CHAPTER ONE

INTRODUCTION

1.1 General Background

Nepal is a republican democratic, independent, secular and sovereign country with a variety of ethnic groups, culture and tradition.

It is land locked country situated in between the most populous countries of the world, India in the west, east and south and China in the north. Geographically, the country is divided in the three ecological belts; Mountain, Hill and Terai (plain land) covering respectively 35, 42, 23 percent of the total land area 1,47,181 sq. km. with 885 km (east - west) length and 193 km. (north - south) mean width,1990 (Basnet).

There are five development regions and 14 zones and 75 districts. The population of Nepal as reported in the population census 2001 was 23.1 million of which 85.80 percent were living in rural areas. It is one of the poorest countries in the world whose economy is mainly based on agriculture. The large population of Nepal work hard to meet their hand to mouth problems.

Nepal is one of the developing countries with a high level of household energy consumption. This consumption is primarily satisfied through excessive burning of biomass. The biomass consumptions has vast implication both for deterioration of natural resources and the work load of rural women and girls charged with responsibility of cooking in the kitchen.

In Nepal, biomass energy: firewood, agri-residue and animal dung is used for cooking and heating purposes. Use of traditional stoves such as "agenu" (open fireplace) and "chulo" (rudimentary stoves) consumes more fuel wood and increased the burden on women. Women are mainly responsible for cooking and collection of biomass, mainly fuel wood from the forest. Use of biomass energy and low-grade biomass fuels lead to excessive levels of indoor smoke/air pollution. Women and children in particular are exposed to the smoke emission.

This is one of the reasons for higher rates of infant mortality and morbidity and other unhealthy living conditions. Release of incomplete carbon gas and other harmful particles in the atmosphere due to poor combustion of biomass fuels in rudimentary stoves results in the emission of Green House Gas (GHG). More than 80% of the energy needs are met by fuel wood thus exerting immense pressure on the forest resources of the country with negative impacts on environment. (Inventory of ICS in Nepal 2000, CRT/N)

Forest resources and other biomass (primary fuel wood) are important sources of household energy in rural and even semi-urban areas all over the developing countries. Nepal relies heavily on fuel wood for its energy requirement. Nearly 90% of the energy requirement is still met by traditional biomass: fuel wood, agri-residue and animal dung.

The annual energy consumption of the Nepal is estimated to be 6,864-7,825 thousand tons of oil equivalents. Looking at total national energy consumption of the last 5 years, the share of the traditional energy is 86-90% and source of the commercial energy is from 10-14%. In the overall energy consumption, 77% energy comes from the firewood, 9% from the agriculture residues and animal dried dung and remaining 14% energy comes from imported petroleum product, coal and electricity. The annual per capita consumption of the commercial energy is 46 kilogram of oil equivalent. Although the rural area consumes 86% of the total energy of the country, share of the biomass energy is the highest. Renewable energy and imported kerosene oil are the two main sources of the energy used in the rural areas.

The biomass consumption has vast implications both for deterioration of natural resources and the workload of rural women and girls charged with the responsibility of fuel wood collection. The poor combustion technology of traditional stoves has serious negative impact on the health of rural women and small children as cooking traditionally takes place inside houses with very poor ventilation. The problems related to sustainable and just energy consumption within Nepal are further exacerbated by a high population growth. The energy problem in Nepal can thus be characterised by over-consumption of one of the renewable energy sources (fuel wood) while other sources e.g. hydro power is not

yet sufficiently developed in order to address the growing energy consumption needs.

1.2 Statement of the Problem

Nepal is one of the developing countries relying heavily on its forest resources to meet its demand for energy. In Nepal biomass energy: fuel wood, agri-residue and animal dried dung are used for cooking and heating purpose. According to AEPC report 2003 rural areas account for about 80% total energy requirements of the country most of which is for cooking. Used of traditional rudimentary stoves consumed more fuel wood and increased the burden on women in cooking and collection of firewood. The biomass consumptions has vast implication both for deterioration of natural resources and the workload of women and girls charged with the responsibility of fuel wood collection. Use of biomass energy and low-grade biomass fuels lead to excessive levels of indoor smoke/air pollution. This was one of the reasons for higher rates of infant mortality and morbidity and other unhealthy living conditions.

Such kinds of programmes are implemented by many I/NGOs but problems have as it is. This programme goal is reduced emissions through efficiency and improved health and well being in Jang VDC and purpose is to reduce fuel consumption and consequent de-forestation pressure by installation of improved cooking stove. Thereby, the study has being benefited to programme implementer; beneficiaries, researchers and other key stakeholders.

The Indian stove models, the Hyderabad and Magan Chulo, were the first Improved Cooking Stoves, introduced in Nepal, during the 1950s. In the 1960s, an agro-Engineering workshop in the Department of Agriculture developed a mould-based stove model, which was disseminated through the mid-1970s, a number of NGOs and GOs (Peace Corps, Women Training Centre, RECAST, and UNICEF) were involved in ICS research and dissemination of the Lorena stove model. Unfortunately, lack of funding led to stagnation in stove dissemination. In the 1980s, HMG/The National Planning Commission addressed the fuel wood consumption issues in its sixth 5 year Plan, and together with the introduction of Community Forestry. HMG initiated dissemination of ceramic pre-fabricated stoves, supported by FAO and UNDP. The ceramic inserts proved inappropriate to most areas of Nepal, since they were often breaking during long and

complicated transportation in hill areas. Up to date 95,000 ICS have been distributed or installed at various districts in the country. Out of this, about 57,000 ICS were distributed by the Community Forest Development Projects (CFDP). Apart from CFDP there are other organizations involved in the promotion of ICS. The other organization together promoted about 40,000 stoves in Nepal.

Later in early 1990s, Research Centre for Applied Science and Technology (RECAST) developed "Improved Tamang Stove" a mud stove model, which is cheap and could be produced at the local level by trained local person using locally available materials. This model was disseminated with new initiative, and with demand-driven, bottom up, participatory and need based approach. Emphasis was given on mass awareness creation and sensitization, for creating demand for ICS in this approach.

HMG/Nepal was given in its 10^{th} plan emphasis to further development of alternative energy sources in particular the improved cooking stove. Renewable energy should primarily be developed through decentralised approach assuring local ownership either by community or individuals. Within the 10th plan period, HMG/N planned for 2, 50,000 ICS to be installed. These initiatives are supported by efforts to involve research and development institutions to develop cost effective appropriate models and designs, which could be disseminated in Mountains and Terai also (Biomass Energy in 10^{th} Plan-2003/2002 to 2007/2008).

1.3 Objectives of the Study:

The general objective of the study is to explore Socio-Economic and Environmental Impact of Improved Cooking Stoves (ICS) on Users however, the specific objectives of this study are:

a. To examine the socio-economic status of ICS users.
b. To assess the firewood consumption pattern before and after utilisation of improved cooking stove.
c. To assess the impact of improved cooking stove in the health & sanitation, social, economic and environmental status of the ICS users.
d. To assess the impact of work load on women and girls after using improved cooking stove.

1.4 Importance of the study:

This study has related to the socio economic and environmental impact assessment of rural areas of the Rukum District. Rukum District is one of the back blocked with high hill of the Rapti Zone. It is about 550 km far from Kathmandu and its lies on mid west region. Rukum is on the conflict affected District and here is nothing could be happened during the conflict period in development point of view. Before last three-four years many I/NGOs and Government Line Agencies have been working here in various development sectors. Though, the community peoples are still fighting against hunger, sickness, illiteracy and injustice. Here, another major problem is disaster it could be natural and men made. Here is high level of fuel wood consumed due to traditional rudimentary stove and increased air respiratory infection (ARI) especially in women and children, carbon emission and deterioration of natural resources. That's why, the researcher is more interested to analyzing, knowing and understanding the impact of promotion of improved cooking stove to improve environmental and health condition programme of the programme target area. This research is focused only in Jang VDC of Rukum District. This research has reflected the impact of programme to the both of implementing and funding organisation. It has given a status of socio economic, environmental and health condition of target community. It can be helpful for I/NGOs to build plans for the poor and marginalised community. The researcher is familiar with implementing organisation, funding organisation and programme target community. At the same time, there is not any research done before about the same programme. Thus, the researcher's interest on the issue and familiarity with the programme and target community; finally led him to choose this title and organization as the study area.

1.5 Conceptual Framework:

This research contains two major aspects: socio-economic; and health and environmental impact of the target community people of MIC-Nepal in Jang VDC. The term socio-economic means a system of social stratification. It refers

to a combination of various social and economic indexes of rank that are used in this research design.

1.6 Limitations of the Study:

This research work has done purely for an academic purpose. It shows that the status of ICS programme impact in Jang VDC of Rukum District. It was purely based on promotion of improved cooking stove programme and its target community of Jang VDC. The research cost was another constraint of the research in limited budget could not possible to carry out field survey in all ICS users house holds and only 38 house hold respondents were taken in randomly out of 188 ICS users. And the study has covered only 20% households' improved cooking stove users among the 188 house hold ICS users. However, the study will be reference for the students, researchers, development worker and any other people who will be interested to know and understand the impact of ICS programme in Jang VDC of Rukum. It may give one level of understanding to the readers about impact in socio economic and environmental and health condition of beneficiaries in Jang VDC.

- This study only focussed on the ICS installation in Jang, VDC of Rukum district.
- This study is only focused the problems and importance (prospects) of ICS in Jang, VDC of Rukum.
- Describing data in this study were based on primary as well as secondary data. Primary data were collected from the field area that is households survey, questionnaire, interview method, interview with key informants, observation method and the secondary data were also collected from journal, reports, bulletin, booklets, newspaper, unpublished journal, related official data etc.
- This study deals only socio-economic and environmental aspects but not the technical aspects of ICS 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.

1.7 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 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 Jang VDC, population, caste and ethnicity, education, economy, transportation and energy use.

Chapter five deals with presentation an analysis of data, family size, caste/ethnic group, sex group, educational status, occupation, landholding size, encouragement to install ICS, reason for ICS installation, source of investment, family benefits, increased living standard, impact of ICS, energy uses, consumption pattern of firewood before and after installation of ICS, firewood collection from the forest, impact of ICS household activities (time saving), time required for collection of firewood before and after installation of ICS, time required for cooking before and after installation of ICS, uses of time saving from cooking, financial benefits after utilization of ICS, economic impact of ICS, uses of saving for productive sector, impact of ICS for the improvement of health sanitation and environment, health impact, impact of ICs to clean the kitchen,

environmental impact, social impact, repair and maintenance, suggestion of ICS user about the ICS, satisfaction of ICS and ICS users request and suggestion for implementing organisation.

Chapter six concerned with summary, the main findings of the study areas, conclusion and recommendation. At the end of this thesis, references and appendix are presented.

CHPATER TWO

LITERATURE REVIEW

2.1 Review of the related literature

Literature Review is one of the important parts of any research work. For this thesis work some literature has 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 have been reviewed.

2.2 Sources of Energy

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

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

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

2.3 The history of ICS in Nepal:

History of ICS dates back to early 1950s with an introduction of some Indian models "Hyderabad and Magan Stoves". In the 1960s mould-based stove model developed by Department of Agriculture was disseminated. A number of institutions such as Peace Corps, UNICEF, Women Training Centre and RECAST[1] etc. have integrated ICS dissemination in their other development activities during 1970s.

During 1980s to address the pressing fuelwood problem, the government massively disseminated prefabricated ceramic ICS through FAO and UNDP assisted Community Forestry Development Project (CFDP). This effort was further complimented with the ICS field-testing and design modification by RECAST in 1982. Consequently Insert stoves came into picture.

Later in early 1990s, RECAST developed "Improved *Tamang* Stove" a mud stove model, which is cheap and could be produced at the local level by trained local person using locally available materials. This model was disseminated with new initiative, and with demand-driven, bottom up, participatory and need based approach. Emphasis was given on mass awareness creation and sensitization, for creating demand for ICS in this approach (Rajan Thapa & Moon Shrestha CRT/N).

The Indian stove models, the Hyderabad and Magan Chulo, were the first Improved Cooking Stoves, introduced in Nepal, during the 1950s. In the 1960s, an agro-engineering workshop in the Department of Agriculture developed a mould-based stove model, which was disseminated through the mid-1970s, a number of NGOs and GOs (Peace Corps, Women Training Centre, RECAST, and UNICEF) were involved in ICS research ad dissemination of the Lorena stove model. Unfortunately, lack of funding led to stagnation in stove dissemination. In the 1980s, HMG/The National Planning Commission addressed the fuel wood consumption issues in its sixth 5 year Plan, together with the introduction of Community Forestry. HMG initiated dissemination of ceramic pre-fabricated stoves, supported by FAO and UNDP. The ceramic inserts proved inappropriate to most areas of Nepal, since they were often breaking during long and complicated transportation in hill areas. Until l998, 95,000 ICS have been distributed or installed at various districts in the country. Out of this, about 57,000 ICS were distributed by the Community Forest Development Projects (CFDP). Apart from CFDP there are other organizations involved in the promotion of ICS. The other organization together promoted about 40,000 stoves in Nepal.

New initiatives for ICS dissemination have been underway since 1990s with new stoves design that can be built completely from cheap readily available local materials and changed approaches from top down, target oriented, subsidized approach to bottom up demand driven, self-construction approach..

To complement these efforts, National ICS Program has been initiated with the support of Energy Sector Assistance Programme (ESAP) of DANIDA. Similarly, Networking of ICS promoting organizations have also been undertaken with the support of ARECOP. In this initiative, Centre for Rural Technology (CRT/N) in

cooperation with various GOs, NGOs is coordinating Network strengthening activities. Alternative Energy Promotion Centre (AEPC) the government agency is supporting to further strengthen the Network activities. The status is that over 150,000 ICS have already been built and the observation is that there is a tremendous and growing demand for them. *(AEPC/CRT/N and ESAP National improved cooking stove dissemination in the mid-hill of Nepal, experiences, opportunities and lesson learnt 2003).*

2.4 Present Status of ICS in Nepal:

Despite more than forty years of ICS programme development implementation and research; ICS programmes in rural Nepal have been of limited success. Presently, some national and international organizations are still rather reluctant to enhance ICS programmes, and ICS related activities are given relatively low priority by development planners, managers and practitioners as well as by the rural communities themselves.

However, ICS developments have had a come back on the development agenda among government of Nepal and I/NGOs in Nepal, and there is now consensus abut the importance of ICS and the need of a new innovative approach to ICS dissemination, among potential stakeholders. Generally, the attitude and approach to ICS implementation has changed over the years from a supply-oriented, quantitative 'hardware' oriented approach, to more demand-oriented, qualitative 'software' –oriented approach *(Government policy and strategies of improved cook stove for dissemination in Nepal AEPC presentation paper Feb 2003)*

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study is based upon the basis of exploratory research design because the study was focused on to find out the impact of ICS on user and its benefit to them. Besides that the study tries to make an attempt to describe the condition of improved cooking stove and the findings are described. Likewise, this study is both descriptive and exploratory for obtaining the goal of the present study.

3.2 Selection of the Study Area

The present study was carried out in the Jang, VDC of Rukum District which is situated in the North-East part of Rukum District, here is highly deforestation and fire wood problems so significant potentiality of other ICS if remaining people are willing to install. This particular area is chosen for the study because this study area is heterogeneous in socio economic and cultural structure. This area has also affected from cholera in last year. So, this study is helpful to study the impact of ICS and effect of environmental protection. And the researcher is very much hopeful to get well knowledge about the improved cooking stove and its impact on users' household in the study area.

3.3 Universe and 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 ICS users' households of Jang VDC of Rukum District. There are altogether 188 house hold installed the ICS by the end of 2010 according to report of MIC-Nepal and UMN-Rukum Cluster. Among them (38 HHs) 20% households were selected for the study. Among the total population, selection of the household was chosen by the use of judgemental sampling method with quantitative techniques and questionnaire was structured.

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 improved cooking stove users 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, reports, presentation papers organizations related to alternative energy sector programme.

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 improved cooking stove user and observation method. And secondary data has also collected from various concerned agencies, books, journal, reports 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 ICS users. 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 questions were asked to the respondents and filled by the researcher.

3.5.2 Field Visit and 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 ICS were observed in the study area. The data were recorded while observing the ICS users households environment, burning improved cooking stoves, cooking time, kitchen rooms, cleaning pots, physical health, drinking water and its impact in health.

3.5.3 Key Informants Interview

Key informants have been interviewed to generate more reliable and confirm the data and information collection. This was helped to collect true data on the issues. Chairperson; vice chair person, secretary; treasure and EC members of MIC-Nepal, 3 person from staffs, 38 persons from target community groups with equal no of male and female who live in Jang VDCs of Rukum district was interviewed with structured questionnaires. The data was collected the based on selected respondents of improved cooking stove of Jang VDC.

3.6 Methods of 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, figures and percentage has also used. Data analysis was done in close supervision of the guide. In this study descriptive method has used to presenting the collected data.

3.7 Reliability and Validity of Data

Research study for its authenticity all the data collected must be valid and reliable. For this, first, this researcher has built a good rapport building with the EC members of the MIC-Nepal, who were helped to reach in selected study area. A structured questionnaire for the personal interview has been used only after the pre-test. Interview and focused group discussion is made the data more reliable and valid. The secondary data is also used to check the validity and reliability of the empirical data collect. This researcher's personal opinions and exaggeration is avoided to a great degree possible.

CHAPTER FOUR

INTRODUCTION TO THE STUDY AREA

4.1 Geographical Setting of Jang VDC.

Rukum district is one of the back-warded District lies in the Mid-west Region of Nepal. The District head quarter Musikot Khalanga is 128 km north from the Tulsipur Dang and it is one of the District of Rapti Zone. The Nepal Human Development Index Report shows that the Rukum is 64^{th} position of overall development among the 75 districts. Chaurjahari is the lowest place (754 mt.) and highest mountain peak Sisne Himal is (6000 mt.) meter from the sea level.

The Rukum district lies in the latitude 28^0.29"- 29^0.0" and longitude 82^0.12"-82^0.53". The political Boundary of the Rukum District covers in East Baglung and Magdi, West Jajarkot, North Dolpa and South Salyan and Rolpa Districts. There are 2 no of constituencies 11 Ilaka and 43 VDCs.

The present research study has been carried out in Jang VDC, of Rukum District, map of the study area is presented in (refer figure-1) which lies in southern part from the District head quarter. The Jang VDC lies in between the Ranmamaikot

VDC in East, Saniveri River in South, Pwang VDC in West and Sisne VDC in North.

Figure No. 1 MAP OF THE STUDY AREA

4.2 Population

Of the total population in the District, Jang VDC occupies 2538 total population among them 1297 are male and 1241 are female (source: District Development Profile of Nepal 2004). The present study area is heterogeneous in the caste and ethnic composition. Some of the castes of this VDC are Magar, Chettri, Thakuri/Malla and Dalit (Kami/Damai). Among the total population most of them in the VDC speaks Nepali language and the ethnic group such as Magar speaks their own Kham Magar language.

4.3 Caste and Ethnicity

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

Table No 4.1 Caste and Ethnicity

Caste/ethnicity	Total Population: 2538
Chettri	1000
Magar	808
Malla/Thakuri	625
B.K.(Kami)	72
Others	33
Total	**2538**

Source: DDC profile Analysis 2063/064

4.4 Education

Regarding the context of education the VDC have been facilitated one secondary school, five primary schools and one lower secondary school. But the VDC has not facilitated the Higher Secondary School and Campus. The VDC has been facilitated one Sub- Health post since the VDC have not enough health facilities. Educational status of the VDC is not seems to be satisfactory. The average literacy rate of the VDC has 35% only and male literacy 50% and female literacy rate has only 29%. But now the literacy rate is increasing because of national literacy campaign programme. In the past it is difficult to get higher education because of access of higher

educational institution. Now the educational status of the VDC is improving due to the rapid awareness among the people of the VDC.

4.5 Economy

Agriculture is the main source of income and way of livelihood among the people of Jang VDC study area. More than 85% of the people are still depending upon agriculture for their survival. Beside that occupation few people are working as a teacher and some are gone to foreign labour in Middle East countries. Being an agricultural area, the VDC hasn't possible to Irrigation in all the VDC area due to up land and steep. Farmer of the VDC produces mainly Maize, Wheat, almond, orange and potatoes. But due to the lack of market and access of transportation facilities farmers are couldn't be an entrepreneur's and their production is only confined to the household consumption.

4.6 Transportation

Transportation is regarded the vehicle or backbone for the development. Transportation facility of Jang VDC is not possible to next some decade due to remoteness and rocky structure of the VDC. The nearest road head is one day walking distance far from the Jang VDC. The study area people's main transportation means is only one mule transportation and it is too expensive for them. The transportation trail is very dangerous for man and mule too.

4.7 Energy Use

Electricity Facilities in the Jang VDC has not got now and will not possible to get for next some years. Among the total population in the VDC all the people were using firewood for cooking rice and there is no other alternative option except firewood. Being a rural remote VDC the using firewood rate is high. So, they have not other option except adopting improved cooking stove by the user is increasing day to day. The reason behind that are the various benefits of improved cooking stove to the household activities. It also saves the time of firewood collection, saving time of cooking and saving expense for firewood and reduces expenses of medical treatment and medicine. Because of increasing awareness programme and regular advertisement through the MIC Nepal staff. There were 188 improved cooking stove installed according to the MIC Nepal project report 2011. Now the installation rate of

improved cooking stove is rapidly increasing in the Jang VDC. And MIC Nepal is ready to announce the model VDC of improved cooking stove in Jang VDC.

Table No 4.2 Ward wise ICS installations in Jang VDC.

S.N	Ward No.	No of ICS
1	1	57
2	2	44
3	3	14
4	4	39
5	5	9
6	6	13
7	7	12
Total		188

Source: MIC Nepal Project Report, 2011.

The above table shows that in the Jang VDC ward no 1 has maximum number of ICS installed and ward no 5 has installed minimum number of ICS than the other wards. According to MIC Nepal project report ward no 8 and 9 is too cold and improved mud cooking stove is an inappropriate so it is need to install improved iron cooking stove.

CHAPTER FIVE

DATA ANALYSIS AND INTERPRETATION

5. Socio-economic status of improved cooking stove (ICS) owners

5.1.1 Age Group

Age of the sampled respondent of Improved Cooking Stove owners are given below

Table No 5.1. Age group of the Sampled Respondent

SN	Age Group	Frequency	Percentage
1	20-30	10	26.32
2	30-40	12	31.58
3	> 40	16	42.10
	Total	38	100

Source: Field Survey, 2011.

Of the total sampled respondent household of the ICS owner 38, the above table shows that of the total respondent household 20-30 age groups occupies 10 (26.32%) ; 30-40 age group occupies 12(31.58%) and similarly 40 to above age groups occupies 16(42.10%). The minimum age of the sampled respondent is 20 and the maximum age of the ICS owner is 66.

5.1.2. Sex Group

Distribution of ICS owner respondent household by sex are given below,

Table No. 5.2 Distribution of ICS owner respondent household by sex

S.N.	Sex Group	Frequency	Percentage
1.	Male	14	36.84
2.	Female	24	63.16
	Total	38	100

Source: Field Survey, 2011.

Of the total sampled respondent household of the Improved Cooking Stove owner 38, 14(36.84%) were male Improved Cooking Stove Owner and 24(63.16%) were female Improved Cooking Stove Owner. The above table shows high percent of the Improved Cooking Stove owner respondent were female.

5.1.3 Occupation:

Agriculture is the main occupation of the ICS owner. Apart from agriculture, some of the respondent of the improved cooking stove (ICS) owner were also engaged in teaching and other small business profession.

Table No 5.3 Occupation of the respondent improved cooking Stove owner.

S.N.	Occupation	Frequency	Percentage
1.	Agricuture	34	89.47
2.	Teachcer	4	10.53
	Total	38	100

Source: Field Survey 2011.

Of the total sampled respondent household, the above table shows that the higher percentage of improved cooking stove owners were engaged in agriculture for the livelihood of the total respondent of Improved Cooking Stove owner 34(89.47%) were engaged in agriculture and 4(10.53%) of the respondent of improved cooking stove owner were engaged in teaching profession and small business as their occupation.

5.1.4 Caste/ Ethnic Group:

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

Table No. 5.4 Distribution of ICS owner by caste

SN	Caste	Frequency	Percentage
1	Thakuri/Malla	12	31.58
2	Magar	16	42.10
3	Chhetri	6	15.79
4	Dalit (Kami/Damai)	4	10.53
Total		38	100

Source: Field Survey, 2011.

The above table shows that the Majority of the household under the study area were Magar (Janjati) of the total sampled respondent household of the Improved cooking stove owner Magar occupies 16(42.10%), Thakuri/Malla occupies 12(31.58%), Chhetri occupies 6(15.79%) and Dalit(Kami & Damai) occupies 4(10.53%). The reason of the higher percentage of Magar, Improved Cooking Stove owner Magars were found in the study area are, they were large scale than other caste and back-warded in social, economic and education.

5.1.5 Family Size:

The size of the family of Improved Cooking Stove users respondents' households are presented in the table below

Table No. 5.5 Family size of the ICS users respondent households

S.N	Family Size	Frequency	Percentage
1	<5	8	21.05
2	5-8	26	68.42
3	>8	4	10.53
Total		38	100

Source: Field Survey, 2011.

The above table shows that among the total respondent household 8 (21.05%) household occupies less than 5 family members, similarly 26(68.42%) household occupies 5-8 family members and 4 (10.53%) household have more than 8 family members. The minimum numbers of household was 3 and maximum number of family household was 11.

5.1.6 Educational Status

Distributions of the sampled respondent ICS owner by education are presented in the table below:

Table No 5.6. Distribution of the sampled respondent ICS owner by education.

S.N.	Educational Group	Frequency	Percentage
1.	Literate	26	68.42
2.	Illiterate	12	31.58
	Total	38	100

Source: Field Survey, 2011.

Of the total sampled respondent household 38 the above table shows that among the improved cooking stove owner household 26 (68.42%) respondent were literate and 12(31.58%) respondent of the improved cooking stove owner were illiterate. The above table clearly shows that in the study area still more than 31% respondent were illiterate among the total respondent. There is higher percentage of literacy level in the study area of the total improved cooking stove owner but still remaining a large number of improved cooking stove owner are illiterate.

5.1.7. Land Holding Size

According to the respondent Land holding size of the Improved Cooking Stove owner are given below

Table No 5.7 Land holding size of the respondent households

S.N.	Land holding size in (Ropani)	Frequency	Percentage
1.	10-20	6	17.65
2.	20-30	10	29.41
3.	30-40	14	35.29
4.	> 40	8	17.65
	Total	38	100

Source: Field Survey, 2011.

Agriculture is the main occupation of the improved cooking stove 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 38 respondents, 6 (15.79%) has 10-20 Ropani of land 10 (26.32%) respondent has 20-30 Ropani, 14 (36.82%) respondent has 30-40 Ropani land and 8(21.05%) respondent of the improved cooking stove owner has above 40 Ropani of land. The sampled respondent 6(15.79%) had 10-20 Ropani minimum size of land and 8(21.05%); respondent had maximum more than 40 Ropani of land.

5.2.1 Encouragement to Install Improved Cooking Stove:

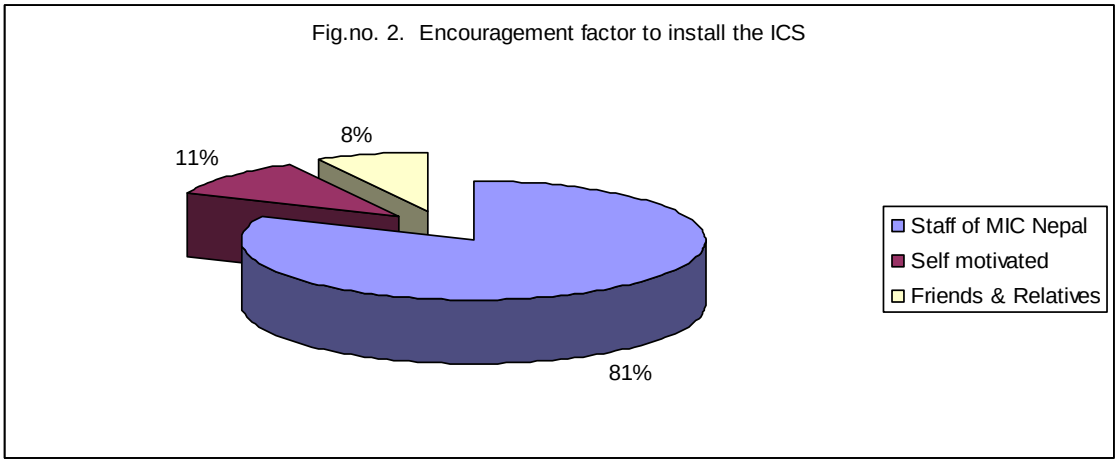
It is needless to say that applied improved cooking stove is more beneficial than the traditional rudimentary stove. The source of encourage to installed the improved cooking stove can be presented in the following table.

Table No 5.8 Encouragement factor to install the ICS:

S.N.	Encouragement Factor	Frequency	Percentage
1.	Staff of MIC Nepal	31	81.58
2.	Self motivated	4	10.53
3.	Friends & Relatives	3	7.89
	Total	38	100

Source: Field Survey, 2011

Figure No 2: Encouragement Factor to Install the ICS



Of the total sampled respondent household, the above table shows that 4(10.3%) household have installed ICS motivated by them, 3(7.89%) household have installed ICS through the motivation from the relatives& friends and 31(81.58%) household installed ICS through the convincement of staff of MIC Nepal. The above table shows that maximum number of Improved Cooking Stove owner were motivated to install to ICS through staff of MIC Nepal and it shows the level of awareness to installed ICS is needed to raise up in potential community in future.

5.2.2 Reason for Improved Cooking Stove Installation

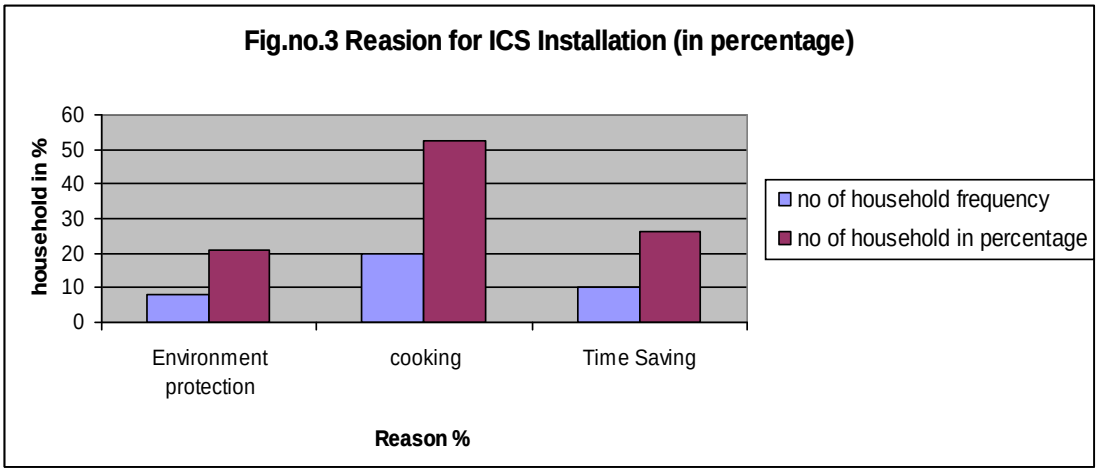
The reason for installation of improved cooking stove can be presented in the table below:

Table No. 5.9 Reason for improved cooking stove installation

S.N.	Reason	Frequency	Percentage
1.	Environment protection	8	21.05
2.	cooking	20	23.07
3.	Time Saving	10	19.23
	Total	38	100

Source: Field Survey, 2011.

Figure No 3: Reason for ICS installation.



Of the total respondent the above table shows that 8(21.05%) households were installed Improved Cooking Stove for environmental protection purpose. 20(52.63%) household of the ICS owners were installed improved cooking stove for cooking purpose and 10(26.32%) household ICS owners were installed improved cooking stove for time saving.

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

5.2.3. Source of Investment:

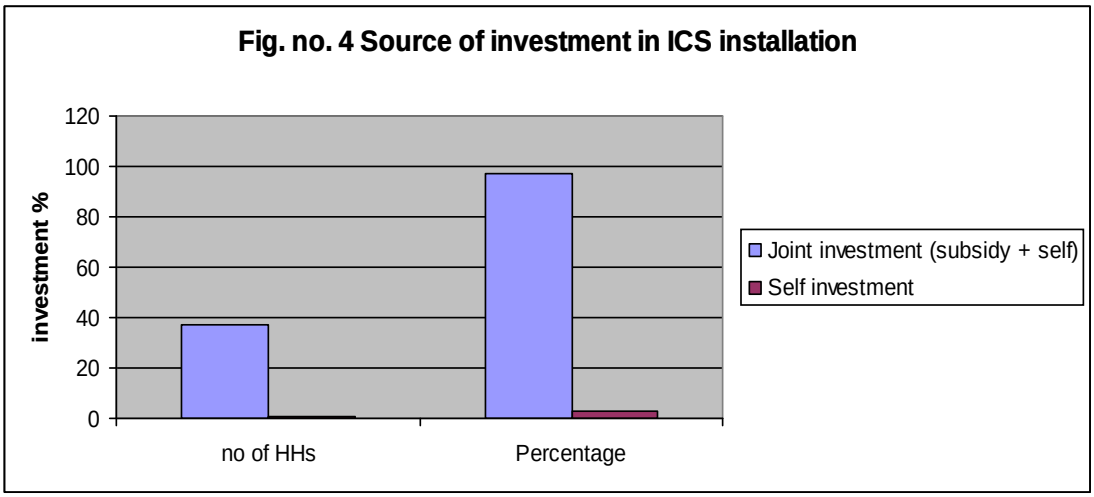
In the study area of the total respondent that there were two source of investment to install the improved cooking stove. They were subsidy + self Investment and self investment. The source of investment can be presented in the table below.

Table N0. 5.10: Source of Investment

S.N.	Source	Frequency	Percentage
1.	Joint investment (subsidy + self)	37	97.37
2.	Self investment	1	2.63
	Total	38	100

Source: Field Survey, 2011.

Figure No. 4: Source of investment in ICS installation.



The above table shows that of the total respondent household of the improved cooking stove owner 37 (97.37%) household were installed ICS through the joint investment (subsidy + community contribution) and 1 (2.63%) respondent household of the ICS owner was installed ICS through the own self investment.

5.2.4. Family Benefit

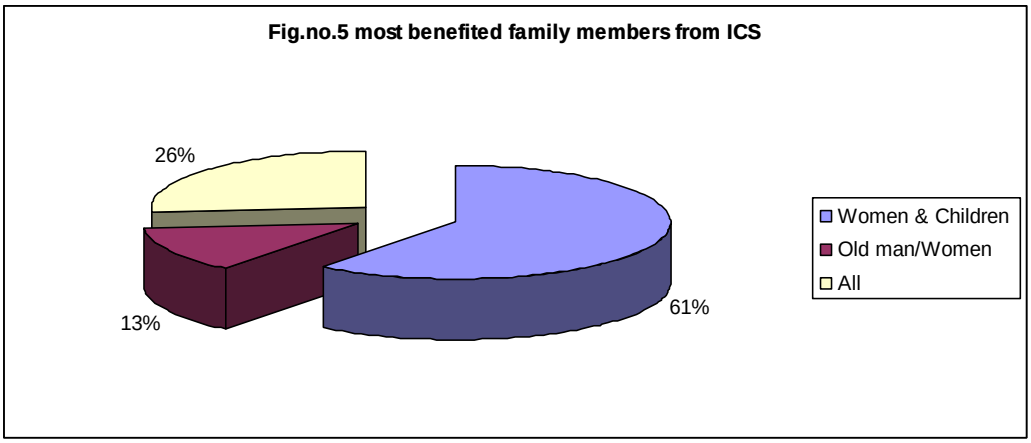
Of the total sampled respondent household, they responded that there were maximum benefits to the member of the family. The benefits of improved cooking stove to the family are presented below.

Table No. 5.11: Family Benefit

S.N.	Benefit for the family	Frequency	Percentage
1.	Women & Children	23	61%
2.	Old man/Women	5	13%
3.	All	10	26%
	Total	38	100

Source: Field Survey, 2011.

Figure No. 5: Benefited family.



The above table shows that of the total respondent of the household 23(61%) household responded that mostly women and children were benefited from the improved cooking stove, 5 (13%) household responded that improved cooking stove is benefited to the old man/women in the family. Similarly 10(26%) household responded that all member of the family were benefited by the improved cooking stove. The above table shows mostly women and children were benefited because of smokeless household environment for cooking and reading. So that it can say more or less all member of the family were benefited through the improved cooking stove.

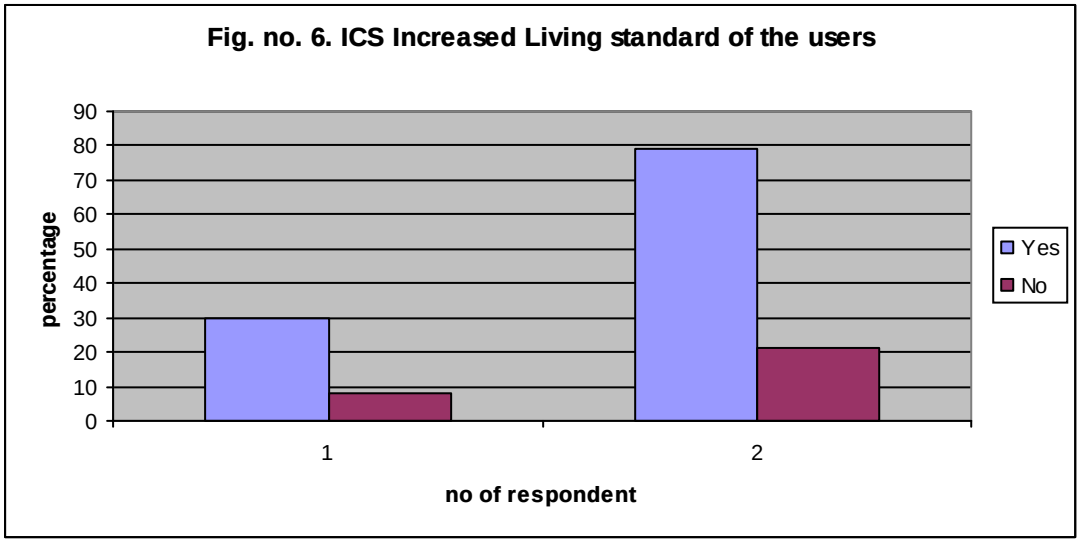
5.2.5. ICS Increased living standard:

Table No. 5.12 Increased living standard of ICS users.

S.N.	ICS increased living standard	Frequency	Percentage
1.	Yes	30	78.95
2.	No	8	21.05
	Total	38	100

Source: Field Survey, 2011.

Figure No. 6: Increased living standard of ICS users.



The above table shows that of the total respondent of the household, 30(78.95%) household responded that increased living standard of the ICS owner from the improved cooking stove and 8(21.05%) household responded that improved cooking stove is not increased the living standard of the ICS owner. So that it can say increased living standard of the ICS owner through the improved cooking stove.

5.3 Impact of Improved Cooking Stove:

The socio-economic and environmental impacts of ICS on users household are described below:

5.3.1 Use of Energy for Cooking and lightning:

Of the total respondent household are used the types of energy for cooking and lightning purpose as presented the table below,

Table No. 5.13: The table shows the energy use for cooking and lightning:

S.N.	Types of energy	Cooking		Lightning	
		Frequency	Percentage	Frequency	Percentage
1.	Firewood	38	100	0	0
2.	Solar	0	0	30	78.95
3.	Kerosene	0	0	8	21.05
	Total	38	100	38	100

Source: Field Survey, 2011.

The above table shows that of the total respondent of the household, 38(100%) household responded were used firewood energy for cooking and there are no other energy option for cooking. Of the total respondent of the 30(78.95%) house hold ICS users were used solar energy for lightning and the 8(21.05%) house hold of ICS users were used kerosene for lightning. In the Jang VDC no electricity and bio-gas energy were used.

5.3.2 Workload of women and girls in firewood collection

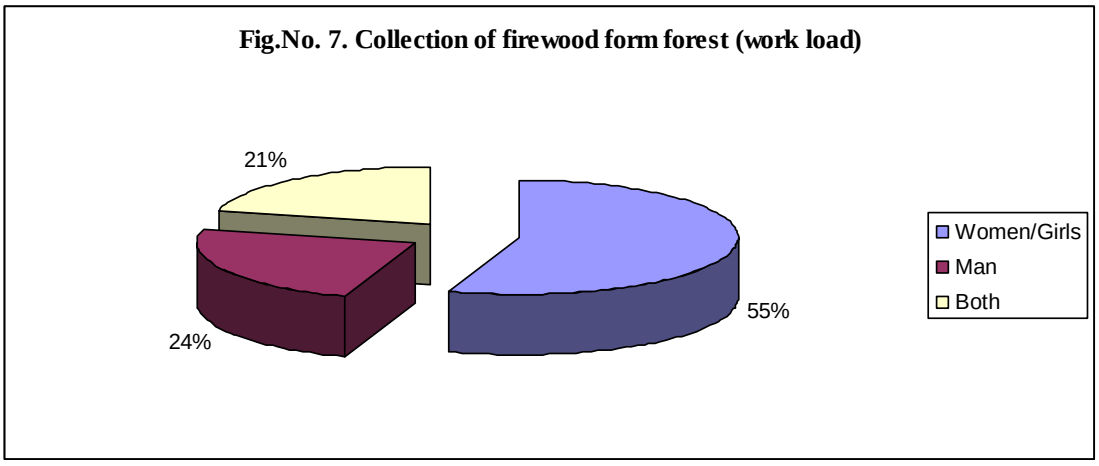
Of the total sampled respondent household, they responded that they were collected firewood from the forest are presented in following table.

Table No. 5.14: Reduced workload of women and girls in firewood collection.

S.N.	Collection of firewood	Frequency	Percentage
1.	Women/Girls	21	55%
2.	Man	9	24%
3.	Both	8	21%
	Total	38	100

Source: Field Survey, 2011.

Figure No. 7: Reduced workload of women and girls in fire wood collection.



The above table shows that of the total respondent household 21(55%) house hold of Women and Girls were collected firewood from the forest. Of the total respondent house hold 9(24%) house hold man were collected fire wood from the forest and similarly 8(21%) house hold were both (women/man) collected fire wood form the forest. So that, above table clearly shows women and girls have heavy work load than man. And the ICS supported to reduce the no of fire wood collection time and save their time too. The girls were got a time for preparation of school homework as a reading and writing.

5.3.3 Consumption Pattern of Firewood before Installation of ICS.

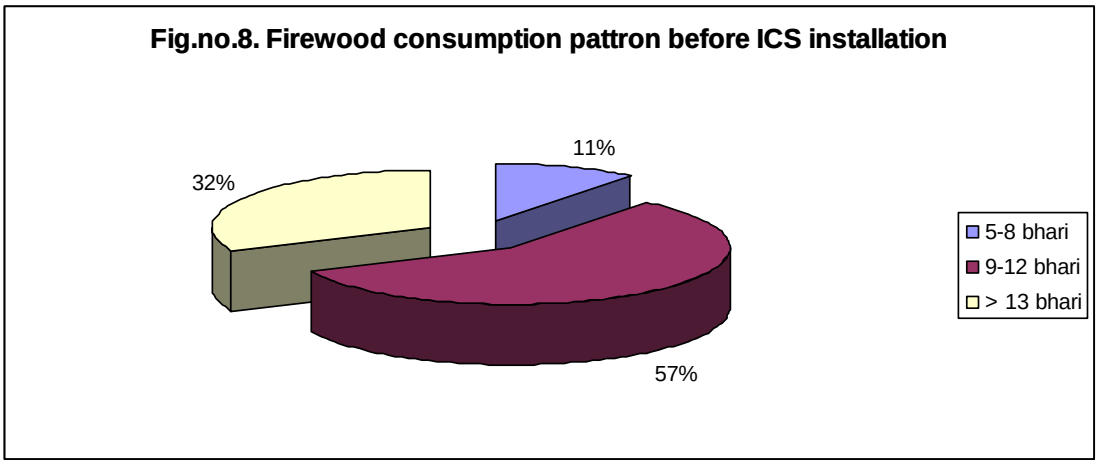
The patterns of firewood consumption before installation of ICS per month are presented in table below:

Table No. 5.15: Consumption pattern of firewood before installation of ICS.

S.N.	Firewood (Bhari)	Frequency	Percentage
1.	5-8	4	10.53
2.	9-12	22	57.89
3.	> 13	12	31.58
	Total	38	100

Source: Field Survey, 2011.

Figure No. 8: Fire wood consumption pattern before ICS installation.



The above table shows that of the total respondent household per month 4(10.53%) consumed 5-8 Bhari firewood for cooking before installation of ICS of the total respondent household 22(57.89%) household consumed 9-12 Bhari firewood similarly 12(31.58%) household were consumed more than 13 Bhari firewood per month for cooking.

5.3.4 Firewood Consumption Pattern after Installation of ICS.

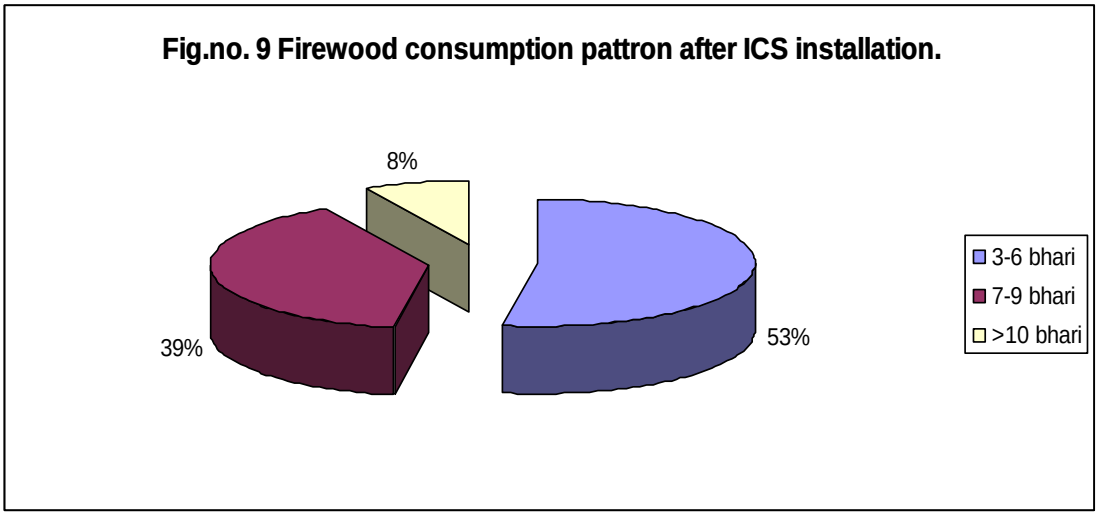
The patterns of firewood consumption after installation of ICS per month are presented in table below:

Table No. 5.16: Firewood consumption pattern after ICS installation.

S.N.	Quantity of firewood per month in (Bhari)	Frequency (No. of household)	Percentage
1.	3-6	20	53
2.	7-9	15	39
3.	>10	3	8
Total		38	100

Source: Field Survey, 2011.

Figure No. 9: Firewood consumption pattern after ICS installation.



The above table shows that of the total respondent household 20 (53%) household were used 3-6 Bhari firewood, 15(39%) household were used 7-9 Bhari firewood and 3(8%) household are using more than 10 Bhari firewood. The table shows that there were great positive changed in the firewood consumption pattern after the installation of improved cooking stove.

5.4 Impact of ICS on Households Activities (Time saving)

Impact of a ICS on households activities can be said, there are different positive impact of Improved Cooking Stove such as time saving for cooking, saving time for firewood collection, saving expenses for buying kerosene etc.

5.4.1 Time Required for Collection of Firewood before Installation of ICS.

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

Table No. 5.17: Workload of women and girls before ICS in firewood collection.

SN	Time required in hours (per week)	Frequency	Percentage
1	1-3 hours	14	36.84
2	4-6 hours	18	47.37
3	7-9 hours	6	15.79
	Total	38	100

Source: Field Survey, 2011.

The above table shows that of the total respondents households 14 household (36.84%) has spent 1-3 hours time for the firewood collections. 18 respondents' households (47.37%) have spent 4-6 hours time for the collection of firewood. Similarly 6 houses hold (15.79%) respondents have spent 7-9 hours time for collection of firewood per week.

5.4.2 Reduced workload from firewood collection after ICS installation.

According to the sampled respondents have used to spent their time for collection of firewood after the installation of ICS. The following table shows the time required after installation of ICS for the respondent household.

Table No. 5.18: Workload of women and girls after ICS in firewood collection.

S.N	Time required in minutes (per week)	Frequency	Percentage
1	30-59 Minutes	12	31.58
2	1-2 hours	20	52.63
3	> 3 hours	6	15.79
	Total	38	100

Source: Field Survey, 2011.

The above table shows that of the total respondent households 12 household (31.58) percent were used to spend 30-59 minutes time for the collection of the firewood collection per week. 20 house hold (52.63) percent were used to spend 1-2 hours time for the collection of firewood per week. Similarly, 6 houses hold (15.79) percent respondent households were used to spend more than 3 hours time for collection of firewood per week. That shows that there were vast differences in fire wood collection time between before and after the installation of improved cooking stove. So that the ICS users saved their more firewood collection time and used in other productive house hold work. Especially in women and girls workload was reduced due to reduction 50% of time in firewood collection.

5.4.3 Time Required for Cooking before Installation of ICS

The time required before installation of improved cooking stove on the users is presented below according to the respondent households.

Table No. 5.19: Time required for cooking before ICS installation.

SN	Time required for cooking(In minutes)	Frequency	Percentage
1	90 per day	4	10.53
2	120 per day	14	36.84
3	>120 per day	20	52-63
	Total	38	100

Source: Field Survey, 2011.

The above table shows that of the total sampled respondent households 38, about 4(10.53) household has used 90 minutes time for cooking before installation of improved cooking stove, about 14(36.84%) respondents household have used 120 minute time for cooking. Similarly 20 (52.63%) households have consumed more than 120 minutes time for cooking. So that it can be said that there were maximum time consumed for cooking before installation improved cooking stove.

5.4.4 Time Required for Cooking after Installation of improved cooking stove.

Of the opinion of improved cooking stove owner respondents household the views of them can be presented in the table below.

Table No. 5.20: Time required for cooking before installation of ICS.

S.N.	Required time/day (in minutes)	Frequency	Percentage
1	45	8	21.05
2	60	16	42.11
3	75	14	36,84
	Total	38	100

Source: Field Survey, 2011.

The above table shows that, of the total sampled respondent households about 8(21.05%) respondents household have consumed 45 minutes time for cooking after installation of improved cooking stove per day. About 16(42.11%) respondents household have consumed 60 minutes time for cooking per day. Similarly 14 (36.84%) respondents household have consumed 75 minutes time for cooking. So the above table shows that there was positive impact of time consuming for cooking in each household of improved cooking stove owner's household.

5.4.5 Uses of Saving Time from Cooking

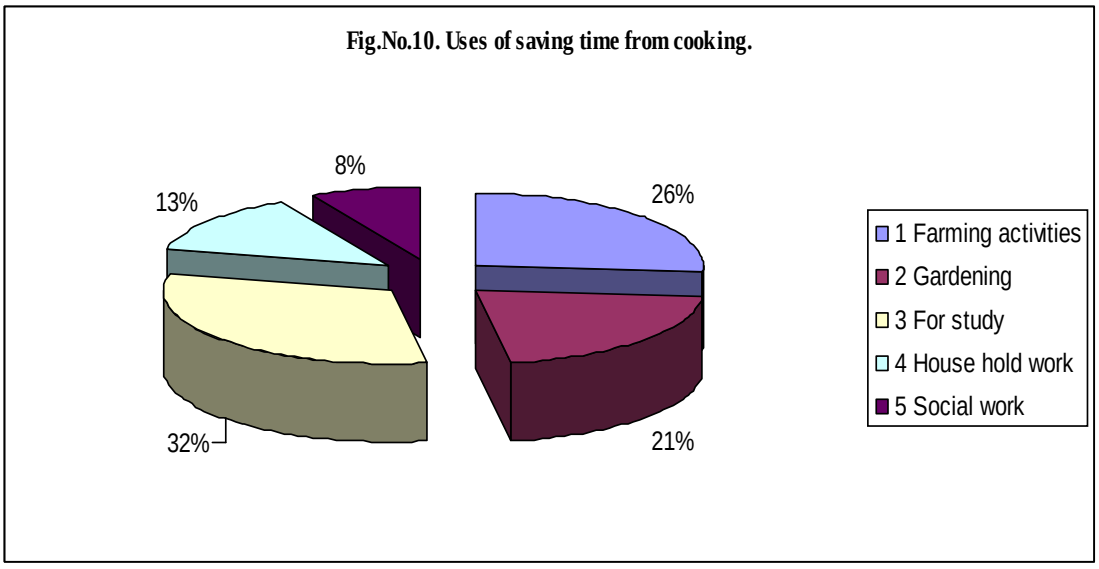
Of the total respondent household uses of saving time from cooking were managed and utilized by the improved cooking stove owner can be presented in table below.

Table No. 5.21: Uses of saving time from cooking.

SN	Activities	Frequency	Percentage
1	Farming activities	10	26.32
2	Gardening	8	21.05
3	For study	12	31.58
4	House hold work	5	13.16
5	Social work	3	7.89
	Total	38	100

Source: Field Survey, 2011.

Figure No. 10: Use of saving time from cooking.



The above table shows that of the total respondent household 38, about 10(26%) respondents have utilized the saving time by doing farming activities. About 8 (21%) respondents household have utilized the saving time by doing gardening activities. About 12(32%) respondents household have utilized the saving time for study. Similarly 5(13%) respondents of the total household have utilized saving time in house hold work, and about 3(8%) respondents household have utilized saving time in social work. 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 improved cooking stove:

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 from buying kerosene, soap, medicine and health treatment expenses and utilized such saving money for productive sector in the households.

5.5.1 Economic Impact of Improved Cooking Stove.

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

Table No. 5.22: Economic impact of improved cooking Stove.

S.N.	Saving	Frequency	Percentage
1	Saving expense in kerosene	5	13.16
2	Saving expense in soap	25	65.79
3	Saving expense in medicine and health treatment.	8	21.05
	Total	38	100

Source: Field Survey, 2011.

The above table shows of the total respondent household 38, about 5(13.16%) households were saving the expense for buying kerosene. Similarly 25(65.79%) households were saving the expense for buying washing and bathing soap and

8(21.05%) respondents household were saving the expense for buying medicine and health treatment. This shows that there were some amounts of money saving for invest in such sector, through the installation of improved cooking stove.

5.5.2. Uses of Saving time for Productive Sector

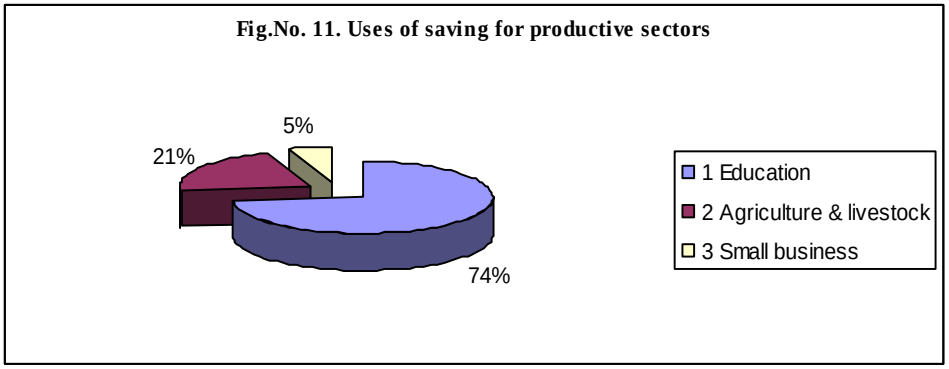
It is needless to say that according to the respondent of the ICS owner household saving amount of money is utilized for the productive sector of the household activities by the ICS owner households. The purpose of utilization such saving is presented in the table below according to the respondent of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

Table No. 5.23: Uses of saving time in productive sector.

SN	Utilization of saving money	Frequency	Percentage
1	Education	28	74%
2	Agriculture & livestock	8	21%
3	Small business	2	5%
	Total	38	100

Source: Field Survey, 2011.

Figure No. 11: Use of saving time in productive sectors.



The above table shows that of the total respondent household, maximum 28(74%) 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(21%) respondent of household were investing such saving money for agricultural and livestock production. Because, the study area under study is the agriculture oriented area. Similarly only small portion 2(5%) households have utilized such saving money in small business for earning money.

5.6 Impact of ICS on Improvement of Health, Sanitation, social and Environment:

It is needless to say that there were positive impacts of ICS on the users household of improved cooking stove in the study area. According to the sampled respondent the impact of ICS are given here.

5.6.1 Health Impact

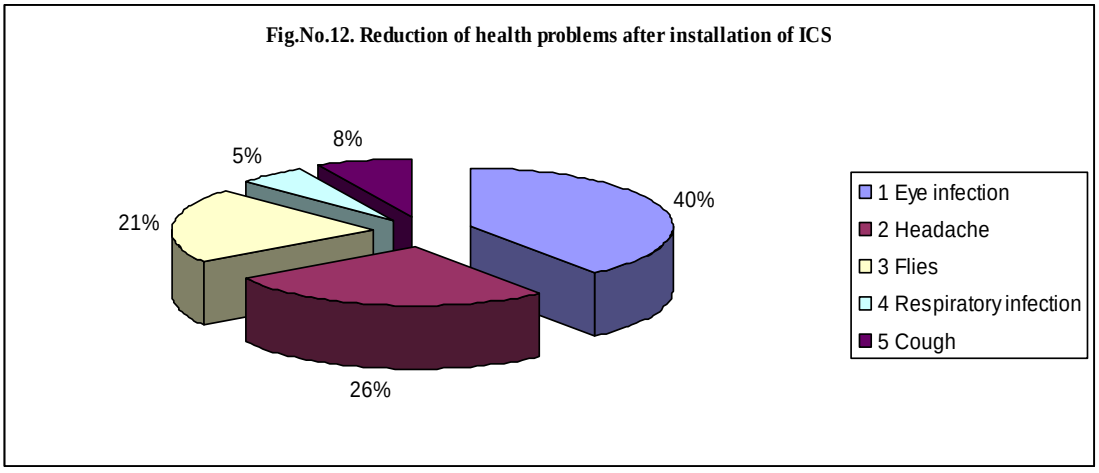
Health is most essential requirement for the long life of the people. According to the sampled respondent of the Households of ICS users health impact in the family after installation of Bio-gas plant is presented in the Table below.

Table No. 5.24: Reduction of health problems after ICS installation.

SN	Reduce health problems	Frequency	Percentage
1	Eye infection	15	40
2	Headache	10	26
3	Flies	8	21
4	Respiratory infection	2	5
5	Cough	3	8
6	Total	38	100

Source: Field Survey, 2011.

Figure No. 12: Reduction of health problems after ICS installation.



The above table shows that, of the total respondents of the respondent households 15 (40%) respondent of the households have suffered from eye infection. About 10(26%) of respondents of the house hold have headache problem. Similarly about 8(21%) respondent of the household have suffered from flies. And 2(5%) of the respondent household have suffered from the problems of respiratory infection. Similarly 3(8%) respondent households have suffered from the problem of cough.

The above table shows that of the total respondent household most of the household have suffered from the problem of the eye infection. But, according to the key informants' opinion, there were overall positive impact in the household after installation of improved cooking stove for the improvement of health to all members of the family.

5.6.2 Impact of improved cooking stove to clean the Kitchen

It is needless to say that improved cooking stove has helped to clean not only the environment of household but also the outdoor environment such as controlling deforestation by reducing the use of firewood for cooking.

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

5.6.3 Environmental Impact

It is needles to say that improved cooking stove is helped to degrade the environment from a rural perspective the use of ICS has helped significantly improve the indoor air quality of homes employing improved cooking stoves by replacing the traditional rudimentary stoves. This is fact that improved cooking stove consumed less firewood and save forest. And it is helped to reduce land slide, drought and other natural disasters automatically. The level of awareness of ICS users was raised and they are started to reforestation in near to their home and jungle. The total of sampled

respondents are responded most of the ICS users were started to improve water resources and used purified water. And after installation of ICS they never used to traditional stoves for cooking purpose. It has also helped to make smokeless environment in the kitchen for cooking. So, that different disease was removed after installation of ICS in the household of ICS owner. From a National perspective, improved cooking stove system has helped to reduce deforestation. This in turn has important implication for watershed management and soil erosion. So that, above information shows that ICS supported to improve environmental situation and made positive impact of Jang VDC.

5.6.4 Social Impact

According to the respondent of the ICS users' household, there were different impacts of ICS after installation of improved cooking stove in the household. They were respondent that after installation of improved cooking stove in the respondents' household the social status of the family has risen. Among the respondent of the ICS users some of them were engaged in social work like a women empowerment activities, school management committee, community forest users group committee and community improvement committee etc. Due to the clean social environment in the study area majority of the respondent were satisfied with the ICS 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 ICS users household, some respondent responded that they were engaged in different committees and organisations and hold different position in different organisations as a executive committee members or as a general members so community people started to respect them and asked to them about the impact of the improved cooking stove. Due to the improved cooking stove they can saved time from cooking and collecting firewood from the forest and increased their involvement in various social activities. They can keep their clean house environment and it's supported to them to be more healthy and maintained personal hygienic. So that, the improved cooking stove supported to ICS users to uplift their social status and made positive impact in their life.

5.7 Suggestion and Repair and maintenance of ICS

5.7.1 Repair and maintenance of ICS

Through the study of the total 38 sampled respondent household, majority of the improved cooking stove users' household were satisfied from the utilisation of ICS. Instead of that, according to some of the respondent there was needed occasional maintenance in the outlet chimney of the improved cooking stove and sometimes blocked outlet chimney and created smoky environment inside the kitchen room. But the MIC-Nepal promoted 12 no of local people as ICS promoters and they were supported to repair and maintenance in problems of improved cooking stove.

5.7.2 Suggestion of improved cooking stove User about the ICS.

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

According to majority of the respondents, the ICS is more feasible source of energy in the study area and provides long-term benefits by investing minimum 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, it saves cooking time and firewood collecting time. And they also suggested that ICS technology is simple, easy, using local materials and more suitable with environment, because it also helps to control environment degradation and also maintained the ecology by controlling deforestation. So that, improved cooking stove is more appropriate for poor and marginalised community, because it is cheap, easy to use, consume less firewood, protect from various sort of disease and local people can make easily it. And the most of the respondents strongly suggested to all remaining community people need to install improved cooking stove as soon as people and they suggested to programme implementing organisation too, to scale-up the ICS installation programme in surrounding communities and VDCs in future.

5.7.3 Satisfaction of the ICS Users from ICS

According to the sampled respondent of the ICS users' household, almost ICS users' household were satisfied with the installation and utilisation of ICS. According to them ICS is more feasible, reliable alternative source of energy for cooking in household as a sustainable way. It is cheap and more appropriate technology for rural communities in environmental protection, safe from various communicable diseases, controlling deforestation and saving times. So that, all respondent house holds were fully satisfied from the ICS installation and utilisation.

5.7.4 ICS Users' request and suggestion for Implementing Organisation.

Most of the sampled respondent households were suggested to implementing organisation (MIC-Nepal) in future need to expand ICS programme in remaining wards and other neighbouring VDCs. And need to add more integrated community development programme such as sanitation, income generation, small safe drinking water system and small irrigation programme alongside ICS programme.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary and Findings

The study attempts to explain the socio-economic and environmental impact of improved cooking stove on users in Jang VDC of Rukum District. And the objectives of the study were

a. To examine the socio-economic status of ICS users.
b. To assess the firewood consumption pattern before and after utilisation of improved cooking stove.
c. To assess the impact of improved cooking stove in the health & sanitation, social, economic and environmental status of the ICS users.
d. To assess the impact of work load on women and girls after using improved cooking stove.

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 Magh to Fagun 2067, B.S. Purposive judgmental sampling methods 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 38 respondent households from 188 universe households of improved cooking stove 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:

After installation of ICS in the study area, there was considerable reduction in the workload of the members of the family especially women and Girls.

Most of the ICS owners are very much satisfied with their improved cooking stove. The main attractions towards installation of ICS were easy to install in minimum cost, it can make by local materials through local promoters, reduce work load of family members especially women and girls. The improved cooking stove is very easy to use. It reduces health problems, such as eye infection, respiratory infection, cough,

and headache. And have not faced any difficulties and found smokeless environment in the kitchen.

Agriculture is the main occupation of the majority of respondents about 89.47 percent respondents households are engaged in agriculture.

Of the total respondents of the improved cooking stove owner households 36.84 percent were male and 63.16 percent were female ICS owners.

Of the total sampled respondents household of the improved cooking stove users majority of ICS users were Magar 42.10 percent, Thakur/Malla 31.58 percent, Chhetri 15.79 percent and 10.53 percent were Dalit (Kami/Dami).

Among the total sampled respondents households age of improved cooking stove is that 26.32 percent households were 20-30 age group, 31.58 percent households were 30-40 age group, and 42.10 households were more than 40 years age group

Of the total respondents, of the respondent 10.53 percent were installed improved cooking stove through the self-motivation and 81.58 percent respondents were installed ICS through motivation of MIC-Nepal Staff. So that MIC-Nepal staff is well facilitated community awareness programme in ICS installation.

Of the total sampled respondents 81.58 percent respondents have installed ICS through the Joint investment of MIC-Nepal ICS programme subsidy and community contribution. So it shows that minimum level of subsidy is needed for community motivation to install ICS.

In the study area, after installation of improved cooking stove firewood consumption pattern was highly reduced in the respondent households of ICS.

Investment pattern of money for buying kerosene, soap, medicine and health treatment expenses were also reduced after installation of ICS in somewhat extent.

In average, per households high amount of time was saved for collection of firewood after installation of improved cooking stove because the ICS consumed low firewood.

The time required for cooking in the sampled respondents household before installation of ICS was 10.53 percent households required 90 minutes, 36.84 percent households required 120 minutes and 52.63 percent households required more than 120 minutes per day. But after installation of ICS only 21.05 percents household required 45 minutes, 42.11 percent required 60 minutes and 36.84 percent household

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

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

In the study area, of 38 sampled ICS user respondents' households' majority of respondents household have saved some amount of money for buying kerosene, soap, and medicine and health treatment expenses after ICS installation.

And, in the study area that net saving amount of money respondents households of ICS users were invested 74 percent for educational activities.

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

After installation of ICS in respondents' household, the use of firewood was reduced by about 50 percent than before installation of ICS. It was helped to deforestation of Jungle and save environmental degradation. And it was helped to clean the kitchen environment as well as outdoor environment too.

6.2 Conclusion

No doubt, improved cooking stove has been proved to be a viable technology especially for the households cooking in rural areas. The impact of ICS 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, respiratory infection etc. The ICS programmed has now become one of the most successful programmes 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 ICS 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 Jang VDC of Rukum district about the impact of improved cooking stove.

The outcome of the study shows that most of the sampled of the ICS users' households were positive about the installation of CIS.

The required time they used to spent for firewood collection is saved and that saving time is utilized by the ICS users household for their agricultural activities and some social activities too.

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

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

The study shows that after utilization of ICS using pattern of firewood consumptions for cooking were highly reduced.

The study shows that of the total sampled respondents, majority of the ICS users household were installed ICS through the joint investment programme subsidy and community contribution and some ICS users house holds installed ICS through self-investment and self-motivation.

The study shows after installation of ICS by the respondent users' households, they always used improved cooking stove for cooking. So, it has significantly improved the indoor air quality of houses applying improved cooking stoves in the place of traditional rudimentary stoves. That significantly helped to control environmental degradation by controlling deforestation.

6.3 Recommendation

Based on the finding of the study, following recommendations have been presented. So that, the concern organisation related to ICS should take essential required steps to further implement ICS alongside integrated community development activities to obtain desired positive and sustainable impact in the study area.

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

To increase the no of the ICS for the poor and marginalized rural people in the study area, this makes easy to access to get ICS installation support.

After installation of ICS, frequent supervision and monitoring from MIC-Nepal is necessary. Therefore, MIC-Nepal should make orientation to ICS users household on operation and maintenance that helps to ICS users household for repair and maintenance in any kind of problem regarding the ICS.

REFERENCES

CRT, (1999) *Inventory and Assessment of Improved Cooking Stove (ICS) Activities in Nepal.* Kathmandu.

SEECON (1999). *Final Report on Baseline cum Needs Assessment Survey for Improved Cooking Stoves.* Kathmandu.

Sulpiya, K.M. (1996). *A study of Performance and Emission Factors of Heating and Cooking Stove at high altitudes; a case study in Nepal*. RECAST T.U. Kathmandu.

Shrestha, S.P. (1997). *Impact of Improved Cook Stoves on Forest Conservation:* A case study of Phujel VDC, Gorkha District. Institute of Forestry, Tribhuvan University Pokhara.

Reid, Holy, F. et al. (1986). *Indoor Smoke Exposures from Traditional and Improved Cook stoves*: *Comparison among rural Nepalese Women*. Mountain Research Development, vol. 6. No. 4. Kathmandu.

Sharma, S. et al. (91991). *An Assessment of Energy in Nepal: Implication for the Planning and Management of Rural Energy*. Kathmandu.

District Profile. (2062). *Map in Rukum 2062/ Rukum*: Deurali Offset Press, Patalisadak Kathmandu.

Rukum District Profile (2062). *Rukum District Profile Analysis Fiscal Year 2064/065* Rukum: Deurali Offset Press, Putalisadak Kathmandu.

Evaluation Report. (2010) UMN. *Impact of Improved Cooking Stove Promotion Programme Evaluation Report 2010. United Mission to Nepal (UMN), Rukum Cluster/Rukum*. UMN monitoring and evaluation team. Kathmandu.

CBS, (2004). *District Development Profile of Nepal 2004.* Kathmandu.

District Development Plan, (2067/068). *Integrated Annual District Development Plan of Rukum District, Fiscal Year 2067/068.* Rukum.

HDI Report, (1998). *In Nepal Human Development 1998.* Nepal South Asia Centre.

CRT/N, (2008). *Annual Report of Centre for Rural Technology, Nepal (CRT/N) 2008*. CRT/Kathmandu.

NG, (2002). *Biomass Energy in 10th Five-Year Plan (2002/2003 to 2007/2008).* HMG/Nepal.

Appendix - I

Interview Questioners

Socio-Economic and Environmental Impact of ICS on Users

Structured Questionnaire

1. General Introduction:

Name of the ICS owner: … … …. …. … … … … … … …

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

Age: … … … … … … … … … … Sex: … … …

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

Religion: … … … … …. … …

1.1. Family size:

(i) Nuclear family (ii) Joint family

Male … … … Female … … … Total … … …

1.2 Status of Education:

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

1.3 Land ownership pattern of the family

Total Land		**Cultivated Land**		**Uncultivated Land**	
Ropani	Aana	Ropani	Aana	Ropani	Aana

2. Information and Advantage of ICS:

2.1 Who encouraged you to install the ICS?

(i) Staff of MIC-Nepal (ii) Govt.-Agencies (iii) Self-Motivated (iv) Friends & Relatives

2.2 When did you install the ICS? … … … Year … … … Month

2.3 In what reason did you install the ICS?

(i) Environment Protection (ii) Cooking

(iii) Time saving

2.4 What is your source of investment for installation of ICS?

(i) Subsidy (ii) Self investment

(iii) Joint investment

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

(i) Women & Children (ii) Older man/women

(iii) All

2.6 Do you think that ICS has increased your living standard?

(i) Yes (ii) No

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	Solar

3.2 Who usually work to collect the fire wood from jungle/forest?

(i) Man (ii) Women/Girls (iii) Both

3.3 How much fire wood did you require per month before and after the installation of ICS.

Firewood	**Before**	**After**
Firewood in (bhari/Kg.)		

(1 bhari = 45 kg.)

4. Time saving pattern of Improved Cooking Stove users.

4.1 How much time did you spend per week to collect firewood before the installation of ICS?

(i) … … … …Hour (ii) … … … …Minutes

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

(i) … … … …Hour (ii) … … … …Minutes

4.3 How much time did you spend for cooking before installation of ICS?

(i) … … … …Hour (ii) … … … …Minutes

4.4 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 work

(v) Social work

5. Financial benefits after the utilization of ICS.

5.1 In your opinion, what is the economic impact of ICS?

(i) Saving expense in Soap

(ii) Saving expense in Medicine

(iii) Saving expense in firewood

(iv) Saving expense in kerosene

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

(i) Small business (ii) Education

(iii) Agricultural and livestock (iv) Lending money

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

6. Impact of improved cooking stove 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 ICS?

Respiratory infection	Yes	No
Cough	Yes	No
Eye infection	Yes	No
Tuberculosis	Yes	No
Headache	Yes	No
Flies	Yes	No

6.2 Do you believe that installation of ICS has helped to clean the kitchen?

(i) Yes No

6.3 Do you believe that installation of ICS has helped to control the environment degradation?

(i) Yes No

7. Repair and maintenance

7.1 Do you have any difficulty for the maintenance of ICS?

(i) Yes No

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

7.2 Do you have some suggestion about the Improved Cooking Sotve for those people who are willing to install? Please specify.

(i) … … … … … … …

(ii) … … … … … … …

(iii) … … … … … … …

7.3 Are you fully satisfied with the Improved Cooking Stove?

(i) Yes No

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

THE END

Appendix- II

Field Observation Checklist

1. Social Attitude and behaviour:

a. Food and nutrition:

b. Personal health and hygiene

c. Toilet use:

d. Clothing

e. Women participation in social activities

f. Family behaviour towards women:

g. Use of improved cooking stove

2. Physical observation:

a. Source of drinking water

b. Plantation/Deforestation

c. Toilet

d. Type of house

3. Facilities:

a. Telephone/mobile,

b. Radio/tape recorder

c. TV/Film hall

d. Computer

e. Electricity

f. Road Access

g. Hospital

h. +2/Campus

i. Market centre