CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Nepal is least development country situated in South Asia. It is a poor country where the level of per capita income and per capita energy consumption is very low. Total area of the kingdom Nepal covers 1,47,181 sq km. More than 85 percent of the people live in rural area and depends upon agriculture for their livelihood. Among them, majority of people are still living in subsistence level and struggling to get out from poverty. Per capita food consumption is also declining day to day. Per capita GDP NRs. 20,821 and Per capita GNP NRs 21,231 in 2004/05 (Nepal in Figures 2005 CBS). The Difficult Terrain and the dispersion of population over a large area is the obstacle for the development of the Country especially of transport and infrastructure facilities. According to Central Bureau of Statistics (CBS 2001) the total number of population is 231,51,423.

In the modern age, energy is identified as one of the basic need of the people. But the energy situation of Nepal is very bad or deplorable in condition. Majority of the people are still using to live in rural areas where people are using traditional fuel like wood, agricultural residue and others. The per capita energy consumption in Nepal is very low ~~(14.6 mj)~~ and most of the energy is being used for domestic purpose ~~(WECS, 2002)~~. In Nepal, the primary source of energy is conventional. The energy resources consumed and the useable energy produce database for Nepal dictates that the nation is basically traditional fuel supported state. In the year 2003 total energy produced is equivalent to 353.541 million Giga Joule (GJ), of which fuelwise it is divided into three different classes. Traditional fuels 87.29 percent; Commercial fuels 12.13 percent, Renewable fuel 0.48 percent. The traditional fuels are the most important fuel resources in Nepal. With regard to the resource or the energy produce it is number one choice for majority of the rural people. This indicates that the dependency on forest for energy in Nepal is very high and forest is being used beyond their utilization capacity causing deforestation and environmental degradation. Because of many constraints of technology, finance, politics, and many others causes the country is unable to create a favorable environment to improve the high potentiality of water resource and other many renewable sources of energy.

Nepal is agricultural country and livestock farming is an integral part of Nepalese agriculture system. The number of house with cattle and buffaloes in Nepal was estimated to be 2.7 million in 2001 (BSP, 2004). Based on this, the technical potentiality of biogas plants installation is assumed to be around 1.9 million in Nepal out of which 57 percent in plains, 37 percent in hill and rest 6 percent falls in mountain region. The total number of biogas plants installed under BSP (BSP, 2004) until January 2005 is 1, 23,395 under BSP.

Biogas is the mixture of gas produced by methanogenic bacteria while acting upon biodegradable materials i.e. cattle dung and organic waste. ~~It is an anaerobic condition with in the temperature of 26^0 to 36^0 for a certain period.~~ It is mainly composed of 60 to 70 percentage methane, 30 to 40 percent carbon ~~dioxid~~dioxide ~~e, 5 to 10 percent nitrogen~~ and other gases~~s~~. It is an odorless gas that burns with clear blue flame similar to that of LPG gas. ~~It's calorific value is about 20 MJ/m3 and 26 percent efficient in a conventional biogas stove (AEPC, 2002).~~

In the Nepalese context, the history of biogas in Nepal goes back to 1955 when the pioneer of biogas in Nepal B.R. Sauboll; a Belgium teacher at Godavari St. Xavier's School built a demonstration plant and only a few farmers were interested in biogas technology and they installed a few biogas plant after 1967 under the design of Khadi and Village Industry Commission (KVIC) model of India. The world energy crisis in 1973/74, Made a global interest in this sector. In the context of Nepal, Biogas Development Committee (BDC) was formed as a part of Energy Research and Development Group (ERDG) under Tribhuvan University in 1975. The analysis of Fiscal Year 1975/76 as "Agricultural Year" included biogas as a special program for its effectiveness in controlling deforestation and preventing burning dung. For the farmers interest free loans were provided who are willing to install the biogas plants. Than after Gobar Gas and Agricultural Equipments Development Company P, LTD known as (GGC) was formed in 1977, with the joint investment of United Mission to Nepal (UMN) and Nepal Fuel Corporation (NFC) to initiative concrete programs and popularize biogas technology. In the beginning government didn't take interest to support activities of GGC; however biogas is given priority as an alternative energy sector during the Seven Five Year Plan (BSP, 1994). In 1992 "Bio-gas Support Program" was introduced at three different stages for the massive dissemination of technology in the country with the long term objectives of ; reducing deforestation and environmental deterioration, improving health and sanitation of rural population especially women; and increasing the agricultural productivity by promoting the use of digested slurry. It has successfully completed its third phase in June 2003 and have stated forth phase from July 2004.

To meet its objective BSP has still been providing subsidy in Terai, Hill and remote Hill districts. The "Bio-gas Nepal 2004", reports that the total number of 1,23,395 plants have been installed by the end of 2004. The expected benefit from bio-gas by the end of fourth stage are reduction of work load of 1,90,000 households mainly women and children with equivalent to 3 hours/day/hh, annual saving of 3,80,000 tons of fuel wood, 66,500 tons agricultural waste, 1,14,000 tons of dung cake and 4.75 million liters of kerosene. Also it is expected to produce 3,32,500 tons (dry weight) bio-compost and improve the rural sanitation by connecting 95,000 toilets. It hopes to reduce the emission of CO_2 to the extent of about 8,90,000 tons annually (BSP, 2004). Biogas program is environment friendly and can implement Clean Development Mechanism (CDM) in Nepal.

BSP Nepal has successfully achieved following results by the end of December 2004. Total installation of biogas plants are 1,23,395 and 57 private biogas appliances manufacturing workshop are developed, high level quality standard and control system is developed, 97 percent of constructed plants are in operation; 88,000 toilets are constructed and connected with biogas plants, 80 percent of the slurry is utilized as an organic compost fertilizer, 104 micro finance institutes are mobilized on biogas lending and 11,000 persons got employment. For networking at the central level policy making and promoting the alternative energy technology, His Majesty's the Government of Nepal has set up an Alternative Energy Promotion Center(AEPC) under the Ministry of Science and Technology ~~in 1996~~. Biogas program is being developed as the Clean Development Mechanism (CDM) project in Nepal. The biogas program has been launched in 65 districts up to now (BSP, 2004)

1.2 Statement of the Problem

Energy is the key indicator for the development because it is the backbone for the transition of modern society. Now a days many developing countries are being facing the problems of energy such as rising the price of fossil fuel and high rate of depletion of forest resources. In the Nepalese context, solar, water, and wind energy have not been fully utilized. High consumption of fuel wood results natural disasters such as, soil erosion, land slides, flood and destruction of forest. The Traditional fuel in Nepal ganerally formed by the wood fuels and forest residues animal dung's and the agricultural residues. Relative resources shared by them and their energy production capabilities in 2003 are summarized below. Wood fuels and forest residues 77.77 percent, animal dung's 5.74

percent and agriculture residues 3.76 percent. Energy share by the fuels consumed in the residential sector of Nepal is Traditional Fuels 95.11 ~~percent which~~percent, which includes wood fuels 85.03 percent animal dung 6.34 percent and agricultural residues 3.73 percent. Commercial Fuels 4.36, petroleum product 3.66 percent, Kerosene 3.21 percent, LPG 0.45 Electricity 0.69 percent, Coal 0.00 percent, and The Renewable Fuels 0.51 percent which includes Biogas 0.50 percent, Microhydro 0.01 percent and Solar 0.00 percent. The residential energy consumption for 2003 in Nepal depict that 95 percent of them is supplied from the traditional Biomass resources. Now the depletion rate of forest is more then 1.3 percent annually, if this situation is prevailing regularly, Nepal will be completely deserted in near future. To get rid of such possible disaster the rate of deforestation should be reduced through promoting alternative energy like biogas and other renewable sources of energy. Being a high potentiality of hydropower, the development of electricity and other sources of energy in Nepal is in poor condition due to the lack of capital; trained manpower and geographical barrier. If we developed biogas technology the demand of petroleum product and foreign exchanged can be saved. On the other hand, fuel wood collection takes more times, more expenditure and ultimately produce health hazard of the people can be also reduced. Before biogas installation people bound to live always in poor condition socially, economically besides that fuel wood consume more time for cooking and heating creates difficulties to clean pan, pots, bowls etc.

In the context of Nepal, biogas energy is comparatively advantageous than other renewable energy sources like hydropower, solar, and wind energy in rural areas. It also improves the health in rural areas. It also improves the health condition of the biogas user's family due to the reduction of indoor pollution. For the development and dissemination of renewable modern technology, sociological research studies are to be carried out as it is related to social and cultural practices. Therefore, it will be beneficial for biogas energy development in rural area. To improve deplorable rural condition, the renewable energy sources are to be developed and biogas promotion will be a significant one, which will cut down both traditional and imported commercial sources such as coal, animal dung, timber kerosene etc.

1.3 Objective of the Study

The general objective of the study is to explore Socio-Economic Impact of Biogas Plant on Users however, the specific objectives of this study are:

a. To study the advantages of utilization of biogas plants.

b. To study the energy, time and financial advantages after utilization of biogas plants.

c. To study the role of biogas in the improvement of health, sanitation and environment.

d. To ~~assess~~ study the advantages of biogas slurry in agricultural production in the study area.

1.4 Importance of the Study

Biogas technology has no doubt a good contribution in the energy sector of Nepal. Nepal is an agricultural country and livestock farming is one of the important parts of agriculture. This technology has a high potentiality and is more suitable than installation of costly micro-hydropower plants, solar and wind energy. It is a rural oriented technology and the progress achieved is encouraging day to day. But many biogas are not fully utilized the plants capacity and mostly they are using biogas energy in cooking only human food.

In the Nepalese context, the task of cooking is approximately given to the women. Several studies have done on the impact of biogas on women have concluded that the positive impacts on women health and their socio-economic activities. This research study will be significant for exploring the changes in socio-economic impact of bio-gas users' household in the area under study. The technology contributes a lot in lessening the burden on the forest resources. By promoting the installation of bio-gas, it is easy to prevent the deforestation. The digested slurry contains more nutrients, which help to increase agricultural production by the installation of bio-gas plant. It also further helps to save time and money and collecting firewood and cooking activities. It also provides a smokeless environment and kitchen.

Among many renewable energy sources bio-gas is the most suitable and viable sources of energy in the Study area Dharampur VDC. Where majority of the people have the tradition of raising livestock like buffaloes and cattle as an integral part of their farming and that VDC, due to the agricultural profession of the majority of the farmer, the bio-gas is significant for them to help the socio economic status of the people of study area~~–~~. But due to the lack of knowledge about the installation of bio-gas and its possible impacts on every day life they are hesitating to adopt bio-gas in their houses. So, it is helpful to study the socio-economic impact of bio-gas in everyday activities on bio-gas users. So, this study will be helpful and beneficial to show the actual reality and possible positive and negligible negative impact of bio-gas on users.

1.5 Limitation of the Study

This study will try to analyze the socio-economic impact of bio-gas on users in Dharampur VDC of Jhapa district. Despite that, it has following limitations;

- This study only focused on the biogas plants installation in Dharampur, VDC of Jhapa district.
- This study is only focused the problems and importance (prospects) of biogas plants in Dharampur ,VDC of Jhapa.
- Describing data in this study were based on primary as well as secondary data. Primary data were~~ill be~~ collected from the field area that is households survey, questionnaire, interview method, interview with key informants, observation method and the secondary data were also~~ill be~~ collected from journal, bulletin, booklets, newspaper, unpublished journal, related official data etc.
- This study deals~~takes~~ only socio-economic aspects but not the technical aspects of biogas plants as a technician in the given area.
- The study was very specific like that of case studies. So, the conclusion drawn from this might not be generalized for the whole but the conclusion might be valid to some extent of those areas, which have similar geographic, socio-economic and environmental settings.

1.6 Organization of the Study

For the organization of the study, the Thesis work consist six chapters:

The first chapter deals with the background, statement of the problem, objectives of the study, importance of the study, limitation of the study and organization of the study.

The second chapter consists literature review, that chapter ~~review of selected relevant studies are~~reviews of selected relevant studies are reviewed.

Third chapter included Research methodology that consist Research Methodology, selection of the study area, sampling procedure, nature and source of data collection, techniques and tools of data collection, household survey, field visit observation and data analysis are included.

The chapter four consists brief introduction of the study area that consist Geographical setting of Dharampur VDC, population, caste and ethnicity, education, economy, transportation, energy use, irrigation facilities.

Chapter five deals with presentation an analysis of data, family size, caste/ethnic group, sex, educational status, occupation, landholding size, livestock, using of Biogas plant, encouragement to install Biogas, reason for Biogas installation, size of the Biogas Plant, total cost, source of investment, family benefits, dung produce, ratio of mixing, gas production, impact of Biogas Plant, energy uses, consumption pattern of firewood before installation of Biogas Plant, firewood consumption pattern after installation of Biogas Plant, consumption pattern of kerosene before installation of Biogas, consumption pattern of kerosene after installation of Biogas, impact of Biogas on household activities (Time saving), time required for collection of firewood before installation of Biogas Plant, time required for collection of firewood after installation of Biogas Plant, cooking time , time required for cooking before installation of Biogas Plant, time required for cooking after installation of Biogas Plant, uses of time saving from cooking, financial benefits after utilization of Biogas Plant, economic impact of Biogas Plant, uses of saving for productive sector, impact of Biogas Plant for the improvement of health sanitation and environment, health impact, impact of Biogas to clean the kitchen, environmental impact, social impact, toilet connection, uses of slurry, effect of slurry on agricultural production, uses of slurry for crops, repair and maintenance, sufficiency and insufficiency of gas, suggestion of Biogas Plant user about the Biogas plant.

Chapter six concerned with summary, conclusion and recommendation.

At the end of this thesis bibliography, appendix~~es~~ are presented.

CHAPTER TWO

LITERATURE REVIEW

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Literature Review is one of the important parts of any research work. For this thesis ~~proposal~~ work some literature has~~are~~ reviewed ~~while preparing this thesis proposal. And to prepare final thesis report the literature review will be reviewed~~ under related field of the study to complete this final thesis work. The major objective of the literature review is to gain too much knowledge about the subject matter. With the view of obtaining definite objectives the available literature of previous writers are reviewed. The literature has reviewed from the thesis presented by previous students research reports, bulletin, journal, different books, articles, plans, policies, information published by various related agencies and books in the concerned topics. The published and unpublished ~~documents related to subject matter has~~documents related to subject matter have been reviewed.

2.1 Review of Selected Relevant Studies

Tamrakar (1997) According to him which he has outlined the reason for installation of Bio-gas in his study shows that the main attraction towards Bio-gas plant was easy cooking on Bio-gas, and have not face more difficulties. There was no smoke in the kitchen. There is no need to blow the fire. Bio-gas improved personal health due to absence of smoke and no money and labour were spent on firewood collection. Absence of smoke while burning of lamp, no need of labour in collecting kerosene are other benefit. Saving firewood 2,1504 kg. in a year by sixteen plant owner can help to protect forest.

Upreti~~,~~ (2004) has carried out the study of the impact of Bio-gas in Khairahni, VDC of Chitawan District. The outcome of this study shows that Bio-gas stoves seems to have succeeded in substituting the traditional Biomass and fossil fuels. However, it has not completely substituted the traditional energy uses. Even now people are using chemical fertilizer in field and firewood in the kitchen. The uses of Bio-gas has brought the significant improvement in the quality of life of the family members and reduction on workload of women who are the sole manager in kitchen and take the responsibility of cooking. Toilet attached Bio-gas plant is not seen in most of the household. However, those who have Toilet attached plant is found to maintain the clean and healthy environment.

Karmacharya (1992) has shown the comparative analysis of installation of Bio-gas plant under the Hill and Terai context. The study has taken Socio-economic approach and shows various benefits obtained through the installation of Bio-gas plant. Higher oil and fuel wood prices and more scarce forests would imply higher rate of plant installation. The difficulties and time consuming factors in collecting other fuel sources would encourages the Bio-gas plant installation . The main use of the produced gas is sufficient. The respondent reported that the gas was only sufficient for cooking, therefore though few of the owners did own gas bulbs, they were not under operation. The other main reason for this was comparatively cheaper availability of electricity in the study areas. Even though the gas is used for cooking purposes, this is the major step since a lot of fuel wood is used in the process of cooking, which is almost entirely saved. The saving from fuel due to plant installation seems significant and some is the case with kerosene consumption.

Plant installation has its effects in the agricultural sector as well. The use of the by product slurry is seen to have increased the per unit of land yield of the cultivated crops. As observation indicates, the slurry has its highest effect in the paddy yield in Hills and maize yield in the Terai. Though not very significant there is a notices benefits in the per ropani yield of the crops cultivated by plant owners. This is due to the high nutrient context in slurry as compared to the previous used dung manure.

Ghimire (1999) outlined the economic and environmental benefit of installation of Bio-gas plant during his study that the outcome of the study suggested that the main benefits of Bio-gas plant to it's owner were cooking and lighting facilities saved a considerable amount of money if the plant and appliances work smoothly. Besides these, other benefits such as time saving, convenient cooking, elimination of indoor air pollution resulting in several health benefits were also cited. Conservation of forest has a greater part in the protection of environment. Forest plays an important role in the formation and conservation of soil, affect rainfall an influence and modify the water yield and regime. Installation Bio-gas has helped in environmental protection.

Sahayta Samaj Nepal (HESON) (2002) has outlined the impact of Biogas Project while conducted field visit in Dang district and concluded about the impact of Biogas plant that, by the Biogas use the cooking time for women has been considerably reduced. The saving time can be utilized for the income generating which helps to reduce the poverty in the project the slurry produced after the Biogas production is high valued fertilizer, which can significantly increase the agricultural production. This also has

helped to reduce the poverty in the programme areas. The Biogas has not only help to reduce the fuelwood consumption but also has helped to reduce the import of kerosene for lighting, buying kerosene is major cost component of rural life in Nepal. This has helped for better education of the children of the houses that has Biogas plant installed.

Lamsal (2003) has outlined the effect of Bio slurry on agriculture production about the study on effective demand collection for maximun installation of Biogas plant in rural community and he concluded that the majority of Biogas users are positive in Bio slurry use on agricultural crops production but some users are negative due to poor knowledge about the method of using slurry. Use of chemical fertilizer has been substantially reduced by the use of Bio slurry and majority users have experienced that slurry used helps to increase the soil fertility. Majority of the respondents both Biogas users and non users are convinced about Bio slurry use on crop production is sustainable approach to install the Biogas plant in rural community.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study is based upon the basis of exploratory research design because the study focuses on to find out the impact of biogas on user and its benefit to them. Besides that the study tries to make an attempt to describe the condition of biogas plants and the findings are described. Likewised, this study is both descriptive and exploratory for attaining the goal of the present study.

3.2 Selection of the Study Area

The present study was carried out in the Dharampur ,VDC of Jhapa District which is situated in the southern part of Mechi Zone, East-west Mahendra Highway, which does have significant potentiality of other bio-gas if remaining people are willing to install. This particular area is chosen for the study because this study area is ~~it is easily accessible and~~ heterogeneous in socio economic and cultural structure. This area has also high potentiality in agricultural production and livestock in an integral part for the farmers. So, ~~the researcher is very much interested to study the~~this study is helpful to study the impact of bio-gas plants and effect of bio slurry in agricultural production and environmental protection. And the researcher is very much hopeful to get excessive knowledge about the bio-gas plant and its impact on users household in the study area.

3.3 Sampling Procedure

The population consist number of units, usually very large and sometimes can be infinitely. In general, there are many cases that are practically not possible to include all units of population for the study. Therefore, a few number of the population unit were selected for the study. Subject matter of the study area was the biogas user households of Dharampur, VDC of Jhapa District. There are altogether 128 bio-gas plants installed up to 2004 according to BSP Nepal. Among them 20% households were selected for the study. Among the total population, selection of the household was chosen through the simple random sampling with quantitative techniques and questionnaire was structural.

3.4 Nature and Source of Data Collection

This part is important for the researcher to explore the desire goals of the study. Therefore, the primary data has collected from the bio-gas user households of the study area, and the secondary data has used for the study which were collected from published and unpublished written

documents from experts, individual, organization related to bio-gas plants.

3.5 Technique and Tools of Data Collection

Household survey was conducted through the structured questionnaire. With the help of questionnaire primary data has collected from the owner of biogas plants user and observation method. And secondary data has also collected from various concerned agencies, books, journal and newspaper etc. The researcher has been visited in the study area for reliable or actual data collection. The data were collected from the following tools and technique.

3.5.1 Household Survey

For the survey of household structured questionnaire was prepared to generate the realistic and accurate data from Households survey of bio-gas plants user. Structured questionnaire has used to conduct the household survey of the study area based on the simple random survey. The researcher has described the objectives of the study with respect to the friendly, homely and environmentally manner. The question were asked to the respondents and filled by the researcher.

3.5.2 Field Visit Observation

In any kind of research, field visit and observation is essential for the researcher to obtain reliable data. The population selected from the sampling household was visited and biogas plants were observed in the study area. The data were recorded while observing the biogas users households environment, biogas plant burning stoves, cooking time, kitchen rooms, cleaning pots, preparation and mixture of slurry, water and its impact in agricultural production.

3.6 Data Analysis

Data analysis is the careful study of the available fact. Considering the nature of the study, analysis has been done in quantitative way of the obtained data the primary and secondary collected data were coded, edited, tabulated and analyzed in appropriate format. Nevertheless, some basic statistical tools have also been used. Apart from these maps, table, charts, diagrams, figures has also ~~be~~ used. Data analysis was done in close supervision of the guide. In this study descriptive method has used to presenting the collected data.

CHAPTER FOUR

BRIEF INTRODUCTION OF THE STUDY AREA

4.1 Geographical Setting of Dharampur VDC.

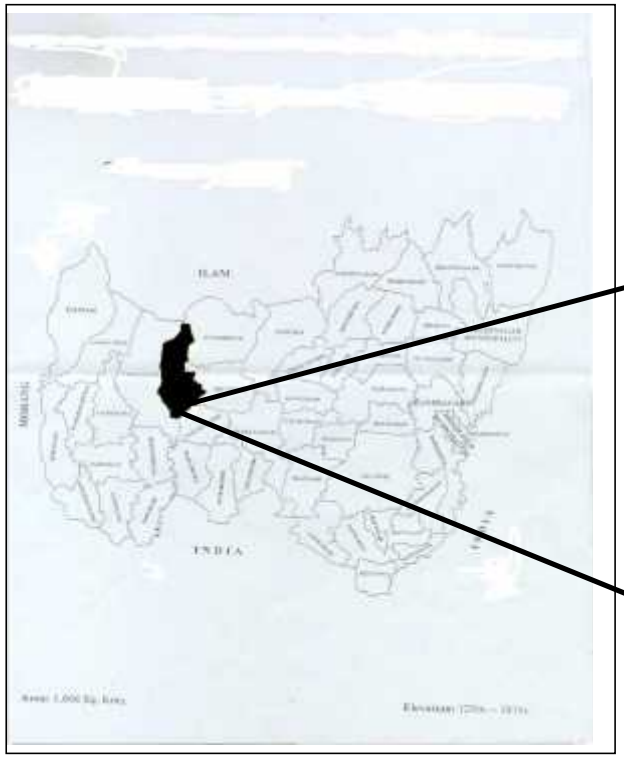
Jhapa district is one of the developed District lies in the Eastern Development Region of Nepal. The District head quarter Chandragadi is 13 km south from the East-West Mahendra Highway at Biratamode. The Nepal Human Development Report shows that the Jhapa is 3th position of overall development among the 75 districts. Kechanakawal is the lowest place(58m) from the sea level and Kankai bridge which is the longest bridge of Nepal also lies under this district. This district covers 1606, Sq Km. area ~~(District Profile2058)~~.

The Jhapa district lies in the latitude 26^0.20'- 26^0.50' and longitude 87^0.3~~0~~9'-88^0.12' and Elevation 58M-381M. The political Boundary of the District Jhapa covers East, West Bengal India, West Morang Nepal, North Illam Nepal and South Bihar India. There are 5 no of constituencies 17 Ilaka, 47 VDCs, 3 Municipalities and 1934 No of settlements.

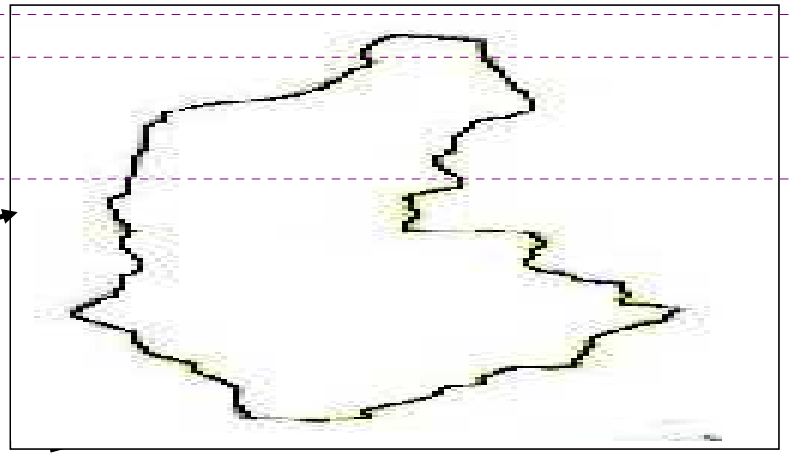
The present research study has been carried out in Dharampur VDC, of Jhapa District, map of the study area is presented in (refer figure-1) which lies in southern part of East west Mahendra Highway. The Dharampur, VDC lies in between Satasidham, Shivagunj VDC in East, Panchgacnhi VDC in South, Topgachhi VDC in the west and East west Mahendra Highway in the North. The length of the VDC, from Dharampur Chow~~e~~k to South Panchgachhi North to South is estimated 12 km from the Black topped East west Mahendra Highway to south Panchgachhi VDC. The general ~~introduction of the VDC are~~introduction of the VDC is given below.

Figure No 1.Map of the Study Area

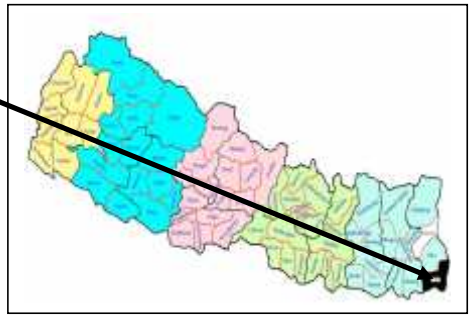
~~Figure 1: Location~~



JHAPA DISTRICT



DHARAMPUR VDC



MAP OF NEPAL

Study Area

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~~Figure No 1.Map of the Study Area~~

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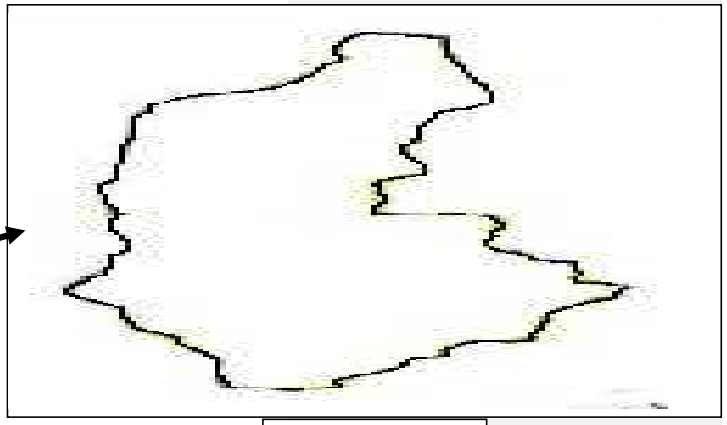
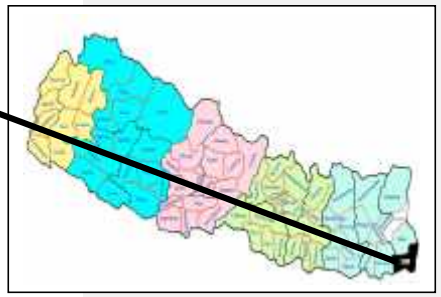
JHAPA

Study Area



DHARAMPUR VDC



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4.1.1 Population

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Of the total population in the District, Dharampur VDC occupies 16082 total population among them 8094 are male and 7988 are female (VDC, 2059). The present study area is heterogeneous in the caste and ethnic composition. Some of the castes of this VDC are Brahimin, Chettri, Rai, Tamang, Gurung, limbu Satar etc. Among the total population most of them in the VDC speaks Nepali language and the ethnic group such as Rai, Tamang, Gurung, Satar speaks their own language.

4.1.2 Caste and Ethnicity

Of the total population in the study area Dharmapur VDC, Distribution of population by caste/ethnicity is given below.

Table No1. Caste and Ethnicity

Caste/ethnicity	Total Population 16082
Brahmin	3745
Chettri	3508
Limbu	2412
Rai	1409
Tamang	792
Satar/Mushahar	588
Bi Ka	656
Rajbanshi/Tajpuriya	568
Newar	504
Darji	353
Gurung	311
Majhi	259
Bhujel	267
Magar	234
Sunuwar	123
Chaudhary	90
Sanyasi	111
Sarki	71
Thakuri	37
Dhimal	20
Gwal	1

Source: Dharampur VDC 2059

4.1.3. Education

Regarding the context of education the VDC have been facilitated three secondary school, three primary school and three private Boarding schools. But the VDC has not facilitated the Higher Secondary School and Campus being a VDC of Terai region. The VDC have been facilitated one Sub-Health post since the VDC have not enough facilities of Higher Secondary School and Campus. Educational status of the VDC is not seems to be satisfactory. But now the educational level is increasing because of

nearness of school and campus. In the past it is difficult to get higher education because of access of higher educational institution in the VDC. Now the educational status of the VDC is improving due to the rapid awareness among the people of the VDC.

4.1.4 Economy

Agriculture is the main source of income and way of livelihood among the people of Dharampur VDC study area. More than 85% of the people are still depending upon agriculture for their survival. Beside that occupation services, trade, poultry farming, sugarcane farming, Banana farming are also adopting in the VDC by the peoples. Being an agricultural area, the VDC have not proper Irrigation facilities in all the VDC area. But only southern part of the VDC area is irrigated. Farmer of the VDC produces paddy, Millet, Maize, Wheat, Oil seeds, vegetable farming such as Radish, Cabbage, Cauliflower, Potatoes, green vegetables etc. But due to the lack of proper market, fruit and vegetable production is only confined to the household consumption but only small portion of the population used to produce vegetable for selling in the Market for earning money for survival.

4.1.5. Transportation

Transportation is regarded the vehicle or backbone for the development. Transportation facility of Dharampur VDC in past was not good but now the condition of transport facility is improving day to day. There is one main North to South gravel road (Dharampur chock to kamaljhoda). which is near to be completed as a gravel road, from Dharampur chock, Mangalbare, Parabari to Kamaljhoda. In The study area VDC, the local gravel transport provides transport facilities to the local villagers linked to the East West Mahendra Highway in the VDC. Now in this VDC through the main gravel road, there is a regular bus facility to the Parabari Bazar from Dharampur Chowek.

4.1.6. Energy Use

Electricity Facilities in the Dharampur VDC has not got properly in all the wards. And the people who were using Electricity are only for lighting and watching T.V., that means only for the domestic purposes. Among the total population in the VDC most of them people were using firewood for cooking rice. Beside that firewood, there is the use of LPG Cylinder gas for cooking purpose is increasing in Bazaar area in the VDC. Being a rural VDC the using firewood rate is high. So, adopting Biogas technology by the user is

increasing day to day. The reason behind that are the various benefits of Biogas to the household activities. It also saves the time of firewood collection, saving time of cooking and saving expense for firewood and electricity. Because of increasing awareness programme and regular advertisement through the Bio-gas staff, biogas company and ADB/N, there are increasing rate of installation of Bio-gas plant in the Dharampur VDC. There were 128 Biogas plant installed according to the BSP Nepal 2005. Now the installation rate of Biogas plant is rapidly increasing in the VDC.

Table No 2. Ward wise Installation of Bio-gas plant in Dharampur VDC.

S.N	Ward No.	No of Bio-gas plant
1	1	2
2	2	20
3	3	12
4	4	6
5	5	51
6	6	11
7	7	2
8	8	12
9	9	12
Total		128

Source: BSP Nepal, 2005

The above table shows that in the Dharampur VDC ward no 1 has minimum number of Bio-gas plant installed and ward no 5 has installed maximum number of Bio-gas plant than the other wards.

4.1.7 Irrigation Facilities

For the Nepalese context forest, land and water are the main natural resources. In the study area Dharampur VDC cultivate arable land is the main natural living resources for the people so, among the total population more than 85% people are directly depend upon agriculture for survival or livelihood. Being a Terai VDC, there is no problem of Drinking water. Most of the households have their own tap for the drinking water and government also provided taps in the public places or Hat- bazaar area.

Being a rural agricultural oriented VDC of the total nine wards only ward No.1, 2, 3 and 4 have got proper irrigation facilities through the Kankai irrigation programme. Apart from these wards, other wards have to depend upon monsoon water for irrigation for farming. But some part of the VDC farmers are using boring for seasonal crops, mostly in the Northern part of the VDC. Traditional agriculture system is removed and Modern Technology were adopting by the farmer by using Tractor, Boring etc. Such system was following by the neighboring farmer of the Bio-gas plant users. And it is hoped that the condition of the farmer will be uplifted in near future.

CHAPTER FIVE

PRESENTATION AND ANALYSIS OF DATA

5.1 Socio-Economic Status of Biogas Plant Owner

5.1.1 Family Size.

The size of the family of Biogas Plant users respondents households are presented in the table below

Table No 3. Family size of the Biogas Plant Users Respondent Households

S.N	Family Size	Frequency	Percentage
1	< 5	3	11.53
2	5-8	11	42.30
3	> 8	12	46.15
Total		26	100

Source: Field Survey, 2006.

The above table shows that among the total respondent household 3(11.53%) household occupies less than 5 family members, similarly 11(42.30%) household occupies 5-8 family members and 12 (46.15%) household have more than 8 family members. The minimum numbers of household was 3 and maximum number of family household was 11.

5.1.2. Caste/ Ethnic Group

Of the total sampled respondent household the caste and ethnicity are given table below.

Table No 4. Distribution of ~~the respondent~~Biogas plant owner by caste

SN	Caste	Frequency	Percentage
1	Brahmin	18	69.23
2	Chhetri	7	26.92
3	Rai	1	3.84
Total		26	100

Source: Field Survey, 2006.

The above table shows that the Majority of the household under the study area were Brahmin of the total sampled respondent household of the Bio-gas plant owner Brahmin occupies 18(69.23%), Chettri occupies 7(26.92%) and Rai occupies 1(3.84%). The reason of the higher percentage of Bio-gas plant owner Brahmins were found in the study area are, They were active and forward in every sector such as social, economic and education.

5.1.3 Age

Age of the sampled respondent are given below

Table No 5. Age of the Sampled Respondent ~~of Users Households~~

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SN	Age Group	Frequency	Percentage
1	20-30	1	3.84
2	30-40	9	34.61
3	> 40	16	61.53
	Total	26	100

Source: Field Survey, 2006.

Of the total sampled respondent household of the plant owner 26, the above table shows that of the total respondent household 20-30 age groups occupies 1(3.84%) ; 30-40 age group occupies (34.61%) and similarly 40 to above age groups occupies 16 (61.53%). The minimum age of the sampled respondent is 29 and the maximum age of the Bio-gas plant owner is 67.

5.1.4 Sex

Distribution of Bio-gas Plant Owner Respondent Household by Sex are given below

Table No. 6 Distribution of Bio-gas Plant Owner Respondent Household by Sex

S.N.	Sex Group	Frequency	Percentage
1.	Male	24	92.30
2.	Female	2	7.69
	Total	26	100

Source: Field Survey, 2006.

Of the total sampled respondent household of the Bio-gas plant owner 26, 24 (92.30%) were male Biogas Plant Owner and 2 (7.69%) were female Biogas Plant Owner. The above table shows only minimum percent of the Bio-gas plant owner were female.

5.1.5 Educational Status

Distribution of the Sampled Respondent Bio-gas Plant owner by Education are presented in the table below:

Table No 7. Distribution of the Sampled Respondent Bio-gas Plant Owner by Education.

S.N.	Educational Group	Frequency	Percentage
1.	Literate	25	96.16
2.	Illiterate	1	3.84
	Total	26	100

Source: Field Survey, 2006.

Of the total sampled respondent household 26 the above table shows that among the Bio-gas plant owner household 25 (96.16%) respondent were literate and 1 (3.84%) respondent of the Bio-gas plant owner were illiterate. The above table clearly shows that in the study area. There is higher percentage of literacy level in the study area of the total Bio-gas plant owner.

5.1.6. Occupation

Agriculture is the main occupation of the Bio-gas plant owner. Apart from agriculture, some of the respondent of the Bio-gas plant owner were also engaged in teaching and other small business profession.

Table No 8. Occupation of the Respondent Bio-gas Plant Owner.

S.N.	Occupation	Frequency	Percentage
1.	Agricuture	22	84.61
2.	Teaching	4	15.18
	Total	26	100

Source: Field Survey 2006.

Of the total sampled respondent household, the above table shows that the higher percentage of Bio-gas plant owner were engaged in agriculture for the livelihood of the total respondent of Bio-gas plant owner 22 (84.61%) were engaged in agriculture and 4 (15.18%) of the respondent of the Bio-gas plant owner were engaged in teaching profession as their occupation.

5.1.7. Land Holding Size

According to the respondent Land holding size of the bio-gas plant owner are given below

Table No 9. Land Holding Size of the Respondent Households

S.N.	Land holding size in (Kattha)	Frequency	Percentage
1.	10-20	6	23.07
2.	20-30	9	34.61
3.	30-40	2	7.69
4.	> 40	9	34.61
	Total	26	100

Source: Field Survey, 2006.

Agriculture is the main occupation of the Bio-gas plant owner. So, all of them have their own cultivable land for to cultivate. And regarding the source of income, they were highly depending upon agriculture.

The above table shows that of the total 26 respondent, 6 (23.07%) has 10-20 Kattha of land 9 (34.61%) respondent had 20-30 Kattha, 2 (7.69%) respondent has 30-40 Kattha land and 9 (34.61%) respondent of the Bio-gas plant owner has above 40 Kattha of land. The sampled respondent 6(23.07%) had 10-20 Kattha minimum size of land and 9(34.61%); respondent had maximum more than 40 Kattha of land.

5.1.8. Livestock

Of the total number of respondent of the Bio-gas plant owner 26, the total number of livestock population of livestock 103 in the research study area. Among the total population of livestock the table below shows 38 (36.89%) Buffaloes 31 (30.09%) Cows and 34 (33.00%) Oxen were found in the study area household.

Table No 10. Kinds of Livestock having in the Respondent Households

S.N.	Livestock	Frequency	Percentage
1.	Buffalo	38	36.89
2.	Cow	31	30.09
3.	Ox	34	33.00
	Total	103	100

Source: Field Survey 2006.

5.1.9 Livestock Size of the Bio-gas Plant Owner

Livestock Size of the Biogas Plant Owner Respondent Household are given below

Table No. 11. Livestock Size of the Biogas Plant Owner

S.N.	No. Of Livestock	Frequency	Percentage
1.	1-3	9	34.61
2.	> 4	17	65.38
	Total	26	100

Source: Field Survey, 2006.

Of the total sampled respondent household 26, the above table shows that 9 (34.61%) household of Bio-gas plant owner has in between 1-3 livestock and similarly 17 (65.38%) of the respondent household of the Bio-gas plant owner has 4 to above livestock population they consist Buffalo, Cow and Ox. In this research study Buffalo, Cow, Ox population was included. Because only buffalo, Cow, Ox and their Dung used for the production of Bio-gas energy. Beside that other domestic animal such as goat, pigs were not taken for the study because of their waste is not used for the production of Bio-gas for cooking and lighting.

5.2. Using of Bio-gas Plant.

Bio-gas system converts animal dung in to Methane gas which is flammable can be used as a domestic fuel for cooking and lighting. The residues slurry from the underground Bio-gas digester can be used as organic fertilizer. The principle benefited of Bio-gas system includes the reduced need firewood and kerosene fuel, improved indoor air quality and human health, reduced impacts of deforestation and improved benefits for soil fertility.

In Nepal Bio-gas is much more suitable renewable energy and greatest potential in Terai and Hill region. Bio-gas energy is acceptable in that part of Nepal specially Terai and Hill due to the cooking, lightning and Bio-slurry for agriculture production. The main purpose of the utilization of Bio-gas is for cooking and lighting purpose.

In the study area Dharampur VDC Jhapa District, majority of household use Bio-gas for the cooking purpose. Apart from that there is not access of Electricity in every house in the VDC. For the cooking purpose the houshold of Bio-gas plant owner were utilized minimum 45 minutes to maximum two hours for cooking purpose two times a day.

In the study area, of the total respondent mostly they were applied Bio-gas energy for the cooking purpose. Saving of time for collection of firewood, saving of money expenses to buy firewood and to protect the environment by controlling deforestation and clean household environment too.

5.2.1 Encouragement to Install~~ed~~ Bio-gas:

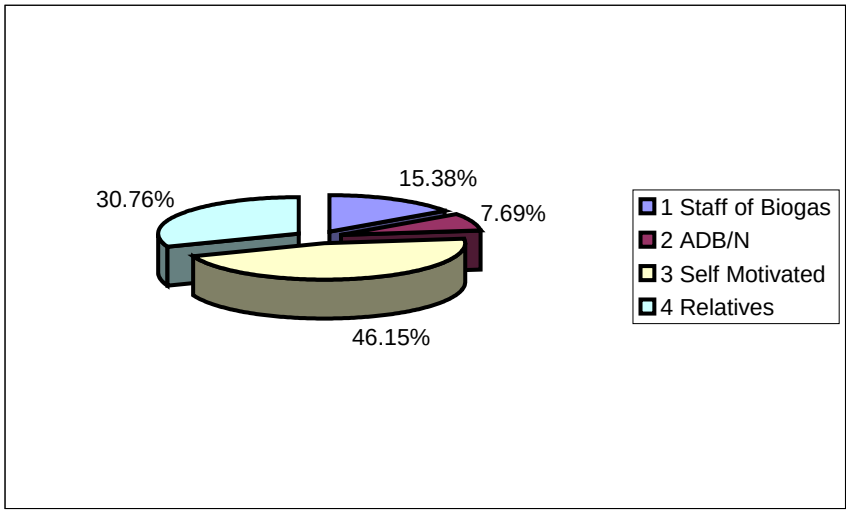
It is needless to say that applied Bio-gas energy is more beneficial than the firewood and kerosene. The encourage source to installed the Bio-gas plant can be presented in the following table.

Table No 12. Encouragement Factor to Install the Biogas

S.N.	Encouragement Factor	Frequency	Percentage
1.	Staff of Bio-gas	4	15.38
2.	ADB/N	2	7.69
3.	Self motivated	12	46.15
4.	Relatives	8	30.76
	Total	26	100

Source: Field Survey, 2006.

Figure No ~~1~~2. Encouragement Factor to Install the Biogas



Of the total sampled respondent household, the above table shows that 12 (46.15%) household have installed Bio-gas motivated by them, 8 (30.76%)

household have installed Bio-gas through the motivation from the relatives, 4 (15,38%) household installed Bio-gas through the convincement of staff of Bio-gas company. And only 2 (7.69%) household installed Bio-gas through the Bank loan. The above table shows that maximum number of Bio-gas plant owner were self motivated to install to Bio-gas. That shows the awareness about to installed Bio-gas to maintained the clean environment.

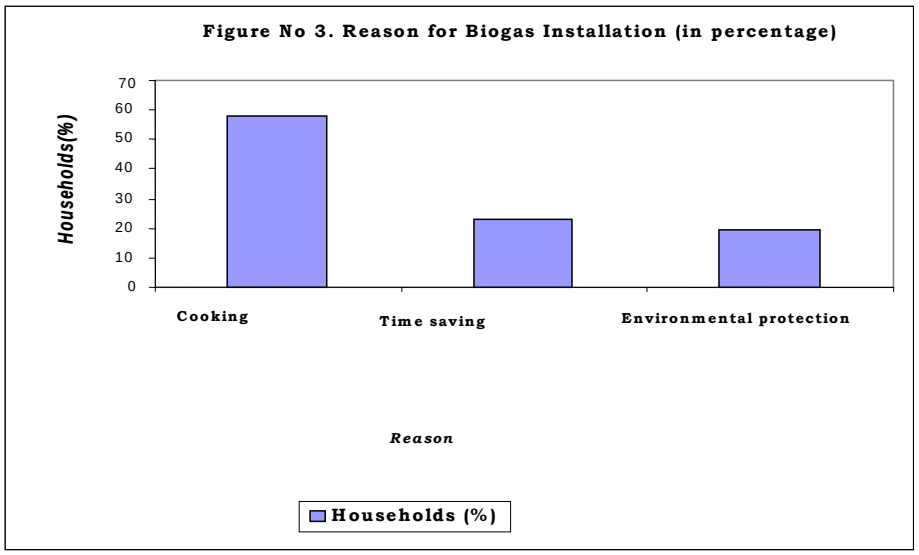
5.2.2 Reason for Bio-gas Installation

The reason for installation of Bio-gas plant can be presented in the table below:

Table No13. Reason for Bio-gas Installation

S.N.	Reason	Frequency	Percentage
1.	Cooking	15	57.69
2.	Time Saving	6	23.07
3.	Environment protection	5	19.23
	Total	26	100

Source: Field Survey, 2006.



Of the total respondent the above table shows that 15 (57.69%) household were installed Bio-gas plant for cooking purpose. 6 (23.07%) household of the plant owner were installed Bio-gas for time saving. Because maximum Bio-gas plant owner household were engaged in agriculture farming activities. Similarly 5 (19.23%) household were installed Bio-gas for environment protection.

The above table clearly shows that maximum household was installed Bio-gas plant for cooking purpose and minimum number of Bio-gas plant owner household were installed Bio-gas plant to protect the environment.

5.2.3. Size of the Bio-gas Plant

Of the total respondent household, there found three size of the Bio-gas plant installed by the Bio-gas plant owner in the study area. Among them 14 respondent household have installed 6 m^3 Bio-gas plant, 9 household's have installed 8 m^3 and similarly 3 household's have installed 10 m^3 Bio-gas plant. This shows that the maximum 14 households have installed 6 m^3 and minimum 3 households have installed 10 m^3 Bio-gas plants.

5.2.4. Total Cost

According to the Bio-gas plant owner household, the cost of installation Bio-gas plant consists two ways.

- Self investment
- Subsidy

Self Investment:

Of the total respondent household of the Bio-gas plant owner, majority of the respondent told that the total cost of self investment is about 6 m^3 size of Bio-gas plant were 14000 to 16000, 8 m^3 were 21000 to 23000 and 10 m^3 were 26000 to 28000. The amount of money is not fixed because due to the availability of required materials for to installed Bio-gas plant in the different area.

Subsidy:

There is a provision of subsidy about to install the Bio-gas plant by the HMG/N. The subsidy rates are given below.

Subsidy rates (for 2061/062)

Region	4 & 6 m^3	8 & 10 m^3
Terai District	Rs. 5500	Rs. 5000
Hill District	Rs. 8500	Rs. 8000
Remote Hill District	Rs. 11500	Rs. 11000

Source: (BSP. 2004)

5.2.5 Source of Investment:

In the study area of the total respondent that there were two source of investment to install the Bio-gas plant. They were family investment and Bank loan. The source of Investment can be presented in the table below.

Table N0 14. Source of Investment

S.N.	Source	Frequency	Percentage
1.	Bank loan	14	53.84
2.	Family investment	12	46.15
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total respondent household of the Bio-gas plant owner 14 (53.84%) household were installed Bio-gas through the bank loan and 12 (46.15%) respondent household of the Bio-gas plant owner were installed Bio-gas through the own self family investment.

5.2.6. Family Benefit

Of the total sampled respondent household, they responded that there were maximum benefits to the member of the family. The benefits of Biogas plant to the family are presented below.

Table No 15. Family Benefit

S.N.	Benefit for the family	Frequency	Percentage
1.	Children	12	46.15
2.	Old man	5	19.23
3.	All	9	34.61
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total respondent of the household 12(46.15%) household responded that mostly children were benefited from the Bio-gas 5 (19.23%) household responded that Bio-gas is benefited to the old man in the family. Similarly 9 (34.61%) household responded that all member of the family were benefited by the Bio-gas plant. The above table shows mostly children were benefited because of smokeless household environment for reading. So that it can say more or less all member of the family were benefited through the Bio-gas plant.

5.2.7. Dung Produced.

Dung is basic essential feeding material in the inlet to produce Bio-gas energy. In the study area maximum Bio-gas plant owner were engaged in agriculture, So there is sufficiency of dung for feeding in inlet to produced of Bio-gas energy. Dung produce of Bio-gas plant owner area presented in table below.

Table No 16. Per day Dung produced of the Bio-gas plant owner house hold.

S.N.	Dung produced (In Kg.)	Frequency	Percentage
1.	20-30	14	53.84
2.	31-40	8	30.76
3.	> 41	4	15.38
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total sampled house of the respondent 14(53.84%) household produced 20-30 Dung per day. About 8(30.76%) household produced 31-40 kg dung per day. Similarly 4(15.38%) household produced more than 41 kg Dung per day. So the above table shows that for the sufficient production of Bio-gas, there was no shortage of Dung. It also said that for the sufficient production of Bio-gas and for getting sustainability satisfaction quantity of Dung is basic requirement for daily using purpose to feeding in inlet.

5.2.8. Ratio of Mixing:

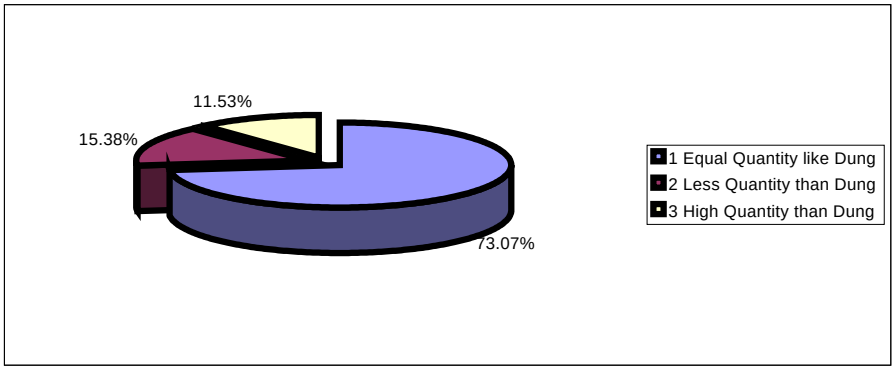
By mixing Dung with water it is feeding in the inlet to produce Bio-gas. So, dung and water are essential material for to produce the Bio-gas energy. So, dung and water are essential for to produce the Bio-gas energy. So, at the time of feeding Dung has to mix with water in the inlet of the Bio-gas plant. The essential recommended quantity of water is equal like Dung according to the Bio-gas support programme (BSP). It is also suggested that if the quantity of water and Dung were high and low the total production of Bio-gas energy will be affected for cooking and lighting. So, for the sustainability of Bio-gas plant it is needed to manage Dung and water properly.

Table No 17. Ratio of Mixing of water with Dung.

S.N.	Water	Frequency	Percentage
1.	Equal quantity like Dung	19	73.07%
2.	Less quantity than Dung	4	15.38%
3.	High quantity than Dung	3	11.53%
Total		26	100%

Source: Field Survey, 2006.

Figure No 43. Mixing of water with Dung.



The above table shows that of the total respondent 19 (73.07%) household used to mixed equal quantity of water with Dung. 4 (15.38%) household used to mixed less quantity of water than dung. Similarly 3 (11.53%) household used to mixed water higher than dung. So it can say that of the total respondent of Bio-gas plant owner maximum household were satisfied about dung and some respondent were unable to manage proper suggested dung due to the lack of sufficient cattle.

5.2.9 Gas Production

It is needless to say that Bio-gas is installed to produce Bio-gas energy. So, in the study area of the total sampled respondent household, they responded that they mostly using Bio-gas for not lighting but for cooking only. So that, there were sufficiency of gas production for cooking. They also responded that gas production is better in summer than winter.

5.3 Impact of Bio-gas Plant

The socio-economic impact of Biogas Plant on users household are described below:

5.3.1 Uses Energy and Firewood

According to the sample respondent household, mostly they used Bio-gas and Electricity as a source of energy used of firewood. Using pattern of energy and firewood before installation Bio-gas can be presented below.

5.3.2 Consumption Pattern of Firewood Before Installation of Bio-gas Plant

The pattern of firewood consumption before installation of Biogas Plant per month are presented in table below:

Table No 18. Consumption Pattern of Firewood Before Installation of Bio-gas Plant

S.N.	Firewood (Bhari)	Frequency	Percentage
1.	3-8	7	26.92
2.	9-12	13	50.00
3.	> 13	6	23.07
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total respondent household per month 7 (26.92%) used 3-8 Bhari firewood for cooking before installation of Bio-gas of the total respondent household 13 (50.00%) household used 9-12 Bhari firewood similarly 6 (23.07%) household was used more than 13 Bhari firewood per month.

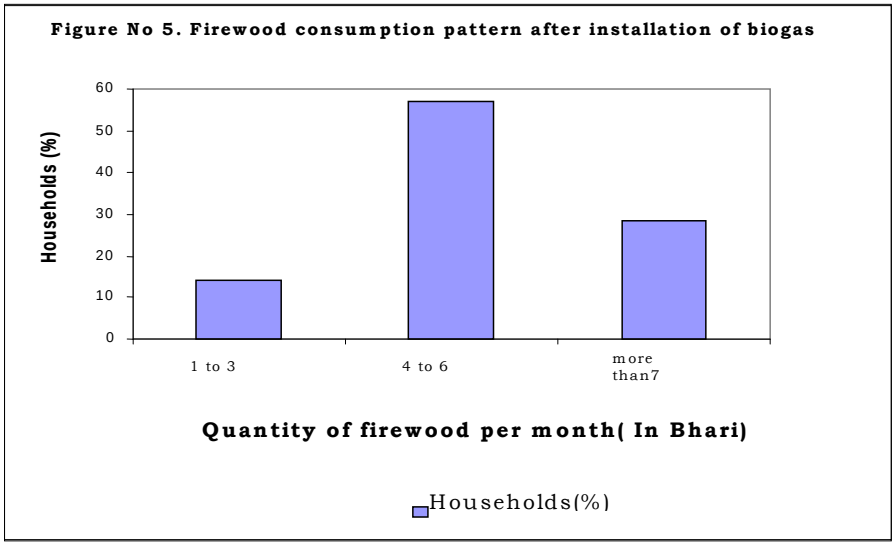
5.3.3 Firewood Consumption Pattern after Installation of Bio-gas Plant.

After installation of Bio-gas plant among the total 26 household only 25% respondent household has used firewood for the purpose of cooking. The consumption pattern of firewood after installation of Bio-gas plant is presented below.

Table No 19. Firewood Consumption Pattern after Installation of Bio-gas Plant.

S.N.	Quantity of firewood per month in (Bhari)	Frequency	Percentage
1.	1-3	1	14.18
2.	4-6	4	57.14
3.	> 7	2	28.57
Total		7	100

Source: Field Survey, 2006.



The above table shows that of the total respondent household 1 (14.18%) household were used 1-3 Bhari firewood, 4 (57.14%) household were used 4-6 Bhari firewood and 2 (28.57%) household are using more than 7 Bhari firewood. The table shows that there were positive changed in the firewood consumption pattern after the installation of Bio-gas.

5.3.4 Consumption Pattern of Kerosene before Installation of Bio-gas

The consumption pattern of kerosene of the total respondents household is presented in the table below.

Table No 20. Consumption Pattern of Kerosene before Installation of Bio-gas.

S.N.	Quantity of kerosene (in Liter) per month	Frequency	Percentage
1.	2-4	10	38.46
2.	5-8	13	50.00
3.	> 8	3	11.53
Total		26	100

Source: Field Survey, 2006.

Of the total respondent, the above table shows that of the total respondent household 10 (38.46%) Bio-gas plant owner has used 2-4 liter kerosene per month before installation of Bio-gas plant. 13 (50.00%) respondent household has used 5-8 liter kerosene and 3 (11.53) percent respondent has used more then 8 liter kerosene per month. The table shows there were harsh investments in kerosene by the Bio-gas plant owner before installation of Bio-gas plant.

5.3.5 Consumption Pattern of Kerosene after Installation of Bio-gas.

Of the total respondent household 26 only 50% respondent household were using kerosene after installation of Bio-gas plant. Kerosene using pattern after installation pf Bio-gas plant per month are given below:

Table No 21. Per month kerosene using of household after installation of Bio-gas plant.

S.N.	Quantity of kerosene in liter (per month)	Frequency	Percentage
1.	1-2	4	30.76
2.	3-5	5	38.46
3.	> 6	4	30.76
Total		13	100

Source: Field Survey, 2006.

The table shows that of the total respondent household 4 (30.76%) household has used 1-2 liter kerosene after installation Bio-gas plant. Similarly, 5 (38.46%) household has used 3-5 liter kerosene and 4 (30.76%) respondent household was used more than 6 liter kerosene per month. The above table shows that there was direct positive economic impact for the Bio-gas plant owner household after installation of Bio-gas plant.

5.4 Impact of Bio-gas on Households Activities (Time saving)

Impact of a Bio-gas on households activities can be said, there are different positive impact of bio-gas plant such as time saving for cooking, saving time for firewood collection, saving expenses for buying firewood etc.

5.4.1 Time Required for Collection of Firewood before Installation of Bio-gas Plant

It is needless to say that there were much more difference between the times required for collection of firewood before and after installation of bio-gas plant. According to respondent household time required before installation of Bio-gas are presented below.

Table No 22. Time Required for Collection of Firewood before Installation of Bio-gas Plant

SN	**Time required in hours (per week)**	**Frequency**	**Percentage**
1	1	15	57.69
2	2	8	30.76
3	3	3	11.53
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total respondents households 15 household 57.69% has spend 1hour time for the firewood collections. 8 respondents' households 30.76% has spend 2 hours time for the collection of firewood. Similarly 3(11.53%) respondents haves spent 3 hours time for collection of firewood per week.

5.4.2 Time Required for Collection of Firewood after Installation of Bio-gas Plant.

According to the respondent in the study area, only 25% household has used to spend time for collection of the firewood after the installation of Bio-gas plant. The following table shows the time required after installation of Bio-gas plant for the respondent household.

Table No 23. Time Required for Collection of Firewood after Installation of Bio-gas Plant

S.N	Time required in minutes (per week)	Frequency	Percentage
1	30	4	57.14
2	>60	3	42.85
	Total	7	100

Source: Field Survey, 2006.

The above table shows that of the total respondent households 4 household 57.14 percent were used to spend 30 minutes time for the collection of the firewood collection per week. Similarly, 3(42.85%) respondent households were used to spend more than 60 minute time for collection of firewood per week. That shows that there were vast difference between the for collection firewood collection before and after installation of Bio-gas plant.

5.4.3 Cooking Time

According to the sampled respondent household in the study area, Dharampur VDC almost all the household has used Bio-gas for cooking purpose.

45.4.3.1 Time Required for Cooking before Installation of Bio-gas Plant

The time required before installation of Bio-gas plant on the users is presented below according to the respondent households.

Table No 24. Time Required for Cooking before Installation of Bio-gas Plant

SN	Time required for cooking(In minutes)	Frequency	Percentage
1	90	3	11.53
2	120	11	42.30
3	>120	12	46.15
	Total	26	100

Source: Field Survey, 2006.

The above table shows that of the total sampled respondent households 26, about 3(11.53) household has used 90 minutes time for cooking before installation of Bio-gas plant, about 11(42.30%) respondent household has used 120 minute time for cooking. Similarly 12 (46.15%) household has consumed more than 120 minutes time for cooking. So that it can be said that there were harsh investment of time for cooking before installation of Bio-gas plant.

45.4.3.2 Time Required for Cooking after Installation of Bio-gas Plant.

Of the opinion of Bio-gas plant owner respondent household the views of them can be presented in the table below.

Table No 25. Time Required for Cooking after Installation of Bio-gas Plant

S.N.	Require time per day (in minutes)	Frequency	Percentage
1	45	3	11.53
2	60	11	42.30
3	75	12	46.15
	Total	26	100

Source: Field Survey, 2006.

The above table shows that, of the total sampled respondent households about 3(11.53%) respondent households has consumed 45 minutes time for cooking after installation of bio-gas plant per day. About 11(42.30%) respondent household has consumed 60 minutes time for cooking per day. Similarly 12 (46.15%) respondent household has consumed 75 minutes time for cooking So, the above table shows that there was positive impact of time consuming for cooking in every household of Bio-gas plant owner household.

5.4.3.3 Uses of Saving Time from Cooking

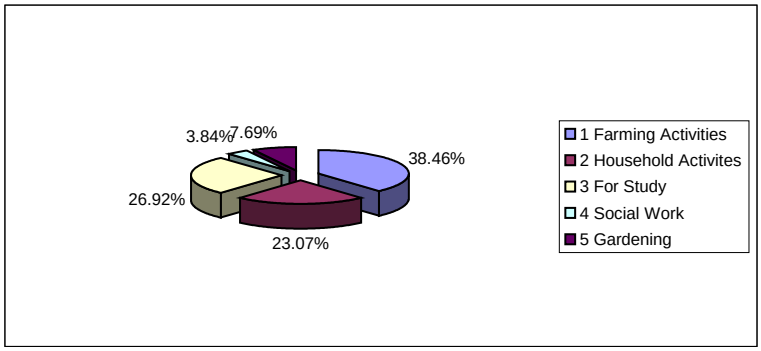
Of the total respondent household uses of saving time from cooking were managed and utilized by the Bio-gas plant owner can be presented in table below.

Table No 26 Uses of Saving Time from Cooking

SN	Activities	Frequency	Percentage
1	Farming	10	38.46
2	Household	6	23.07
3	For study	7	26.92
4	Social work	1	3.84
5	Gardening	2	7.69
	Total	26	100

Source: Field Survey, 2006.

Figure No ~~5~~6. Uses of Saving Time from Cooking



The above table shows that of the total respondent household 26, (38.46%) respondent has utilized the saving time by doing farming Activities. About 23.07% respondent households has utilized the saving time by doing household Activities. Similarly 26.92% respondent households has utilized the saving time for study. Similarly 3.84% respondent of the total household has utilized saving time in social work, and about 7.69% respondent household has utilized saving time in gardening. So that, with the help of above table it can be said that there were much more time were saved for doing different household as well as farming activities from the cooking.

5.5 Financial Benefit after utilization of Bio-gas plant

During field visit and observation of the study area, it came to know that there were positive impacts in the economy of the respondent household, because they were saving more money for buying firewood; kerosene and chemical fertilizer, and utilized such saving money for productive sector in the households.

5.5.1 Economic Impact of Bio-gas Plant.

The economic impact of Bio-gas plant on the users' household can be presented table below.

Table No 27. Economic Impact of Bio-gas Plant

S.N.	Saving	Frequency	Percentage
1	Saving expense in kerosene	6	23.07
2	Saving expense in electricity	0	0.0
3	Saving expense in firewood	13	50.00
4	Saving expense in chemical fertilizer	7	26.092
	Total	26	100

Source: Field Survey, 2006.

The above table shows of the total respondent household 6(23.07) household were saving the expense for buying kerosene. Similarly 13(50%) households were saving the expense for buying firewood and 7(26.92) respondent household were saving the expense for chemical fertilizer. This shows that there were high amount of money saving for invest in such sector, through the installation of Biogas on Users.

5.5.2. Uses of Saving for Productive Sector

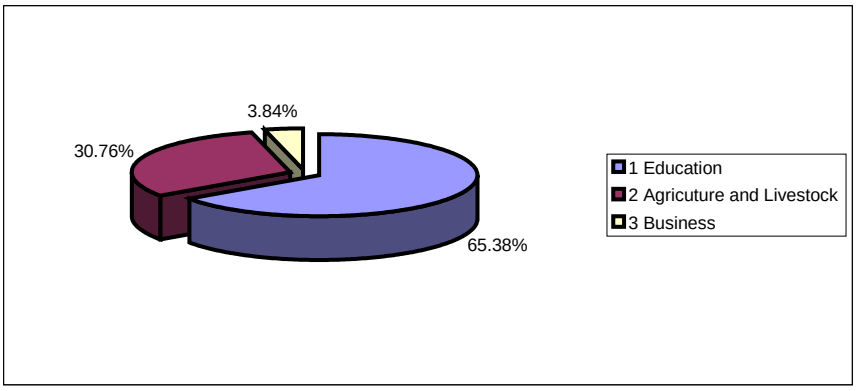
It is needless to say that according to the respondent of the Bio-gas plant owner household saving amount of money is utilized for the productive sector of the household activities by the Bio-gas plant owner household. The purpose of utilization such saving is presented in the table below according to the respondent of the Bio-gas plant user households.

Table No 28. Uses of Saving for Productive Sector

SN	Utilization of saving money	Frequency	Percentage
1	Education	17	65.38
2	Agriculture & livestock	8	30.76
3	Business	1	3.84
	Total	26	100

Source: Field Survey, 2006.

Figure No ~~6~~7. Uses of Saving for Productive Sector.



The above table shows that of the total respondent household, maximum 17(65.38%) households used to utilize the saving money for educational sector. Now especially in the study area the awareness about education is increasing. So that, they invested the saving money for education. About 8(30.76%) respondent of household were investing such saving money for agricultural production and livestock rearing. Because, the study area under study is the agriculture oriented area. Similarly only small portion 1(3.84%) respectively household has utilized such saving money to business for earning money.

5.6 Impact of Bio-gas Plant for the Improvement of Health, Sanitation and Environment

It is needless to say that there were positive impacts of Bio-gas plant on the users household of Bio-gas plant in the study area. According to the sampled respondent the impact of Bio-gas plant are given here.

5.6.1 Health Impact

Health is most essential requirement for the long life of the people. According to the sampled respondent of the Households of bio-gas plant users health impact in the family after installation of Bio-gas plant is presented in the Table below.

Table No 29. Reduction of Health Problem after Installation of Bio-gas Plant.

SN	Problems	Frequency	Percentage
1	Eye infection	3	11.53
2	Headache	3	11.53
3	Mosquitoes	10	38.46
4	Flies	7	26.92
5	Respiratory infection	1	3.84
6	Cough	2	7.69
	Total	26	100

Source: Field Survey, 2006.

The above table shows that, of the total respondent of the respondent household 3 (11.53%) respondent of the households has suffered from eye infection and headache problem. Similarly maximum 10(38.46%) respondent of the household has suffered from mosquitoes. And 7(26.92%) of the respondent household has suffered from flies problem. Similarly 1(3.84%) respondent household has suffered from respiratory infection. And 2(7.69%) respondent household has suffered from the problem of cough.

The above table shows that of the total respondent household most of the household has suffered from the problem of mosquitoes and flies. But, according to the key informants opinion, there were overall positive impact in the household after installation of Bio-gas plant for the improvement of health to all members of the family. In summer season, the mosquitoes and flies troubled them because of spell water around the yard or near the house.

5.6.2 Impact of Bio-gas to Clean the Kitchen

It is needless to say that Bio-gas technology has helped to clean not only the environment of household but also the outdoor environment such as controlling deforestation by absence of using firewood for cooking.

Of the total respondent household total 100% respondent household has respondent that installation of Bio-gas plant in the household has helped to clean the environment of the kitchen. That leads to all round benefits to the respondent after installation of Bio-gas plant the problem of the eye infection, cough, respiratory infection etc has improved that helped to direct benefit to the family of Bio-gas plant users.

5.6.3 Environmental Impact

It is needles to say that burning of firewood, agricultural residue and cow dung helped to degrade the environment from a rural perspective the use of Bio-gas has helped significantly improve the indoor air quality of homes employing Bio-gas stoves in the place of wood stoves. In addition installation of Bio-gas systems has resulted in better management and disposal of animal dung. This fact alone has helped improve the sanitation in the immediate 123, 395 rural homes using Bio-gas system. So according

to the respondent total respondent of the household mostly they agreed that after installation of Bio-gas plant in the house, they did not used to burn firewood, agricultural residue and cow dung. That is why, in the study area, there was sustainable improvement of environment. Using cow dung for cooking is harmful for the agricultural production. And after installation of Bio-gas plant they never used to burn cow dung for cooking purpose. Instead of that cow dung's Bio-slurry has helped to produced agricultural crops better than before installation of Bio-gas plant in the respondent households. It has also helped to make smokeless environment in the kitchen for cooking. So, that different disease was removed after installation of Bio-gas plant in the household of Bio-gas plant owner. From a National perspective, Bio-gas systems have helped to reduce deforestation. This in turn has important implication for watershed management and soil erosion. In addition installation of Biogas system slurry is collected and returned to field have helped to reduced the depletion of soil nutrients this in turn reduces the pressure to expand the area of land cleared for agriculture, the principle causes of deforestation in Nepal.

5.6.4 Social Impact

According to the respondent of the Bio-gas plant users household, there were different impact of Bio-gas plant after installation of Bio-gas pant in the household. They respondent that after installation of Bio-gas plant in the respondent household the social status of the family has raised. Among the respondent of the Bio-gas plant users some of them were engaged in social work. Due to the clean social environment in the study area majority of the respondent were satisfied with the Bio-gas technology. According to the respondent, because of clean environment around the household, the prestige of the family was raised.

Among the total respondent of the Bio-gas plant users household, some respondent responded that there were no increase the prestige of family by installation of Bio-gas plant ~~of~~ in the household. But prestige of the family will be improved through the manner and behaviour of the people.

5.6.5 Toilet Connection

In the study area, according to the respondent household the connection of toilet with the Bio-gas plant can be described that maximum number of respondent household have not connected toilet with Bio-gas plant. The reasons behind not connection of toilet with Bio-gas plant was farmer were hesitate to use Bio-slurry in the field. And the old man and women they did not like to eat cooking rice cooked by connecting toilet with the Bio-gas plant.

5.7 Uses of Slurry

Nepal is an agricultural country so, fertilizer is the basic requirement for the better production of crops. The encouraging factor to install~~ed~~ Bio-gas plant in rural areas is the production of compost slurry fertilizer, which is more productive nutrient fertilizer than dung. The important factor of slurry for better production of crops and beneficial for plant is that the plants can observe such Bio-compost slurry easily in the field. Such digested compost slurry is also beneficial for the small plants, removing or killing insects that troubled the plants.

In the study area according to the respondent of the total respondent they utilized digested compost Bio-slurry in the field for better agricultural production. Similarly they were utilizing such productive slurry for vegetable farming fruits etc. According to the sampled respondent of the household majority of respondent responded that Bio-slurry has increased the agricultural production. So, they were applied the digested compost slurry in the field as a fertilizer. Among them maximum respondent also responded that using Bio-slurry is more effective than chemical fertilizer in the field. Because the digested compost slurry has ~~o~~abserve by the plant easily while applied such compost slurry fertilizer in the field. According to them the foremost important benefits of slurry was the replacing chemical fertilizer in the field, which is much more harmful in the field. And applied slurry in the field also saved more money for buying chemical fertilizer.

5.7.1 Effect of Slurry on Agricultural Production

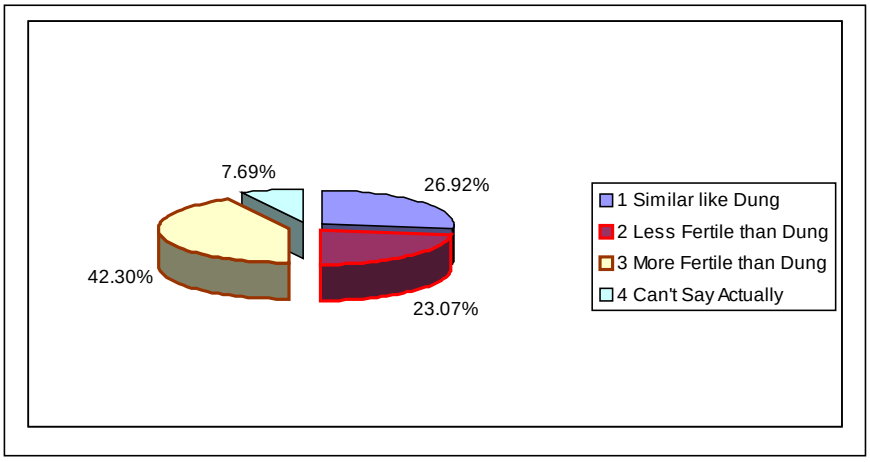
Slurry is more effective fertilizer than dung. According to the sampled respondent of the household after installation of Bio-gas plant there was no decreasement of the agricultural production. Instead of that, it has maintained soils nutrients capacity properly in sustainable way. According to the sampled respondent household, effect of Bio-slurry on agricultural production is presented in the table below.

Table No 30. Effect of Slurry on Agricultural Production

SN	Effect of slurry	Frequency	Percentage
1	Similar like dung	7	26.92
2	Less fertile then dung	6	23.07
3	More fertil~~iz~~e than dung	11	42.30
4	Can't say actually	2	7.69
	Total	26	100

Source: Field Survey, 2006.

Figure No 8~~7~~. Effect of Slurry on Agricultural Production



The above table shows that of the total respondent 7(26.92%) respondent of the household responded that the Bio-slurry is similar like dung, about 6(23.07%) respondent of the household responded that Bio-slurry is less fertile than dung, similarly 11(42.30%) respondent of the household

responded that the Bio-slurry is more fertile than dung. According to them the Bio-compost slurry is more fertile than dung because the effect of the slurry can be seen at once while applying slurry in the field. And 2 (7.69%) respondent's household's respondent can't say actually either Bio-slurry is more fertile or less fertile than dung for the agricultural production.

5.7.2 Uses of Slurry for Crops

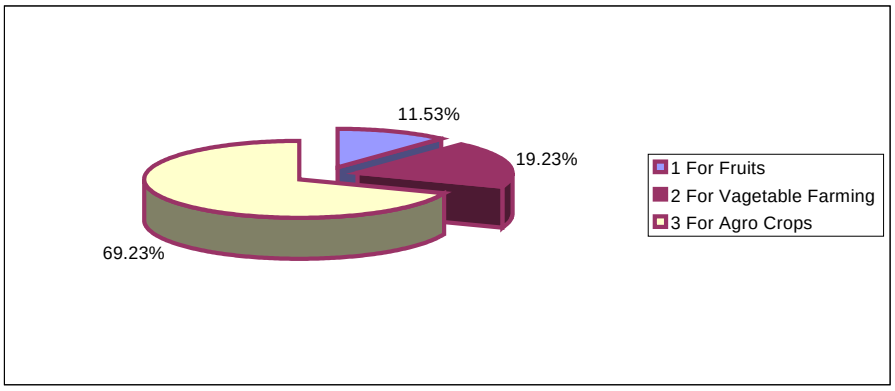
According to the respondent of the bio-gas plant users household, majority of users were utilizing Bio-slurry for agricultural production in the cultivated land. According to the respondent of the bio-gas plant users household the uses of slurry for agricultural production are presented in the table below.

Table No 31. Uses of Slurry for Crops.

S.N	Uses of slurry	Frequency	Percentage
1	For fruits	3	11.53
2	For vegetable farming	5	19.23
3	For agro-crops	18	69.23
	Total	26	100

Source: Field Survey, 2006.

Figure No 98. Uses of Slurry for Crops.



Regarding the uses of Bio-slurry for agricultural production, according to the respondent the above table shows that of the total respondent of the Bio-gas plant users household 3(11.53%) respondent household responded that they have been utilizing Bio-slurry for production for fruits. Similarly 5(19.23%) respondent responded that they have been utilizing Bio-slurry

for vegetable farming. And similarly majority of respondent household 18(69.23%) have been utilizing Bio-slurry for the production of agro crops.

Thus the above table shows that there was better utilization of Bio-gas slurry for agricultural production in the study area. And the respondents were highly satisfied with the production of crops in their field by applying such Bio-compost fertilizer.

5.8 Repair and maintenance

Through the study of the total 26 sampled respondent household, majority of the Bio-gas plant users household were satisfied from the utilization of Bio-gas plant. Instead of that, according to some of the respondent there was needed occasional maintenance problem in the burner of the Gas stove, and sometimes stoppage of gas in the burner.

5.8.1 Sufficiency and Insufficiency of Gas

According to the sampled respondent households majority of Bio-gas plant users household respondent that there were sufficiency of has in summer season. And some of the respondent of bio-gas plant user's household responded that there were insufficiency of has in the winter season.

5.9 Suggestion of Bio-gas Plant User about the Bio-gas Plant

According to the sampled respondent of the Bio-gas plant users household, majority of Bio-gas plant users household were satisfied with the installation and utilization of Bio-gas plant. According to them Bio-gas is more feasible, reliable alternative source of energy for cooking and lighting in household as a sustainable way.

According to majority of the respondents, the Bio-gas is more feasible source of energy in the study area and provides long-term benefits by investing money in one time for installation. It makes environment clean, reduces the problem of eye infection, cough, respiratory infection and overall benefits to all member of family from child to old. According to the majority of the respondent, Bio-digested slurry is more productive and can utilize any time in the field and it also saves time, and money for buying chemical fertilizer and it also maintained long-term productive capacity of soil. And they also suggest that bio-gas technology is more suitable with environment, because it also helps to control environment degradation and also maintained the ecology by controlling deforestation.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary:

The study attempts to explain the socio-economics impact of Biogas Plant on users in Dharampur VDC, Jhapa District. And the objectives of the study were,

i. To study the advantages of utilization of Biogas Plants

ii. To study the energy, time, financial advantages after utilization of Biogas Plants.

iii. To study the role of Biogas in the improvement of health, sanitation and environment

iv. ~~Access~~ To study the advantages of Biogas slurry in agricultural production in the study area.

The research study was conducted on the basis of primary data sources in the study area.

For the research study, the field survey was conducted in Chaitra 2062 to 2063 Baisakh (BS).

Purposive sampling was adopted for the selection of the head of households as its methodological procedures.

The design of the research study was both explorative and descriptive.

Regarding the methods of research, the sample size was 26 respondent households from 128 universe households of Biogas plant users. Structured questionnaire was prepared to conduct the household survey and field visit observation was the tools for data collection.

The main findings of the studies are as follows:

In the study area the uses of Biogas is only for cooking purposes not for the purpose of lighting.

After installation of Biogas plant in the study area, there was considerable reduction in the workload of the members of the family especially women.

Most of the Biogas Plant owners are very much satisfied with their Biogas Plants. The main attractions towards installation of Biogas Plant was easy cooking on Biogas, and have not face any difficulties and smokeless environment in the kitchen.

Agriculture is the main occupation of the majority of respondents about 84.61 percentage respondents households are engaged in agriculture.

Of the total respondents of the Biogas Plant owner household 92.30 were male and 7.69 were female Biogas Plant owners.

Of the total sampled respondents household of the Biogas Plant users majority of Biogas Plant users were Brahmin 69.23 percent, Chhetri 26.92 and 3.84 are Rai.

Among the total sampled respondents households age of Biogas Plant owner is that 3.84 percent households were 20-30 age group, 34.61 percent households were 30-40 age group, and 61.53 households were more than 40 years age group

Among the total respondents 34.61 percent households occupies 1-3 livestock and 65.38 percent respondent's households occupies more than 4 livestock.

Of the total respondents majority of the respondent 46.15 percent were installed Biogas through the self-motivation

Of the total sampled respondents 53.84 percent respondents has installed Biogas through the Bank loan and 46.15 percent respondent household has installed Biogas through the family investment.

The net dung produced of the sampled respondent household were 53.84 percent occupies 20-30 kg. per day, 30.76 percent occupies 31-40 kg. per day and 15.38 percent occupies more than 41 kg. dung per day.

In the study area, after installation of Biogas Plant firewood consumption pattern was highly reduced in the respondent households of Biogas plant users.

Investment pattern of money for consuming firewood and buying kerosene was also highly reduced.

In average, per households high amount of time was saved for collection of firewood after installation of Biogas Plant.

The time required for cooking in the sampled respondents household before installation of Biogas Plant was 11.53 percent household required 90 minutes, 42.30 percent households required 120 minutes and 46.15 percent households required more than 120 minutes per day. But after installation of Biogas Plant only 11.53 percents household required 45 minutes, 42.30 percent required 60 minutes and 46.15 percent household

required 75 minutes per day that shows, there was substantially 50 percent time was saved after installation of Biogas in the respondents household.

The majority of respondents utilized the net saving time for farming activities.

In the study area, of 26 sampled Biogas plant user respondents households majority of respondents household have saved high amount of money for buying firewood, kerosene and chemical fertilizer after installation of Biogas Plant.

And, in the study area that net saving amount of money respondents households of Biogas users were invested 65.38 percent for educational activities.

After installation of Biogas Plant in the study area, there was substantially improvement of health, sanitation and environment in the respondents household of Biogas Plant users.

After installation of Biogas Plant in respondents household, they didn't use to burn firewood, cow dung and agriculture residue that helped to clean the kitchen environment as well as outdoor environment.

In the study area, more than 90 percent sampled respondent household were used the digested slurry for agricultural production and of the total respondent 42.30 percent responded that the slurry is more fertile than dung.

In the study area, slurry is highly used in agro crops, of the total sampled respondent household 69.23 percent Biogas Plant users household has used that slurry for agro crops.

6.2 Conclusion

No doubt, Biogas technology has been proved to be a viable technology especially for the households cooking, good qualified fertilizer etc in rural areas. The impact of Biogas Plant can be further observe in the rural areas where there are scarcity of the firewood and mostly people especially women and children have problems of smoke related disease such as cough, eye infection etc. The Biogas programmed has now become one of the most successful programme and it has made the overall positive socio-economic impact in rural areas. Such as education, health, environment and saving time and money etc. The main role of Biogas technology is to reduced the time of firewood consumption and controlled deforestation and

healthy environment in the kitchen as well as household. Following conclusion are drawn from the present research study in the Dharampur VDC of Jhapa district about the impact of Biogas Plant.

The outcome of the study shows that most of the sampled of the Biogas plant users households were positive about the installation of Biogas plant.

The study shows, use of Biogas Plant in the study area is only for cooking purposes not for lighting purposes.

The required time they used to spent for firewood collection is saved and that saving time is utilized by the Biogas Plant users household for their income generating activities and agricultural activities.

After installation and utilization of Biogas Plant by the users the health condition of the sampled respondents household were highly improved.

After installation of Biogas Plant, The slurry is highly used by the sampled respondent Biogas Plant users households and gradually improved agricultural production.

The outcome the study suggested that the main benefits of the installation of Biogas Plant in the users households were easy and smokeless cooking that saved a considerable amount of time.

The study shows that, of the total sampled respondents household of the Biogas Plant users majority of users were not connecting toilet with Biogas Plant.

The study shows that after utilization of Biogas Plant using pattern of firewood for cooking were gradually removed in the users households.

The study shows that of the total sampled respondents, majority of the Biogas Plant users household were installed Biogas through the self-investment and self-motivation.

The study shows after installation of Biogas Plant by the respondent users households, they never used to burn cow dung and firewood for cooking. So, it has significantly improved the indoor air quality of houses applying Biogas stoves in the place of wood stoves. That significantly helped to control environmental degradation by controlling deforestation and stops to burn cow dung for cooking.

6.3 Recommendation

Based on the finding of the study, following recommendation have been presented. So that, the concern institution related to Biogas should must take essential required steps to further implement Biogas development related activities to obtain desired positive and sustainable impact in the study area.

The Biogas Plant promotion activities should be forwarded to make aware of the people in the study area that helps to install the further maximum Biogas Plant in rural areas and helped to uplift the socio-economic condition of rural people.

Nepal is an agricultural oriented country so, fertilizer is essential for better agricultural production and chemical fertilizer is not access to all the farmer so, awareness programme should be conducted regularly for the Biogas Plant users household in the context of application of slurry to increase agricultural productivity and best utilization of Biogas Plant.

The farmer of the Biogas Plant users households should be made aware about the importance of attaching toilet with the Biogas Plant. That significantly help to better toilet environment and sufficiency of gas production for cooking.

Research and development are mostly needed for sustainable increasing the sufficient gas production during the winter season. So, it is recommended to implement it.

To increase the access of the Biogas Plant for the poor and marginalized rural people in the study area, more subsidies should be provided them for installation of Biogas Plant.

After installation of Biogas Plant, frequent supervision and monitoring from Biogas Company is necessary. Therefore, Biogas Company should provide the training to Biogas Plant users household on operation and maintenance that helps to Biogas Plant users household for maintenance any kind of problem regarding the Biogas Plant.

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Appendix I : Interview Schedule

Socio-Economic Impact of Bio-gas Plant on Users

Structured Questionnaire

1. General Introduction:

Name of the plant owner: … … …. …. … … … … … … … … … … …

Name of the respondent: … … … … … … … … … … … … … … … … …

Age: … … … … Sex: … … … Plant size: … … … … … … m^3

Occupation: … … … … … … … Caste: … … … … …. … …

Religion: … … … … …. … … …

1.1.Education Qualification:

	Male	**Female**	**Total**
Literate			
Illiterate			

1.2 Family Status:

(i) Nuclear family (ii) Joint family

Male … … … Female … … … Total … … …

1.3 Land ownership pattern of the family

Total Land		**Cultivated Land**		**Uncultivated Land**	
Bigha	Kattha	Bigha	Kattha	Bigha	Kattha

1.4 Livestock pattern of household

Animal	**Buffalo**	**Cow**	**Ox**	**Other**
Number				

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Dung Produced per day (Kg)				

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2. Information and Advantage of Biogas:

2.1 Who encouraged you to install the Bio-gas plant?

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(i) Staff of Bio-gas company (ii) ADB/N

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(iii) Govt. Agencies (iv) NGOs

(v) Self Motivated (vi) Relatives

2.2 When did you install the Bio-gas Plant ? … … … Year … … … Month

2.3 In what reason did you install the Bio-gas plant?

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(i) Lighting (ii) Cooking

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(iii) Time saving (iv) Environment Protection

2.4 Do you think that Bio-gas plant has increased your living standard?

(i) Yes (ii) No

2.5 In your opinion which member of your family as really most benefited form it ?

(i) Children (ii) Old man

(iii) Old women (iv) All

2.6 What is your source of investment for installation of Bio-gas plant?

(i) Subsidy (ii) Bank loan

(iii) Family investment (iv) Relatives

(v) Money lender (vi) Total cost…….

2.7 How much dung and water do you mix and feed in the Bio-gas plant daily?

(i) Dung in Kg.:…… (ii) Water in liter: ……

2.8 Is your Bio-gas plant producing gas sufficiently?

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(i) yes (ii) No

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2.9 Give information about consumption pattern of kerosene, firewood and agricultural residue before and after the installation of Bio-gas plant.

	Before	**After**
Kerosene (liter)		
Firewood in (bhari/Kg.)		
Agricultural residue and dung cake (bhari/kg.)		

(1 bhari = …….. kg.2.9 Give information about consumption pattern of kerosene, firewood and agricultural residue before and after the installation of Bio-gas plant.

(1 bhari = …….. kg.)

3. Uses of energy and energy saving pattern

3.1 Which type of energy do you use mostly for cooking and lighting?

Firewood	Kerosene	Bio-gas	Electricity	Others

3.2 How much energy (fuel) did you require per month before that installation of Bio-gas plant?

Sources	**Quantity**
Firewood in kg/Bhari	
Kerosene in liter	
Electricity in unit	
Others	

3.3 How much energy (fuel) do you require per month after the installation of Bio-gas plant?

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~~Sources~~	~~Quantity~~
~~Firewood in kg/Bhari~~	
~~Kerosene in liter~~	
~~Electricity in unit~~	
~~Others~~	

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3.4. Who usually work to bring dung and water to feed the Bio-gas plant?

Dung (i) Male (ii) Female

Water (i) Male (ii) Female

4. Time saving pattern of Bio-gas plant users.

4.1 How much time did you spend to collect firewood before the installation of Bio-gas plant?

(i) … … … …Hour (ii) … … … …Minutes

4.2 How much time now you spend to collect the firewood?

(i) … … … …Hour (ii) … … … …Minutes

4.3 Where did you go to collect the firewood before the installation of Bio-gas plant?

(i) Forest (ii) Buy from the market

(iii) Collect form own land

4.4 How much time did you spend for cooking before installation of Bio-gas plant?

(i) … … … …Hour (ii) … … … …Minutes

4.5 How much time now you spend for cooking?

(i) … … … …Hour (ii) … … … …Minutes

If, it has saved time in firewood collection and cooking, how are you utilizing surplus time?

(i) Farming activities (ii) Gardening

(iii) Study (iv) House hold activities

(v) Social work

5. Financial benefits after the utilization of Bio-gas plant.

5.1 In your opinion, what is the economic impact of Bio-gas plant?

(i) Saving expense in Kerosene

(ii) Saving expense in electricity

(iii) Saving expense in firewood

(iv) Saving expense in chemical fertilizer

5.2 How are you utilizing the savings for the productive sector?

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(i) Business (ii) Education

(iii) Agricultural and livestock (iv) Lending money

(v) If others, specify …. …. … …. …. … …. …. .. … … …

6. Impact of Bio-gas plant for the following health, sanitation and environment.

6.1 Do you think that the following health, sanitation and environmental problems have been reduced after installation of biogas plant?

Kitchen environment Yes No

Respiratory infection Yes No

Cough Yes No

Eye infection Yes No

Tuberculosis Yes No

Headache Yes No

Mosquitoes Yes No

Flies Yes No

6.2 Do you believe that installation of Bio-gas plant has helped to clean the kitchen?

(i) Yes No

6.3 Do you believe that installation of Bio-gas plant has helped to control the environment degradation?

(i) Yes No

6.4 Have you attached your toilet to the Bio-gas plant?

(i) Yes No

If Not, why? …

7. Advantage of Bio-gas slurry in your farm?

(i) Yes No

If Not, why? …

7.2 Do you think that bio-gas slurry has increased agricultural production?

(i) Yes No

7.3 Do you think that biogas is more effective in agricultural production than chemical fertilizers?

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(i) Yes No

7.4 Would you find any sufficiency and insufficiency of gas production in summer and winter?

(i) Yes No

7.5 Say preferentially (1,2,3) the use of slurry for agriculture production.

(i) For fruit

(ii) For vegetable production

(iii) For agro crops

(iv) For Plantation crops

7.6 Bio gas plant owner's view on slurry for agricultural production as compared to dung.

(i) Similar like dung

(ii) Less fertile than dung

(iii) More fertile than dung

(iv) Can't say actually

8. Repair and maintenance

8.1 Do you have any difficulty for the maintenance of Bio-gas plant?

(i) Yes No

If yes, specify … … … … … … … … … … … … … … … …. … …

8.2 Do you have some suggestion about the biogas plant for those people who are willing to install? Please specify.

(i) … … … … … … …

(ii) … … … … … … …

(iii) … … … … … … …

8.3 Are you fully satisfied with the biogas plant?

(i) Yes No

8.4 Do you anything else that you would like to share with researcher about queries? …

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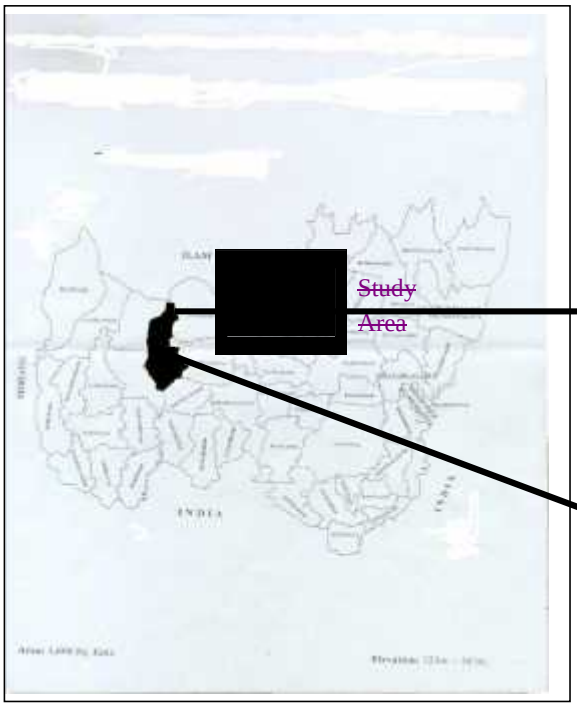

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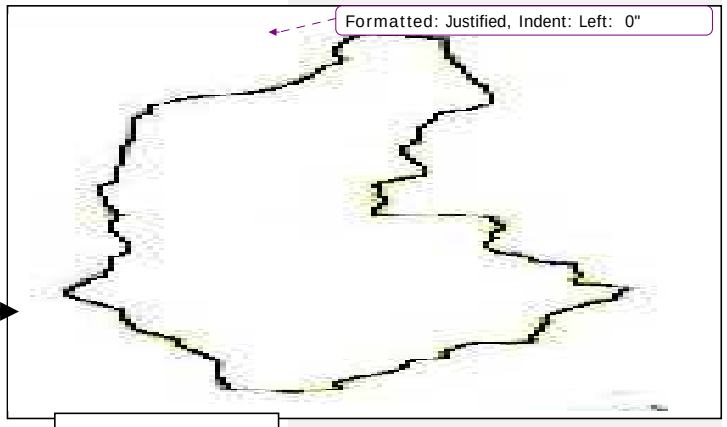

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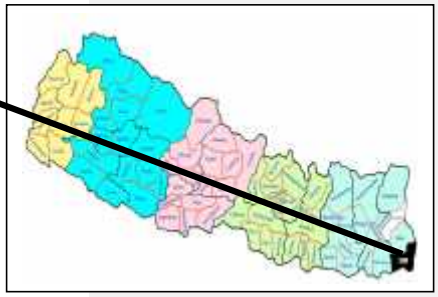
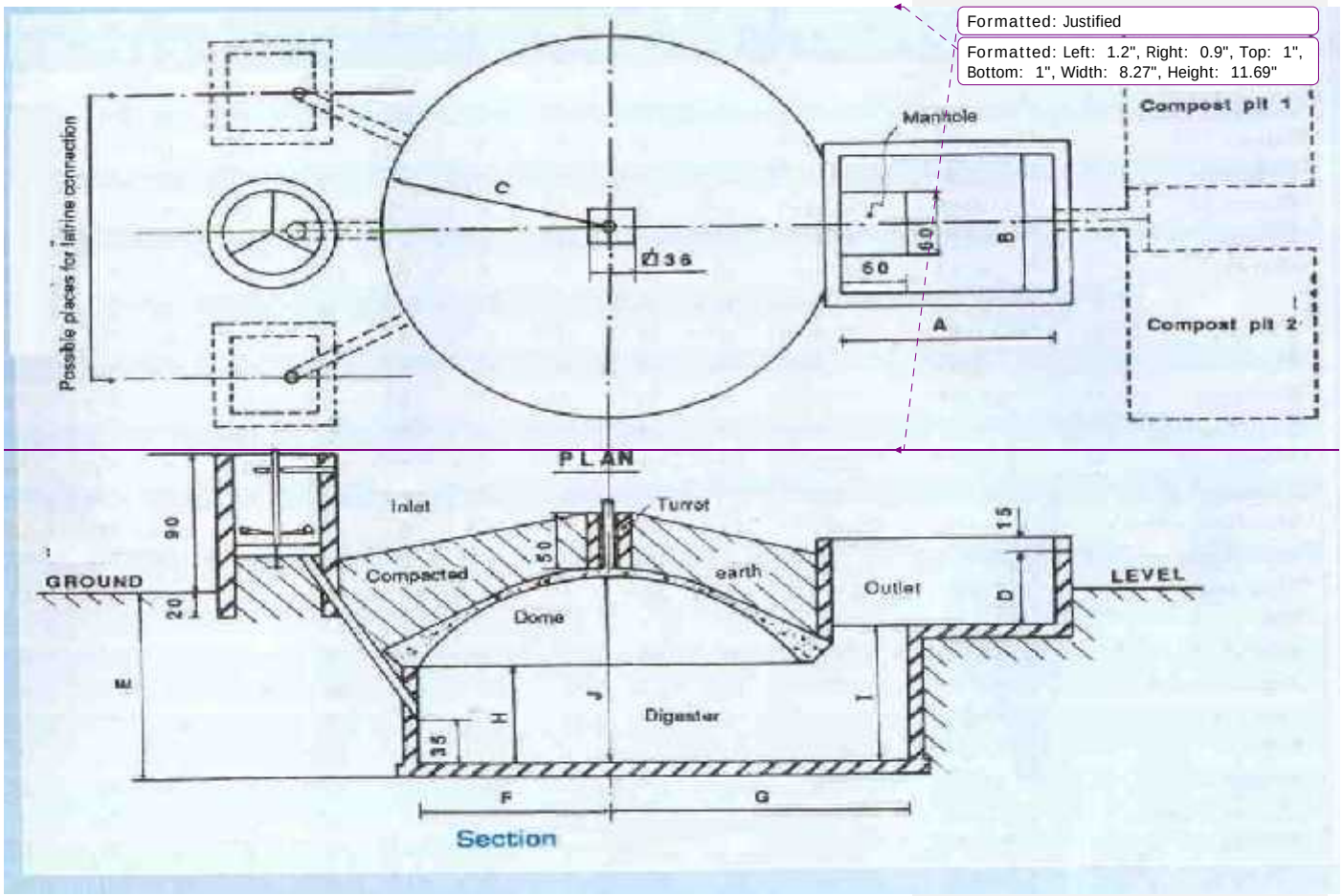


Appendix III Fig: Schematic Diagram of Biogas System



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Appendix I: Interview Schedule

Socio-Economic Impact of Bio-gas Plant on Users

Structured Questionnaire

1. General Introduction:

Name of the plant owner: … … …. …. … … … … … … … … … … …

Name of the respondent: … … … … … … … … … … … … … … … …

Age: … … … … Sex: … … … Plant size: … … … … … m^3

Occupation: … … … … … … Caste: … … … … …. … …

Religion: … … … … …. … …

1.1.Education Qualification:

	Male	**Female**	**Total**
Literate			
Illiterate			

1.2 Family Status:

(i) Nuclear family (ii) Joint family

Male … … … Female … … … Total … … …

1.3 Land ownership pattern of the family

Total Land		**Cultivated Land**		**Uncultivated Land**	
Bigha	Kattha	Bigha	Kattha	Bigha	Kattha

1.4 Livestock pattern of household

Animal	**Buffalo**	**Cow**	**Ox**	**Other**
Number				
Dung Produced per day (Kg)				

2. Information and Advantage of Biogas:

2.1 Who encouraged you to install the Bio-gas plant?

(i) Staff of Bio-gas company (ii) ADB/N

(iii) Govt. Agencies (iv) NGOs

(v) Self Motivated (vi) Relatives

2.2 When did you install the Bio-gas Plant ? ... ... Year ... ... Month

2.3 In what reason did you install the Bio-gas plant?

(i) Lighting (ii) Cooking

(iii) Time saving (iv) Environment Protection

2.4 Do you think that Bio-gas plant has increased your living standard?

(i) Yes (ii) No

2.5 In your opinion which member of your family as really most benefited form it ?

(i) Children (ii) Old man

(iii) Old women (iv) All

2.6 What is your source of investment for installation of Bio-gas plant?

(i) Subsidy (ii) Bank loan

(iii) Family investment (iv) Relatives

(v) Money lender (vi) Total cost.....

2.7 How much dung and water do you mix and feed in the Bio-gas plant daily?

(i) Dung in Kg.:..... (ii) Water in liter: .....

2.8 Is your Bio-gas plant producing gas sufficiently?

(i) yes (ii) No

2.9 Give information about consumption pattern of kerosene, firewood and agricultural residue before and after the installation of Bio-gas plant.

	Before	**After**
Kerosene (liter)		
Firewood in (bhari/Kg.)		
Agricultural residue and dung cake (bhari/kg.)		

(1 bhari = ... kg.

3. Uses of energy and energy saving pattern

3.1 Which type of energy do you use mostly for cooking and lighting?

Firewood	Kerosene	Bio-gas	Electricity	Others

3.2 How much energy (fuel) did you require per month before that installation of Bio-gas plant?

Sources	**Quantity**
Firewood in kg/Bhari	
Kerosene in liter	
Electricity in unit	
Others	

3.3 How much energy (fuel) do you require per month after the installation of Bio-gas plant?

Sources	**Quantity**
Firewood in kg/Bhari	
Kerosene in liter	
Electricity in unit	
Others	

3.4. Who usually work to bring dung and water to feed the Bio-gas plant?

Dung (i) Male (ii) Female

Water (i) Male (ii) Female

4. Time saving pattern of Bio-gas plant users.

4.1 How much time did you spend to collect firewood before the installation of Bio-gas plant?

(i) ... ...Hour (ii) ... ...Minutes

4.2 How much time now you spend to collect the firewood?

(i) ... ...Hour (ii) ... ...Minutes

4.3 Where did you go to collect the firewood before the installation of Bio-gas plant?

(i) Forest (ii) Buy from the market

(iii) Collect form own land

4.4 How much time did you spend for cooking before installation of Bio-gas plant?

(i) ... ...Hour (ii) ... ...Minutes

4.5 How much time now you spend for cooking?

(i) ... ...Hour (ii) ... ...Minutes

If, it has saved time in firewood collection and cooking, how are you utilizing surplus time?

(i) Farming activities (ii) Gardening

(iii) Study (iv) House hold activities

(v) Social work

5. Financial benefits after the utilization of Bio-gas plant.

5.1 In your opinion, what is the economic impact of Bio-gas plant?

(i) Saving expense in Kerosene

(ii) Saving expense in electricity

(iii) Saving expense in firewood

(iv) Saving expense in chemical fertilizer

5.2 How are you utilizing the savings for the productive sector?

(i) Business (ii) Education

(iii) Agricultural and livestock (iv) Lending money

(v) If others, specify ....

6. Impact of Bio-gas plant for the following health, sanitation and environment.

6.1 Do you think that the following health, sanitation and environmental problems have been reduced after installation of biogas plant?

Kitchen environment	Yes	No
Respiratory infection	Yes	No
Cough	Yes	No
Eye infection	Yes	No
Tuberculosis	Yes	No
Headache	Yes	No
Mosquitoes	Yes	No
Flies	Yes	No

6.2 Do you believe that installation of Bio-gas plant has helped to clean the kitchen?

(i) Yes No

6.3 Do you believe that installation of Bio-gas plant has helped to control the environment degradation?

(i) Yes No

6.4 Have you attached your toilet to the Bio-gas plant?

(i) Yes No

If No, why? ... ...

7. Advantage of Bio-gas slurry in your farm?

(i) Yes No

If No, why? ... ...

7.2 Do you think that bio-gas slurry has increased agricultural production?

(i) Yes No

7.3 Do you think that biogas is more effective in agricultural production than chemical fertilizers?

(i) Yes No

7.4 Would you find any sufficiency and insufficiency of gas production in summer and winter?

(i) Yes No

7.5 Say preferentially (1,2,3) the use of slurry for agriculture production.

(i) For fruit

(ii) For vegetable production

(iii) For agro crops

(iv) For Plantation crops

7.6 Bio-gas plant owner's view on slurry for agricultural production as compared to dung.

(i) Similar like dung

(ii) Less fertile than dung

(iii) More fertile than dung

(iv) Can't say actually

8. Repair and maintenance

8.1 Do you have any difficulty for the maintenance of Bio-gas plant?

(i) Yes No

If yes, specify ... ...

8.2 Do you have some suggestion about the biogas plant for those people who are willing to install? Please specify.

(i) ... ...

(ii) ... ...

(iii) ... ...

8.3 Are you fully satisfied with the biogas plant?

(i) Yes No

8.4 Do you anything else that you would like to share with researcher about queries? ... ...

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