Status of Improved Cooking Stoves (ICS) in Rural Nepal

A Case Study of Nareshwor VDC of Gorkha, District

A Thesis Submitted to

Central Development of Rural Development

Tribhuvan University,

In Partial Fulfilment of the Requirements for the

Degree of Master of Arts (M.A.)

In

Rural Development

Submitted by

Shobha Basnyat

Central Department of Rural Development

Tribhuvan University, Kirtipur, Kathmandu

T.U. Reg. No: 7-1-285-146-2000

Roll No: 281151

March, 2017

Declaration

I hereby declare that the thesis entitled **"Status of Improve Cooking Stove (ICS) in Rural Nepal. A Case Study of Nareshwor VDC, of Gorkha District"** submitted to Central Department of Rural Development, Tribhuvan University, is entirely my original work prepared under the guidance and supervision of my supervisor. I have made due acknowledgements to all ideas and information borrowed from different sources in the course of preparing this thesis. The result of this thesis have not been submitted anywhere else for the award of any degree or for any other purposes. I assure that no part of the content of this thesis has been published in any form before.

Shobha Basnyat

Name of student

TU.Reg.No:7-1-285-146-2000

Date: 3-12-2073

Recommendation Letter

The thesis entitled **"Status of Improve Cooking Stove (ICS) In Rural. A Case Study of Nareshwor VDC Gorkha District"** has been prepared by **Shobha Basnyat** under my guidance and supervision. I hereby forward this thesis to the evaluation committee for final evaluation and approval.

.....

Ratna Mani Nepal

Supervisor

Date: 16 –03-2017

3 -12-2073

Approval Letter

The thesis entitled **"Status of Improve Cooking Stove (ICS) in Rural Nepal. A Case Study of Nareshwor VDC** Gorkha District" submitted by Shobha Basnyat in the partial fulfilment the requirement for the Master's Degree (M.A.) in Rural Development has been approved by the evaluation committee.

Evaluation Committee

…….

Dr. Prem Sharma

Department Head CDRD

……

External Examiner

……

Ratna Mani Nepal

Supervisor

Date: 8-12-2073

21 March 2017

ACKNOWLEDGMENTS

I am very grateful to my thesis supervisor Ratna Mani Nepal lectures, Central Department of Rural Development, Tribhuvan University for his guidance and supervision. I was benefited from his guidance during the course of the study and comments on the various drafts of the thesis.

I would like to express my sincere thanks to Dr. Prem Sharma, Head of Department, Central Department of Rural Development for providing me the opportunity to undertake this study.

I also like to thank my friend Pramila Maharjan for her incessant support on different aspects of the dissertation preparation.

Also, I am highly indebted to Nareshwor VDC secretary Mr. Nanda Prashad Tiwari, teacher Bishnu Hari Aryal, Darim Bota Mahila Samuha and ICS technician Mrs. Sushila Aryal.

I also thankful to my husband Mr. Biken Bogati and my sons Reejan and Richard Bogati and my father and mother for their inspiration and support. I am grateful to Pramila KC for her technical support.

I am also want to thankful to all the respondents of Nareshwor VDC ward no. 4 for their contribution to complete my study.

ABSTRACT

The study entitled was carried out in Nareshwor Village Development Committee (VDC) of Gorkha district on the topic, Impact of cooking Stove (ICS) in Rural Nepal. In this topic we try to analyse the financial requirement and cost of ICS, also try to identify health impact on women and children and lastly try to identify causes of drop out of ICS user of the study area.

For the study, Improved Cooking Stoves (ICS) installed households were selected randomly including both men and women. The study cover only one ward i.e. 4, of Nareshwor VDC.The study was based on primary as well as secondary sources of information. The secondary information was collected from previous researches, journals, publications and related materials of ICS. The research technique included household survey, interview with key informants and field observation.

A total of 50 respondents were selected. Literacy rate of the respondents was fairly satisfactory. Mostly people of Nareshwor VDC are engaged in agriculture sector. A large population of the respondent has income of 12000-15000. The people of Nareshwor VDC have accepted improved cook stoves. Majority of them have been using 2 holes type of ICS. Shree Swarna Integrated Community Development Centre seen as main motivators to install ICS in Nareswor VDC.

Most of the respondents said that maintenance was not required since the installation of ICS.Status of ICS is visible in Nareshwor VDC. It has been able to save fuel wood per month. Majority of respondents of the study area found Chettri. Respondents use ICS for different purpose for eg. Cooking, boiling water, making liquor, animal food etc.

Time is also saved in improved cooking stoves in comparison to TCS. ICS also helped to reduce frequency of fuel wood collection since the fuel wood consumption has reduced. Most of the respondents brought fuel wood from community forest.

The health problems in women and children were reduced resulting less medical expenses.

Reduction in fuel wood collection, illegal tree felling and decreased in fire wood sale help to conserve forest, so forest seen denser in Nareshwor VDC. The utensil are easy to clean as it does not make utensil much black as in traditional cooking stove and it takes less time to clean. Kitchen and surrounding environment also remain net and clean according to the respondents of the study area. Thus, the impact of the ICS is seen positive in Nareshwor VDC.

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List of Abbreviations

ADB/N	Agriculture Development Bank/ Nepal
AEPC	Alternative Energy Promotion Centre
ARECOP	Asia Regional Cook Stove Program
CARE/Nepal	Co-operative for Assistance and Relief Everywhere
CBS	Central Bureau of Statistics
CDM Clean	Development Mechanism
CFDP	Community Forestry Development Project
CRT/Nepal	Centre for Rural Technology
EJ	Exajoule
FAO	Food and Agriculture Organization
GHG	Green House Gas
GJ	Giga Joule
GoN	Government of Nepal
GOs	Government Organization
GW	Giga Watt
HMG/N	His Majesty Government/ Nepal
IAEE	International Association for Energy Economic
ICS	Improve Cooking Stove
ICSPs	Improve Cooking Stove Programmes
IEC	Information Education and Communication

INGOs	International Non-Government Organization
IUCN	International Union for Conservation of Nature
Kcal/Kg	Kilo Calorie/ Kilogram
LPG	Liquefied Petroleum Gas
MoF	Ministry of Forestry
NGOs	Non-Government Organization
NPC	National Planning Commission
PCRW	Production Credit for Rural Women
RCUP	Resource Conservation and Utilization Project
RECAST	Research Centre for Applied Science and Technology
REDP	Rural Education and Development Programme
RETs	Renewable Energy Technology
SFDP	Small Farmer Development Project
SSICDC	Shree Swarna Integrated Community Development Centre
TCFDP	Terai Community Forest Development Project
TCS	Traditional Cooking Stove
TERI	Tata Energy Research Institute
UMN	United Mission Nepal
UNDP	United Nation Development Programme
UNICEF	United Nation International Children's Emergency Fund
USA	United Nation of America
WDD	Woman Development Division
WECS	World energy Consumption

CHAPTER ONE

INTRODUCTION

1.1 Background

Nepal is a sovereign independent country situated in the foot hills of the Himalayas in South Asia with an area of 147,181 sq. km. It is located between 26°22'N to 30°27'N latitude and 804°' to 881°2' E longitude. The location of latitude within 35 degree from the equator means it is a favourable environment for solar energy resources, because of low diffuse radiation at higher altitude and increasing albedo factor due to snow. This landlocked country is bordered by India in the east, south and west and by China in the North with about 800 km of Himalayan range as shown in figure 1 below. The altitude varies from 70 meters to almost 8,848 meters showing potential for enormous hydropower generation. The country has been divided into 5 development regions containing 14 administrative zones, 75 districts and 3,913 village development committees at the ground level.

1.1.1 Energy Status

More than 80% of the country's population live in rural areas and are meeting their energy needs from traditional resources (87%), such as fuel wood, agricultural residue, cattle dung etc (WECS, 2011). Energy supply and balance statistics show that the major consumption of energy in Nepal is in the domestic sector, whereas the major supply of energy comes from biomass, of which fuel wood is the dominant energy source, as it covers 77 percent of the total biomass energy supply in Nepal. The other energy supply sources like non-renewable (oil and gas) and renewable energy cover 11.76 percent and 0.53 percent respectively of the total energy supply (WECS, 2011).

One of the interesting facts is that although Nepal is blessed with natural resources and a steep gradient topography, it has harnessed only 650 MW of 43,000 MW (1.51%) of technically and economically feasible potential of hydropower (Nepal Ministry of Finance 2011, 164-175). It does not have any fossil fuels suitable for power generation.

1.1.2 Renewable Energy

The large proportion of the population from rural areas and their massive dependence on traditional energy resources show that the rural sector is the most important sector for the implementation of the concentrating development programs to accelerate the country's development index. The low consumption level of imported energy shows that the industrial activity is very low whereas household energy dominates the major energy portion of the market. Due to the geographical terrain, it will cost massive investment and time to link rural areas with the national grid. Based on this fact, the government started to promote locally available environmentally friendly renewable energy resources in Nepal which are more affordable to those rural populations, helping to raise the rural economy. The National Planning Commission (Nepal National Planning Commission 2008) stated in its report that there is technically feasible potential of 50MW micro hydro power, 1132.7 MW of solar energy (considering 5% of the area potentially suitable @ 4-5 kWh/sq.m/day) and 1.9 million biogas plants.

The Government of Nepal (GoN) has established the Alternative Energy Promotion Centre (AEPC) in 1996 for the promotion of renewable energy technologies in Nepal. The main programmes are micro hydro, solar and biomass (bio-diesel, cooking stoves, and biogas). Currently, AEPC is coordinating with Ministries, GOs, donors, INGOs, NGOs, the private sector and stakeholder/user groups to make policy recommendations to the government. For the small scale RE deployment, it acts as a one door channel for the mobilization of funds. There are different programs under AEPC funded via unilateral, bilateral donor organizations (AEPC, 2010) which will be discussed in detail in different journals and booklets.

The GoN has subsidized almost all of these renewable energy technologies through the "Rural Energy Policy 2006" revised in 2006 and 2009. The supporting policies are "Subsidy Policy for Renewable (Rural) Energy" and Renewable (Rural) Energy Subsidy Delivery Mechanism" (AEPC, 2010). The Subsidy Policy defines objectives as well as the types, level of subsidy and the delivery mechanism (AEPC, 2010). Since the programme is running since last 15 years, there is a need for the evaluation and Analysis

of the Impacts of Subsidies on Small Scale Renewable Energy Technologies Dissemination in Nepal (AEPC, 2010).

1.2 Statement of the Problem

The people in rural area are using conventional form of energy like fuel wood, animal dung and agricultural residue. This conventional method of energy consumption is not suitable for rural people as it has a lot of negative impacts on the life of rural people. Firstly the rural people have little access to the source of energy like hydroelectricity. In addition to this, looking at the economic status of the country, it seen hard to install plants for the production of the energy. The geographical structure of the country also seem to be obstacle for the installation of the infrastructure to enable the rural people to meet the needs of energy, the renewable source of energy which can be installed through fewer budgets and can be affordable by the rural people should be given more importance. Some of the renewable source of energy are being developed in the rural area like solar energy, micro hydro power, wind energy, biomass energy etc.

Due to the rapidly growing population, the demand of firewood is increasing in rapid rate. The population growth rate is 1.35 per annum (CBS, 2011). On the other hand fossil fuel are too much expensive and the infrastructure to ensure their availability is lacking increasing the supply the bio-mass fuels, and using them more efficiency will be vital task in the coming years. A rural person in Nepal heavily depends on biomass such as fuel wood, agriculture residues, cattle dung etc. to meet their domestic energy needs. The traditional stoves has been observed over consume these low grade but cheap and readily available biomass fuels resulting into excessive pollution of the indoor environment (air and sanitation) and poor family health especially those of women and children. Incomplete combustion in the traditional cooking stoves results into emissions of greenhouse gas, which has adverse effect on human health too. In this context, ICS can play important role for efficient utilization of fuel wood in terms of saving the quantity of fuels and cooking time reduction in health hazards and greenhouse gas emission, and lowering the pressure on forest for fuel wood extraction (TRUST, 2006).

This study focused on these problems of Nareshwor VDC-4 of Gorkha District, which are as follow,

So, in general, this study has attempts to find out the real sequences of energy crisis and people moments accordingly to the energy demand specially, the present study has tried to explain following research questions.

i. What is the financial requirements and costs of ICS?

ii. What is the health impact on woman and children after installation of the study area?

iii. What are the causes of drop out of ICS uses?

1.3 Objective of the Study

The general objective of the study has to assess the Impact of ICS in health of women and children of Nareshwor VDC of Gorkha District. However, the specific objectives were given below.

a. To analyses financial requirements and costs of ICS

b. To identify health impact on woman and children

c. To identify the causes of drop out of ICS user.

1.4 Significance of the Study

The growing scarcity of firewood and other consequences resulting from forest depletion, the search of alternative energy source is seen very crucial. Forests are now being rapidly depleted by indiscriminate and disproportionate felling of trees and illegal encroachment for settlements and agricultural purpose. As forest resources become scarce, the balance between what people need and what they can obtain would shift. As a result, people has to struggle to survive that becomes harder. The study is very important for understanding and identifying the changes in the status, way of living and activities of ICS user household in the study area. Assessment of the impacts of ICS users, their

activities, their capacities and understanding on utilization of ICS will certainly be helpful in Clean Development Mechanism (CDM). The outcomes of the study will be of great importance to policy makers to formulate appropriate plan for further development of the appropriate technology that better sots the rural people needs from is and every aspects.

1.5 Limitation of the Study

The study mainly focuses on assessing impact of ICS on health of women and children, fuel wood consumption, saving of cooking time, impact on environment. The study tried to assess impact on social and economic aspect only so the technical aspect of the ICS is lacking. And secondary data have been collected from VDC office of Nareshwor and Gorkha Hospital of Gorkha district. The study was focused only on one VDC of Nareshwor VDC, Ward no-4. Therefore, the findings of this study may not be generalized in overall context of all places of Nepal and the study was conducted at a specific site with a limited sample.

1.6 Organization of the Study

This Study is divided into five chapters. The first chapter includes introduction, statement of the problem, objective of the study, signification of the study, assumption and limitation of study and organization of study. Likewise, the second chapter of study includes review of literature. Similarly, the chapter three includes research methodology which deals source of data and information, method of data collection, data processing and method of analysis. The chapter four deals description of study area, educational condition of HHS and problems on improved cooking stove in the study area. Finally the chapter five deals findings, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1. Conceptual Review

In this part researcher has collected different theoretical literature on improved cooking stove system in Nepal. Literature review gives many information and knowledge about the concerned study field which will be very important guidance to the new researcher to make the study systematic, scientific, objective oriented so it is the back bone of the study.

Energy is one of the basic needs of people. It is very important for our daily life particularly for the economic and overall development. In general, the energy consumption scenario of the world indicates that people largely depend upon non-renewable source of energy to meet their energy demand. This scenario is intense in most of the developing countries of the world. However, a positive symptom of using renewable source of energy looks to be developing and it is gradually replacing the use of non – renewable source of energy. In this context, the use of alternative technology looks much more relevant for the sustainable use of renewable source of energy for the human betterment. Energy consumption of a nation considered as an indicator of its development. This is because all survival and development activities directly and indirectly depend upon energy. It is an essential of human progress and prosperity. It is clear that the economic development of the country requires access to affordable and sustainable energy. The energy situation in Nepal has characterized by very low energy consumption per capita of 14.06GJ. The developed countries like USA and Canada constitute 5 percent of the world g countries consume energy i.e. less than 1GJ/person/year. This reality shows that the life style and living standard are closely relating to meet their energy needs. Thus, the developing nations have to think about different strategies and method to meet their requirement by utilizing the renewable energy sources available in their geographical area (WECS, 1994), population but consume one fourth of global Energy i.e. 300GJ per person/year.

The total energy demand of Nepal has estimated to be about 248 million GJ in 1990/91 and this has been increasing by an average of 2.4 percent per annum during the past 10 years. The total energy consumption in the year 1992/93 has estimated to be about 270 million GJ 91 percent. In other sector amount 91 percent of the energy demand is meet from traditional sources (i.e. fuel wood 68 percent, agriculture residues 15percent and animal dung 8 percent) the share of petroleum fuel, charcoal, and electricity in the total consumption are estimated to be7.21percentage and 0.9 percent respectively. Only about 12 percent of the total population have access to the electricity the rural population which comprise about 90 percent of the total population has very limited access to electricity 3 percent (WECS, 1994/95)

The amount and type of energy consumption also indicates the level of human development and living standard of the people to certain extent (Goldenberg, 1996). Nepal is one of the five least energy-consuming countries in the world (MoF, 2005). In this context Nepalese are not only economically poor but also their exits a state of energy in sufficiency, since major part of that is traditional resource like fuel wood that is used in most primitive way.

Energy sources of Nepal can be categorized into three main heads like as traditional, commercial, and renewable energy. In fiscal year (FY 2005/06), traditional, commercial, and renewable energies occupied 85.5percent, 13.54percent, and 0.61percent respectively of the total energy consumption. This indicates that the dependency of Nepalese economy on the traditional source of energy has not changed (WECS, 2003).

Traditional energy includes fuel wood agriculture residues and animal waste and share of consumption was 88.68 percent, 4.85 percent and 6.47 percent respectively, on the commercial energy side share of petroleum products was 68.54percent, coal 22.74percent and electricity consumption was 18.81 percent of total consumption of energy in FY 2005/06 (WECS,2003)

"Alternative Energy" is a kind of energy (physics) the capacity of a physical system to do work; the units of energy are joules or ergs. Energy derived from sources that do not use up natural resources or harm the environment. There are five types of

alternative energy a. solar power b. wind power c .natural gas d. tidal power e. biomass energy etc.

ICS is the reformed device of traditional cooking stove. Comparatively it consumes less fuel wood; it is easy to cook food, keeps the clean environment in kitchen room, and reduces the indoor pollution than the traditional cooking stove. Technically, it is simple and acceptable than the other stove like as LP gas, biogas, kerosene stove etc. the use of low-grade biomass fuel in traditional stoves leads to excessive levels of indoor air pollution. Women and children of rural and poor families are particularly exposed to the smoke emission. This is one of the reasons of higher rates of infant mortality in rural area. Release of incomplete carbon products in the atmosphere due to poor combustion of biomass fuel results greenhouse gas emission too (AEPC, 2000).

2.1.1. Energy

According to the Gottfried Leibniz proposed the idea of the Latin: vis viva, or living force in the late 17^{th} century, which defined as the product of the mass of an object. Its velocity squared; he believed that total vis viva was conserved. To account for slowing due to friction, Leibniz theorized that thermal energy consisted of the random motion of the constituent parts of matter, a view shared by Isaac Newton, although it would be more than a century until this was generally accepted. The modern analogue of this property, kinetic energy, differs from via viva only by a factor of two.

In 1807, Thomas Young was possibly the first to use the term "energy" instead of vis viva, in its modern sense, Smith, Crosbie (1998). Gustave-Gaspard Coriolis described "kinetic energy" in 1829 in its modern sense, and in 1853, William Rankine coined the term "potential energy". The law of conservation of energy was also first postulated in the early 19th century, and applies to any isolated system. It was argued for some years whether heat was a physical substance, dubbed the caloric, or merely a physical quantity, such as momentum. In 1845 James Prescott Joule discovered the link between mechanical work and the generation of heat.

Energy Situation in Nepal

Nepal is dominated by rural areas where 85% of the populations living in rural areas are poverty ridden and about 35% of the rural people are poor (CBS 2001). They are living below average life standard without enjoying even the basic amenities. Poverty in rural areas is reflected in low level of income, low level of literacy and poor health status. Poverty is also reflected in low level of energy use. Though total energy consumption is gradually increasing, per capita energy consumption remained more or less constant and it is about 145 Gega joules. Like other developing countries, Nepal is heavily dependent on traditional energy sources.

The heavy dependency on biomass energy, especially fuel wood, agriculture waste and cattle dung, particularly in rural areas has given rise not only to environmental degradation and irreversible consequences in the country, but also has caused the social burden on majority of the rural women and the large number of children who have to allot about 20% of the work time for fuel collection (Joshi et al., 2003). Similarly kerosene has given rise to economic burden as well as major health and environmental impacts. Therefore, there is a dire need to substitute as well as supplement the traditional energy supply system by modern forms of sustainable energy in terms of resources and technology. Because of the country's dependence on imported fossil fuel, high cost of grid connection and low and scattered population density, a decentralized renewable energy supply system becomes the natural and feasible choice which includes micro hydro, solar photovoltaic, biogas, ICS etc. And fortunately we also have immense opportunities for developing such renewable energy technologies.

2.1.2 Types of Energy

There are two types of energy conventional and non-conventional**.**

Conventional Source

The conventional sources of energy are generally non-renewable sources of energy, which are being used since a long time. These sources of energy are being used extensively in such a way that their known reserves have been depleted to a great extent. It is becoming increasingly difficult to discover and exploit their new deposits. It is envisaged at known deposits of petroleum in our country will get exhausted by the few decades and coal reserves are expected to last for another hundred years. The coal, petroleum, natural gas and electricity are conventional sources of energy.

Source Non-conventional

It is also known as a renewable energy source because this type of energy can continuously give power in the earth and it never end which are as follows:

Wind Energy: Wind power is harnessed by setting up a windmill which is used for pumping water, grinding grain and generating electricity.

Tidal Energy: Sea water keeps on rising and falling alternatively twice a day under the influence of gravitational pull of moon and sun. This phenomenon is known as tides.

Solar Energy: Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. AH other sources of energy draw their strength from the sun.

Geo-Thermal Energy: Geo-thermal energy is the heat of the earth's interior. This energy is manifested in the hot springs.

Energy from Biomass: Biomass refers to all plant material and animal excreta when considered as an energy source. Some important kinds of biomass are inferior wood, urban waste, bio-gases, farm animal and human waste.

Bio-energy

Biomass is biological material derived from living, or recently living organisms. It most often refers to plants or plant-derived materials which are specifically called lignocelluloses biomass. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of bio fuel. Conversion of biomass to bio fuel can be achieved by different methods which are broadly classified into: thermal, chemical, and biochemical methods. Wood remains the largest biomass energy source today; examples include forest residues – such as dead trees, branches and tree stumps, yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibres or other industrial chemicals, including bio fuels. Industrial biomass can be grown from numerous types of plants, including miscanthus, switch grass, hemp, corn, poplar, willow, sorghum, sugarcane, bamboo,

Agricultural waste is common in Mauritius (sugar cane residue) and Southeast Asia (rice husks). Animal husbandry residues, such as poultry litter, are common in the United Kingdom. Bio fuels include a wide range of fuels which are derived from biomass. The term covers solid, liquid, and gaseous fuels. Bio energy is renewable energy made available from materials derived from biological sources. Biomass is any organic material which has stored sunlight in the form of chemical energy. As a fuel it may include wood, wood waste, straw, manure, sugarcane, and many other by products from a variety of agricultural processes. By 2010, there was 35 GW (47,000,000 hp) of globally installed bio energy capacity for electricity generation, of which 7 GW (9,400,000 hp) was in the United States.

Types of Bio energy

There are different types of bio energy. They are liquid bio fuels, gas bio fuels and solid bio fuels.

Liquid Bio fuels

Bio liquids are liquid fuels made from biomass for energy purposes other than transport (i.e. heating and electricity). Bio liquids are usually made from virgin or used vegetable and seed oils, like palm or soya oil. These oils are burned in a power station to create heat, which can then be used to warm homes or boil water to make steam.

Gas Bio fuels

The most common kind of gaseous bio fuel is biogas or bio methane, which is composed mostly of methane and carbon dioxide and is produced from the anaerobic digestion or fermentation of biomass including manure, sewage sludge, municipal solid waste, biodegradable waste or any other feedstock. Biogas can either be burned to produce heat and electricity or purified to be used as a vehicle fuel, sometimes mixed with natural gas.

Solid Bio fuels

Solid bio fuels include wood, manure or charcoal burned as fuel as well as more recent innovations like high-density clean burning pellets. Solid biomass can be burned for heat or to produce electricity either by itself or as part of a co-firing power plant.

Solid Energy went into voluntary administration in August 2015.There are two type of solid energy which includes briquette and improved cooking stove.

Briquette

A briquette (or briquette) is a compressed block of coal dust or other combustible biomass material such as charcoal, sawdust, wood chips, peat, or paper used for fuel and kindling to start a fire. The term comes from the French language and is related to brick.

Some briquettes are compressed and dried brown coal extruded into hard blocks. This is a common technique for low rank coals. They are typically dried to 12-18percent moisture, and are primarily used in household and industry.

Improves Cooking Stove

Introduction

Improved cook stove (ICS) is a device that is designed to consume less fuel and save cooking time, convenient in cooking process and creates smokeless environment in the kitchen or reduction in the volume of smoke produced during cooking against the traditional stove. The direct and indirect benefits of ICS includes: increased thermal efficiency, the conservation of forests by cutback in firewood consumption, reduction in women's labour, reduction in indoor air pollution and hence smoke-released health disorders, prevention of fire hazards, reduction of cooking time.

Among the various technologies introduced in the realm of efficient household heating and cooking methods, stoves are the most popular and widespread in both urban and rural communities. Especially in developing countries, stoves occupy a central place in the health, environmental, economic and social domains of life. By improving the efficiency of wood burning stoves, the amount of toxic smoke produced can be reduced and health risks to the family be minimized. In view of these and other concerns, a good cooking stove is defined as one that meets technical, scientific and safety standards, and has high combustion quality, technical efficiency, minimal smoke emission, ergonomics and structural stability. Most sources cite the fuel-efficiency of traditional stoves as five to ten percent (Barnes et al., 1994).

Since about 1.5 billion people in the world use traditional stoves for cooking (and heating), efforts to improve the efficiency of cook stoves have been increasingly popular in the developing world. Improved stoves come in different forms and sizes. Improved Cook Stoves (ICS) can be designed and built in various ways, depending on the local conditions. At their simplest, ICS provide an enclosure for the fire to reduce the loss of radiant heat and protect it against the wind. In addition, attention can be given to methods of controlling the upward flow of the combustion gases, so as to increase the transfer of heat to the cooking pot. Many of these stoves are made of mud or sand since both are almost free and readily available.

In the developing countries, energy required for cooking often constitutes the biggest share of the total national energy demand and is normally met mostly by biomass.

Realisation that ICS can relieve pressure on biomass resources led to ICS programmes in most developing countries. A World Bank report cited137 ICS projects in 41 developing countries initiated during 1981-1991 (Barnes et al., 1994). In spite of the on-going and past projects, an ICS programme still remains important in the context of the developing countries. It is estimated that about 2.4 billion people burn biomass for cooking and heating. About half of these people use traditional stoves (Warwick and Doig, 2004). It is known that pollutants emitted from cook stoves cause serious indoor air pollution and have a negative impact on health of people in rural areas, particularly women and children. It is estimated that indoor air pollution due to combustion of solid fuels causes about 1.6 million deaths annually (Warwick and Doig, 2004).

Although the most effective way to address indoor air pollution created by smoke would be to switch to cleaner gaseous and liquid fuels (such as ethanol/methanol or bio gasification stoves), it is likely that for the vast majority of poor people, improved biomass-fired cook stoves will remain the most important option for many years to come. It is concluded that "[t]he improved biomass stove should be considered a new stepping stone between the traditional biomass stoves used by rural and urban poor families and the modern fuels and appliances mainly used by urban better-off households" (Barnes et al., 1994).

In Nepal, biomass energy: fuel wood, agro-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 increases 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 80percent 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. In

order to achieve reduction in indoor smoke / air pollution and increased fuel efficiency and protect the forest resources and environment, Improved Cook Stove (ICS) development and dissemination activities were initiated in Nepal from early 1950s with the introduction of some Indian models Hyderabad and Magan stoves. Since then, a number of Improved Cooking Stove Programs (ICSPs) have been promoted in rural communities of Nepal. In early 1970s, the focus was on improving the fuel efficiency of stoves. During 1980s, interest and efforts were revived when the National Planning Commission (NPC) included ICS in its development plan as an attempt to address the pressing fuel wood problem. The government's concern for fuel wood conservation was also reflected with the inclusion of ICS dissemination efforts as an important component of Food and Agriculture Organization (FAO) of the United Nations assisted Community Forestry Development Project (CFDP) in 1981.Besides, other donor organizations as well as International Non-Government Organizations (INGOs) initiated promotion and dissemination of ICS in various regions of Nepal with a top-down and supply driven approach. With the combined effort of the government and NGOs, basically through the community forestry development project, about 57000 ceramic prefabricated models of ICS were disseminated in different parts of the country.

However, the prefabricated model turned out to be not as appropriate as substantial breakage occurred during the prolonged and difficult transportation process in hills and mountain areas. Thus, ICS efforts in Nepal during 1980s delivered mixed results and limited successes. As an example of domestic applications in developing countries, China has established an exemplary programme to reduce indoor air pollution in rural areas by promoting clean cooking options through nearly total replacement of traditional biomass-fired stoves by ICS and biogas burning stoves. The use of networks for supplying producer gas for cooking has also been initiated, which increases the likelihood that major ICS programmes and clean cooking fuels will be initiated in other developing countries. In developed countries, improved wood heaters will similarly replace traditional fireplaces (IAEE 2009). Also, use of biomass-fired district heating systems is expected to grow in these countries as a part of national strategies to reduce Greenhouse Gas (GHG) emissions.

2.1.3. History of ICS in Nepal

Improved cooking stoves (ICS) programs started in early 1950s in Nepal. At that time "Hyderabad and Magan stoves" (an Indian model of ICS) were implemented as part of Village Development Services of the “Tribhuvan Village Development Program”. That program was ended in the early 1960s. After that number of organizations such as UNICEF, Peace Corps etc. have integrated ICS dissemination in their other development activities during 1970s.

In 1980s the National Planning Commission included ICS in a Plan document in attempt to address the pressing fuel wood problem. In 1981 [[Community Forest Development Project]] (CFDP) developed prefabricated ceramic ICS. In 1982, prefabricated ceramic stoves were tested, and after some modification, RECAST developed Ceramics Insert Stoves. During 1985 Small Farmer Development Project (SFDP) of Agriculture Development Bank (ADB/N) distributed Ceramic Insert Stoves. Other major organizations and projects which took up further ICS dissemination efforts include United Mission to Nepal (UMN), [[Terai Community Forestry Development Project]] (TCFDP), Nepal-Australian Forestry Project, [[Resource Conservation and Utilization Project]] (RCUP), CARE/Nepal etc. RECAST developed a new model of a stove known as "Improved Tamang Stove". They tried to make the stove with cheap readily available local materials. Since early 1990s, new initiatives from various NGOs, INGOs and GOs, for ICS dissemination have been underway. Most of the organizations working on ICS programs concentrate on mid hill and Terai regions, and they are mainly working on Mud Stoves. Very few of them are involved in high altitude places, and very few work on metal stoves. Cost is the factor making it difficult to work on metal stoves.

According to AEPC (Alternative Energy Promotion Centre), which is a government organization, there are no subsidies in ICS programs now. There used to be subsidy programs on ICS a few years ago, but now they only give training on building stoves using local resources and materials.

The development of mud brick stove by Research Centre for Applied Science and Technology, Nepal (RECAST) in early nineties relaunched the stove program. Indeed,

since early 1990s, new initiatives for ICS dissemination create new stoves design, which can be built completely from cheap readily available local materials. The target-oriented approach was abandoned and replaced by a subsidized bottom-up and demand-driven approach. ICS was promoted and disseminated by various organizations with different financial arrangements such as with and without subsidies, equity participation by users etc. ICS became an important and integral component of development initiatives and was supported by quite a number of programs, donor agencies and promoting/disseminating organizations. The collective efforts of over 25such organizations together promoted about 40,000 improved stoves of various types (mud, metallic) in different districts of Nepal. In 1995, ICS network supported by Asia Regional Cook Stove Program (ARECOP) and managed by Centre for Rural Technology, Nepal (CRT/N) was established. The network is aimed at bringing together various organizations working in ICS promotion and dissemination and expanding the utilization of ICS. The network Inventory of ICS in Nepal 2000, CRT/N has concentrated its effort in bringing uniformity among approaches of various organizations involved by advocating a bottom up and subsidy less approach. His Majesty's government of Nepal (HMG/N) provided policy guidelines to encourage development and application of energy saving devices as well as promotion and dissemination of alternate energy technologies from 9th plan (1997–2002). HMG/N set a target of promoting 250,000 ICS during the plan period through the collective efforts of government, non-government organizations and the private sectors. However very little of the target was achieved. Within the present 10th five-year plan(2003-2007) HMGN has further emphasized ICS dissemination with target to install 250,000 ICS as well as the development of research and development activities. (10th Five-Year Plan, HMG/N)

The history of the ICS is not new in Nepalese context. The development of ICS can be divided into three phase. The first phase started in the 1950s by introducing “Magan Chulo” which originated in India. At that time, the village development services, “Gramin Vikash Sewa” started promoting ICS in some areas of Nepal. The program has aimed at uplifting the living conditions of the people and reducing exposure to smoke. However, the program was unsuccessful in terms of wider dissemination because of easy accessibility to the forest nearby as well as the low price of firewood.

The second phase started in the early 1970s and focused on improving fuel efficiency. Technological expertise about large mud stoves with a number of rings, known as the "Lorena" stove, came from South America (Guatemala). The Women's Training Centre of Nepal was involved in training women in the construction of Lorena Stoves. The main objective during this period was to find a solution to the fuel wood crisis and accompanying deforestation. In the late seventies, RECAST became involved in the improvement of these stoves and renamed them Nepali chulo.

The third phase, which began in the early 1980s, has taken up by research and development (R&D) and laboratory-based work. This included a detailed assessment of cooking-stove performance, standardized procedures for testing, and design methodologies to obtain higher performance and efficiency. The Lorena Stoves replaced by ceramic insert and Double Wall Stoves. These cooking stoves were design by RECAST under a contract with the HMG/UNDP/FAO Community Forestry Development Project (CFDP). Large-scale distribution has carried out by the CFDP. After some years, with support from UNICEF the ceramic cooking stoves and the new Nepali chulo were also introduced through the Agricultural Development Bank, Nepal (ADB/N), the Small Farmer's Development Project (SFDP) and the Women Development Division (WDD) through their Production Credit for Rural Women (PCRW) Program. Thousands of these stove were distributed some modifications to ceramic Tata Energy Research Institute (TERI) models were made, especially on the second ring and its size. Distribution was limited and confined only to the field trail. As in the first phase, socio-economic issues once again occupied the centre- stage of activities. ICS Production had reviewed and planned for a self-propelling distribution process. (WECS 2004)

Later the Tamang Stove (Improved Village Stove) introduced. It consist of a mud-brick or mudstone ICS with an iron tripod, which has driven into the combustion chamber to form a better foundation. It is a two-ring stove with a chimney (ceramic or mud-brick). The stove can withstand excessive force, Such as that exerted during cooking maize porridge. The chimney has modified for easy cleaning.

1) The first phase started in 1950s by introducing magan chulo.

2) The second phase started in the 1970s by introducing Lorena Stoves (Guatemala model)

3) The third phase started in early 1980s has taken by research and development. Laboratory based work, ceramic insert and double wall stoves replaced the Lorena stove. These stoves were design by RECAST under a sponsorship with the GON, UNDP, FAO, and CFDP. The ceramic cooking stoves and the new Nepali chulo also introduced through the agriculture development bank. New modification stoves called Tamang completely from cheap readily available local materials stoves dissemination have been underway (CRT/N, 2003).

ICS is the reformed device of traditional cooking stove. Comparatively it consumes less fuel wood; it is easy to cook food, keeps the clean environment in kitchen room, and reduces the indoor pollution than the traditional cooking stove. Technically, it is simple and acceptable than the other stove like as LP gas, biogas, kerosene stove etc. the use of low-grade biomass fuel in traditional stoves leads to excessive levels of indoor air pollution. Women and children of rural and poor families are particularly exposed to the smoke emission. This is one of the reasons of higher rates of infant mortality in rural area. Release of incomplete carbon products in the atmosphere due to poor combustion of biomass fuel results greenhouse gas emission too (AEPC, 2000).

Many researcher and conferences have been done for the promotion, dissemination, and development of Improved Cooking Stove (ICS).

According to Joshee 1986, “employed person, educated person, large family, rich person were the users of ICS.

According to sulpya 1986, “the ICS save firewood about 18-42percent and efficiency is 25-40percent”.

According to Wood, 1987, “ceramic insert type stove has mostly abandoned in favour of stoves built on the site from locally available materials”.

CFDP 1984 reveals that the most common features of ICS are firewood saving it works on the principle of increasing the concentration of heat directly under the first cooking

pot and then channels the heat back to the second burner to cook second pot at once. It conserves heat and reduces heat dissipation with minimum waste 30-50percent firewood could be saved through the proper use of ICS.

The 'Nada chulha' could reduce fuel wood consumption and improve the women's quality of life has developed between June 1980 and April 1983. It emerged as a response to the women requests for smoke removal from their kitchen. The experience of working with village women has demonstrated the importance of making technology adoptable to unreliable needs (Clarke, 1985).

2.1.4. Subsidy Policy

The exploitation of various sources of alternative and renewable energy like: biogas, small and micro hydropower, solar energy (Photovoltaic and Thermal), improved cooking stove, wind energy, etc. has great potentiality in Nepal. His Majesty Government has created the Alternative Energy Promotion Centre (AEPC) with the objective of developing and promoting different sources of renewable energy, considering the fact that the maximum utilization of these renewable energy resources could contribute to environmental protection and sustainable rural development. Even though HMG had already provided subsidy to encourage the use of RETs for exploiting renewable energy resources, it is desirable to make necessary adjustment in the existing system of subsidy for extensive use of RETs. Government of Nepal has approved and implemented the new subsidy policy for Renewable Energy to achieve the following objectives.

Objectives

To protect environment by encouraging the use of renewable energy resources and RETs in the rural areas and to provide opportunity to low income rural households to use RET's. It has four objectives, which are given below:

To support rural electrification as well as gradually reduce the growing gap of electricity supply, consumption, etc. between rural and urban areas. Another is to make the use of grant assistance provided by donors, existing and forthcoming more effective and objective oriented and thereby attracts the donors and other investor in RETs sectors.

Then to support development and extension of RET market by attracting private sector entrepreneurs. And last one is to support to the envisaged targets of RETS program of the long term plan.

Improved Cooking Stove Subsidy Policy

Improved Cook Stoves (ICS) is a one of the RET which is simple, cost effective and can be built with the local material and local trained people. His Majesty's Government of Nepal (HMG/N) has given the equal importance and priority to ICS like other RETs: Biogas, Micro hydro, Solar, Improved Water Mills etc. HMG/N has first formulated the Subsidy Policy for Renewable Energy in 2000. In this policy document, ICS has the following subsidy policy:

No direct subsidy will be provided to ICS. But there will be indirect subsidy like supporting local organizations in terms of capacity building and technical assistance, which include providing the Information Education and Communication (IEC) materials, training manuals for promoters, users and organizers. Then training will be given to promoters, staff of local organizations working willing to work in ICS. It integrates ICS programme with existing local organizations' activity to attain synergetic effect. Enabling of local institutions: GOs, NGOs and other development projects to adopt ICS dissemination as one of their activity. Installing stove by private entrepreneurs with focus on women to address gender issues and poverty reduction is another subsidy. Another subsidy is rapid installation of quality stoves and dissemination of subsidy less ICS mainly for low-cost stove in the Mid Hills.

Rural Energy Policy, 2006

There are huge possibilities of producing energy in Nepal. Availability of enormous water resources and topographic situation gives rise to a potential for 83,000 MW of hydropower of which about 43,000 MW of power production seems to be economically and technically feasible. Till now, where only about 563 MW has been harnessed which is mainly consumed in urban areas, the rural and remote areas of the

nation has no access to reliable and clean energy. In the other hand, in spite of enough possibility of producing energy in rural areas in the form of biogas, solar energy, wind energy, improved water mill, micro and mini hydropower, it has not been used as per the needs. In Nepal, only 160,000 biogas plants have been installed out of the installation potential of 1.9 million biogas plants. There has been savings in the energy consumption by installing 250,000 improved cooking stoves. Similarly, in spite of huge potential of solar energy, only 75,000 solar home systems have been installed. With regard to the wind energy, it has not been possible to harness its potential. Up to now about 2,000 traditional water mills have been improved. Only about 8 MW power is produced through micro hydro. These efforts have made it possible to provide electricity services to about 40 percent of the population in the country. In the rural areas, only 29 percent of the population has access to electricity. There has been difficulty in availability of kerosene and LPG due to low purchasing power of the people and adverse topographic condition, most rural population are compelled to meet their energy needs through traditional energy sources like fuel-wood, dung cake, rice husk etc. Statistics show that 77 percent of the energy demand is met by fuel wood, 9 percent by agricultural residues and animal dung, 14percent by imported petroleum products, coal and electricity in the energy consumption of rural areas of Nepal. Since, 86 percent of the energy consumed in rural areas comes from the traditional sources, which results on environmental degradation and there has been reduction in agricultural production due to reduction in productivity of agricultural land because of use of dung and agricultural residues. There has also been adverse impact on the health of rural population mainly women and children because of use of traditional energy resources. Similarly, rural children are also deprived of opportunity of education, as they have to spend most of time in collecting such energy source. In this context, there is ample possibility of improving the living standards of rural population by developing environment- friendly energy resources in rural areas by making financially affordable to reduce dependency on traditional and fossil fuel resources.

Goal

The overall goal of this policy is to contribute to rural poverty reduction and environmental conservation by ensuring access to clean, reliable and appropriate energy in the rural areas. In order to achieve this goal, the "Rural Energy Policy" will have three objectives. First one is to reduce dependency on traditional energy and conserve environment by increasing access to clean and cost effective energy in the rural areas. Then second is to increase employment and productivity through the development of rural energy resources. Last one is to increase the living standards of the rural population by integrating rural energy with social and economic activities.

Policies

Above objectives will be achieved by adopting following policies:

Emphasis will be given to the development of the environmental friendly Rural Energy Technologies. The capacity of the local bodies will be improved for playing a leadership role in rural energy project planning, implementation, monitoring and evaluation at the local level and involvement of cooperatives, user groups, NGOs, private sector will be increased. Rural Energy Fund will be established at the central level to mobilise financial resources to be availed from various sources and fund will be expanded to the local level as per need. Alternative Energy Promotion Centre under Ministry of Environment, Science and Technology, Government of Nepal will provide necessary support to the local bodies to develop its capacity to formulate and implement rural energy programmes. Emphasis will be given in the development of affordable and suitable rural energy resources. An arrangement will be made for increasing human resource capacity of rural population for rural energy development through human resource development activities that are integrated with activities of academic institutions for skill enhancement training and awareness improvement. Economic activities will be implemented in integrated way for increasing energy consumption capacity at rural level by development of Micro and Mini Hydro, Biogas, Improved Cook Stove, Improved Water Mills, Solar Energy Systems, etc. and expansion of the central grid. Private sector and non-governmental organisations will be involved in the rural energy development for development and expansion of new technologies. In this activity, the role of the Government of Nepal will be that of facilitator and promoter. Economic and industrial

activities based on rural energy technologies will be encouraged. Community management through social mobilisation will be encouraged in activities of rural energy development and dissemination. Emphasise will be given to increase private sector participation by motivating the involvement of private sector in manufacturing of equipment related to rural energy. Economic instruments will be used to mobilize the capital from banks and financial institutions, internal capital market, community capital for rural energy development. The local body, cooperatives, private sector, user organisation or community management will be encouraged to purchase and distribute electricity from electricity production. The efficiency of rural energy technology will be increased and diversification of the productive end-use will be encouraged. A special emphasis will be given to bring improvement in social, economic and environmental aspect by coordinating rural energy with local bodies. The emphasis will be given for development and management of new technology to increase efficiency of use of traditional energy. Similarly the emphasis will be given for Research and Development of rural energy technology. Special programmes of promotional activities will be implemented that emphasize on access to rural energy and role of rural energy in sustainable development, poverty reduction and positive impacts on women and children. In order to ensure quality of rural energy, an arrangement will be made for quality standard tests and quality control by increasing capacity of Renewable Energy Test Station. Off-grid and small rural energy system can be integrated mini-grid with national grid.

Working Policies on ICS

There are four working policies on ICS. First one is Improved Cooking Stove Technology Second is the public awareness will be increased on smokeless and fuel-wood efficient improved cooking stove. Third one is emphasis will be given on research, development and dissemination of household and institutional stoves appropriate for varying geographical and cultural needs and last one is activities of technology transfer of improved cook stove in rural areas will be undertaken.

2.2 Review of Related Studies

In this part I have reviewed few of old thesis dissertation in related to improve cooking stove which will be helpful for the further my study.

Sheela Pradhan, (2006) has studied on impact of improved cooking stove on rural livelihood: A case study of siwalik area of chulachuli VDC of Ilam. The general objective of the study is to assess the impact of Improved Cooking Stoves on the rural livelihoods of Chulachuli VDC of Ilam District that includes the fuel wood consumption at the household level and impact on the health of women and children, time saving (collection of fuel wood and cooking), kitchen management and natural resource conservation and the specific objectives are to assess the social impact of Improved Cook Stoves, to assess the efficiency of ICS in terms for energy consumption and time saving, to assess the impact of ICS on health and environment. The research technique included household survey, interview with key informants and field observation. A total of 90 respondents were selected and of which 50 percent respondents were female and 50 percent were male. Mostly people of Chulachuli VDC are engaged in agriculture but the majority of them have food sufficient for 3 months to 6 months. A large population of the respondent has income of less than Rs. 1000.00. The people of Chulachuli VDC have accepted improved cook stoves. Majority of them have been using 2 holes type since 2-3 years. The staffs of the organizations were seen as main motivators to construct ICS in Chulachuli. Most of the respondents said that maintenance was not required since the installation of ICS. Impact of ICS is visible in Chulachuli VDC. Time is also saved from improved cooking stoves. The average time saved during cooking was 0.44 hour compared to the traditional stoves. The ICS also helped to reduce frequency of fuel wood collection since the fuel wood consumption has reduced. The health problems were reduced resulting less medical expenses. Reduction in fuel wood collection, illegal tree felling and decreased in fire wood sale and forest was seen denser in Ilam Siwaliks. The pots do not get black due to smoke and takes less time to clean. Thus, the impact of the ICS is seen positive in Chulachuli VDC.

The another scholar Rupakheti (2014) has studied on improved cooking stove is a device that is designed to consume less fuel and save cooking time convenient in cooking process and create smoke less environment in the kitchen or reduction in the volume of

smoke produced during cooking against the traditional stove the direct and indirect benefits of ICS were increased thermal efficiency, the conservation of forest by less fire wood consumption reduction in woman's labour, reduction in indoor air pollution and smoke released health disorder prevention of fire hazards, reduction of cooking time .

His study was conducted in Dhading district with specially focused to Jiwanpur VDC the main objectives of the study was to access the present situation of ICS on Dhading district to, to analysed the potentiality of improved cooking stove in Dhading district and find out problems and challenges of improved cooking stove in Jiwanpur VDC for this study descriptive and analytical research design have been adopted to obtain necessary information.

In Nepal biomass energy: fuel wood agricultural residues and animal dung is used for heating and cooking purpose. Use of traditional cooking stove such as "agenu" and "chulo" consumes more fuel woods and increases 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 level of indoor smoke and air pollution. Women and children in particular are exposed to the smoke emission. This is one of the reasons for the higher rates infant mortality and morbidity and other unhealthy living conditions. Released of incomplete monoxide and other harmful particles in the atmosphere due to poor combustion of biomass fuel in rudimentary stoves emission of greenhouse gas (GHS). More than eighty percent of the energy needs are meet by fuel wood thus exerting immense pressure on the forest resource of the country with negative impacts.

Joshi (2010) has studied on solar home system and its impact conducted in jogimara VDC of Dhading district. The general objective of study was to find the socio economic impact of solar home system and the specific objectives were to find out the accessibility of the rural people towards solar technology, to find out the status of the SHS in the study area, to study the socio-economic characteristics of the SHS users, to find out the extent of utilization of the solar technology by rural people and assess the energy and other benefits from the installed SHS, to identify the obstacles, challenges of local community for the solar technologies ,to suggest the possible effective measures so

that the obstacles can be reduced, to provide recommendation for possible programs related to the solar technology, and to find out local idea to solve the existing problem and to promote the solar energy technology. Household's

data were collected from purposively selected 15 user's households from 29 users of solar home systems and 15 non users' households using semi structured interview schedule. Besides, data required was also collected from the installing company especially regarding the installation of system and its socio economic impacts. Focus group discussion was also conducted to collect the common data and to verify the data gathered from household survey. SHS of 20 were most popular in the study area. Solar Home System has been mainly used for well functioning in the study area, with good lighting facility.

In this the researcher found that children were most benefited group through improvement study environment. Better lighting has prolonged study time and also facilitated the guardians in tutoring the children. It has enabled female members to accomplish more household chores. Chatting and interaction among the family members, which is important developing better understanding, also increased. On the average, SHS has increased wake up duration of the family members approximately by two hours via alternation in bed time and wake up time. Tuki was widely used lighting device before installation of SHS and distantly followed by lantern and battery. Kerosene was prevalent used fuel expenditure to maximum extent. It has also improved woman's level of awareness and knowledge through access to TV and radio.

Evolution of Cooking Stoves in the World Evidence of the use of biomass fuel, particularly wood, has been found within the caves of Peking man as early as 400,000 years ago (Bronowski,1973).At that time, biomass was presumably used as fuel for weather conditioning (warmth). Its application to cooking developed later. While styles and methods of cooking have developed into a variety of artistic and elaborate forms, the biomass cooking stoves which are the hardware supporting this activity (as holders for cooking utensils and as fuel combustion chambers) have changed very little in structure and performance from their ancient predecessors. When compared with modern stoves such as oil, gas, and electric, the biomass cooking stoves are far less efficient. The

efficiency of kerosene or LPG fuelled stoves can be as high as 45-48percent, while that of a wood stove averages only 15-20 percent. Even though the efficiency is partially explained by the lower calorific value of the wood fuel, the main problem still rests heavily on the hardware design of the stove itself. The development of stoves can be seen as recurring over two periods of time. The first period began with the birth of the three stone stoves and continued until the discovery and application of electricity. The second period has lasted from that time until the present. While the latter period amounts to only about 100 years, the first period lasted many thousands of years.

The slow development of biomass cooking stoves in the early period can be explained by the abundant supply of wood and the consequent lack of any demand for higher efficiency stoves. Most of the effort toward improved stove design in the second period of time has been in the area of the electric, gas, and oil stoves popular in western countries. The application of scientific principles and knowledge to the design of better biomass cooking stoves has been neglected. However, as the world population has increased tremendously in the last 100 years, particularly in poor and less developed countries that are dependent on biomass cooking stoves, the demand for wood fuel has risen sharply. The increase in demand coupled with the rapid loss of forest land to agriculture has made the procurement of wood for cooking both difficult and expensive. With the current situation, the time has come for humankind to start applying modern engineering principles to the design of biomass cooking stoves in order to improve this long neglected but widely and daily used appliance.

Traditional stove is a common stove that is widely used in rural areas to cook food and animal feed. Three stones stove, tripod, mud stove with one or two holes, etc. are the traditional stoves. These stoves are inefficient; they consume a lot of firewood and fill the kitchen with smoke. These stoves are built in open space and fire is distributed widely even outside the stove. Therefore, pot could not absorb the heat so that takes more time to cook food. As a result, fire wood is used more and takes more time to cook. Due to this, women has to spend a lot of time collecting firewood and suffer from lung diseases and eye problems which are common in the rural areas. This also causes deforestation and imbalance in environment (REDP, 2003).

Defects of Traditional Stoves

There may many defects of traditional stove but few of them are, use of it is less than 10 percent efficient (in using the energy store in the wood).Another is the smoke produced stays in the kitchen due to absence of vent pipe and harmful to the health of users and their families. Next utensils and clothes are blackened by soot. Another is open fire may results in risk of accidents with children burn and/or household. Lastly the stove needs regular blowing. (CRT Nepal)

The development of mud brick stove by Research Centre for Applied Science and Technology, Nepal (RECAST) in early nineties relaunched the stove program. Indeed, since early 1990s, new initiatives for ICS dissemination create new stoves design, which can be built completely from cheap readily available local materials. The target-oriented approach was abandoned and replaced by a subsidized bottom-up and demand-driven approach. ICS was promoted and disseminated by various organizations with different financial arrangements such as with and without subsidies, equity participation by users etc. ICS became an important and integral component of development initiatives and was supported by quite a number of programs, donor agencies and promoting/disseminating organizations. The collective efforts of over 25 such organizations together promoted about 40,000 improved stoves of various types (mud, metallic) in different districts of Nepal.

In 1995, ICS network supported by Asia Regional Cook stove Program (ARECOP) and managed by Centre for Rural Technology, Nepal (CRT/N) was established. The network is aimed at bringing together various organizations working in ICS promotion and dissemination and expanding the utilization of ICS. The network has concentrated its effort in bringing uniformity among approaches of various organizations involved by advocating a bottom up and subsidy less approach.

2.3 Conclusion of Reviews

ICS is the traditional technology even it was in use in many villages of Nepal. In context of Nepal it is reliable and cheapest sources of energy too. So must of the people of village use for cooking. Nepal has not more energy sources as other developed

countries .In the current context of the energy crisis .ICS is one of alternative sources of energy. ICS helps to save energy as use of traditional cooking stove waste energy while cooking food about 90 percent energy waste and only 10 percent energy is used in cooking food. So ICS help to save energy it also help to reduce pollution and save our environment .It is also easy to use than traditional cooking stove .It is affordable too. It doesn't need more cost for installation .Even it can be made by village woman by using local material after simple training.

Since ICS help to minimize the consumption of firewood and keep the kitchen atmosphere safer and relatively smoke free, it certainly contributes to create a better rural environment. As a result, women and girls are spending less time and effort on gathering firewood, cooking, washing blacked utensils and heating water in inefficient ways. The time saved by women can be productively used in learning skills that help generate additional income for themselves and to get together in groups to save money, begin small individual or group enterprises and more importantly, to either talk about and participate in community social development work.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Methodology is the backbone of the study. So, it needs to be well defined to conduct the study. Therefore in this study the following methodology has been adopted to fulfil the objectives.

3.1 Research Design

It is the blueprint for the collection of data. It is a work plan owing to the objective of the research. For this study, a descriptive and exploratory research design was followed. The purpose of the study is to describe the status of improved cooking stove (ICS) in rural Nepal. The descriptive method was used for the qualitative data obtained during the study. The data that are not quantifiable was explained literally. On the other hand Researcher had analysed and discovers degree of interdependence between various characteristics/activities that are influenced by ICS in such cases the exploratory research design has been used. Researcher have also looked into the problem by exploring the views of different set of respondents, as well as by exploring different literatures related with the study.

3.2 Rational of the Selection of Study Area

Since last decade Improved Cooking Stove has emerged as an important source of alternative energy in Nareshwor VDC of Gorkha district. So the present study has been carried out in Nareshwor VDC. As researcher is the local inhabitant of the same district, so this place is familiar for me with the local culture and practices. The another reason is, it is easily accessible for me in data collection and field study of ward no.-4 of Nareshwor VDC. It was well convinced that by the selection of this VDC, it could get more accurate information to fulfil my objectives easily and effectively under any circumstance than any other study area.

3.3 Nature and Sources of Data

Data is a set of fact, sheets the wholesome aggregate of which gives the information. This information in fact contributes to the inquiry of truth and approaches towards the reality. Both primary and secondary data were used in this study. Data gathered are both qualitative and quantitative in their nature.

3.3.1 Primary Data

In the due course of my research, primary data were collected through field observation, interview, and through structured and semi structured questionnaire as per the convenience to aid to the study. Questionnaire was the main tool for collecting information in the field survey.

3.3.2 Secondary Data

Since, this research is mounted on the basis of description and analysis, secondary data plays the vital role. The various internal and external sources were used for acquiring the secondary data. The various sources consist of village development committee, central bureau of statistics, alternative energy promotion canter, reports, articles, hospital and NGOs etc.

3.4 Universe Population and Sample

From census of 2011, there were 1,026 individual households in Nareshwor VDC of Gorkha districts. In ward no 4, 137 household and 509 population were found. Among these 220 male and 289 were female. Now, the researcher has found 195 the population size. There was 977 population in ward no- 4. Among these houses, 104 HHs were user of ICS and 91 were non-users. The researcher had taken 48.07 percent (50 HHs) of sample size. The selection of sample was non-random (judgemental/purposive) sampling. This sample includes dropper of ICS.

3.5 Techniques and Tools of Data Collection

This research has been conducted by employing various methods for data collection. Both primary and secondary data has been collected. I have collects the primary data

from the respondents by conducting the questionnaire survey with the ICS users. For the collection of primary data following data collection techniques and tools were adopted.

3.5.1 Household Survey

The name list of the household head was obtained from the VDC office and house to house survey was conducted. The questionnaire forms were filled up by the researcher interviewing with household heads. In the absence of household head, another senior person present at the home was taken as the respondent (see Annex i).

3.5.2 Field Observation

To explore ICS related problems and prospects in the study area, visual observation was also conducted. Impact of ICS on health of woman and children, cost requirement for the installation of ICS, drop out of ICS as well as problem in ICS use, expenditure in health check-up, time consumption by ICS in cooking etc. were observed from the study area (see Annex ii)

3.5.3 Key Informant Interview

A key informant interview is loosely structured conversations with the people who have specialized knowledge about the topic. To dig out its major key informant's interview were conducted within the study area. The key informants were teacher Mr. Bishnu Hari Aryal, ICS technician Mrs. Sushila Aryal, VDC staffs, and local ICS users. By interviewing them on the basis of prepared set of questionnaire more necessary information about ICS were collected from the study area. Unstructured questions for KII are in (Annex iii).

3.5.4 Focus Group Discussion

The focus group discussion was held in only one group with 12 participation of Darimbota Mahela Samuha Ward no. 4, who were the user of improved cooking stove. This discussion was based on the impact of ICS on health of women and children which was recorded in my mobile and also noted in note book. It was the randomly selected household member in the village of Darimbotaie ward no. 4. (cheque list in Annex iv).

3.6 Data Processing and Analysis

The collected raw data was modified as per requirement and objectives of the research. The various steps that were followed are:

3.6.1 Data Processing

- **Editing:** The collected raw data were edited to detect error and omissions. So to overcome the possible error in our research editing was done carefully.
- **Coding:** In order to make the research more systematic and scientific, assigning of numerals or symbols to answer has been carried out, so that it helped to allocate the answer whenever necessary.
- **Classification:** The result of research study is at large volume in the form of raw data. So in order to simplify it has been classified into homogeneous groups, so a meaningful relationship can be profoundly studied.
- **Tabulation:** After the necessary classification of data the next step taken was arranging the data in respective tables/ charts. The tabulation is essential in order to systematize and logical arrangement of data for further manipulation.

3.6.2 Data Analysis

All the data has been analysed systematically and scientifically by using different statistical tools. Primary data has been analyzed according to its nature, so as to address the objectives of the study. Quantitative data has been analyzed using simple statistical tools like percentage distribution. Qualitative data has been analyzed descriptively and to the extent possible with use of tables and frequency distribution.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

This chapter is based on analysis and data generation through questionnaire, observations, discussion and personal study of the ICS consumers. The data taken from field visit are presented in tabular forms and they are analyzed in different point of view in order to find the objectives of the study.

4.1 Introduction of the Study Area

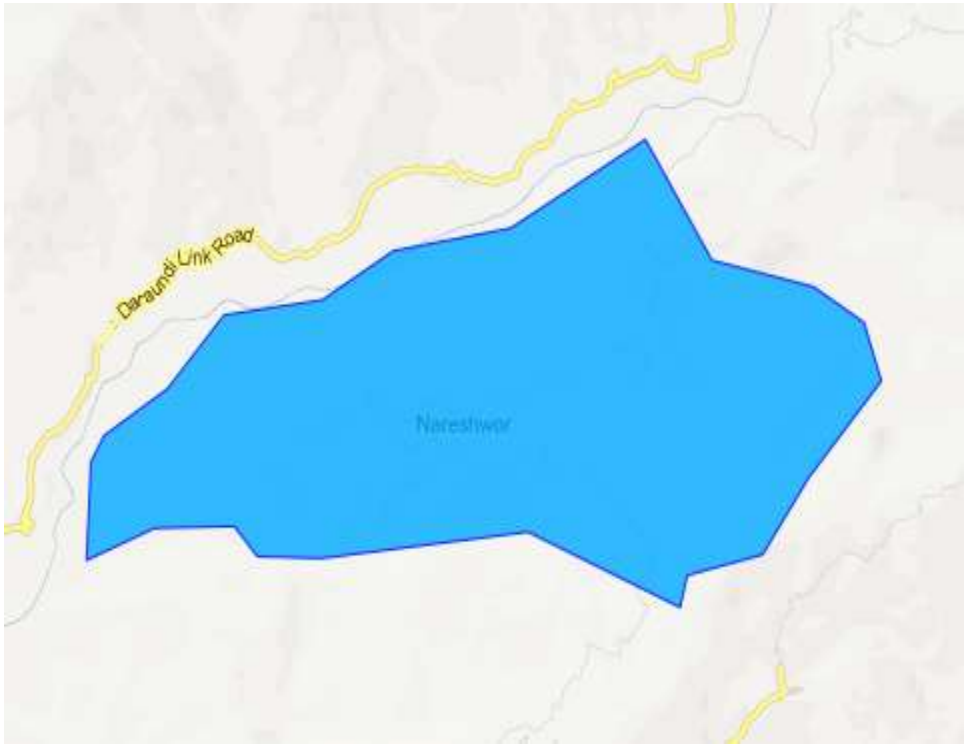
Gorkha District

Gorkha District lies in the Gandaki zone of western Development Region. The district, with Pokharithok (Gorkha), later known as Prithivi Narayan Nagarpalika as its district headquarters. It's located at 28°28'35.04" Northen latitude and 84°41'23.28" longitude. Its total area is 3,610 km². This hilly district is situated at western part of capital Kathmandu. Its shares Dhading, Chitwan, Lamjung and Thanau. There are 71 VDC and 2 Municipality.

According to National Population and Housing Census 2011, the total population of the district is 271,061 with male 121,041and female 150,020. There is total 66,506 households with an average household size3.78 of among 56,049 HHs use firewood for cooking, 268 HHs use kerosene, 7,214 HHs use LP gas, 20 HHs use cow dung , 2,558 HHs use bio gas, 37 HHs use electricity, 53 HHs use others and 259 HHs use not stated for cooking.

It is the location of the Manakamana Temple. Also, the temples of great sage Gorakh Nath and goddess Gorakhkali temple is located in this district, after which the district got its name. Four major rivers run within and along it, they are Chepe, Daraudi, Marsyangdi and Budhi Gandaki. The major occupations of people are agriculture.

Figure 1: Map of Nareshwor VDC



Source: Google Map

The study was undertaken at Nareshwor VDC of Gorkha district. Its located at 28.03°northen latitude and 84.63° eastern longitude. Total population of Nareshwor VDC is 3,692 having 1,563 male and 2,129 female populations. According to the census report 2011, there are all together 1,026 individual households.

Among which 925 HHs uses firewood for cooking, no HHs use kerosene for cooking. Similarly 44 HHs use LP gas for cooking, no HHs use cow dung for cooking, 51 HHs use bio gas for cooking, no HHs use electricity for cooking, no HHs use other type of fuel for cooking and 6 HHs use not stated for cooking (National population and Housing Census 2011).

With the VDC, our study is mainly focused in ward no. 4 which is composed of different ethnic groups; largest population in the Nareshwor is Chettri, Brahmin and Dalit

respectively. Besides, other castes and ethnicities like Dalit, Chhetri and Brahmin have their considerable presence.

Most of the houses have tile/slate roof houses followed by thatch/straw roof house. The wall of the house was made by mud and stone. The villagers are getting drinking

water supply from different sources like 226 were benefiting from tap/piped water, no HHs form covered well/kuwa, 125 HHs form uncovered well/kuwa, 668 HHs form spout water and no HHs form river, no HHs from other and 6 HHs not stated . They get health services from a health post and private clinic.

There are also social organizations are concerned, mainly four types of organizations are found namely community forest users group, Mahela Samuha and Political Parties and Schools. There are one higher secondary, two secondary and three primary schools in the VDC. The governmental representation was limited with public schools, health posts and police bits.

Most of the people involved in farming. Some people are found involved in business and government job, as well as some gone abroad for economic activity. The climatic condition is suitable for the horticulture. Most household used to sell fruits, vegetables, milk of cows and buffalos which is collected and transported to Gorkha headquarter. Numbers of households are also found involved in poultry farming.

4.2 Occupation of the Respondent

Occupation play a vital role in the technology installation and the informal utilization of any new treands of technology depends up on the occupation. In the study area most of the respondents are involved in agriculture occupation. So most of the farmers have installed ICS because they get fuel from their farm. Beside this teacher and buisness men also installed ICS in the study area.

Table no.3: Occupational Status of Respondent

Occupation	No. of HHs	Percent of HHs
Agriculture	27	54
Teacher	5	10
Buisness	8	16
Other	10	20
Total	50	100

Source: Field survey 2016

From the above table 54 percent respondent are involved in agriculture, 10 percent respondent have teaching occupation, 16 percent respondent have business occupation and 20 percent

respondents are involved in other occupation. Most of the respondents of the study area are involved in agriculture. It can be also shown from column chart. The figure below presents the major occupation of the respondents. Nepal's more than 75 percent population relies on agricultural products. It shows that most of the respondents too rely on agriculture.

4.3 Monthly Income Beside From Farming

Prosperity of the house-hold depends upon the source of income and its extent. Higher the income better will be the household status. The annual income of most Nepalese people based on agriculture. But here we need annual income from other sources like services, business and other sources. The power of purchasing capacity also depends up the income of family.

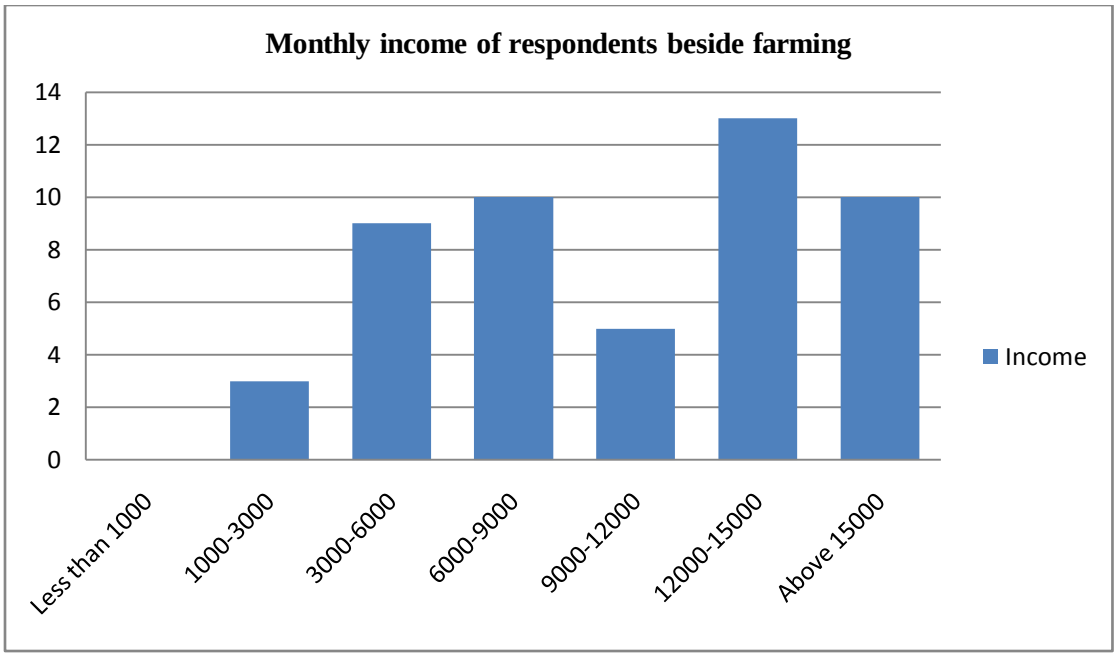
Table no. 4: Monthly Income besides Farming

Monthly Income	No. of HHs	Percent
Less than Rs. 1000	0	0
Rs. 1000-3000	3	6
Rs. 3000-6000	9	18
Rs. 6000-9000	10	20
Rs. 9000-12000	5	10
Rs. 12000-15000	13	26
Above Rs. 15000	10	20
Total	50	100

Source: Field Survey, 2016

The data presented on above table shows that diverse income range was observed among the respondents where majority of 26% house-hold have income Rs.12000-15000 thousand per month,20% respondents have monthly income above 15000 and again 20% respondents have monthly income 6000-9000, 18% respondents have monthly income 3000-6000, 10% respondents have monthly income 9000-12000 and 6% respondent income 1000-3000.Income of the respondents was categorized in different ranges that are presented in the chart below.

Figure 2: Monthly Income of the Respondent besides Farming



Source: Field Survey, 2016.

4.4 Age of ICS

All the people did not installable ICS in same time. So different people install ICS in different time depend on their willing.

Table 5: Duration of ICS Installation

When the ICS was installed	No. of HHs	Percent
0 to 1 year	3	6
1 to 2 year	5	10

2 to 3 years	12	24
3 to 4 years	5	10
4 to 5 years	8	16
More than 5 years	17	34
Total	50	100

Source: Field Survey, 2016

Majority of the ICS (34%) were constructed more than four year before. Twenty four percent respondents have installed it before 1-2 years. Sixteen percent constructed ICS before 3-4 years. Ten percent Respondents have installed it before 2-3 years and again ten percent respondents have installed it before one year and only 6 percent respondents installed it less than one year before. This shows that use of ICS is accepted by the people in Nareshwor VDC of Gorkha.

4.4.1 Type of ICS Installed

ICS may of various types. For example one hole, two hole and three hole. In study area some respondents have installed one hole ICS and some installed two hole.

Table no. 6: Types of ICS

Type of ICS installed	No. of HHs	Percent

One hole	11	22
Two hole	39	78
Three hole	0	0
Total	50	100

Source: Field survey, 2016.

From above table most of the respondents have installed two hole ICS i.e. 78 percent and 22percentrespondents have installed one hole ICS and no respondents have installed three hole ICS.

4.4.2 Motivation for ICS Installation

Without motivator most of people do not install ICS because motivator provides information and knowledge about ICS and its benefits. Also Organization play vital role of motivator in installing ICS. Friends and groups members can also inspiring to install ICS.

Table 7: Motivators to install ICS

Motivator to install the ICS	No. of HHs	Percent
Promoter	21	42
Neighbour	13	26
Friends	10	20
Group member	6	12
Total	50	100

Source: Field survey, 2016.

From above table 42% respondents installed ICS inspired by promoter, 26% respondents installed it inspired by their neighbors, 20% respondents installed it inspired by friends

and 12% respondents installed it inspired by group member. It shows role of motivators, neighbor, friends and group member have significant role in installation of ICS.

4.4.3 Money Spent in ICS Installation.

ICS installation requires some cost. In past years it requires less money but now a day its cost is increasing slowly**.**

Table no.8: Money spent in ICS installation

Money spent	No. of HHS	Percent
Rs. 500-800	11	22
Rs. 900-1200	7	14
Rs. 1300-1600	9	18
Rs. 1700-2000	13	26
Above 2000	10	20
Total	50	100

Source: Field survey, 2016.

From the above table 22 percent respondent answered ICS installation require Rs. 500-800, 14percent respondent answered ICS installation require Rs.900-1200, 18 percent respondent answered ICS installation require Rs. 1300- 1600, 26 percent respondent answered ICS installation require Rs. 1700-2000, 20 percent respondent answered ICS installation require above Rs. 2000.

4.4.4 Money Required for Installation of Types of ICS.

Cost of ICS installation differs according to their types. Cost of one hole ICS is cheaper than two hole and three hole. But efficiency of one hole is more than two and three hole. Efficiency of three hole stove is less than two hole stove no-one use three hole stove. So most of people use one hole and two hole stove.

Table no.9: Cost of ICS

Cost of one hole ICS	No. of HHs	Percent	Cost of two hole ICS	No. of HHs	Percent
Rs.500-800	13	26	500-800	16	32
Rs.800-1100	21	42	1200-1600	11	22
Rs.1100-1400	16	32	1700-2000	24	48
Total	50	100	Total	50	100

Source: Field survey, 2016

From the above table 26 percent respondents answered Rs.500-800 is required for installing one hole stove, 42 percent respondents answered Rs.800-1100 is required for installing one hole stove and 32 percent respondents answered Rs.1100-1400 is required for installing one hole stove. Similarly 32 percent respondents answered Rs.500-800 is required for installing two hole stove, 22 percent respondents answered Rs.1200-1600 is required for installing two hole stove and 48 percent respondents answered Rs.1700-2000 is required for installing two hole stove.

4.4.5 Use of Installed ICS

Even though ICS was introduced in the era of 70s, it was not able to gain popularity due to several reasons. Mostly reported reasons were technical problems due to which people stopped using ICS in mid way. This study also tried to examine whether people are giving continuation to use ICS. However, the finding of this study is seen fairly positive.

Table no. 10: Use of ICS

Use of ICS	No. of HH	Percent
Cooking	37	74
Boiling	0	0
Make animal food	6	12
Make liquor	7	14
Heating room	0	0
Total	50	100

Source: Field survey, 2016

From the above table majority of the respondents i.e. 74 percent are using ICS for cooking purpose, 12 percent respondents use ICS to make animal food and 14 percent respondents use ICS to make liquor. No respondents use ICS for boiling water and heating room. From this, we can conclude that the perception towards ICS has been changed and people are accepting the improved technology.

4.4.6 Frequency of Maintenance

Operation and maintenance is one of the vital aspects in the successful dissemination of ICS. The frequency of maintenance here means not repairing but frequent maintenance like chimney cleaning. As smearing with cow dung and mud is a daily job, this is not accounted under maintenance category. Even though ICS needs frequent maintenance than the traditional stoves,

Table 11: Frequency of Stove Maintenance

Frequency of Stove Maintenance	No. of HH	Percent
Once	17	34
Twice	11	22
Thrice	6	12
More than 3 times	2	4
Not yet repaired	14	28
Total	50	100

Source: Field survey, 2016

From the above table majority of the respondents i.e.34 percent respondents have done maintenance their ICS only once time, 22 percent respondents have done maintenance twice from the installation, 12 percent respondents have done maintenance 3 times from its installation, 4 percent respondents have done maintenance more than three times and 28 percent respondents have not repaired ICS from its installation. This shows that ICS users do not have to spend more time and cost in repair and maintenance.

4.5 Impact of ICS

This section analyses the impact of ICS on the basis of perception of the ICS using households. The impact will be analyzed on firewood consumption, saving in cooking time, impact on health of women and children and environment, financial requirement and cost of ICS and drop out of ICS. The analysis will be made by comparing the situation of before and after installation of ICS.

Table no.12: Problems Facing by ICS Users

Problems from ICS	No. of HHs	Percent
Direction of chimney against wind direction	13	26
Does not burns wood properly	5	10
Consumes more firewood	11	22
Cook food slower than traditional stove	7	14
No one of above	14	28
Other	0	0
Total	50	100

Source: Field survey, 2016

From above table 26 percent respondents facing problem like direction of chimney against wind direction, 10 percent respondents answered does not burns wood properly, 22 percent respondents answered consumes more fire wood than in traditional stove, 14 percent respondents answered cook food slower than traditional stove were the problem faced by using ICS, 28 percent respondents replied no one of above that means 28 percent respondents found no problem from use of ICS and they like use of ICS and zero percent respondents answer they are facing other type of problems.

4.6 Amount of Fuel Wood Consume by TCS and ICS

Both TCS and ICS require fuel wood. That means fuel wood is very important for these stoves to perform work. Fuel wood consumption by these stoves may differ. One stove may consume more fuel wood and another may consume little fuel wood.

Table no. 13: Amount of Fuel Wood Consumption

Amount of fuel wood in TCS(Kg)	**No. of HHS**	**Percent**	**Amount of fuel wood in ICS(Kg)**	**No. of HHS**	**Percent**
5-7	17	34	2-3	11	22
7-9	21	42	3-5	18	36
9-11	12	24	5-7	21	42
Total	50	100	Total	50	100

Source: Field survey, 2016.

From the above table 34 percent respondents answered amount of fuel wood required in TCS is range from 5-7 Kg, 42percent respondents answered amount of fuel wood required in TCS is range from 7-9 Kg and 24 percent respondents answered amount of fuel wood required in TCS is range from 9-11 Kg whereas 22 percent respondents answered amount of fuel wood required in ICS is range from 2-3 Kg, 36 percent respondents answered amount of fuel wood required in ICS is range from 3-5 Kg and 42 percent respondents answered amount of fuel wood required in ICS is range from 5-7 Kg. From answer of respondents we can conclude that TCS require more fuel wood in comparison to ICS.

4.6.1 Source of Firewood Collection for Fuel

Firewood is important for ICS as fuel. There are different source of firewood. People may manage firewood from community forest, government forest, private forest, from own farmland, where as some people buy firewood.

Table no.14: Source of Fire Wood

Source of firewood	No. of HHS	Percent
Community forest	27	54
Government forest	0	0
Private forest	13	26
From own farmland	8	16
Buy	2	4
Other	0	0
Total	50	100

Source: Field survey, 2016

From above table 54 percent respondents answered they brought firewood from community forest, and there is no government forest, 26 percent respondents answered they brought firewood from private forest, 16 percent respondents answered they brought firewood from their own farmland, 4 percent respondents buy firewood from

market, and zero percent respondents answered other source. We can conclude that most of the respondents brought fire wood as fuel from community forest.

4.6.2 Time Consumption for Cooking

It was not that easy to identify time utilization by respondents in terms of direct benefits. Normally people do not record time for any work they do in the rural areas. Every activity is seen as routine work that is not recorded in their memory too. However, respondents mentioned that there has been decrease in cooking time after installation of the ICS.

Table15: Time taken by traditional stove and ICS

Cooking time	**Traditional stove**		**ICS**	
	No of HH	**Percent**	**No of HH**	**Percent**
Less than 1 hour	3	6	16	32
1 hour	17	34	24	48
1 to 2 hours	30	60	10	20
Total	50	100	50	100

Source: Field Survey, 2016

From the above table 6 percent respondents answered less than one hour time required for cooking food traditional stove where as 32 percent respondents answered less than one hour time was enough for cooking food in ICS, 34 percent respondents answered one hour time require for cooking food in traditional stove where as 48 percent respondent answered one hour time is enough for cooking food in ICS,60 percent respondents answered one to two hour time is required for cooking food in traditional stove where as 20 percent respondents answered one to two hour time is required for cooking food in ICS. From above table we found that less time is required for cooking food in ICS than traditional stove.

4.7 Health Problem in Women and Children before Installation of ICS

There observed many health problem due to smoke comes from traditional stove. Smoke may cause different health problem like respiratory problem, cough and cold, chest pain, asthma, eye problem, headache etc**.** Indoor air pollution is a significant threat in households using traditional stoves. More than 75 percent people living in rural areas of Nepal, burn biomass (wood, crop residues, and dung) for cooking and heating. Specifically, indoor air pollution affects women and small children far more than any other sector of society. Women typically spend three to seven hours per day by the fire, exposed to smoke, often with young children nearby. This survey also revealed that significant proportion of the households were suffering from various health problems before ICS installation because of smoky environment resulting from traditional stoves. It was observed that biomass fuels were the main cooking source.

Table no.16: Health Problem in Women and Children

Health Problems	**No. of HH before Installation of ICS**	**Percent**
Respiratory	8	16
Cough and cold	4	8
Chest pain	5	10
Asthma	9	18
Eye problem	13	26
Headache	11	22
Other	0	0

Total	50	100

Source: Field survey, 2016.

From above table 16 percent respondents were suffered from respiratory problem, 8 percent respondents answered they were suffered from cough and cold, 10 percent respondents answered they were suffered from chest pain, 18 percent respondents answered they were suffered from asthma, 26 percent respondents answered they were suffered from eye problem, 22 percent respondents answered they were suffered from headache and 0 percent respondents answered they were suffered from other before installation of ICS. It shows that there were many health problems from use of traditional cooking stove (TCS).

4.7.1 Money Spend in Health Checkup of Women and Children Before and After ICS Installation

There found many health problem from smoke comes by use of stoves. But traditional stove produces more smokes than ICS. Woman and children will be fall sick if the stove produces more smoke and require more money for their health checkup. Similarly woman and children will fall less sick if the stove produces little smoke and require less money for their treatment.

Table no.17: Money Spent in Health Checkup

Money spend in health checkup annually	**No. of HHs before ICS installation**	**Percent**	**No. of HHs after ICS installation**	**Percent**
Less than 1000	4	8	23	46

1000-3000	7	14	14	28
3000-6000	14	28	5	10
6000-9000	9	18	3	6
9000 and above	11	22	1	2
No idea	5	10	4	8
Total	50	100	50	100

Source: Field survey, 2016.

From above table 8 percent respondents answered less than 1000 rupees spend in health checkup annually while using TCS where as 46 percent respondents answered less than 1000 rupees spend in health check up annually while using ICS, 14 percent percent respondents answered 1000-3000 rupees spend in health checkup annually while using TCS where as 28 percent respondents answered 1000-3000 rupees spend in health checkup annually while using ICS, 28 percent respondents answered 3000-6000 rupees spend in health checkup annually while using TCS where as 10 percent respondents answered 3000-6000 rupees spend in health checkup annually while using ICS,18 percent answered 6000-9000 rupees spend in health checkup annually while using TCS where as 6 percent respondents answered 6000-9000 rupees spend in health checkup annually while using ICS, 22 percent respondents answered 9000and above rupees spend in health checkup annually while using TCS where as 2 percent respondents answered 9000 and above rupees spend in health checkup annually while using ICS and 10 percent respondents answered no idea in health checkup annually while using TCS where as 8 percent respondents answered no idea in health checkup annually while using ICS. From the table we found more money spend in health checkup annually while using TCS in

comparison to ICS. Above table also show that health problems have been greatly reduced and significant improvement seen in smoke-borne diseases after the ICS installation.

4.7.2 Improvement on Health After Installation of ICS

There found significant improvement in health of women and children after installation of improved cook stoves in the rural areas.

Table no.18: Health Status after Installation of ICS

Exists health problems after ICS installation?	No. of HHS	Percent
Yes and health condition is same as before	5	10
Yes but not serious as before	21	42
No problems at all	24	48
Total	50	100

Source: Field survey, 2016.

From the above table 10 percent respondents answered there exist health problem same as before ICS installation, 42 percent respondents answered there exist health problem but not serious as before ICS installation and 48 percent respondents answered there exist no problem at all after installation of ICS.

4.8 Impact on Environment

The study also tried to assess the impact of ICS on environment which was completely based on the general perception of respondents. As ICS produce less smoke in comparison to traditional stove, so ICS is environment friendly stove.

Table 19: Impact on Environment

Impacts	No. of HHS	Percent
Firewood collection load is reduced	17	34
Illegal tree falling is reduced	14	28
Minimized firewood sale	7	14
Compared to 5 years back, forest looks dense	10	20
Others	2	4
Total	50	100

Source: Field Survey 2016.

From the above table 34 percent respondents answered reduced in firewood collection load, 28 percent respondents answered reduced in illegal tree falling, 14 percent respondents answered minimized in firewood sale, 20 percent respondents answered forest look dense as compared to 5 years back and 4 percent respondents answered other. We can conclude that reduction in illegal tree felling from the forest and decrease in firewood sale supports conserving the forest.

4.9 Number of Drop out Respondents out of 50 Households

50 were our sample households. All the HHS we take do not use ICS continuously that means few of these HHS have been left it to use.

Table no. 20: Number of Drop out Respondents

Respondents	No. of HHS	Percent
Non dropper	37	74
Dropper	13	26
Total	50	100

Source: Field survey 2016

From the above table 74 percent respondents were continuously using ICS from its installation where as 26 percent respondents have been left it to use.

4.9.1 Causes of Drop Out

In the field study we found some drop out respondents who have been use ICS in past but due to certain reason they left it to use and now a days they use other types of stove.

Table no. 21: Causes of Drop Out

Causes	No. of HHS	Percent
Back fire	3	23
Consume more fuel wood	3	23
Smoke not pass out	5	38
Take more time for cooking food	2	15
All of the above	0	0

Total	13	100

Source: Field survey 2016

From the above table out of ICS drop out respondents i.e. 13, 23 percent drop out respondents answered back fire was the cause of their drop out, similarly 23 percent drop out respondents answered ICS consume more fuel wood was the cause of their drop out, 38 percent drop out respondents answered smoke not pass out while using ICS was the cause of their drop out, 15percent drop out respondents answered ICS take more time for cooking food was the cause of their drop out, and zero percent respondents answer all of above are the cause of the drop out.

4.10 People Suffered from Different Type of Disease Cause by Smoke in Nareshwor VDC, Ward no. 4 from the Year 2011 to 2016.

Traditional stove produce more smoke, which influence the health of stove user mainly women and children because in most of houses women cooks and children
also stay in home with their mother. Smoke may cause different types of disease like head ache, eye problem, asthma, respiratory problem etc. Data on, people (of Nareshwor VDC ward no. 4) suffered from disease caused by smoke collected from Gorkha Hospital are tabulated and analyzed below.

Table no. 22: People Suffered from Smoke over 6 years

Disease	**No Of People**					
	Year 2011	**Year 2012**	**Year 2013**	**Year 2014**	**Year 2015**	**Year 2016**
Eye problem	115	90	66	53	40	34

Asthma	50	45	41	39	37	35
Head ache	75	60	43	37	33	24
Respiratory problem	60	53	47	41	35	29
Total	300	258	197	160	145	122

Source: Field survey, 2016

From the above table we found no. of patient due to smoke is decreasing in study area from 2011 to 2016. Total no of patient due to smoke are 300, 258, 197, 160, 145 and 122 respectively in year 2011, 2012, 2013, 2014, 2015, 2016. This show decreasing the no. of patient due to smoke. That means people of this area are became more health conscious and start to use less smoke producing stove like ICS and other modern stoves like bio-gas, LP gas etc.

CHAPTER FIVE
MAJOR FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Major Findings

Following are some of the highlights of the key findings:

- Ward no-4, Nareshwor VDC of Gorkha district is the study area.
- The VDC has 1,026 households with total population 3,692 male 1,563 and female 2,129.
- It is found that out of total households 50 households has been taken as sample household.
- All these 50 HHs who are the users of ICS taken as sample HHs (100%) taken from a ward.
- Average household size of Nareshwor VDC is 3.78
- Major occupation status of the sample HHs, Agriculture 54% service in Teacher 10%, business8% and others 10%
- In the study area 42% HHs installed ICS after getting information from promoter while 26% household installed ICS inspired by neighbour, 20% HHs installed ICS inspired by friends and 12% HHs installed ICS inspired by group member.
- In the study area majority of 26% HHs have income Rs. 12000-15000, 20%HHs have income Rs. above 15000, 20%HHs have income Rs. 6000-9000, 18%HHs have income Rs. 3000-6000, 10%HHs have income Rs.9000-12000 and 6% HHs have income Rs. 1000-3000 per month.
- Majority of the ICS (34%) were constructed more than four year before. Twenty four percent respondents have installed it before 1-2 years. Sixteen percent constructed ICS before 3-4 years. Ten percent Respondents have installed it before 2-3 years and again ten percent respondents have installed it before one year and only 6 percent respondents installed it less than one year before. This shows that use of ICS is accepted by the people in Nareshwor VDC of Gorkha.
- In the study area most of the respondents have installed two hole ICS i.e 78percent and 22pecentrespondents have installed one hole ICS and no respondents have installed three hole ICS
- In the study area 42% respondents installed ICS inspired by promoter, 26% inspired by their neighbours, and 20% inspired by friends and 12% inspired by group member.
- In the study area 22 percent respondent answered ICS installation require Rs. 500-800, 14 percent respondent answered Rs.900-1200, 18 percent respondent answered Rs. 1300-

1600, 26 percent respondent answered Rs. 1700-2000, 20 percent respondent answered ICS installation require above Rs. 2000.

- In the study area 26 percent respondents answered Rs.500-800 is required for installing one hole stove, 42 percent answered Rs.800-1100 and 32 percent answered Rs.1100-1400 is required for installing one hole stove. Similarly 32 percent respondents answered Rs.500-800 is required for installing two hole stove, 22 percent answered Rs.1200-1600 and 48 percent answered Rs.1700-2000 is required for installing two hole stove.
- In the study area 74 percent respondents are using ICS for cooking purpose, 12 percent use to make animal food and 14 percent use to make liquor. No respondents use ICS for boiling water and heating room.
- In the study area 34percentrespondents have done maintenance their ICS only one time, 22 percent done twice, 12 percent done 3 times, 4 percent done more than three times and 28 percent have not repaired ICS from its installation.
- In the study area 26 percent respondents facing problem like direction of chimney against wind direction, 10 percent comment does not burns wood properly, 22 percent comment consumes more fire wood than in traditional stove, 14 percent comment cook food slower than traditional stove, 28 percent replied no one of above that means 28 percent respondents found no problem from use of ICS and they like use of ICS and zero percent respondents answer they are facing other type of problems.
- In the study area 34 percent respondents answered amount of fuel wood required in TCS is range from 5-7 Kg, 42 percent respondents answered 7-9 Kg and 24 percent respondents answered 9-11 Kg fuel wood required in TCS whereas 22 percent respondents answered amount of fuel wood required in ICS is range from 2-3 Kg, 36 percent respondents answered 3-5 Kg and 42 percent respondents answered 5-7 Kg fuel wood required in ICS.
- In the study area 54 percent respondents answered they brought firewood from community forest, and there is no government forest, 26 percent brought firewood from private forest, 16 percent brought firewood from their own farmland, 4

percent buy firewood from market, and zero percent respondents answered other source.

- In the study area 6 percent respondents answered less than one hour time required for cooking food, 34 percent respondents answered one hour, 60 percent respondents answered one to two hour time required for cooking food traditional stove where as 32 percent respondents answered less than one hour time was enough for cooking food, 48 percent respondent answered one hour, 20 percent respondents answered one to two hour time is required for cooking food in ICS.
- In the study area 16 percent respondents suffered from respiratory problem, 8 percent suffered from cough and cold, 10 percent suffered from chest pain, 18 percent suffered from asthma, 26 percent suffered from eye problem, 22 percent suffered from headache and 0 percent suffered from other before installation of ICS.
- In the study area 8 percent respondents answered less than 1000 rupees, 14 percent percent respondents answered 1000-3000 rupees, 28 percent respondents answered 3000-6000 rupees, 18 percent answered 6000-9000 rupees, 22 percent respondents answered 9000 and above rupees spend in health check up annually and 10 percent answered no idea while using TCS where as 46 percent respondents answered less than 1000 rupees,28 percent respondents answered 1000-3000 rupees,10 percent respondents answered 3000-6000 rupees, , 6 percent respondents answered 6000-9000 rupees, 2 percent respondents answered 9000 and above rupees spend in health check-up annually, and 8 percent answered no idea while using ICS.
- In the study area 10 percent respondents answered there exist health problem same as before ICS installation, 42 percent respondents answered there exist health problem but not serious as before ICS installation and 48 percent respondents answered there exist no problem at all after installation of ICS.
- In the study area 34 percent respondents answered reduced in firewood collection load, 28 percent answered reduced in illegal tree falling, 14 percent answered minimized in firewood sale, 20 percent answered forest look dense as compared to 5 years back and 4 percent answered other.

- In the study area 74 percent respondents were continuously using ICS from its installation where as 26 percent respondents have been left it to use.
- In the study area, 13 percent were ICS drop out HHs out of 50 HHS, assuming this 13 percent as 100 percent, 23 percent drop out respondents answered back fire, 23 percent drop out respondents answered ICS consume more fuel wood, 38 percent drop out respondents answered smoke not pass out and zero percent respondents answer all of above were the cause of their drop out of ICS.

5.2 CONCLUSION

The success of the energy intervention program largely depends on whether the users accept the ICS. The study shows that respondents are accepting the improved technology by knowing its benefits and efficiency. Shree Swarna Integrated Community Development Centre (SSICDE) is working actively to motivate people for installation of ICS. Generally, in the rural areas new technologies are not accepted due to lack of proper information, lack of money, tedious to maintain after installation etc. However, in the case of Nareshwor VDC, ward no-4, some respondents reported that maintenance was done 1-2 times after the construction. This shows that, maintenance was not a great problem while using ICS.

a. The study conducted in 50 houses. The majority of house installed ICS in high cost which may affect the low income people and benefit of ICS can't spread to all people. Cost of two hole ICS is relatively higher than one hole. If cost could be lower, more people will install two hole ICS since its benefit is greater than one hole.
b. Greatest percentage of houses spent big money for heath check up before installation of ICS whereas there was very lower percentage of houses who were spent large money for health check up after installation of ICS. It reflects the benefit of ICS.
c. Smoke not pass out was the major cause of being dropped out after installation of ICS among other causes therefore there must be concerned while installing the

ICS. There should be concentration regarding the technique of maintenance after installation, direction of air and so on. On this matter, technician should aware about this technology and must inform the proper information related to ICS uses to the people.

Overall, the findings of the study showed that ICS is effective in reducing forest pressure. It not only save energy but also save money.

Fuel wood collection and cooking are two major activities which directly showed the saving of time after installation of ICS however fuel wood collection and consumption was higher before installation of ICS. The women and children do not have to go to forest for collection of fuel wood. The time can be used to another activities like income generating activities, agriculture, caring livestock and cleaning house and most importantly health is being well day after day as compared to that of before installation. Therefore it is necessary to make a reliable policy to install ICS properly and must spread this technology throughout the rural area of Nepal which will be beneficial for poor people and health cost will be reduced and people will be more productive which is effective in country's economy.

5.3 RECOMMENDATIONS

As we have discussed the benefits of ICS above, it is wiser and most appropriate solution during energy crisis, not only for remote areas but also for urban areas. Based on the study following recommendations are made for its wider applications throughout the nation.

1) A wider level promotion for ICS installation, specifically in its technical aspects is required as people are still hesitant to install ICS because of technical issues.

2) Baseline survey to measure impact of ICS is missing. Therefore, there is need to conduct baseline survey to assess impact at the end of the project. Non users survey should be conducted to help compare in the future;

3) Although government has given some space for ICS promotion in its 10th five year plan, implementation in the field is negligible. ICS program is seen as the program of development agencies only. Thus, this should be integrated with VDC level program. This also helps to sustain the program in the long run.

4) More awareness programs and encouragement in installing ICS in the community is required.

5) Training to build ICS should be provided to the local people, so that they can make ICS themselves and help to build for other local people also.

6) According to data analysis the researcher find out that literate were more than illiterate to use ICS. Although ICS was necessary to all rural people, so that to participate them in counselling program, awareness, and those program which encourage them in ICS

7) Though ICS brings improvement in respondent's health status there need to increase the access of non–user people.

8) Government should run campaign to make people aware about ICS, its use and impact on the users.

9) Effective implementation of clean development mechanism (C.D.M) for ICS should be ensured.

10) Effective monitoring and evaluation of various institutions and programs on ICS should be done in regular basis.

11) ICS is necessary for all people, so that the government considerably in maintained and manage in the above recommended point as well as local body should be involved in implementation

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Annex I

(Questionnaire)

1. General Information of the Respondents

a) Name: b) Ward

f) Occupation:

2. Economic condition

a) For how many months can farming feed you?

- Less than 3 months
- 3-6 months
- 6-9 months
- 9-12 months
- 12 months and surplus to sell
- No land

b) What do you do if it insufficient for consumption from farming?

- Wage Labour
- Share-crops farming
- Business
- Service
- Foreign employment
- None
- Other (specify if any)

c) What is your family's income from other profession besides farming?

- Less than Rs. 1000
- Rs.1000-3000
- Rs. 3000-6000
- Rs. 6000-9000
- Rs. 9000-12000
- Rs. 12000-15000
- Above Rs.15000

3. Information on ICS installation

a) When did you install ICS at your home?

- Less than 1 year
- 1 year
- 2 years
- 3 years
- 4 years
- more than 4 years

b) Which type of stove have you installed?

- One hole
- Two holes
- Three holes

c) Who motivated you to install ICS?

- Promoter
- Neighbour

- Friends
- Group members
- Other (Specify if any).....

d) How much money you have paid for installing ICS?

For one hole?

.....Rs.

For two holes?

.....Rs.

For three holes?

.....Rs.

e) How did you manage the cost ?

- .....Rs. is reasonable cost
- Government should share 50%
- NGOS/INGO provided to free installation

f) Did you get subsidy from govt.?

- Yes
- No

g) Are you using the stove?

- Once
- Twice

If no, why?

……

……

If you are using the stove please respond to the following questions:

a) For what purpose do you use ICS?

- Cooking
- Boiling water
- Make animal food
- Make liquor
- Heating room
- Other (Specify if any).....

b) How often have you done maintenance after installing ICS?

- Once
- Twice
- Thrice
- More than 3 times
- Not at all

c) How much cost involve in maintenance?

- ..... Rs.

d) What type of problems are you facing in using ICS? (You can check more than one question)

Problem of smoke outlet

- Direction of chimney against wind direction
- Does not burn wood properly
- Consumes more firewood
- Cooks food slower than tradition stoves
- None of the above
- Other (Specify if any).....

e) What other types of stoves are you using beside ICS?

- Bio gas
- LPG
- Kerosene stove
- 3 stones
- Tripod
- Traditional mud stoves

4. Effectiveness of ICS

a) How much fuel wood was used in Traditional Stove in a day?

…….. kg

b) How much fuel wood is required now in a day?

…….. kg

c) What types of bio fuel do you use at your home?

- Fire wood
- Cow dung cake
- Hay/straw
- Twigs and agricultural residue

- Other (Specify if any).....

d) Where do you collect firewood from?

- Community forest
- Government forest
- Private forest
- From own farmland
- Buy
- Other (Specify if any).....

e) Who goes to collect fuel wood in your family?

- Self
- Father-in-law
- Husband
- Wife
- Mother-in-law
- Son
- Daughter
- Daughter-in-law
- All the family members
- Buy
- None of the above
- Other (Specify if any).....

f) How much time do you spend to collect fuel wood?

……. Mins/hour

g) How much time did you require to prepare food in Traditional stoves?

…… mins/hour

h) How long it takes to prepare food in improved cooking stoves?

…… mins/hour

i) How long did you used to spend to collect a bhari of fuel wood while using traditional stove?

- Less than 1 hour
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- More than 4 hours

j) How long does it take now to collect a bhari of fuel wood after ICS installation?

- Less than 1 hour
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- More than 4 hours

5. Impacts of ICS on Health

a) What kind of health problems that woman and children have been facing while using traditional stove?

- Respiratory

- Cough and cold
- Chest pain
- Asthma
- Eye problem
- Headache
- Other (Specify if any).....

b) Do you still have those problems?

- Yes, same as before.
- Yes, but not serious as before
- No

c) How often you visit for health check-up?

- Before ICS
- After ICS

d) How much money do you used to spend on health check-up of woman and children while using traditional stove in a year?

- Less than thousand
- 1000-3000
- 3000-6000
- 6000-9000
- 9000 and above
- No idea

e) How much money is spent now on health check-up after using traditional stove in a year?

- Less than thousand
- 1000-3000
- 3000-6000
- 6000-9000
- 9000 and above
- No idea

6. Impacts of ICS on Environment

a) What impacts are seen in forest conservation after the use of ICS (you can check more than one responses)

- Reduce in fire wood collection
- Illegal tree felling has been minimized
- Minimized fire wood sale
- Compared to 5 years back, forest looks dense
- Other (Specify if any).....

b) What other improvements are seen in environment conservation after using ICS?

……

……

……

c) What impacts are seen in sanitation after use of ICS?

……

……

……

7. For dropped out ICS users:

a) Did you use ICS previously?

- Yes but now we are using another stove
- No

b) Why you are not using ICS despite it has many benefits?

- Difficult for use and maintenance
- Lack of skill full technician
- Having many problems
- If others please specify.....

c) What are the causes for dropped out of ICS?

- Back fire
- Consume more fuel wood
- Smoke not passed out
- Take more time for cooking food
- All of the above

e) Do you want to use ICS again if trained technician come to build it?

- Yes
- No
- Need to discuss with family
- Others

f) Are there any houses who have constructed ICS but not using them?

- Yes

- No

If yes, what might be the reason?

.....

8. Financial requirement and cost for ICS use.

a) How much money do you spent in ICS installation?

- Rs. 500-800
- Rs. 900-1200
- Rs.1300 -1600
- Rs.1700-2000
- Above Rs. 2000

b) From where are you getting fire wood as a fuel?

- From forest
- From market
- From own agricultural

c) If buy firewood from market how much cost you pay for one bundle of firewood?

- 40-50 Rs.
- 60-80 Rs.
- 80-100 Rs.

d) How many days do you use one bundle of fuel wood in ICS?

- 2-3 days
- 3-4 days
- 4-5 days
- More than five days

e) Do you feel reduced in fuel wood cost of ICS than in traditional cooking stove?

- Yes
- No
- Same cost in both

9. Other Benefits from use of ICS

a) Have you been able to save your cooking and cleaning time after use of ICS?

- Yes
- No

If yes, how much time?

..... Mins/hour

b) What do you do to utilize your time?

……

……

……

c) How many people in your area are engaged in promoting/constructing ICS?

…… people

d) How much does it cost to construct an ICS?

Rs. ……to

Rs. ……

9. Other Information Regarding use of ICS

a) Do you want to continue using ICS?

- Yes
- No

Why?

..... ……

……..

b) What should be done to make ICS program more effective? Please give your suggestions.

……

……

……

Thank You!

Annex - II

Questionnaire for the Key Informants

Confidential, Information to be used for Research Purposes only

Namastay!

(My name is Shobha Basnyat and student from Central Department of Rural Development two years Programmers conducted by Tribhuban University, Kirtipur, Kathmandu Nepal. On another new curriculum initiate science 2002 A.D. On a level of master degree with taking of objectivity to enable the student to work as competent rural development cadres and to meet the demand for the higher level rural developers in governmental and non-governmental sectors within and out side country. Here my mission through project work on Energy trend and solution through Solar panel is mainly concerning the issue of energy demand as the mode of energy supply to the concerning people.)

Your participant in this survey is voluntary and you choose not answer to any individual question or all of questions. However may I be hope that you will participant in this survey since your views are important? May I proceed with the question?

Respondent No. ……

Name of Respondent: …….. Age: …. Sex : F/M

District: ……..… Name of VDC…….. Ward No. …

Native Language: …… Occupation: ……

Education Level: …….. Place of interview: ……

Religious: …… Date and Time of interview: ……

Interviewers's Name : Shobha Basnyat

Signature: ..…….....

Appendix – III

Unstructured Question for Key Informant Interview

1. When did you install ICS at your home
2. Which type of stove have you installed
3. Who motivated you to install ICS
4. How much money you have paid for installing ICS
5. How often have you done maintenance after installing ICS
6. How much cost involve in maintenance
7. What type of problems are you facing in using ICS
8. What types of bio fuel do you use at your home
9. Where do you collect firewood from
10. What kind of health problems that woman and children have been facing while using traditional stove
11. How much money do you used to spend on health check-up of woman and children while using traditional stove in a year
12. How much money is spent now on health check-up after using traditional stove in a year what impacts are seen in forest conservation after the use of ICS
13. What other improvements are seen in environment conservation after using ICS
14. How many people in your area are engaged in promoting/constructing ICS
15. What should be done to make ICS program more effective

ANNEX IV

Checklist – Focus Group Discussion

Status of Improved Cooking Stove in Rural Nepal: A Case Study of Nareshwor VDC

1. Location

   District:

   VDC:

   Ward No. :

   Village/ Tole:

2. Date:

   Time:

   Facilitator:

3. List of Participants:

S.N.	Name	Sex	Age

4. General Information

4.1 Total population of the VDC: ……

4.2 Total Population in the ward: ……

5. Impact of ICS

5.1. Amount of Fuel Wood Consumption

5.2. Source of Fire Wood collection for Fuel

5.3. Time Consumption for Cooking

5.4. Health Problem in Women and Children Before Installation of ICS

5.5. Money Spend in Health Check-up of Women and Children Before and After ICS Installation

5.6. Improvement on Health after Installation of ICS.

6. Sustainability

6.1. Acceptability of the technology

6.2. Time saving because of technology.

6.3. Good heath after installation.

6.4. Reduction in fuel wood.

Name of Respondent Participation FGD in Darembotee Mahila Samuha

1. Hira Aryal
2. Parbati Adhikari

3. Ramita Aryal
4. Purnima Bogati
5. Til Kumari Khatri
6. Maya Tiwari
7. Sangita Thapa
8. Puspa Shrestha
9. Sita Bogati
10. Nirmala Aryal
11. Laxmi Pariyar
12. Muna Pariyar

Thank You!