



"Inception Study on Energy Efficient Cooking Technology in High Mountains"

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Nepal Energy Efficiency Programme (NEEP)

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List of Abbreviation

AEPC	Alternative Energy Promotion Centre
BME	Banepa Metal Udhyog
CECI	Centre for International Studies & cooperation
CES	Centre for Energy Studies
CMI	Chandra Metal Industries
CRT/N	Centre for Renewable Technology, Nepal
DDC	District Development Committee
DEEU	District Energy and Environment Unit
DTL	Development Trade Link
ESAP	Energy Sector Assistance Programme
FECOFUN	Federation of Community Forestry Users, Nepal
HH	Households
ICS	Improved cook stove
INGOs	International Non-governmental Organizations
IOE	Institute of Engineering
KU	Kathmandu University
KVM	Karnali Vidhyut & Metal Workshop
LIBIRD	Local Initiatives for Biodiversity, Research and Development
MCS	Metallic cook stove
MEM	Mustang Engineering Metal Workshop
NAST	Nepal Academy of Science and Technology
NGOs	Non-government Organizations
RECAST	Research centre for Applied Science and Technology
REU	Rijwan Engineering Udhyog
RIDS	Rural Integrated Development Services
SDM	Shree Dhungeshowari Mechanical Workshop
SHE	Shanti Engineering Works
SSB	Shree Singha bahini Engineering Works and Energy Pvt. Ltd
STARIC	Sustainable Technology - Adaptive Research & Implementation Center, Nepal
SUP	Sindhu Urja Prabardan Kendra Pvt. Ltd
TAT	Trishul Agri-tools and Engineering Pvt. Ltd
TCS	Traditional cook stove
VDC	Village Development Committee

CHAPTER ONE

INTRODUCTION

1.1 Country Background

Nepal is characterized with large number of beautiful landscape having diverse topographical, geographical and physiographical situation within a span of 200 kilometers from South to North and about 800 kilometers distance in East West direction. Within this short span, the elevation ranges from below 100 meters in south to 8848 meters in northern part. Rugged hills and mountains cover more than 80% of the land. In the south, there consists a belt of almost plain land 20 to 40 kilometer wide, which is the extension of the Gangatic plain of India. Country has five major physiographic landscapes extending from east to west. High Himalayan region is situated above 3000 meter elevation occupying about 23% of Nepal which is mostly covered by snow and ice all year round. High Mountain region is located below the High Himalaya region which is at 2300-3000 meters elevation on the ridges and top of the mountain but this area also goes up to 1000 meter elevation in the valley and gorges. Middle Mountain region is the great central belt of Nepal covering about 30% of the country's land. This belt is composed mostly with the network of mountain ridges and valleys with small portion found as flat land. Siwalik zone is located below the middle mountain region, with a series of low, hogback ridges in a twisting pattern. It is the first and lowermost ridges of the Himalayan Mountain system. They enclose several cultivated valleys and plains. The zone occupies about 13% of the country at an elevation of 120 to 2000 meter. Terai region is the outer most part of country's physiography going through north to south. This region ranges from about 50 to 330 meters with gentle southward slopes. It covers about 14% of the land surface.

The low land and the Siwalik region have hot Monsoons or subtropical climates with hot, wet summers and mild, dry winters. The lower middle mountains, up to about 2000 meter elevation, have a warm temperate monsoon climate with warm, wet summers and cool, dry winters. The Middle Mountains at around 3000 meter elevation have a cool temperate monsoon climate, with mild wet, wet summers and cool, dry winters. The high mountains, at around 4000 meters elevation, have an alpine climate, cool summers and frosty winters. The high Himalayan above the snowline has a tundra type arctic climate, with perpetual frost and cold desert conditions. Precipitation varies greatly from one place to another. The average annual rainfall ranges from 250 to 4500 mm.

According to latest population census of June 2011, the annual rate of growth is equal to 1.40%, i.e. 26.6 million in population which is still high when compared with the international

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level. Population distribution is very unequal in terms of physiographic areas. Only about 6.75% people live in the Mountain region. This region occupies about 35% of the total land area, since Hilly region occupies about 42% of the total land and supports about 43.1% people to live in. Only 23% of the country's land is located in Terai region. However, this region supports 50.15% of the population. Due to the migration of male population, there are currently 94 males to 100 females (CBS, 2011).

1.2 Present scenario of metallic cook stove in High Mountain and upper mid hill

In order to achieve reduction in indoor smoke / air pollution and increased fuel efficiency and protect the forest resources and environment, Metallic Cook Stove (MCS) development and dissemination activities were initiated in Nepal from early 1950s. 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.

MCS can even be used for space heating by adding a cast iron/mild steel plate kept tight over the pot holes of the pots or by putting a metal pipe around the space/room to make the pots or by putting a metal pipe with hot air around the space/room. Within the framework of the 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 government of Nepal. At present, the promotion of improved solutions kitchens in the High Mountain and Upper Mid Hill areas of Nepal comprises different organizations, different technologies and different approaches. The list of those organizations is given in Table 1.1.

Table 1.1: Present organizations, technologies and approaches for promotion of MCS

S.N.	Name of organization	Technology	Modality
1	AEPC/ESAP	MCS	Subsidy for transportation
2	Practical Action	Smoke Hood	Savings-cooperative and seed money for revolving fund
3	RECAST	Smoke Hood	Demonstration only
5	Community health initiative project, CECI	MCS	Promoter
6	Kathmandu University (RIDS Nepal)	MCS	Promoter
7	CRT/N	MCS	Promoter
9	NAST	MCS	Promoter
10	STARIC/N	MCS	Promoter
11	Local Manufacturers	MCS	On demand
12	Chinese	MCS	Imported at buffer zone

1.3 Environmental and social aspect of present metallic cook stove (MCS)

Present Metallic Cook Stove is better than previous one with respect to reduction in smoke emission and increase in efficiency. The direct and indirect benefits of MCS includes: increased thermal efficiency, the conservation of forests by cutback of firewood consumption, reduction in women's labour, reduction in indoor air pollution and hence smoke-released health disorders, prevention of fire hazards, and reduction of cooking time. These all are qualitative advantages only.

Having a Metallic Cook Stove is not energy efficient cooking option but it should emphasis on how, where and when it is used that plays important role in energy efficiency and energy conservation.

Nepal to date more than 10% of rural households already owns an improved stove. However, the prefabricated model turned not so appropriate, as substantial breakage occurred during the prolonged and difficult transportation process in hills and mountain areas. Fuel choice and cook stove design are important considerations for cooking.

If someone doesn't cook much, more efficient cooking appliances won't save much energy. On the other hand, these appliances tend to have long lives, so it is worth using efficiency as one guide when someone purchases new kitchenware. The current improved cooking and space heating technology have delivered mixed results and limited successes. The drawbacks of current cooking technology are listed below;

- Limited feedstock choices, only wood can be used as fuel.

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- Practical field efficiency is still much less than what has been studied under ideal conditions.
- Users feel difficulty in chopping the wood into small pieces.
- Improper technology transfer in different levels creating hazardous situations such as fire.
- Many of the communities do not accept it due to cultural reasons.
- Lack of knowledge of maintenance of the ICS by users makes it useless after certain period.

1.4 Objectives**Main objective**

- To scale up the use of energy efficient metallic cook stoves for cooking and space heating in high mountains and upper hills

Specific objectives are

- To identify customers' need and priorities for efficient cooking and space heating
- To study the existing cooking practices and barrier of dissemination of metallic cook stove (MCS)
- To conduct analysis on various aspects: health, indoor air pollution, fuel wood consumption, types of stoves, available resources, saving of time, cost, and gender issues, etc.
- To modify the design of existing technology for cooking and space heating
- To analyze cost efficiency, long term availability and affordability of modified technology
- To formulate guidelines for effective implementation of modified technology for cooking and space heating
- To develop supply and demand network of MCS

CHAPTER TWO

OVERVIEW OF PRESENT METALLIC COOK STOVE

There are 1557 VDCs situated above 2000m in altitude from the sea level within the 56 districts. The total number of households in these VDCs is 1,214,866 (District Development Profile Nepal 2004). It seems about 20,000 MCS has been installed; that is, only about 2% of households have MCS and smoke hood installed. Though the installation of MCS have been started in late nineties the success rate is very low.

2.1 Present status of organizations involved in promotion/dissemination of MCS

Table 2.1: Present scenario of MCS

S.N.	Promoters	Technology	Dissemination approaches	Location	Target group	Disseminated quantity	Present status
1	AEPC/ESAP	MCS	Subsidy provider	Above 2000 m	All	2000/year	Small implementation
2	Practical Action	Smoke hood + ICS	Soft loan through revolving fund	Rasuwa, Gorkha, Dhading	All	1800	Small implementation
3	RECAST	Smoke hood	Demonstration	Kathmandu	All	-	Technology development
4	Child Welfare Scheme	Leo stove (India)	Cross-subsidy for poor	Kaski	Poor HH	Min.	Pilot testing
5	Community health initiative project, CECI	MCS	Subsidized distribution to target group	Jumla	All	6460	Small implementation
6	Kathmandu University	MCS	Subsidy	Jumla, Humla, Mugu	All	4500	Small implementation
7	CRT/N	MCS	Subsidy	High hill and mountains	All	100	Pilot testing
8	STARIC/N	MCS	Through WWF-Nepal, funded by SNV	Solukhumbu, Dolpa	All	24	Pilot testing.
9	Local Manufacturer	MCS	On demand	High hill and mountains	All	As per demand	Small implementation
10	Chinese	MCS	Imported	Buffer zones	All	As per demand	Small implementation

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2.2 Information about different model MCS

The present Metallic Cook stoves have different effects on specific consumption of firewood as well as indoor air pollution. The information about different model MCS is given in Table 2.2.

Table 2.2: Information about different model MCS

S.N.	Existing Model	Specific fuel consumption	Indoor air quality	Speed of scaling up	Cost (NRs)	Sustainability			
						Availability	Affordability	Demand	Service/ Maintenance
1	AEPC/ ESAP: 2/3 pot hole	Less fuel wood consumption than in traditional stoves. Fuel efficiency is about 18-32%	Better and improved	Slow	5,000-10,000	On request	Difficult for poor	High	Smoke leakage from joints, chimney clogging*
2	Practical action: Smoke Hood with improved stoves		Better	Difficult without support	5000	Project based	Expensive for poor	Low	Leakage of air pollutants from joints
3	Leo Stove (India)		Improved	N.A.	3000 (subsidized)	Project based	Expensive for poor	High	Smoke leakage from joints, chimney clogging*
4	Chinese stove		Improved	Slow	5,000-27,000	Only at buffer zone	Expensive for poor	High	Smoke leakage from joints, chimney clogging*

* Chimney is locally fabricated.

2.3 Application of existing MCS

The application of metallic cook stove can be categorized into 3 types: namely; main application, need based application and cultural application.

Main application: The stove is either used for cooking or both cooking and space heating purposes depending on the need of the family and household location (altitude). In some cases the stove is used only for space heating to warm the room.

Need based application: The animal feed is usually warmed up before feeding to livestock in the high hills and mountain regions. Sometimes the stove is used for boiling water. Boiled water has multiple applications. It is found very useful to dry meat, fish and vegetables/fruits in the metallic stove. The dried food products are stored for future use.

Cultural application: Local wine preparation is quite popular in some ethnic community. In traditional stove it consumes quite significant fuel wood. So the use of metallic cook stove not only saves the fuel wood but also saves the wine preparation time in smokeless environment. In some community the charcoal preparation is also carried out in metallic stoves where combustion control is easier for forging.

Promotion and dissemination of MCS in various regions of Nepal are top-down and supply-driven approach. The customers' needs and priorities are not defined clearly. The cooking and space heating needs also depend on altitude. This might also be a result of diverting situations within the areas above 2,000m altitude based on availability of fuel wood and space heating requirements.

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2.4 Support to technology development and release

Description and comparison of the different initiatives in respect of their concept of technology development and release of technologies for the high mountain area are given in Table 2.3.

Table 2.3: Technology development and release

S.N.	Name of organization	Development of technology	Release of technology (date)	Process of dissemination	Involved person/organization			Outcomes
					Product development	Product release	Product dissemination	
1	AEPC/ESAP	Metallic stove	2/3 pot holes with water boiler and chimney-2009	Subsidy	KU/AEPC	AEPC/ESAP	Manufacturing companies	5,318
2	Practical Action	Smoke hood	2005-2010	Project based	Practical Action	Practical Action	Practical Action	1,800
3	Kathmandu University	Metallic stove	2/3 pot holes with water boiler and chimney - 1998	Project based	KU	KU	KU/RIDS	4,500
4	NGOs	Metallic stove	2/3 pot holes with water boiler and chimney	Project based	Adopted	Self	Self	About 10,000

AEPC/ESAP in consultation with local manufacturers and feedback from monitoring team modifies the design of MCS that is to be subsidized. After modification in design the field test is carried out with the new metallic stoves and approved it for subsidy. Besides, research institutes like Kathmandu University, RECAST, NAST, CES/IOE also design, modify, fabricate and test the performance of stoves.

Manufacturing companies prequalified by AEPC/ESAP, INGOs, NGOs and few local manufacturers are promoting, disseminating and installing the metallic cook stoves as per demand. But due to high cost of MCS and difficulty in its supply side the number of installed MCS is not high. In bordering districts (buffer zone) Chinese metallic stoves are not easily available but are also very expensive, beyond the reach of poor family.

The target groups are located in the high hills and mountain region whereas almost all the MCS manufacturers have established their workshop in Terai, Kathmandu Valley and Pokhara. Therefore, there is a problem of access to technology as well as delivery of MCS to the needy groups. The cost of transportation of MCS from low altitude region to high altitude region is very expensive due to lack of appropriate transportation means and road infrastructure. It is very difficult to supply the MCS in small scale to needy people all year round even though they wish to own it. Many poor families cannot afford to pay the cost of MCS without subsidy and instead they stick to the traditional stoves consuming more fuel wood in smoky environment. The subsidy for transportation cost provided by AEPC/ESAP is a flat rate of NRs 2,700 for 2 pot hole and NRs 4,000 for 3 pot holes MCS irrespective of distance from the manufacturing company to installation site.

2.5 Strengths, weaknesses, opportunities and threats

Strengths, weaknesses, opportunities and threats of the different technology development are given in Table 2.4.

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Table 2.4: Strengths, weaknesses, opportunities and threats of the different technology

S.N.	Type of technology	Strengths	Weaknesses	Opportunities	Threats
1	AEPC/ESAP metal stove	Clean, strong, suitable for cooking 3 items and space heating and other need based application	Leakage from the joints; heavy, rigid pot hole size, expensive and fabrication is possible in the metal workshops only	Demand is high and useful for reducing GHG and indoor air pollution	High metal cost and transportation cost; difficult to sustain without subsidy
2	Smoke Hood	Alleviate indoor air pollution & clean stove	Leakage from the joints, fabrication is possible only in the metal workshop	Useful to reduce health impact caused by indoor air pollution	Expensive and high transportation cost
3	Stove promoted by local manufacturer	Custom made	Expensive but not standardized	Helpful to scale up the metallic stove if they meet the national standard of stove	High metal cost and transportation cost
4	Chinese stove	Clean, strong, suitable for cooking 2/3 items and space heating	Expensive, difficult to get	Demand is high; bulk import will reduce the cost	Low availability

2.6 Pre-qualified companies for installation of MCS

The following table shows the installation of MCS by 11 companies whose application for subsidy is approved by AEPC/ESAP.

Table 2.5: Company wise installation of MCS from January 1, 2009 to October 18, 2011

S.N.	District	BMU	CMI	DTL	KVM	MEM	REU	SDM	SHE	SSB	SUP	TAT	Total	VDC
1	Baglung	-	-	-	-	-	-	-	63	-	-	-	63	6
2	Bhojpur	-	-	-	-	-	10	-	-	62	24	-	96	8
3	Dhading	-	-	11	-	-	-	-	-	-	62	-	73	3
4	Dolakha	-	-	-	-	-	-	420	-	-	-	-	420	27
5	Gulmi	-	-	-	-	-	-	-	9	-	-	-	9	1
6	Humla	-	-	-	-	-	30	-	-	-	-	-	30	1
7	Illam	-	-	-	-	-	-	-	-	12	-	-	12	8
8	Jajarkot	-	-	-	-	-	35	-	-	-	-	-	35	5
9	Jumla	-	-	-	745	-	-	-	-	-	-	-	745	29
10	Kalikot	-	-	-	-	-	37	-	-	-	-	-	37	2
11	Kaski	-	177	-	-	-	-	-	22	-	-	-	199	4
12	Kathmandu	-	-	-	-	-	-	-	-	-	93	-	93	5
13	Kavrepalanchowk	47	-	-	-	-	-	-	-	-	50	-	97	10
14	Lalitpur	-	-	-	-	-	-	-	-	-	140	-	140	10
15	Lamjung	-	-	-	-	-	-	-	22	-	17	-	39	7
16	Makwanpur	-	-	-	-	-	-	-	-	-	46	135	181	9
17	Mugu	-	-	-	111	-	390	-	-	-	-	-	501	6
18	Mustang	-	-	-	-	29	-	-	188	-	-	-	217	3
19	Myagdi	-	-	-	-	-	-	-	124	-	-	-	124	7
20	Nuwakot	-	-	-	-	-	-	-	-	-	302	-	302	11
21	Okhaldhunga	2	-	-	-	-	-	-	-	88	-	-	90	7
22	Panchthar	-	-	-	-	-	-	-	-	7	-	-	7	2
24	Ramechhap	19	-	-	-	-	-	60	-	-	33	-	112	6
25	Rasuwa	-	-	-	-	-	-	-	-	-	64	71	135	6
26	Rolpa	-	-	-	-	-	52	-	-	-	-	-	52	4
27	Rukum	-	-	-	-	-	118	-	-	-	-	-	118	1
28	Salyan	-	-	-	-	-	16	-	-	-	-	-	16	1
29	Sindhuli	8	-	-	-	-	-	-	-	-	-	-	8	1
30	Sindhupalchowk	-	-	-	-	-	-	-	-	-	923	105	1028	31
31	Solukhumbu	-	-	-	-	-	-	-	-	74	-	-	74	5
32	Syangja	-	-	-	-	-	-	-	96	-	-	-	96	3
33	Taplejung	-	-	-	-	-	-	-	-	49	-	-	49	11
34	Tehrathum	-	-	-	-	-	-	-	-	120	-	-	120	8
-	Total	76	177	11	856	29	688	480	524	412	1754	311	5318	248

Source: AEPC, 2011

BMU Banepa Metal Udhyog, Banepa, Kavre

CMI Chandra Metal Industries, Pokhara, Kaski

DTL Development Trade Link, Teku, Kathmandu

KVM Karnali Vidhyut & Metal Workshop Pvt. Ltd, Jumla

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MEM	Mustang Engineering Metal Workshop, Pokhara, Kaski
REU	Rijwan Engineering Udhyog, Nepalgunj, Banke
SDM	Shree Dhungeshowari Mechanical Workshop, Jiri, Dolakha
SHE	Shanti Engineering Works, Pokhara, Kaski
SSB	Shree Singha Bahini Engineering Works and Energy Pvt. Ltd., Itahari, Sunsari
SUP	Sindhu Urja Prabardan Kendra Pvt. Ltd., Kalanki, Kathmandu
TAT	Trishul Agri-tools and Engineering Pvt. Ltd., Jorpati, Kathmandu
VDC	Village Development Committee

AEPC/ESAP has pre-qualified 32 manufacturing companies (Annex A) that are eligible for claiming subsidy for the installation of MCS in the districts located at mountain and uphill regions. Among them 11 manufacturing companies are actively involved in installation of 5,318 MCS in 248 Village Development Committee (VDC) of 34 districts from Jan 1, 2009 to Oct 18, 2011. AEPC/ESAP has approved subsidy for 829, 2,200 and 2,289 MCS in 2009, 2010 and 2011 (till October) respectively. The increased number of MCS indicates the growing demand for MCS in these regions. Sindhu Urja Prabardan Kendra Pvt. Ltd (SUP) has installed the maximum number of MCS equal to 1754 in 11 districts. It has installed 923 MCS in Sindhupalchowk district only. Similarly, Karnali Vidhyut & Metal Workshop Pvt. Ltd (KVM) and Rijwan Engineering Udhyog (REU) have installed 856 in Jumla and Mugu districts and 688 in 8 districts respectively.

The maximum number of MCS is installed in Sindhupalchowk district followed by Jumla and Mugu districts. There are more than 500 MCS installed in these districts. Two manufacturing companies are involved in installation of MCS in Sindhupalchowk and Mugu districts where as in Jumla only one company (KVM) has installed 745 MCS. The distribution coverage of MCS in Sindhupalchowk is 1028 in 31 VDC followed by Jumla with 745 MCS in 29 VDC and Dolakha with 420 in 27 VDC respectively

The number of MCS in 19 districts is less than 100. The lowest number of MCS (less than 10) is installed in Panchthar, Sindhuli and Gulmi districts respectively.

CHAPTER THREE

SAMPLE SURVEY METHOD AND POTENTIAL AREA

Physically Nepal is divided into five Development Regions; i.e., Eastern Development Region (EDR), Central Development Region (CDR), Western Development Region (WDR), Mid Western Development Region (MWDR), Far Western Development Region (FWDR). The list of districts lying above the altitude of 2000m in each of these development regions are given in the table below.

Table 3.1: List of districts lying above 2000m above sea level in 5 Development Regions

S.N.	Region	District	S.N.	Region	District
1	Eastern Development Region	Solukhumbu	4	Mid Western Development Region	Humla
		Sankhuwasabha			Kalikot
		Taplejung			Jumla
2	Central Development Region	Rasuwa			Mugu
		Sindhupalchok			Jajarkot
		Dolakha			Dolpa
3	Western Development Region	Baglung			Rukum
		Myagdi	5	Far Western Development Region	Darchula
		Mustang			Bajhang
		Manang			Bajura
		Kaski			
		Lamjung			
		Gorkha			

Each of the districts is shown in map of Nepal below by blue and green colors.



Fig. 3.1: Map of Nepal

In higher altitudes of Nepal, cooking requires a lot of energy due to a range of low to extremely low temperatures. Most of the people in these regions cook traditionally. Different organizations are currently involved in the energy efficient cooking technologies in these regions and ICS, MCS, Solar cooker, etc. are being promoted. However, adoption of these technologies is still limited.

For the welfare of the people's health and economy of fuel wood, AEPC/ESAP had started the dissemination of the improved metallic cook stove with standard design for the high altitude above 2000m of the country. Various metallic stove manufacturing company promises for their manufactured stove to meet the standard designed parameter as set by AEPC/ESAP but in the field the condition may vary. Government of Nepal has a provision of subsidy (NRs. 4000) facility for a particular family for one time to install metallic cook stove at the high altitude region. Thus this subsidy amount had potential to be misused by the local manufacturing company and the intended user themselves.

3.1 Development of criteria to select promising areas/ communities

CES is going to accomplish inception study on energy efficient cooking technologies in high mountains above 2000m. There are 23 districts that possess the altitude of and above 2000m.

The following few parameters that were discussed with experts to propose potential districts:

- Districts above 2000m
- Current progress in installation of ICS and MCS
- Technical feasibility (of the energy options)
- Initial readiness to pay for better mode of cooking and space heating technology
- Overall sustainability (of the intended project)

The selection of appropriate location is done with the following criteria:

- Altitude of installed location
- Installation density of ICS/MCS
- Success and failure locations and progress trend
- Accessibility
- Annual production of biomass
- Availability of biomass resources, in surplus/ deficit

Based on above criteria the districts having maximum and minimum MCS are given in the table below:

Table 3.2: Number of installed metallic cook stoves in the various districts

S.N.	Development Region	Number of district above 2000 m	District	
			Maximum MCS	Minimum MCS
1	EDR	3	Taplejung	Sankhuwasabha
2	CDR	3	Sindhupalchok	Rasuwa
3	WDR	7	Kaski	Gorkha
4	MWDR	7	Jumla	Jajarkot
5	FWDR	3	Bajura	Bajura

The selected districts and its reasoning are given in table below:

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Table 3.3: List of selected districts for survey

S.N.	Selected districts	Reasons	Remarks
1	Sankhuwasabha	Minimum MCS	1 out of 3 Districts
2	Rasuwa	Minimum MCS	1 out of 3 Districts
3	Mustang and Dolpa	Due to altitude	2 out of 3 Districts
4	Jajarkot and Humla	Minimum MCS and altitude	2 out of 3 Districts
5	Bajura	Minimum MCS	1 out of 3 Districts

The proposed districts are circled below in the Map of Nepal:



Fig. 3.2: District map of Nepal

Based on installation of MCS, household density and accessibility the selected VDC of each district are given below:

Table 3.4: List of VDC selected in various districts for survey

S.N.	Selected District	Selected VDC	Remarks
1	Sankhuwasabha	Matsyapokhari and Makalu	2 VDC from each district
2	Rasuwa	Gatlang and Bridhim	
3	Mustang and Dolpa	Jomsom and Kawang from Mustang as well as Dunai and Tinje from dolpa	
4	Jajarkot and Humla	Majhakot and Dandagaun from Jajarkot as well as Gothi and Thehe from Humla	
5	Bajura	Jugada and Bichhaiyan	

CHAPTER FOUR

ANALYSIS OF SURVEY DATA

4.1 Sampling technique

In higher altitudes of Nepal, cooking requires a lot of energy due to a range of low to extremely low temperatures. Most of the people in these regions use traditional cook stove for cooking. Different organizations are currently involved in the energy efficient cooking technologies in these regions such as ICS, MCS, solar cooker, etc. However, adoption of these technologies is still limited. Seven sample districts of high altitude (above 2,000m) regions are selected for survey. Sampling data were collected by direct asking to the random household including different genders and ethnic groups. Separate questionnaires were prepared for those household using with and without MCS. Information was collected from DDC, VDC and supporting organizations involved in the promotion of MCS in these districts.

4.2 Analyzing technique

Two set of surveys in each district was collected about cooking behavior and energy consumption along with other socio economic conditions. Analysis was made on these data with different prospective. The data collected from DDC, VDC and supporting organization involved in the promotion of MCS in these districts were used as supporting data for analysis. Photographs and check lists of observations verify as the physical evidence and validation of the work.

4.3 Surveyed districts

Physically Nepal is divided into five Development Regions i.e., Eastern Development Region (EDR), Central Development Region (CDR), Western Development Region (WDR), Mid Western Development Region (MWDR) and Far Western Development Region (FWDR). The districts lying above the altitude of 2000m in each of these Development Regions are three, three, seven, seven and three respectively. Among them seven random districts from all Development Regions and districts that are situated close to Chinese border were taken as survey districts. The districts close to Chinese border use Chinese MCS, which are not cost effective to all the households in that area. Sankhuwasabha (Eastern Development Region), Rasuwa (Central Development Region), Mustang (Western Development Region), Humla (Mid Western Development Region), Jajarkot (Mid Western Development Region), Dolpa (Mid

Western Development Region) and Bajura (Far Western Development Region) are the seven districts selected for survey. The climate of these districts is cold and so they need stove for cooking and space heating.

4.3.1 Description of surveyed districts

The information on number of municipalities, VDC, households and area coverage were collected. There is only one municipality among the seven districts surveyed. Total number of VDCs are 181, total number of households is 114,546 and average household density is five square kilo meter per households (Appendix B). The analysis shows that the households are rather scatter type and at remote areas.

4.3.2 Demographic record of surveyed districts

Demographic records of surveyed districts are collected from DDC, VDC and Ministries of Nepal Government. Population size of these districts varies from upper scale of 176,459 in Sankhuwasabha district to lower scale of 15,627 in Mustang district and corresponding population densities per square km are 51 to 4.2. The average household size and literacy rate is six and forty five (Appendix B). This shows that these districts are in rural areas which are less developed and people in these districts needs better technologies for cooking and space heating (Appendix B).

4.3.3 Firewood resource and availability of surveyed districts

The most prominent energy resource in the hilly district is firewood. People in these districts mostly use traditional type of stoves for cooking purpose. As these districts are situated in high altitudes, climate in winter is cold so they need stoves for space heating purpose also. The average forest in these districts is seventy six thousand hectors. This can give average availability of two hundred nine thousand metric ton per year firewood. Average per capita per day available firewood is eight kilograms (Appendix B).

4.4 Respondents of surveyed districts

In the process of survey, the expected respondents include the uniform number of genders and ethnic groups. Among total 420 respondents in whole survey program, 132 respondents are below thirty years old, 240 respondents are between 30 to 60 and remaining 48 are above 60 years old. Gender respondent of male to female respondent ratio is 1.85. The respondents of ethnic group composing of Dalit, Janajati, Brahmin, Chhetri and Sherpa are in 70,142, 26, 139

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and 43 respectively. The education qualifications of the respondents are from informal education to above grade ten (Appendix B).

4.5 Existing cooking and space heating technology

4.5.1 Type of main cook stove and cooking fuel

Among seven sample surveyed districts, most of the villagers are using traditional cook stoves along with few MCS for the fulfillment of cooking and space heating. Though there are various alternatives of cooking practices like TCS, MCS, ICS, kerosene stove, electric cooker, solar cooker, and other stoves only TCS, MCS and ICS were used for cooking and space heating. Among 420 stove users there are 223 numbers of TCS users, 165 numbers of MCS users and 32 numbers of ICS users. All seven districts have TCS and MCS types of cooking stoves in different proportion. Only Mustang district has 32 numbers of ICS along with TCS and MCS. The percentage of TCS, MCS and ICS users are 53%, 39% and 8% respectively in these seven districts.

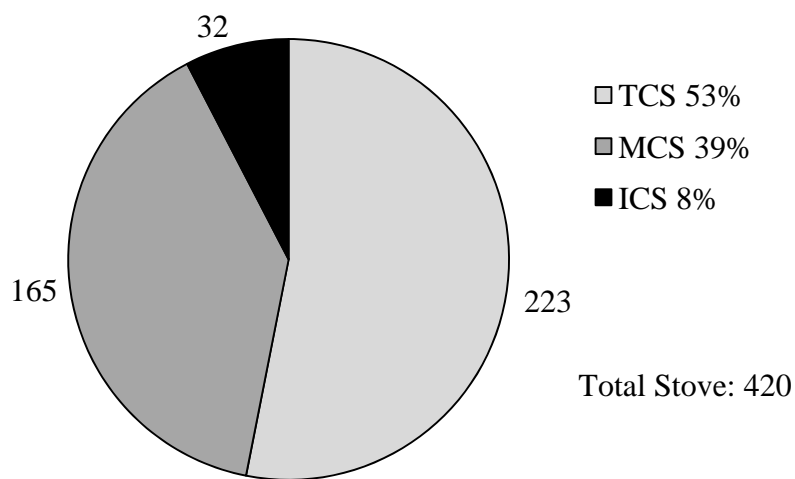


Fig. 4.1: Type of main cook stove

Survey data show that almost 416 respondents out of 420 respondents use firewood as cooking fuel whereas, only four households of Dolpa district use dung cake as cooking fuel.

4.6 TCS

4.6.1 General information about TCS/ICS

All seven sample surveyed districts are using TCS, MCS and ICS for cooking and space heating purposes. There were 223 numbers of TCS users, which is almost 53% of total 420 stoves. These TCS are locally manufactured without technical parameters. These stoves generally produce lots of smoke. Among 223 numbers of TCS, numbers of users for One Pot Hole, Two Pot Hole, Three Pot Hole, Open Fire (Iron) and Open Fire (Stone) are 34, 64, 15, 53 and 57 respectively. It shows that, Two Pot Hole users rank highest in number.

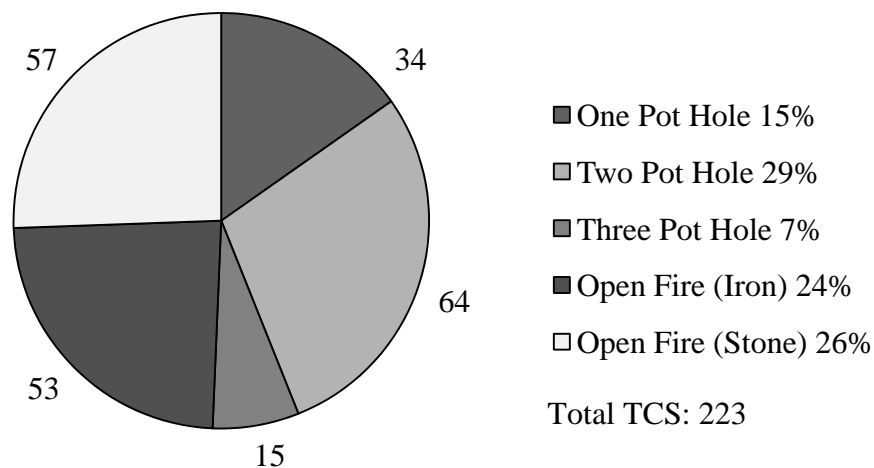


Fig. 4.2: Type of TCS

4.6.2 Cost of existing TCS

All seven sample surveyed districts are using locally manufactured TCS. The cost of TCS varies from district to district. The average cost of One Pot Hole, Two Pot Hole, Three Pot Hole, Open Fire (Iron) and Open Fire (Stone) are found to be NRs 557, NRs 1,105, NRs 1,844, NRs 5,144 and NRs 1,454 respectively. The average cost of closed type with different numbers of pot holes is NRs 1,168. This shows that cost of TCS is low and users can easily afford this stove but it has disadvantage of smoke and low efficiency.

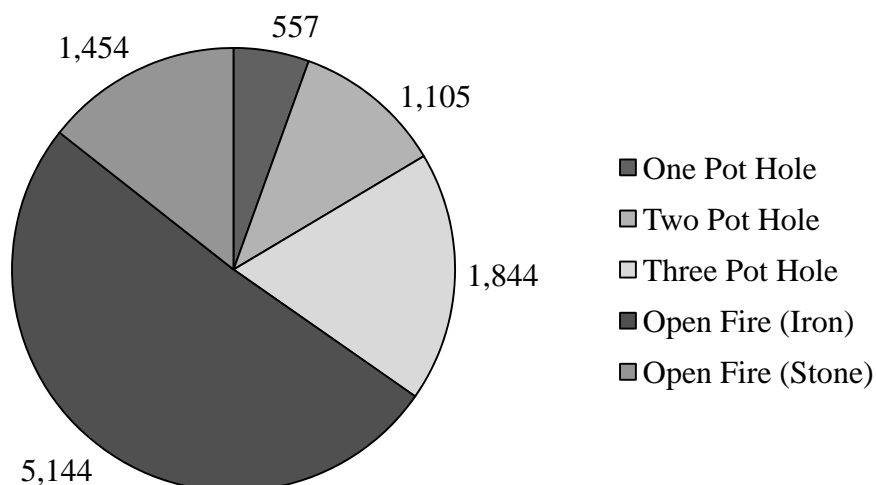


Fig.4.3: Average cost of TCS in NRs

4.7 Additional cooking and space heating technology for TCS users

Almost all seven sample survey districts are situated in high mountains. The climate in winter is very cold so they need stoves for space heating purposes. Various means are practiced by villagers to get rid of cold. Survey was performed whether these TCS would be sufficient to meet cooking as well as space heating purpose or not. The additional cooking and space heating technologies in addition to TCS users are found to have different patterns in different districts.

4.7.1 Shankhuwasabha

This district has highest TCS users among seven districts surveyed. Among the 53 respondent in Shankhuwasabha district, 42 respondents are satisfied to use TCS for both space heating and cooking purposes. Among these 11 unsatisfied respondents, use Open Fire Stone and Open Fire Iron for additional cooking purpose. These respondents are using other alternative stoves for space heating purpose. Eight respondents are using Open Fire (without Tripod) and three are using TCS (Tripod or Three stone) for additional space heating purpose.

4.7.2 Rasuwa

Among the 34 respondents in Rasuwa district, 29 respondents are satisfied using TCS for both space heating and cooking purpose. Among these five unsatisfied respondents, 4 respondents

use LPG and one respondent uses open fire Stone for additional cooking purpose. These four respondents are using Open Fire (Without Tripod or Three stone) and one is using TCS (Tripod or Three stone) for additional space heating purpose.

4.7.3 Mustang

Among the 34 respondents in Mustang district, 5 respondents are satisfied to use TCS for both space heating and cooking purposes. Among these 29 unsatisfied respondents, 2 respondents use Charcoal Stove (Metallic), 22 respondents use LPG (4 respondents use both Kerosene and LPG Stoves) and 5 respondents use Open Fire Stone for additional cooking purpose. Two respondents are using electrical equipment, 22 respondents are using Charcoal stove (Metallic) and one respondent is using Open Fire (Without Tripod or Three stone) for additional space heating purpose.

4.7.4 Humla

Among the 32 respondents in Humla district, 20 respondents are satisfied to use TCS for both space heating and cooking purposes. Among these 12 unsatisfied respondents, one respondent uses Solar Cooker, ten respondents use MCS and one respondent uses Electrical Equipment for additional cooking purpose. One of the respondents is using Electrical Equipment and 11 respondents are using Open Fire (Without Tripod or Three stone) for additional space heating purpose.

4.7.5 Jajarkot

Among the 48 respondents in Jajarkot district, 37 respondents are satisfied to using TCS for both space heating and cooking purposes. Among these 11 unsatisfied respondents, two respondents use Husk Stove, four respondents use Mud Stove and five respondents uses Open Fire Iron for additional cooking purpose. The five respondents are using TCS (Tripod or Three stone) and 6 respondents are using Open Fire (Without Tripod or Three stone) for additional space heating purpose.

4.7.6 Dolpa

This district has lowest TCS users among seven districts surveyed. Among the 3 respondent in Dolpa district, 2 respondents are satisfied using TCS for both space heating as well as cooking purposes. Among the unsatisfied respondents, one respondent uses Open Fire Stone for

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additional cooking purpose. This one respondent is using Open Fire (Without Tripod or Three stone) for additional space heating purpose.

4.7.7 Bajura

Among the 51 respondents in Bajura district, 43 respondents are satisfied using TCS for both space heating and cooking purposes. Among these 8 unsatisfied respondents, five respondents use Open Fire Stone and three respondent uses Open Fire Iron for additional cooking purpose. These two respondents are using TCS (Tripod or Three stone) and 6 respondents are using Open Fire (Without Tripod or Three stone) for additional space heating purpose.

4.8 Need of TCS

4.8.1 Application based need

It is important to know how the TCS has been used in all seven different districts. The villagers of these districts use TCS for cooking, space heating, animal feed preparation, traditional wine preparation etc. It is found that among 223 TCS users 57 use the stove for cooking purpose and remaining 166 uses the stove for both cooking and space heating purposes. Thus TCS is extensively used for both the purposes of cooking and space heating, though there are numerous problems like smoke and low efficiency.

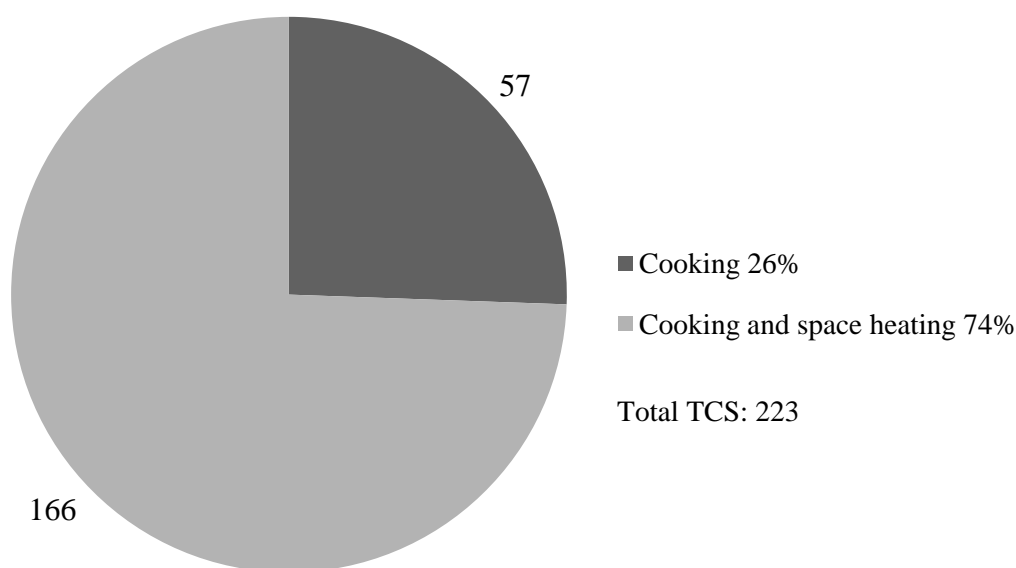


Fig. 4.4: Application of TCS

4.8.2 Ethnic group based need

There are various combinations of ethnic groups living in harmony. They use various types of stove for their different needs. According to their traditional belief and culture their needs and purposes are different. They generally use TCS, Open Fire (Iron) and Open Fire (Stone) in majority. Normally TCS are used for cooking purpose in almost all ethnic groups. Open Fire (Iron) and Open Fire (Stone) are used for space heating purpose. One other notable factor for animal feeding and traditional wine preparation is that users generally use large type Open Fire (Iron) and Open Fire (Stone), which has additional advantage of space heating. This emphasis on multi type of stove use.

4.9 Metallic cook stove

People are attracted to use MCS. There are various advantages of using MCS. Various types MCS manufactured by different promoters and manufactures. Effort has been put for improvement of its quality and affordability to villagers.

4.9.1 Type of Metallic cook stove

All seven sample surveyed districts use TCS, MCS and ICS for cooking and space heating purposes. There were 165 numbers of TCS users, which is almost 39% of total 420 stoves. Among 165 numbers of MCS, users numbers of One Pot Hole, Two Pot Hole and Three Pot Hole, are 15, 35, 96 respectively. It shows that, Three Pot Hole is highly favorable than one pot hole.

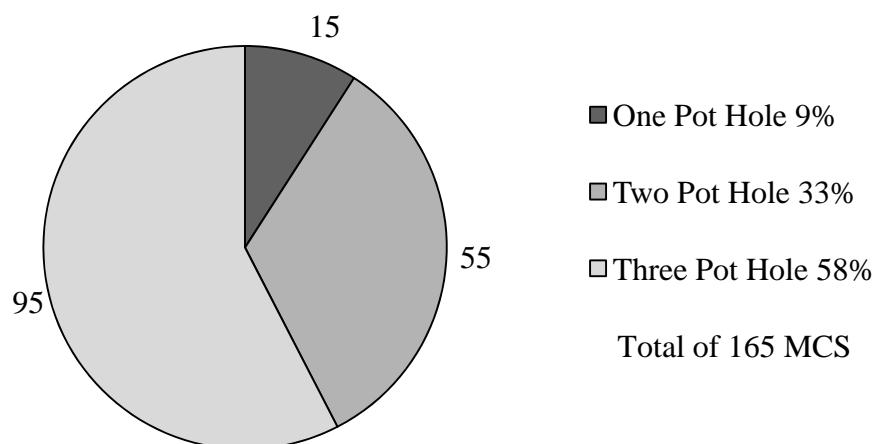


Fig. 4.5: Type of MCS

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4.9.2 Location of MCS

Better technology and accessories like smoke hood or chimney are incorporated in MCS. Various types of MCS manufactured by different manufactures are in use in these districts. Some of these MCS are manufactured by Local manufacturers, District headquarter manufacturers, Chinese manufacturers and others. District Headquarter manufactured and Chinese manufactured dominate almost 82%. MCS manufactured locally is negligible. This concludes that District Headquarter manufactured and Chinese manufactured are common and preferred by the villagers.

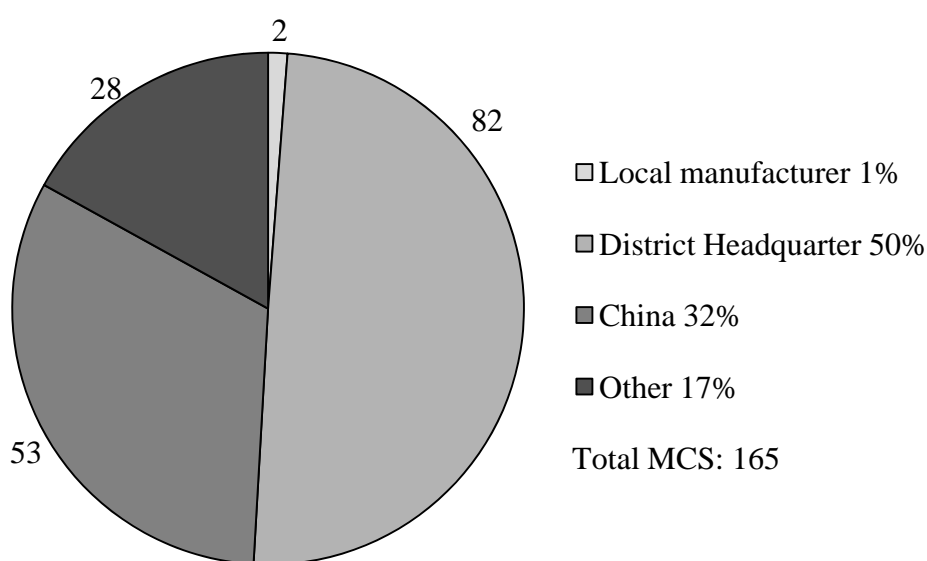


Fig. 4.6: Location of MCS

4.9.3 Mode of transport of MCS

There is limited number of local MCS manufacturers and transportation of these MCS to needy households is difficult. They may use air, land vehicles, porters and animals for transportation of MCS. So it should be kept in mind that transportation means should be given priority in dissemination of MCS. Since air route is expensive and has less access to these districts, not even a single MCS is transported by air route. Among total 165 MCS used by villagers, numbers of MCS transported by vehicles, porters and animals are 67, 65 and 33 respectively.

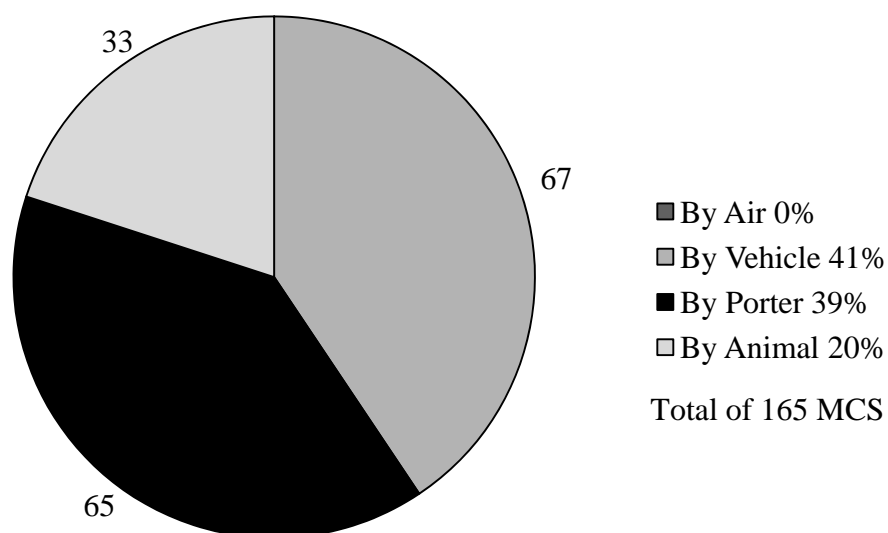


Fig. 4.7: Mode of Transport of MCS

4.9.4 Manufacturer and supplier of MCS

Survey data of various manufacturers and suppliers of MCS are given in Table 4.1. Some of the manufacturers in the surveyed districts are Chinese manufacturer, Sindhu Urja Promotion Centre (SUP), Shanti Engineering Workshop (SEW), Self Help Initiative Promotion Center (SHIP), Kathmandu University (KU) and Rijwan Engineering Udhog (REU). Similarly the suppliers are AEPC, Red Cross, Rural Integrated Development Service (RIDS), Local Initiatives for Biodiversity, Research and Development (LIBIRD) and self supplied by the users.

Table 4.1: Manufacturer and supplier of MCS

SN	Description	District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	Manufacturer	China	SUP/ China	SEW/ China	KU/ SHIP Nepal/ China	REU	RIDS/ China	REU
2	Supplier	Self	AEPC/ Self	Red cross/ Self	RIDS /LIBIRD	AEPC/ Self	Self	AEPC/ Self

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4.9.5 Cost of MCS

All seven sample surveyed districts using MCS are manufactured by various manufacturers and supplied by various means of transportation. The cost of MCS varies from district to district. The average cost of MCS that are locally manufactured for One Pot Hole, Two Pot Hole and Three Pot Hole, are found to be NRs 1,500, NRs 5,369 and NRs 7,239 respectively.

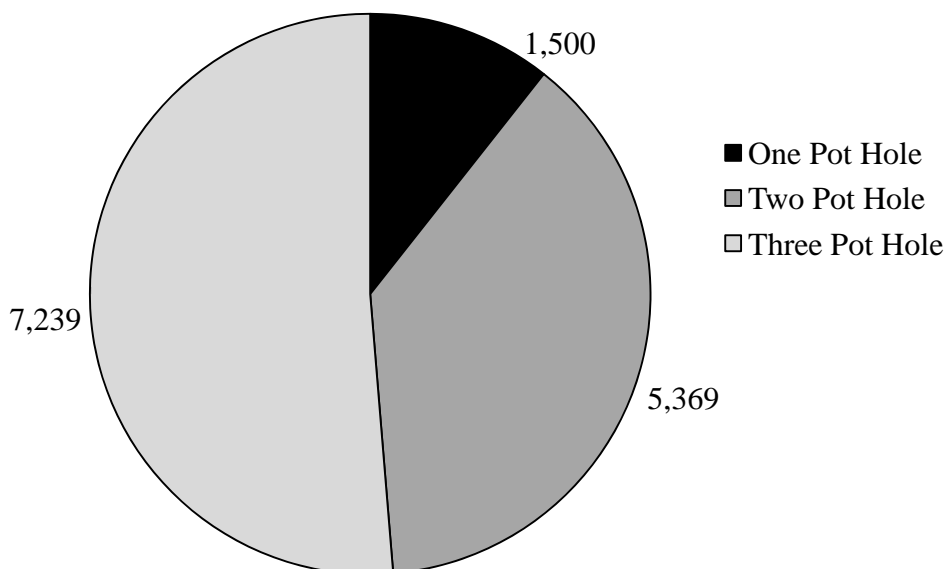


Fig.4.8: Cost of MCS manufactured by local manufactures in NRs

Cost of MCS is quite high relatively to TCS, which is NRs 1,168 as indicated in sub title 4.6.2. Most of the users are using duel stoves for cooking and space heating. In addition, they are using stoves for cooking animal feed and wine preparation. It means if new technology can incorporate to be used for main cooking, animal feed and wine preparation and space heating the cost may not be a great deal for its dissemination. Cost range of One Hole to Three Hole Chinese MCS is from NRs 5,000 to NRs 27,500 which varies from district to district. The cost of Chinese MCS is highest in Sankhuwasabha district and lowest in Mustang district. Variation may be due to ease of access to Chinese market from these districts. This show, with proper manufacturing in accordance to the demand and with better technology the price can be of less importance.

4.9.6 Operation and maintenance of MCS

For better performance of MCS, continuous maintenance is very important. As these MCS models are quite new to users and are operating smoothly, the users are less aware about maintenance of MCS. The users have adapted this new technology not more than 2 years. They only clean the chimney frequently in between the range of a week to two months according to their need. There is high tendency of filling mud in the stove with around 25 mm of thickness which may decrease its performance. Not a single manufacturer has gone for after sales service. For the proper use of MCS, maintenance and after sales service could be given high priority in the process of dissemination and stability of whole system.

4.10 Additional cooking and space heating technology for MCS users

Climatically all seven sample surveyed districts are very cold in winter since they are situated in the high mountains. Thus they need stoves for cooking as well as for space heating purposes. Survey was performed whether these MCS will be sufficient to meet cooking as well as space heating purpose or not. The additional cooking and space heating technology in addition to MCS users are found to be different in different districts. Though the users of MCS are small so the sample sizes are small, the analytical result still carries high value in the process.

4.10.1 Shankhuwasabha

This district has lowest MCS users among seven districts surveyed. Only among the 7 respondents in Shankhuwasabha district, 5 respondents are satisfied to use MCS for both space heating as well as cooking purposes. The 2 unsatisfied respondents use Open Fire Stone for additional cooking purpose. These respondents use Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.2 Rasuwa

Among the 26 respondents in Rasuwa district, 21 respondents are satisfied using MCS for both space heating as well as cooking purposes. The five unsatisfied respondents use Open Fire Iron for additional cooking purpose. These five respondents are using Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.3 Mustang

Among the 26 respondents in Mustang district, 8 respondents are satisfied to use MCS for both space heating as well as cooking purposes. Among these unsatisfied respondents, 11

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respondents use LPG, seven respondents use Kerosene for additional cooking purpose. Five respondents are using Electrical Equipment, seven respondents are using Metallic Charcoal stove and six respondents are using Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.4 Humla

Among the 28 respondent in Humla district, 26 respondents are satisfied using MCS for both space heating as well as cooking purposes. The two unsatisfied respondents use Electrical Equipment for additional cooking purpose. These two respondents use Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.5 Jajarkot

Among the 12 respondents in Jajarkot district, 9 respondents are satisfied using MCS for both space heating as well as cooking purposes. Among these unsatisfied respondents, one respondent uses Husk Stove, two respondents use Mud Stove for additional cooking purpose. These three respondents use Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.6 Dolpa

This district has highest MCS users among seven districts surveyed. Among the 57 respondent in Dolpa district, 52 respondents are satisfied using MCS for both space heating as well as cooking purposes. Among these unsatisfied respondents, two respondents use Kerosene Stove, two respondents use Electrical Equipment and one respondent uses Open Fire Iron for additional cooking purpose. These three respondents are using Electrical Equipment and two of the respondents are using Open Fire (Without Tripod or Three stone) for space heating purpose.

4.10.7 Bajura

This district has second lowest MCS users among seven districts surveyed. Among the 9 respondents in Bajura district, one respondent is satisfied using MCS for both space heating as well as cooking purposes. Whereas the other unsatisfied respondent uses Open Fire Iron for additional cooking purpose and Open Fire (Without Tripod or Three stone) for space heating purpose.

4.11 Socio-economic indicators

Success of MCS development and dissemination mainly depends upon socio-economic factors. These factors directly and indirectly influence satisfaction and motivation towards MCS development. Smoke and other heating technologies leads toward improvement in health condition of the users. Among 165 MCS user respondents, 155 respondents have positive impact on their health condition with only 10 not finding any improvement in their health condition after using MCS. There were almost 50-50 percent responses for change in educational circumstance. Respondents for time saving after using MCS were 99 verses 66. We should take this seriously that the saving of time should be linked to income generation programs. Hence it is suggested that this project could be disseminated along with some other income generation activities which closely relates to sustainability and motivation factor of the whole project. Respondents for extra income data after using MCS were 6 out of 165. This shows that there is no effect on extra income generation after having MSC. The respondents show positive result in fuel saving and change in environment, which is the positive part of owning MCS which will help sustainability of the firewood supply in long run.

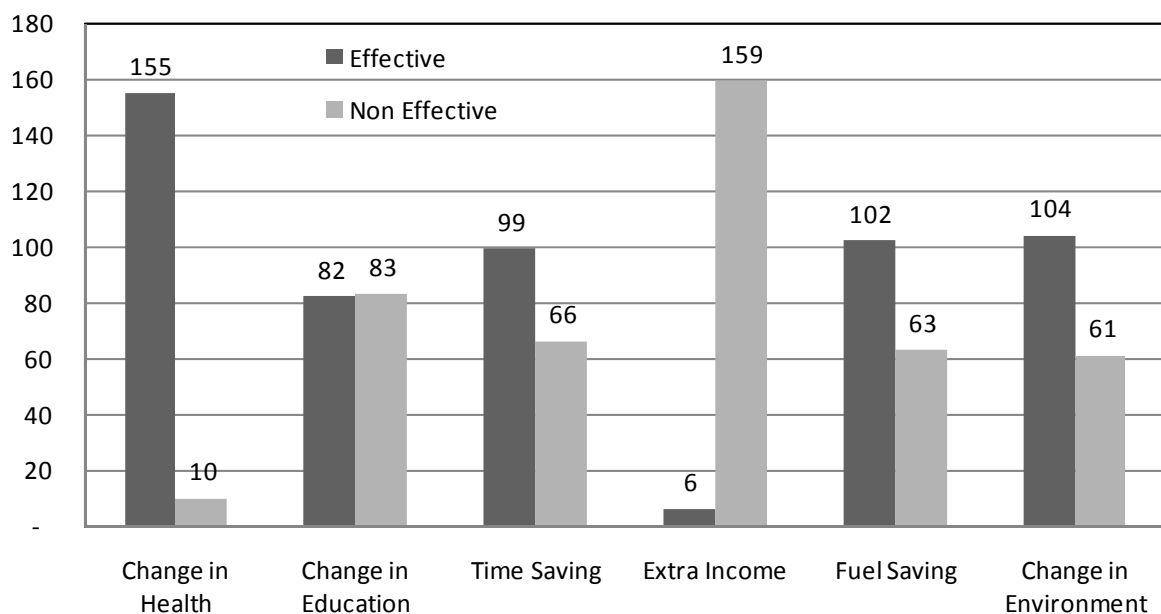


Fig. 4.9: Socio-economic indicators of MCS

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4.12 Need of MCS

4.12.1 Application based need of MCS

It is important to know how MCS is used in these seven districts. The villagers of these districts use MCS for cooking, space heating, animal feed preparation, traditional wine preparation etc. It was found that among 165 MCS users 41 users use the stove for cooking purposes and remaining 124 users use the stove for both cooking and space heating purposes. Thus MCS is extensively used for both cooking and space heating purposes.

4.12.2 Ethnic group based need of MCS

Ethnic groups use various types of MCS for different purposes. According to their traditional belief and culture their needs and purposes are different for them. Normally MCS are used for cooking purpose in almost all ethnic groups. Open Fire (Iron) and Open Fire (Stone) are used for space heating purpose. Though some MCS users are using it for animal feed cooking and traditional wine preparation, most of them use large Open Fire (Iron) and Open Fire (Stone) stoves. Thus MCS is used as multi-type of stove.

4.13 Requirement of new technology

Survey regarding the requirement of new technology of MCS was responded by 222 users of TCS and ICS. MCS has better technology and additional advantage for space heating. It was found that 167 users responded positively. Among 167 respondents 17% prefer MCS because of fuel efficiency, 59% prefer because of cleanliness and 24% prefer it because it saves time.

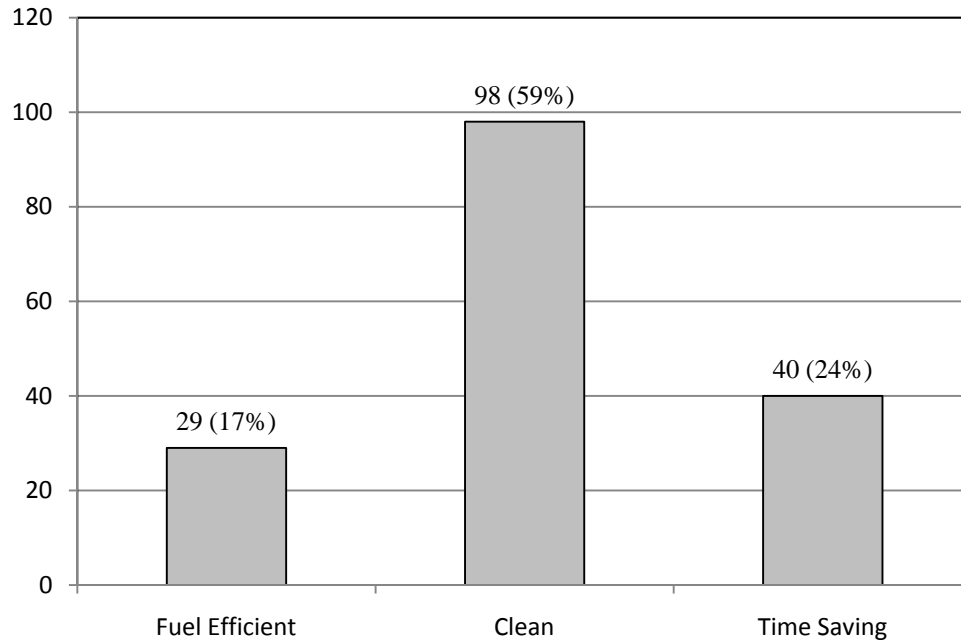


Fig. 4.10: Cause of requirement of MCS

It was found that 55 users responded negatively to use MCS. Among 55 respondents 42% did not prefer MCS because of high cost, 15% did not prefer because of indifferent nature, 24% do not prefer because of tediousness, 16% did not prefer because of difficulty in repair /maintenance and remaining 4% have some other cause.

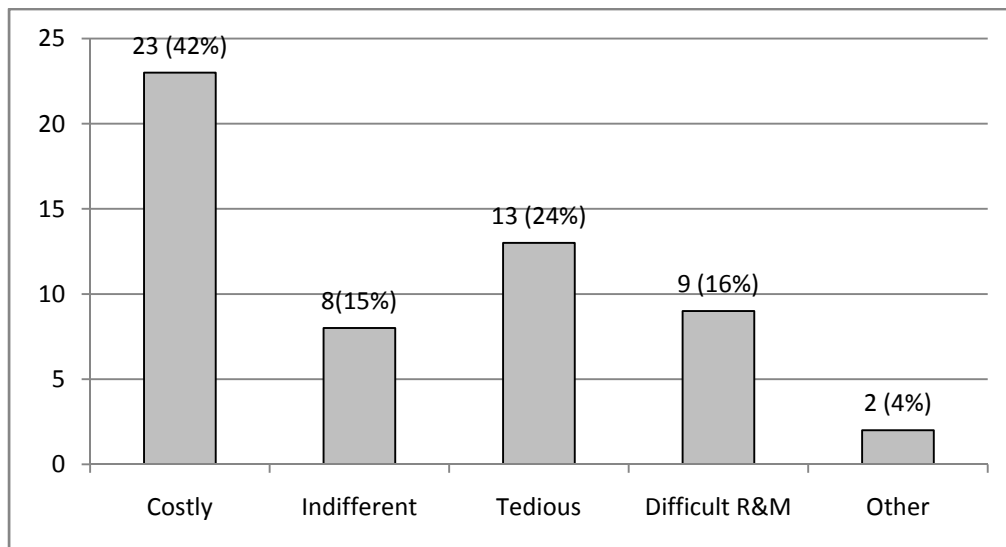


Fig. 4.11: Cause of not requirement of MCS

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4.14 Cooking behavior

Survey was performed on cooking behavior of villagers. In average they cook 137 kg per month of rice, Dal and curry which takes 93 hours for cooking time and consume 107 kg of firewood. They cook 28 kg per month of Tiffin which takes 8 hours for cooking time and consume 35 kg of firewood. They cook 402 kg per month of animal feed which takes 44 hours for cooking time and consume 132 kg of firewood. They prepare 147 kg per month of local wine which takes 89 hours for cooking time and consume 41 kg of firewood.

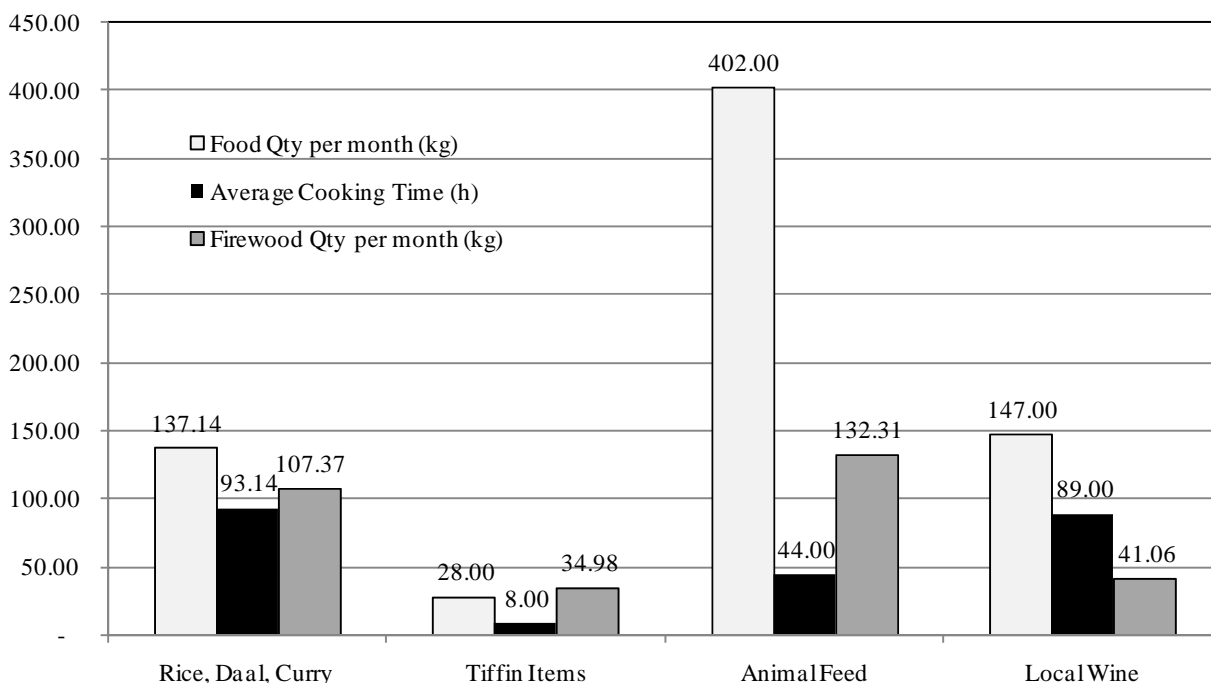


Fig. 4.12: Cooking behavior of MCS users

These data indicates that, users cook 24 kg per day of foods including animal feed and local wine. To cook all these items they need 8 hours of cooking time and consume 10.4 kg of firewood per day. Hence stove for cooking should meet requirements with respect to amount and time.

4.15 Fuel for cooking and space heating

Among 420 respondents of stove users, 416 use firewood as cooking fuel whereas, only four households of Dolpa district use dung cake as cooking fuel. Among 416 respondents of firewood users, 32% responded that fire wood is easily available. In the survey, 35% responded for moderate and 33% responded that wood is difficult to get and scarcity.

Average annual firewood available in these seven surveyed districts is 209,447 metric tons. The average annual consumption of firewood is 4,689 kg in different stoves. They use 3,789 kg (81%) of firewood for the various cooking purposes and 900 kg (19%) of firewood for space heating purposes. Average distance of fetching fire wood is 4 km and average cost of fire wood is NRs 8 per kg. Though there is availability of firewood in most of the districts it is wiser to design a stove that gives higher efficiency.

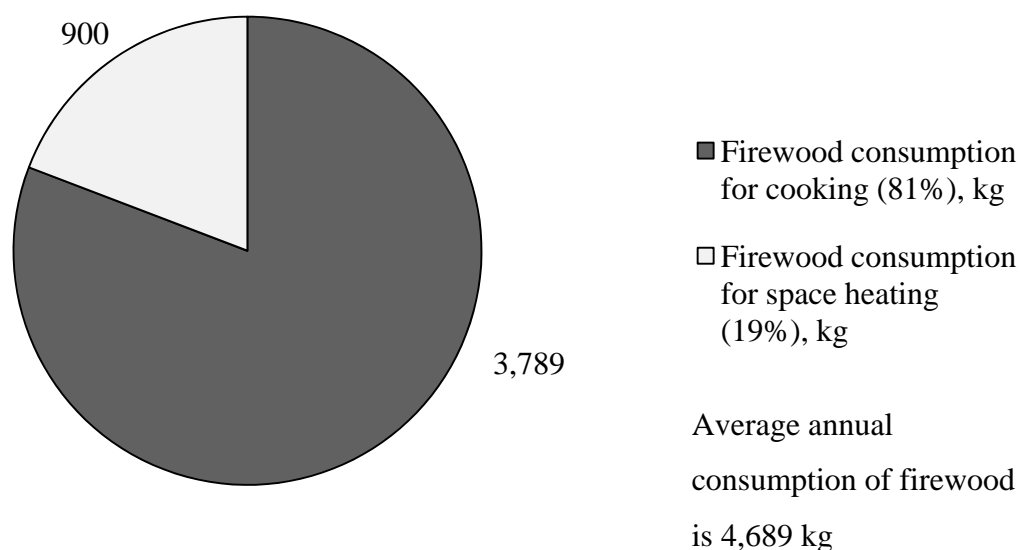


Fig. 4.13: Annual firewood consumption for cooking and space heating

4.16 Annual income

The income of these villagers is very low. In average each household earn NRs 10,664 by agriculture, NRs 45,068 by employment, NRs 52,308 by trade-commerce and NRs 46,996 by daily wage. Average annual income of each household of these villagers is around NRs 155,000. The average daily income of each household is NRs 425, which is very low. It is default for them to mange MCS and fire wood, after spending their income in other daily necessities.

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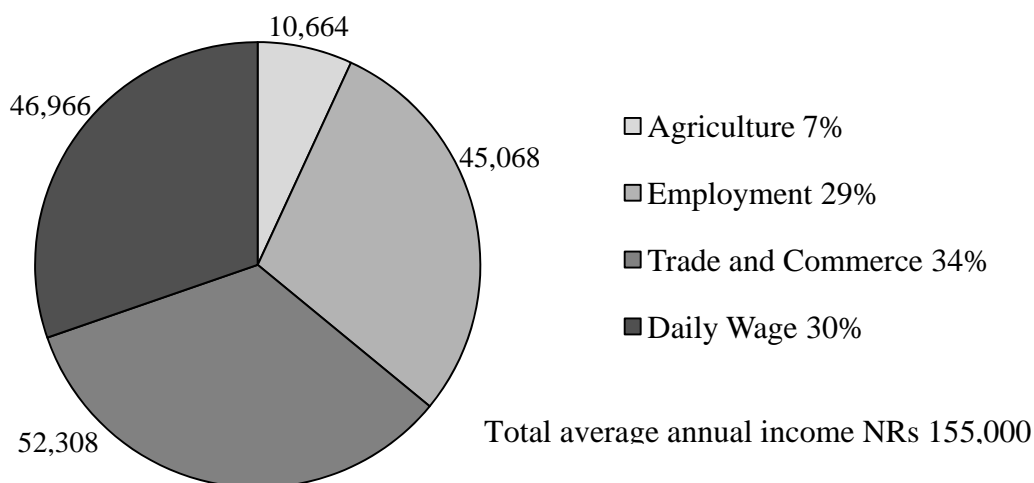


Fig. 4.14: Average annual income (in NRs) of each household

4.17 Need base priority

In all seven districts surveyed, cooking their main food items is first priority for all ethnic groups. The second priority varied among them. Their second priority is to cook animal feed, wine preparation and space heating. The second priorities are ranked according to their tradition, altitude and importance of animal feed preparation.

4.18 Cooking and space heating need

Application and use of stoves are different among the users according to the altitudes and living standards of them. Both rich and poor, living in relatively lower areas use stoves for cooking only. But rich and poor users living at higher altitude (i.e. above 2000m) use the stoves differently. Rich people use stoves for both cooking and space heating whereas poor people were bound to use it for cooking only.

CHAPTER FIVE

COST-EFFICIENCY AND SUSTAINABILITY OF APPROACHES

Different types of stoves are used either for cooking or for both cooking and space heating purposes depending on the need of the family and household location (altitude). The animal feed is usually warmed up in stoves before feeding. Local wine preparation is quite popular in some ethnic community. The traditional stove consumes quite a significant amount of fuel wood. Different manufactures are involved in designing and supplying metallic cook stoves. Use of metallic cook stove not only saves the fuel wood but also saves cooking time with a smokeless environment.

According to survey data in seven sample districts, MCS are manufactured by various manufacturers and supplied by different means of transportations. Cost of MCS varies from districts to districts. The average cost of MCS that are manufactured within the nation for one pot hole, two pot holes, three pot holes, are found to be NRs 1,500, NRs 5,369 and NRs 7,239 respectively. It seems that the two pot hole is quite common and convenient for the users. Cost of MCS is quite high compared to TCS which costs NRs 1168.

Higher cost of MCS can be justified by its technology. Smokeless environment and other heating technologies improved user's health conditions and their education. There are savings in time and fuel wood. One important finding in the survey is that villagers use more than one stove for their various needs. If MCS can be designed for multipurpose use, it can benefit villagers in cooking & space heating.

It is important to note that some of the villagers are using MCS that are manufactured in China. These Chinese models are so popular amongst them, because of their look, improved technology and easy handling. But these Chinese stoves could not serve multipurpose of cooking and heating. The cost range of its one pot hole to three pot holes is from NRs 5,000 to NRs 27,500. The most difficult part for the Chinese model is its supply. This stove users have to buy it by crossing border of Nepal-China. The popularity of the Chinese model reflects strong desire of users for better technology and comfort. MCS can be manufactured with better technology in accordance to demand. This will motivate users to buy it.

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Effective use and sustainability of the project depends upon proper use of technology by the users. From the survey, it was noticed that no such materials or pre-awareness of events was organized by either manufacturers or suppliers, leading to misguidance and misinterpretation. In this regards some cases were found where, the users were using the stove by blocking air circulation. In most of the cases they did not close the lid provided, which causes great loss of heat. There is a high tendency of stove being filled with 25 mm thickness of mud leading to ill performance.

For better performance of MCS, continuous maintenance is one of the important parts of the process. The users, manufacturers and suppliers are less aware of it. As a repair and maintenance part they are only cleaning chimney with the frequency of a week to two months according to the need. Not a single manufacturers or suppliers go for after sales service facilities. For the proper use of MCS, maintenance and after sales service should be given high priority in the process of dissemination and stability of whole system.

CHAPTER SIX

POTENTIAL ROLE OF DISTRICT ENERGY AND ENVIRONMENT UNIT (DEEU) AND FEDERATION OF COMMUNITY FOREST USERS NEPAL (FECOFUN)

6.1 District Energy and Environment Unit (DEEU)

AEPC, in co-ordination with Ministry of Local Development and financial support from UNDP, has established District Energy and Environment Unit (DEEUs) in 41 districts of Nepal. The objective of establishing DEEUs under the District Development Committee (DDCs) is to support the DDCs in energy planning, monitoring and promotion of RETs and environmental protection activities. The DEEUs closely work with DDCs to build up technical capacity of DDCs in Renewable Energy Technology (RET) sector and environment. AEPC has about 3 years of experience of the units. Since their establishment, units have been providing technical support to DDCs and have been able to mobilize resources from DDCs and Village Development Committees (VDCs) for promotion of RET. The resource is mobilized for software and hardware part.

DEEU is primarily involved in renewable energy management in the district in order to maximize the efficient use of renewable energy resources by using appropriate renewable energy devices, equipment etc. It can promote the metallic cook stove up scaling by optimizing its activity related to the dissemination, installation and maintenance of metallic cook stove in the district. It can also cooperate in establishing the capacity building of human resources needed for these activities. It can coordinate among stakeholders of metallic cook stove. By analyzing needs of households of various VDC it can collect the demand of MCS and coordinate with DDC to establish manufacturing unit of MCS in the district to meet the immediate need of villagers.

6.2 The Federation of community Forestry Users, Nepal (FECOFUN)

The Federation of Community Forestry Users, Nepal (FECOFUN) is a formal network of Forest User Groups (FUGs) from all over Nepal. FECOFUN emerged from the idea that forest users from all parts of the country should be linked in order to strengthen the role of Users in policy making processes. Since its inception in July 1995, FECOFUN has grown into a social movement organization with about 8.5 million people represented all of whom are forest users. It is a national federation of forest users across Nepal dedicated to promoting and protecting users' rights.

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The mission of FECOFUN is to promote and protect the rights of community forest users through capacity strengthening, economic empowerment, sustainable resource management, technical support, advocacy and lobbying, policy development, and national and international networking and to uphold the values of inclusive democracy, gender balance, and social justice. Since FECOFUN is actively engaged in sustainable forest management, environment and alternative energy and women's empowerment it can also promote the use of metallic cook stoves in the mountain and high hill region of the country together with its other activities. The promotion of metallic cook stove will not only reduce the fire wood consumption and indoor air pollution but also decrease the drudgery of women and girls so that they will have more time for other activities.

CHAPTER SEVEN

FINDINGS AND STRATEGIES FOR SUSTAINABLE UTILIZATION OF TECHNOLOGY

7.1 Findings

Based on the analysis of survey carried out in 14 VDCs of 7 districts the following findings are listed:

7.1.1. Technical

- Thickness should be sufficient to resist heat throughout its life span.
- It should have proper strength to prepare all types of food items.
- Pot hole should be appropriate for different types of utensils.
- The damper should be fixed at correct angle and height.

7.1.2. Social

- Flexibility in different religious and cultural beliefs
- Dissemination in correct community
- Appropriateness for different cooking options in different ethnic groups
- Increase in awareness regarding cook stove and cooking habits
- Special provision for Dalit or low cast people
- Ease of handling so that male is attracted to cooking easily
- Affordable for low and medium income families
- Stove position should be flexible
- Familiar design and operating characteristics of stove
- Useful in both summer and winter season

7.1.3. Manufacturer

- Ease of manufacturing
- Low manufacturing cost

7.1.4. Supplier

- Low transportation cost
- Ease of handling and carrying

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7.1.5. Dissemination approach

- Right stove, right customer and right time
- Local manufacturing

7.1.6. Problems related to existing One Pot Hole MCS

- Stoves are not manufactured according to the requirement of customers.
- Few models of one pot hole metallic cook stove exist in Nepal.
- Chinese stove is popular among existing cook stove but it is not available commercially.
- The material thickness is not sufficient to resist heat except Chinese stove; however, side wall plate of combustion chamber of Chinese stove is also thin.
- The pot hole is not appropriate for different utensils of household.
- It cannot be used for animal feed and local wine preparation.
- Ash tray and drying chamber are not available in all Models.

7.1.7. Modification

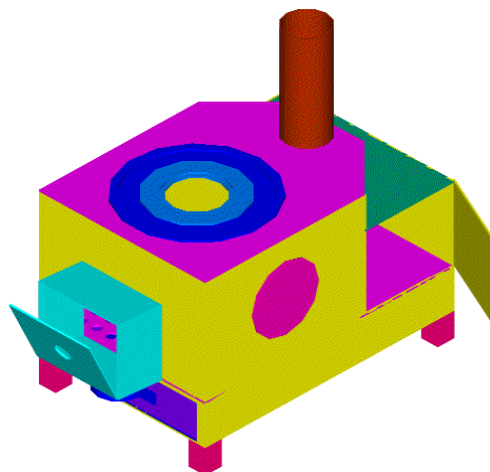
- The thickness of side wall of combustion chamber is increased.
- Different size pot rings are used.
- Drying chamber and ash tray are provided.
- Provision of chappati preparation at the side wall of combustion chamber.
- It has appropriate pot hole and sufficient strength for animal feed and wine preparation.
- Materials at the top of drying chamber are reduced.
- Fire gate is extended according to the available size of firewood.

7.2 Proposed MCS Models

Model One: One Pot Hole Metallic Cook Stove

Beneficiaries Household:

Either less than or equal to **Four** members.



Application:

Preparation of breakfast, lunch, dinner, animal feed and wine preparation.

Overall dimensions of proposed one pothole MCS is 600 mm x 400mm x 450 mm. The estimated weight is 37.06 kg and maximum cost is estimated to be NRs. 9930.00. The detail breakdown of total cost is given in table below.

Table 7.1: Cost estimation for one pot hole metallic cook stove

SN	Description	Fabrication Cost*	Transportation Cost	Business House Benefit	Installation Cost	Total Cost
1	1 Day Travel	5930	500	1000	500	7930
2	2 Day Travel	5930	1000	1000	500	8430
3	3 Day Travel	5930	1500	1000	500	8930
4	4 Day Travel	5930	2000	1000	500	9430
5	5 Day Travel	5930	2500	1000	500	9930

* It can be fabricated at existing pre qualified Metal workshop

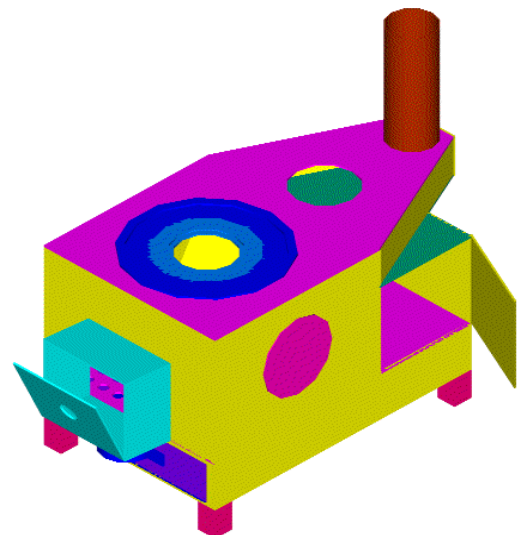
The fabrication cost includes material cost, labor cost and profit of workshop.

Model Two: Two Pot Hole Metallic Cook Stove

Beneficiaries Household: More than **Four** members.

Application: Preparation of breakfast, lunch, dinner, animal feed and wine preparation.

Overall dimensions of proposed two pothole MCS is 615 mm x 400mm x 450 mm. The estimated weight is 40 kg and maximum cost is estimated to be NRs. 10400.00. The detail breakdown of total cost is given in table below.



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Table 7.2: Cost estimation for two pot hole metallic cook stove

SN	Description	Fabrication Cost*	Transportation Cost	Business House Benefit	Installation Cost	Total Cost
1	1 Day Travel	6400	500	1000	500	8400
2	2 Day Travel	6400	1000	1000	500	8900
3	3 Day Travel	6400	1500	1000	500	9400
4	4 Day Travel	6400	2000	1000	500	9900
5	5 Day Travel	6400	2500	1000	500	10400

* It can be fabricated at existing pre qualified Metal workshop

The fabrication cost includes material cost, labor cost and profit of workshop.

Model Three: Three Pot Hole Metallic Cook Stove

Beneficiaries: Hotels, Schools and Colleges.

Application: Preparation of breakfast, lunch, dinner, animal feed and wine preparation.

Overall dimensions of proposed two pothole MCS is 615 mm x 500mm x 450 mm. The estimated weight is 46.24 kg and maximum cost is estimated to be NRs. 11400.00. The detail breakdown of total cost is given in table below.

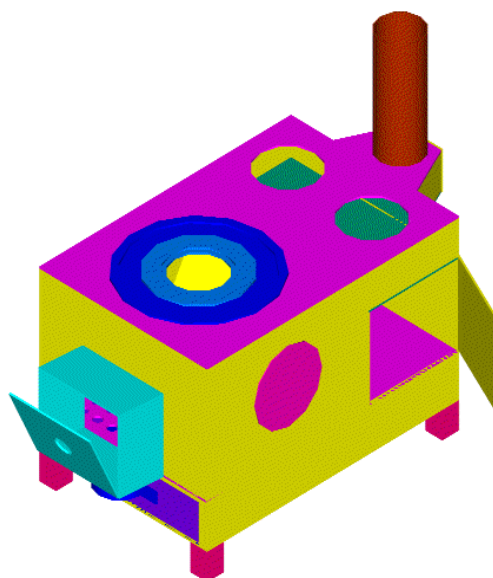


Table 7.3: Cost estimation for three pot hole metallic cook stove

SN	Description	Fabrication Cost*	Transportation Cost	Business House Benefit	Installation Cost	Total Cost
1	1 Day Travel	7400	500	1000	500	9400
2	2 Day Travel	7400	1000	1000	500	9900
3	3 Day Travel	7400	1500	1000	500	10400
4	4 Day Travel	7400	2000	1000	500	10900
5	5 Day Travel	7400	2500	1000	500	11400

* It can be fabricated at existing pre qualified Metal workshop

The fabrication cost includes material cost, labor cost and profit of workshop.

7.3 Ranking the results of the inception studies

Ranking of survey results can be categorized into three groups namely; target groups, technology options and dissemination approaches.

Table 7.4: Best target group identification

Priority		0.25	0.25	0.25	0.25	1.0
S.N.	Target group	Density	Willingness to change	Willingness to pay	Income/saving	Rank
1	HH size	2.5	2.5	1.5	1.5	2.00
	Up to 4 persons	2	3	2	2	2.25
	More than 4 persons	3	2	1	1	1.75
2	Hotel users	1	3	3	3	2.50

Ranking

Density: Low (<100 HH) - 1, Moderate (100<HH<200) - 2, High (>200) – 3.

Willingness to change: No – 1, Cannot say – 2, Yes – 3

Willingness to pay: Low (<2000) – 1, Moderate (2000<Rs. <5000) - 2, High(>5000) -3

Income/saving: No saving – 1, Moderate (<30,000) – 2, High (>30,000) – 3

Firewood is extensively consumed in all households and small hotels for cooking and space heating. The penetration of MCS is targeted to those groups of population in the mountain and high hills situated at and above 2000m and north facing households at 1500m from the sea level. The household size is further grouped into two, each consisting of up to 4 family members

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and more than 4 family members respectively. The criteria developed for ranking the target group are the density of households or hotels, willingness to switch to MCS from TCS in order to reduce the firewood consumption and indoor air pollution, desire to pay for MCS and purchasing power based on household income or saving. Equal priority is given to all these criteria. The ranking of each criterion is numbered from 1 (minimum) to 3 (maximum) as shown in the Table 7.4.

The hotel users provide the hospitality service to local as well as foreign tourists. MCS can be good device for them to meet their demand of fast cooking and space heating with smokeless environment in the kitchen. So, the small hotels are ranked highest followed by households having up to 4 members family size. The decision making of switching to MCS from TCS and willingness to pay for appropriate size of MCS will be faster and easier in the case of household with small family size than the household with larger family size.

Most of the households are situated at the altitude of 2000m to 4000m in all districts in high Mountain Region as seen in Table 7.5. So, the priority should be given to the target groups in these areas, that is, households with less than 4 members and small hotel owners. People living in these areas should have easy access to firewood; in other words, the firewood is sufficiently available to meet the demand for cooking and space heating.

Table 7.5: Number of household at different altitude

S.N.	Development Region	District	Number of household		Total number of household	
			2000 m - 4000 m	Above 4000 m	2000 m – 4000 m	Above 4000 m
1	Eastern Development Region	Solukhumbu	21693	2046	81091	4237
		Sankhuwasabha	32800	1301		
		Taplejung	26598	890		
2	Central Development Region	Rasuwa	9637	728	126180	3875
		Sindhupalchok	67336	2339		
		Dolakha	49207	808		
3	Western Development Region	Mustang	1613	1770	59202	5560
		Manang	462	2490		
		Gorkha	57127	1300		
4	Mid Western Development Region	Humla	6223	2021	65862	5291
		Jumla	16965	1368		
		Mugu	9435	342		
		Jajarkot	28053	0		
		Dolpa	5186	1560		
5	Far Western Development Region	Darchula	24560	175	81059	986
		Bajhang	33312	344		
		Bajura	23187	467		
-	-	Total	413,394	19,949	413,394	19,949

Source: District and VDC profile of Nepal 2010 and Geophysical Map of Nepal 2007, Intensive Study and Research Center

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Table 7.6: Best technology options

Priority		0.2	0.2	0.2	0.1	0.15	0.15	-	1.0
S. N.	Technology	Fuel consumption	Indoor air pollution	Acceptability	Affordability	Availability	Application	Technology release	Rank
1	AEPC model	2	2	2	2	2	2	Available	2.00
2	Smoke hood	1	2	2	2	1	2	Available	1.65
3	Leo Stove (Indian)	2	2	2	2	1	1	Available	1.7
4	Chinese model	3	2	3	1	1	2	Available	2.15
5	Local manufacturer	2	2	2	2	2	2	Available	2.00
6	Proposed model	3	2	3	2	2	3	After 6 months	2.55

Ranking

Fuel consumption: Low (<15% efficient) – 1, Medium (15-20% efficient) – 2, High (>20% efficient) – 3

Indoor air pollution: Poor (smoky) – 1, Satisfactory – 2, Good (No smoke) – 3

Acceptability: Rigid in use /poor appearance – 1, Satisfactory -2, Flexible in use/good appearance – 3

Affordability without subsidy: Low (>Rs. 10,000) -1, Medium (<Rs. 10,000) – 2, High (<Rs. 5,000) – 3

Availability: Difficult – 1, Moderate – 2, Easy - 3

Application: Single – 1, Partial – 2, All (main, need base, cultural) - 3

The existing technologies in practice are traditional cook stove (tripod or 3 stones), metallic cook stove and smoke hood. The traditional cook stove, though flexible and cheap produces indoor air pollution and consumes relatively more firewood, whereas smoke hood serves the purpose of alleviating indoor air pollution but it is not flexible and cheap. Metallic cook stove meets both the requirements of reducing indoor air pollution through chimney and consuming less firewood. Besides cooking it also meets the requirement of space heating and food product drying for future consumption.

There are different types of MCS in use; such as, AEPC model promoted by AEPC/ESAP, smoke hood and Leo stove (Indian) promoted by Practical Action and Child Welfare Scheme

respectively. Similarly, a significant number of Chinese metal cook stoves are in use in northern districts close to Chinese border. There are local manufacturers (32 prequalified by AEPC/ESAP and others) that manufacture MCS on demand and CES/IOE has proposed a new MCS Model with one, two and three pot hole. The criteria for the selection of best technology for MCS are fuel consumption, indoor air pollution, acceptability, affordability, availability and application. Based on these criteria and priority all the possible technologies are ranked as shown in the Table 7.6. The proposed model by CES/IOE is ranked highest (in the grading scale of 1, 2 and 3) since it considers the shortcomings of other technologies; such as inclusion of ashtray, convenience in use etc.

Dissemination approach

Dissemination approach of MCS has been practiced by providing partial or full subsidy to the target groups. Since MCS is expensive and not easily available in the region the household users are provided incentives in the form of subsidy to switch to MCS from their TCS. AEPC has introduced subsidy for MCS. It pays the subsidized amount to manufacturing company after completion of installation of MCS. Practical action has created a revolving fund to install the smoke hood in the household. INGOs and NGOs are providing full or partial subsidy to install the MCS in their target groups. Chinese metal stoves are usually bought by direct payment to supplier. The dissemination approach proposed by CES/IOE incorporates creating a revolving fund in the VDC from where households can borrow money to buy the stove (Fig. 7.1). The hotel users will purchase the stove from business house located in VDC by direct payment. It assumes the establishment of, at least one manufacturing company in the district headquarter. It will supply the MCS to needy households of VDC on demand through business house.

The criteria developed for selecting the dissemination approach are supply duration, demand for MCS, sustainability, financial support, accessibility, coverage area, living standard, availability of firewood. Based on these criteria and priority the proposed dissemination approach by CES/IOE is ranked highest (in the scale of 1, 2 & 3) followed by direct payment approach (Table 7.7).

Mobilization of revolving fund

The sources of revolving fund could be allocated budget from DDC/VDC, support from development partners, donation etc. In the present context, VDC can get support from GIZ

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project through AEPC for the establishment of revolving fund (Fig. 7.1). The role of DEEU will be planning, monitoring and coordinating the renewable energy related projects.



Fig. 7.1: Mobilization scheme of revolving fund

The available fund can be mobilized through local cooperatives to the needy household owner to buy metallic cook stoves. The villagers can repay the loan on installment basis as fixed by the cooperatives. The paid back money is further used to buy metallic cook stove for another household. The revolving fund can be circulated until all the households that wish to have metallic cook stove own it. The role of FECOFUN will be to create awareness among households about metallic cook stove. The GIZ project can support FECOFUN to conduct this kind of activities in collaboration with VDC and local cooperatives.

Table 7.7: Best dissemination approach

Priority		0.015	0.1	0.2	0.1	0.1	0.15	0.1	0.1	1.0
S.N.	Dissemination Approach	Supply duration	Demand	Sustainability	Financial support	Accessibility	Coverage area	Living standard	Availability of firewood	Rank
1	Subsidy (AEPC)	1	3	2	2	1	2	2	2	1.85
2	Revolving fund	1	2	2	3	2	1	2	2	1.80
3	Direct payment	3	1	3	0	3	3	1	3	2.30
4	Through NGO/INGO	2	3	1	2	2	1	3	2	1.85
5	Proposed Approach	2	2	3	2	3	2	2	3	2.40

Ranking

Supply duration: Slow (> 6months) – 1, Moderate (3 < months < 6) – 2, Fast (< 3 months) – 3

Demand: Low -1, Moderate – 2, High – 3

Sustainability: No – 1, Doubt – 2, Yes – 3

Financial support: Low (<30% of total cost) – 1, Medium (30% <Total Cost<50%) – 2, High (>50% of total cost) – 3

Accessibility: Difficult – 1, Moderate – 2, Easy – 3

Coverage area: Low -1, Medium -2, High – 3

Living standard: Rich – 1, Both – 2, Poor – 3

Availability of firewood: Deficit -1, Both – 2, Surplus – 3

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7.4 MCS forecasting in districts of Mountain Region

According to District Profile of Nepal 2011 there are 366,153 households (HHs) in 16 districts of Mountain Region. The number of households that need MCS is calculated based on the survey conducted in the 7 districts during the study period. The detail estimation method is given in **Appendix D**. The projected number of MCS to be disseminated in 2012, 2013 and 2014 are presented in Table 7.8.

Table 7.8: MCS Forecasting in Mountain Region and Jajarkot

S.N.	District	Total HH	HH/sq.km	HH having TCS	HH need MCS	Projected MCS			
						2012	2013	2014	Total
1	Taplejung	28,692	7.80	25,344	20,562	616	977	1,226	2,819
2	Sankhuwasabha	35,182	10.05	31,077	25,213	756	1,223	1,626	3,605
3	Solukhumbu	24,392	7.37	21,546	17,481	524	846	1,127	2,497
4	Dolakha	48,833	22.36	27,672	26,858	805	1,302	1,732	3,839
5	Sindhupalchowk	70,437	27.70	39,914	38,740	1,162	1,879	2,499	5,540
6	Rasuwa	10,502	6.87	5,951	5,776	173	280	372	825
7	Manang	2,470	1.09	1,317	878	26	42	56	124
8	Mustang	3,275	0.92	1,746	1,164	34	56	75	165
9	Dolpa	6,799	0.85	1,926	1,871	56	91	121	268
10	Jumla	15,301	5.19	4,335	4,211	126	204	272	602
11	Kalikot	22,157	12.72	6,277	6,097	183	296	393	872
12	Mugu	9,672	2.73	2,740	2,662	80	129	172	381
13	Humla	7,847	1.39	2,223	2,159	64	105	139	308
14	Bajura	22,920	10.47	19,482	15,829	475	768	1,128	2,371
15	Bajang	32,573	9.51	27,687	22,446	673	1,088	1,448	3,209
16	Darchula	25,101	10.80	21,335	17,334	520	841	1,118	2,479
-	Total	366,153	-	240,572	209,281	6,273	10,127	13,504	29,904
17	Jajarkot	27,590	12.38	22,072	17,014	510	825	1,097.00	2,432
-	Total	393,743	-	262,644	226,295	6,783	10,952	14,601	32,336

Data source on household (HH): District Development Profile 2010/11, Megha Publication & Research Centre, Nepal

The numbers of MCS to be installed in 240,572 households are 6,273, 10,127 and 13,504 in 2012, 2013 and 2014 respectively. By the end of 2014 there will be 29,904 MCS installed. This is 14% of the total requirement. If we consider the 35% constant growth of MCS dissemination every year it will take about 12 years from 2012 to meet the demand of all households. Projection for Jajarkot district is also included since sample survey was performed there.

7.5 Supply and demand network of MCS

From the field survey it has been found that the transportation cost is high, client has to wait a long time to get the metallic cook stove, difficult to operate and maintain the stove and many households are not aware of the existence of metallic cook stove. CES/IOE has

proposed the following dissemination approach to minimize these problems and easy access to MCS. It is a bottom up approach: The client buys MCS from business house located in the VDC and business house brings MCS from the manufacturing company located at or near district headquarter. The client can borrow money if needed to buy the MCS from the revolving fund through cooperative available at VDC. Small hotels in the village will buy the stove by direct payment.

The capacity building is very important to meet the demand of MCS in time. It is therefore, suggested to establish one or two manufacturing companies of MCS in the district headquarters or at the business centers where electricity is available. Local artisans are encouraged to upgrade their manufacturing skill by providing them necessary upgrading training. DDC can prequalify the manufacturing companies based on their capacity in order to monitor the quality of products. The manufacturing company is equipped to handle other metal works too in order to diversify its activities.

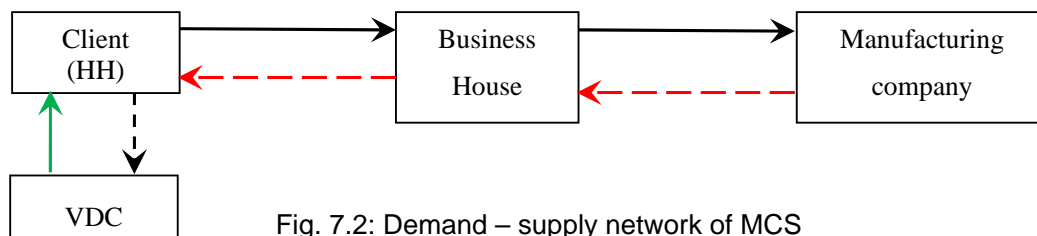


Fig. 7.2: Demand – supply network of MCS

The MCS should fulfill the following requirements of client (HH). It should be cheaper or affordable, flexible, attractive and clean, easily available and easy to operate and maintain. At the same time the use of MCS should reduce indoor air pollution and consume less firewood than the traditional stoves. The client buys the MCS from the local business house that maintains the supply of minimum quantity of MCS from the manufacturer.

Business house in the village (VDC) will provide service to client by selling MCS. It will sell the MCS to needy households and small hotels. It works as intermediary between client and manufacturer. It maintains the minimum quantity of MCS so that the client does not have to wait long time to get it. There can be more than one business house in the VDC. Business house has to provide after sales services to clients. VDC can prequalify the business house in order to maintain/monitor the service of business house. Business house usually collects the requirements from the clients and places order to the manufacturer.

Manufacturing company located at or near district headquarter will continuously produce one pot hole, two pot hole and three pot hole metallic cook stoves and sell them to clients

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through business centers in the VDC. It gets manufacturing orders from business houses from various VDCs in the districts.

CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

- The dissemination of metallic cook stove is essential in order to reduce the consumption of firewood and indoor air pollution since it consumes less fuel and smoke is diverted outside the house through chimney.
- AEPC/ESAP has prequalified 32 manufacturing companies for installation of MCS but only 11 of them are actively participating to deliver the MCS. AEPC/ESAP has approved 5318 MCS in 34 districts covering 248 VDC in total from January 1, 2009 to October 18, 2011.
- NGOs and INGOs have disseminated few metallic stoves in the households of their target group on project basis.
- Chinese metal stoves have captured good market in the regions close to China border.
- The cost of Chinese metal stoves varies from district to district ranging from NRs 5,000 to 27,000 whereas the MCS manufactured in Nepal cost NRs 5,000 to 10,000.
- The application of MCS includes cooking, space heating, animal feed preparation, food drying, wine preparation and charcoal making.
- The availability of firewood is getting difficult day by day. The average distance of fetching firewood is 4 km and its cost is NRs 8 per kg.
- Few households do not prefer to have MCS because of its high cost, difficult repair and maintenance and tedious operation. Most of the MCS have problems related to chimney; e.g., clogging and leakage from the joints.
- Two pot hole metallic stoves are quite popular but it does not meet all the requirements of the client.
- The dissemination approach of MCS initiated by AEPC/ESAP is limited in number due to lack of manufacturing companies in the Mountain Region. Almost all the manufacturers are located in the southern part of the country or in Kathmandu and Pokhara. Many of them are not willing to supply the MCS as per this approach because of high transportation cost.
- After sales service of MCS is lacking.
- MCS cannot be promoted in the area where firewood is deficit. In some places in Dolpa households are using dung cake for cooking. An alternative source of fuel is searched instead of firewood and dung cake in this type of locality. The dung cake fuel is not environment friendly.

8.2 Recommendations

Capacity building

One way of meeting the local demand of MCS in high hills and mountain region is capacity building of local artisans. Local workshop can be established nearby micro-hydro power plant to manufacture the metallic stoves and other metal structures. Local artisans will be capable of manufacturing these stoves after getting necessary training/skill. Similarly, local business center is encouraged to establish to carry out the marketing of metallic cook stoves. Many NGOs are involved in dissemination and promotion of MCS. They can also play a vital role on providing necessary skill oriented training to these local artisans for manufacturing metallic cook stoves. Capacity building of local manufacturer is very essential to upscale the installation of MCS and provide necessary services afterwards in high hills and mountain region.

Income generation

Dissemination of MCS should be linked with the income generating activities. Having a MCS at home will save cooking time and consume less firewood in better kitchen environment. Less time will be spent on collecting firewood. The available time of the family members is found spent for doing nothing. These free hours can be used for income generating activities if they get an opportunity.

Technology

The existing available technologies do not meet all the requirements of households. The need also varies from place to place, one ethnic group to another and its location. More research and development should be carried out in order to meet their requirements at affordable cost. The stove should be flexible and convenient to use.

The proper insulation of house is very important in order to minimize the consumption of firewood for space heating. An adaptable technology related to house warming and space heating should be promoted.

Dissemination approach

The sustainable way of disseminating MCS to the client is introducing revolving fund and income generating activities for poor household and direct sale to those households or hotel owners who can pay for it. The sources of revolving fund could be from DDC/VDC, development partners, donation, etc.

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APPENDIX

Appendix A: List of manufacturers that are pre-qualified by AEPC/ESAP

S.N.	Name of the manufacturer	Address	Tel. no.
1.	Rijwan Engineering Industry	Nepalgunj Industrial Area, Banke	081-522052
2.	Siddhartha Engineering Works	Nepalgunj Industrial Area, Banke	081-523017
3.	Karnali Electric and Metal Workshop Pvt. Ltd.	Jumla	087-520261
4.	Mustang Engineering Metal Workshop	Pokhara, Kaski	061-531430
5.	Chandra Metal Industries	Pokhara, Kaski	061-534788
6.	Shanti Engineering Works	Pokhara, Kaski	061-521305
7.	Sun Works Nepal Pvt. Ltd.	Balkhu, Kathmandu	01-4330854
8.	Sindhu Urja Promotion Centre	Kalanki, Kathmandu	01-2054100
9.	Trishul Agritools And Engineering	Jorpati, Kathmandu	01-4420888
10.	Development Trade Link	Teku, Kathmandu	01-4671657
11.	National Structure and Engineering Pvt. Ltd.	Patan Industrial Area, Lalitpur	01-5542393
12.	Banepa Metal Industry	Banepa, Kavre	011-660435
13.	Shree Dhungeshwori Mechanical Workshop	Jiri, Dolkha	9741045668
14.	Shree Singhabahini Metal Works And Energy	Itahari, Sunsari	025-587169
15.	Nepal Energy Development Pvt. Ltd.	Ekantakuna, Lalitpur (Workshop at Bharatpur, Chitwan)	056-527663
16.	Prabidhi Uthhan Engineering Centre	Hetauda, Makwanpur	057-522880
17.	Grameen Urja Tatha Prabidhi Sewa Kendra Pvt. Ltd.	Kumaripati, Lalitpur	01-5008536
18.	Krishna Grill and Engineering Pvt. Ltd.	Biratnagar, Morang	021-471492
19.	Panchakanya Metal Engineering	Pokhara, Kaski	061-527797
20.	Gorkha Energy and Environment Pvt. Ltd	Palungtar, Gorkha (Workshop at Nayabazar, Kathmandu)	01-4380896
21.	Mallika Engineering and Mechanical Works	Dhangadi, Kailali	091-525330
22.	Motherland Engineering Group Pvt. Ltd.	Kalanki, Kathmandu	01-4385585
23.	S.K Engineering Industries	Butwal, Rupandehi	071-548305
24.	Jagadamba Engineering Works	Nepalgunj, Banke	081-522184
25.	Metal Nepal	Siddharthanagar, Rupandehi	01-4354981
26.	Nilkantha Technology Solution Pvt. Ltd.	Dhadingbesi, Dhading	010-520782
27.	Nawakaraniya Urja Khanepani Tatha Sarsafai Parwardhan Kendra	Chandranigahapur, Rautahat	055-690405
28.	Centre for Rural Energy Promotion And Environment Technology Service	Kalaiya, Bara	051-533728
29.	Shree Trishakti Engineering Workshop	Fidim, Pachthar	9742019986
30.	Ananta Iron Industries	Dharan, Sunsari	025-521563
31.	Himali Power Development Pvt. Ltd	Narayangadh, Chitwan	056-692893
32.	Shree Aditya Grill Industry	Illambazar, Illam	027-520422

Source: AEPC/ESAP, 2011

Nepal Energy Efficiency Programme (NEEP)

Appendix B: Survey data

Description of surveyed districts

S.N.	Region	District	Municipality	VDC	Total HH	HH per sq. km
1	Eastern Development Region	Sankhuwasabha	1	34	34101	8.50
2	Central Development Region	Rasuwa	0	19	10365	5.83
3	Western Development Region	Mustang	0	17	3383	0.84
4	Mid Western Development Region	Humla	0	28	8244	1.14
		Jajarkot	0	31	28053	11.67
		Dolpa	0	24	6746	0.83
5	Far Western Development Region	Bajura	0	28	23654	9.67

Source: District Development Profile 2009/10, Megha Publication & Research Centre, Nepal

Firewood resource and availability of surveyed districts

The most prominent energy resources in these hilly district is fire wood. People in these districts use

S.N.	Districts	Forest Area (ha)	Available firewood (MT/year)	Per capita per day available firewood (kg)
1	Sankhuwasabha	89921	206818	3.21
2	Rasuwa	52290	100920	5.19
3	Mustang	18488	44371	7.78
4	Humla	74783	216871	12.34
5	Jajarkot	135615	393284	6.88
6	Dolpa	63875	185238	14.80
7	Bajura	98646	318627	6.91

Source: District Development Profile 2009/10, Megha Publication & Research Centre, Nepal

General information of respondents of surveyed districts

S.N.	District	Age of respondents			Sex of Respondents		Ethnic Group of respondents					Education of respondents			
		Below 30	30 to 60	Above 60	Male	Female	Dalit	Janajati	Brahmin	Chhetri	Sherpa	Informal	Up to grade 5	Grade 6 to 10	Above grade 10
1	Sankhuwasabha	16	37	7	47	13	3	35	2	5	15	15	11	22	12
2	Rasuwa	26	28	6	33	27	3	40	0	0	17	37	4	14	5
3	Mustang	13	40	7	26	34	12	34	0	11	3	26	4	24	6
4	Humla	21	32	7	41	19	9	0	14	35	2	26	11	14	9
5	Jajarkot	17	34	9	44	16	19	8	3	30	0	27	19	9	5
6	Dolpa	20	38	2	43	17	7	25	1	21	6	28	4	18	10
7	Bajura	19	31	10	39	21	17	0	6	37	0	33	7	14	6

Nepal Energy Efficiency Programme (NEEP)

Type of Main Cook Stove

S.N	Cooking Stove	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	TCS	53	34	2	32	48	3	51
2	MICS	7	26	26	28	12	57	9
3	ICS	0	0	32	0	0	0	0
4	Kerosene Stove	0	0	0	0	0	0	0
5	Electric Cooker	0	0	0	0	0	0	0
6	Solar Cooker	0	0	0	0	0	0	0
7	Other	0	0	0	0	0	0	0

Type of Main Cooking and space heating fuel

S.N	Cooking Fuel	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	Firewood	60	60	60	60	60	56	60
2	Kerosene	0	0	0	0	0	0	0
3	LP gas	0	0	0	0	0	0	0
4	Dung Cake	0	0	0	0	0	4	0
5	Other	0	0	0	0	0	0	0

General information on TCS/ICS

S.N.	Type of TCS	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	One Pot Hole	6	1	2	0	14	0	11
2	Two Pot Hole	9	0	0	0	22	0	33
3	Three Pot Hole	3	0	0	0	9	0	3
4	Open Fire (Iron)	11	2		32	3	3	2
5	Open Fire (Stone)	24	31	0	0	0	0	2

Cost of existing TCS

S.N	Type of TCS	Average Cost of TCS (Rs.)						
		Sankhuwasabha	Rasuwa	Mustang	Huml	Jajarkot	Dolpa	Bajura
		a	a	g	a	t	a	a
1	One Pot Hole	683	400	600	NA	650	NA	450
2	Two Pot Hole	978	NA	940	NA	1400	NA	1100
3	Three Pot Hole	1333	NA	NA	NA	1900	NA	2300
4	Open Fire (Iron)	2736	2000	3000	3172	2800	1900 0	3300
5	Open Fire (Stone)	1678	1483	NA	NA	NA	NA	1200

NA: not applicable

Additional cooking and space heating technology for TCS users

Shankhuwasabha

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Shankhuwasabha	53	42	11	Solar Cooker	0	Electrical Equipment	0
				Biogas	0	TCS (Tripod or Three stone)	3
				Electrical Equipment	0		
				Open Fire Stone	7	Open Fire (Without Tripod or Three stone)	8
				Open Fire Iron	4		

Nepal Energy Efficiency Programme (NEEP)

Rasuwa

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Rasuwa	34	29	5	Solar Cooker		Electrical Equipment	
				LPG	4	TCS (Tripod or Three stone)	1
				Electrical Equipment			
				Open Fire Stone	1	Open Fire (Without Tripod or Three stone)	4
				Open Fire Iron			

Mustang

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Mustang	34	5	29	Charcoal Stove (Metallic)	2	Electrical Equipment	2
				LPG	22	Charcoal stove (Metallic)	22
				Kerosene Stove	4		
				Open Fire Stone	5	Open Fire (Without Tripod or Three stone)	5
				Open Fire Iron	0		

4 respondent uses both Kerosene and LPG for cooking

Humla

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Humla	32	20	12	Solar Cooker	1	Electrical Equipment	1
				MICS	10	MICS	11
				Electrical Equipment	1		
				Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	0
				Open Fire Iron	0		

Firewood and Dung cake are used for Cooking and space heating in Humla

Jajarkot

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Jajarkot	48	37	11	Husk Stove	2	Electrical Equipment	0
				Biogas	0	TCS (Tripod or Three stone)	5
				Mud Stove	4		
				Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	6
				Open Fire Iron	5		

Nepal Energy Efficiency Programme (NEEP)

Dolpa

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Dolpa	3	2	1	Solar Cooker	0	Electrical Equipment	0
				Biogas	0	TCS (Tripod or Three stone)	0
				Electrical Equipment	0		
				Open Fire Stone	1	Open Fire (Without Tripod or Three stone)	1
				Open Fire Iron	0		

Bajura

District	Total No. of TCS respondent	Existing TCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
		Sufficient	Insufficient				
Bajura	51	43	8	Solar Cooker	0	Electrical Equipment	0
				Biogas	0	TCS (Tripod or Three stone)	2
				Electrical Equipment	0		
				Open Fire Stone	5	Open Fire (Without Tripod or Three stone)	6
				Open Fire Iron	3		

Application based need

S.N.	District	Type of TCS	Need				No. of respondent	
			Cooking	Space heating	Animal feed	Wine preparation	Cooking	Cooking and space heating
1	Shankhuwasabha	Mud Stove	Yes	No	No	No	7	46
		Open Fire (Iron)	Yes	Yes	Yes	Yes		
		Open Fire (Stone)	Yes	Yes	Yes	Yes		
2	Rasuwa	Mud Stove	Yes	No	No	No	2	32
		Open Fire (Iron)	Yes	Yes	No	No		
		Open Fire (Stone)	Yes	Yes	Yes	Yes		
3	Mustang	Mud Stove	Yes	No	Yes	Yes	2	0
		Open Fire (Iron)	Yes	Yes	Yes	No		
		Open Fire (Stone)	No	No	No	No		
4	Humla	Mud Stove	No	No	No	No	29	3
		Open Fire (Iron)	Yes	Yes	Yes	Yes		
		Open Fire (Stone)	No	No	No	No		
5	Jajarkot	Mud Stove	Yes	No	Yes	Yes	11	37
		Open Fire (Iron)	Yes	Yes	Yes	No		
		Open Fire (Stone)	No	No	No	No		
6	Dolpa	Mud Stove	No	No	No	No	2	1
		Open Fire (Iron)	Yes	Yes	Yes	Yes		
		Open Fire (Stone)	No	No	No	No		
7	Bajura	Mud Stove	Yes	No	Yes	No	4	47
		Open Fire (Iron)	Yes	Yes	Yes	Yes		
		Open Fire (Stone)	Yes	Yes	Yes	Yes		

Nepal Energy Efficiency Programme (NEEP)

Ethnic group based need

SN	District	Type of TCS	Need of Ethnic group							
			Cooking		Space heating		Animal feed		Wine preparation	
			Bramin & Chhetri	Other	Bramin & Chhetri	Other	Bramin & Chhetri	Other	Bramin & Chhetri	Other
1	Sankhuwasabha	Mud stove	Yes	No	No	No	No	No	No	No
		Open Fire (Iron)	No	Yes	Yes	Yes	Yes	Yes	No	No
		Open Fire (Stone)	No	Yes	No	Yes	Yes	Yes	No	Yes
2	Rasuwa	Mud stove	NA	Yes	NA	No	NA	No	NA	No
		Open Fire (Iron)	NA	No	NA	No	NA	No	NA	No
		Open Fire (Stone)	NA	Yes	NA	Yes	NA	Yes	NA	Yes
3	Mustang	Mud stove	Yes	Yes	No	No	No	Yes	No	Yes
		Open Fire (Iron)	No	Yes	Yes	Yes	Yes	Yes	No	No
		Open Fire (Stone)	No	No	No	No	No	No	No	No
4	Humla	Mud stove	No	No	No	No	No	No	No	No
		Open Fire (Iron)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
		Open Fire (Stone)	No	No	No	No	No	No	No	No
5	Jajarkot	Mud stove	Yes	Yes	No	No	Yes	Yes	No	Yes
		Open Fire (Iron)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
		Open Fire (Stone)	No	No	No	No	No	No	No	No
6	Dolpa	Mud stove	No	No	No	No	No	No	No	No
		Open Fire (Iron)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
		Open Fire (Stone)	No	No	No	No	No	No	No	No
7	Bajura	Mud stove	Yes	Yes	No	No	Yes	Yes	No	Yes
		Open Fire (Iron)	Yes	Yes	Yes	Yes	Yes	Yes	No	No
		Open Fire (Stone)	No	No	Yes	Yes	Yes	Yes	No	Yes

Type of Metallic cook stove

S.N	Type of MICS	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	One Pot Hole	1	1	0	0	0	13	0
2	Two Pot Hole	2	12	12	0	7	19	3
3	Three Pot Hole	4	13	14	28	5	25	6

Bringing Location of MICS

S.N	Bringing Location of MICS	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	Local manufacturer	1	1	0	0	0	0	0
2	District Headquarter	0	13	23	26	0	20	0
3	China	4	8	3	2	0	34	2
4	Other	2	4	0	0	12	3	7

Mode of Transport of MICS

S.N	Mode of Transport	Respondents of District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	By Air	0	0	0	0	0	0	0
2	By Vehicle	2	21	19	0	12	6	7
3	By Porter	5	5	5	28	0	20	2
4	By Animal	0	0	2	0	0	31	0

Nepal Energy Efficiency Programme (NEEP)

Manufacturer and supplier of MICS

S.N.	Description	District						
		Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	Manufacturer	China	SUPC/ China	SE/ China	KU/ SHIP Nepal/ China	REU	RIDS/ China	REU
2	Supplier	Self	AEPC/ Self	Red cross/ Self	RIDS/ LIBIRD	AEPC/ Self	Self	AEP C/Sel f

SUPC: Sindhu Urja Promotion Centre

SE: Shanti Engineering

SHIP: Self help initiative promotion center

RIDS: Rural integrated development service

Cost of MCS

SN	Model of MICS	Manufacturer	Cost of MCS (Rs.)						
			Sankhuwasabha	Rasuwa	Mustang	Humla	Jajarkot	Dolpa	Bajura
1	One Pot Hole	Local Manufacturer	1500	1500	NA	NA	NA	NA	NA
2	Two Pot Hole	Local Manufacturer	6500	6007	5722	NA	5500	1485	7000
3	Three Pot Hole	Local Manufacturer	NA	11696	8000	3211	8500	2525	9500
4	One Pot Hole	Chinese	NA	NA	NA	NA	NA	9577	NA
5	Two Pot Hole	Chinese	NA	NA	5000	2000	NA	11500	NA
6	Three Pot Hole	Chinese	27000	18833	9500	NA	NA	11293	23000

4.9.6 Operation and maintenance of MCS

S.N.	District	Operating Period	O&M Period	O&M Cost	Cleaning frequency of Chimney (Day)	No. of respondent		Thickness of mud (mm)	No. of respondent	
						Mud Filling			Contact of Supplier/ Manufacturer	
						Yes	No		Yes	No
1	Sankhuwa-sabha	1 month to 2 years	NA		7	0	7	NA	0	7
2	Rasuwa	4 months to 8 years	1.5 years	Chimney replacement	59	4	22	25	0	26
3	Mustang	5 months to 8 years	2.5 years	Chimney replacement	5	13	13	25	0	26
4	Humla	1 month to 29 years	2 years	Chimney replacement	6	18	10	25	0	28
5	Jajarkot	1 Months to 1 Year	NA	NA	15	9	3	25	0	12
6	Dolpa	1 month to 13 years	2 years	Chimney replacement	16	0	57	NA	0	57
7	Bajura	3 Months to 5 years	2.5 Years	Chimney replacement	7	7	2	25	0	9

Nepal Energy Efficiency Programme (NEEP)

Additional cooking and space heating technology for MCS users

Sankhuwasabha

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
	Sufficient	Insufficient				
7	5	2	Solar Cooker	0	Electrical Equipment	0
			Biogas	0	TCS (Tripod or Three stone)	0
			Electrical Equipment	0		
			Open Fire Stone	2	Open Fire (Without Tripod or Three stone)	2
			Open Fire Iron	0		

Rasuwa

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
	Sufficient	Insufficient				
26	21	5	Solar Cooker	0	Electrical Equipment	0
			Biogas	0	TCS (Tripod or Three stone)	0
			Electrical Equipment	0		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	5
			Open Fire Iron	5		

Mustang

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
	Sufficient	Insufficient				
26	8	18	Solar Cooker	0	Electrical Equipment	5
			LPG	11	Metallic Charcoal Stove	7
			Kerosene stove	7		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	6
			Open Fire Iron	0		

Humla

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
	Sufficient	Insufficient				
28	26	2	Solar Cooker	0	Electrical Equipment	2
			Biogas	0	TCS (Tripod or Three stone)	0
			Electrical Equipment	2		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	0
			Open Fire Iron	0		

Nepal Energy Efficiency Programme (NEEP)

Jajarkot

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondent
	Sufficient	Insufficient				
12	9	3	Husk Stove	1	Electrical Equipment	0
			Biogas	0	TCS (Tripod or Three stone)	0
			Mud Stove	2		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	3
			Open Fire Iron	0		

Dolpa

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondents
	Sufficient	Insufficient				
57	52	5	Solar Cooker	0	Electrical Equipment	3
			Kerosene Stove	2	TCS (Tripod or Three stone)	0
			Electrical Equipment	2		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	2
			Open Fire Iron	1		

Bajura

Total No. of MCS respondent	Existing MCS		Additional CT	No. of respondent	Additional SHT	No. of respondents
	Sufficient	Insufficient				
9	8	1	Solar Cooker	0	Electrical Equipment	0
			Biogas	0	TCS (Tripod or Three stone)	0
			Electrical Equipment	0		
			Open Fire Stone	0	Open Fire (Without Tripod or Three stone)	1
			Open Fire Iron	1		

Nepal Energy Efficiency Programme (NEEP)

Socio-economic indicators

S.N.	District	No. of Respondents													
		Change in Health		Change in Education		Time Saving		Extra Income		Fuel Saving		Change in Environment		Gender for cooking	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	F	Both
1	Sankhuwasabha	5	2	4	3	7	0	0	7	7	0	4	3	4	3
2	Rasuwa	24	2	4	22	7	19	0	26	24	2	7	19	24	2
3	Mustang	20	6	7	19	17	9	2	24	1	25	10	16	26	0
4	Humla	28	0	26	2	28	0	0	28	27	1	12	16	28	0
5	Jajarkot	12	0	8	4	12	0	1	11	11	1	10	2	9	3
6	Dolpa	57	0	29	28	19	38	1	56	23	34	52	5	31	26
7	Bajura	9	0	4	5	9	0	2	7	9	0	9	0	6	3

Need of MCS

Application based Need of MCS

SN	District	Type of MCS	Need				No. of respondents	
			Cooking	Space heating	Animal feed	Wine preparation	Cooking	Cooking and space heating
1	Sankhuwasabha	One Pot Hole	Yes	No	Yes	Yes	0	7
		Two Pot Hole	Yes	Yes	Yes	Yes		
		Three Pot Hole	No	Yes	No	No		
2	Rasuwa	One Pot Hole	Yes	No	Yes	No	20	6
		Two Pot Hole	Yes	Yes	No	Yes		
		Three Pot Hole	Yes	Yes	No	Yes		
3	Mustang	One Pot Hole	No	No	No	No	2	24
		Two Pot Hole	Yes	Yes	Yes	Yes		
		Three Pot Hole	Yes	Yes	No	Yes		
4	Humla	One Pot Hole	No	No	No	No	9	19
		Two Pot Hole	No	No	No	No		
		Three Pot Hole	Yes	Yes	No	Yes		
5	Jajarkot	One Pot Hole	No	No	No	No	0	12
		Two Pot Hole	Yes	Yes	Yes	Yes		
		Three Pot Hole	Yes	Yes	No	Yes		
6	Dolpa	One Pot Hole	Yes	No	Yes	Yes	9	48
		Two Pot Hole	Yes	Yes	Yes	Yes		
		Three Pot Hole	Yes	Yes	No	Yes		
7	Bajura	One Pot Hole	No	No	No	No	1	8
		Two Pot Hole	Yes	Yes	Yes	Yes		
		Three Pot Hole	Yes	Yes	No	No		

Nepal Energy Efficiency Programme (NEEP)

Ethnic group based Need of MCS

SN	District	Type of MCS	Need of Ethnic group							
			Cooking		Space heating		Animal feed		Wine preparation	
			Bramin & Chhetri	Other	Bramin & Chhetri	Other	Bramin & Chhetri	Other	Bramin & Chhetri	Other
1	Sankhuwasabha	One Pot Hole	No	Yes	No	No	Yes	Yes	No	Yes
		Two Pot Hole	Yes	Yes	Yes	Yes	Yes	No	No	Yes
		Three Pot Hole	No	No	Yes	Yes	No	No	No	No
2	Rasuwa	One Pot Hole	NA	Yes	NA	No	NA	Yes	NA	No
		Two Pot Hole	NA	Yes	NA	No	NA	No	NA	Yes
		Three Pot Hole	NA	Yes	NA	Yes	NA	No	NA	Yes
3	Mustang	One Pot Hole	No	No	No	No	No	No	No	No
		Two Pot Hole	Yes	Yes	No	No	Yes	Yes	No	Yes
		Three Pot Hole	Yes	Yes	Yes	Yes	No	No	No	No
4	Humla	One Pot Hole	No	No	No	No	No	No	No	No
		Two Pot Hole	No	No	No	No	No	No	No	No
		Three Pot Hole	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
5	Jajarkot	One Pot Hole	No	No	No	No	No	No	No	No
		Two Pot Hole	Yes	Yes	No	Yes	No	Yes	No	Yes
		Three Pot Hole	Yes	Yes	Yes	Yes	Yes	No	No	Yes
6	Dolpa	One Pot Hole	Yes	Yes	No	Yes	Yes	No	No	No
		Two Pot Hole	Yes	Yes	Yes	Yes	Yes	No	No	Yes
		Three Pot Hole	Yes	Yes	Yes	Yes	No	Yes	No	No
7	Bajura	One Pot Hole	No	No	No	No	No	No	No	No
		Two Pot Hole	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
		Three Pot Hole	Yes	No	Yes	No	No	No	No	No

Requirement of New technology

SN	District	No. of Respondents											Average Willingness to Pay (Rs.)
		Requirement of MCS		Cause of Need				Cause of not needed					
		Yes	No	Fuel Efficient	Clean	Time Saving	Other	Costly	Indifferent	Tedious	Difficult R&M	Other	
1	Sankhuwasabha	13	10	3	8	2	0	4	2	1	2	2	2,906
2	Rasuwa	33	1	0	32	1	0	1	0	0	0	0	2,252
3	Mustang	10	21	0	7	3	0	7	5	6	2	0	750
4	Humla	32	0	9	12	11	0	0	0	0	0	0	1,075
5	Jajarkot	37	11	6	19	12	0	7	0	3	2	0	1,500
6	Dolpa	3	0	0	2	1	0	0	0	0	0	0	3,500
7	Bajura	39	12	11	18	10	0	4	1	3	3	0	1,050

Nepal Energy Efficiency Programme (NEEP)

Cooking Behavior

S N	District	Cooking items											
		Rice, Daal, Curry			Tiffin Items			Animal Feed			Local Wine		
		Qty per month (kg)	Average Time (h)	Utensil	Qty per month (kg)	Average Time (h)	Utensil	Qty per month (kg)	Average Time (h)	Utensil	Qty per month (kg)	Average Time (h)	Utensil
1	Sankhuwasabha	183	122	Both	28	8	NPC	402	44	NPC	147	89	NPC
2	Rasuwa	166	114	Both			NPC			NPC			NPC
3	Mustang	81	56	Both			NPC			NPC			NPC
4	Humla	129	26	Both			NPC			NPC			NPC
5	Jajarkot	120	130	Both			NPC			NPC			NPC
6	Dolpa	155	78	Both			NPC			NPC			NPC
7	Bajura	126	126	Both									

Fuel for cooking and space heating

S N	District	Type of Fuel	No. of Respondent			Annual Consumption (kg)	Fetching Distanc e (km)	Price Per kg (Rs.)
			Easily Available	Moderate	Scar e			
1	Sankhuwasabha	Fire Wood	57	3	0	3180	2	0.8
		Kerosene				0	0	0
		LP Gas				0	0	0
		Electricity				0	0	0
2	Rasuwa	Fire Wood	0	4	56	10908	4.62	11.5 1
		Kerosene				0	0	0
		LP Gas				143	1.1	141
		Electricity				0	0	0
3	Mustang	Fire Wood	9	32	19	6396	5	9
		Kerosene				17 L	1.8	115
		LP Gas				107	0.2	124
		Electricity				0	0	0
4	Humla	Fire Wood	0	24	36	4055	5	8
		Kerosene				0	0	0
		LP Gas				0	0	0
		Electricity				0	0	0
5	Jajarkot	Fire Wood	27	33	0	1920	1.5	5
		Kerosene	0	0	0	0	0	0
		LP Gas	0	0	0	0	0	0
		Electricity	0	0	0	0	0	0
6	Dolpa	Fire Wood	18	10	28	4178	4.5	15
		Kerosene						
		Dung Cake	0	4	0	5490	4.1	12
		Electricity						
7	Bajura	Fire Wood	22	38	0	2250	2.5	5.5
		Kerosene	0	0	0	0	0	0
		LP Gas	0	0	0	0	0	0
		Electricity	0	0	0	0	0	0

Nepal Energy Efficiency Programme (NEEP)

Annual income

S.N.	District	Source of Income	Yearly Income (Rs.)
1	Sankhuwasabha	Agriculture	18,000
		Employment	96,000
		Trade and Commerce	141,000
		Daily Wage	60,000
2	Rasuwa	Agriculture	3,117
		Employment	6,453
		Trade and Commerce	16,860
		Daily Wage	13,883
3	Mustang	Agriculture	7,500
		Employment	33,000
		Trade and Commerce	18,917
		Daily Wage	27,335
4	Humla	Agriculture	0
		Employment	22,750
		Trade and Commerce	13,750
		Daily Wage	6,450
5	Jajarkot	Agriculture	16,147
		Employment	43,607
		Trade and Commerce	15,450
		Daily Wage	95,910
6	Dolpa	Agriculture	14,333
		Employment	57,700
		Trade and Commerce	153,258
		Daily Wage	4,667
7	Bajura	Agriculture	15,550
		Employment	55,967
		Trade and Commerce	6,924
		Daily Wage	120,515

Priority of TCS

SN	Type of TCS	Priority							
		Firewood consumption	Indoor air quality	Convenience of cooking/heating	Space heating	Cooking time	Easiness of ignition	Gender	
								M	F
1	Mud stove	2 nd	1 st	2 nd	3 rd	3 rd	1 st	3 rd	1 st
2	Open Fire Iron	1 st	2 nd	1 st	2 nd	2 nd	3 rd	2 nd	2 nd
3	Open Fire Stone	3 rd	3 rd	3 rd	1 st	1 st	2 nd	1 st	3 rd

Priority of MCS

SN	Type of MCS	Priority								
		Firewood consumption	Indoor air quality	Convenience of cooking/heating		Space heating	Cooking time	Easiness of ignition	Gender	
				HH	Hotel				M	F
1	One pot hole	2 nd	3 rd	2 nd	3 rd	3 rd	3 rd	2 nd	3 rd	2 nd
2	Two pot hole	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st
3	Three pot hole	3 rd	1 st	3 rd	1 st	1 st	1 st	2 nd	1 st	3 rd

Need base Priority

SN	Ethnic group	Need base Priority			
		Cooking	Space heating	Animal feed	Wine preparation
1	Dalit	1 st	4 th	2 nd	3 rd
2	Janajati	1 st	4 th	3 rd	2 nd
3	Brahmin	1 st	3 rd	2 nd	None
4	Chhetri/Thakuri	1 st	3 rd	2 nd	4 th
5	Sherpa	1 st	2 nd	4 th	3 rd

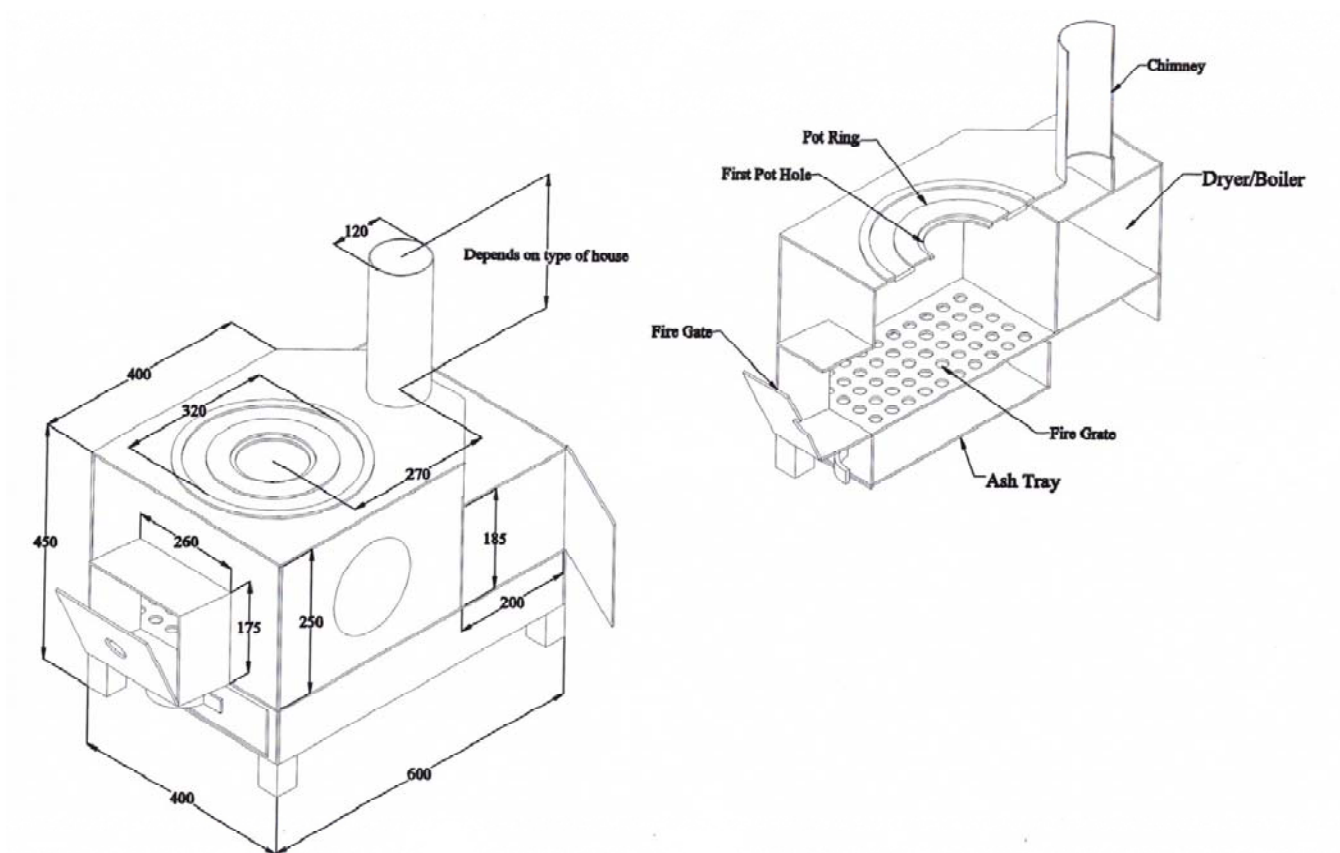
Nepal Energy Efficiency Programme (NEEP)

Cooking and space heating need

SN	Altitude	Living standard		Availability of firewood		Ethnic group	
		Rich	Poor	Surplus	Deficit	Brahmin	Other
1	Lower	C	C	C	C	C	C
2	Higher	C & SH	C	C & SH	C	C & SH	C

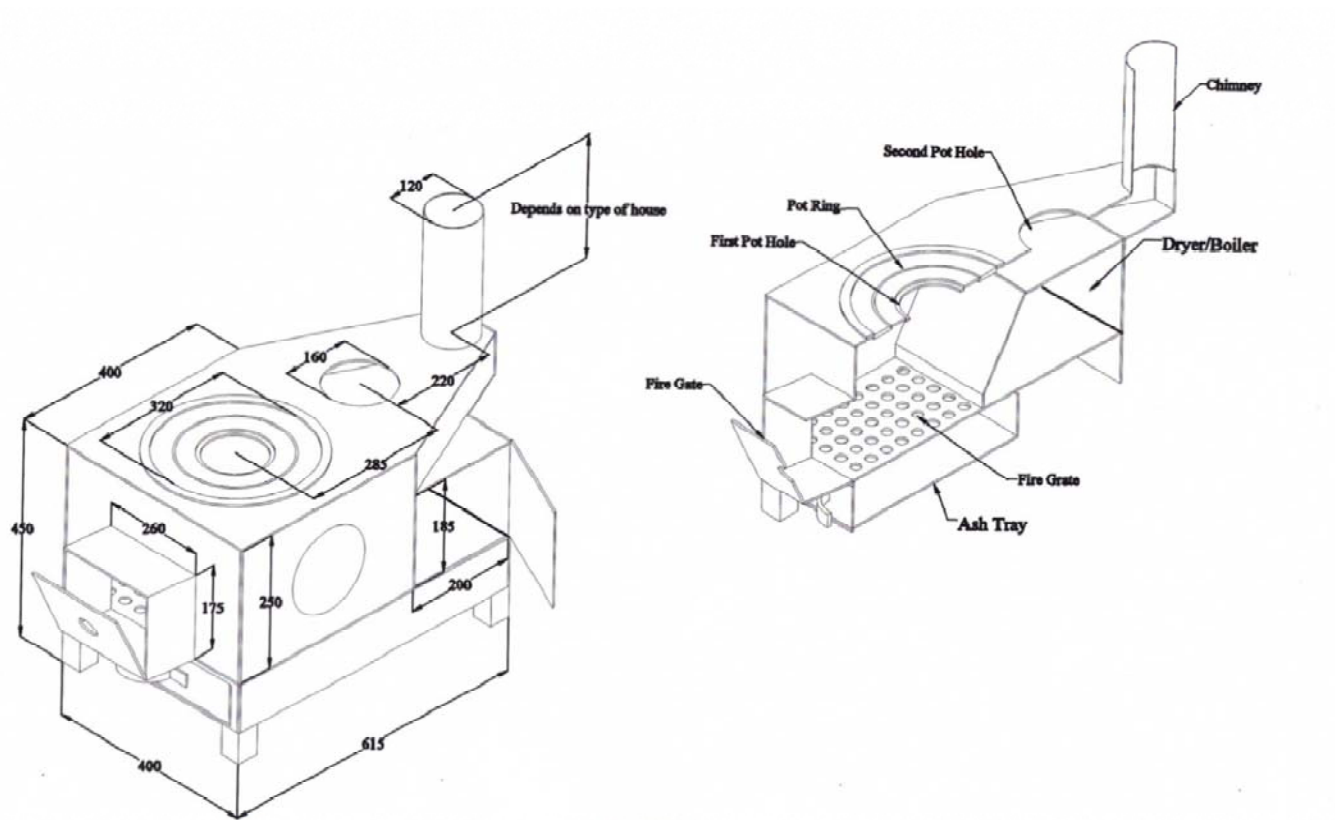
Appendix C: Proposed design of metallic cook stove by CES/IOE

One Pot Hole MCS

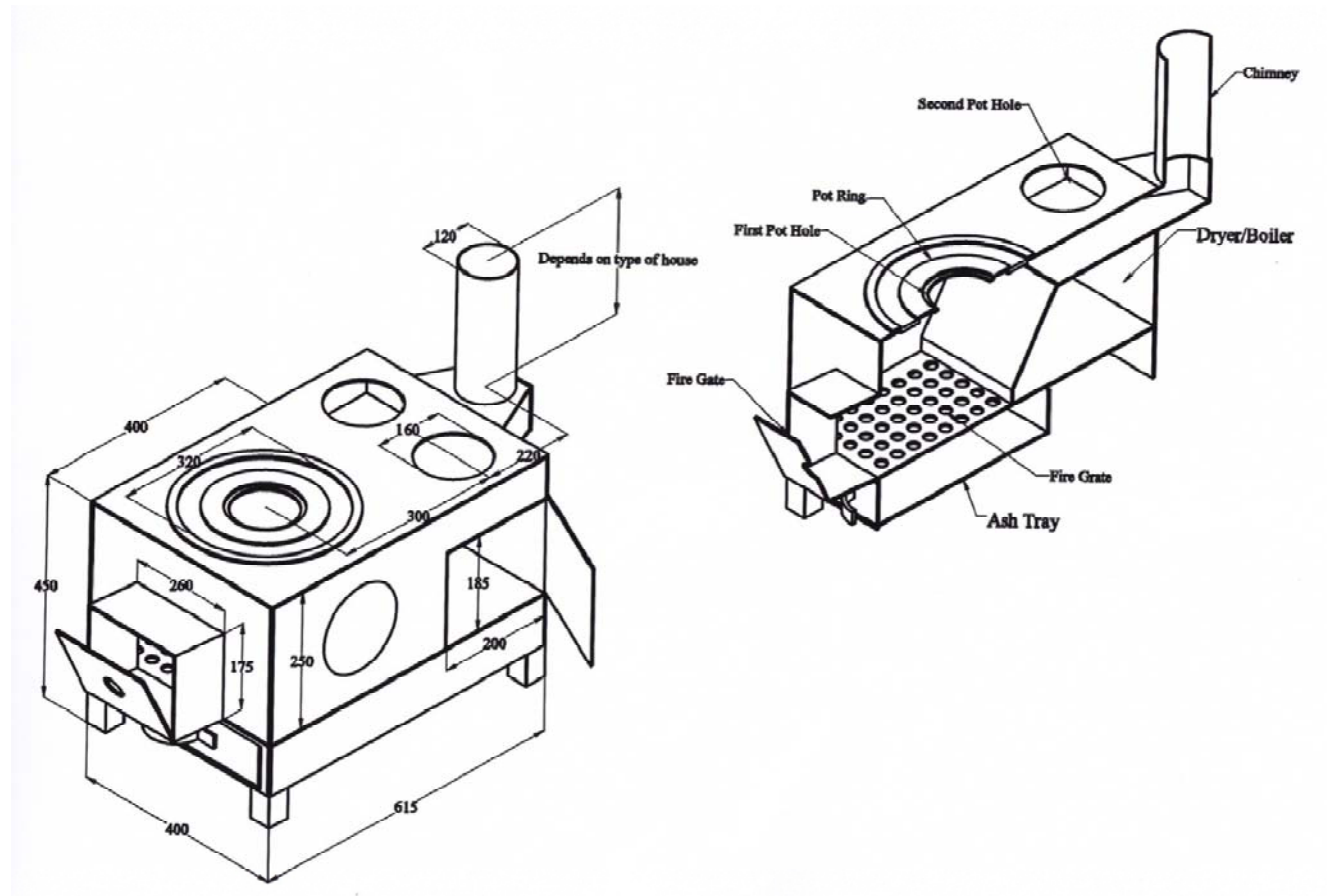


Nepal Energy Efficiency Programme (NEEP)

Two Pot Hole MCS



Three Pot Hole MCS



Appendix D: Detail of forecasting

Development Regionwise Method of Projection of HH Need MCS

District having MCS

Sample VDC: VDC having MCS

Total HH in all VDC having MCS	Sample size	Sample TCS	Total no. of TCS	No. of sample HH needs MCS	Total no. of HH need MCS
Z	30	X out of 30	$=Z * X/30$	Y out of X	$A = (Y/X) * Z * X/30$

Total of HH
Need MCS in
District
A + B

Sample VDC: VDC without MCS

Total HH in all VDC without MCS	Sample size	Sample TCS	Total no. of TCS	No. of sample HH needs MCS	Total no. of HH need MCS
P	30	Q out of 30	$=P * Q/30$	R out of Q	$B = (R/Q) * P * Q/30$

District without MCS

VDC: Both VDC without MCS

Total HH in all VDC without MCS	Sample size	Sample TCS	Total no. of TCS	No. of sample HH needs MCS	Total no. of HH need MCS
P	60	Q out of 60	$=P * Q/60$	R out of Q	$C = (R/Q) * P * Q/60$

Total of HH
Need MCS in
District
C

HH Need MCS	2012	2013	2014	Total
X	A = 3% of X	B = 5% of (X-A)	C = 7% of (X-A-B)	14%

Appendix E: Some photographs of field visit



Mud stove and stone stove at Bajura District

Nepal Energy Efficiency Programme (NEEP)



Mud stove at Jajarkot District



Indoor air pollution and use of mud stove and tripod at Shankhuwasabha District

Nepal Energy Efficiency Programme (NEEP)

Metallic cook stove at Mustang District



Metallic stove at Rasuwa district



Metallic stove at Humla district

Nepal Energy Efficiency Programme (NEEP)



Metallic stove at Dolpa district

Appendix F: Survey questionnaire

CHECK LIST TO BE FILLED AT DDC

1. D.D.C. Profile (Short profile of D.D.C. including number and approximate density of households as well as topographical description):

.....

.....

.....

.....

.....

2. Please collect following documents

2.1 Copy of District Energy Plan/ District Energy situation report (Latest)

2.2 Copy of District development profile

- 3 General Information:

3.1 Total number of household

3.2 Total population

3.3 Household under electricity coverage

%

3.4 Types of Ethnic Group

Dalit

Percentage

Janajati

Percentage

Brahmin

Percentage

Chhetri

Percentage

Thakuri

Percentage

Others (Specify)

.....

Percentage

3.5 Average Family Size

Male..... Female..... Total.....

3.6 Educational Status

Illiterate

%

Literate

%

Informal education

%

Upto Grade Five

%

Grade Six to Ten

%

Grade Ten or Above

%

Nepal Energy Efficiency Programme (NEEP)

3.7 What are the biomass resources available in the district?

SN	Type of Energy resource	Surplus	Deficit	Annual consumption (kg)	Remarks
1	Firewood				
2	Agriculture residue				
3	Animal dung				
4	Shrub residue				
5	Saw dust				
6	Others (Specify)				

CHECK LIST TO BE FILLED AT VDC

1. V.D.C. Profile (Short profile of V.D.C. including number and approximate density of households as well as topographical description):

.....

.....

.....

.....

.....

2. Please collect following documents

- 2.1 Copy of VDC Energy Plan/ VDC Energy situation report (Latest)
- 2.2 Copy of VDC development profile

3. General Information:

- 3.1 Total number of household

- 3.2 Total population

- 3.3 Household under electricity coverage

%

- 3.4 Types of Ethnic Group

Dalit

Percentage

Janajati

Percentage

Brahmin

Percentage

Chhetri

Percentage

Thakuri

Percentage

Others (Specify)

.....

Percentage

- 3.5 Average Family Size

Male..... Female..... Total.....

- 3.6 Educational Status

Illiterate

%

Literate

%

Informal education

%

Upto Grade Five

%

Grade Six to Ten

%

Grade Ten or Above

%

Nepal Energy Efficiency Programme (NEEP)

3.7 What are the biomass resources available in the VDC?

SN	Type of Energy resource	Surplus	Deficit	Annual consumption (kg)	Remarks
1	Firewood				
2	Agriculture residue				
3	Animal dung				
4	Shrub residue				
5	Saw dust				
6	Others (Specify)				

QUESTIONNAIRE FOR HOUSEHOLD SURVEY: HOUSEHOLDS WITH MICS

1. General Information

1.1 Full name of respondent

Age Sex..... Education.....

1.2 V.D.C..... Ward No..... Village.....

1.3 On average, how many hours a day does the sun shine in your village? hrs

1.4 Which types of stove do you use?

TCS ☐ ICS ☐ MICS ☐ Biogas ☐ Electric cooker ☐

Solar cooker ☐ Other (Specify)

1.5 What fuel do you use for cooking?

Firewood ☐ Kerosene ☐ LP Gas ☐ Biogas ☐ Others.....

2. About MICS

2.1 What model of MICS do you use?

MICS ☐ One pot hole ☐ Two pot hole ☐ Three pot hole ☐

Others (specify)

2.2 From where did you bring the MICS?

The manufacturer delivered it to your house ☐

From district headquarter ☐

From any other town of the country ☐

Specify the name of the town

2.3 How did you bring the MICS?

By air ☐ By vehicle ☐ By Porter ☐ By Carriage animals ☐

Other.....

2.4 From which company/ organization have you bought the MICS?

.....
.....

Nepal Energy Efficiency Programme (NEEP)

2.5 Name of manufacturing company labeled on your MICS?

.....

2.6 Who assembled the MICS at your home?

Representative of the manufacturing company ☐

Yourself assembled the stove ☐

Somebody else ☐ Specify the person.....

2.7 Did you fill up the subsidy form on buying the MICS?

Yes ☐

No ☐

2.8 Total cost of the MICS that you paid Rs.....

2.9 Subsidy amount on MICS Rs.....

2.10 Did you get some warranty/ guarantee on you MICS upon buying?

Yes ☐

No ☐

If yes specify the type of warranty/ guarantee.

.....

2.11 How often do you clean chimney?

a) b) Never done till now ☐

2.12 Is the stove filled with mud in the slot provided below combustion chamber?

a) Yes ☐ b) No ☐

2.13 Has your MICS needed some repair and maintenance till now?

Yes ☐

No ☐

If yes specify what type of repair or maintenance was done and by whom?

.....
.....
.....

2.14 Has the supplier/ manufacturer made any contacts to you to know the performance of your MICS?

Yes ☐

No ☐

2.15 Since how many years/ months have you been using the current MICS?

.....

2.16 What are the drawbacks of the current MICS that you have observed?

.....
.....

2.17 Is the MICS easy to operate than your previous stove?

a) Yes ☐ b) No ☐

2.18 Do you prefer a separate technology for space heating purpose?

Yes ☐

No ☐

2.19 Has the MICS fulfilled all the cooking/ space heating needs of your family?

Yes ☐

No ☐

2.20 If No, what type of technology do you use for the partial fulfillment of your needs?

Cooking

Traditional stove ☐ Solar cooker ☐ Biogas ☐ Electrical equipments ☐

Others

Space heating

3. Cooking Behavior and Energy Consumption

3.1 What is the cooking behavior of your family? (Specify the items cooked daily and frequency of cooking)

.....

Nepal Energy Efficiency Programme (NEEP)

3.2 What type of utensils do you use for daily cooking?

Pressure Cooker ☐ Non pressure utensils ☐ Others (Specify)

3.3 Average cooking quantity and time:

Quantity kg Cooking Time minutes

3.4 Besides cooking do you use the stove for other applications? Yes ☐ No ☐

If Yes, specify the applications.

.....

3.5 Which type of following fuels do you use for fulfillment of your energy requirements such as cooking, lighting, space heating etc.

- | | | | | |
|---------------------------------------|--------------------------|------------------------------|----------------------|-------------------|
| <input type="checkbox"/> Firewood | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Agri.Residue | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Kerosene | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> LP Gas | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Electricity | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Dung cakes | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Others | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |

3.6 Do you use the byproducts from your land for energy generation?

Yes ☐ No ☐

If Yes specify the source and quantity

Source Quantity.....

Source Quantity.....

Source Quantity.....

3.7 Do you buy fuelwood for cooking purpose?

a) Yes ☐ b) No ☐

If yes, what is the market price of fuel wood at that location?

Rs. per(Kg, Bhari, etc.)

3.8 Fuel wood accessibility?

a) Easily available ☐ b) Moderately available ☐ c) Scarce ☐

3.9 What is the price of following fuels in your area?

Firewood	Tentative price	Rs <input type="text"/>
Agri. Residue	Tentative price	Rs <input type="text"/>
Kerosene	Tentative price	Rs <input type="text"/>
LP Gas	Tentative price	Rs <input type="text"/>
Electricity	Tentative price	Rs <input type="text"/>
Dung cakes	Tentative price	Rs <input type="text"/>
Others	Tentative price	Rs <input type="text"/>

4. Socio- Economic

4.1 Have you observed any changes in the health status of your family before and after having MICS? Yes ☐ No ☐

If Yes, what are the changes?

.....

.....

.....

.....

4.2 Have you observed some progress in the study of your children after having MICS at your home? Yes ☐ No ☐

If Yes, what is the extent of progress:

To some extent ☐ Great Progress ☐

4.3 Is there any saving in cooking time before and after having MICS at your home?

Yes ☐ No ☐

If yes specify the save in time hrs

Nepal Energy Efficiency Programme (NEEP)

4.4 Is any extra income generating activity is conducted by your family after having MICS?

Yes ☐

No ☐

If Yes, specify the following:

Activity	Income
.....
.....
.....

4.5 What is the difference between fuel consumption before and after MICS installation?

a) Before kg b) After kg

4.6 Is there any improvement in the surrounding environment of your village?

Yes ☐

No ☐

If yes, specify the improvement

.....

4.7 Who is involved in cooking of food in your family?

Before having MICS Male ☐ Female ☐ Both ☐

After having MICS Male ☐ Female ☐ Both ☐

5. Family Status

5.1 Yearly Income of Family

Agriculture	Rs.	<input type="text"/>
Employment/ Pension/ Foreign Employment	Rs.	<input type="text"/>
Trade and Commerce	Rs.	<input type="text"/>
Daily Wage	Rs.	<input type="text"/>
Others	Rs.	<input type="text"/>
Total	Rs.	<input type="text"/>

5.2 Do you have toilet at your home?

Yes ☐

No ☐

5.3 Do you have drinking water facility at your home?

Yes ☐ No ☐

If no, Nearest drinking water source?

Distance

km

Collection Time

hrs.

5.4 Do you have electricity supply at your home?

Yes ☐ No ☐

If Yes, specify the source

QUESTIONNAIRE FOR HOUSEHOLD SURVEY: HOUSEHOLDS WITHOUT MICS**1. General Information**

1.1 Full name of respondent

Age Sex..... Education.....

1.2 V.D.C..... Ward No..... Village.....

1.3 On average, how many hours a day does the sun shine in your village? hrs

1.4 Which types of stove do you use?

TCS ☐ ICS ☐ MICS ☐ Biogas ☐ Electric cooker ☐Solar cooker ☐ Other (Specify)

1.5 What fuel do you use for cooking?

Firewood ☐ Kerosene ☐ LP Gas ☐ Biogas ☐ Others.....**2. About TCS**

2.1 What model of TCS do you use?

One pot hole ☐ Two pot hole ☐ Three pot hole ☐ Open fire ☐Others ☐

2.2 Total cost of the stove Rs.....

2.3 Has the stove fulfilled all the cooking/ space heating needs of your family?

Yes ☐ No ☐

2.4 If No, what type of technology do you use for the partial fulfillment of your needs?

CookingSolar cooker ☐ Biogas ☐ Electrical equipments ☐ Others***Space heating***

2.5 Since how many years/ months have you been using the current TCS?

.....

2.6 What are the drawbacks of the current TCS that you have observed?

.....
.....
.....

2.7 Do you prefer a separate technology for space heating purpose?

Yes ☐

No ☐

2.8 In your view, what type of energy and time efficient technology can fulfill all of your cooking and space heating needs?

.....
.....
.....
.....

2.9 Do you know about MICS?

Yes ☐

No ☐

2.10 Do you think it is good to have MICS at your home?

Yes ☐

No ☐

If Yes, what can be the reasons?

Fuel Efficient ☐

Clean ☐

Time saving ☐

Others

If No, what can be the reasons

Costly ☐

Not quite different than the performance of TCS ☐

Tedious to operate ☐

Difficult to repair and maintain ☐

Others

Nepal Energy Efficiency Programme (NEEP)

2.11 Do you have willingness to pay for the MICS?

Yes ☐

No ☐

If yes how much? Rs

3. Cooking Behaviour and Fuel Consumption

3.1 What is the cooking behavior of your family? (Specify the items cooked daily and frequency of cooking)

.....

3.2 What type of utensils do you use for daily cooking?

Pressure Cooker ☐ Non pressure utensils ☐ Others (Specify)

3.3 Average cooking quantity and time:

Quantity kg

Cooking Time minutes

3.4 Besides cooking do you use the stove for other applications? Yes ☐ No ☐

If Yes, specify the applications.

.....

3.5 Which type of following fuels do you use for fulfillment of your energy requirements such as cooking, lighting, space heating etc.

- | | | | | |
|---------------------------------------|--------------------------|------------------------------|----------------------|-------------------|
| <input type="checkbox"/> Firewood | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Agri.Residue | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Kerosene | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> LP Gas | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Electricity | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Dung cakes | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |
| <input type="checkbox"/> Others | <input type="checkbox"/> | Tentative quantity per month | <input type="text"/> | Fetching distance |

3.6 Do you use the byproducts from your land for energy generation?

Yes ☐

No ☐

If Yes specify the source and quantity

Source Quantity.....

Source Quantity.....

Source Quantity.....

3.7 Do you buy fuelwood for cooking purpose?

a) Yes ☐

b) No ☐

If yes, what is the market price of fuel wood at that location?

Rs. per(Kg, Bhari, etc.)

3.8 Fuel wood accessibility?

a) Easily available ☐

b) Moderately available ☐

c) Scarce ☐

3.9 What is the price of following fuels in your area?

Firewood Tentative price Rs

Agri. Residue Tentative price Rs

Kerosene Tentative price Rs

LP Gas Tentative price Rs

Electricity Tentative price Rs

Dung cakes Tentative price Rs

Others Tentative price Rs

4. Family Status

4.1 Yearly Income of Family

Agriculture Rs.

Employment/ Pension/ Foreign Employment Rs.

Trade and Commerce Rs.

Daily Wage Rs.

Others Rs.

Total Rs.

Nepal Energy Efficiency Programme (NEEP)

4.2 Do you have toilet at your home?

Yes ☐No ☐

4.3 Do you have electricity supply at your home?

Yes ☐No ☐

If Yes, specify the source

4.4 Does your village have drinking water facility?

Yes ☐No ☐

If no, Nearest drinking water source?

Distance

 km

Collection Time

 hrs.

CHECK LIST TO BE FILLED THROUGH OBSERVATION BY SURVEYOR

1. Structure of House

Mud and Bamboo ☐

Mud and Stone ☐

Brick Masonry ☐

Stone masonry ☐

2. Description of Indoor air pollution level

.....
.....
.....

3. Outside surface temperature of stove and chimney:

Stove °C Chimney °C

4. What is the position of stove in the kitchen? (Specify the direction).....

5. Does the air flow takes place across the kitchen? Yes ☐ No ☐

If Yes, specify the direction of air flow.

Nepal Energy Efficiency Programme (NEEP)

QUESTIONNAIRE TO BE FILLED FROM SUPPORTING ORGANIZATION INVOLVED IN THE PROMOTION OF MICS

1. Name of the supporting organization

2. Address.....

3. On which districts/ VDCs does the organization work?

-
-
-

4. Is the organization supplier or supporter organization?

Supplier ☐Supporter ☐

For Supplier Organization,

Is the organization self manufacturer of the stove that it supplies?

Yes ☐No ☐

If No, specify the name of the manufacturer of the MICS that the organization supplies.

.....

For Supporter Organization,

Name of the manufacturer of the MICS that is supplied under the support of organization

.....

5. What is the support that is provided by the organization?

Financial support ☐ Specify the amount Rs per stove.....Technical support ☐ Specify the amount Rs per stove.....Transportation support ☐ Specify the amount Rs per stove.....

Other (Specify)

6. What are the activities performed by the organization?

SN	Type of stove	Model*	Annual Demand	Annual supply	Annual production capacity	Supply locations
1	MICS					
2	Husk Stove					
3	Metallic Rocket Stove					
4	Fan attached stove					
5	Others					

*A = One pot hole

B = Two pot hole [B1 = with tank, B2 = with back boiler, B3 = Ash tray, B4 = with Chapati warmer]

C = Three pot hole [C1 = with tank, C2 = with back boiler, C3 = Ash tray, C4 = with Chapati warmer]

Questionnaire to be filled from MICS Manufacturer

5.1 Name of company.....

5.2 Address.....

5.3 Starting date of Fabrication

5.4 Model of stove:

MICS ☐ One pot hole ☐ Two pot hole ☐ Three pot hole ☐

Others (Please Specify)

With tank Yes ☐ No ☐

With Back Boiler Yes ☐ No ☐

With Ash Tray Yes ☐ No ☐

With Chapati warmer Yes ☐ No ☐

5.5 Photograph

Nepal Energy Efficiency Programme (NEEP)

5.6 Fill up the size of the cooking stove

LengthWidthHeight.....

5.7 Height of chimney above the top surface of stove (If applicable)m

5.8 Average size of wood fuel that can be used (lxbxh).....

5.9 Size of fire gate (w x h)

5.10 Condition of fire gate during operation: Open ☐ Closed ☐

5.11 Position of damper from top of stove (If applicable).....cm

5.12 Presence of grate in the stove: Yes ☐ No ☐5.13 Radius of Individual potholes: 1st cm 2nd cm 3rd cm5.14 Radius of chimney hole: cm

5.15 Size of combustion Chamber (l cm x b cm x h cm):

5.16 Angle of baffle with respect to horizontal (Degrees):

5.17 Condition of top edge of baffle: Sharp ☐ Rounded ☐ Irregular ☐

5.18 Condition of back of baffle:

Vertical ☐ Inclined Inwards ☐ Inclined Outwards ☐5.19 Inside finishing of the stove: Smooth ☐ Rough ☐

5.20 Indicate the materials and Thickness used for the construction of the stove

Type of materials

Cast iron Thickness mm
Steel Thickness mm
Readymade Chimney Outlet Thickness mm
Others

5.21 Thickness of effective mud insulation (If applicable)mm

5.22 Annual production capacity

5.23 Factory price Rs.....