# CHAPTER- I

## 1.1 Background of the study.

### Improved Cooking Stoves

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.

### History of ICS in Nepal

Improved cooking stoves (ICS) programs started in early 1950s in Nepal. At that time "Hydarabad 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 a 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 fuelwood problem. In 1981 [[Community Forest Development Project]] (CFDP) developed prefabricated ceramic ICS. In 1982, prefabricated ceramic stoves were tested, and after some modification, RECAST/T.U 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/T.U 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 Midhill 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 Center), which is a government organization, there is 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.

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 fuelwood problem. The government's concern for fuelwood 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.

Improved Cook Stoves Development in 1990s: The development of mud brick stove by Research Center 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 Nepal1.

In 1995, ICS network supported by Asia Regional Cookstove 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 networ Inventory of ICS in Nepal 2000, CRT/N

has concentrated its effort in bringing uniformity among approaches of various organizations involved by advocating a bottomup and subsidyless 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 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 National ICS Program: Within the framework of the 9th plan, the National ICS program has been initiated in Nepal from early 1999 with the support from Energy Sector Assistance Program (ESAP) of DANIDA and Alternative Energy Promotion Center (AEPC) of the HMG/N. Many district level NGOs and CBOs like the Centre fir Rural technlogy (CRT/N) implement this programme.

The general objective of this program is to establish a sustainable framework and strategy to make available technically and socially appropriate ICS in rural communities based on local capacity building and income generation. This program has been promoting ICS in 33 mid-hill districts of the country. The type of ICS promoted is made up of 3-part mud/earth, 2 parts straw/husk and 1 part animal dung. The whole structure is plastered smooth with the same mud mortar. ICS has two fire openings for cooking pots, one behind the other.

There is no need to blow the fire. It utilizes the heat, generated by burning fuelwood, more by the deflection of the flames and heated air inside it which travel to the second opening with the help of an in-built baffle located just below the second opening, before the hot air exits out of the chimney, which is made of un-burnt clay bricks that can be made in the village. The iron plates are fitted on the potholes for pots. The potholes are round in shape; the pot bottom fits tight on them. It can be made in different sizes and capacities to suit the family size and pot size. It can have one or more openings for pots/pans.

ICS can even be used for space heating by adding a cast iron/mild steel plate put tight over the pot holes for the pots or by putting a metal pipe around the space/room to make the pots or by putting a metal pipe around the space/room to make the hot air pass Technical Specification of Two Pot Hole ICS .(www.ics.gov.np)

Basanta Thapa is one of the very successful promoters of Arghakhanchi district. He had to leave his studies due to poor financial conditions of his family and look for sustaining his family's livelihood. He received the promoters training under the National ICS program. Up until now,he

has installed 302 ICS and has earned NRs 69, 000 (1US$=NRs 70). In addition to the ICS he has been promoting ICS with fan and back boiler, which has been well appreciated by the community. He has been traveling outside his villages to install ICS and aware people on its benefits. He says he will continue installing ICS as an important source of his livelihood. Seeing his enthusiasm and motivation other promoters are also following in his footstep. (Source: Centre for Rural Technology, Nepal 2005)

around the room through the pipe before going out through the chimney. Nowadays, use of ICS for water heating by attaching a back boiler on the side or around the chimney pipe is increasing in the mid hills and mountain regions of Nepal. The materials required for the construction of ICS are locally available and includes stones/bricks, mud/earth, straw/rice husk, iron plates/ rebar/sheet, animal dung. In addition to the domestic ICS, promotion of institutional improved cook stoves in hotels, teashops, schools, hostels, and barracks is being carried out.

In Nepal, women are mainly responsible for cooking activities and collecting firewood.. Studies have shown that ICS has efficiency of 15-25% and fuel wood saving is 30-35% thus favoring the drudgery reduction of women as ICS cuts down their cooking time and hardship in collection of scarce fuel wood. Women and their children are generally exposed to indoor air pollution. The indoor air pollution due to the combustion of biomass fuel is the main cause of Acute Respiratory Infection (ARI), Chronic Obstructive Lung Diseases (COLD), eye infection and pneumonia in women and children. Studies have shown that with the use of ICS human exposure to pollutants in the kitchen environment has been reduced by an average of 69% carbon monoxide concentration, 53% Total Suspended Particle (TSP) Concentration and 63% HCHO (Formaldehyde) Concentration2. The majority of the women using ICS have responded that they had asthma and eye burning due to traditional stoves but also that the situation has improved after installation of ICS and they don't suffer from burning eyes and breathing problems. (www.Aepc .gov.np)

The materials required for the ICS construction are locally available and the users have to bear the cost of iron rod and installation charge only. The cost varies depending on the place although it is generally around 200-300 Nepalese rupees (1 US $ = Nepalese rupees 70.). This amount includes the cost of iron rod, which ranges from 80 to100 Nepalese rupees as well as the labor cost, which ranges from 100 to200 Nepalese rupees. The labor cost includes the cost of mud, brick preparation and ICS installation. There has always been difference in approaches among various organizations involved in ICS promotion and dissemination. Some organizations provide direct subsidy for ICS installation. The National ICS program has avoided ‘direct end-user subsidies’. The total cost of the stove installation is borne by the users themselves. There are other indirect subsidies in the form of awareness campaign, trainings, monitoring and evaluation, human resource development, which have been crucial for ICS demand-generation in the community.

ICS Program Implementation Strategies: • The success of the National ICS program has been achieved thanks to its proactive and flexible strategy, which has been implemented as follows:The major thrust of the program is on information-dissemination and awareness -aising through initiation workshops, demonstrations, school orientation activities and campaigns such as poetry, debate or song competition. • The program is implemented through network of local-partners organizations that facilitate ICS utilization through trained promoters. The involvement of local organization in dissemination process is ensured from decision-making, to monitoring and implementation of ICS program. • Local community members are trained as promoters for ICS installation. More precisely, women, people from disadvantaged group and financially weak background are particulary trained as promoters. These Status of Improved Cookstove Technology in Nepal, ITDG 2000.

promoters are trained in all the aspects of ICS installation and monitoring, enhancing their economic opportunities. In some cases, ICS construction has been the major source of income generation. The sustainability of ICS has also been enhanced as these local promoters are responsible for regular monitoring of the performance of the stove.

The emphasis given on monitoring and evaluation has been very crucial for the sustainability and success of the program. • In addition to ICS installation, the National ICS program has been promoting the concept of kitchen management. Improving the overall kitchen environment is essential to have a broader impact on the life, especially of women. The concept of kitchen management includes improved kitchen ventilation, overall management of kitchen wares, maintaining hygiene, waste-water drainage systems and waste management. The concept of kitchen mangament is thus increasing the kitchen efficiency as well as reducing hardship of women.

Problems and Solutions: ICS is a simple technology based on scientific concepts and easy to operate. Users do not face any severe technical problems during its operation. The problems may arise if ICS promoters do not adhere to the technical specification during installation or if users neglect regular maintenance. In the Nepali context, users clean the cook stove and plaster with the mud daily. This tends to change the pothole size and decrease the efficiency of stoves. Some of the typical problems encountered in the stoves are smoke backfiring because of wrong placement of chimney outlet, lack of regular cleaning of the chimney and slow cooking in the second pothole. However, the promoters always provide orientation on probable problems and their solution to the users. Users are also provided with the manual on operation and maintenance of the stove. Moreover, promoters regularly monitor the operation, check stoves efficiency and solve remaining problem.

Progress Status: From its initiation in May 1999 to the end of June 2005, the National ICS Program has disseminated about 125,000 ICS serving the same number of households in 33 mid-hill districts. The combined effort of national ICS Program and other organizations led to a dissemination of 200,000 ICS in the country by the end of June 2005. One should remember,

however, that it remains a meager number compared with the 2 million wood-burning households located in the rural areas.

The National ICS Program exemplifies the success of ICS dissemination program. The lessons learned from this program can be incorporated in other programs: • Demand generation from the community members themselves is very important for acceptance of the technology and its sustainability. This can only be achieved through effective information campaigns and awareness-development activities. • Involvement of local organizations in ICS dissemination and their building-capacity is essential for mass scale-up of ICS without too much external supports. • Development of technical service providers or promoters at local level creates an opportunity for self- employment at local level. It will continue to provide the monitoring and technical back-up, essential to the mass distribution of ICS.

Nepal is characterized by large number of beautiful landscape having diverse topographical, geographical and physiographical situation. Most of the people live in the rural and semi urban or peri urban area. Biomass is the major sources of energy in this area. The overall energy consumption of Nepal is largely dominated by the use of traditional non commercial forms of energy such as fuel wood, agricultural residues and animal waste. The share of traditional biomass resources is 87% . These fuels are used for household cooking and heating.

Traditional use of biomass is often linked to degradation of forests and woodland resources as well as soil erosion. Cooking by using traditional fuels leads to emissions of greenhouse gases and soot due to poor combustion and later it contributes to global warming through absorption of incoming radiation. The indoor air pollution due to the combustion of biomass fuel is the main cause of Acute Respiratory Infection (ARI), Chronic Obstructive Lung Diseases (COLD), eye infection and pneumonia in women and children. Studies have shown that with the use of ICS human exposure to pollutants in the kitchen environment has been reduced by an average of 69% carbon monoxide concentration, 53% Total Suspended Particle (TSP) Concentration and 63% HCHO (Formaldehyde) Concentration

One response to this firewood challenge has been the introduction of the Improved Cooking Stove (ICS) in Nepal. This type of stove was introduced in the 1980s to reduce the rate of deforestation, reduce indoor air pollution and increase the efficiency of household energy use . 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. Currently most common ICS in Nepal are the two-pot-holes mud stove and its variation the three pot- holes. The various models of such ICS are fitted with or without a chimney. The direct and indirect benefits of ICS includes: increased thermal efficiency, the conservation of forests by cutback in 10% to 30% of firewood consumption, reduction in women's labor, reduction in indoor air pollution and hence smoke-released health disorders, prevention of fire hazards, reduction of cooking time.

Adoption of fire tens of thousands of years ago was surely one of the most powerfuldevelopments in all of human history. Fire for cooking made possible the consumption ofa much wider variety of foodstuffs and greatly enhanced food safety. Fire for heatingallowed us to expand our range to higher latitudes and elevations, and it fundamentallytransformed our patterns of social development. But with fire also came the firstanthropogenic pollution, evidenced by the soot still found in prehistoric caves. Over thepast few centuries about half of humanity has been able to afford to transition fromtraditional biomass fuels (wood, animal dung, crop residues such as rice husks, etc.) tofossil fuels such as kerosene or gas, or to electricity. The remaining half of humanity,almost all in developing countries, continues to use biomass fuels or coal, often in openfires or in inefficient, smoky stoves. Consequently, the United Nations EnvironmentProgramme/World Health Organization Global Environment Monitoring System (GEMS) has confirmed that the worst overall air pollution conditions and the largest indoorpollutant concentrations and exposures are found in both rural and urban areas of the developing world.

The noxious and hazardous products of combustion from stoves,particularly indoors, in poorly ventilated houses, are a major source of health problemsincluding acute and chronic respiratory diseases, malignancies of the aero-digestive tractand lungs, burns, eye diseases, low birth weights and increased infant mortality. The totalpopulation in developing countries subjected to excessively high indoor pollutants from poorly ventilated household stoves is probably several hundred million. Women andyoung children bear the brunt of illness as a result of their exposure in the home. Butcooking smoke also remains an occupational hazard, especially for food vendors and food preparers like fish-driers,3 and it contributes significantly to outdoor pollution especiallyin densely populated areas.

Demand for traditional fuel also places significant pressure on local forests andwoodlands, contributing to deforestation, soil erosion and desertification. Frequently, theneed for wood is so great that reforestation attempts of badly degraded regions proveimpossible because even young trees are rapidly harvested for cooking fuelwood orcharcoal production. In the most severely affected regions, the poorest fuel sources,animal manures, grasses, crop residues, roots and shrubs are also harvested.Unfortunately, this increasingly common practice, especially in parts of Africa and SouthAsia, leads to a spiraling loss of soil fertility as natural fertilizers are not returned to theground. In other areas, such as rural China, exhaustion of traditional fuels has prompted aswitch to coal for household use with its own consequences. This review focuses on theenormous detrimental health and environmental impacts related to the use of cookingstoves in the developing world and examines some promising intervention strategieswhich may alleviate these burdens.

## Health Effects :

The adverse health effects of cooking stove smoke in developing countries has beenmuch less studied than the effects of tobacco or outdoor air pollutants affecting thepopulations of developed nations. Epidemiological studies have been limited by the factthat both short-term outcomes such as Acute Respiratory Infections (ARI), and long-termoutcomes like cancer and obstructive lung diseases can have multiple determinants. Longlatency periods between exposure and disease outcomes have also clouded the picture.Some studies on respiratory health in developing countries have also been hampered bymore subtle household and socio-economic confounding factors such as arrangement of rooms, floor type and ownership of a television or radio. Nonetheless, a growing bodyof literature has begun to document a variety of health problems of enormousproportions.

Acute Respiratory Infections Acute respiratory infections (ARI) are the leading cause of burden of diseaseworldwide and account for the deaths of 4-5 million children under five in developingcountries each year. A recent review examined the relationship between indoor airpollution from domestic biomass fuels in developing countries and acute lower respiratory infections, the major killer of children. The authors concluded on the basisof nine case control studies (n=4311, OR 2.2-9.9), four cohort studies (n=910, OR 2.2-6.0) and one case fatality study (n=206, OR 4.8), that pneumonia/ARI is probably the largest disease outcome from air pollution exposure worldwide. More minor symptomssuch as cough, cold, congestion and phlegm have been associated with kerosene and mixed fuel use in India. Among Jordanian23 and Indian24 school children, exposure to woodand kerosene cooking smoke was associated with sharp reductions in pulmonary function. In Turkey25 and Malaysia children in households cooking with wood had similarreductions in lung function

## Environmental Effects :

Shortages of wood and other biomass cooking fuels have forced communities to makesignificant changes to their local ecosystems. As populations increase and the demand forfuel rises, the surrounding environment is increasingly exploited resulting in markedreductions in tree cover. Particularly in arid and semiarid regions of the world, the needfor fuelwood results in significant deforestation, with all its detrimental consequences. Infact, in arid and semiarid parts of West Africa, fuelwood shortages limit the carrying capacity of the land more so than do low crop and livestock yields.This fuelwood shortage does not just affect rural areas. In many developing nations, electricity services in urban areas are irregular and often do not reach poor sectors. Since many households can not afford kerosene and liquefied petroleum gas (LPG), a substantial portion of the urban poor continue to rely on fuelwood and charcoal. Some have argued that urban fuelwood demand is more destructive of forests than rural needs,because of the intensity of cutting around cities, along roads and later from more distant sources. Urban demands are more often met by commercial entities that have equipment like chain saws and log splitters capable of

harvesting larger diameter trees. It is projected that in the Sahel, urban fuelwood use will soon exceed that of rural areas.

Global Deforestation Worldwide, over the last twenty years, roughly 300 million hectares (ha; 100 x 100meters, or 10,000 square meters or 2.47 acres) of forest (an area six times the size ofFrance) have been cleared to make way for farming, grazing, and large scale plantations of oil palm, rubber, bananas and other cash crops. The United Nations Food and Agriculture Organization (FAO) reports that during the 1990s, global loss of natural forests was 16.1 million hectares per year, and 15.2 million of these hectares were in the tropics.95 Deforestation was highest in Africa and South America; in Asia, deforestationwas somewhat compensated for by new plantation forests. Generally, the three major causes of deforestation are expansion of agricultural activities, logging and fuelwood collection; the relative contribution of each varies by region. In Africa, it is primarily expansion of subsistence farming. In forestry terminology, there is transition from closed forest systems, through intermediary stages of depletion, to shrub and fallow lands. In Latin America deforestation is typically due to large economic development programs involving resettlement, agriculture and infrastructure. There one sees more abrupt change from closed forest to other land cover, such as permanent agriculture, cattle grazing or water reservoirs. In Asia, both processes take place, with more gradual depletion resulting from rural population pressure, and abrupt changes from centrally planned resettlement schemes and plantation programs. In all regions, over-harvesting of industrial wood and fuelwood is an important factor. Other factors also contribute to global deforestation, such as overgrazing, fire, insect pests, diseases, storms, air pollution, and poor harvesting practices.

Recently, the FAO reported that the global rate of deforestation may have slowed for the years 2000-2001, to approximately 9 million ha per year (i.e., still a net loss). This trend is based on preliminary figures obtained by satellite imaging, but does not pertain to Africa, where deforestation rates continue to rise. In terms of percentages, the world's forest cover decreased annually by 0.2% during the 1990s. In contrast, Africa's rate was 8%, the highest worldwide (South America was next, at 0.4%). Within Africa, the rates vary greatly from country to country. Extremely high rates are seen in Burundi (9.0%), Comoros (4.3%), Rwanda (3.9%), Niger (3.7%), Togo (3.4%), Cote d'Ivoire (3.1%), and Sierra Leone (2.9%). Of these top seven, six are nations in the midst of economic and political turmoil and suffer extreme poverty. On the other hand, countries known for their rich forests and aggressive timber cutting, such as Cameroon and the Democratic Republic of the Congo, actually manage with much lower rates of 0.9% and 0.4% respectively. Thus, the great pressure exerted on forest lands by populations in poverty and conflict (subsistence farming, displaced populations without sense of land ownership, 20land mine disruption of forest management) can be as important as timber harvesting itself Dhading district is situated in central development tregion in bagmati zone. The study area is jiwanpur VDC wad no 8 of dhading is 90 km far from Dhading besi. In the north of Jiwanpur VDC there is nuwakot district, in the east there is chhatre deurali VDC of dhading, in

western there is kewalpur VDC and in south there is nau bise VDC. In the study area there are 150 house hold.

As we know that energy is most needed in our daily life. For many proposes the scientific use of energy can help in balancing the environment and it can reduce the health hazard of the people. The implementation of ICS use was from 9th plan(1997-2002) in Nepal HMG has set a target of promoting 250000 ICS during through the collective effort of government. Like wise the implementation of the use of ICS in jiwanpur VDC of dhading district.

There is great change in environment and in health of local people after the implementation of ICS program in this VDC. The proper use of ICS will help in many aspect of the local people so this study can help to reduce some health and environmental problem of the study area.

## 1.2 Statement of the Problem

Nepal is one of the developing countries LDC relying heavily on its forest resources to meet its demand for energy. Rural areas account for about 80% of total energy requirements of the country most of which is for cooking. The annual consumption of Nepal is estimated to be 68647825 thousand tons of oil equivalent. Looking at the total national energy consumption of last five years, the share of the traditional energy is 86-90% and the source of the commercial is about 10-14%. In the overall energy consumption 77% energy comes from the firewood, 9% from the agriculture residues and animal dried dung and remaining 14% energy comes from imported petroleum product, coal and electricity. The annual per capita consumption of the commercial energy is 46 kilogram of oil equivalent. Although the rural areas consume 86% of the total energy of the country, share of the biomass energy is the highest. Renewable energy and imported kerosene are the two main sources of the energy used in the rural areas. The biomass combustion has vast implication both for deterioration of natural resources and workload of rural women and girls charged with the responsibility of fuel wood collection. The poor combustion technology of traditional stoves has serious negative impact on the health of rural women and small children as cooking traditionally takes place inside houses with very poor ventilation. The problems related to sustainable and just energy consumption within Nepal are further exacerbated by a high population growth. The energy problem in Nepal can thus be characterized by over consumption of one of the renewable energy sources while other sources e.g. hydro power is not yet sufficiently

developed in order to address the growing energy consumption needs. The Main problem of this VDC are following

1. Social and religious belief of the society
2. Rapid deforestation for fuel wood

## 1.3 Objectives of the Study

1 To access the social and economic impact of ICS on rural women .

2 Find out the performance of ICS on rural development.

## 1.4 Significance of the Study

In the view of growing scarcity of fuel wood ics play significant role for the consumption of fire wood . Compared to simple open fires, enclosed stoves can offer greater efficiency and control. In free air, solid fuels burn at a temperature of only about 240 °C (464 °F), which is too low a temperature for perfect combustion reactions to occur, heat produced through convection is largely lost, smoke particles are evolved without being fully burned and the supply of combustion air cannot be readily controlled. In this context many ics project have been operated but how far the project are succeeding in term of endues efficiency , how far it effect for the upliftment in the health of rural people . here this impact study will be rounded on the pivot of the health and envermental effect of ics in the study area

## 1.5 Limitation of the study

This research was conducted for the study that is focused in impact if health and environment of ics in the rural area of Nepal .

This project work mainly for academic purpose based on information from secondary data and field suffered from certain limitation . This study will be limited only to ics , wich canot be generalized especially to other types of plant.

The research is limited in ward No 8 of jiwanpur VDC of Dhading district . The impact of occurs by ics in the derivation of health and environmental impact .Moreover ,the health indicators are less factual which will make some difficulties to analyze health impact and environmental and pre-electricaication information will be depended on the user group saying and other secondary .

## 1.6 Organization of the study

This study is organized in to five chapters . The first chapter deals with the introduction. It includes the general background , statement of problem, objective of the study, significance of the study, limitation of the study, organization of the study. The second chapter presents the review of literature Review . The third chapters deals with the research methodology . It includes rational for the selection of study area, research design, nature and source of data, universe and sampling, data collection technique and tools, household survey, interviewed with key informants, observation, interview, data analysis .The fourth chapter presents the data presentation and analysis with profile of the study area. The last chapter of the study offers summary/finding, conclusion and suggestion. Appendices and reference have been kept at the end of this report

# CHAPTER II

# LITRATURE REVIEW

Literature review is essential to conduct any research work. So for this study review of different literature will be done under two different categories. The conceptual and review of empirical study.For this study, different available books, journals, previous research works, reports, acts, articles, plans and policies, other published unpublished documents related to the subject will be reviewed. However some of the literature has been reviewed.

Nepal is characterized by large number of beautiful landscape having diverse topographical, geographical and physiographical situation. Most of the people live in the rural and semi urban or peri urban area. Biomass is the major sources of energy in this area. The overall energy consumption of Nepal is largely dominated by the use of traditional non commercial forms of energy such as fuel wood, agricultural residues and animal waste. The share of traditional biomass resources is 87% . These fuels are used for household cooking and heating.

Traditional use of biomass is often linked to degradation of forests and woodland resources as well as soil erosion. Cooking by using traditional fuels leads to emissions of greenhouse gases and soot due to poor combustion and later it contributes to global warming through absorption of incoming radiation. The indoor air pollution due to the combustion of biomass fuel is the main cause of Acute Respiratory Infection (ARI), Chronic Obstructive Lung Diseases (COLD), eye infection and pneumonia in women and children. Studies have shown that with the use of ICS human exposure to pollutants in the kitchen environment has been reduced by an average of 69% carbon monoxide concentration, 53% Total Suspended Particle (TSP) Concentration and 63% HCHO (Formaldehyde) Concentration

These emissions are believed to represent on the order of 5% of total global warming derived from human activities. One response to this firewood challenge has been the introduction of the Improved Cooking Stove (ICS) in Nepal. This type of stove was introduced in the 1980s to reduce the rate of deforestation, reduce indoor air pollution and increase the efficiency of household energy use .

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. Currently most common ICS in Nepal are the two-pot-holes mud stove and its variation the three pot- holes. The various models of such ICS are fitted with or without a chimney. The direct and indirect benefits of ICS includes: increased thermal efficiency, the conservation of forests by cutback in 10% to 30% of

firewood consumption , reduction in women's labor, reduction in indoor air pollution and hence smoke-released health disorders, prevention of fire hazards, reduction of cooking time.

Approximately three billion persons around the world eat daily meals cooked with fuel consisting of wood, twigs, agricultural waste, animal dung and charcoal. They cook in diverse ways with diverse foods in diverse pots across many cultures, often on three-stone fires. A three-stone fire refers to three stones placed on the ground, supporting a pot under which a fire is lighted. Cooking with these traditional cookstoves is mostly inefficient and grossly polluting. Exposure to smoke from traditional cookstoves and open fires causes four million premature deaths annually (eight per minute), and is the largest environmental threat to health in the world today, measured in disability-adjusted life years.

Women and newborn infants kept close to them are at the greatest risk, as the women spend countless hours tending to these polluting stoves. Cook-fire smoke contributes to a range of chronic illnesses and acute health impacts such as early childhood acute lower-respiratory infections (including pneumonia), which lead to mortality, low birth-weight, and associated long-term adverse health impacts. For adults, the smoke can lead to risks and mortalities from lung cancer, emphysema, chronic obstructive pulmonary disease, cataracts, and bronchitis. According to public health researchers, "A fire in the kitchen, if you're cooking a meal, produces about the same pollution per hour in a typical house as a thousand cigarettes burning."

Reliance on low-efficiency ways (for example, three-stone fires) of using biomass for cooking and heating also forces women and children to spend many hours each week collecting wood. In humanitarian displacement settings such as Darfur, women face severe personal security risks when they collect fuel and some must trade their food aid rations for cash to purchase wood.

Lastly, residential biofuels' contribution to the total sunlight absorbing black carbon (BC) emissions is substantial, comprising 63 percent of the total BC emissions from India, 30 percent from China, 67 percent from Africa and 33 percent globally. Thus, airborne pollution from biomass cookstoves contributes significantly to indoor air pollution locally, and also to global warming. BC particles in the atmosphere absorb solar radiation and reduce the sunlight reaching the planet's surface. This absorbance directly heats the atmosphere, and also produces solar dimming as observed from the planet's surface. This dimming reduces surface evaporation and atmospheric moisture. This atmospheric BC effect has been shown to reduce precipitation in some areas.

Overall, BC has emerged as an important contributor to global warming. Recent studies estimate it is responsible for 18 percent of the planet's heating overload (technically called climate forcing), compared with 40 percent contribution from anthropogenic carbon dioxide. Studies have also shown that BC deposition on snow and ice increases their rate of melting. There is

increasing concern that BC-induced melting may contribute to the depletion of fresh water reservoirs stored in mountain glaciers and snow packs. Due to the short atmospheric lifetime of BC particles (a few weeks compared to a lifetime of about a century for CO2), reducing emissions of BC can immediately mitigate global warming and lessen impacts on water resources.

The Old English word *stofa* meant any individual enclosed space, such as a room, and 'stove' is still occasionally used in that sense, as in 'stoved in'. Until well into the 19th century 'stove' was used to mean a single heated room, so that Joseph Bank's assertion that he 'placed his most precious plants in the stove' or René Descarte's observation that he got 'his greatest philosophical inspiration while sitting inside a stove' are not as odd as they first seem.

In its earliest attestation, cooking was done by roasting meat and tubers in an open fire. Pottery and other cooking vessels may be placed directly on an open fire, but setting the vessel on a support, as simple as a base of three stones, resulted in a stove. The three-stone stove is still widely used around the world. In some areas it developed into a U-shaped dried mud or brick enclosure with the opening in the front for fuel and air, sometimes with a second smaller hole at the rear.

Improved Cook Stoves Development in 1990s: The development of mud brick stove by Research Center 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 Nepal1.

In 1995, ICS network supported by Asia Regional Cookstove 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 1 Inventory of ICS in Nepal 2000, CRT/N

has concentrated its effort in bringing uniformity among approaches of various organizations involved by advocating a bottomup and subsidyless 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 National ICS Program: Within the framework of the 9th plan, the National ICS program has been initiated in Nepal from early 1999 with the support from Energy Sector Assistance Program (ESAP) of DANIDA and Alternative Energy Promotion Center (AEPC) of the HMG/N. Many district level NGOs and CBOs like the Centre fir Rural technlogy (CRT/N) implement this programme.

The general objective of this program is to establish a sustainable framework and strategy to make available technically and socially appropriate ICS in rural communities based on local capacity building and income generation. This program has been currently promoting ICS in 33 mid-hill districts of the country. The type of ICS promoted is made up of 3-part mud/earth, 2 parts straw/husk and 1 part animal dung. The whole structure is plastered smooth with the same mud mortar. ICS has two fire openings for cooking pots, one behind the other.

There is no need to blow the fire. It utilizes the heat, generated by burning fuelwood, more by the deflection of the flames and heated air inside it which travel to the second opening with the help of an in-built baffle located just below the second opening, before the hot air exits out of the chimney, which is made of un-burnt clay bricks that can be made in the village. The iron plates are fitted on the potholes for pots. The potholes are round in shape; the pot bottom fits tight on them. It can be made in different sizes and capacities to suit the family size and pot size. It can have one or more openings for pots/pans.

ICS can even be used for space heating by adding a cast iron/mild steel plate put tight over the pot holes for the pots or by putting a metal pipe around the space/room to make the pots or by putting a metal pipe around the space/room to make the hot air pass

Basanta Thapa is one of the very successful promoters of Arghakhanchi district. He had to leave his studies due to poor financial conditions of his family and look for sustaining his family's livelihood. He received the promoters training under the National ICS program. Up until now,he has installed 302 ICS and has earned NRs 69, 000 (1US$=NRs 70). In addition to the ICS he has been promoting ICS with fan and back boiler, which has been well appreciated by the community. He has been traveling outside his villages to install ICS and aware people on its benefits. He says he will continue installing ICS as an important source of his livelihood. Seeing his enthusiasm and motivation other promoters are also following in his footstep. (Source: Centre for Rural Technology, Nepal 2005)

around the room through the pipe before going out through the chimney. Nowadays, use of ICS for water heating by attaching a back boiler on the side or around the chimney pipe is increasing in the mid hills and mountain regions of Nepal. The materials required for the construction of ICS are locally available and includes stones/bricks, mud/earth, straw/rice husk, iron plates/ rebar/sheet, animal dung. In addition to the domestic ICS, promotion of institutional improved cook stoves in hotels, teashops, schools, hostels, and barracks is being carried out.

In Nepal, women are mainly responsible for cooking activities and collecting firewood.. Studies have shown that ICS has efficiency of 15-25% and fuel wood saving is 30-35% thus favoring the drudgery reduction of women as ICS cuts down their cooking time and hardship in collection of scarce fuel wood. Women and their children are generally exposed to indoor air pollution. The indoor air pollution due to the combustion of biomass fuel is the main cause of Acute Respiratory Infection (ARI), Chronic Obstructive Lung Diseases (COLD), eye infection and pneumonia in women and children. Studies have shown that with the use of ICS human exposure to pollutants in the kitchen environment has been reduced by an average of 69% carbon monoxide concentration, 53% Total Suspended Particle (TSP) Concentration and 63% HCHO (Formaldehyde) Concentration2. The majority of the women using ICS have responded that they had asthma and eye burning due to traditional stoves but also that the situation has improved after installation of ICS and they don't suffer from burning eyes and breathing problems.

The materials required for the ICS construction are locally available and the users have to bear the cost of iron rod and installation charge only. The cost varies depending on the place although it is generally around 200-300 Nepalese rupees (1 US $ = Nepalese rupees 70.). This amount includes the cost of iron rod, which ranges from 80 to100 Nepalese rupees as well as the labor cost, which ranges from 100 to200 Nepalese rupees. The labor cost includes the cost of mud, brick preparation and ICS installation. There has always been difference in approaches among various organizations involved in ICS promotion and dissemination. Some organizations provide direct subsidy for ICS installation. The National ICS program has avoided 'direct end-user subsidies'. The total cost of the stove installation is borne by the users themselves. There are other indirect subsidies in the form of awareness campaign, trainings, monitoring and evaluation, human resource development, which have been crucial for ICS demand-generation in the community.

ICS Program Implementation Strategies: • The success of the National ICS program has been achieved thanks to its proactive and flexible strategy, which has been implemented as follows:The major thrust of the program is on information-dissemination and awareness -aising through initiation workshops, demonstrations, school orientation activities and campaigns such as poetry, debate or song competition. • The program is implemented through network of local-partners organizations that facilitate ICS utilization through trained promoters. The involvement of local organization in dissemination process is ensured from decision-making, to monitoring and implementation of ICS program. • Local community members are trained as promoters for ICS installation. More precisely, women, people from disadvantaged group and financially weak background are particulary trained as promoters. These 2 Status of Improved Cookstove Technology in Nepal, ITDG 2000

promoters are trained in all the aspects of ICS installation and monitoring, enhancing their economic opportunities. In some cases, ICS construction has been the major source of income generation. The sustainability of ICS has also been enhanced as these local promoters are responsible for regular monitoring of the performance of the stove.

• The emphasis given on monitoring and evaluation has been very crucial for the sustainability and success of the program. • In addition to ICS installation, the National ICS program has been promoting the concept of kitchen management. Improving the overall kitchen environment is

essential to have a broader impact on the life, especially of women. The concept of kitchen management includes improved kitchen ventilation, overall management of kitchen wares, maintaining hygiene, waste-water drainage systems and waste management. The concept of kitchen mangament is thus increasing the kitchen efficiency as well as reducing hardship of women.

Problems and Solutions: ICS is a simple technology based on scientific concepts and easy to operate. Users do not face any severe technical problems during its operation. The problems may arise if ICS promoters do not adhere to the technical specification during installation or if users neglect regular maintenance. In the Nepali context, users clean the cook stove and plaster with the mud daily. This tends to change the pothole size and decrease the efficiency of stoves. Some of the typical problems encountered in the stoves are smoke backfiring because of wrong placement of chimney outlet, lack of regular cleaning of the chimney and slow *cooking* in the second pothole. However, the promoters always provide orientation on probable problems and their solution to the users. Users are also provided with the manual on operation and maintenance of the stove. Moreover, promoters regularly monitor the operation, check stoves efficiency and solve remaining problem.

Progress Status: From its initiation in May 1999 to the end of June 2005, the National ICS Program has disseminated about 125,000 ICS serving the same number of households in 33 mid-hill districts. The combined effort of national ICS Program and other organizations led to a dissemination of 200,000 ICS in the country by the end of June 2005. One should remember, however, that it remains a meager number compared with the 2 million wood-burning households located in the rural areas.

The National ICS Program exemplifies the success of ICS dissemination program. The lessons learned from this program can be incorporated in other programs: • Demand generation from the community members themselves is very important for acceptance of the technology and its sustainability. This can only be achieved through effective information campaigns and awareness-development activities.

## Stoves

In different areas of South Asia, different types of improved cook stoves are developed which have their own merits and demerits but are popular as these are suitable to particular area. While the most popular stoves from Sri Lanka and Nepal are described as below.

## "Anagi" Stove Construction in Sri Lanka

The most popular ICS in Sri Lanka is marketed under the trade name "Anagi". Word "Anagi" in Sinhala language means 'preciouses or 'excellent'. So "Anagi" stove is an excellent and precious stove because it saves firewood and cooking time provided it is made to the correct dimensions. Lab tests carried out on the stove spell the technical efficiency of 21%, and numerous field-cooking tests tell average firewood savings to be over 30%, twice as good as traditional stoves.

Anagi is two pot single piece clay stove designed to meet the cooking needs of a family of 6 people. It can accommodate medium size hard or soft wood and other loose biomass residues such as coconut shells, fronds and leaves.

The stove design has been carefully developed to suit the cooking habits and the types of food cooked in Sri Lanka. The stove can be used directly, which is preferred for short cooking as done in urban houses. For cooking over a long period of time as in many rural houses, insulating the stove with a mud mixture improves the firewood saving capability. The lifetime of the stove may be about 3 years instead of 1 year if used directly without any insulation.

Anagi stove has three main components: (i) Fire box, (ii) 2nd pot hole, and (iii) Tunnel (which connects the firebox and the 2nd pot seat). Likewise, secondary components are: (i) pot rests, (ii) buttresses, (iii) baffle, (iv) flame shield, and (v) the door.

Anagi was first introduced in 1986 by the Ceylon Electricity Board in collaboration with the ITDG under the Urban Stoves Programme. Its success prompted the stove to be selected for commercialization in the rural areas with the participation of the Integrated Development Association (IDEA) and the ITDG. Later, the Asian Cook stove Programme (ARECOP) supported the programme, which got success in installing 300,000 stoves in remote villages.

## Improved Cook Stove in India

The National Programme on Improved Chulha (NPIC) was started in 1986-87 by Govt. of India as a programme for women, by women & through women with the following objectives:

Conservation of fuel wood and other biomass.

Removal of smoke from kitchen.

Check on deforestation and environmental up gradation.

Reduction in the drudgery of women and girl children from cooking in smoky kitchen.

Reduction of health hazards and in cooking time.

Provides employment opportunities to rural people.

## Cumulative Achievement:

Over 350 Lakh (35 million) Improved Chulhas (as against estimated the total potential of 1200 Lakh or 120 million) up to March 2003 have been installed in various states of India.

NPIC is implemented with a multi-agency approach.

"Self Employed Workers", mainly women, from Rural & Semi urban area are twist-trained hands on who are providing service for the proper construction and maintenance of the fixed type chulhas.

More than 30 models of durable fixed with chimney and portable improved chulhas are available for family, community and commercial applications.

There are fifteen manufacturers of ISI marked portable metallic chulhas in the country.

In India several models have been developed and promoted, out of which two models are presented here:

### Udairaj:

Udairaj cook stove is a double pot design suitable for burning firewood, dry dung cakes, crop residues and other traditional fuels. Stove is suitable for roasting chapatti in open combustion chamber. On the rear of the space for the two cooking pots a chimney has been provided to let off the smoke and products of combustion. The stove is meant for using both the fire pots simultaneously. Construction is of good quality bricks and cement mortar. Additional mud insulation is provided on the exteriors of the stove to reduce skin bum on contact.

### Laxmi:

This chulha accepts two pots at a time. It is also provided with a chimney. There are no pot raisers, and because the pots sit flush on the potholes, the flue gases do not escape into the kitchen, but are taken out of the house.

Out of the total heat generated by the fuel, about 60% is available at the first pothole and 40% at the second pothole. It is thus possible to cook food simultaneously on both the potholes. The disadvantage of a two-pot chulha is that a part of the heat is wasted if the second pothole is not used.

## Improved Cook Stove– CRT Nepal

The type of Improved Cook Stove (ICS) promoted in Nepal is made up of 3-part mud/earth, 2 parts straw/husk and 1 part animal dung. The whole structure is plastered smooth with the same mud mortar. ICS has two fire openings for cooking pots, one behind the other.

There is no need to blow the fire. It utilizes the heat, generated by burning fuel wood, more by the deflection of the flames and heated air inside it which travel to the second opening with the help of an in-built baffle located just below the second opening, before the hot air exits out of the chimney, which is made of un-burnt clay bricks that can be made in the village. The iron plates are fitted on the potholes for pots. The potholes are round in shape; the pot bottom fits tight on them. It can be made in different sizes and capacities to suit the family size and pot size. It can have one or more openings for pots/pans.

ICS can even be used for space heating by adding a cast iron/mild steel plate put tight over the pot holes for the pots or by putting a metal pipe around the space/room to make the pots or by putting a metal pipe around the space/room to make the hot air pass around the room through the pipe before going out through the chimney. Nowadays, use of ICS for water heating by attaching a back boiler on the side or around the chimney pipe is increasing in the mid-hills and mountain regions of Nepal. The materials required for the construction of ICS are locally available and includes stones/bricks, mud/earth, straw/rice husk, iron plates/ rebar/sheet, animal dung. In addition to the domestic institutional improved cook stoves (ICS), promotion of institutional ICS is being carried out in hotels, teashops, schools, hostels, and barracks.

The materials required for the ICS construction are locally available and the users have to bear the cost of iron rod and installation charge only. The cost varies depending upon the place but in general it is approximately 300-400 Nepali rupees.

## Problems and Solutions:

ICS is a simple technology based on scientific concept and easy to operate. Users do not face any severe technical problems during its operation. The problems may arise when ICS Promoters do not adhere to the technical specification during installation and due to negligence of users during regular maintenance.

The development of mud brick stove by Research Center for Applied Science and Technology, Nepal (RECAST) in early nineties, which could be built on site in users households, by trained self employed workers (Promoters) with locally available materials gave the stove program a new look. 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.

## Stoves for Using Honeycomb/Beehive Briquettes

For burning honeycomb/ beehive biomass briquettes specially designed stoves are required, which could either be made of metal or clay. In India normally metal stove with provision of using two honeycomb/beehive briquettes are used as shown in pictures.

In Nepal both metal stoves as well as clay stoves are used, as can accommodate one briquette of ½ kg inside the combustion chamber of the stoves. The two models of biomass briquettes stoves, one made of metal and the second one of clay, are designed specifically to burn single honeycomb/ beehive briquettes at a time. Because charcoal is frequently used for barbeques and by restaurants requiring large heat capacity for cooking or grills, in Nepal a metal barbeque stand has been developed in which up to 8 honeycomb/ beehive biomass briquettes could be placed. Ventilation holes are provided in the bottom, through which the briquettes could be fired.

# CHAPTER III

# RESEARCH METHODOLOGY

## 3.1 Research Design

This study is carried out on the basis of description and analytical in nature . It has given focus on the impact of improve cooking stove on health and environment Jiwanpur VDC of dhading. This research had found out the impact of ICS on health and social women and environment of Dhading district

## 3.2 Rational for the selection of study area.

Jiwanpur VDC lies in Dhading district . This area far from 90 km from dhading beshi. I have selected this area because of my own interest that the place where I want to get new experience in my study and impact of ICS knowledge. The Study had found out the impact of ICS on health and environmenton Dhading district . Jiwanpure VDC is remote area of Dhading beshi . The Study area support a broad rank of impact of ICS on social, economic and environment .

## 3.3 Nature and source of Data

The quantitative data is obtained from questionnaire and is analyzed using statistical tools . The collected qualitative information is presented in a descriptive way. The information obtained is presented in appropriate tables and figures .They are categorized and tabulated according to the objective of the research.

The study is conducted on the basis of both primary as well as secondary data. The source of primary data are obtained from field work and through observation, questionnaire and interview of some key informants applying some additional questions where needed. Similarly information are obtained through secondary sources. The sources of secondary data are collected from alternative energy office , Ministry of Energy , National planning commission, , different bulletins relate, Library, District development committee and Jiwanpur VDC of Dhading

## 3.4 Universe and sampling

The Universe of this study is Dhading district. In this study purposive sampling method is used for VDC & wards. There are 150 household in Jeewanpur VDC ward no 08, Dhading. I have selected 40 respondents by using random sample method. Different people using ICS (Improved Cooking Stoves) are selected purposively to meet the objective. The respondents were categorized into three parts. 30 are the rural women of that area using ICS and 10 are the local intellectuals and NGO's working in the field of ICS.

## 3.5 Data Collection Techniques and Tools

The study was based on both primary and secondary data. The primary data are collected from the fieldwork conducted during household survey, key informant interview and observation using following techniques;

### 3.5.1 Household Survey

Household survey was conducted and a set of questionnaire is used as a tool to collect primary data in order to achieve the research objectives. Sex, ethnicity, education, family size, attitude and practices through household's survey. Female of households are interviewed in order to get relevant information of their respective households.

### 3.5.2 Key Information Interview

Key information interview is applied to obtain information from the knowledgeable persons of the community (teachers, government officers, elder persons, institutions etc) who known the aspect of environmental ,social, cultural and provides the information in details about their knowledgeable and experience in using ICS in rural areas.

### 3.5.3 Observation

Observation is carried out number of times, during field visit. Observation is made about present condition of ICS use and its interrelationship with local people. The environmental,health and social values also were under spotlight of research of further the level use of the local people also include inside the circle of research. Important information are observed through Questionare and check list method during fieldwork .

### 3.5.4 Data Analysis and Interpretation

Data collection is used to describe a process of preparing and collecting data. The purpose of data collection is to obtain information to keep on record to make decision about important issues, to pass information onto others. Primarily data is collected to provide information regarding a specific topic. Various techniques like table,graph ,charts, statistical tools ,computer software etc will be employed during the research study.

# CHAPTER IV

# DATA PRESENTATION AND ANALYSIS

In this chapter, the collected data is analyzed for fulfillment of objectives. The analysis is mainly based on questionnaires collected from local people, key informants,  and  and intellectuals persons.

## 4.1 Respondent by sex using ICS

Table 4.1 respondents by age and sex

| Sn. | Age | Male | Female | Total | Percentage |
|---|---|---|---|---|---|
| 1 | Above 18 | 18 | 12 | 30 | 75 |
| 2 | Below 18 | 6 | 4 | 10 | 25 |
| | total | 24 | 16 | 40 | 100 |

Source: Field survey 2015

The information given in the table is shown in the diagram below:

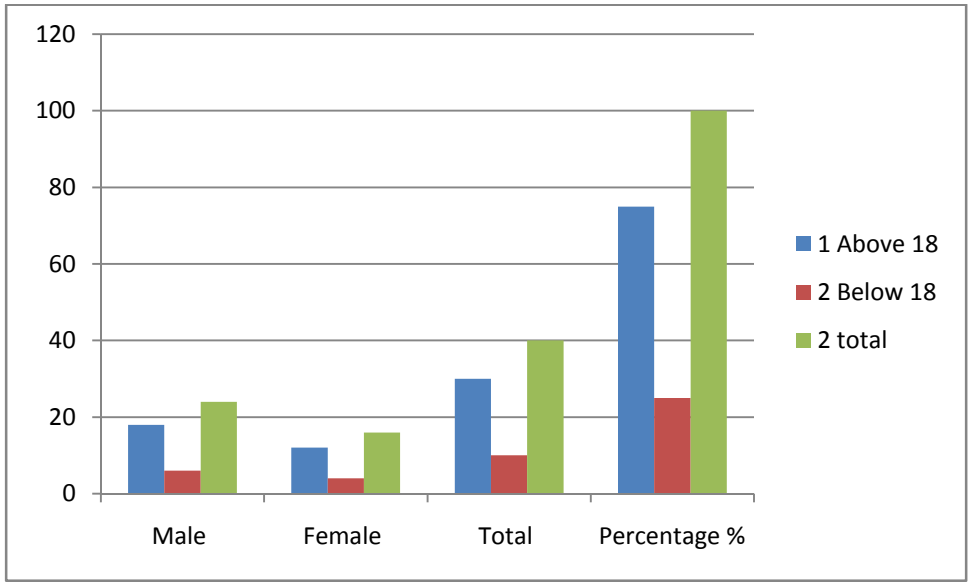



Fig:1 Respondent by sex using ICSS

The above figure represents no. of males and females of age below 18 and above 18 using Improved cooking stove (ICS). We can conclude that 75 percent of the total population is above 18 who are using ICS and only 25 percent of the total population which is below 18 are using

ICS.

## 4.2 ICS User by level of education

Table 4.2 Respondents by level of education

| Sn. | Education | Male | Female | Total | Percentage |
|---|---|---|---|---|---|
| 1 | Masters | 5 | 4 | 9 | 22.5 |
| 2 | Bachelor | 10 | 3 | 13 | 32.5 |
| 3 | Intermediate | 5 | 4 | 9 | 22.5 |
| 4 | SlC | 6 | 3 | 9 | 22.5 |
| | Total | 26 | 14 | 40 | 100 |

Source: Field survey 2015

It can be shown below in diagram:

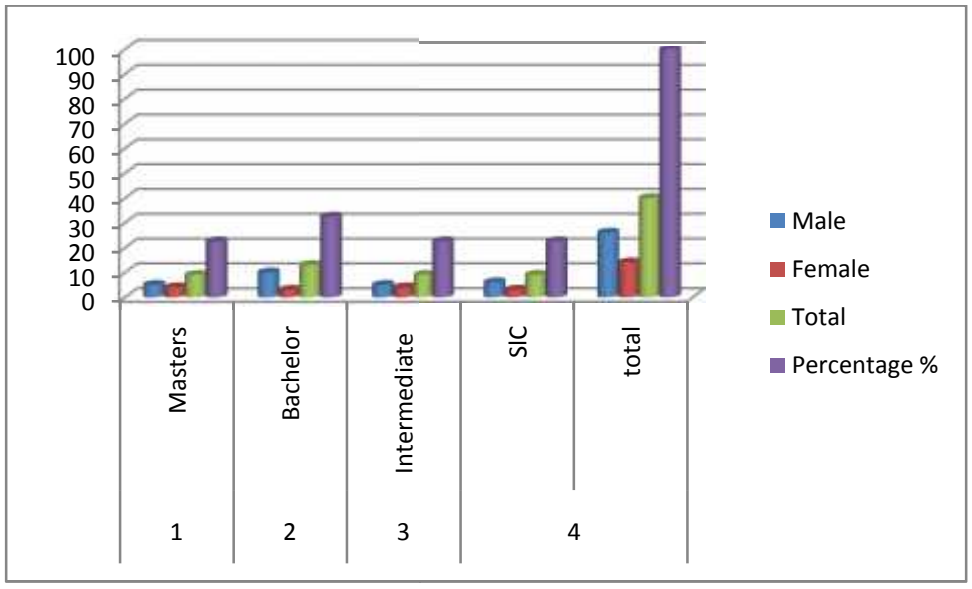



Fig:2 ICS user by level of education

The above table shows the number of educated peoples using ICS. We can see that there are 5 males and 4 females who have completed masters similarly there are 10 males And 3 females who have completed bachelor and 5 males and 4 females completing intermediate and 6 males and 3 females completing SLC who are using ICS in the study area.

## 4.3 Income source of the ICS user

Table 4.3 Respondents by source of income

| Sn. | Description | Male | Female | Total | Percentage |
|---|---|---|---|---|---|
| 1 | Teacher | 5 | 2 | 7 | 17.5 |
| 2 | Business | 6 | 1 | 7 | 17.5 |
| 3 | Agriculture | 12 | 6 | 18 | 45 |
| 4 | Government job | 3 | 1 | 4 | 10 |
| 5 | NGO | 2 | 2 | 4 | 10 |
| | Total | 28 | 12 | 40 | 100 |

Source: Field survey 2015

It can be shown in the digram below:

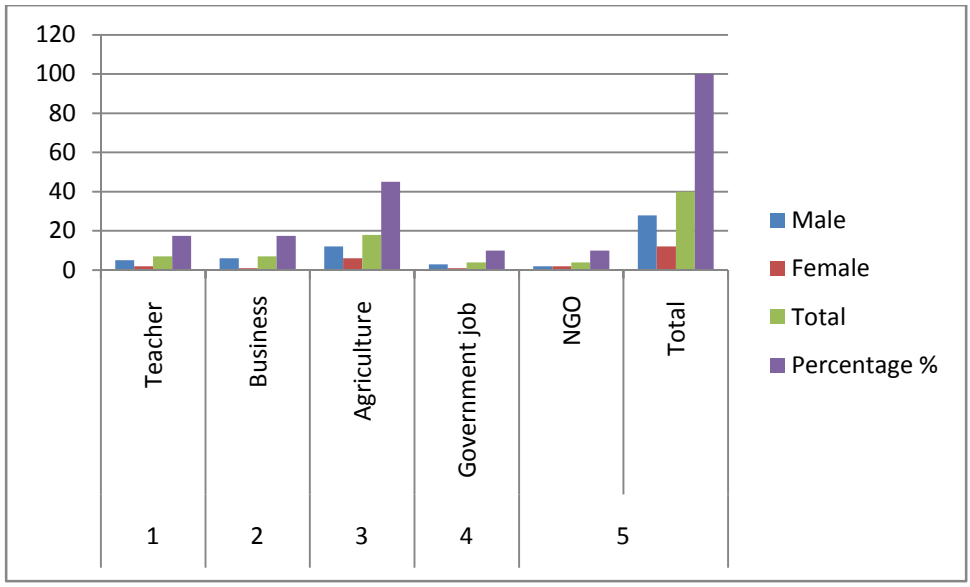



Fig: 3 income source of the ICS user

In the above figure we can see that there are different people with different profession by which they are supporting their families. There are 5 males and 2 females working as a teacher similarly 6 males and 1 female working in a business and 12 males and 6 female working in agricultural sector and 3 males and 1 female working in the government offices and 2 males and 2 female working in the private sector using ICS.

## 4.4 Food Sufficiency of the ICS user

Table 4.4 Respondents by food sufficiency

| Sn. | Month | Number of Respondents | Percentage |
|---|---|---|---|
| 1 | 1-3 | 7 | 17.5 |
| 2 | 4-6 | 8 | 20 |
| 3 | 7-9 | 10 | 25 |
| 4 | 10-12 | 10 | 25 |
| 5 | More than 12 | 5 | 12.5 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following diagram:

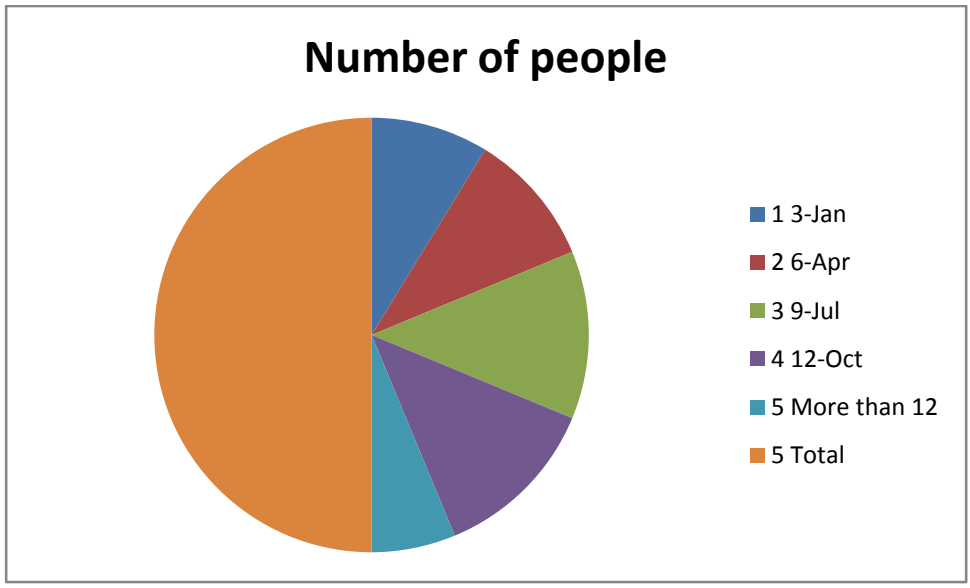



Fig: 4 Food sufficiency of ICS user

In the above figure we can see that there are different people whose house hold income supports the family for some duration. We can see that there are 7 peoples whose house hold income supports for 1-3 months similarly 8 peoples for 4 -6 months and 10 peoples for 7-9 months and 10 ‘peoples for 10-12 months whereas 5 peoples for more than 12 months who are using ICS.

## 4.5 Energy consumption from ICS

Table 4.5 Respondents by energy consumption

| Sn. | Description | Quantity | Market cost(RS) |
|---|---|---|---|
| 1 | Fuel wood kg | 600 | 600*4=2400 |
| 2 | Agriresidue kg | 400 | 400*5=2000 |
| 3 | Cattle dung kg | 700 | 700*8=5600 |
| 4 | Electricity unit | 400 | 400*10=4000 |
| 5 | LPG cylinder | 4 | 4*1500=6000 |
| 6 | Kerosene liter | 40 | 40*60=2400 |
| 7 | Microdot power wp | --- | ------ |
| 8 | Solar power wp | 80 | ------ |
| 9 | Others | -------- | -------- |

Source: Field survey 2015

In the above table we can see that there are different people using ICS. There are different other types of energy consumption annually. About 600 kg of fuel wood is used and 400 kg of agriresidue and 700 kg of cattle dung and 400 units of electricity and 4 cylinders of LPG cylinder and 40 liters of kerosene etc.

## 4.6 Major household by cooking fuel

Table 4.6 Respondents by major household by cooking fuel

| Sn. | Description | Number of people | Percentage |
|---|---|---|---|
| 1 | Fuel wood | 25 | 62.5 |
| 2 | Other | 15 | 37.5 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown below in the following digram:

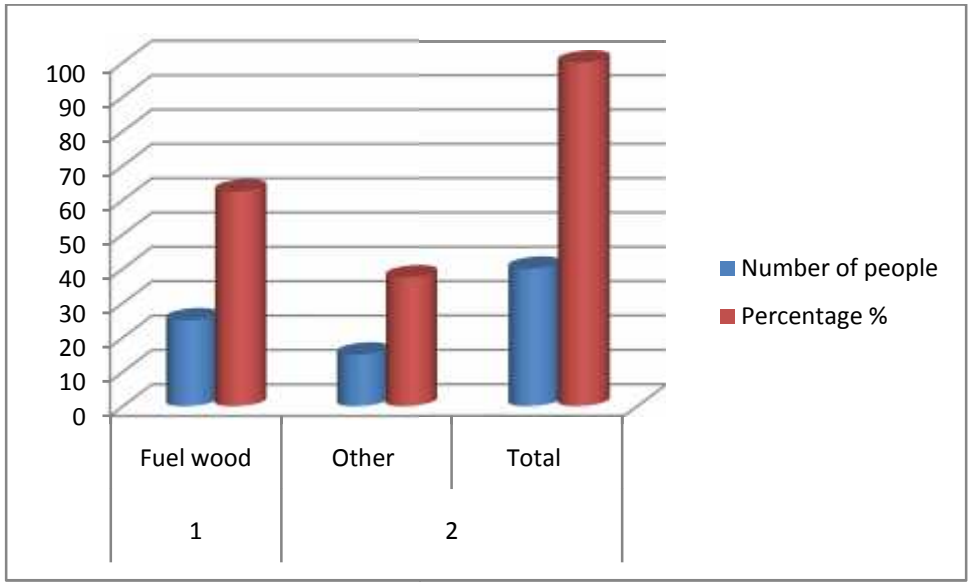



Fig: 6 major household cooking fuel

In the above figure we can see that fuel wood is the major source of energy which is used by 25 peoples in the study area nd only 15 peoples are using other source of energy.

## 4.7 Types of stoves used by the people

Table 4.7 Respondents by types of stoves used by the people

| Sn. | Description | Number of people | Percentage |
|---|---|---|---|
| 1 | TCS | 12 | 30 |
| 2 | ICS | 28 | 70 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following figure:

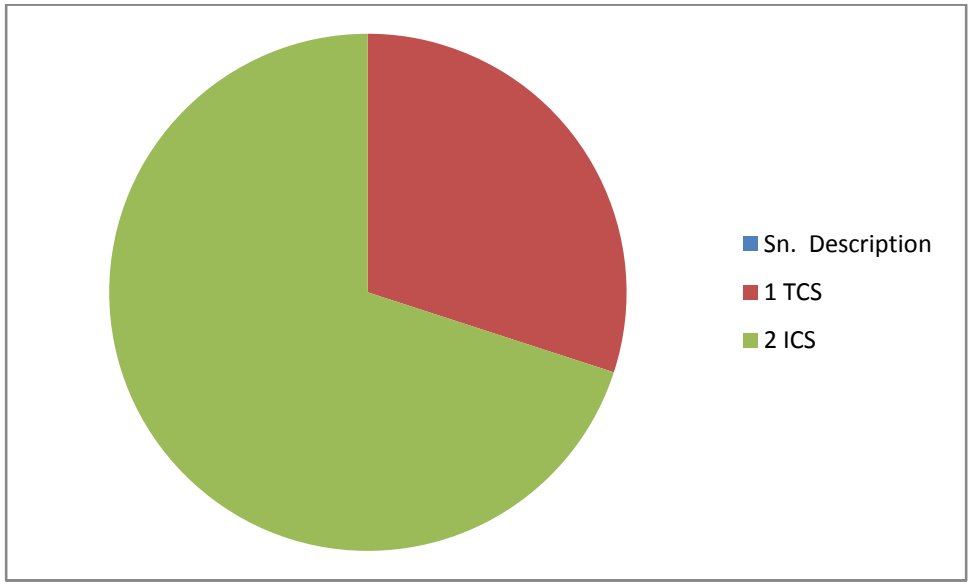



Fig:7 Types of stoves used by the people

In the above table we can see that there are only two types of stoves used by the peoples in the study area. 28 peoples are using ICS whereas only 12 people are using TCS stoves in the study area.

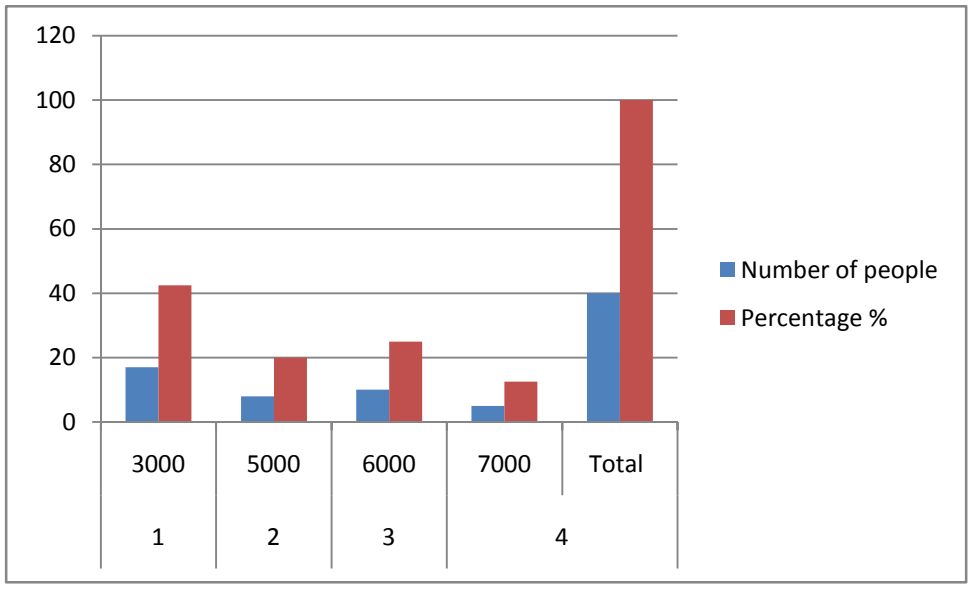
## 4.8 Price paid for the installation of ICS

Table 4.8 Respondents by price paid for the installation

| Sn. | Price (RS) | Number of people | Percentage |
|---|---|---|---|
| 1 | 3000 | 17 | 42.5 |
| 2 | 5000 | 8 | 20 |
| 3 | 6000 | 10 | 25 |
| 4 | 7000 | 5 | 12.5 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following figure:




Source: Field survey 2015

Fig:8 price paid for the installation of ICS

In the above figure we can see that there are different people who have paid different prices for the installation of the ICS. There are 17 peoples who have paid RS 3000 for the installation of the ICS similarly 8 peoples have paid RS 5000 for the installation whereas 10 people have paid RS 6000 for the installation and 5 people have paid RS 7000 for the installation.

## 4.9 Fuel required to cook meal/Before and after Implementation of ICS

Table 4.9 Respondents by the fuel required to cook meal

| Sn. | Fuel required/month | | Number of people | Percentage |
|---|---|---|---|---|
| | Bhari | Kg | | |
| 1 | 15 | 450 | 12 | 30 |
| 2 | 10 | 300 | 18 | 45 |
| 3 | 12 | 360 | 10 | 25 |
| | | Total | 40 | 100 |

Source: Field survey 2015

It can be explained below with the help of following digram:

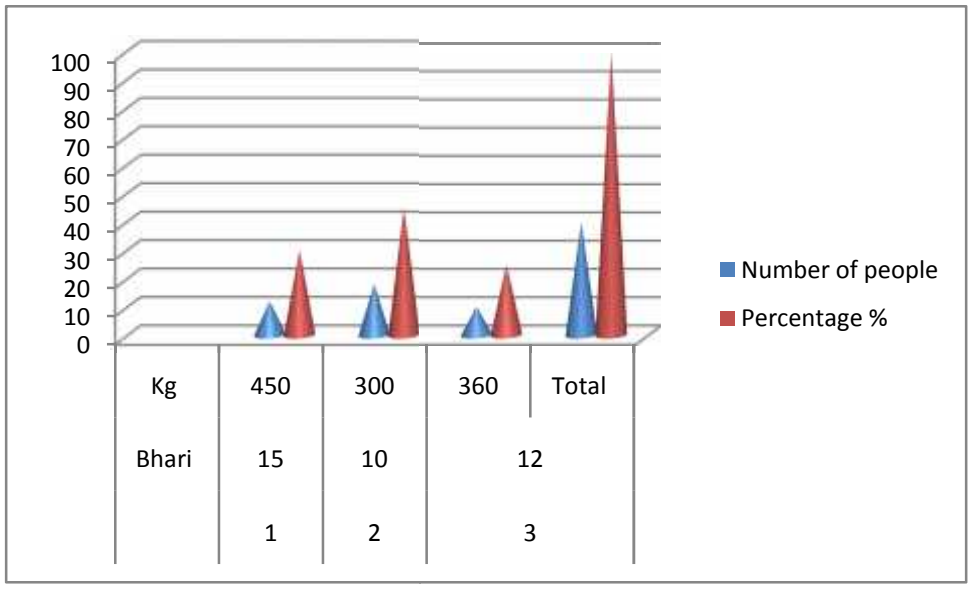



Fig:9 Fuel required to cook meal/Before and after Implementation of ICS

In the above figure we can see that there are different peoples using certain amount of fuel to cook food. There are 12 peoples using 15 bhari or 450 kg fuel every month whereas 18 people using 10 bhari or 300 kg fuel every month and 10 peoples using 12 bhari or 360 kg of fuel every month.

## 4.10 Source of fire wood

Table 4.10 Respondents by the source of fire wood

| Sn. | Sources | Number of people | Percentage |
|---|---|---|---|
| 1 | Forests | 12 | 30 |
| 2 | Community forest | 8 | 20 |
| 3 | Other forest | 6 | 15 |
| 4 | From market | 14 | 35 |
| | Total | 40 | 100 |

Source: Field survey 2015
it can be shown in the following diagram:

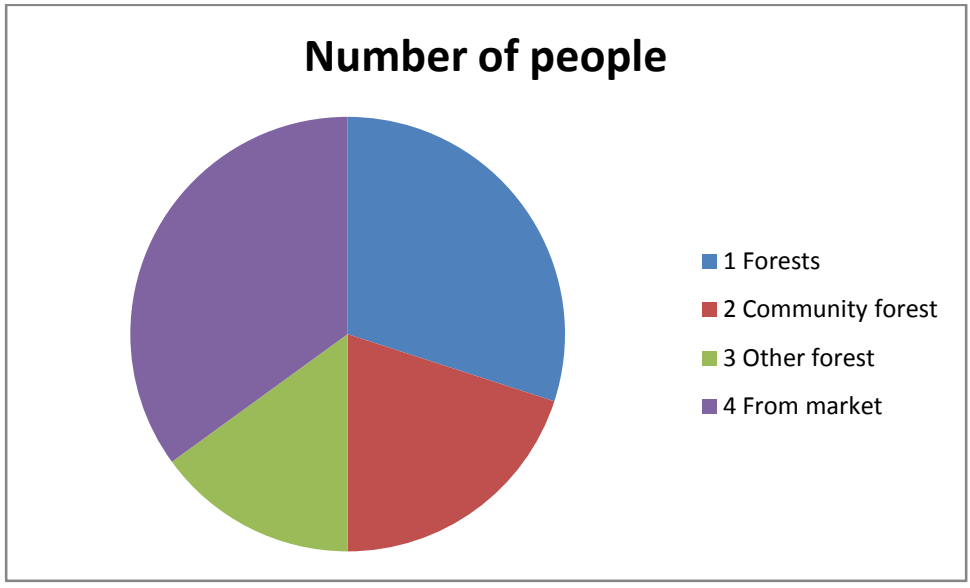



Fig:10 source of fire wood

In the above table we can see that there are different people using fire wood from different source. About 12 peoples carry from forests and 8 people from community forest and 6 people from other forest whereas 14 peoples from market.

## 4.11 Type of ICS used

Table 4.11 Respondents by the types of ICS used

| Sn. | Type | Number of people | Percentage |
|---|---|---|---|
| 1 | Brick mud | 18 | 45 |
| 2 | Medulla | 14 | 35 |
| 3 | others | 8 | 20 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following figure:

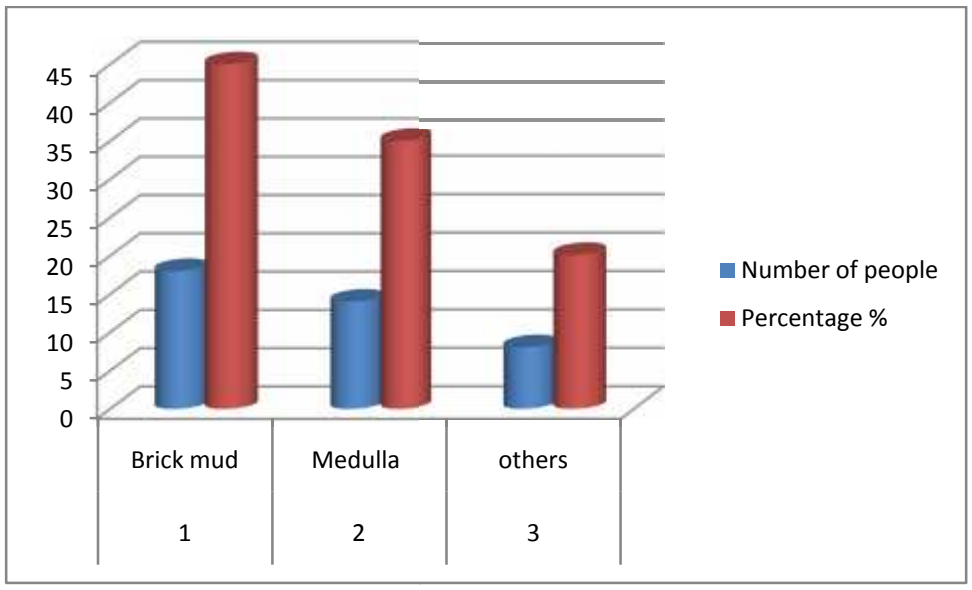



Fig:11 types of ICS used

In the above figure we can see that there are 18 peoples using ICS made up of brick mud whereas 14 peoples using ICS made up of medulla and 8 peoples using ICS made up of other.

## 4.12 Numbers of pol used in ICS

Table 4.12 Respondents by the number of pol used

| Sn. | Pol | Number of people | Percentage |
|---|---|---|---|
| 1 | One | 15 | 37.5 |
| 2 | Two | 19 | 47.5 |
| 3 | Three | 6 | 15 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following diagram:

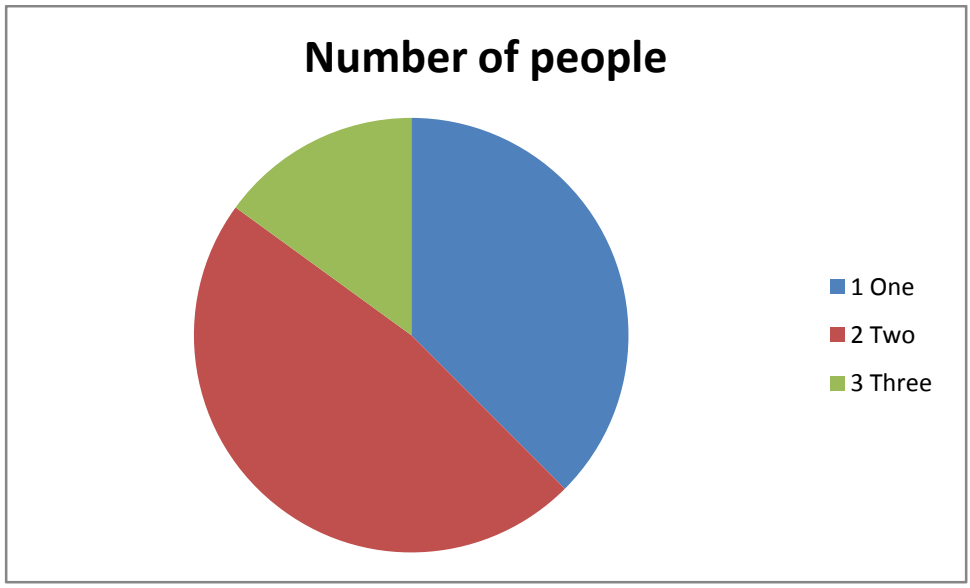



Fig 12: number of pol used in ICS

In the above table we can see that there are different people who are using ICS . There are 15 people who are having 1 pol in ICS and there are 19 people who are having 2 pol in ICS and there are 6 people who are having 3 pol in ICS.

## 4.13 Perception of responds with ICS generating smoke

Table 4.13 Respondents by the perception with smoke

| Sn. | Generating smoke | Number of people | Percentage |
|---|---|---|---|
| 1 | Yes | 26 | 65 |
| 2 | No | 14 | 35 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following digram:

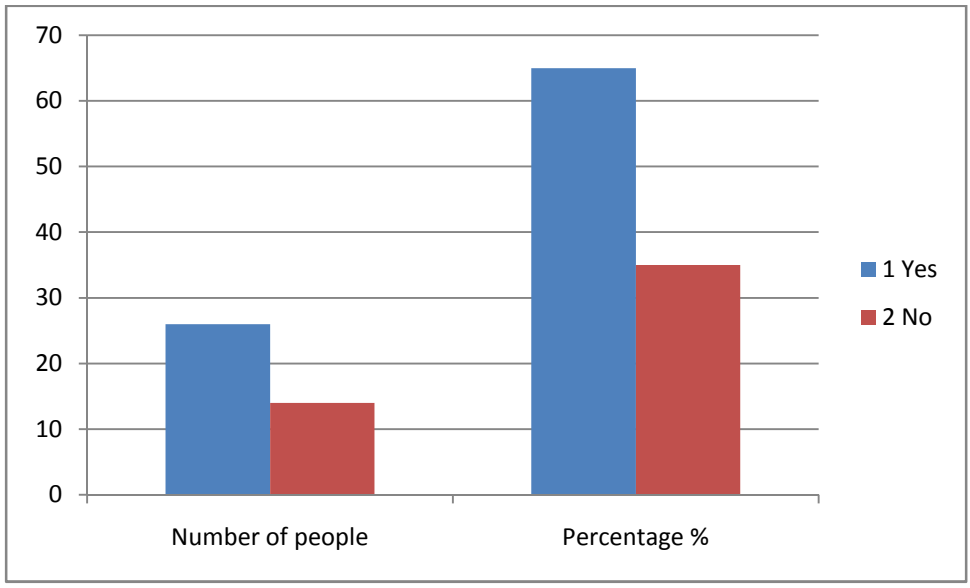



Fig 13: ICS generating smoke

In the above figure we can see that there are 24 people whose ICS produce smoke and 16 peoples ICS don’t produce smoke.

## 4.14 Perception of Respondents about ICS with modern metallic stove

Table 4.14 Respondents about ICS modern metallic stove

| Sn. | Replacement | Number of people | Percentage |
|---|---|---|---|
| 1 | Yes | 16 | 40 |
| 2 | No | 24 | 60 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following figure:

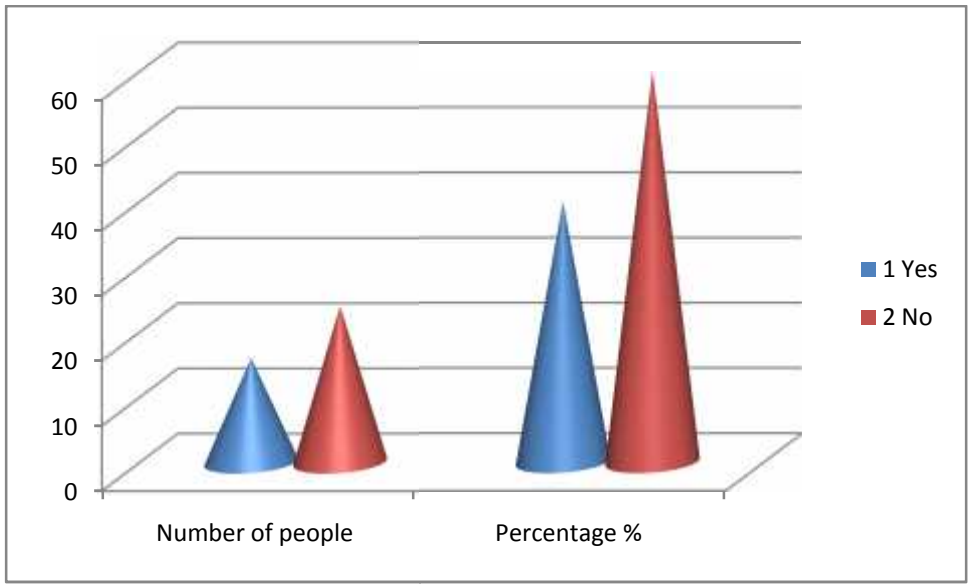



Fig: Perception of Respondents about ICS with modern metallic stove

In the above figure we can see the number of people who want to and doesn't want to replace their ICS with modern metallic stove. There are 16 people who want to change their ICS with the modern metallic stove and there are 24 people who doesn't want to replace their ICS.

## 4.15 Performances of ICS

Table 4.15 Respondents by performance of ICS

| Sn. | Satisfaction | Number of people | Percentage |
|---|---|---|---|
| 1 | Good | 12 | 30 |
| 2 | Very good | 14 | 35 |
| 3 | Bad | 8 | 20 |
| 4 | Satisfactory | 6 | 15 |
| | Total | 40 | 100 |

Source: Field survey 2015

It can be shown in the following diagram:

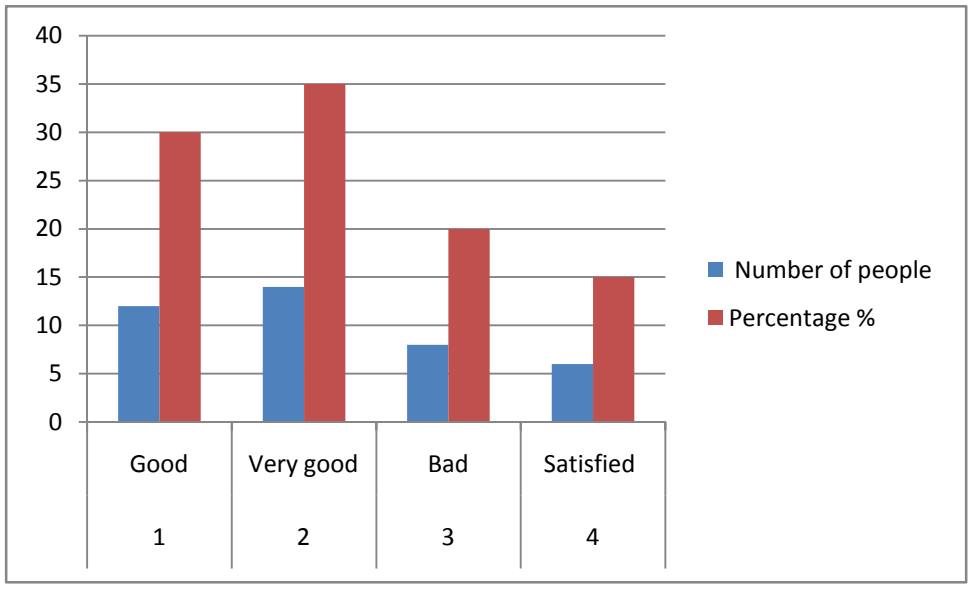



Fig 15: Performances of ICS

In the above figure we can see that there are different people which are having different satisfaction. There are 12 people which are saying good about ICS and there are 14 people which are saying very good about the ICS and there are 8 which are not satisfied with ICS and there 6 people which are satisfied.

# CHAPTER V

# SUMMARY AND CONCLUSION

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.

## 5.1 Major Finding

- The main objective of the study was to find out the total population of jiwanpur VDC and the specific objective to find out the applied technology in the VDC.
- To fulfill these objectives 40 samples household were randomly selected. This sample size has been distributed proportionally main one wards of jiwanpur VDC. The research mainly depended on primary data.
- Information collected from questionnaire was transformed into a mastersheet and raw were tabulated on the basis of different groups. To analyze the data different tools has been used ..
- ICS is more cheaper than of the other equipment llike as LPG gas, TCS etc.
- Most of the people of jiwanpur VDC are using ICS.
- The INGO's has been helping this VDC for using ICS.
- In the study area most of the people are satisfied using ICS

## 5.2Conclusion

In jiwanpur VDC most of the people are using ICS for cooking food. Which is helping in conservation of the forest.The lower caste people are dominated by all high class people such as Brahmin, chhetri etc. The womens are less educated in comparison with male.In the study area most of the people do not want to replace their iCS with modern cooking stoves. The people are using ICS made up of brick mud and specially of one pol.In the study area most of the people are engaged in the agricultural sector. The people carry firewood from the local forests, community forest, buy from the market for their daily purpose in using the ICS. The people are using ICS rather than the TCS, LPG gas or other sources of energy.Most of the people who are using ICS are educated. The emphasis given on monitoring and evaluation has been very crucial for the sustainability and success of the program. In addition to ICS installation, the National ICS program has been promoting the concept of kitchen management. Improving the overall kitchen environment is essential to have a broader impact on the life, especially of women. The concept of kitchen management includes improved kitchen ventilation, overall management of kitchen wares, maintaining hygiene, waste-water drainage systems and waste management. The concept of kitchen mangament is thus increasing the kitchen efficiency as well as reducing hardship of women. ICS can even be used for space heating by adding a cast iron/mild steel plate put tight over the pot holes for the pots or by putting a metal pipe around the space/room to make the pots or by putting a metal pipe around the space/room to make the hot air pass around the room through the pipe before going out through the chimney. Nowadays, use of ICS for water heating by attaching a back boiler on the side or around the chimney pipe is increasing in the study area. The materials required for the construction of ICS are locally available and includes stones/bricks, mud/earth, straw/rice husk, iron plates/ rebar/sheet, animal dung. In addition to the domestic institutional improved cook stoves (ICS), promotion of institutional ICS is being carried out in hotels, teashops, schools, hostels, and barracks.

## 5.3 Recommendation

The following suggestion are made for improved cooking stove in jiwanpur VDC ward no.8 in dahding district:

- Most of the  people are not aware about the ICS awareness program should be run
- Female should be provided proper training about ICS and they should be given proper education.
- Government should provide loan for the use of the ICS
- The people should be encouraged to use ICS
- Different governmental and non governmental organizations should work in the study area.

# REFERENCES

Chen and Smith, (1990). Indoor air pollution in developing countries. World Health Stat Q 1990;43(3):127-38

CRT, (1999). "Inventory and Assessment of Improved cooking stove (ICS Activities in Nepal ."

World Bank, (2000). Wood Production and Trade, World Resources 2000-2001

HMG/N 10th Five year plan: Sagha publication KTM Nepal 2002

ReidHoly,(1986). Indoor Smoke Exposures Traditional and Improved cook stove.

Shrestha , (2000). : Improve cooking stove Technology in Nepal, IDDG

Sharma , (1991). An Assessment of Energy in Nepal :Implication for the planning and management of rural Energy ,"

Shrestha , (1991). Impact of Improved cook stove on forest conservation :A case study of Phujal VDC, Gorkhey District."

Sangi , (2012). Rentech symposium compendium, Volume 2, kathmandu, Nepal

pant and Ariyal, (2012) .Community awareness in renewable energy technology improved cooking stove in jhaukhel, Nepal.

Thapa, (2005). Center for the Rural technology of Nepal :Ekta books Ltd Ktm.

Bhattarai and Risal ,( 2001). “Barrier for implementation of improved cook stove program in Nepal,” Journal of the Institute of Engineering.7:1-5District Profile: Bhaktapur. CBS, 2001

Energy Sector Synopsis Report, (2010) . Water and Energy Comission Secretariat, 2010.

Nepa, and Grimsrud, (2010) . “Which type of stove is best? An Environmental Impact Assessment from Nepal,”Policy Brief. SANDEE.46-10

“Renewable Energy Perspective Plan of Nepal, 2000-2020: An Aproach.,” Alternative Energy Promotion Center.,pp 40-44

Shrestha, Acharya, (2003). “National Improved Cook Stove Dissemination in the Mid- Hills of Nepal, Experience, Opportunities and Lesson learnt.”

“Status of Improved Cookstove Technology in Nepal.” CRTN, 2000Nijaguna B.T., Biogas Technology , New age international (P) Ltd, Publishers, (2006).

www.ics.gov.np

www.Aepc.gov.np

www.Alternativeenergy .gov.np

- Alternative Energy Promotion Centre (AEPC)
- Improved Cook Stove (ICS) Development: A Case from Nepal