear blue flame similar to that of LPG gas. Its calorific value is about 20 mj per m^3 and burns with 60 percent efficiently in a conventional biogas stove. Biogas technology is a complete system in itself with its set objectives (cost effective, production of energy and soil nutrient factors such as microbes, plant design, construction materials, climate, chemical and microbial characteristics of inputs) and the interrelationships among these factors influence production of gas in a digester. The slurry from the biogas plant is supposed to be very fertile and its use in agriculture increases the productivity of crop tremendously (AEPC, 2000).

Nepal has over 187000 household size biogas plants and over 300 institutional size plants constructed in some 2650 of 3915 Village Development Committees (VDCs) or Municipalities in 68 Districts out of 75 District in Nepal. Plant Construction has also recently started in Bajura, Jumla, Manang and Mustang. BSP has a plan to construct at least few plants in the remaining 3 District by mid 2009, with these achievements, BSP is the second largest (to improve cooking stove Programme) alternative rural energy programme in Nepal and probably the largest in terms of VDC out reach. BSP also become first Clean Development Mechanism (CDM) Project of Nepal (BSP Year Book, 2008).

Dr. Poornakanta Adhikari (1996) in report entitled effects of bio-gas on family health, sanitation and nutrition: has evaluated both positive and negative impacts of bio-gas. The positive impacts on health were most significantly reduction on eye diseases, headache,

coughing and throat ache. The negative impacts of bio-gas were increased prevalence of mosquito and loss of warmth in house in winter, sanitation conditions and practices were improved and the study reported 62 percent reduction in firewood collection.

(Pokhrel 2001: 8): Bio-gas promotion has suffered due to the initial capital cost required for the plant, low yield of gases in region with cold climate and low social acceptance of use of gas. The capital cost involved in the stage still discourages the most rural people from making effective use of bio-gas potential. A possible alternative is identified as being the community sized Issues are concerning the mode of community ownership, its organizational form for day to day operations and equitable distribution of the benefits from the byproducts still remains unanswered.

Sigdel and Das (1990): had done a study entitted “Bio-gas development in Kaski district” in rural context. They had surveyed 13 biogas plants in Leknath V. D.C. The report revealed that there was a growing awareness in this technology as forest saver. People felt that it would be applicable in a semi-urban area where people were richer since majority of the village people suffered from problem of found capital to repay loan and installation cost was found to be high. Realization of subsidy could be observed.

According to the final report of bio-gas use survey 2000/001. A Bio-gas user household saves 990kg of firewood & 6 liter of kerosene oil per year. The gas production was insufficient of in the winter as reported by majority of the respondents one third of the household are attached their latrines to the bio-gas plants. Above half of the respondents used the slurry in the cultivated land and other uses in gardens. The decrease in occurrence of disease was the positive benefit of bio-gas plant installation. However

negative part of installation was increased prevalence of mosquito and some even reported occurrence of typhoid. Most of the household were in the value of male. The major problem in the bio-gas plant in the value problems, high rate of interests, high cost and non-availability of spares, increased prevalence of mosquito.

(Shrestha 2002, 3)- Bio-gas plant is a device to produce bio-gas. The structure of the plant consists of central pit covered with dome structure. The pit serves as digester and the done serves as gas holder. Animals dung is mixed with water and through by inlet. The dung in the pit is an aerobically digested by the bacteria with generation of gas. The gas bubbles up and collects in the dome. Which is then supplied to house for its use through the pipeline. After digesting the digested slurry flows outsides through the out let.

Britt (1994) has shown concise overview of studies specifically designed to measure the effects of biogas on women's workloads in different geographical setting of Nepal and the studies were done in Rolpa, Rupandehi, Nuwakot and Chitwan districts.

The result from the study states that given the overwhelming workloads for women in most part of Nepal the saving in time in the majority of instances is quite significant.

But, it remarks that the introduction of biogas doesn't appear to fundamentally alter the position of women. So called traditional or unequal patterns in the division of labours are sustained, with working women for long hours simply substituting one labour activity for another.

The research design used were district based and village based workloads effects were calibrated in terms of before and after installation of the biogas plant.

It was found from the study that, estimated time saving for women in Rupandhi was 4 hours and 30 minutes (on average) and 2 hours and 35 minutes (on average) in Nuwakot. However, in a village based research, the estimated time saving was found to be 1 hour and 55 minutes in Madan Pokhara, 3 hours and 14 minutes in Pithuva and 15 minutes in Hathilet village.

Ghimire (1999) has tried to document the benefits of biogas produce by harvesting. The more popular and appropriate renewable energy resource cattle dung and assessed the immediate impact of biogas on respective users. The outcome of the study revealed that the main benefits of biogas plants to its owner was the cooking and lightning facilities that saved a considerable amount of money.

Economic analysis, which is not done in this case, this study, has only dealt with the general impact of the biogas plant on the users. In general, biogas plants are found to have very positive impact on the users which is well appreciated by them. The total saving of 1.22 hours/days/family on an average from the installation of biogas plants suggests that it has been successful to lower the family workload.

Karki(2001) has implemented the research programme to study the influence of bio-slurry application on maize and cabbage in lalitpur district. The result of the experimentation has revealed the supremacy of organic manure in all forms FYMC (farm Yard Manures) slurry compost and liquid slurry over the inorganic manure. The

increment in the field of cabbage and maize was realized after the application of slurry comport.

Karki, etal (2002) have to use the study in Dhading district. The study was mainly focused on the adoption of renewable Energy Technology (RET) and its impact on income generating activities. The outcome of this study show that among the five of bridge as outcome of this study show that three among the five of biogas user reported an increase in crop production by 5 to 10 percent due, to the application of bio gas slurry. However, use of other type of renewable energy technology (RET) did not report increase in crop production as experienced by the bio gas users. The bio gas users house hold main income generating activities are agriculture based like vegetable , butter (ghee) and local wine (rakshi) production, fertilizer required for vegetable production has reduced and so the amount of money spending on chemical fertilizer.

The bio gas technology as suggestion by the study has been helpful in relieving members from daily house hold chores. However, proper skill training needs to be imparted to the beneficiaries for producing marketable production. This of course requires initial capital requirement which these days is readily available from rural lending institutions in view of the above the study has been suggested to implement the bio gas technology in a more intelligent in a more integrated approach in future days.

Policy of Government

Tenth plan

Only 7 percent of the total people living in the rural areas are currently using electricity service generated from sources of alternative energy. While looking into the total national power consumption trend of last five year traditional source of energy is only contributes 80-90 percent while the share of commercial energy is only from 10-14 percent. In totality 77 percent of the total power consumption is generated from firewood while 9 percent from agriculture by products dung and remaining 14 percent from imported petroleum product, coal and electricity. The per-capita Nepal is equivalent to 336 kg oil energy while per-capita consumption of power from commercial sources is 46 kg oil energy.

Quantity target

1) Providing electricity services to 12 percent of the rural people from the source of alternative energy. Under this plan, electricity will be supplied to 1000 VDC's.

2) Proving 44 MW energy by installing 2, 00,000 biogas plants in 65 districts.

Bio gas program

As the popularity of biogas is growing among rural families due to its diverse benefits, it would be expanded since it saves fire wood, reduce dependency on imported energy and there is no negative impact in the people's health. In addition, the use of bio gas plant brings no environmental pollution and the slurry, which came out from the plant as by

product is use as the best fertilizer. So, the tenth plan has target of installing a total of 2,00,000 bio gas plant, including 199,500 private bio gas plants and 500 community bio gas plants. Priority will be given to suitable and relatively smaller size plants and necessary researches would be carried out for its expansion in the Himalayan region and to reduce costs.

The forest serves as the main source of fire wood. Excessive use of fire wood has posed a serious burden on the forest. Our population is increasing day by day while the forest area is decreasing. So the forest alone is not capable of sustaining the increasing energy demand of growing population. In this situation there is a threat of depletion of the forest. This depletion will lead to many natural calamities such as soil erosion, land slide, flood and destruction of natural balance.

For, the collection of fire wood, rural women spent a great part of time further more, they spend considerable amount of time in cooking. Another problem of using firewood in kitchen is smoke produced which makes the women suffer from indoor air pollution.

To understand about bio gas provided direct benefit, especially rural area. For reduction work load when shifting from cooking on fire wood. It saves 3 hours time a day per family due to the reduction in time used for collecting fuel-wood, cooking and cleaning utensils.

CHAPTER –III

RESEARCH METHODOLOGY

These chapter discuses the method employed to conduct the present study. Research methodology is an important component of a study. It involves decision about the research design, sources of data and information, sampling design if primary data is to be collected and survey tools for data collection.

3.1 Research Design

The study uses exploratory cum descriptive design. This study being a socio-economic study of biogas users, the objectives of the study could be best fulfilled by using exploratory cum descriptive research design.

3.2 Sources of Data

The study is based on both secondary and primary data and information. Secondary data is used to present the background of the study and supplement and complement the findings of the study. Secondary data ias collected from various sources such as books, journals, previous theses on the subject and government publications. Primary data is collected by conducting field survey in Tanahunsur VDC of Tanahu District.

3.3 Sample Design

The survey households are selected by using probability proportional sampling technique.

3.4 Sample Frame

The sampling frame is the total number of households using biogas in the VDC. The biogas users in the VDC by ward are presented in Table 3.2. The total number of biogas users in the VDC is 145. Out of this total 40 biogas users are selected as sample size. The sample size is about 28 percent of the population.

Table 3.1: Bio gas energy of Tanahunsur VDC

Ward No	1	2	3	4	5	6	7	8	9	Total
No of plant	36	11	11	3	6	9	20	40	9	145

Source: BSP Nepal (2051 to 2066)

3.4.1 Distribution of Sample by Caste/Ethnicity

The sample is distributed not by ward but by cast/ethnicity. Since one of the basic purpose of the study to find out the status of biogas users and the problems faced by them, it was considered to be valuable if there was difference in these attributes by caste/ethnicity. For this the users were categorized by major castes and sample size was allocated to these castes on proportional to size basis.

3.5 Introduction of the study area

The present study has been carried out in Tanahunsur VDC of Tanhun district, which is located in the western development region in Gandaki Zone The economic status of this

district is normal. Main sources of energy are traditional source of energy but in urban areas fossil fuel is used

The total area of the district is 1546 sq. km. According to 2001 census, the total population of Tanahun is 315237 comprising 146788 males and 168449 females. The population density is 204 people per square kilometer .This district is among the densely populated hilly districts of the country.

This district has one municipality and 46 VDCs. Prithivi Highway is the life line of the district .The high way crosses the district is east – west section with parallel elongation. From the Mugling Bridge over Trishuli River in the east to the bridge over kotre khola in the west a distance of 71 kilometer section of Prithivi Highway lies in this district.

The total households of study V.D.C. is 712 and total population is 3262. Among which 1444 are males and 1818 are females (Census 2001).

The reason for selecting Tanahunsur V.D.C as the study area is that the researcher is familiar to the study area. He is also familiar with the local bio-gas companies and the local people. Hence it was believed that the researcher would be able to collect factual information and present actual scenario.

Table 3.2: Population of ward wise and sex – wise distribution of study VDC

Ward No	Total Households	Population				Total Population
		Male	Percent	Female	Percent	
1	132	261	18.1	330	18.2	591
2	55	145	10.1	140	7.7	285
3	54	109	7.5	130	7.2	239
4	55	102	7.0	150	8.3	252
5	55	91	6.4	115	6.4	206
6	80	165	11.4	225	12.5	390
7	71	125	8.6	183	10.2	308
8	106	235	16.3	266	14.7	512
9	104	211	14.6	268	14.8	479
Total	712	1444	100.00	1818	100.00	3262

Source: CBS, 2001.

Agriculture is the main occupation of people and only some are involved in business service etc. The major crops of the agriculture are paddy, wheat, maize, millet. This place is very suitable for spent life.

3.6 Sample Size

Selected study area Tanahunsur VDChas all wards. but the present study has been concentrated only Tnahunsur VDC. There are altogether 712 households in ward this VDC. Out of the total households having biogas plants of Tanahunsur VDC of Tanahu District at 26.59 percent of bio gas user's household have been taken as samples. About 145 Biogas plants established in this VDC but I have taken 40 samples from this VDC by using simple random sampling technique.

The name of the selected head of the households has been interviewed according to the prepared pre tested questionnaires.

3.7 Methods of Data Collection

Structured questionnaire, FGD, key informant interview and observation were used for collecting data from the selected households. The field survey was conducted in November 2009.

3.7.1 Household Survey

The household survey has been conducted in order to collect qualitative and quantitative facts about socio-economic status of bio-gas users, operational status of bio-gas plants the problems faced and benefits received.

3.7.2 Observation

Certain information were collected by observation method. The operating status of the plants and especially the benefits of bio gas plants have been observed by the researcher and recorded in the note book.

3.7.3 Key Informant interview

Key informant interview is also used using checklist. The key informants are energy specialist, staff of Biogas Company, intellectuals of biogas, local biogas user people who are not include for household survey.From these persons information on the status of bio-gas plant, people's attitude and perception about bio-gas, problems faced by the users and support needed for promoting bio-gas was collected.

3.8 Method of Data Analysis

Information collected from questionnaire has been transformed into a master sheet and data is tabulated on the basis of master sheet. Information is grouped, sub-grouped and classified as per the necessity so as to meet the objective. The data has been processed with the help of computer. Data analysis is made by using percentage, chart, diagram.

CHAPTER - IV

PRESENTATION AND DATA ANALYSIS

4.1 Socio-economic characteristics of the bio-gas users

This chapter describes the background characteristics of the bio-gas users of the Tanahunsur VDC.The Economic status of the plant owners is somehow better of the study area. This chapter describes the main finding related to the economic condition of biogas users such as their cast/ethnicity, family size, Educational status, Occupational, Landholding size, and Livestock Population.

4.1.1 Caste/Ethnicity

There are different castes and ethnic groups in Tanahunsur VDC of Tanahun. The data on ethnicity of the sampled biogas household is given in Table 4.1

Table 4.1: Distribution Respondents by Caste/Ethnicity

S.N.	Caste/Ethnicity	No. of Households	Percentage
1.	Brahmin	17	42.5
2.	Chhetri	11	27.5
3.	Newar	5	12.5
4.	Damai	4	10
5.	Others	3	7.5
Total		40	100

Source: Field Survey, 2009.

Table 4.1 shows, that the majority of the households under study are Brahmins (42.5%) followed by Chhetri (27.5%), Newar (12.5%), Damai (10%) and others (7.5 %). The reason behind the higher percentage of biogas users (Brahmins) is found that they are socially and economically forward in each and every sector.

The sample households of Brahmin and Chhetri is large than other castes because of large number of Brahmin and Chhetri biogas user households in the VDC.

4.1.2. Educational Status

Most of the plant owners are educated. They have admitted their children to school about 27.5 percent owners out of total interviewed completed class 1 to 5. 20 percent have completed grade 6 to SLC and remaining 30 percent of total plant owners

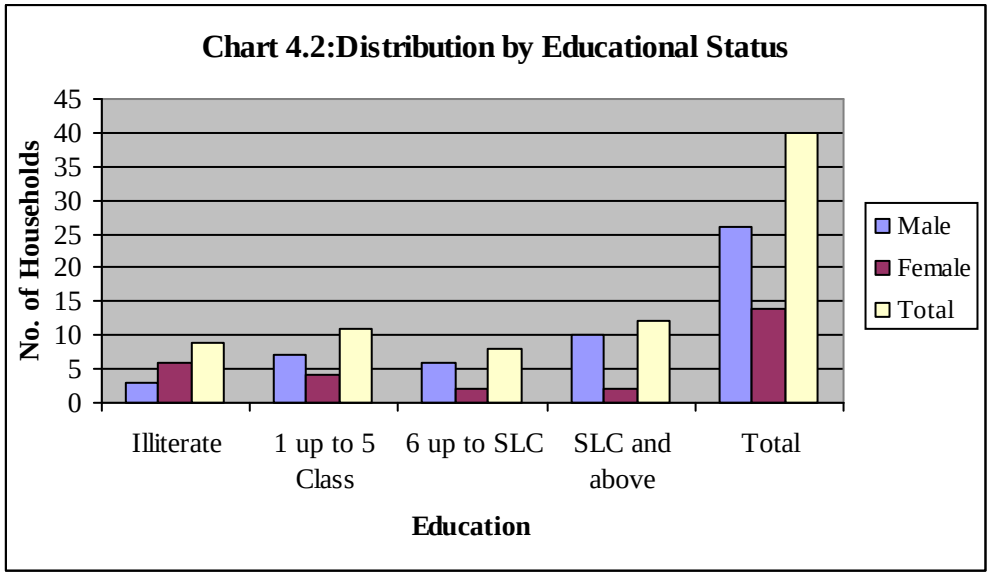
have completed grade SLC and above .Table 4.2 shows educational status of the sampled plant owners.

Table 4.2: Distribution by Educational Status

S.N.	Education	Male		Female		Total	
1.	Illiterate	3	11.6	6	42.8	9	22.5
2.	1 up to 5 Class	7	26.9	4	28.6	11	27.5
3.	6 up to SLC	6	23.0	2	14.3	8	20
4.	SLC and above	10	38.5	2	14.3	12	30
Total		26	100	14	100	40	100

Source: Field Survey, 2009

The data presented in table 4.1.2 reveals that majority of the plant owners are literate (77.5%). Among 20 percent respondents have completed class 6 up to SLC. This result shows that only 9 persons (22.5%) are illiterate.



4.1.3 Occupation

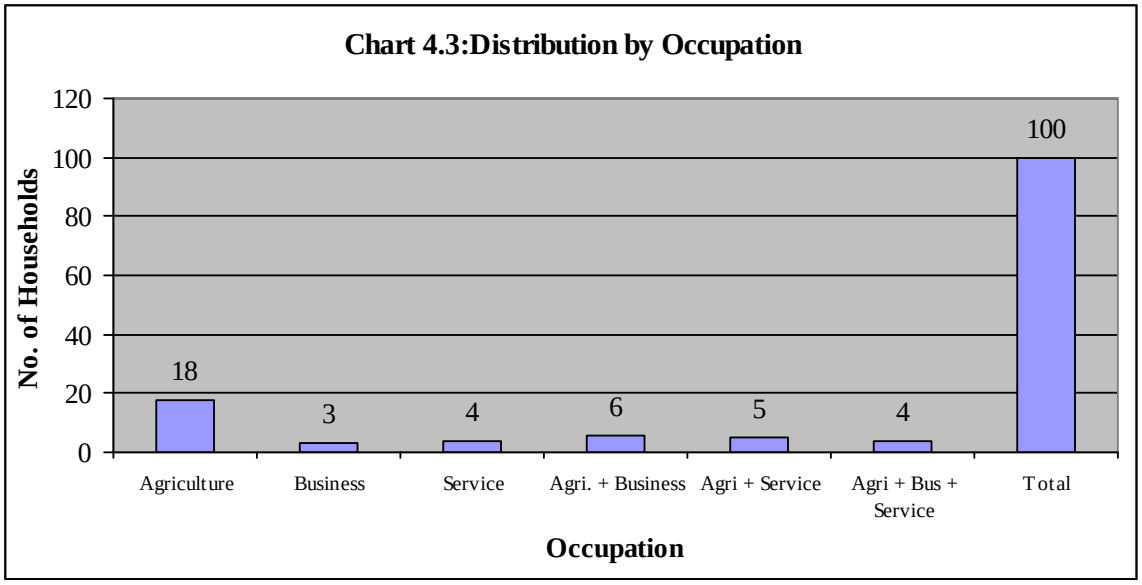
The main Occupation of the plant owners is agriculture. Besides agriculture, service and business are the main occupation of the plant owners. Major occupation practiced by the sampled households is given in the table 4.3

Table 4.3: Distribution by Occupation

S.N.	Occupation	No. of Households	Percentage
1.	Agriculture	18	45
2.	Business	3	7.5
3.	Service	4	10
4.	Agri. + Business	6	15
5.	Agri + Service	5	12.5
6.	Agri + Bus + Service	4	10
Total		40	100

Source: Field Survey, 2009.

Table 4.3 shows that the higher percentage of the plant owners is engaged in agriculture sector. About 45 percent of the plant owners are involved in agriculture, 12.5 percent in agriculture plus service, and 10 percent in service, 7.5 percent in business, 15 percent in agriculture plus business and 10 percent in agriculture plus business plus service. The farmers have more land and more animals for the dung needed for biogas in comparison to the serviceman and businessman. Besides agriculture, most of the households has secondary source of income as well. They are government service pensions and other business. It supports them economically to fulfill basic requirements.



4.1.4 Family Size

The result of the survey reveals that average family size of the sampled biogas household is 4.5. Table 4.4 shows that distribution of households by family size.

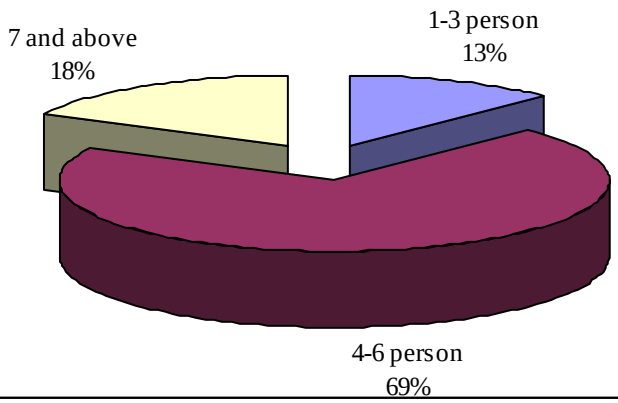
Table 4.4: Distribution of Households by Family Size

S.N.	Family Size	No. of Households	Percentage
1.	1-3 person	5	12.5
2.	4-6 person	28	70
3.	7 and above	7	17.5
Total		40	100
Average family size is 4.5 per household.			

Source: Field Survey, 2009

Table 4.4 shows that among all 40 plant owners, 5 households (12.5%) have 1 to 3 Family members. 28 households (70%) have 4 to 6 family members and 7 above member's households (17.5%). The average family size is 4.5.per household.

Chart 4.4: Distribution of Households by Family Size



4.2 Landholding

The main occupation of all plant owners being agriculture, all of them have their own land to cultivate. While calculating the landholding, only operational land holding has been taken into account. It is found in most of the cases that the land is cultivated by owners themselves. Table 4.5 shows the distribution of land holding of the plant owners.

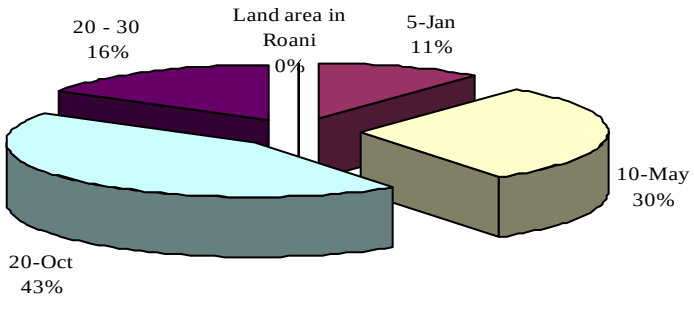
Table 4.5: Distribution by landholding

S.N.	Land area in Ropani	No. of Households	Percentage
1.	1-5	4	10
2.	5- 10	11	27.5
3.	10- 20	16	40
4.	20 - 30	6	15
5.	30 and above	3	7.5
Total		40	100

Source: Field Survey, 2009.

Table 4.5 shows that 10 percent, 27.5 percent, 40 percent, 15 percent, 16 percent of houses with land below 1-5 Ropani, , 5-10- Ropani, 10-20 Ropani, 20-30 Ropani and above 30 Above Ropani respectively. So the highest and lowest responses are recorded in respondent having land of 10-20 Ropani and 1-5 Ropani.

Chart 4.5: Distribution by landholding



4.2.1 Livestock

Since livestock dung is the main raw material for installing biogas plant. Livestock is an integral part of agricultural farming in Nepal. It fulfills the demand of manure for land, meat to eat and milk to drink.

4.2.2 Livestock Population

The situation of the livestock holding in the sampled household in the study area is presented in table 4.6

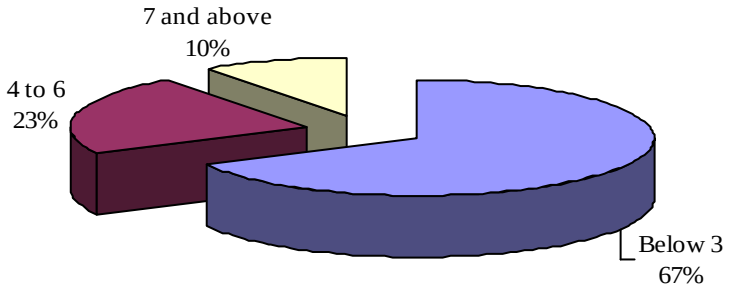
Table 4.6: Livestock Population

S.N.	Total no. of Livestock	No. of Households	Percentage
1.	Below 3	27	67.5
2.	4 to 6	9	22.5
3.	7 and above	4	10
Total		40	100
Average livestock population is 3.22 per household.			

Source: Field Survey, 2009.

Table 4.6 shows that the average livestock population is 3.22 per household. About 67.5 percent respondents out of total interviewed reported that their livestock population is below 3. 22.5 percent or majority of the respondents have 4 to 6 and only 10 percent out of total interviewed stated that their livestock population is 7 and above.

Chart 4.6: Livestock Population



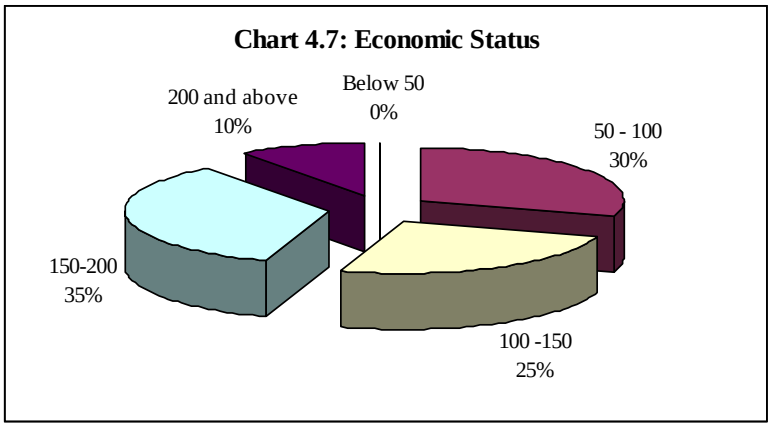
4.2.3 Economic Status

The income of the plant owner has observed by adding the total current market value of all agriculture production and total income from non agricultural sector .As shown in the table 4.7 the house hold within annual income below 50,000 has not been found to be installing the biogas plant proportion of household whose income range Rs. 1,50,000 to 2,00,000 was higher in the sample households.

Table 4.7: Economic Status

S.N	Income (Rs. 000')	No. of household	Percentage
1.	Below 50	-	-
2.	50 - 100	12	30
3.	100 -150	10	25
4.	150-200	14	35
5.	200 and above	4	10
	Total	40	100

Source: Field Survey, 2009.



Main expenditure heading of the sample households are food, cloths, health education and interest of loan. The sample households live in their own house so that spending on housing is not accounted in their own house so that spending on housing is not accounted in the study share of expenditure on food would be greater if we count the market price of self produced good also. Similarly, spending on education is second large part of the expenditure. Since, the number of private schools in increasing in the village area with increasing rate of student enrollment and moving of local student to Kathmandu and other cities of Nepal for the study of higher level education the expenditure on education is growing. Increasing share of education in the study area shows consciousness of people

towards education. Expenditure on health and clothing and health are also significant part of the expenditure reduction of expenditure on health has been experienced by the some of the samples. According to them, some diseases generated through the smokes and burning cares have declined after the installation of plant. However due to the lack of accurate information how much expenditure on health, the plant owners have saved, could not have been explained.

CHAPTER - FIVE

INSTALLATION OF BIO GAS PLANT

5.1 Size of Biogas plant

Many types of biogas plants were introduced in world. Properly used size of biogas plants are $4m^3$, $6m^3$, and $8m^{3.}$ The factors e.g. capacity of land holding, capacity of livestock are the source for determining the size of the plant. Size of biogas plant is given

in the Table 5.1. Widely used size of biogas plants. But biogas plant of 6m3 is appropriate in rural area.

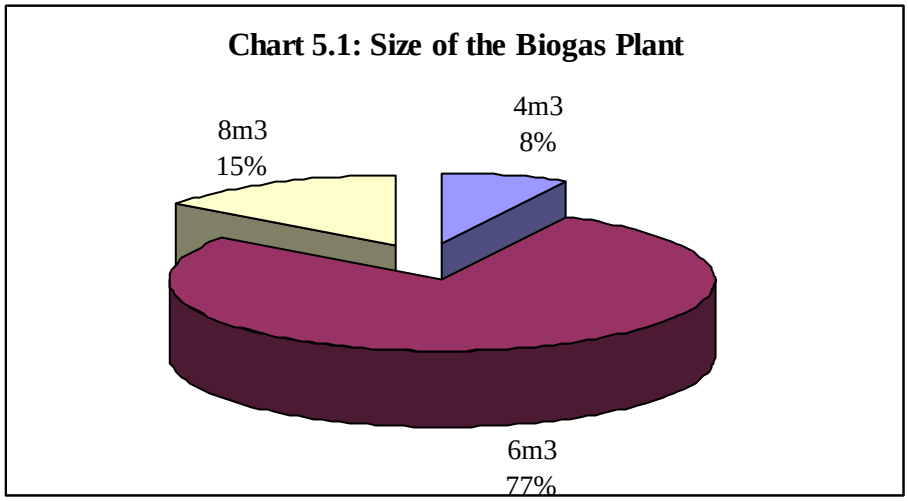
Table 5.1: Size of the Biogas Plant

S.N.	Plant Size	No. of Households	Percentage
1.	$4m^3$	3	7.5
2.	$6m^3$	31	77.5
3.	$8m^3$	6	15
Total		40	100

Source: Field Survey, 2009.

Table 5.1 shows that only three types of biogas plan sizes, $4m^3$, $6m^3$ and $8m^3$ were reported. About 77.5 percent people in this study area installed $6m^3$ Biogas plants, 15 percent people in the study area installed $8m^3$ of Biogas plant and 7.5 percent people in this study are installed $4m^3$ Biogas plant. So, the $6m^3$ Biogas plant were popular in this study area.

A large proportion has constructed $6m^3$ plant size because it does not require large number of livestock head and this size is suitable for a small size family.



5.2 Source of Information/inspiration

There are several sources to encourage for the biogas plant installation. Biogas Company, Media, Neighbor, and NGO is major source of information.

Table 5.2: Sources of encouraged for Biogas plants

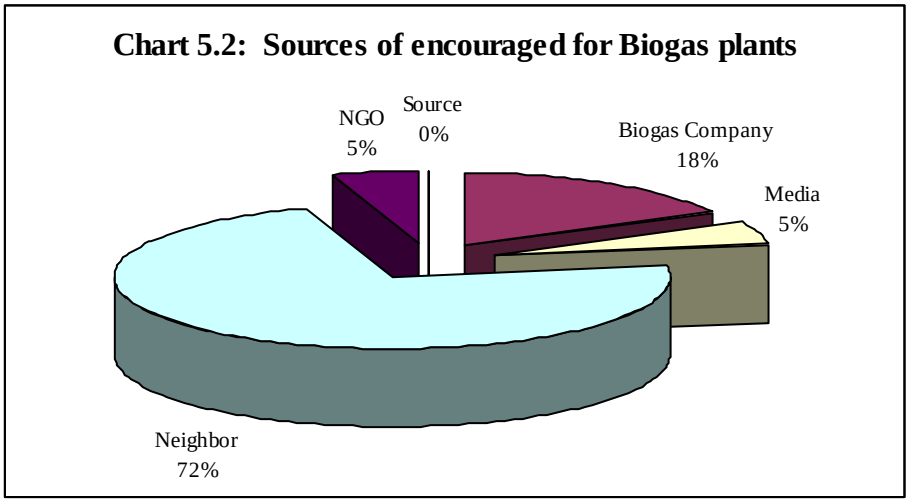
S.N.	Source	No. of Households	Percentage
1.	Biogas Company	7	17.5
2.	Media	2	5

3.	Neighbor	29	72.5
4.	NGO	2	5
Total		40	100

Source: Field Survey, 2009.

Table 5.2 shows that majority of the plants owners (72.5%) has Neighbor as a source of encourage followed by Biogas Company (17.5%), Media (5%) and NGO is 5%.

Neighbours are the closest persons in the rural areas to obtain information on a variety of matters.



5.3 Reasons for Biogas Plant Installation

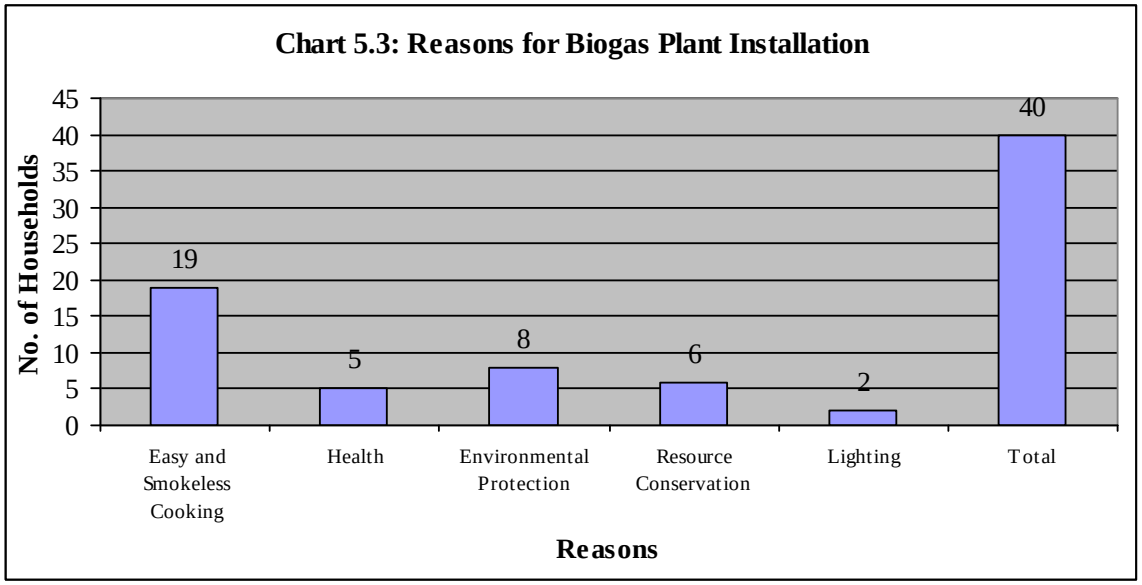
There are so many reasons behind the installation of biogas plant. Among them, cooking is the main reason for biogas plant installation.

Table 5.3: Reasons for Biogas Plant Installation

S.N.	Reasons	No. of Households	Percentage
1.	Easy and Smokeless Cooking	19	47.5
2.	Health	5	12.5
3.	Environmental Protection	8	20
4.	Resource Conservation	6	15
5.	Lighting	2	5
Total		40	100

Source: Field Survey, 2009

Table 5.3 Shows that the main reason behind the installation of biogas plant is easy and smokeless cooking (44.5%) followed by Environmental Protection (20%), Resource Conservation of (15%) Health (12.5%) and only 5 percent of lighting. out of total interviewed reported that main reason for biogas plant installation is Easy and Smokeless Cooking.



5.4 Loan

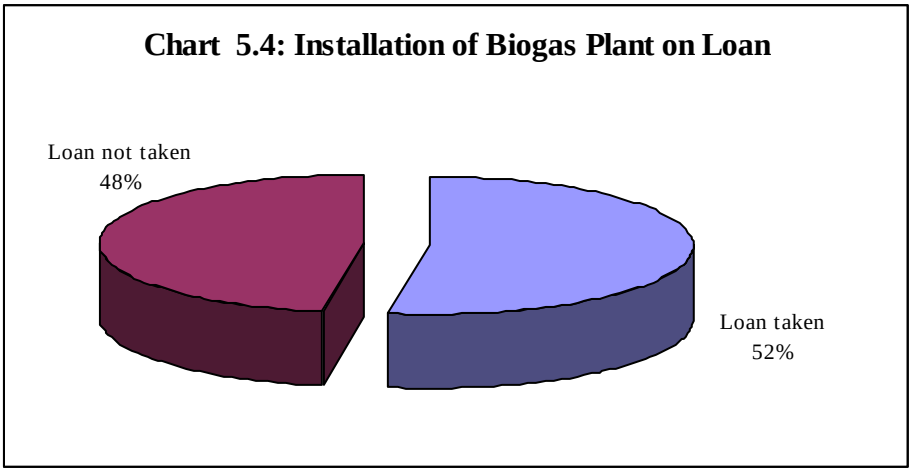
Many financial institutions have provided loan for the purpose of installing the biogas plant. Majority of the people have used to take loan from these (financial) institution and Many of them have not taken loan while installation of biogas plant.

5.4.1 Biogas Plant Installation on Loan

Majority of the households have taken loan from financial institutions. Many of have not taken loan from these institutions. Table 5.4 clearly shows the situation of loan taken of sampled households.

Table 5.4: Installation of Biogas Plant on Loan

S.N.	Loan	No. of Households	Percentage
1.	Loan taken	21	52.5
2.	Loan not taken	19	47.5
Total		40	100
47.5 percent households out of total interviewed have not taken loan			



5.4.2 Financing Company

Many companies have provided loan for the establishment (installation) of biogas plant. They are mainly ADB/N, Rural Development Bank, Institutional and Self. However, the plant owners have installed biogas Plant on self.

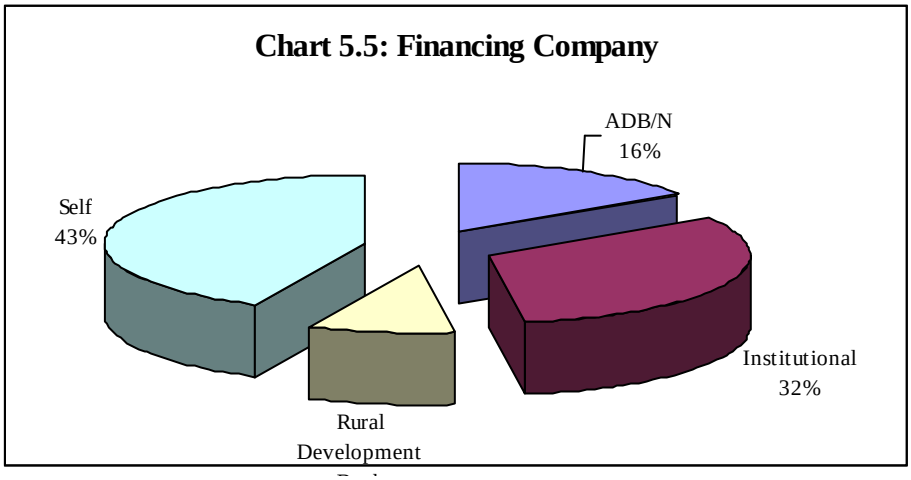
Table 5.5: Financing Company

S.N.	Financed by	No. of Households	Percentage
1.	ADB/N	7	17.5
2.	Institutional	14	35
3.	Rural Development Bank	4	10
4.	Self	19	47.5
Total		40	100

Source: Field Survey, 2009.

Table 5.5 shows that majority of the plant owners out of total interviewed have taken loan from ADB/N (17.5%), followed by Institutional (35%), Rural Development bank (10%) and self finance (17.5%). The plant owners have installed on self finance.

Chart 5.5: Financing Company



5.5 Construction Company

Recent data reveal 6 bio-gas private construction companies have been established.

Table 5.6: Construction Companies

S.N.	Construction company	No. of Households	Percentage
1.	Rastriya Gobar Gas Nirman Thatha Sewa Pvt.Ltd.	12	30
2.	Prakriti Gobar Biogas Thatha Sewa Kendra	10	25
3.	Sulav Bio Gas Alternative Energy Develpment Centre	7	17.5
4.	Ratna Jyoti Gobar Gas Thatha Urja Bikas Company	6	15
5.	Machhapuchre Bio Gas Thatha Grameen Urja Bikas Company	2	5
6.	Nipuna Gobar Gas Company	3	7.5
Total		40	100.0

Source: Field Survey, 2009.

The Restrya Gobar Gas Nirman Thatha Sewa Pvt.Ltd has constructed 12 out of 40 plants. Nextt 10 it is Prakriti Gobar Biogas Thatha Sewa Kendra. These are the old companies

and providing good counseling and hence relatively large number of households have constructed the plants through these two companies.

5.5.1 Interest Rate of loan

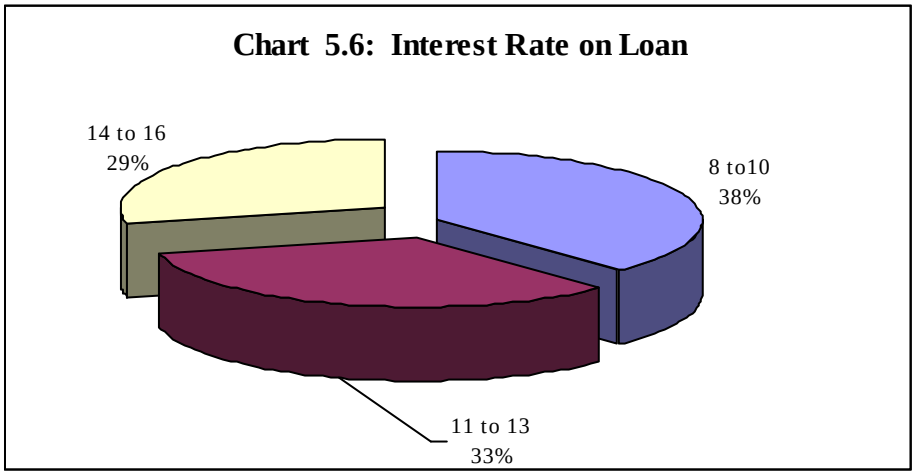
As we know in earlier table the major source of investment is loan from financial institution. Persons those who want to take loan should pay certain interest rate. Interest rate is presented in table 5.7.

Table 5.7: Interest Rate on Loan

S.N.	Interest Rate (in percentage)	No. of Households	Percentage
1.	8 to10	8	38.1
2.	11 to 13	7	33.3
3.	14 to 16	6	28.6
Total		21	100
Average interest rate is 11.7 percent.			

Source: Field Survey, 2009.

Table 5.7 shows the distribution of interest rate on loan. About 52.5 percent plant owners out of total interviewed reported that they have taken loan by paying 8 to 10 percent, 11 to 13 percent of interest on loan followed by 38 percent has paid 14 to 16 percent of interest on loan. The average interest rate is 11.7 percent.



5.5.2 Toilet Attached With Biogas Plant

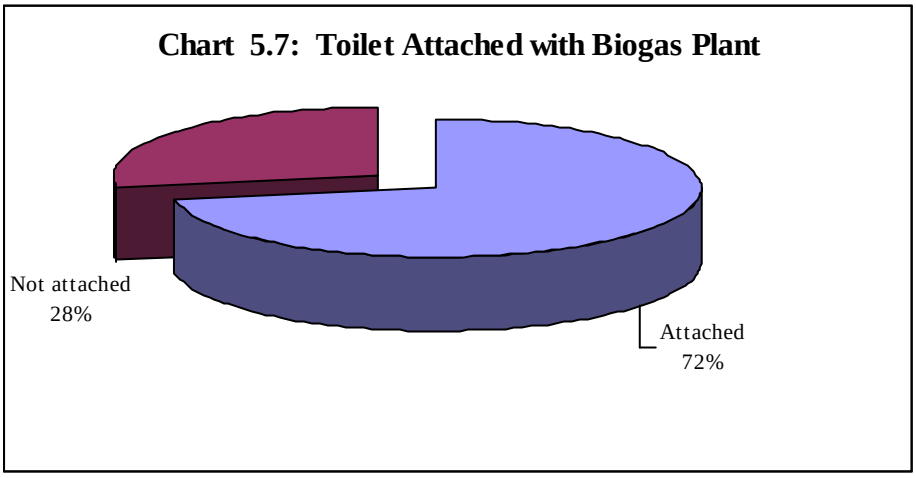
It is found that majority of the plant owners have not attached toilet with the biogas plant.

Table 5.8: Toilet Attached with Biogas Plant

S.N.	Toilet Attached	No. of Households	Percentage
1.	Attached	29	72.5
2.	Not attached	11	27.5
Total		40	100

Source: Field Survey, 2009.

Table 5.8 shows that majority of the households out of total interviewed reported that they have attached toilet with biogas plant (72.5%) and (27.5%) reported that they have not attached toilet with biogas plants.



There are still 27.5 percent households which have not attached toilet to the bio-gas plant.

The main reason is households' disliking to get this food cooked through human excreta.

5.5.3 Operational Status of Biogas Plant

5.5.3.1 Satisfied with this technology

It is found that majority of the plant owners have satisfied with this technology.

Table 5.9: Satisfied with this technology

Plant owners	No. of Households	Percentage
Satisfied	36	90
Not Satisfied	4	10
Total	40	100

Source: Field Survey, 2009.

Table 5.9, shows that majority of the household out of total interview reported that they have satisfied with this technology 90 percent and 10 percent not satisfied with this technology.

5.5.3.2 Satisfied with this Plant Size

It is found that majority of the plant owners have satisfied with this Plant Size (Table 5.10)

Table 5.10: Satisfied with this Plant Size

Plant owners Size	**No. of Households**	**Percentage**
Satisfied	26	65
Not Satisfied	14	35
Total	40	100

Sourse: field survey, 2009

Table 5.10, shows that majority of the household out of total interview reported that they have satisfied with this Plant Size 65 percent and 35 percent not satisfied with this Plant Size.

Those not satisfied with the plants forwarded the problems of inadequacy of gas during winter season and increase of mosquito during summer season.

5.5.3.3 Use of Biogas

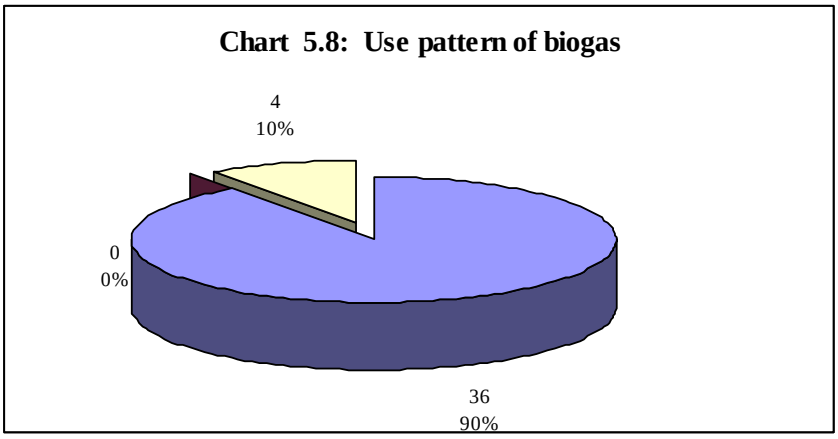
The foremost purpose of installation of biogas is cooking and lighting .But in the study area, electricity from the national grid is available so, people of this area used biogas for cooking purpose .But where electricity from national grid is not available they used it as lighting and cooking purposes .Table 5.11 shows the using pattern of biogas in the study in the study area.

Table 5.11: Use pattern of biogas

Use purpose	**No of Households**	**Percentage**
Cooking	36	90.
Lighting	-	-
Both	4	10
Total	40	100

Source: Field Survey, 2009.

Table 5.11 shows that 90 percent of the household have used biogas only for cooking purpose because they have electricity and energy for lighting purpose and 10 percent have both used.



The reason for not being satisfied is the smallness of size, which they did not know before.

5.6 Problems and Perceptions the Use of Biogas Plant

There are so many problems of the use of biogas plant, maintenance, operational, dung availability, temperature, water availability, gas leakages and paying loan are the major problems of biogas use. In this section perception of respondents also have been dealt in detail regarding the use of biogas.

5.6.1 Problems of Biogas Plant

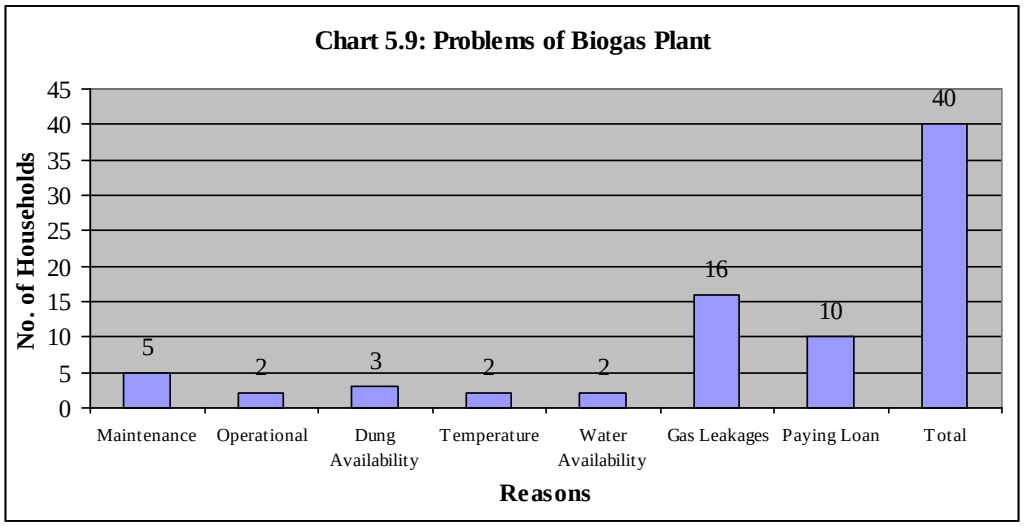
Table 5.12: Problems of Biogas Plant

S.N.	Problems	No. of Households	Percentage
1.	Maintenance	5	12.5
2.	Operational	2	5
3.	Dung Availability	3	7.5
4.	Temperature	2	5
5.	Water Availability	2	5
6.	Gas Leakages	16	40
7.	Paying Loan	10	25
Total		40	100

Source: Field Survey, 2009.

Table 5.12, shows that about 40 percent respondents out of total interviewed reported that they have problem of Gas Leakages followed by paying loan 25 percent, Problem of maintenance 12.5 percent , problem of operation 5 percent, Dung Availability 7.5 percent, problem of Water Availability 5 Percent and 5 percent respondent have problem of temperature especially in winter season .

Gas leakage is the major problem, this may be due to bad fitting, used polythene pipe which gets blocked during winter, and loose fitting of pipes.



5.7 Impact of Biogas plant

This section includes the impact of biogas in reduction of workload, use of saved time, impacts on health and sanitation and other social, environmental impacts.

5.7.1 Saving on Time and Reduction in Workload

This study shows that the use of biogas technology has been able to save time and also to reduce workload in household. Table 5.13 shows that situation of saving in time in detail.

Table 5.13: Saving on Time and Reduction in Workload

S.N.	Activities	Average time taken (hours/day)		Reduction in workload (saving in times) hours/day
		Before installation	After installation	
1.	Firewood collection	2hrs	1hrs	1
2.	Cooking	2hrs	1hrs	1
3.	Washing utensils	2hrs	1hrs	1
Total average time taken per house per day		6 hours	3 hrs	3 hrs

Source: Field Survey, 2009.

Table 5.13 shows that the average time taken per day before installations 6 hrs. After installation, 3 hrs per day is spent on all activities and the saving of time per day is 3 hrs. This time (1 hrs per day) is used in different activities. Saving of time directly reduces workloads in household's women activities.

5.7.2 Saving of money on energy

In this study, money is saved after the installation of biogas plant as compared to before installation of biogas plant. Especially in energy consumption. The situation of saving of money on energy in sampled households is presented in table 5.14.

Table 5.14: Average Saving of Money on Energy

S.N.	Types of Energy	Average Consumption of Energy (Rs./Month)		Average Saving (in Rs./month)	Cost Per Unit (In Rs.)	Average Saving (in %)
		Before Installation	After Installation			
1.	Firewood	500	200	300	80/ Bhari	60
2.	Kerosene	100	56	44	56/ Liter	44
3.	LPG	300	150	150	1250Cylinder	50
Total Average (in Rs.)		900	406	494		54.9

Annual saving amount of money is (494×12) Rs. 5928

1 Bhari = 40kgs.

Cost per unit (Rs 2)

Source: Field Survey, 2009.

Table 5.14 shows that the amount of money which saved after the installation of biogas plant. Before installation Rs. 900/- was spent but after installation it is Rs.406/. Hence, the average saving amount of money is Rs. 494/- per month. This table also classified that the annual saving amount of money (494×12) is Rs.5928 can be contributed to pay the loan on installment of expenditure of biogas plant.

5.7.3 The Source of Firewood Collection before Installation of Biogas Plant

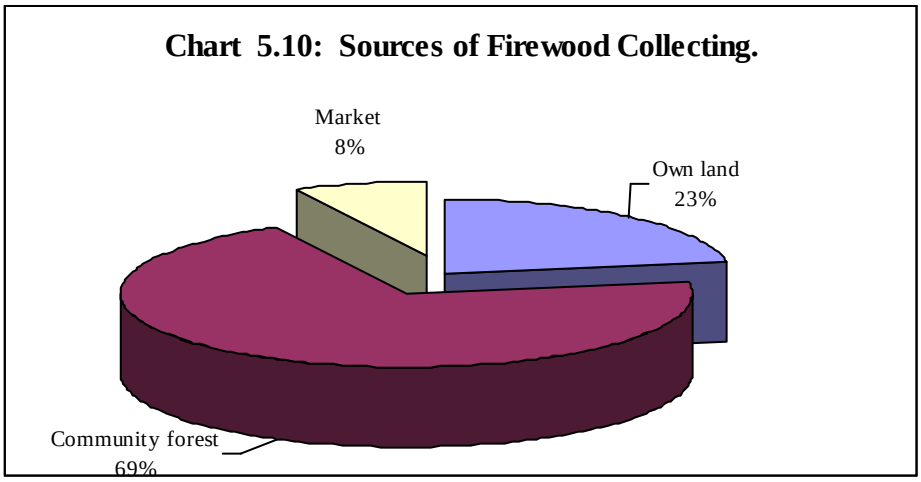
There are several source of firewood collection before installation of biogas plant. Among them, own land (private forest), government forest and market have been taken into consideration. An overwhelming proportion of households have used community forest for collecting firewood because of growth of community forest. This is shown in table 5.15.

Table 5.15: Sources of Firewood Collecting.

S.N.	Source	No. of Households	Percentage
1.	Own land	9	22.5
2.	Community forest	28	70
3.	Market	3	7.5
Total		40	100

Source: Field Survey, 2009.

Table 5.15 shows that about 70 percent out of total interviewed respondents reported that they collect firewood from community forest, followed by 22.5 percent collect firewood from own land . Only 7.5 percent out of total interviewed reported that they bring firewood from market. This table clarifies that the chief source of firewood collection is community forest.



5.7.4 Utilization of Saved Time

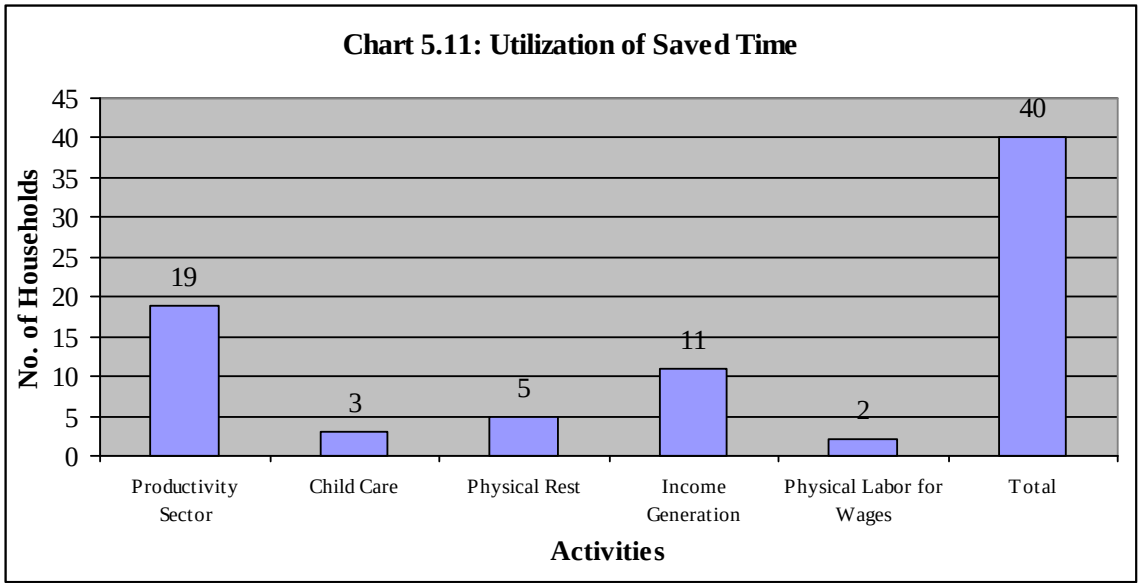
As shown in table 5.16 the average time saving per day is 3 hrs. It has been utilized in different activities. Saving of time has reduced the workloads in household activities. The use of saved time is presented in table 5.16.

Table 5.16: Utilization of Saved Time

S.N.	Activities	No. of Households	Percentage
1.	Productivity Sector	19	47.5
2.	Child Care	3	7.5
3.	Physical Rest	5	12.5
4.	Income Generation	11	27.5
5.	Physical Labor for Wages	2	5
Total		40	100

Source: Field Survey, 2009.

Table 5.16 shows that about 47.5 percent of respondents out of total interviewed reported that they use their saved time on Productivity Sector. Followed by 27.5 Percent use on Income generation, and 12.5 percent use the saved time on Physical Rest, 7.5 percent of respondent out of total interviewed sampled household reported that they use the saved time on child care and 5 percent use on physical labor for wages. Data clearly show that the saved time after the installation of biogas plant has been used on production Sector.



5.8 Health and Sanitation

The study has shown that biogas has positive impacts towards health and sanitation of the respondents. Change in surrounding after the installation of biogas plant and the feeling of the menace of flies, or mosquito. Remarkable achievement has been made on health and sanitation of household. The situation of health and sanitation is presented below.

5.8.1 Change Found in Surrounding After the Installation of Biogas Plant

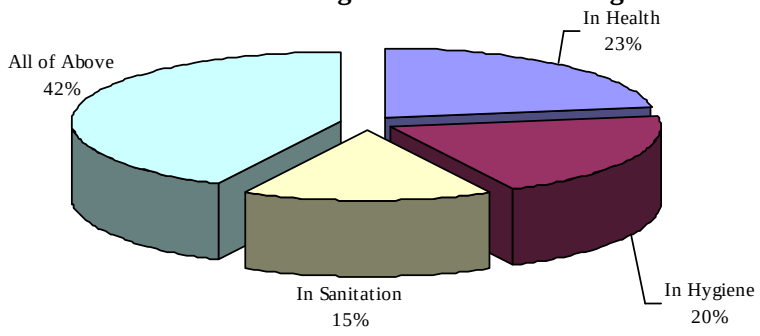
Table 5.17: Change Found in Surrounding

S.N.	Change Found	No. of Households	Percentage
1.	In Health	9	22.5
2.	In Hygiene	8	20
3.	In Sanitation	6	15
4.	All of Above	17	42.5
Total		40	100

Source: Field Survey, 2009.

Table 5.17 shows that about 22.5 percent respondents out of total interviewed reported that they found change in health, followed by 20 percent found change in hygiene. And only 15 percent respondents out of total interviewed reported that they found change in sanitation and 42.5 percent all of above. The change is considered the improvement in all these given aspects in this study.

Chart 5.12: Change Found in Surrounding



5.8.2 Money Spend on Health Treatment

In this study, amount of money spend on health treatment has also been studied. The money spend on health treatment is presented in Table 5.18.

Table 5.18: Money Spend on Health Treatment

S.N.	Treatment Item	Average Money Spent on Health Treatment per year (in Rs.)		Saving (In Rs.)
		Before Installation	After Installation	
1	Respiratory problem	6000	2000	4000
2	Others	4500	2000	2500
Total		12000	4000	6500

Source: Field Survey, 2009.

Table 5.18 shows that the amounts of money spend on health treatment before and after installation of biogas plant. It also shows the saving amount of money per year. After installation of plant. Plant owners have been able to save Rs. 4000/- in the treatment of Respiratory problem, Rs 2500/- in the treatment of others (Headache, eyes etc) .The respondent or plant owner us able to save as 6500/-per year in the treatment of health related disease.

5.8.3 Benefited By the Biogas Plant

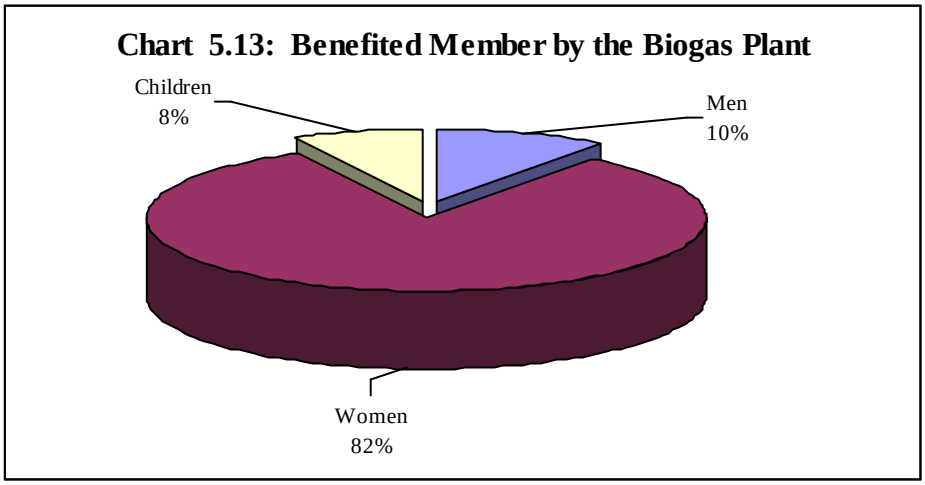
This study found that the women are highly benefited by the installation of biogas plant. It is also a social impact of biogas plant installation. Women were benefited much from the biogas because they are the ones to cook food. The situation of benefited members of households has been presented in table 5.19.

Table 5.19: Benefited Member by the Biogas Plant

S.N.	Benefited Member	No. of Households	Percentage
1.	Men	4	10
2.	Women	33	82.5
3.	Children	3	7.5
Total		40	100

Source: Field Survey, 2009.

Table 5.19 shows that majority of the respondents out of total interviewed reported that the woman are highly benefited by the biogas plant installation 82.5 percent followed by 7.5 percent reported that children are benefited. And 10 percent respondents are of Men. Out of total sampled households interviewed reported that Women are highly benefited by the biogas plant installation.



5.8.4 Benefits of biogas plant of Women

This study found that the women are highly benefited by the installation of biogas plant. It is also an impact of biogas plant installation there are so many reasons behind the installation of biogas plant. Table 5.20.

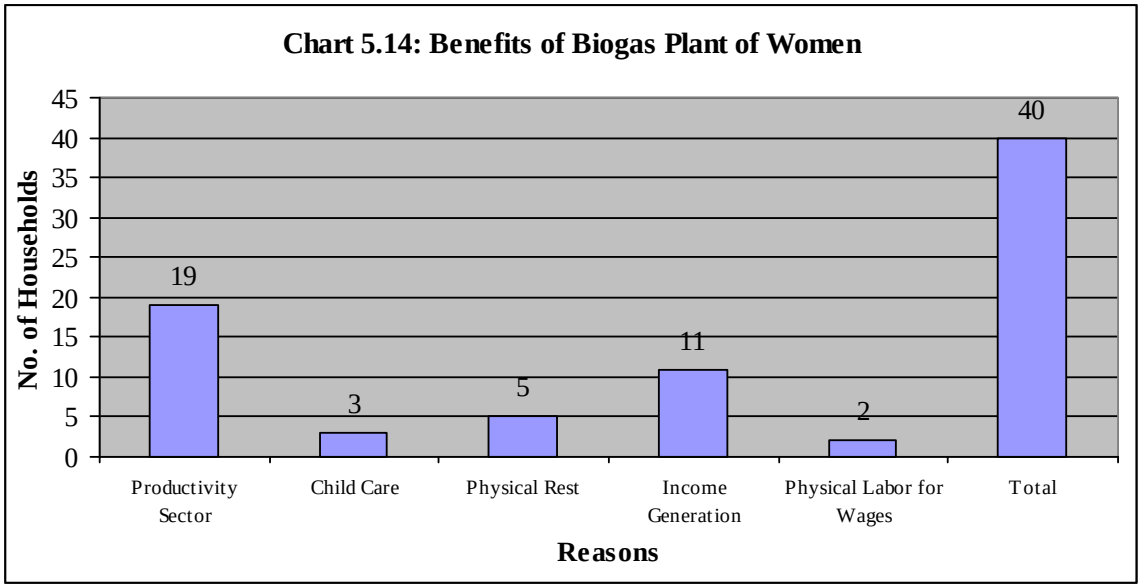
Table 5.20: Benefits of biogas plant of Women

S.N.	Reasons	No. of Households	Percentage
1.	Washing Utensils	7	17.5
2.	Washing clothes	11	27.5
3.	Protects hand	13	32.5
4.	Protects cookeries	5	12.5
5.	Saving Physical energy	4	10
Total		40	100

Source: Field Survey, 2009

Table 5.20 Shows that the main Benefits of installation of biogas plant is Washing Utensils (17.5.%) followed by Washing clothes (27.5%), Protects hand of (32.5%), Protects cookeries (12.5%) and only 10 percent of Saving Physical energy. out of total interviewed reported that Benefits of biogas plant of Women is Protects hand.

The largest proportion of users reported protection of hand because use of bio-gas keeps the hands and cooking pot clean.



5.8.5 Feeling on the Menace of Flies or Mosquito

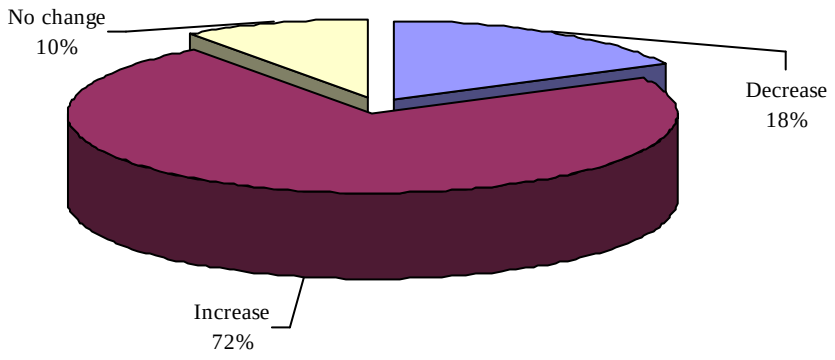
Table 5.21: Feeling on the Menace of Flies or Mosquito

S.N.	Activities	No. of Households	Percentage
1.	Decrease	7	17.5
2.	Increase	29	72.5
3.	No change	4	10
Total		40	100

Source: Field Survey, 2009.

Table 5.21 shows the distribution of feeling on the menace of flies, or mosquito. Majority of the respondent (72.5 percent) out of total interviewed reported that the menace of flies or mosquito Increase, The proportion of households reporting decrease 17.5 percent and no change 10 percent of respondent no change. Increase in flies and mosquito is due to conducive environment for mosquito in the outlets of the plants.

Chart 5.15: Feeling on the Menace of Flies or Mosquito



5.8.6 Increase in Socio-economic Status

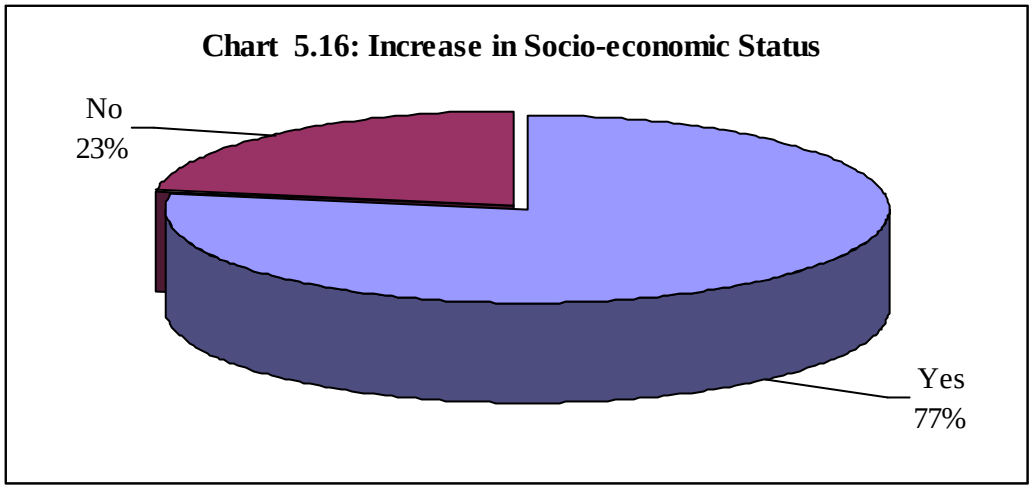
Table 5.22: Increase in Socio-economic Status

S.N.	Increase in Socio-economic Status	No. of Households	Percentage
1.	Yes	31	77.5
2.	No	9	22.5
Total		40	100

Source: Field Survey, 2009.

Table 5.22 shows that about 77.5 percent respondents out of total interviewed reported that the social status has been raised after the installation of biogas plant whereas only 22.5 percent respondents reported that the social status has no change. Increase in socio-economic status is due to differential perception of village people about users and non users. These who use bio gas are considered to be economically better off families. Women also save time which would have been required in collecting fuel-wood, and in cooking and cleaning utensils. They can use the time thus save in productive activities and earn additional income.

Chart 5.16: Increase in Socio-economic Status



CHAPTER - VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

Biogas technology is an appropriate alternative source of energy for household purpose. Forest resources are only the source of fuel wood for daily requirement of energy in rural area. Excessive use of firewood directly leads to deforestation. So the promotion and development of biogas is essential in the context of Nepal. In this context, the present study on the socio-economic impact of biogas plant installation in rural area was made.

This study was conducted in Tanahunsur VDC of Tanahun district. This study is based on the sample of 40 households who were selected by using simple random sampling technique. In this VDC, there are 712 households. Total sampled households are 40. Before conducting the study, a brief review on existing literature was made. The review focused mainly on the impact studies. For the reviews, central library of TU, BSP office and biogas experts and biogas companies were consulted.

The major findings of the study are summarized as follows:

- Size of $6m^3$ biogas plants was more popular in this area as compared to other size of plants ($4m^3$, $8m^3$).
- This study found out that there were also the size of $6m^3$ biogas plants (77.5%) and $4m^3$ biogas plants (7.5%) and $8m^3$ biogas plants 15 percent were installed.
- The main source of loan for investment was Institutional (35%).

- People installed biogas as a substitute to firewood and to have ease in cooking.
- The use of biogas is only for cooking nowadays but before the availability of electricity biogas was also used for lighting purpose.
- There is a considerable reduction in the workload of the family member and women are highly benefited (82.5%) by the biogas plant installation.
- Subsidies provided by the BSP were very encouraging factor for installation of biogas.
- Majority of time has been saved and the saved time has been used mostly in productivity sector (47.5%) followed by income generation activities (27.5%).
- Majority of the households have connected attached toilet (75.5%) with the biogas plant.
- Medical expenses also have been reduced after the installation of biogas plant.
- Average livestock population size is 3.22 per household
- Economic Status of the house hold within annual income below 50,000 has not been found to be installing the biogas plant proportion of household whose income range Rs. 1,50,000 to 2,00,000 was higher (35 percent) in the sample households. Main expenditure heading of the sample households are food, cloths, health education and interest of loan.
- Average family size is 4.5 per household.

- Landholding size is 14.5 Ropani per household.
- The users felt reduction in health related problems such as Respiratory problem and others such as, headache and eye problems.
- Majority of the plant owners are not satisfied with the existing interest rate for loan and they also want to decrease the interest rate of the installation of biogas plant.
- Majority of the respondents felt that the menace of flies or mosquito has been increased (72.5%).
- 77.5 Percent of respondents reported that the social status has been raised.
- Benefits of biogas plant of Women are Protects hand in 32.5 percent.

  Majority of the respondents reported that the overall economic, environmental and energy condition has been improved.

6.2 Conclusion

This study was conducted in Tanahunsur VDC of Tanahun District. Forty households out of 712 households have been taken as sampled households in this VDC. In this VDC out of total 145 biogas Plant installed but the present study cover only 40 biogas plant owners is sampled size.

Being an appropriate alternative source of energy biogas technology has been proved very useful especially in rural women.

Biogas has improved the economic condition of biogas plant owners. It has reduced the workload of women in household activities because before installation of biogas plant they had to invest more time and after the installation of biogas plant they have spent less time on cooking, cleaning utensils and collecting firewood.

Biogas technology has also improved the health and sanitation situation. It has helped to reduce the prevalence of smoke borne disease such as respiratory problem, headache and eye Problem etc. This technology has also improved the hand protection, clean clothes, and clean pots and save physical energy.

This before installation of biogas plant each household used to collect firewood from forest in large amount whereas after installation it has been reduced by 80 percent. Biogas plant has improved the surrounding environment. And it also has improved the economic condition of women and saving money spent on energy source such as kerosene, firewood and LPG.

In a nutshell, biogas technology has been proved as an appropriate alternative source of energy to fulfill the increasing demand of energy requirement for growing population in rural women of Nepal. It also has been able to protect the forest resource which is the main source for firewood in rural area. Hence, biogas technology is very useful technology for rural women.

6.3 Recommendations

Following recommendations have been derived from the present study. It is recommended that the concerned organizations should take necessary steps to implement the recommendations of this study in the coming days.

- Supervision which has been conducting by BSP should be regularizing because low quality construction may bring negative impacts on the users.
- Repairing, maintaining and dung replacement after 10 years instillation of biogas plant provides subside BSP office**.**
- It is found that, all the plant owners have used the gas for cooking purposes. Thus, it is necessary to conduct detail studies about the uses of bio-gas to other income generating and productivity sector.
- The use of human excreta and its advantages must be made known to the installers for this purpose training, seminars; workshop and awareness programmed should be induesed regularly.
- Initiate R&D (Research and Development) for developing low cost models appropriate for the poorest section of the population.
- Insufficiency of the gas in cold season has been the major problem for the biogas users. So proper alternative design of biogas plant is becoming a need.
- Provision of easy loan and cheap interest rate on loan should be made including higher percentage of subsidy
- A great deal of time and money of households has been saved after installation of biogas plant. Therefore, women members should have chance

to work in income generation activities. Concerned authorities should pay attention to this.

- Due to the lack of resources and manpower, the GGC may not be able to send technical manpower to all constructed plants but this problem can be solved if the respective plant owners are provided with an operation and maintenance training. This will be more useful because plant owners can easily repair and maintain biogas plant themselves.

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Socio-economic Status of Bio Gas Users: A Case study of Tanahunsur Village Development Committee of Tanahun District

Questionnaire for Biogas User

Name of biogas plant users:…….….
Address: Ward No:……. Village:……..

1. Socio-economic Characteristics of the biogas users

1.1 Caste/ethnicity:……

1.2 Structure: Respondents their family

S.N.	Relation with the respondent	Age	Sex	Education	Occupation	Remarks
1.	Respondents					
2.						
3.						
4.						
5.						
6.						
7.						
8.						

Total Number of Family:…… Male:…….. Female:…….

1.3 Land Holding (in Ropani):……. Khet…….. Bari……
1.4 Number of cattle Holding: Buffaloes:…… Cows:……. Others:……
1.5 Yearly income and expenditure:

Source of Income	Amount (Yearly)	Expenditure on	Amount (yearly)
Agriculture		Fooding	
Livestock		Housing	

Salary and Wages		Health	
Business		Clothing	
Remittance		Interest of Loan	
Others		Others	

2. Installation of Biogas Plant

2.1 size of biogas plant

i. 4 m3
ii. 6 m3
iii. 8 m3
iv. 10 m3
v. Other (Please Specify):……

2.2 Who encouraged you to install the biogas plant?

i. Biogas Company
ii. Media
iii. Neighbor
iv. NGO
v. Other (Please Specify):……

2.3 What are the reasons behind the installation of biogas plant?

i. Easy and Smokeless Cooking
ii. Health
iii. Environmental Protection
iv. Resource Conservation
v. Lighting
vi. Other (Please Specify):……

2.4 Did you take loan for financial institutional?

i. Loan taken
ii. Loan not taken

2.5 If yes, which is the source of loan?

i. ADB/N
ii. Institutional
iii. Rural Development Bank
iv. Self
v. Other (Please Specify):……

2.6 Which construction company use in bio gas plant install?

i. .....
ii. .....
iii. .....
iv. .....
v. .....
vi. .....

2.7 How much percent interest do you pay for loan?

i. 8 to10
ii. 11 to 13
iii. 14 to 16
iv. 16 to 20
v. Other (Please Specify):……

2.8 Have you attached toilet with this plant
i. Attached
ii. Not attached

2.9 Are you satisfied for this technology?
i. Yes ii. No

2.10 Are you satisfied with the selected plant size?
i. Yes ii. No

2.11 What is the purpose for the installation of biogas plant?
i. Cooking
ii. Lighting
iii. Both

2.12 What are the problems faced with the installment of biogas plant?

i. Maintenance
ii. Operational
iii. Dung Availability
iv. Temperature
v. Water Availability
vi. Gas Leakages
vii. Paying Loan
viii. Other (Please Specify):……

3. Impact of biogas plant

3.1 Do you saving on a time and reduction in world load installation biogas plant?

S.N.	Activities	Average time taken (hours/day)		Reduction in workload (saving in times) hours/day
		Before installation	After installation	
1.	Firewood collection			
2.	Cooking			
3.	Washing utensils			

3.2 How much saving of money on energy install biogas plant?

S.N.	Types of Energy	Average Consumption of Energy (Rs./Month)		Average Saving (in Rs./month)	Cost Per Unit (In Rs.)	Average Saving (in %)
		Before Installation	After Installation			
1.	Firewood					
2.	Kerosene					
3.	LPG					
Total Average (in Rs.)						
Annual saving amount of money is ..... 1 Bhari = ...kgs. Cost per unit (Rs .....)						

3.3 Where did you collect the firewood before the installation of biogas?

i. Own land
ii. Community forest
iii. Market
iv. Other (Please Specify):……

3.4 In which activity, do you utilize this saved time?

i. Productivity Sector
ii. Child Care
iii. Physical Rest
iv. Income Generation
v. Physical Labor for Wages
vi. Other (Please Specify):……

3.5 If there any change after the installation of biogas plant?

i. In Health
ii. In Hygiene
iii. In Sanitation
iv. All of Above

3.6 Money spend on health treatment?

S.N.	Treatment Item	Average Money Spent on Health Treatment per year (in Rs.)		Saving (In Rs.)
		Before Installation	After Installation	
1				
2				

3.7 Which member of family is highly benefited by the plant?

i. Men
ii. Women
iii. Children

3.8 What are the main benefited of biogas plant to the female members of the family?

i. Washing Utensils
ii. Washing clothes
iii. Protects hand
iv. Protects cookeries
v. Saving Physical energy

3.9 What is you feeling on the menace of files, or mosquitoes in and around your houses after the installation of biogas plant?

i. Decrease
ii. Increase
iii. No change

3.10 Do you think that biogas plant raise social status of the family?

i. Yes ii. No

Name of interviewer:……

Date:……

Signature:

Thank You !s