

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia

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Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

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Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Contents

Acknowledgements.....	ii
List of Acronyms.....	v
Executive Summary.....	1
1. Introduction.....	4
1.1 Background.....	4
1.2 Rationale of the Study.....	4
1.3 Objective of the Study.....	5
2. Literature Review.....	7
2.1 Household Energy, Gender, Livelihood, and Health Impact of Stoves.....	7
2.2 Gender and Stove Adoption.....	9
2.3 Women Involvement in the Cookstove Value Chain.....	10
2.4 Gender Perspectives of Household Energy Policies and Programs in South Asia.....	11
3. Study Methodology.....	13
3.1 Sampling, Study Area, and Data.....	13
3.1.1 Household Surveys.....	14
3.1.2 Focus Group Discussions (FGDs).....	15
3.1.3 Interviews with Clean Cookstove Promoters and Technicians.....	16
3.1.4 Interviews with Stove Entrepreneurs and Distributors.....	16
3.1.5 Interviews with Stakeholders Supporting the Scaling-up of Stoves.....	16
3.1.6 Literature Review.....	16
3.1.7 Analysis, Draft Report Preparation, and Stakeholders Workshops.....	16
3.2 Definitions and Measurements.....	16
3.3 Scope and Limitations of the Study.....	17
4. Characteristics of the Surveyed Households.....	18
4.1 Household Size and Composition.....	18
4.2 Occupation.....	18
4.3 Types of Fuel and Stoves in Use for Household Cooking.....	19
5. Clean Cookstove Adoption, Use, and Impacts.....	21
5.1 Stove Adoption.....	21
5.1.1 Gender and Stove Adoption.....	21
5.1.2 Education and Stove Adoption.....	21
5.1.3 Income Level and Stove and Fuel Adoption.....	22
5.1.4 Reasons for Traditional Stove Use.....	22
5.1.5 Source of Information for Clean Cookstoves.....	23
5.1.6 Women's Involvement in Social Groups and Adoption.....	24
5.1.7 Firewood Availability and Adoption.....	24
5.1.8 Performance of Stoves and Adoption.....	24
5.2 Gender and Livelihood Impact of Stoves.....	25
5.2.1 Fuel Saving.....	25
5.2.2 Time for Firewood Collection, Gender, and Drudgery Reduction.....	26
5.2.3 Impact on Education.....	28
5.2.4 Gender Equity.....	29
5.2.5 Household Air Pollution and Health.....	31
6. Cookstove Market System.....	33

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

6.1	ICS Market Chain and Gender (Level 1)	33
6.2	Business and Extension Services, and Input Providers (Level 2)	35
6.3	Enabling Environment Policy (Level 3).....	39
6.4	Socio-Cultural Aspects.....	40
6.5	Contribution and Role of Women in Increasing Stove Adoption	40
7	Conclusion and recommendation	42
7.1	Conclusions	42
7.2	Overall Recommendations	43
	REFERENCES.....	48
Annex 1	Study locations	51
Annex 2	Generic ICS Market System MAP	52
Annex 3	Incubation support required for Women Stove Entrepreneurs	53
Annex 4:	List of Stakeholders Workshop Participants	54
Annex 5	Detail survey indicators	61
Instrument 1	Household Questionnaire	65
Instrument 2	Focus Group Discussion (FGD) Questionnaire.....	79
Instrument 3	Key Information Interview Questionnaire – Entrepreneurs and Distributers..	82
Instrument 4	Key Information Interview Questionnaire for Stove Promoters and Technicians	87
Instrument 5	Interview with Key Stakeholders	90
Annex 7	List of Key Informants.....	94
Annex 8	List of Focus Group Discussions	96

Supplementary Reports

Report 1: Gender and Livelihood Impact of Clean Cookstoves in Himachal Pradesh, India

Report 2: Gender and Livelihood Impact of Clean Cookstoves in Karnataka, India

Report 3: Gender and Livelihood Impact of Clean Cookstoves in Odisha, India

Report 4: Gender and Livelihood Impact of Clean Cookstoves in Nepal

Report 5: Gender and Livelihood Impact of Clean Cookstoves in Bangladesh

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

LIST OF ACRONYMS

µg/m ³	Micrograms per cubic metre
AAP	Ambient Air Pollution
AEPC	Alternative Energy Promotion Centre, Nepal
BLN	Biogas-LPG-electricity-natural gas
CAP	Country Action Plan
COPD	Chronic Obstructive Pulmonary Diseases
CO	Carbon Monoxide
ENPHO	Environment and Public Health Organization
FGD	Focus Group Discussions
GACC	Global Alliance for Clean Cookstoves
GOB	Government of Bangladesh
HAP	Household Air Pollution
HH	Household
IAP	Indoor Air Pollution
ICS	Improved Cookstoves
IGIDR	Indira Ghandi Institute of Development Research
IEA	International Energy Agency
IFC	International Finance Corporation
LPG	Liquefied Petroleum Gas
MNRE	Ministry of New and Renewable Energy
NGO	Nongovernmental Organization
PAC	Practical Action Consulting
PM	Particulate Matter
RCDC	Regional Centre for Development Cooperation
RES	Renewable Energy Schemes
SE4All	Sustainable Energy for All
SME	Small and Medium Enterprise
TCS	Traditional Cookstoves
TIDE	Technology Informatics Design Endeavor
toe	Tonnes of Oil Equivalent
WHH	Women Headed Household
WHO	World Health Organization
WSCG	Women's Savings and Credit Group

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

EXECUTIVE SUMMARY

In South Asia, women play a significant and dominant role within the household cooking sector. Generally women do most of the cooking and, therefore, are disproportionately affected by household air pollution (HAP) caused by the inefficient burning of solid biomass cooking fuels. They are also required to spend a significant amount of time and effort collecting the traditionally used biomass fuels, a physically draining task that can take up to 20 or more hours per week.

The governments of India, Nepal, and Bangladesh have recognized that the burning of solid biomass fuels in household kitchens is a significant environmental and health problem in their respective countries and that women can play a key role in efficiently and effectively overcoming this problem. The Global Alliance for Clean Cookstoves (GACC, also referred to as the “Alliance”) has also recognized the central role that women play in meeting its sector-wide target of 100 million households adopting clean and efficient cookstoves and fuels by 2020; and that achieving this goal is dependent on the full inclusion of women throughout the entire value chain (GACC n.d.). This research was commissioned by the Alliance to help build a body of evidence around gender, economic empowerment, and livelihoods in the improved cookstove (ICS) and fuel sectors within South Asia.

This study aims to analyze the gender impacts of clean cooking solutions on households that have adopted them, as well as women’s current and potential involvement in ICS market systems in each of the three South Asian countries. This study focuses primarily on improved biomass cookstoves, but also analyzes the use of other cooking solutions, including kerosene and liquefied petroleum gas (LPG). Efforts have been made to generate recommendations on women’s involvement in ICS market chains that can effectively reach the “last mile” households in South Asia. To this aim, surveys were administered in 613 households in Karnataka, Himachal Pradesh, and Odisha states in India using household survey tools. In addition, focus group discussions (FGDs) were carried out in 33 locations with 547 people, as well as key informant interviews and semi-structured interviews with 52 people in the 3 locations in India. Detailed literature reviews and key informant surveys were carried out in Nepal and Bangladesh, and workshops were carried out in 5 locations in 3 countries to elicit additional input from relevant local stakeholders.

The research indicates that, except for a few exceptional cases, the uptake of ICS contributed to fuel saving and the reduction of household air pollution (HAP). This leads to the reduction of drudgery through reduced fuel collection, as well as time saving and health improvements leading to a range of benefits for women. On average there is a 28.1% reduction in firewood consumption due to the use of an ICS compared to a traditional cookstove (TCS). Firewood collection requires significant time, with the TCS user household (HH) spending around 660 hours per year on average for firewood collection compared to 539 hours/year/HH time by an ICS user household (equating to 122 hours/year/HH of time saving). For firewood collection, there is greater involvement of women as compared to men. On average, in a TCS user household, 56.7% of the time required for fuel collection falls on women, equating to around 374 hours per year, compared to 286 hours for men. However, women who use ICS spend only 305 hours on fuel collection, saving approximately 70 hours per year.

Despite this success, the acceptance and availability of ICS still remains a significant issue in South Asia. The results also indicate that there is a comparatively higher adoption of ICS and Biogas-LPG-electricity-natural gas (BLEN) stoves by women-headed households compared to men-headed households. Higher adoption of ICS was also found amongst households with a literate head of the household compared to an illiterate head. However, no significant difference in ICS adoption was observed with respect to the education level of the cooks. This indicates that in joint families, women cooks have little role in making decisions with respect to investment in stove and fuels. The use of clean cookstoves (ICS and BLEN) was also found to be highest amongst middle-income groups of households followed by the richest household group. The adoption of ICS is significantly higher among women who are members of social groups as within social groups, women have the opportunity to interact with other members, allowing them to exchange information about the quality of ICS products, as well as confirm the benefits of particular brands leading to their adoption. Except in a few cases, most users are happy with the performance of the ICS they are using. The research also showed that the main source of information for women on clean cookstoves in the surveyed locations was from government-run ICS projects and non-governmental organization (NGO) staff.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

In areas where ICS are available, many households were found to still be using TCS, with the one of the main reasons being the inability of the ICS to meet other uses of cookstoves such as cooking with large pots, baking *roti* bread, drying cereals and meats, etc. Many families still use TCS even when they are using LPG or an ICS, with stove stacking found to be quite prevalent in most regions. The availability of “free” firewood was also found to be a potential barrier to more widespread adoption of clean cookstoves, as households do not directly benefit from fuel purchase savings. In the surveyed locations, the majority (82.8%) of the households collect the required firewood themselves, with about 8.5% collecting as well as purchasing fuels, and only 2% being dependent on purchased firewood only. The surveys included a range of stove types and it was reported that some of the so-called ICS are not performing very well, therefore creating a negative impression of ICS in general. This further highlights the importance of ICS performance testing and tier rating awareness to overcome this issue. Additionally, stronger after-sales services such as warranties and maintenance, and adequate orientation and awareness of users for proper handling of ICS are also very important to increase household confidence in ICS usage.

Gender stereotypes with respect to household tasks and responsibilities was still found to be prevalent; cooking is almost entirely carried out by women, requiring on average about 4 hours a day for cooking using a TCS. There is an average a time saving of 30 minutes (12.5%) per day using a biomass ICS and 1 hour 10 minutes (29.2%) per day through a BLEN cookstove. This saved time was found to contribute to women’s increased involvement in social and family activities, including activities to give more time to their children, more time to agricultural activities, attending community meetings, meeting friends and relatives, and other social activities such as watching television while knitting. It was reported that mothers who use ICS are able to devote more time to preparing their children to go to school and monitoring their studies. Likewise, due to the reduced drudgery and time saving, women require less support from their children for household chores and fuel collection. The survey results also report that clean cookstove user households were more likely to send their children to school than traditional cookstove user households.

Key family finance-related decisions, including purchasing of significant assets and lands, taking out loans, selecting the children’s school, and health treatment expenditure were found to all be made by men. Decision-making by women was generally found to be limited to kitchen utensils and what food to cook. A significant difference was also found between the priorities of men and women; ICS and fuels did not fall within the top five priorities of men, while it was only the fifth most important priority of women in the surveyed locations. However, family health was found to be the second most important priority for both men and women, indicating both men and women are worried about the environmental conditions they are living in, but they do not directly relate any health benefits to the increased usage, and resulting improved environmental conditions, of ICS and BLEN. Evidence suggests that there is a need for large-scale awareness programs to clearly make the connection between ICS and health benefits for the users.

The health problems reported to be related to HAP included asthma, chronic coughing, severe headaches and fever, eye discomfort, weakness, fatigue, strokes, and heart disease.¹ As women, and often small children, have to spend a considerable part of their days in the kitchen, they are the most affected by these ailments. Compared to the TCS users, significantly fewer ICS users reported having respiratory illnesses during the last year, however this did not seem to directly result in any reduction in health expenses and working day losses due to these changes. It is believed that the reduction of health costs and day losses are due to the reduction of chronic illnesses due to long-term reduction to HAP exposure. The use of ICS for a period of only two to three years does not appear to lead to noticeable reduction in chronic illnesses, although this may need to be investigated in more detail.

To ensure the development of a vibrant market for a range of technologies it is important to support the entire market system surrounding household cooking technologies. This includes the ICS market chains, the required supporting inputs, services, and finance, as well as the enabling environment factors, which all need to be in place and functional. Broadly, the market chain for improved cookstoves can be divided into three main models:

- i) Model 1 – Local on-site construction and installation of ICS
- ii) Model 2 – National factory produced ICS

¹ <http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

iii) Model 3 – Internationally produced ICS

Model 1 ICS market chains in Nepal and Karnataka, India, significantly involve women, but this is not the case in Bangladesh and the Himachal Pradesh and Odisha states of India. Women's involvement in Models 2 and 3 ICS value chains was found to be very low in all surveyed countries and states of India. Despite the potentially good economic prospects within the sector, the overall involvement of women in ICS value chains is very low due to a number of socio-cultural and economic constraints. Currently, the majority of women lack the skills and flexibility to work in manufacturing and after-sales service of most ICS value chains. Women also prefer to work in locations closer to their homes, which is generally not compatible with most ICS companies.

To establish more sustainable ICS markets in the region, there is a need for access to a number of support services, including:

- i) National cookstove testing protocols, facilities, and quality assurance mechanisms
- ii) Appropriate design facilities and research
- iii) Capacity building support
- iv) Access to finance (for consumers and entrepreneurs)

Although there have been efforts to strengthen these services, evidence suggests that they are still not yet at a desirable level to transform the ICS sector in South Asia. While different organizations are carrying out field testing of stoves, there is lack of uniform national testing methodologies. Likewise, there are limited appropriate design facilities and research centers conducting research and development of new cookstove designs. Mostly these services have been limited to donor-led programs and large, multinational private companies. Women's involvement within these design facilities and research institutions has generally been very limited. As the primary users of cookstoves, women have better knowledge about their needs and should be involved more systematically within the entire market system of ICS. Women's perspectives could play a central role in product design, quality assurance, research, capacity building activities, and increasing access to finance.

There have been some efforts to build the technical skills of women in ICS production, but it has not included or led to supporting women in establishing new ICS enterprises. To date, there has been a lack of long-term, women-focused training programs, incubation support to women entrepreneurs, and provision of follow-up services and resources to encourage women to be a part of ICS and fuel value chains. In addition, women entrepreneurs have limited access to finance. Generally, men control the family finances and make decisions regarding the management of assets and land. This lack of asset ownership results in a lack of collateral: one of the more significant obstacles encountered by women entrepreneurs trying to access loans for starting businesses.

Another reason for the low involvement of women within ICS value chains is the absence of well-established and sustainable markets for stoves. In many cases, cookstove production is only carried out informally in South Asia, with ICS production only taking place after an order has been placed, as opposed to production on a regular basis. Consequently, many ICS fabrication units prefer to employ part-time staff, which does not appeal to many women. The research highlights that unless a woman is well-educated, from an urban background, and is mobile (owns and drives a vehicle), she is usually unable to overcome the social constraints and cultural barriers to establish a new enterprise to manufacture, distribute, and/or sell ICS, a market almost completely dominated by men in most parts of South Asia.

It is believed that more active engagement of women within ICS and fuel value chains can help generate demand, allow more appropriate products to be designed, and increase their adoption and use. To achieve this, specific gender-sensitive energy interventions and policies should be developed that effectively address women's basic energy needs and labor activities, as well as the related income, time-saving, and improved health outcomes. In addition, the effective promotion of women within ICS enterprises requires the development of a favorable environment supported by policies, capacity building support and access to supplier finance. To establish more sustainable markets for clean cookstoves in South Asia with the more active involvement of women, there is a need to remove existing barriers, provide incubation support to women cookstove entrepreneurs, and provide holistic support from, and coordination between, public, private and civil society organizations throughout the region.

1. INTRODUCTION

1.1 Background

Inefficient cooking practice in developing countries results in significant environmental and health problems. More than 3 billion people worldwide, mostly from developing countries, still depend on solid fuels, including biomass (in particular firewood, dung, and agricultural residues) and coal, to meet their basic energy needs such as cooking, boiling water, and space heating, particularly in high altitudes (WHO, 2006). According to the World Health Organization (WHO) 2014 estimates, indoor air pollution was linked to 4.3 million deaths globally in 2012, in households cooking over coal, firewood, and biomass stoves. However, the problem continues to grow—the International Energy Agency (IEA) estimates that by 2030, 100 million more people will be using traditional biomass fuels than do so today, considering the current rates of usage and growth.

Over the last three decades, South Asia has seen a proliferation of mainly government-led programs for ICS solutions, with a general shift from grant-assisted household energy programs to more commercial approaches. This has led to an increasing focus on marketing and promotion of ICS and biogas by NGOs, private entrepreneurs, and microfinance providers. Despite the progress made, the appropriate technologies are still far from meeting the needs of the people due to various reasons including gender issues. The estimated percentage of solid biomass fuel users is still around 89% in Bangladesh, 66% in Pakistan, 67% in India, 75% in Sri Lanka, and 74% in Nepal. Only 40% of households (23% in rural areas) have access to non-solid fuels in Southern Asia (SE4ALL 2013).

In South Asia, women play a significant role within decentralized energy systems, as part of their subsistence and productive tasks, including fetching fuel, fodder, and water for homes and engaging in micro-enterprises. Gender roles and inequalities impose differential costs on family members, with women bearing the majority of the negative effects of fuel collection and transport, household air pollution, and the use of time-consuming and unsafe cooking technologies (Clancy, Skutsch, and Batchelor 2002). Collecting traditional fuels is a physically draining task that can take from 2 to 20 or more hours per week (UNDP n.d.), which could alternatively be spent on child care, education and other self-improvement activities, socializing or income-generating activities. Premature deaths and work day losses due to HAP-induced illness in the region are very high. The WHO has attributed around 660,900 annual premature deaths in the region to HAP from inefficiently burning solid biomass fuel in kitchens (WHO 2009).

The legal frameworks in South Asian countries support gender equality, but in practice women lack awareness of their rights and have lower access to productivity-enhancing resources (e.g., credit facilities, information, and training) compared to men, and are poorly represented in decision-making at all levels in the energy sector, including household cooking.

1.2 Rationale of the Study

The Alliance and its members believe that the scope and severity of the impact of traditional cooking practices on the health and environment of nearly half of the world's population—in particular girls and women—necessitate an immediate and concerted response from global research, policy makers, implementing organizations, and the donor community. There is evidence from many developing countries that women's needs, views, and participation have persistently been excluded from energy policy and practice (Cecelski 2004, Clancy et al. 2014, Cecelski and CRGGE 2006, Lambrou and Piana 2006, Practical Action 2010, Kohlin et al. 2011). The lack of sex-disaggregated data regarding energy use, supply, and impact is a major hindrance in applying effective methodologies and tools for incorporating a more balanced gender perspective in project design and implementation (UNDP 2007), which this report aims to start to address.

The Alliance's partners believe that the use of cleaner cookstoves and fuels can have many varied benefits for women and their families. Likewise, women have the potential to play an important role in accelerating

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

the adoption of clean cooking solutions. It is also widely believed that the adoption rate of ICS by households is likely to increase if women are more involved in awareness and promotion, but there is still a lack of research evidence that clearly defines the potential level of impact women's involvement can have within the sector. The Alliance recognizes the central role women need to play in meeting its sector-wide targets of 100 million households adopting clean and efficient cookstoves and fuels by 2020; and achieving this goal is dependent on full inclusion of women throughout the entire value chain (GACC n.d.). Within this context, the Alliance commissioned PAC and its partners to carry out a research project to help build the body of evidence on gender and economic empowerment and livelihoods within the ICS and fuel sectors in South Asia.

Focused research on gendered aspects of the supply and demand of clean cookstoves in the South Asia region can provide important evidence of the potential impacts of clean cooking solutions on women, economic empowerment, and livelihoods, as well as the development of more effective strategies for scaling up a range of ICS technologies. It is intended that the findings of this study will be able to better substantiate the benefits of gender equity within the development and adoption of policies related to clean cookstoves within the region. It is hoped that this will then result in the development of new appropriate implementation programs to increase the adoption of clean cookstoves by households and communities in the South Asia region and beyond.

1.3 Objective of the Study

This study aims to analyze the impacts of clean cooking solutions on women in the South Asian countries of India, Bangladesh, and Nepal. It aims to address a number of gaps and needs in the clean cookstove market system from a gender perspective. It is focused primarily on improved biomass-based cookstoves, but also analyzes the use of other cooking solutions, including kerosene and LPG. The specific objectives of the study are as follows:

- Analyze the impacts of clean cookstoves adoption on women users and their families with respect to overall quality of life, livelihood enhancement, and gender equity.
- Analyze impacts of women entrepreneurs' involvement in the ICS market system in terms of:
 - On-the-ground feasibility of women taking an active role in various areas of the ICS value chain from material collection to production, marketing, and distribution.
 - Women's contribution in the ICS market chain with respect to women's specific skills in marketing and social mobilization, and the resultant influence on adoption rates, sustained use, and project effectiveness.
 - Impact of women's economic activity within ICS businesses on their quality of life, livelihood enhancement, and their positions in their households and society.
 - Opportunity costs and benefits to women entrepreneurs in ICS value chains.
- Collect, compile, and analyze best practices on the creation of livelihood opportunities for women and how to overcome key barriers on women's involvement in a range of areas.
- Understand the complete process of ICS adoption and use from a gender perspective, in terms of women's preferences in cookstove design, their gender roles (women are generally in charge of using the stoves and fuel collection, while men often control the family finances and make household decisions, particularly on whether or not to purchase ICS), effectiveness of cookstove technology information channels in reaching women, and implications on efficient and low emissions cookstove use and maintenance.
- Generate and disseminate recommendations for innovative distribution models that help reach the "last mile."

This research aims to document evidence on how, and to what extent, clean cooking solutions have impacted women and how they are adopting clean cookstoves.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Efforts have also been made to analyze women's involvement in the ICS market system and to identify the barriers that limit their increased ability to engage in economic opportunities within the ICS market system. The research focus and rationale is outlined as follows:

- Better understanding of the primary cook's needs, preferences, and constraints. Women are key to increasing awareness and generating demand for new cooking technologies and can help raise awareness about the dangers of HAP.
- Documenting cultural sensitivity in cookstove adoption. If the customers' needs with respect to their cultural context are not respected, they won't use a new cookstove.
- Gathering information about women's networks and relationships, which can influence the adoption of ICS and its scale.
- Documenting long-term impacts of clean cookstoves on women. Freeing up women's time and energy from subsistence tasks such as gathering firewood can enable women to have more time for leisure and self-improvement. Experience shows that 'new' income earned is typically reinvested in children's education and business development. If freed from assisting mothers in subsistence chores, children—in particular girls—can go to school.
- Analyzing women's ability to engage in income generation, as many enterprises become viable once there is sufficient demand and access to reliable energy resources.
- Analyzing the ability of clean cookstoves adoption to empower women. Where empowering women can lead to increased decision-making roles of women and their increased involvement to gain technical knowledge.

The report aims to generate concrete evidence to develop specific policy recommendations that are focused on improving the performance and uptake of cookstoves, in addition to establishing sustainable national and global clean cookstove market systems with the active participation of women. This can then be used to develop future improved cookstove programs in the region, with all relevant organizations, including donors, NGOs, private sector companies, and financial service providers, including carbon finance developers.

2. LITERATURE REVIEW

2.1 Household Energy, Gender, Livelihood, and Health Impact of Stoves

Energy is considered to be one of the basic human needs, playing a major role in improving people's well-being and reducing poverty. Even so, 2.6 billion people do not have access to clean cooking facilities. For many of the world's poor the primary source of energy readily available and affordable to them for cooking and space heating is "traditional biomass,"² which includes firewood, crop residues, and animal waste. As these generally burn quite inefficiently, solid, unprocessed biomass fuels are the most polluting fuels and, therefore, lie at the bottom of the energy ladder. The majority of households in South Asia are still dependent on such solid unprocessed fuels, specifically biomass and coal, to meet their cooking, boiling water, and heating needs.

According to the Sustainable Energy for All (SE4ALL) initiative (unpublished 2013) only 9% of households in Bangladesh, 36% in Pakistan, 42% in India, 25% in Sri Lanka, and 18% in Nepal are using non-solid fuel for cooking (2010 data). The majority of households still use open fires or poorly performing stoves, most often with inadequate ventilation, creating high levels of HAP, which predominantly women and young children are exposed to on a daily basis. Current forecasts show that the use of biomass as the main cooking fuel is expected to remain at significant levels in the near future.

There is also a strong link between energy poverty and income poverty. Burning unprocessed solid biomass contributes to multiple deprivations of poverty, including economic, socio-cultural, and ecological aspects. These socio-economic and cultural deprivations have an important influence on human capabilities, mainly for women, limiting their opportunities and production capacities (e.g., limited time and labor for production and social activities and access to decision-making) (Ramani 2000, Mahat 2004, Moghadam V. M. 2005). The United Nations Development Programme's (UNDP) Multidimensional Poverty Index (MPI) considers cooking fuels to be one of the ten indicators for measuring poverty, and households cooking with wood, charcoal, or dung are considered to be deprived. According to the MPI, South Asia leads the world in poverty, housing between 52% and 62% of the bottom billion. Bangladesh has 57.8% of people who are MPI-classified poor; Nepal has 64.7%, and India 53.7% (Afghanistan, no data; Pakistan, 49.4%; Bhutan, 27.2%; Maldives, 5.2%; Sri Lanka, 5.3%) (Alkire et al. 2011). The MPI reflects the inextricable linkages of poverty and cooking fuel.

Open fires and rudimentary cookstoves are generally inefficient, unhealthy, and unsafe due to the inhalation of the acrid smoke and fine particulates they produce (GACC 2011). Recent WHO (2014) estimates indicate that indoor air pollution is linked to 4.3 million deaths in households cooking over coal, firewood, and biomass stoves (analysis based on 2012 data). A large proportion of households remain dependent on traditional biomass fuels for cooking within South Asia, which is a major household need and one which has received minimal support and investment considering its importance. The following section details recent HAP figures for each country assessed:

Nepal HAP: HAP in Nepal was found to be the highest in kitchens having traditional stoves and using solid biomass fuels (PM₁₀ level 2127 µg/m³) (Joshi S. 2006). According to ENPHO (2008), the average 24-hr mean PM_{2.5} concentration in Nepalese kitchen is 2127 µg/m³ with TCS, and with ICS it is 728 µg/m³. The average 24-hr mean CO concentration with the TCS is 22.2 ppm compared to 8.3 ppm with the ICS. The average percent reduction of the IAP concentration with ICS compared to TCS is 65.7% for PM_{2.5} and 62.3% for CO.

Bangladesh HAP: Poor households in Bangladesh depend heavily on firewood, dung, and other biomass fuels. A study by Dasgupta et al. (2004) concluded that HAP is dangerously high for many poor families in

² Traditional biomass refers to solid biomass that is combusted in inefficient, and usually polluting, open fires, stoves, or furnaces to provide heat energy for cooking, comfort, and small-scale agricultural and industrial processing, typically in rural areas of developing countries (REN 21 2013).

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Bangladesh. Concentrations of respired airborne particulates (PM₁₀ of 300 µg /m³ or larger) are common in households sampled, implying the widespread exposure to a serious health hazard. The econometric results also indicated that fuel choice significantly affects indoor pollution levels, with natural gas and kerosene being significantly cleaner than biomass fuels.

India HAP: In India, measurements of HAP concentrations from burning solid cooking fuels in kitchens of rural households were estimated to be, on average, 455 µg/m³ (Balakrishnan et al. 2013). The study estimated daily average exposure to PM_{2.5} was 285 µg/m³, 337 µg/m³, and 204 µg/m³ for children, women, and men, respectively.

HAP is responsible for over 1.3 million deaths per year in Asia. Of these, almost half of the deaths occur in South Asia (Colbeck I. & Nasir Z. A. 2012, based on WHO 2009 data). Every year around 488,200 persons in India, 8,700 persons in Nepal, and 49,400 persons in Bangladesh die prematurely due to illnesses related to household air pollution from solid biomass fuel burning in kitchens, mainly women and children (WHO 2009).

As women cook and small children (usually less than five years of age) spend most of their time in the kitchen area, these two groups are the most vulnerable to HAP. Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary diseases (COPD), such as chronic bronchitis or emphysema, than women who cook with electricity, gas, or other cleaner fuels. The use of coal doubles the risk of lung cancer, particularly among women. Moreover, studies have linked exposure to indoor smoke to asthma, cataracts (Pokharel et al.), tuberculosis, blindness, and adverse pregnancy outcomes (in particular low birth weight) (Misra et al. 2004, Smith 1999), as well as ischemic heart disease, cataracts, interstitial lung disease, and nasopharyngeal and laryngeal cancers. It has been estimated that the improved access to modern cooking fuels has the potential to avert between 0.6 million and 1.8 million premature deaths, on average, each year until 2030, including between 0.4 million and 0.6 million deaths per year of children under the age of five in sub-Saharan Africa, South Asia, and Pacific Asia (Pachauri, S., N.D. Rao, Y. Nagai and K. Riahi 2012).

According to an Indira Gandhi Institute of Development Research (IGIDR) study (Laxmi et al. 2003), the health impacts of the use of biomass fuels are quite high for adult women. Since HAP is concentrated in the kitchen, mainly affecting the health of women, and considered a low health priority, these impacts are often unavoidable and tend to be ignored. It has been estimated that the losses incurred because of cooking fuels, including work days spent, expenditure on illness, and lost working days due to illness are estimated at Rs 29 billion/year in rural Rajasthan. In addition, evidence from Himachal Pradesh, India, has shown that girls under five and females in the 30–60 age group have a higher proportion of respiratory symptoms than males of similar age groups (Parikh 2011).

However, the use of traditional stoves and biomass fuels not only contributes to negative health impacts for women, but also contributes to increased drudgery and loss of time due to the collection and transportation of biomass fuels. Usually women are involved in firewood collection in South Asia, outlined as follows:

Nepal: On average, there are 18.3 *bharis* (headloads of about 30 kg on average) of firewood collection per capita per year in Nepal. On average, a household spends 5.01 hours collecting one bhari of firewood in Nepal (Baland et al. 2008).

India: In Himachal Pradesh, women walk 30 km each month on average, over hilly terrain, often at high altitudes, taking an average of 2.7 hours per trip for firewood collection. During these trips they undergo stress including stiff necks, backaches, headaches, and loss of workdays. In addition, they experience dangerous encounters with wild animals, including the possibility of snake bites (Parikh 2011). In India, women devote between two and seven hours each day collecting fuel for cooking (UNDP, UNDESA and World Energy Council 2002, IEA, 2002), which could alternatively be spent on child care, education,

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

socializing, or income-generating activities. In Rajasthan, women often walk between one and two km per day to collect firewood (IRADe 2009). A study by Barnes and Sen (2004) shows that in rural India, women spend about 40 minutes per day collecting fuel, and almost three hours cooking.

Bangladesh: The BRAC 2011 report shows that women in Bangladesh are the dominant individuals involved in cooking and related preparations. Nearly one third of a woman's day is spent on cooking alone. Indeed, women spend between six and eight hours in the kitchen daily and three to four of those hours cooking.

Both women and men are involved in firewood collection, but to varying degrees, with women often doing the majority of the collecting. This fuel labor allocation between men and women, and between sources of fuel, has been shown to be responsible for shadow wages, as well as for reinforcing cultural norms (Köhlin G. et.al. 2011). The fuel-related burden experienced by women in developing countries has been shown to hinder their social and economic progress and to have long-lasting impacts when personal and social development opportunities are lost. When women are overburdened with such tasks, they are more likely to keep their daughters at home, away from school, to assist with household activities like fuel and water collection (UNDP 2001). Access to clean, reliable, and appropriate energy services for cooking and other household activities directly reduces time spent on these activities. Less time spent on basic subsistence activities coupled with access to modern energy services could contribute toward other income-generating activities, both within and beyond the household. More efficient productive work and savings in both energy and health expenditures could improve household economies, which again could lead to improved access to education and the empowerment of both young girls and boys (Norad 2011 and extracted from ADB 2013).

Simple and cost-effective cleaner energy technologies could have a positive effect on the lives of the poor, especially women and children. However, meeting the needs of poorer communities requires providing services that are practical, culturally appropriate, and affordable. Energy interventions can have significant gender-equality benefits, which can be realized through carefully designed and targeted interventions, based on a context-specific understanding of energy scarcity and household decision-making. In most developing countries, for example, electricity is not typically used for cooking. Therefore, it is not considered as a direct substitute for traditional cooking technologies and fuel sources, and it is unlikely that will change in the near future. Thus, there are significant potential health gains, particularly for women and children, from effective dissemination of biomass ICS or other modern energy technology for cooking and heating such as LPG (Köhlin G. et.al. 2011). Increased income and greater control over household resources for women can enhance a country's growth prospects by changing spending patterns in ways that better benefit children. Improvements in women's education and health have been linked to better outcomes for their children. Greater gender equality can enhance productivity, improve development outcomes for the next generation, and make institutions more equitable from a gender perspective (World Bank 2012). Taking a gender approach in policy and implementation is necessary to achieve the target of universal access to energy by 2030 (Energia n.d.).

2.2 Gender and Stove Adoption

Systematic scientific research and dissemination of ICS started in South Asia in the 1980s. Despite significant and prolonged efforts by governments, NGOs, and donor agencies, the demand for ICS has not been increasing at a significantly high level in South Asia. There is a need for greater awareness building, particularly targeted at women and school children (Rahman L. 2010). The impact of interventions designed to promote energy access depends on household decision-making, and in particular, women's preferences, opportunity costs, and household welfare status. Realizing the full potential of ICS interventions therefore requires that their designs are based on a context-specific understanding of energy usage and how household energy decisions are made (Köhlin G. et.al. 2011). Women can play a central role in the increased adoption and use of clean cooking solutions due to their lead responsibility as cooks and

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

managers of households. As women often excel in entrepreneurial activities and can leverage their existing networks for distribution, marketing, and sale, they can play a unique role within ICS and fuel value chains, when they are given the opportunities and required support. Kelkar and Nathan (2005) state that the opportunity cost of women's time is an important factor, and as long as women's participation in income-earning activities is low, there will continue to be a heavy reliance on collected rather than purchased fuel, and a rural fuel transition is unlikely to occur. Indeed, many believe it is not possible to design effective and appropriate clean cookstove and fuel solutions without the full participation and input of women. It is therefore important to identify gender-focused empowerment activities required to sustainably develop clean cookstove and fuel markets, as well as to ensure that women are economically empowered within these emerging and growing markets (Banerjee A. & E. Duflo 2007).

It is also important to note that socio-cultural barriers often prevent many women from accessing and engaging within improved cookstoves and fuel markets (Köhlin G. et.al. 2011). Likewise, the lack of knowledge about the costs and benefits of improved cooking technology (Mohamed 2003, Malla 2009), income levels of households, and lack of effective monitoring systems of cookstove programs are all believed to be contributing factors for slow adoption rates of ICS in many developing countries. A study in Sudan by Muneer and Mohamed (2003) concluded that the level of education of women and their awareness of the relative advantages of improved cookstoves are the most important factors for increasing cookstove adoption.

It is also important for stakeholders to recognize that stoves are not a "one-size-fits-all" technology; each region, country, community, and even individual households, may have unique cooking needs that can often only be met by different ICS technologies, and often the use of several technologies for different tasks. A study in Haryana, India, shows that certain tasks such as the simmering of milk and the preparation of animal fodder were generally not believed to be effectively accomplished using advanced cookstoves, but required the use of traditional stoves (Mukhopadhyay R. et al. 2012). The SE4ALL initiative (2013) suggests the inclusion of a measure of the "convenience factor" of a stove, as well as its technical performance, to obtain a comprehensive measure of its level of access. The time and effort invested in cookstove preparation and cleaning, as well as comfort and ease of using the stove itself, are also important dimensions to consider. It is therefore important to work with women's groups during the design of new cookstoves to determine the unique attributes that might be relevant or desired by the women using the stoves. Women, as managers and users of stoves and fuels, have a central role in increasing the adoption and use of a range of new ICS technologies. Without understanding their needs or effectively involving them, ICS scale-up is unlikely to be successful. The Alliance is currently engaged in various activities relating to the design and testing of ICS, including laboratory and field testing protocols, as well as bringing together all ICS testing results that have been determined within a clean cooking catalogue. Further work on ICS testing is underway, including the capacity building of local stakeholders in a number of countries.

As evidence has shown that energy poverty has distinct gender characteristics, with a disproportionately negative effect on women and girls, this needs to be factored in by energy planners when considering pro-poor and pro-women interventions, including who makes the decisions about energy within the household, and who benefits (Practical Action 2010). There is a great need to collect further evidence around gender, economic empowerment, and livelihoods with the ICS and fuel sectors. The Alliance is committed to pulling together collective action, including training, financing, and stove standards to provide people with the tools and the resources they need to overcome the problems of inefficient cookstove use (Coleman et al. 2010).

2.3 Women Involvement in the Cookstove Value Chain

As noted, evidence suggests that women need to play a critical role within ICS and fuel value chains. They need to be consulted during research, product design and development, as well as included in the market chain, in consumer financing, and in distribution and retail of ICS and cooking fuels where possible. When engaged and supported appropriately, women's increased involvement in value chains can lead to

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

increased access to female markets and increased sales (Coleman et al. 2010). Investments in increasing women's access to enterprise development of energy services can also contribute to their economic empowerment. When a woman is given an opportunity to earn income, it has positive impacts on many other areas of her life outside of the clean cooking sector, including the health, education, and wellbeing of her family. Studies have shown that women reinvest 90% of their income in their families and communities, while men reinvest only 30 to 40%; highlighting that the economic empowerment of women reaches far beyond the individual (Borges 2007).

Women's networks can open doors for new cooking products and provide access to consumers in hard-to-reach markets. Women entrepreneurs in less-developed economies are more likely than men to be motivated by necessity. Although the networks of women entrepreneurs and business owners are generally smaller and less diverse than those of their male counterparts, they tend to draw more on their personal relationships over other sources and, as a result, are able to reach women who cannot easily access cities or markets (Brush et al. 2011).

However, there are several common constraints that can slow women's involvement in the clean cooking market sector either as employees of an ICS business or as entrepreneurs. These constraints are important to understand and are summarized as follows:

- i) Women often cannot access affordable financing
- ii) Women lack access to formal education and business training
- iii) Women lack access to a variety of market actors and intermediaries, as well as valuable market data
- iv) Women often lack mobility
- v) Women face discriminatory cultural and gender norms that can limit opportunities to grow their businesses (GACC n.d.).

In addition to the general barriers women face when involved with a business, women entrepreneurs face an extra set of challenges that can be exacerbated by the size and nature of their business, the socio-demographic background of women entrepreneurs, and their geographic location (IFC 2011).

In Bangladesh, the major barriers of women's involvement and empowerment were identified as the lack of awareness on ICS and its benefits of adaptation, social or familial constraints, non-affordable price for many users, low quality of ICS, lack of after sales service, less participation of women in the male headed entrepreneurship, women's limited mobility, lack of female headed entrepreneurship at local level, lack of financial support to start ICS business, attitude towards women, dominant role of rural power structure and institutions (Dey N.C. 2013). Empowerment of women is a key measure that will address the issue through better awareness. Their participation will guide and improve decision making process to achieve the desired goals (Practical Action. 2009).

2.4 Gender Perspectives of Household Energy Policies and Programs in South Asia

The governments in Nepal, India and Bangladesh have recognized the importance of household air pollution and household energy efficiency related issues. Within these countries, specific policy level efforts are in progress to mitigate the problems, summarized as follows:

Nepal: The government of Nepal has been promoting cleaner cooking solution since its 7th National Plan (1985-90). Concerted efforts were initiated in early 2000 with the National ICS Programme, later changed to the Biomass Energy Support Programme, which focused on mud stoves. In 2013, the government announced its commitment to "Clean Cooking Solutions for All (CCS4ALL) by 2017." With the multi-donor funded National Rural Renewable Energy Programme (NRREP, 2012-17) and the announcement of CCS4ALL, interest in biomass cookstove and HAP has increased sharply. The national NRREP program document mandates Gender Equality and Social Inclusion (GESI) mainstreaming in all its components,

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

stating that specific affirmative action should be planned, implemented, and monitored across all component activities. The aim is to empower women and marginalized groups through the enhancement of their technical capabilities and assist them in taking ownership of ICS technologies.

India: The central and state governments in India have developed various energy schemes and policies. However, the focus has mostly been on energy production (e.g., electricity) and its distribution. Although the government has initiated some major ICS programs, minimal effort has gone towards energy efficiency, particularly cooking options for vulnerable communities. This initiative gained momentum in the 1980s. Focus was given to biogas and ICS, primarily through incentivized and subsidized schemes. Institutions, including agricultural universities and branches of department of science and technology, started research and innovations in the field. Private ICS companies came on board later.

In 2009, the Ministry of New and Renewable Energy (MNRE) announced the National Biomass Cook-stoves Initiative (NBCI).³ NBCI's mission was to enhance "the availability of clean and efficient energy for the energy deficient and poorer sections of the country." The NBCI is designed to be structured differently from the earlier National Programme on Improved Stoves (NPIS), aiming to build on the successes and lessons learned from earlier initiatives. It includes a series of pilot projects using several commercially available improved cookstoves and different grades of processed biomass fuels to explore the deployment of a range of technologies, biomass processing, and delivery models leveraging public-private partnerships (PPPs). One of the components of the National Action Plan on Climate Change is the Green India Mission in which there is a mandate to increase biomass cover of forests by reducing use of firewood for cooking. However, these programs still lack explicit gender elements and do not outline a plan of action. This must be addressed going forward.

Bangladesh: The government of Bangladesh launched its Country Action Plan (CAP) for Clean Cookstoves at the end of 2013, providing a comprehensive five-year plan through 2018. The CAP outlines the necessary steps towards affecting change and providing interested parties opportunities to scale up the widespread adoption of clean cooking solutions in Bangladesh. The CAP has designed interventions to strengthen supply and enhance demand of the ICS market in Bangladesh with many women-focused interventions included for the first time. Although some of the targets have yet to be defined, the CAP has set indicators for measuring success, including health and livelihood improvement and women's empowerment.

There are a few promising breakthroughs with the potential to propel the sector to a 'tipping point', including: ICS designs that better reflect consumers' needs, more precise health and climate data detailing the harmful impacts of traditional cookstove use, innovative business models and financing mechanisms, comprehensive national programs, robust testing protocols, and inexpensive but effective monitoring devices. It is believed that a concerted and coordinated international approach amongst all the key stakeholders to create a robust market for clean cookstoves and fuels has the great potential for success (GACC 2011). The government, civil society organizations and private should work in parallel to develop pro-poor energy policy frameworks such as dissemination of improved cooking technologies. A study in Pakistan shows dire need of coordinated, consistent, and focused cooperation of all stakeholders on the supply and demand side (Jan I. 2011).

Although some research has been carried out on gender and cookstoves in South Asia, it has generally been focused on specific issues and limited to particular states or at the broad national level. Detailed and holistic analysis of cookstoves market systems from a gender perspective in South Asia is lacking. Likewise, gender-disaggregated data regarding energy use, supply, and impact has not been produced (UNDP 2007).

³ <http://www.mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/>

3. STUDY METHODOLOGY

3.1 Sampling, Study Area, and Data

Both qualitative and quantitative tools were used to collect the data presented within this report, including household surveys, focus group discussions (FGDs), workshops, key informant interviews, and semi-structured interviews. Based on the indicators included in Annex 5, questionnaires and checklists were prepared to collect the required information and data to meet the objectives of this study, included in Annex 6. Five types of survey instruments were used:

- Household survey questionnaire
- Checklist for FGD with ICS users and non-users
- Checklist for interview with entrepreneurs and distributors
- Checklist for interview with technician and promoters
- Checklist for interview with key stakeholders

In addition, secondary information was collected and cross-checked with the primary data. Short descriptions of the information and data source for this study are in the following sections. In this study, a range of types of ICS and biogas-LPG-electricity-natural gas (BLEN) stoves have been classified as “clean cookstoves” and/or “improved cookstoves” throughout the report.

The study was carried out in India, Bangladesh, and Nepal (see Annex 1 for specific study locations). Detailed surveys were carried out in Karnataka, Himachal Pradesh, and Odisha states in India, while only stakeholders’ consultations, assessments of the cookstove value chain, and literature reviews were carried out in Nepal and Bangladesh. Only learnings from the best case studies of the cookstove sector in Nepal and Bangladesh were captured. Brief introductions of the selected study countries are as follows:

India is the seventh-largest country by area, the second-most populous country with 1.2 billion population (2011 census), and the most populous democracy in the world. Bounded by the Indian Ocean in the south, the Arabian Sea on the southwest, and the Bay of Bengal on the southeast; it shares land borders with Pakistan to the west; China, Nepal, and Bhutan to the northeast; and Burma and Bangladesh to the east. Sri Lanka and the Maldives are located off the southern coast of India; in addition, India’s Andaman and Nicobar Islands share a maritime border with Thailand and Indonesia. India is a federation composed of 29 states and 7 union territories. The Census of India estimates that 833 million people live in rural India. Approximately 412 million of them live without access to electricity and 668 million people depend on traditional biomass for cooking. According to World Bank, 21.9 % of Indian population live below \$1.25 per day on purchasing power parity (PPP) (based on 2012 data).

Nepal is a landlocked country located in South Asia with an area of 147,181 sq km (56,827 sq mi). Nepal’s energy situation reflects the challenging terrain (over 75% mountainous) and very low income levels. The nation is among the poorest countries in the world. It has a population of 26.5 million, 83% of which live in rural areas. About 25% of the population lives below the poverty line, which varies by region, but averaged 19,261 NPR per year (0.75 USD per day) in FY 2010/11. Poverty rates between the different geographic areas vary significantly. Unemployment has been increasing in recent years, creating a “brawn and brain drain” for employment. Nepal is divided into three physiographic areas: Mountain, Hill, and Terai. Nepal is divided into 75 districts, grouped into five development regions. Nepal’s per capita annual energy consumption, at 0.34 tonnes of oil equivalent (toe) per capita in 2010, is one of the lowest in the world. Per capita energy consumption grew with an estimated Compounded Annual Growth Rate (CAGR) of 1.8% between 2006/07 and 2010/11.⁴ The primary energy consumption is mostly derived from traditional biomass, contributing to deforestation and Green House Gas (GHG) emissions.⁵ Furthermore, excessive

⁴ Calculated based on data from Economic Survey: Fiscal Year 2011/2012 (op. cit.).

⁵ Other major contributors are cutting of trees for timber, clearing land for agriculture, and livestock impacts.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

dependence on biomass leads to serious HAP-linked health hazards as well as inefficiencies in energy use. The majority of the nation's GHG emissions in 1994/95 came from land conversion, by a substantial margin over fuel use (1,465Gg net CO₂ emissions due to fuel use versus 8,117Gg net CO₂ emissions due to land use change).⁶ Traditional biomass resources supply about 85% of total energy needs, whereas commercial energy supplies 14% of the population. New renewables account for less than 1% of consumption (WECS 2010). For cooking, over 74% of households use traditional biomass stoves (CBS 2012), followed by kerosene and gas stoves (21%) mainly in urban areas; improved biomass cookstoves are currently only used by 3% of the population (NLSS 2010/11).

Bangladesh is located in southern Asia, bordered by India to the north, west, and east, Myanmar to the southeast, and the Bay of Bengal to the south. The country's total land area is 143,998 sq km and occupies one of the largest river deltas in the world. Its topography is comprised of fertile alluvial plains and an extensive network of rivers. Due to its unique geographic location, Bangladesh remains one of the world's most environmentally vulnerable countries and is susceptible to devastating cyclones and floods. From 1980 to 2000, nearly 60% of the worldwide deaths from cyclones occurred in Bangladesh.⁷ The effects of climate change are likely to increase, causing more frequent and severe cyclones and other natural disasters. Deforestation and the burning of biomass continue to contribute to the climate challenge in Bangladesh with the coastal areas experiencing the worst effects. With a population of approximately 152.5 million, Bangladesh is among the most densely populated countries in the world.

Energy shortage is the most critical infrastructure constraint on Bangladesh's economic growth. Presently, 62% of the total population has access to electricity (including off-grid renewable energy), mainly through government efforts. Compared to other developing countries power generation per capita is very low - only 321 kWh. The gap between electricity supply and demand in July 2012 was still 500-800 MW. There is still much to do for the energy poor population, especially the rural population. Biomass supply and demand accounts for 68% of primary energy consumption, and over 90% of household energy needs. Consequently, only about 10% of the population has access to modern fuels. Annual household biomass consumption is 44 million tons, or 79% of the country's total biomass consumption. Firewood constitutes 41% of the total biomass cooking energy with some 84% of households using firewood for cooking. Biomass is the dominant fuel source in Bangladesh, accounting for 90% consumption in rural areas and 60% in urban areas. In urban areas, natural gas usage is more prevalent given the presence of pipe networks and government subsidies, albeit many are not connected to the grid, and the supply itself is often unreliable. Similarly, electricity supply (rural and urban) is also unreliable, and access is often limited for many rural households. On average, 0.25 kWh of energy is consumed annually by a single household in Bangladesh.

Bangladesh has a large potential market for ICS, estimated at greater than 30 million households; however, only 510,000 stoves are thought to be in use, a penetration rate of less than 2% (ADP 2012).

3.1.1 Household Surveys

Household surveys were administered in 613 households in Karnataka, Himachal Pradesh, and Odisha states in India by TIDE, Jagriti, and RCDC respectively during June–October 2013 (Table 3.1). Sample households were identified using a stratified random sampling methodology to ensure the participation of different socioeconomic and agro-ecologic zones with the study. Under the household survey, information was collected on demographic characteristics, resources, skills, household characteristics, energy use, HAP levels, estimated income, health status, and gender role (survey instruments are provided in Annex 6). Interviews were carried out mainly with women cooks. The survey was carried out in three different

⁶ First National Communications to the UNFCCC (July 2004).

⁷ <http://www.cleancookstoves.org>

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

states of India—Karnataka, Odisha, and Himachal Pradesh—to capture data from a range of different agro-climatic zones and socio-cultural settings, fuel types, and cooking behaviors.

Karnataka: The state of Karnataka covers an area of 191,976 sq km (74,122 sq mi), or 5.83% of the total geographic area of India. According to 2011 census, the state population is 61,130,704 (31,057,742 males; 30,072,962 females). The rural population is 61.33% and the urban population is 38.67%.

Odisha: Odisha state is on the subcontinent's east coast, by the Bay of Bengal. It is surrounded by the Indian states of West Bengal to the north, Jharkhand to the northwest, Chhattisgarh to the west and Andhra Pradesh to the south. Odisha is the 9th largest state by area, and the 11th largest by population in India. Odisha is also the poorest state of India, and bears the ignominy of having the highest percentage of rural poverty. The total population of Odisha is 41,974,218 with 9,661,085 households. Its population density is about 269 sq km, with about 83.3% of the state's population residing in rural areas.

Himachal Pradesh: Himachal Pradesh (HP) covers an area of 55,673 sq km in the northwest of the country. It is nearly entirely mountainous, and according to elevation can be divided into three zones: the lower sub-tropical belt (including Shivalik Range) between approximately 400 to 1500 meters in altitude; the temperate mid-Himalaya up to about 3,600 meters elevation; and the trans-Himalaya which is above 3,600 meters and lies beyond the central Himalayan axis with cold desert conditions. The total population of Himachal Pradesh is 6,856,509 (Census of India 2011).

Within the states, the surveys were carried out in rural and peri-urban areas where families use solid biomass fuel for cooking. The three states were selected to include different weather conditions, food habits, and biomass availability for cooking in different locations as summarized in Table 3.1 below:

Table 3.1 Survey locations

States	Survey locations
Odisha, India	Balangir, Gajapati, Kendrapada, Mayurbhanj, Khordha, and Ganjam districts
Karnataka, India	Raichur, Gadag, Tumkur, Davanagere, Shimoga districts
Himachal Pradesh, India	Kullu district – 44 villages/hamlets

Attempts were made to capture data from as many different types of improved stoves being used in each state as possible. In most households, more than one type of cookstove is frequently used, so the study grouped households based on the main cookstove used, as summarized in Table 3.2 below.

Table 3.2 Number of surveyed households

Survey states in India	User HHs	
	TCS	Clean cookstoves (ICS & BLEN)
Karnataka	46	167
Himachal Pradesh	31	169
Odisha	89	111
Total	166	447

3.1.2 Focus Group Discussions (FGDs)

FGDs were held with women cooks and household heads in each the survey locations, with separate discussions with clean cookstove users and non-users, in a total of 33 locations with a total of 547 people (see details in Annex 8).

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

3.1.3 Interviews with Clean Cookstove Promoters and Technicians

Interviews were carried out with about 20 stove market actors, including producers and fabricators, craftsmen, and promoters of a range of ICS technologies and fuels to generate an in-depth understanding of their roles and the effectiveness of these roles, including women's involvement in ICS and fuel commercialization (see list of respondents in Annex 7). Likewise, the pros and cons of women's involvement in cookstove value chains were analyzed, in particular the impact on their lives, and those of their families and communities. Information was also collected on their present status, as well as the challenges and opportunities they face and their access to finance and other resources (Interview Checklist 2 in Annex 6).

3.1.4 Interviews with Stove Entrepreneurs and Distributors

Interviews were carried out with 12 cookstove entrepreneurs, suppliers, and distributors, including traditional cookstoves suppliers such as village potters (see list of respondents in Annex 7). Efforts were made to maintain an equal ratio of male and female respondents (Interview Checklist 2 in Annex 6).

3.1.5 Interviews with Stakeholders Supporting the Scaling-up of Stoves

Interviews were carried out with 22 key stakeholders, including government agencies and non-governmental organizations actively working on the promotion of ICS technologies in the 3 countries (Interview Checklist 2 in Annex 6 and list of respondents in Annex 7).

3.1.6 Literature Review

Literature related to gender, cookstoves, and health—mainly focused on South Asia—was reviewed to build upon the previous findings. Efforts were made to cross-check the secondary information from Nepal and Bangladesh with the primary data in the three regions of India.

3.1.7 Analysis, Draft Report Preparation, and Stakeholders Workshops

The collected data was cleaned, compiled, and analyzed per the major indicators of the study, summarized in Annex 5. Five separate reports were compiled from Odisha, Karnataka, Himachal Pradesh, Nepal, and Bangladesh, and the findings were shared with relevant stakeholders at five regional workshops, one in each of the three states in India, and one each in Nepal and Bangladesh, to collect their feedback. This was combined as this main report (Annex 4 summarizes workshop participants).

3.2 Definitions and Measurements

Cookstove types: In the survey areas the different types of stoves being used are summarized within Table 3.3 below, as well as their estimated tier of performance.

Table 3.3 Types of cookstoves in use in survey locations

States	Types of stoves in survey locations	Estimated Performance Tier
Odisha, India	Jeevan Jyoti (Envirofit)	3
	SPT 0610	3
	Arti, Annapurna	2
	ORKA	3
	Traditional cookstove (TCS)	0
	Kerosene stove	3
	LPG	4
Karnataka, India	Mud stove (traditional)	0
	Chulika ICS	3
	Gram Panchayat ICS	1
	Greenway ICS	3
	Envirofit	3
	Sarala stove	2
	LPG	4
	Kerosene stove	3

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

	Biogas	4
	Astra Stove	2
Kullu- Himachal Pradesh, India	LPG	4
	Kerosene stove	3
	Electric oven/stove	4
	Iron tripod/ three stone (traditional)	0
	Mud chula (traditional)	0
	Tandoor traditional	0
	Tandoor improved	2

Note: The above tier ratings are estimates based on the Global Tracking Framework methodology supported by the SE4ALL initiative (2013). These estimates were made on the basis of direct observation of the technical performance of the stove in terms of efficiency, indoor pollution, overall pollution, and the comfort, convenience, and adequacy in actual use. This was done to allow some form of comparison between the range of cookstoves assessed, but it is important to note that these need to be formally verified through both laboratory and field testing.

Income level: As the research team recognized it would not be possible to obtain accurate income levels directly based on their recent research experience, the income levels of households were instead estimated based on a standardized research methodology recently used in India, based on the holding of 13 types of assets. The households were divided into three income groups (poor, middle income, and rich), based on the holding of the following assets: television; electric fans/room heater; water filter; pressure cooker; radio; mobile phone; LPG cylinder; mixer/grinder; motorcycle; two wheeler moped / scooter; livestock; type of roof of the house; and land holding. Households with less than 5 types of assets were listed as poor; 5-8 types of assets were listed as middle income; and more than 8 types of assets as a rich household.

Education level: The education level of the interviewees was determined using seven levels: i) illiterate, ii) literate without any formal education, iii) primary level of grades 1–5, iv) lower secondary of grades 6–8, v) secondary levels of grades 9–10, vi) higher secondary level for grades 11 and 12, and vii) above higher secondary level.

3.3 Scope and Limitations of the Study

Detailed household surveys were administered in three states of India (Karnataka, Himachal Pradesh, and Odisha), along with a literature review and an assessment of the ICS market chains in Nepal and Bangladesh. However, as the South Asia region has diverse socio-cultural settings, climatic conditions, geography, fuel types, income, and cooking behavior, this limited survey was unable to accurately represent the South Asia region as a whole, although it provides important indicative data. This research is focused mainly on biomass cookstoves, but also analyzes the use of other cooking solutions including kerosene and LPG.

A range of types of biomass stoves being used in the survey areas have been grouped under the term improved cookstove (ICS), even though it is believed they have diverging performance levels, as there was a lack of adequate data for accurately determining their performance. As most stoves being used in the region have not yet been properly tested, their exact tier rating⁸ could not be accurately determined. Similarly, the data on household air pollution, cookstove efficiency, and health costs used within this study as reported by the respondents, was based on estimations without using specific testing protocols, which could not be included within this study. Likewise, the study is based on a stratified, random sampling to capture the data from a range of cookstoves users, with the number of users of ICS being higher (447) than non-users of ICS (166). Finally, due to the difficulty of getting the exact figures in monetary terms, income levels of households were indirectly determined through an assessment of 13 types of assets following an established methodology. The literature review in this study is also mainly focused on South Asian literature.

⁸ Tier rating is the categorization of stoves (recently developed through GACC and World Bank initiatives) based on their performance levels, including their efficiency, safety, and emissions, as well as comfort, convenience, and adequacy in actual use.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

4 CHARACTERISTICS OF THE SURVEYED HOUSEHOLDS

4.1 Household Size and Composition

The average household size was determined to be 4.8 persons per household. In Karnataka the household size is comparatively less than Odisha and Himachal Pradesh. There was no significant difference in the household size of users of traditional stoves (average 4.7 persons) and improved stoves or BLEN (4.9). A similar pattern was also observed in the sex ratios; the number of males is slightly higher to female in both cases—the sex ratio (male/female) is 1.4 with traditional cookstove user households and 1.3 in clean cookstoves (ICS or BLEN) user households (Table 4.1)—but this is not believed to be significant or relevant.

Table 4.1 Household Size and Composition (unit in number)

	ICS or BLEN	Traditional	t-stat
- Karnataka	3.9	4.2	
- Himachal Pradesh	5.0	5.5	
- Odisha	5.0	5.0	
Total	4.9	4.7	1.0
- Female	2.4	2.3	1.1
-Male	2.5	2.4	0.5
- Sex ratio	1.3	1.4	0.6

There is also no significant difference in the size of the household population in different age groups between traditional and the ICS and BLEN users (Table 4.2). The majority, 66%, belongs to the economically active group (16-60 years) while those above 60 years were only 5% of the total.

Table 4.2 Age Ratio of Population per Household (unit in number)

	ICS or BLEN	Traditional	t-stat
Below 5	0.41 (8%)	0.36 (7%)	-0.691
6–15	1.00 (21%)	0.92 (19%)	-0.756
16–60	3.21 (66%)	3.15 (65%)	-0.468
Over 60	0.25 (5%)	0.27 (5%)	0.291
Number of observation	165	448	

4.2 Occupation

Among the economically active age group (16-60 years), the majority of men are engaged in agricultural labor followed by daily wage labor, while the majority of women are engaged in household activities followed by agricultural and daily wage labor.

The percentage of people engaged in agriculture is higher among traditional cookstove users compared to ICS and BLEN cookstove users. Similarly, the percentage of people involved in the service industry, studying, wage labor, and business are higher among ICS and BLEN cookstove users compared to traditional cookstove users (Table 4.3). However, the difference is not believed to be significant between the two groups.

Table 4.3 Main Occupations of Economically Active Population (unit as %)

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Occupation	Female		Male	
	ICS or BLEN	Traditional	ICS or BLEN	Traditional
Agriculture	21.0	25.2	41.8	51.9
Works overseas	0.0	0.0	1.0	0.5
Business	0.8	0.0	6.0	4.4
Industry	0.3	1.3	1.4	2.7
Services	2.2	0.0	8.4	5.5
Student	11.4	11.0	13.3	12.0
Wage labor	6.6	7.7	23.6	21.3
Household chores	57.7	54.8	0.0	0.0
Others	0.0	0.0	4.4	1.6

The primary occupation of the majority of the household heads (58.7%) is agriculture followed by daily wage labor (20.7%), with the same trends between traditional and non-traditional usage.

Table 4.4 Occupation of Household Head (unit as %)

Occupation	Traditional	ICS or BLEN	Total
Agriculture	63.0	57.1	58.7
Overseas employment	0.6	0.0	0.2
Business	3.0	5.6	4.9
Industry	0.0	1.3	1.0
Services	3.0	5.8	5.1
Students	0.0	0.2	0.2
Wage labor	23.0	19.9	20.7
Others	7.3	10.0	9.0

4.3 Types of Fuel and Stoves in Use for Household Cooking

The use of several fuels and multiple stoves was found to be quite high. More than 57% of households use more than one cookstove, with two stoves being the most common. Households tend to have multiple cooking devices for convenience and for the various foods they like to prepare. They prefer to use LPG when they need to cook fast, while for regular food making they prefer to use biomass stoves. Likewise, the LPG user HHs were found to also use biomass stoves, as they are not always sure on the timely availability of LPG and to minimize their expenditure on LPG fuel. Most BLEN cookstove user households (97.7%) use more than one cookstove, with a significant number of BLEN users often using three stoves in addition to biomass fuel stoves. The use of a single cookstove is comparatively higher among traditional cookstove users (Table 4.5).

Table 4.5 Number of Cookstoves in a Household (unit as % of HHs)

Number of stoves	BLEN	ICS	Traditional stove	Total
Single stove	2.3	52.4	56.4	42.6
Two stoves	67.7	39.7	33.9	44.2
Three stoves	27.8	7.0	8.5	11.9
Four stoves	2.3	1.0	1.2	1.3
Total users (nos.)	133	315	165	613

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Within the surveyed households, an ICS is the main cookstove used by the majority (51.4%) of households followed by traditional stoves in 26.9% of households. BLEN stoves are in use as the main cookstove in 21.7% of households. Use of BLEN stoves is quite low in Odisha while it is in comparatively high use in Kullu, Himachal Pradesh.

Table 4.6 Number of Cookstoves in a Household (unit as % of HHs)

States/stove type	Main stove	Second stove	Third stove	Fourth stove	Total
Karnataka					
- BLEN	23.5	17.4	1.4	0.5	42.7
- ICS	55.4	15.5	8.9	0.0	79.8
- Traditional stove	21.1	4.7	0.9	0.5	27.2
Kullu, Himachal Pradesh					
- BLEN	39.5	31.5	11.0	2.5	84.5
- ICS	45.0	41.0	2.0	0.0	88.0
- Traditional stove	15.5	9.5	13.0	0.5	38.5
Odisha					
- BLEN	2.0	4.0	1.5	0.0	7.5
- ICS	53.5	21.5	0.5	0.0	75.5
- Traditional stove	44.5	28.0	1.0	0.0	73.5
Total					
- BLEN	21.7	17.6	4.6	1.0	44.9
- ICS	51.4	25.8	3.9	0.0	81.1
- Traditional stove	26.9	13.9	4.9	0.3	46.0

It was reported that LPG use is gradually on the increase in the surveyed areas. The principal drivers for this shift include an expanding road network that is reaching more villages, and the demand and availability of daily wage labor has increased, thus providing additional income that can be used to pay for the cost of LPG. There is also a significant direct subsidy program for domestic use customers of LPG in India, which is increasing its usage. Furthermore, LPG is being more widely recognized as a cleaner and more efficient fuel compared to other readily available fuels at present, with its usage greatly reducing drudgery in the lives of women.

LPG was found to have quite high usage in Kullu, Himachal Pradesh where 28% of households are using LPG as their main fuel and 43.5% are using it as a secondary fuel for cooking. LPG is an aspirational product and is often the first choice cooking fuel for almost all women, but uncertainty over its ready availability, high cost, difficulty for cooking traditional food items, and fear of safety are the factors that were found to limit its wider adoption.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

5 CLEAN COOKSTOVE ADOPTION, USE, AND IMPACTS

5.1 Stove Adoption

The adoption of clean cookstoves was analyzed in terms of family composition and gender, education status, family income, awareness, socio-cultural practices, social institutors, and performance of stoves as described in the following sections.

5.1.1 Gender and Stove Adoption

Among the 613 surveyed households 13.2% were women-headed households. The data shows that there is a slightly higher adoption of ICS and BLEN stoves as the main cookstove being used in women-headed households (WHHs) compared to men-headed households—77.8% for women-headed households compared to 72.4% for men-headed households. There are various reasons for the higher adoption of clean cookstoves among WHHs. One of the main reasons is that in WHHs, women can choose to adopt products that benefit their health and savings more freely. Additionally, time poverty in women headed household is significant, so they are more likely to adopt stoves which offer time savings.

Table 5.1 Gender of Household Head and Cookstove Adoption

	Female headed	Male headed	t-stat
Adoption of ICS or BLEN	77.8%	72.4%	1.022
Total surveyed HHs	81	532	
Percentage of total surveyed HHs	13.2%	86.8%	

However, it should be noted that within the survey locations, clean cookstoves were largely disseminated through NGOs, and women-headed households are preferentially supported by such organizations, which may be a reason of higher adoption rate among female-headed households. Only a much larger national level survey will be able to confirm this interesting trend.

5.1.2 Education and Stove Adoption

The extent to which household education levels affects cookstove adoption was analyzed from four different angles. The data shows that there is a higher adoption of clean cookstoves (ICS and BLEN stoves) amongst household heads who are literate compared to illiterate household heads. Among the literate household heads, 75.6% have adopted clean cookstoves compared to only 69.3% of households who have illiterate household heads.

Similar results were observed with the household head having a secondary level education or higher, compared to the household head having below a secondary level education. However, no significant differences were observed with respect to the education level of the cooks and cookstove adoption. This indicates that the education level of the head of the household seems to be a potentially important factor impacting ICS adoption, but the education level of the cook does not seem to be as important.

Table 5.2 Education of Household Head and Cook, and Clean Cookstove Adoption

Education status	HH Head		Cook	
	N	%	N	%
Group 1 Analysis: Comparison between literate and illiterate				
Illiterate	244	69.3%	330	72.7%
Literate	369	75.6%	283	73.5%
T-stat		1.74*		0.21
Group 2 Analysis: Comparison between below secondary level education and above				
Below secondary level	499	71.7%	538	73.1%

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Secondary level or above	114	79.0%	75	73.3%
T-stat		1.57		0.05

5.1.3 Income Level and Stove and Fuel Adoption

The use of BLEN stoves is highest among middle-income group households followed by the richest-income households, while ICS adoption is fairly equal across the three income groups. Traditional stove use is highest amongst the poor, followed by the rich and then the middle-income group. This indicates that clean cookstove usage tends to rise with rising incomes, although the relatively lower usage of the rich households is due to the fact that they tend to have larger families and livestock, so use multiple stoves including traditional ones. In addition, senior women in the richest households often don't cook because they are able to pay someone to do the cooking, leading to less concern about the quality of the stoves and the kitchen environment. However, in cases where the woman is from a professional class, such as a teacher, she adopts the clean cookstoves to save time and avoid the smell of smoke on her clothes (Sinha 2011). In addition, it is believed that many rich households have the aspiration to migrate to urban areas, so they less inclined to invest in their current households in the short-term. The use of TCS is significantly higher among poor households, with low BLEN usage, but still quite high levels of ICS usage.

Table 5.3 Income Group and Stove Use

Stove type	Poor	Middle income	Rich	Total
BLEN	5.9%	29.7%	20.0%	21.7%
ICS	52.4%	50.4%	55.6%	51.4%
Traditional stove	41.7%	19.9%	24.4%	26.9%
Total HH (nos.)	187	381	45	613

Amongst the 13 listed assets in the questionnaire and mentioned in the methodology above, the BLEN cookstove users had an average of 6.57 asset holding per household; the biomass ICS users having a slightly lower number of assets (5.56 per HH); with the traditional cookstove users having the lowest number of assets (4.95 per HH); which seems to reinforce the link between income and stove usage as per the “energy ladder” concept.

Table 5.4 Stove Type and Average Assets Holding

Stove Type	Average assets holding	Number of cases	Std. Deviation
BLEN	6.57	133	1.55
ICS	5.56	315	2.07
Traditional stove	4.95	165	2.21
Total	5.62	613	2.08

5.1.4 Reasons for Traditional Stove Use

Within areas where ICS are available, many households (26.9%) are still using traditional stoves for a number of reasons. One of the main reasons is affordability. Poor families are often unable to purchase clean cookstoves, and/or they do not have access to finance to purchase one. Around 33.3% of traditional cookstove users reported that they are unable to afford ICS. Approximately 25% of traditional cookstove users are still unaware of the negative health impacts of HAP. A significant number of families (19.9%) still think a TCS best fits their cooking needs and 3.8% of families do not want to change their traditional cooking practices.

Table 5.5 Reasons for Traditional Cookstoves Use (unit in %)

Headings	Karnataka	H.P.	Odisha	Total
Can't afford ICS	14.9	76.6	14.3	33.3

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Don't know about negative impact of indoor smoke	41.8	0.0	26.2	25.0
Traditional stoves better fits to needs	10.4	6.4	50.0	19.9
Improved stove/clean fuel not easily accessible	10.4	0.0	0.0	4.5
Don't want to change traditional practice	4.5	0.0	7.1	3.8
Others	17.9	17.0	2.4	13.5

It is important to note that in Himachal Pradesh some households that are still using TCS have indicated an awareness of the negative impacts of biomass cooking, including that only awareness is not enough to motivate people to adopt ICS.

The use of more than one cookstove and fuel type is also quite high. Many families like to use traditional stoves even if they use LPG or an ICS. The main reported reasons include that the ICS is not suitable to cook local foods or to cook using large pots, which is the most important reason. In addition, ICS is not comfortable to use, they prefer to use traditional stoves or they have not observed any benefits of ICS, as listed in Table 5.6, below.

Table 5.6 Reasons for Not Fully Using ICS and BLEN Stoves (unit as number of HHs)

Reasons	Karnataka		Himachal Pradesh		Odisha		Total	
	BLE N	IC S	BLE N	IC S	BLE N	IC S	BLE N	IC S
Not suitable to cook local food and use large pots	7	9	77	68	0	16	84	93
Not comfortable to use	0	2	0	0	0	16	0	18
Prefer to use traditional stoves	2	1	0	0	0	11	2	12
Not seen any benefit of ICS	0	0	0	0	0	2	0	2

In Himachal Pradesh in particular, many families reported that an ICS or BLEN cookstove is not suitable to cook local dishes like Bhaturu or corn-unleavened roti that are better cooked on red hot coals in a traditional *chulla*. A tandoor is preferred in cold regions like Kullu, Himachal Pradesh, because of their more efficient space heating capacity (as reported during FGDs). In Odisha few respondents felt uncomfortable to use ICS mainly due to its height not matching with their traditional way of cooking—sitting down (women cooks who care for small children at home prefer to cook in a sitting mode)—and so ICS and BLEN designs need to adapt to these local needs to be successfully adopted. During the FGDs in Odisha it was reported that ICS users had difficulties with cleaning the chimneys of ICS, and that follow-up services by the ICS suppliers were lacking. From the suppliers' perspective, the current market price of the stoves are not able to include this follow-up maintenance service cost, and still be considered to be affordable by the consumers.

5.1.5 Source of Information for Clean Cookstoves

As many ICS programs have been donor led, the main source of information about clean cookstoves has been through projects and NGOs. In Himachal Pradesh, the cooperatives play a significant role in creating awareness. So far, the role of the private sector (cookstove manufacturers and distributors) seems to still be very low (Table 5.7).

Table 5.7 Source of Information for Clean Cookstoves (unit as %)

Source of information	Karnataka	H.P.	Odisha	Total
Projects/NGO	60.8	49.7	90.2	67.3
Cooperative	0.7	18.6	0.0	6.3
Neighbors/Relatives	6.1	3.4	2.0	3.8

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Stove manufacturers/suppliers	3.4	0.0	2.0	1.8
Self	0.0	15.2	0.0	4.9
Others	29.1	13.1	5.9	15.9

Note: The “Others” category includes information from the radio, television, and health workers etc.

5.1.6 Women’s Involvement in Social Groups and Adoption

The adoption of ICS is significantly higher among women who are members of social groups: 61% of ICS users, compared to only 39% of TCS users. Within social groups, women have the opportunity to interact with other members, allowing them to exchange information about the quality of ICS products, as well as confirm the benefits of particular brands leading to their adoption. For example, in Kullu, these "social groups" are often Women’s Savings & Credit Groups (WSCGs) that have been organized by Jagriti who target their members with information to learn about and then adopt particular clean cooking solutions.

Table 5.8 Women’s Involvement in Social Groups

Type of stoves	% of involvement in social groups
Traditional stove users	38.6%
ICS	60.8%

During focus group discussions, women have reported that their only source of information on cookstoves has been through awareness meetings, exhibitions, etc.; basically through person-to-person interaction with the project staff and neighbors. Some women said that they were reached through sales and marketing materials like pamphlets, van campaigns, etc. Hardly any women reported information reaching them through mass media channels, although some stove companies are advertising on radio and television. Information disseminated to women has been about health impacts and stove attributes only.

5.1.7 Firewood Availability and Adoption

The availability of perceived “free” firewood (wood collected without any payment, although it does result in drudgery and lost time) is a significant barrier to more widespread adoption of clean cookstoves, as reported by the FGD participants. Dependence on forests for firewood has not diminished due to "free riding,"⁹ and the undervaluing of women’s time. The use of LPG and ICS is higher in firewood-scarce areas as reported by the users during focus group discussions.

5.1.8 Performance of Stoves and Adoption

The survey data confirmed that the preferred attributes of an ICS are fuel efficiency, low emissions, faster cooking, and increased cooking ease/comfort and safety, as listed in Table 5.9. In Himachal Pradesh a significant percentage of households prefer an ICS because their cooking vessels get less dirty.

Table 5.9 Reported Preferred Attributes of ICS (Unit: % of total responses)

S.N.	Preferred attributes	Karnataka	Odisha	Himachal	Total
1	Fuel saving	12.4	51.7	31.5	31.9
2	Fast cooking/time saving	41.4	12.1	26.0	26.5
3	Less smoke	33.1	26.8	13.0	24.3
4	Cooking vessels get less dirty	0.0	0.0	25.3	8.4
5	Portable	6.2	4.0	0.0	3.4
6	Easy and safe to cook	6.2	2.7	0.7	3.2
7	Can cook multiple food at a time	0.7	2.7	1.4	1.6

⁹ This is an activity which benefits from resources, goods, or services without paying for the cost of the benefit.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

S.N.	Preferred attributes	Karnataka	Odisha	Himachal	Total
8	Kitchen gets clean	0.0	0.0	2.1	0.7

The majority (68.5%) of users think ICS are much better than traditional stoves, while a further 24.5% rate them a bit better than traditional stoves. Together, these constitute nearly 93% of ICS-using households who prefer ICS compared to traditional stoves. A few users (4.9%) still have negative impressions of ICS as the stoves are not performing as per their expectations, however it is important to note that as the respondents in different states were using different tiers of ICS, they have different perceived benefits of ICS, and these negative impressions may be due to the use of an ICS is not actually performing well, further highlighting the need for more comprehensive testing of ICS.

Table 5.10 Performance of ICS Compared to Traditional Stoves (unit as % of total responses)

Responses	Karnataka	Himachal	Odisha	Total
Much better	71.9	99.3	35.5	68.5
A bit better	17.8	0.0	54.6	24.5
About the same	4.8	0.0	1.3	2.0
A bit worse	2.7	0.0	1.3	1.3
Much worse	2.7	0.7	7.2	3.6

The highest levels of dissatisfaction of ICS was in Karnataka and Odisha states, and comes from the need to cut wood into small pieces, its longer cooking times, and higher fuel consumption followed by more smoke and requirement for more cleaning and maintenance. As some of these issues are supposed to be addressed by ICS, it appears that some supposed improved stoves are not performing well, potentially creating negative impression on ICS more widely. For example, in Karnataka state, several local, untrained masons are constructing the Gram Panchayat cookstove (localized version of the Astra cookstove) supported by the local government (the Gram Panchayat). The users of the cookstove seem to have mixed experiences and are wary of using these poorly performing Gram Panchayat stoves.

5.2 Gender and Livelihood Impact of Stoves

5.2.1 Fuel Saving

The main fuel for cooking is firewood in surveyed households in Karnataka, Kullu, Himachal Pradesh, and Odisha. Use of LPG is quite high in Himachal Pradesh, and agricultural residue is quite high in Karnataka state in India. Cow dung cake as secondary fuel was found in use in Karnataka and Odisha.

Table 5.11 Fuel for Cooking (unit as %)

Fuel type for cooking	Karnataka		Himachal Pradesh		Odisha	
	Main fuel	2nd fuel	Main fuel	2nd fuel	Main fuel	2nd fuel
Firewood	74.2	25.4	72.0	34.5	83.0	8.0
Cow dung	0.5	2.3	0.0	0.0	7.0	6.5
Agricultural residue	21.6	49.3	0.0	0.0	6.0	9.0
Charcoal	0.0	0.0	0.0	0.0	1.5	0.0
Kerosene	0.0	1.9	0.0	3.5	2.0	1.0
LPG	3.8	3.8	28.0	43.5	0.5	0.0
Electricity	0.0	0.0	0.0	0.0	0.0	1.0
Biogas	0.0	0.9	0.0	0.0	0.0	0.0

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

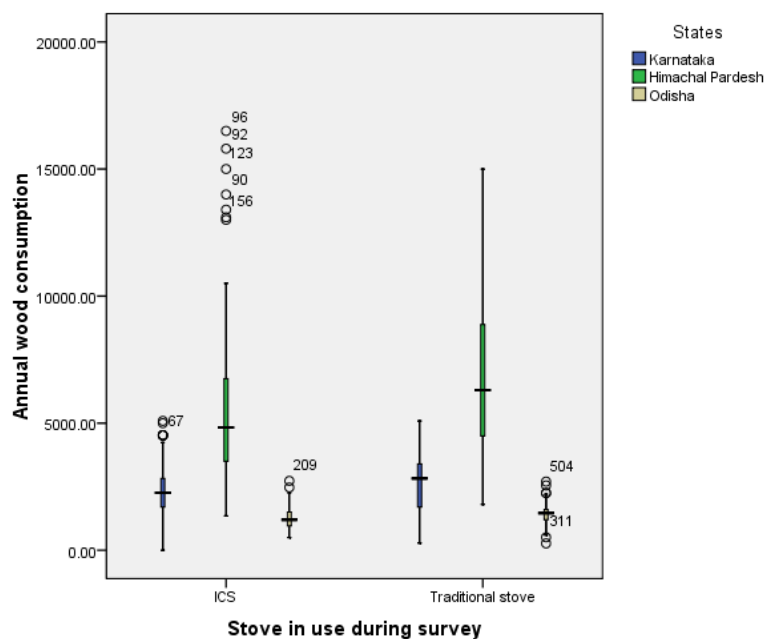
On average, per capita firewood consumption is 641 kg with ICS compared to 892 kg with TCS (28.1% reduction with ICS). There is a huge difference in the total firewood consumption between regions due to various reasons, including the type of firewood available, its price, the food being prepared, family size, the use of cookstoves for space heating purposes and preparing feed for animal, the number of cooking sessions, and the use of other fuels and stoves. For example, in Kullu, Himachal Pradesh, as firewood is used for space heating as well as cooking, due to its high altitude and colder climate, there is a higher consumption compared to the other survey locations. In Odisha, coal is used as well as firewood for cooking, so the firewood consumption seems low compared to other states.

Table 5.12 Annual Per Capita Firewood Consumption

	ICS (kg/year/person)	Traditional stove (kg/year/person)	Reduction (%)
Karnataka	593	780	24.0%
Himachal Pradesh	1042	1587	34.4%
Odisha	288	308	6.5%
Total average	641	892	28.1%

In Karnataka and Odisha various types of ICS are used with different combustion efficiencies. In Kullu, Himachal Pradesh, through the initiative of Jagriti, traditional biomass stoves have been replaced by LPG stoves and improved tandoor ovens, through credit being supplied by WSCGs to their members, as well as other types of support. These two interventions (LPG and improved tandoor) have resulted in more than 3,100kg/year of firewood being saved per household compared to the use of traditional cookstoves.

Figure 5.1 Annual Firewood Consumption in ICS and TCS User Households (kg/year)



5.2.2 Time for Firewood Collection, Gender, and Drudgery Reduction

In the surveyed locations, the majority of households collect the required firewood themselves. In Himachal Pradesh none of the surveyed households purchase firewood (all of them collect firewood themselves). In Karnataka, 62.9% of surveyed households collect their required firewood themselves, while 37.1% partially purchase and collect firewood, as the collected firewood is not sufficient for them to meet their year-round

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

needs. In Odisha 6% of sampled households fully rely on purchased firewood. About 8.5% collect as well as purchase, while 82.8% of households collect their required firewood themselves. Households tend to purchase firewood only when they are unable to collect it themselves or opportunity cost of their time is higher, rather than choosing to purchase firewood for any other reason, which highlights the difficulty of getting households to switch from using firewood when they have access to it for free.

Table 5.13 Methods of Firewood Management (unit as % of total responses)

Firewood Management	Karnataka	Himachal Pradesh	Odisha	Total
Collect all themselves	62.9	100.0	85.5	82.8
Purchase	0.0	0.0	6.0	2.0
Both	37.1	0.0	8.5	15.2

A traditional cookstove using household spends, on average, 660 hours annually collecting firewood. There is a significant time saving in fuel collection (122 hours/year/HH) for households using ICS, due to the increased combustion efficiency of the cookstove and its requirement for less firewood (Table 5.14).

Table 5.14 Time Spent for Firewood Collection (unit in hrs/year/HH)

States	Traditional stove (hrs/year/HH)	ICS (hrs/year/HH)	Time saving (hrs/year/HH)
Karnataka	573	479	94
Himachal Pradesh	951	807	144
Odisha	457	328	129
Average	660	538	122

Concerning firewood collection, the data highlights a greater involvement of women compared to men in the surveyed locations, although less than typically stated by ICS proponents, who tend to indicate an overwhelming burden on women for firewood collection. On average, a female traditional cookstove user spends 374 hours (56.7% of the total hours spent by the family) per year to collect firewood compared to 286 hours by men and 305 hours by ICS user women.

There is a significant difference in the gender allocation of fuel collection between the different regions of India. A higher involvement of women compared to men was found in Himachal Pradesh whereas there is almost equal participation of both in Odisha. Concerning cow-dung fuel preparation and agriculture residue collection, there is a significantly higher involvement of women than men in all regions (Table 5.15). This is due to the fact that dung processing and agricultural residue collection are considered tedious works, and dung is considered dirty, so men usually don't like to get involved, resulting in the higher involvement of women in this work.

Table 5.15 Gender Focused Involvement in Fuel Collection (unit as % of involvement)

Fuel	Gender	Karnataka	H.P.	Odisha	Average
Firewood					
	Women	52.6	67.0	50.6	56.7
	Men	47.4	33.0	49.4	43.3
Agri residue and cow-dung					
	Women	70.1	64.8	75.6	70.2
	Men	29.9	35.2	24.4	29.8

Logically, switching to using BLEN stoves will result in significant huge time saving and drudgery reduction.

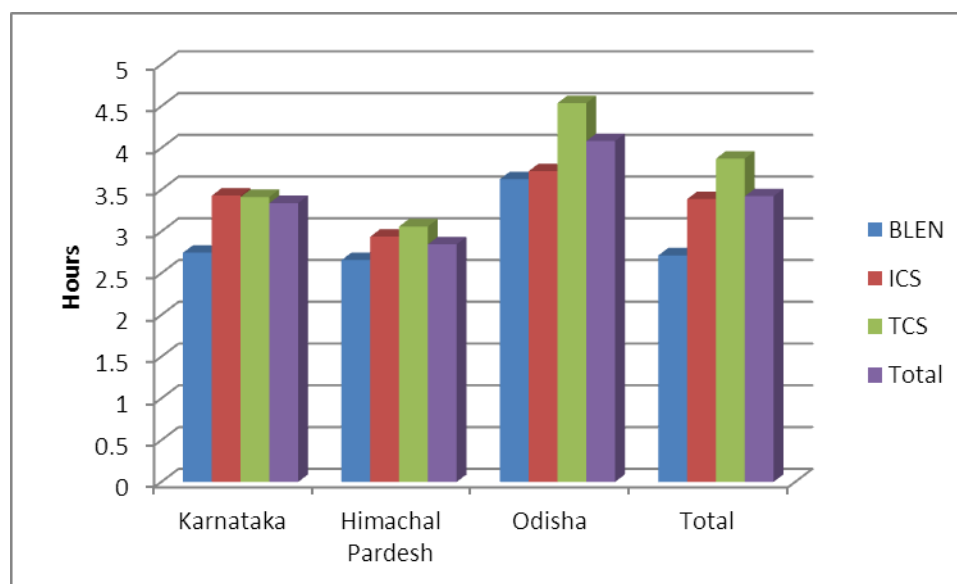
5.2.2.1 Time for Cooking and Gender

The survey data indicates that households have three main cooking sessions (breakfast, lunch, and dinner), with all cooking being done primarily by women. Using traditional stoves, a woman spends about four hours

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

per day for cooking. Approximately 30 minutes (12.5% of total cooking time using TCS) is saved per day by using an ICS, while 1 hour 10 minutes (29.2%) is saved per day by using a BLEN cookstove. The cooks are generally happy with this faster cooking time, especially during the morning periods, as they are often very busy with tasks such as preparing food, preparing their children to attend school, preparing livestock feed, and fetching water. There is a large difference in the cooking times between the three regions, due to the different types of food being cooked in each region, and whether the cooks are using their stoves for making livestock feed. In Odisha, the majority of households (52%) reported three or more sessions of cooking, so there is a slightly longer use of stoves for cooking than the other regions.

Figure 5.2 Time for Cooking



5.2.2.2 Use of Saved Time

The saved time due to using an ICS generally contributes to an increased involvement of women in social and family activities. The largest group of women (34.7%) use the saved time to tend and care for their children. About 20% are able to give more time to agricultural activities, leading to increased production, while about 12.4% of women reported that they can spend time attending community meetings. About 9% of women reported that they have more free time to meet friends and relatives, watching more television while knitting, etc., or just resting, which can lead to greater community coherence and satisfaction levels (Table 5.16).

Table 5.16 Use of Saved Time (unit as % of women respondents)

Activities	Karnataka	H.P.	Odisha	Total
Give more time to children's care	30.4	27.9	45.2	34.7
Give more time to agricultural activities	34.8	15.6	16.9	20.0
Able to attend community meetings	15.9	0.0	25.0	12.4
Meet other friends and relatives	17.4	4.1	10.5	9.1
More time to do household chores	0.0	42.2	2.4	19.1
Have a rest	1.4	10.2	0.0	4.7

5.2.3 Impact on Education

It has been reported that mothers who use ICS are able to give more time to their children to prepare them to go to school. Likewise, due to the reduced drudgery and time saving, they don't need as much support from their children for household chores and fuel collection. A 2001 UNDP report reveals that when women

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

are overburdened, they are more likely to keep their daughters at home away from school to assist with household activities like fuel and water collection. The survey results show that there is a higher school enrollment percentage of children among ICS user households compared to TCS user households. Although overall school enrollment is high, still the girls' school enrollment is comparatively lower than boys for both ICS and TCS using households.

Table 5.17 School Enrollment of Children (6–15 Years Old) (unit as %)

Group	TCS	ICS	Difference	t-stat
Boys	96.7%	99.4%	2.7%	1.6
Girls	90.6%	92.0%	1.5%	0.3
Total	96.2%	98.8%	2.6%	1.5

5.2.4 Gender Equity

5.2.4.1 Gender Wise Roles and Responsibilities

Gender stereotypes are significant in household tasks and responsibilities. Women tend to focus mainly on household chores (cooking, feeding livestock, fetching water, collecting and processing firewood, etc.), while men are more involved in key economic activities such as farming, selling livestock and agricultural products, etc. (Table 5.18). The data suggests that there is an almost equal involvement of men and women for firewood collection, but women tend to have a slightly higher involvement in fuel collection within ICS-using households than TCS-using households. This indicates that the time saving from the use of ICS is not only to women's benefit; the time saved by the smaller amount of fuel being required by ICS is generally being enjoyed by men as well.

Within households using TCS, women were generally more involved in the fuelwood processing, while women are more involved in the fuelwood collection within households using ICS. Time saving in fuel consumption does not help much to women but that help their male counterparts. With saved time from using ICS, the women can give more time for firewood collection so the men can involve in other income generating activities or social activities. The least preferred work for male members in order is: i) fuel processing (if cow dung cake), ii) collecting firewood, iii) involved in agricultural activities etc.. In family, the male members want to leave not preferred activities to women members, if the women can manage time to carry-out those activities.

The data shows that women's participation in community or group meetings is higher among ICS users compared to TCS users. Women's involvement in other income generating activities is also slowly growing. This can be partially attributed to the overall growth of the self-help group movement where women have increased access to credit and saving schemes of the group. The results even show that a few men are starting to get involved in cooking when using ICS, which is not the case with TCS usage (Table 5.18).

Table 5.18 Work Division and Women's Involvement in Each Activity (unit as %)

Activities	TCS	ICS
Cooking	100.0	98.4
Cooking feed for livestock	99.1	92.3
Attend community/NGO/Group meetings	62.3	73.9
Fetching water	60.4	69.7
Collecting fuels	49.7	54.9
Firewood processing (cutting, drying)	52.6	34.9

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Activities	TCS	ICS
Purchasing of daily household items from market	17.6	24.5
Purchasing fuels – making payment	27.3	20.9
Visit agri. service center or veterinarian	17.4	17.2
Carry out farming activities	7.6	16.3
Selling agricultural and livestock products	10.9	13.8

5.2.4.2 Decision Makers in Family

The results show that most key financial decisions, including the purchase of assets and land, taking out loans, selecting children's schools, and expenditure for health treatment are made by men. Decisions relating to the kitchen, including what kitchen utensils to buy and what food to cook, are mostly made by women.

Importantly, regarding the decisions on which cookstove and fuel to use, there is generally an equal role of women and men, although with slightly different results in different states. In Himachal, the role of women is comparatively less, while in Odisha it seems relatively higher. Besides the typical reasons of the cultural barrier of women's restricted travel, which is more prevalent in northern India, Himachal Pradesh poses an additional constraint: the hilly terrain and remoteness of villages makes it extra difficult for women to travel out, which has implications on their ability to gain education, training, and exposure to outside world. All these factors reduce women's preparedness in dealing/ transacting with the outside world, for example, with banks, in markets, and in formal city-based institutions.

Table 5.19 Women's Involvement in Household Decision Making (unit as %)

Family Decisions	Karnataka	Himachal	Odisha	Total
Kitchen utensils	55.0	86.8	67.2	69.7
Foods for family	64.3	17.6	91.2	57.7
Stove and fuel	52.6	34.7	69.0	52.1
Health check-ups and treatment	46.4	15.7	16.0	26.0
Children's school	19.3	11.8	19.1	16.8
Assets/lands	12.3	11.5	9.5	11.1
Taking out loans	13.3	9.6	10.2	11.0

5.2.4.3 Gender Wise Priorities

There seems to be a significant difference in the priorities of men and women, with the use of ICS not falling within the top five priorities of men, but being the fifth highest priority of women in the surveyed locations. However, seemingly in direct conflict to this, family health is the second priority of both men and women. This indicates that both men and women are worried about the environmental conditions they are living in and access to health services, but are not directly relating this to emissions from cooking. Evidence suggests that this is because the respondents still do not fully understand the direct health benefits of clean cookstoves, and so better awareness of the health benefits of ICS is required so that their use is a higher priority of both men and women.

Table 5.20 Household Priorities

Priority order	Men	Women
1st	Financial security (land & assets)	Food for family
2nd	Health	Health

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Priority order	Men	Women
3rd	Better job or business	Financial security (land & assets)
4th	Skills and education	Skills and education
5th	Access to financing	Better stoves

5.2.5 Household Air Pollution and Health

5.2.5.1 Reported Health Problems

The reported health problems from HAP include asthma, chronic cough, severe headache and fever, discomfort in eyes, and weakness and fatigue as summarized in Table 5.21.

Table 5.21 Reported Health Problems Due to HAP (unit as % of cooks having the problem)

Illness	Karnataka	Odisha	Total
Asthma	2.8	3.0	2.9
Chronic cough	5.2	8.0	6.6
Severe headache and fever	2.8	9.5	6.2
Discomfort in eyes	1.9	5.0	3.4
Weakness and fatigue	1.4	12.0	6.7

Note: In Himachal Pradesh, the research team observed difficulty to collect reliable health information from the respondents with short and small sample size survey. Need was felt for a separate in-depth study that is specifically designed for health impact research.

Within the focus group discussions, women cooks reported that they feel that irritation and watering of eyes, breathing problems, cough (sometimes chronic) and fever are all attributed to HAP. As women—and along with them their small children—have to spend a considerable part of the day in the kitchen, they are most affected by these ailments. Older people who spend a significant amount of time in the kitchen, especially during the winter, also reported suffering from respiratory problems.

5.2.5.2 Treatment, Health Expenditure, and Days Lost

Compared to TCS users, significantly fewer ICS users experienced respiratory illnesses during the last one-year period. However, no significant differences were observed in terms of health expenses and day losses due to these health issues. Such expenses and day losses are believed to be mainly due to chronic illnesses which are the result of very long exposure to household air pollution (HAP). As most households had only had their ICS for a relatively short time (1–2 years), it does not seem that their use has yet led to any improvements in such chronic illnesses, and perhaps it is only with their longer use that such tangible health benefits will be realized.

Table 5.22 Illness Among Women Cooks, Health Expenditure, and Day Loss Due to HAP During the Last One Year Period

States	Stove users	Illness among cooks due to HAP (%)*	Cash expenditure (in USD/year)	Day loss/year
Karnataka	TCS	28.3	9.5	2.3
	ICS	9.6	9.8	3.5
Odisha	TCS	39.3	0.0	4.3
	ICS	6.3	0.0	0.6
Total	TCS	35.6	3.2	3.6
	ICS	8.3	5.9	2.3

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

* Percentage of total cooks surveyed

Note: In Himachal Pradesh, the study team faced difficulty to get reliable health information, so data from there is missing in this table.

It is important to note that the actual health costs of household air pollution are believed to be much higher than the figures indicated in the table above, as people in rural areas, in particular women, tend to not seek treatment or take time away from work for minor illnesses. Untreated, these illnesses may develop into more serious health issues (Parikh 2011). However, this is a complicated area and requires more detailed and longer term research.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

6 COOKSTOVE MARKET SYSTEM

To have a vibrant cookstove market system, three levels of an energy market system (Annex 2) should be in place and functional. The three levels include:

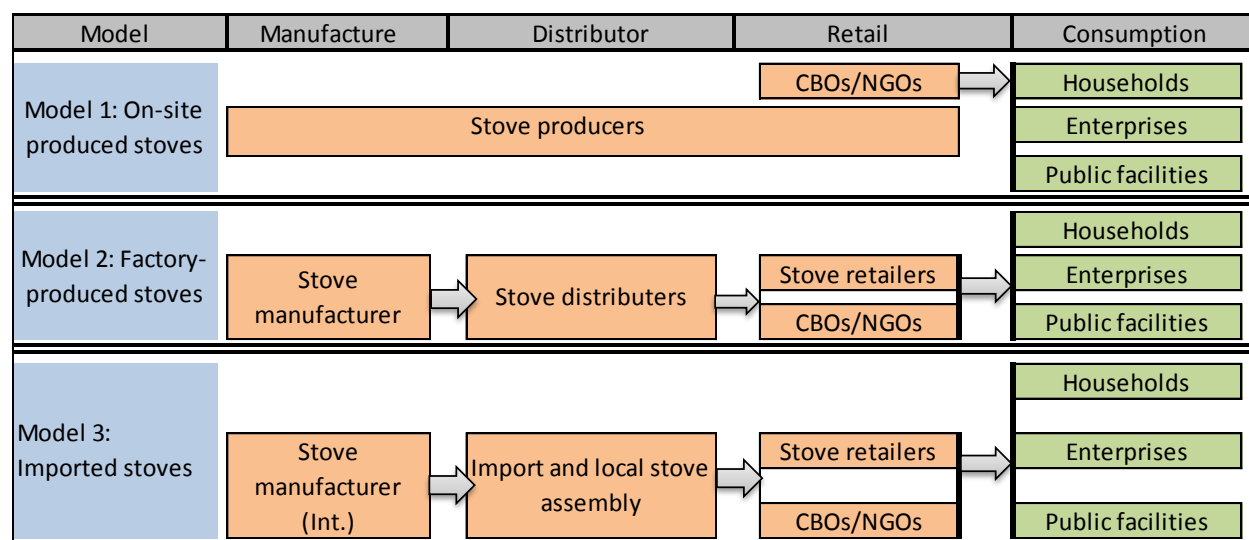
- i) ICS market chain
- ii) Supporting inputs and services
- iii) Enabling environment

6.1 ICS Market Chain and Gender (Level 1)

Broadly, the ICS market chain can be divided into three main types of models, as described below and in Figure 6.1.

- i) Model 1: On-site produced and installation of ICS
- ii) Model 2: Factory-produced ICS
- iii) Model 3: Imported ICS

Figure 6.1 ICS Market Chain



Based on the type of production model, the cookstoves assessed within this study can be grouped as described in Table 6.1.

Table 6.1 Grouping of Stoves Based on Cookstove Market Chains

Country/Sates	On-site produced/installed stoves (Model 1)	Factory manufactured or imported (Models 2 & 3)
Karnataka, India	Sarala, Gram Panchyat ICS, Mud chula (traditional)	Chulika, Greenway ICS; Envirofit
Himachal Pradesh, India	Traditional tandoor	Improved tandoor; LPG
Odisha, India	Aarti, Annapurna; Traditional clay stove	Jeevan Jyoti (Envirofit); SPT 0610; ORKA
Nepal	Mud brick ICS with chimney; Hoodstove	Metal ICS
Bangladesh	Clay chulha/ICS; Concrete chulha/ICS, traditional stove	LPG stove

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

Most ICS market chains in South Asia have not been able to attract a satisfactory level of women entrepreneurs, as well as women within ICS market chains, to significantly impact their adoption. Evidence suggests that only in Nepal and Karnataka, India, are there satisfactory¹⁰ participation levels of women in on-site manufactured cookstove markets, as highlighted in Table 6.2. In Nepal, the national ICS program under the Alternative Energy Promotion Center (AEPCC) trained more than 10,000 ICS technicians (Stove Masters), with about 50% participants being women. The government of Nepal has given top priority for gender and social inclusion (GESI) in promotion of stoves which resulted in Renewable (Rural) Energy Policy 2006, Subsidy Policy for Renewal Energy (AEPCC 2013), Subsidy Delivery Mechanism Policy 2013, and National Plans, as well as support from ENERGIA to try and ensure gender mainstreaming within the national energy strategy. In addition, the continuing trend of mass emigration of men from rural areas to cities in Nepal, and from Nepal to other countries, has also effectively enforced the increased involvement of women in local businesses such as ICS. In Karnataka, India, many women have been trained by TIDE to work within ICS companies, in particular the on-site cookstove manufacture.

Table 6.2 Status of Involvement of Women in Cookstove Market Chains

States/Country	Model 1			Model 2			Model 3		
	M	D	R	M	D	R	M	D	R
Karnataka, India	M	NA	NA	M	D	R	NA	D	R
Himachal Pradesh, India	M	NA	NA	M	D	R	NA	D	R
Odisha, India	M	NA	NA	M	D	R	NA	D	R
Nepal	M	NA	NA	M	D	R	NA	D	R
Bangladesh	M	NA	NA	M	D	R	NA	D	R

Note: M = manufacturing; D = distribution; R = retail; NA = not applicable

Legend:

more than 40% involvement	M	10- 40% involvement	M
less than 10% involvement	M		

Women are able to participate within different parts of ICS market chains, and either as part of the workforce or as an entrepreneur leading the development of a new ICS initiative. At present, women's involvement in both the Model 2 and Model 3 stoves market chain is very low due to the following socio-cultural and economic limitations:

i) Women as Cookstove Entrepreneurs (manufacturers, importers, distributors and retailers):

Evidence suggests that there is a relatively low involvement of women as ICS entrepreneurs (manufacturers, importers, distributors and retailers) mainly due to economic factors. As highlighted above, there is relative higher participation of women in a Model 1 ICS market chain (on-site produced/installed stoves), while there is relatively very low involvement of women in Model 2 and 3 ICS market chains (factory manufactured or imported). The lack of access to suitable capital for investing in start-ups and financing the development of new ICS businesses are the two main obstacles for women. This is because men generally control the family finances and make decisions regarding the management of assets and land, and banks generally require collateral to provide loans. Due to this lack of asset ownership, women are unable to take the risks associated with taking out loans.

In addition, most women lack the necessary managerial and marketing skills required to set up and run a new ICS business. Technical, economic, and socio-cultural issues also hinder women from starting

¹⁰ "Satisfactory" in this context refers to an involvement of women of over 40%.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

cookstove enterprises even if they are able to access suitable finance. Moreover, as the ICS market is still in a relatively underdeveloped state in much of South Asia, with relatively low levels of demand for ICS and BLEN stoves, it requires greater risk-taking than other, more established markets, something that women are less willing and able to engage in. The risk-bearing capacity of women is comparatively less than their male counterpart due to various reasons, but mainly due to their lack of economic security (Fletschner D. and L. Kenney 2011, Fletschner et al. 2010, and Croson and Gneezy 2008). Evidence from the interviews suggests that women in South Asia tend to invest in more stable and less risky markets.

As stove production in South Asia is often still based on demand (stoves are only produced when an order is placed rather than stoves being produced and then efforts made to sell them), existing fabrication units are not willing to engage large numbers of staff, including specific marketing activities. This leads to the low engagement of part-time staff, and as women are more interested in taking up part-time positions as they have other responsibilities, this leads to the lower engagement of women in the ICS sector. It was also noted that unless a woman is well educated, of an urban background, and mobile (owns and drives a vehicle), she is usually unable to overcome the social constraints and cultural barriers that restrict the development of women entrepreneurship particularly in manufacturing and marketing of ICS, which is currently almost completely dominated by men.

ii) Women as Workers within Cookstove Market Chain Companies (manufacturers, distributors and retailers):

In general, women in the surveyed countries still lack the skills and flexibility to work in the manufacturing, distribution, retail, and after-sales service of ICS market chains. The skill set required for factory-produced stoves generally involves sheet metal work, which includes cutting, bending, turning, welding, etc. Women typically do not enroll for such activities, and so there is a mismatch in their required skills. In the past, training to develop female masons and after-sales service providers was provided by some donor-led projects and programs, but this was also limited to certain locations and to their immediate working area coverage. Further support is required from these existing ICS promoting agencies and governments to increase women's technical skills throughout each country. This would help decentralize the ICS market chain, in particular distribution and retail, as well as manufacturing, while maintaining quality control and performance of the technologies.

In general, evidence suggests that women are searching for better economic opportunities as subsistence agriculture is often regarded as insufficient for them to meet their basic needs, and this includes working in ICS market chains. However, due to socio-cultural reasons, women prefer to work closer to home, and this low level of mobility has been highlighted as being one of the main hindering factors for the low level of involvement of women in cookstove market chains. Many existing cookstove companies believe that the role best suited to women in their market chains is on awareness creation, marketing, and retail, for all models of ICS.

6.2 Business and Extension Services, and Input Providers (Level 2)

To establish a sustainable ICS market system, there needs to be easy access to a range of support services, defined as the services required by each ICS market actor within the market chain, including business and extension services, finance, and material inputs. These support services include:

- National stove testing protocols, facilities, and quality assurance mechanisms
- Appropriate design and research facilities
- Training institutions
- Transport providers
- Micro-finance service providers
- Stove maintenance service providers (if this is not provided by the ICS market actors themselves)
- Networks, forums, and associations

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

The study has tried to analyze the level of access to these support services from the perspective of their overall availability in each country, and more specifically the level of women's involvement in these services when they are available.

National Stove Testing Protocols, Facilities, and Quality Assurance Mechanism: In most South Asian countries a number of organizations are involved in the field testing of cookstoves, but national uniform testing methodologies for effectively comparing all cookstoves are still lacking. There is no single recognized national testing facility in Bangladesh, while in Nepal, there are two cookstove testing centers: i) The Regional cookstoves Testing and Knowledge Centre (RTKC) at Centre for Rural Technology (CRT/N)—established with financial and technical support of the Alliance; and ii) The cookstove testing facility at the Renewable Energy Test Station (RETS) at the Nepal Academy of Science and Technology (NAST), established with financial and technical support of AEPC and GIZ. There are around 60 female staff (around 50%) within the centers.

In India, the recognized testing centers include: i) The Indian Institute of Technology Delhi (IIT Delhi) at the Center for Rural Development & Technology; ii) The Design & Rural Technology Department at the Institute of Minerals & Materials Technology (IMMT), Orissa; and iii) The Department of Renewable Energy Sources at the College of Technology and Engineering, Maharana Pratap University of Agriculture & Technology

India also has its own cookstove standard and certification process, while in Nepal, efforts are going on to set national cookstove standards with testing and certification procedures accordingly. In both countries, there is strong policy support for strengthening the stove testing units, including capacity development opportunities that prioritize women. Furthermore, in Nepal AEPC has made it mandatory that cookstove masters, 75% of whom are female, should be involved in the monitoring whether clay stoves are being used properly.

Appropriate Design and Research Facilities: To develop and introduce new models of ICS into South Asia, market research is very important. However, South Asian countries currently have limited design facilities and research centers which focus on ICS. The development of new cookstove designs is mostly limited to donor-led programs and large, multinational private companies. Women's participation within the design process and research activities, in particular the end users of the stoves, are also limited. At the field level, most development organizations are trying to ensure women's perspectives are included in new cookstove designs, however the consultees (including stove manufacturers and active NGOs) questioned the success of these initiatives, as they believe there are still user needs relating to the appropriateness of the cookstove that are not being met adequately.¹¹ It is believed that long-term action research is still required with the active participation of women cookstove users to further improve ICS designs in South Asia. This is particularly the case as one type of ICS design is unlikely to meet all the diverse socio-cultural settings, climatic conditions, geography, fuel types, income, and cooking behaviors in each region of each country.

Capacity Building and Training Institutions: In South Asia to date, most capacity building activities have been limited to donor-funded projects within specific time frames and with the specific focus being on building the technical skills for cookstove manufacturing rather than other parts of the market chain. Capacity building on business development, entrepreneurship, and the distribution, retail, and marketing of stoves is still lacking. Although efforts are being made at the project level by several organizations, their support is often limited to providing targeted subsidies and building technical skills for cookstove manufacturing only. Most initiatives focus on supporting only specific parts of the market chain of ICS or on-demand creation without providing adequate support to the entire market system. Without systematically removing all the barriers within ICS market systems, evidence suggests it will be difficult to establish vibrant

¹¹ In cold regions there is a need for space heating. Likewise, there is a practice of drying grains and meat using the smoke from stoves. In some cultures they even consider the stove as holy and worship it. Other needs related to behavior, socio-cultural, and cooking needs, are detailed within the Supplementary Reports section of this study.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

and sustainable cookstove enterprises in the South Asian countries. More specifically, there is currently a lack of long-term, women-targeted training programs, as well as incubation support to women entrepreneurs, and the follow-up services and resources that are required to enable women to take a more equitable position within ICS and fuel market chains.

Table 6.3 Status of Support Services and Finance for Stove and Women Participation

Services and Finance	KT	HP	OD	NP	BD
National stove testing protocols and facilities	S	P	P	S	P
Appropriate research and design facilities	S	P	P	S	S
Capacity building/training institutions	S	P	P	S	S
Access to finance	P	S	P	G	G
Subsidies (e.g., carbon financing)	S	S	S	G	S

Legend:

more than 40% involvement		10–40% involvement	
less than 10% involvement			

Note:

- Karnataka (KT); Himachal Pradesh (HP); Odisha (OD); Nepal (NP); Bangladesh (BD); Good (G); Satisfactory (S)
- The color shows status of women involvement, and the letter inside the box shows status of facility in the country.

Networks: Various networks are active in South Asia to develop coordination, knowledge/information sharing, and advocacy in the area of cookstove and gender. In Nepal, there is Nepal Alliance for Clean Cookstoves (NACC), Indoor Air Pollution and Health Forum (IAPHF) Nepal, and Gender, Energy and Water Network (GEWNet). Likewise, there is network of ENERGIA in India and Bangladesh (Gender and Energy Network Bangladesh—GEN-Bangladesh and India Gender and Energy Network). The networks have made significant contributions to knowledge sharing, capacity building, and advocacy. It is believed that if networks of women cookstove entrepreneurs can be established and supported this will help more clearly raise the issues of women entrepreneurs, which can then be addressed.

Access to Finance: Microfinance institutions, including cooperatives, are already playing a major role in providing consumer credit for new technologies, particularly in rural communities in South Asia. Some ICS organizations are starting to partner with MFIs and finance cooperatives to provide finance specifically for ICS, but it still remains to be seen if consumer loans for cookstoves are a viable business for them. Likewise, the coverage of such initiatives is currently limited to small pocket areas in South Asia.

In addition, there have been policy level efforts in South Asia to increase access to finance for women entrepreneurs, as summarized below:

Bangladesh: The government of Bangladesh has fixed a minimum allocation of 15% of bank funds allocated to small and medium-sized enterprises (SMEs), specifically to women entrepreneurs at lower interest rates. Banks and financial institutions are also instructed to accept and settle all types of loan applications from women entrepreneurs with the high priority. Women entrepreneurs can obtain a maximum loan of around Tk 25 lakhs (around USD32,800) against only a personal guarantee (without collateral). Special advice and service centers for women entrepreneurs in selected branches of selected banks have also been established.¹² However, despite all these efforts, not many women have taken advantage of

¹² Small and Medium Enterprise (SME) Credit Policies & Programs, Bangladesh Bank, available at <http://www.bangladesh-bank.org/sme/smepolicye.pdf>.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

these financial services. In addition, although renewable energy has been prioritized for potential investment, it does not specifically include clean or improved cooking stoves, which needs to be amended.

Nepal: In rural Nepal, cooperatives often provide financial services to the rural population. There are more than 20,000 cooperatives in Nepal, and many of them are women led. Many women are also involved in the promotion and increasing access to finance through savings and credits groups, as well as microfinancing. However, the finance is generally used for other income generating activities rather than establishing ICS businesses or purchasing ICS products, as these are not yet prioritized.

Karnataka, India: In this region, microfinance institutions (MFIs) are already supporting the marketing of ICS to end users. These MFIs share lists of their members with the cookstove companies either freely or for a fee. On some occasions they also provide assistance in organizing presentations and discussions on ICS in the regular meetings of members at the cluster or the federation level. Often MFIs also provide loans to groups for ICS purchase, and a number of factory-produced cookstove companies, including Envirofit and Greenway Stoves, have benefitted from these initiatives (although no exact data on numbers of ICS could be obtained from these companies). There are many organizations concentrating on the empowerment of rural women that organize self-help groups along the lines of joint liability groups and provide infrastructure and finance through microcredit to the rural population.

However, despite the success on providing consumer finance for ICS purchase, MFIs have not yet started specifically providing loans to women to start new ICS businesses, and the taking out of loans by women to start such ICS manufacturing, distribution, or retail enterprises is still very rare.

Kullu, Himachal Pradesh: In Kullu, Himachal Pradesh, over 100 Women's Savings & Credit Groups (WSCGs) have formed with support from Jagriti. These groups provide loans to end users to purchase new improved tandoor and LPG cookstoves, and from this many families, especially women, have benefitted. Again, however, the increased supply of ICS consumer finance has not led to a corresponding increase in finance for women to establish new ICS businesses, as this type of finance is quite different and requires different support for the finance institutions and potential women entrepreneurs.

Odisha, India: A few cookstove manufacturers have partnered with microfinance institutions (MFIs) and NGOs to sell their ICS products, with success stories from Envirofit and TERI. However, overall, the interaction between ICS companies and finance institutions is still weak in Odisha. Such initiatives are limited to few specific areas, and the coverage is so far only benefitting a limited number of households. These initiatives are also very much dependent on donor funding, with neither the cookstove end users nor the ICS market actors benefitting significantly, due to the current low demand for ICS and low supply of specific financial products.

Overall Observations in South Asia: Although things are starting to move in a positive direction towards access to consumer finance for ICS end users, the practical access to financing for women entrepreneurs for ICS is still lacking. In addition, technical, economic, and socio-cultural issues are hindering women from accessing finance to start stove enterprises or purchase stoves. Generally the men control family finances and make decisions regarding management of assets and land. The lack of asset ownership, and resulting lack of collateral, is one of the biggest obstacles encountered by women entrepreneurs. In the case where loans are available without collateral, women are generally still unable to take out loans due to the perceived associated risk. Although there have been some success stories of promoting women entrepreneurs, in particular Grameen Bank and Grameen Shakti in Bangladesh, in addition to women-managed cooperatives in Nepal and India, the study team could not find any evidence of women using the opportunity to start new cookstove enterprises.

6.3 Enabling Environment Policy (Level 3)

The governments of India, Nepal, and Bangladesh have all recognized the burning of solid biomass fuel in household kitchens as being a significant environmental health problem in their respective countries. Importantly, they have all also recognized the key role that women can play in solving this problem efficiently and effectively.

Nepal: The government of Nepal is committed to “Clean Cooking for All by 2017 (CC4All 2017)” which was announced on January 20, 2013, and is a testament to the very high level of support for clean cooking technologies in the country. Nepal is currently implementing a multi-donor renewable energy program (2012–17) with ICS as a key intervention. The government is subsidizing specific biomass energy technologies or systems, with a 50% subsidy for metallic ICS. There is no direct subsidy for mud ICS, but local bodies are encouraged to provide financial support to install mud ICS. The NRREP program requires that at least 50% of Stove Masters must be female and prioritizes women and people from socially disadvantaged groups, are all positive initiatives from a gender equality perspective.

Bangladesh: In Bangladesh there is a comprehensive five-year (2013–2018) plan by the government entitled the Country Action Plan (CAP) for Clean Cookstoves. The CAP provides opportunities for interested parties to scale up the widespread adoption of clean cooking solutions in Bangladesh. The CAP also includes interventions to strengthen supply and enhance demand in the cookstove markets, with many women-focused interventions being included for the first time. The CAP also emphasizes the leveraging of government funds to finance women-led businesses in the cookstove sector. It also sets clear indicators for success measurement in areas such as health and livelihood improvement and women’s empowerment. However, despite all these policy convergences, until now, many government institutions involved—especially with respect to energy—have not been able to function in a well-coordinated manner. The 2008 Renewable Energy Policy suggests the establishment of a Sustainable Renewable Energy Development Authority (SREDA) to improve coordination, but the lack of action on this is another example of the lack of such inter-agency coordination.

India: The government of India launched its ambitious “National Biomass Cookstoves Initiative (NCI)” in late 2009 to extend the use of clean energy to all of India’s households through the development of “the next-generation of household cookstoves, biomass-processing technologies, and deployment models” (MNRE 2009). The initiative aims to distribute 15 million stoves every year for the next decade, aiming to supply 87% of households across India and avoid 17% of premature deaths. The government has also established cookstove testing centers for certification of stoves, as per the BIS standards. In India, there is a fairly large cookstoves market, which is outside of the government subsidy regime. This is led by private sector manufacturers, as well as NGOs.

However, despite these positive changes, there is still a lack of specific policies which principally target and focus on women. The policies are generally gender blind, theoretically providing “space” for women in the stages of planning, technology choice or mix, and in exploring financial arrangements, but to change the status quo, it is believed that the policies need to specifically support women in the short term to bring about any significant change. Likewise, the current support programs and projects to support cookstove promotion are based on direct delivery approach (subsidies and targeted capacity building activities). Past experience suggests that the direct delivery approach is not adequate to create a sustainable market of cookstoves, as their functioning is dependent on other market system actors like input and service providers, and an enabling environment. To create a vibrant market of cookstoves, cookstove market systems should be strengthened, with emphases on stakeholders’ participation, systems thinking, and facilitation from the design phase of the project. It is important to ensure equitable participation for women in all components of the cookstove market system.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

6.4 Socio-Cultural Aspects

Evidence from the surveys indicates that in South Asia, there is generally still a patriarchal society, with women often being confined to household chores and child care; most women still consider other work to be a burden. Many women are unable to pursue prolonged training or further education due to these household responsibilities and educational limitations. Women are often culturally averse to working on mechanical and electrical aspects of devices, as this is something that is still assumed to be a man's job. Even when some women do manage to acquire such required skills, they are often unable to transform them into income generation due to social and cultural taboos. Stove construction is not believed to be a traditional livelihood activity for women, so obtaining the required family consent for engaging in the ICS sector is often not available to most women. In addition, the general low level of mobility of women reduces their ability to enter the ICS market; women's travelling to work in other villages and towns is not the norm, and there is still a cultural resistance to this. Staying away from home for even slightly lengthy periods is a barrier considering the multiple responsibilities of women within the home, in addition to fear for safety and social rebuff. Working in an alien kitchen or factory, and in the presence of strange men, is also perceived as a risk for women.

6.5 Contribution and Role of Women in Increasing Stove Adoption

Evidence from the surveys indicates that a greater involvement of women in the front end operations of ICS market chains (the operations directly linked to the end users), including awareness creation, market development, sales, and servicing, is likely to lead to increased cookstove adoption. This has been shown in Kullu, where the Women's Savings &

Case Story: Laxmi Adhikari of Nuwakot District, Nepal

Being a promoter and installer of ICS has provided opportunities for a new, lucrative profession for many women. "Within a period of three years they (women ICS workers) have earned as high as NPR 300,000 (3,206 USD)", says Laxmi Adhikari of Nuwakot district, Nepal. With the income the women working as promoters and Stove Masters have made, they've been able to pay their children's education and marriage costs, as well as pay off all their loans. They are happy with their earnings, which are also able to cover costs of medical care, household amenities, and agricultural inputs like fertilizers and seeds, and paying insurance premiums, all leading to significant livelihood benefits.

Credit Groups (WSCGs), have been very effective in motivating their members to increase ICS sales. In Nepal, women ICS promoters have been very successful in creating increased demand. However, women's involvement in manufacturing, material movement, and packaging may not lead to such increases in ICS adoption, although it does lead to their economic empowerment.

Also, women know the preferences and need of users better and can better design appropriate stoves. The involvement of women at the design stage is vital in ensuring that a user-friendly product is developed and then made available through the best channels. In addition, women can generate awareness and create demand among a wide range of consumers by leveraging their networks. Importantly, women who are involved in such businesses gain great satisfaction from being able to generate their own incomes. Most women tend to invest this income in better education for their children. Women also tend to invest in household assets that lead to a more secure future for themselves and their families. They also like that they are perceived as role models by their peers, and are able to motivate other women to take on similar responsibilities, leading to further involvement of women in ICS markets (based on discussion with women stove entrepreneurs).

In Karnataka, there are more than 195,585 women's self-help groups that directly address their poverty and social issues. Similarly, there are significant numbers of such groups in other states of India and other South Asian countries, and there is a huge potential to mobilize such groups for ICS uptake. However, evidence indicates that it is equally important to create awareness in men as well. In Bangladesh, Winrock involved

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

men as a target group in their ICS promotion strategy, which led to quite significant success in creating sustained clean cookstove demand.

7 CONCLUSION AND RECOMMENDATION

7.1 Conclusions

The use of “traditional”¹³ often poorly designed and manufactured stoves for cooking leads to significant environmental and health problems in South Asia. In contrast, the use of clean cookstoves—defined as improved cookstoves (ICS) (biomass stoves which perform significantly better than traditional stoves) and BLEN (biogas-LPG-electricity-natural gas) stoves and fuel—often leads to a range of livelihood benefits for households in South Asia, in particular for women who are the primary users of the stoves and fuels. Except in a few cases, the use of ICS has contributed to fuel savings and reduced HAP, leading to drudgery reduction related to the collection of fuel, time saving, and health improvements. The survey results indicate that, on average, there is a 28.1% reduction in firewood consumption when an ICS is used compared to a TCS.

Firewood collection has been shown to require significant time, with the traditional cookstove user household (HH) spending on average of around 660 hours per year on firewood collection compared to 539 hours/year/HH time by a ICS user household (equating to 122 hours/year/HH or an 18% time saving). For firewood collection, there is greater involvement of women as compared to men: on average, for a traditional cookstove user household, 56.7% of the time required for fuel collection falls to women, equating to around 374 hours per year, compared to 43.3 % and 286 hours for men. In contrast, women who use ICS spend only 305 hours on fuel collection, saving approximately 70 hours per year. It seems that when ICS are used, the time saving is generally enjoyed more by men for income generating activities or social activities, while the women take on the greater burden of firewood collection. The health problems reported by women cooks from HAP included asthma, chronic coughing, severe headaches and fever, eye discomfort, weakness and fatigue. Compared to the TCS users, significantly less ICS users reported having respiratory illnesses during the last year. Cooking is almost entirely carried out by women, with, an average of about four hours a day required for cooking with a TCS. There is an average time saving of 30 minutes (12.5%) per day when using a biomass ICS and 1 hour 10 minutes (29.2%) per day when using a BLEN cookstove. This saved time was found to contribute to women’s increased involvement in social and family activities, including time with their children, agricultural activities, attending community meetings, meeting friends and relatives, visiting market and attending social events such as marriage ceremonies etc. and labour contribution for development activities,. It was reported that mothers who use ICS are able to give more time to prepare their children to go to school and monitor their studies. Likewise, due to reduced drudgery and time saving, women require less support from their children for household chores and fuel collection. The survey results showed that there are a higher percentage of school enrollments of children (both boys and girls) among ICS user households compared to TCS users.

However, the rate of increase in adoption of clean cookstoves has been an important issue in most South Asian countries. As the key decisions on family spending are made by men, and ICS does not fall within their top purchasing priorities, the demand for ICS often remains quite low. The other reasons for the low demand for ICS include a lack of awareness and inadequate information about the benefits of ICS, as well as inadequate access to finance and the lack of timely availability of quality stoves and follow-up maintenance services. The adoption of ICS has been shown to be higher in women-headed households, indicating that when women are able to make such choices they prefer to purchase and use ICS. There is also a higher adoption of ICS among households where the household head is literate compared to illiterate. However, there was no significant difference observed with respect to the education level of the cooks and ICS adoption, as they are often not the ones who decide on whether to purchase an ICS.

Evidence suggests that the majority of users are happy with the performance of their ICS. However, as the ICS surveys included a range of types of stoves, it was reported that some of the stoves are not performing

¹³ These are stoves that have been designed and manufactured as an alternative to cooking on open fires, but generally with little consideration of their performance in terms of reduced emissions or increased fuel efficiency.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

well, creating a negative impression of ICS. Therefore, testing of stoves and tier ratings are required to allow consumers to make the most informed choices about which models to purchase.

The evidence suggests that engaging women in ICS market chains can ensure the creation of more appropriate products, as well as help generate demand and increase adoption and use. However, due to various socio-cultural and economic constraints, women's current level of involvement in ICS market chains in South Asia is very low. Women's involvement was found to be comparatively higher for on-site manufactured stoves (mainly mud ICS), as these have often been supported by civil society organizations who prioritize gender equity and also because it fits with some skills sets they already have, such as pottery. However, women's involvement in the market chains of factory-produced and imported cookstoves is generally very low due to a number of socio-cultural, economic, and technical reasons.

The development of women entrepreneurs requires a comprehensive strategy to address the systemic constraints that are still in place prohibiting them from entering the sector. There is a need for long-term, women-targeted training programs, incubation support to women entrepreneurs, and provision of follow-up services and resources to enable women to form a more equitable part of the ICS and fuel market chains. To encourage women's involvement in the ICS sector there is a need for government and development agencies to provide tools and environments that allow private sector organizations to implement and sustain the increased involvement of women, something they're already aware of, but are unable to support themselves. The interventions should focus on educating women and their male counterparts, their families, and the greater society on women's potential to be more involved in the ICS sector. Interventions to enhance the skill set and capacity of women to engage in ICS market chains are needed, not only for them to form part of the workforce, but also as entrepreneurs. In addition, the provision of comprehensive business development, market analysis, and business plan development support—not just financial support—is required in order to ensure the sustainability of women's involvement in ICS businesses.

Women are often organized in social networks that can reach vast new customer segments. They have access to hard-to-reach households, can utilize woman-to-woman marketing techniques, and are trusted promoters of household products among their peers. It is clear that if the cookstove adoption is to increase, women have to be involved in front end operations like sales and marketing. Furthermore, involvement of women at the design stage is vital because it ensures that a user-friendly product is developed and made available through different channels.

Great effort has been made in India, Nepal, and Bangladesh to increase demand for clean cookstoves—and ensure their manufacture, distribution, and retail—through government and donor-supported projects and programs for entrepreneurs and cookstove technicians.. There have also been various efforts to increase women's involvement in cookstove enterprises, but the success has been limited. The direct delivery approach through targeted subsidies and capacity building activities were found to be inadequate in encouraging women's involvement in cookstove market chains. Evidence shows that just supporting clean cookstove market chains in general does not directly lead to increased involvement of women. Targeted support needs to be provided to better involve women in the clean cookstove market chains. Support should also be provided to companies and organizations that provide supporting service and help build the enabling environment to create vibrant cookstove market systems with a significant level of women's involvement.

7.2 Overall Recommendations

To create more vibrant markets for cookstoves, the whole cookstove market system should be strengthened, with emphasis on stakeholders' participation, systems thinking, and facilitation from the design phase of the project through the monitoring of its impacts. The market chain actors are very much dependent on input and service providers that are supported by a positive, enabling environment. The development of sustainable and gender inclusive clean cookstove markets in South Asia requires the active

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

engagement of women in all aspects of the cookstove market systems. The following recommendations are made based on the research findings:

7.2.1 Increasing Stove Adoption and Sustained Use (Demand Side):

Technical Aspects:

- Testing of efficiency, emissions reduction, safety, convenience, ease of use, and availability of fuel and durability of the cookstoves should be considered during the design process. The systematic and standardized field testing of stoves with women users should be made mandatory during all new ICS design processes. There should also be a system for tracking stove performance over time.
- Performance and ease of use testing should be carried out for all stoves to establish their performance tier rankings, and this should be clearly communicated to the end users through media and clear labeling to ensure the end users understand the attributes of the various stoves that are available to them.
- The quality of the cookstoves should be assessed through an authentic certification agency, and warranties for all stoves should be provided by the suppliers.
- Promotion of local manufacturers can help provide ready availability of cookstoves and repair and maintenance of the stoves.

Social Aspects:

- Massive awareness activities on clean cookstoves should be carried out, targeting both men and women. Health benefits should be the main focus of an awareness package, but other benefits of clean cookstoves should also be highlighted.
- The surveys showed that in spite of awareness about health implications of smoke, people are not purchasing ICS. This suggests that the awareness messages need to be repositioned in terms of the priorities of the household decision makers.
- In order to further emphasize health benefits, it is suggested that relevant stakeholders work with health institutions, particularly with social change actors like Female Health Volunteers (active in Nepal and Bangladesh) and Female Health Workers (active in many parts of India) in South Asia.
- Short, women-focused trainings on kitchen and fuel management should be carried out at scale in each country. These trainings need to inform women on the methods of efficient and proper handling of the fuel and stoves, as well as relate to the access, storage, and preparation for use of the fuel and stoves, and their safety in the house. Simple improvements in cooking practices can lead to substantial fuel savings.

Institutional Aspects:

- Women's networks should be strengthened and involved in awareness creation activities and advocacy activities.

Financial Aspects:

- Increased access to consumer finance should be made available to ICS users. A wide base and diversity of finance options need to be developed together with Financial Service Providers (FSPs) and marketed to the clean cookstove consumers and market chain companies. Working in partnership with rural cooperatives, in particular women cooperatives, can help to finance stoves and expand their uptake.
- A targeted subsidy can also be provided to women-headed households and ultra-poor families to support their adoption, which may not otherwise be possible.

7.2.2 Strengthening Clean Cookstove Market Chain and Increasing Women's Involvement

A participatory market system development (PMSD) approach should be applied to establish sustainable cookstove markets with the active participation of women within the whole market system (Annex 2). In addition to direct support to the clean cookstove and fuel market chain actors, there is need to build strong linkages with the input and service providers. There is also a need to develop an enabling environment for clean cookstoves. In addition to direct delivery approaches, systemic market development approaches need to be considered with the active involvement of women in all parts of the cookstove market systems.

7.2.2.1 Strengthening Cookstove Market Chain

Capacity Building of Women Cookstove Market Chain Actors

- Targeted training packages for women entrepreneurs should be provided on cookstove manufacturing, marketing, business planning, financial management, and entrepreneurship including quality control techniques. Women need additional support to help them overcome the barriers to attending such training programs and entering these markets. When conducting such training for women, the following should be considered:
 - **Venue:** The training venues should be near to the target women's homes and in socially acceptable places to encourage their attendance, which is often low.
 - **Duration:** There is need to spread the trainings over a long period and ask women to be present only for half a day to encourage women's attendance. Care should also be taken to avoid the harvest and sowing seasons when women are usually engaged.
 - **Composition:** If possible, mixed training should be avoided, as women tend to not open up if men are in attendance. If mixed trainings are unavoidable, ensure the attendance of a critical mass of women. Mixed trainings can be arranged so that women are present during the second half and men in the first half.
 - **Mode:** Reduce dependency on written presentations during trainings, and instead focus on role play, open discussion, breakout groups, and practical work—learning by doing. Pictures, slide shows, and charts should be used as well as durable and diagrammatic learning material that attendees can take with them to show to others.
 - Direct facilitation is also required to build the confidence of women entrepreneurs.

Support to Establish Women-Led Clean Cookstove Enterprises

- To create a critical mass of women entrepreneurs and build their confidence, potential women cookstove entrepreneurs should be provided with incubation support for at least a two-year period (Annex 3).
 - Women entrepreneurs need help to establish links with the market system actors (market chain actors and support services) at the initial phase.
 - They also need business analysis support with the provision of adequate market sector data.
- The increased decentralization of ICS manufacturing and supply can help increase the involvement of women, as it allows more women to work from home and provides more flexible working schedules. Some components of factory manufactured stoves can be produced locally, such as combustion chambers and liners, and assembled locally with the greater involvement of women.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

- There is a need to build the strength of women workers and entrepreneurs through institutional support, such as through an ICS promoters' association. Group investment may also help them to establish new businesses more effectively, with minimized risks.

7.2.2.2 Strengthening the Linkages with Input and Service Providers

Access to Finance:

- Targeted financing for women ICS entrepreneurs should be provided without the need for collateral, but rather, based on their business plans and group or personal guarantees.
- As finance institutions are often far away from potential women entrepreneurs, which presents an obstacle for them to access finance, efforts need to be made to link these women with relevant finance institutions.

Other Input and Service Providers:

- Women cookstove entrepreneurs should be linked with the other input and service providers (e.g. national stove testing facilities, appropriate design and research facilities, training institutes, etc.). Efforts should be made to ensure an equitable representation of women in these facilities.

7.2.2.3 Creating Favorable Policy Environments

- There is a number of national and global commitments and targets regarding clean cooking solutions in South Asia, which are potentially very important in building the confidence of market actors. These commitments need to be effectively communicated to these actors, including women, and need to be backed up by the allocation of sufficient resources, action plans, and institutional capacity building to ensure these targets are met. Throughout this process women need to be involved in each step.
- Equal participation by women should occur throughout the project cycle and all sections of the cookstove market system.
- Additional support packages, such as tax exemption and subsidies, should be provided for women entrepreneurs and women-headed households.

7.2.3 Sustainable Cookstove Demand Creation

To attract greater women's involvement in the ICS market chain sector, clear profitable business models with long-term business potential need to be promoted to women, as evidence suggests that they tend to be more risk adverse than men. To achieve this, there is need of push strategy at the beginning as following:

- Need to work with women groups/cooperatives to scale efforts, build capacity, and provide a support system.
- Need facilitation for greater partnerships between stakeholders and sharing of knowledge within the sector.
- Woman-to-woman knowledge transfer in maintenance is often more effective than man-to-woman knowledge transfer, particularly in conservative communities. Women can implement trial periods and warranties more easily because they have direct access to users, so effort should be given for woman-to-woman knowledge transfer.
- Provide warranties on cookstoves that cover servicing and repair/maintenance needs.
- Support should be provided to establish an effective communication channel between the customers and the service providers. Use of modern communication technologies like mobile phones should be encouraged for this.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

- Cost and benefits, including impacts and adoption of different types of cookstoves, is not the same across technologies and in different regions of South Asia. Further analysis is required to ensure increased access and women's involvement in all cookstove tiers.

7.2.4 Monitoring and Evaluation (M&E) of Clean Cookstove Programs

- Women's participation in quality assurance and quality control should be encouraged.
- Use of sex disaggregated indicators/data for monitoring and evaluation should be used.
- Access to clean cookstoves should be monitored using multi-tier monitoring framework.
- Gender audits¹⁴ using gender sensitive indicators should be used within clean cookstove projects and programs.

¹⁴ An assessment tool and process for identifying stakeholders' perceptions of how gender issues are addressed in the project planning and implementation processes.

Gender and Livelihoods Impacts of Clean Cookstoves in South Asia Study

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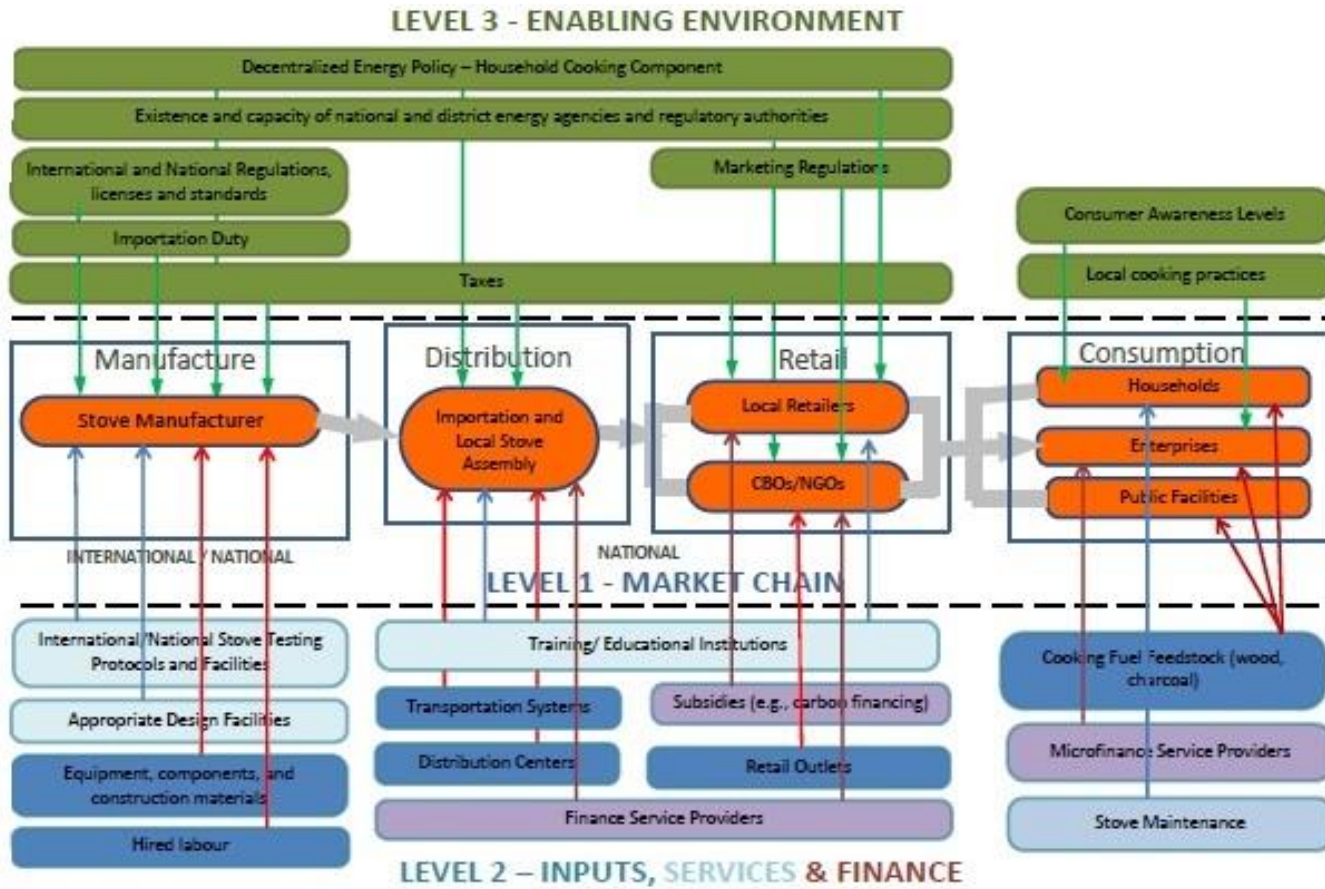
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ANNEX 1 STUDY LOCATIONS

1. Nepal
2. Bangladesh
3. Himachal Pradesh, India
4. Odisha, India
5. Karnataka, India



ANNEX 2 GENERIC ICS MARKET SYSTEM MAP



Source: PAC, Energy Market System Assessment Framework, prepared by Practical Action Consulting (PAC) and European Union Partnership Dialogue Facility (EUEI PDF) (2015 expected date of publication)

ANNEX 3 INCUBATION SUPPORT REQUIRED FOR WOMEN STOVE ENTREPRENEURS



ANNEX 4: LIST OF STAKEHOLDERS WORKSHOP PARTICIPANTS

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9	Mr. Hans Mathiesen	Tandoor fabricator
10	Ms. Sarla Shashni	Scientist, GB Pant Institute, Kullu
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ANNEX 5 DETAIL SURVEY INDICATORS

Indicators and Information Source Related to Stove Use

Headings	Indicators	Information Source
Socio-Economic	<ul style="list-style-type: none"> • Size of families, education level, and occupation • Annual income and expenditure • Food sufficiency • Household saving and investment, asset holdings 	HH survey
	State/District level information <ul style="list-style-type: none"> • Number of households, family size, population change forecast, economic growth rate, religion/ethnicity/caste/culture 	Secondary source: census report
Energy use	<ul style="list-style-type: none"> • Fuel use pattern • Fuel availability and source • Annual fuel consumption 	HH survey & secondary source
	<ul style="list-style-type: none"> • Number of households by type of stoves • Number of user households by type of fuel • Annual demand for fuelwood and its sustainable supply • Other potential fuel options (substitutes) 	Secondary source: census report
Cost of energy	<ul style="list-style-type: none"> • Prices of fuel and stove • Annual use quantity • Time loss in fuel collection • Drudgery in fuel collection 	Focus group discussion, HH survey
Capacity building	<ul style="list-style-type: none"> • Training users to operate, repair, and maintain the stove 	HH survey
Technology	<ul style="list-style-type: none"> • Type of stoves in use and cost • Life of stove • Number of stoves in a house and type • Cooking place, user's acceptability, willingness to install, and appropriateness of new technology • Operation and maintenance of the stove • Guarantee and follow-up services 	HH survey, focus group discussion

Headings	Indicators	Information Source
	<ul style="list-style-type: none"> Performance of technology Emission level from the particular technology 	Literature (previous testing results), HH survey, and observation
Gender equity and women's empowerment	Gender disaggregated data on: <ul style="list-style-type: none"> Spent time for fuel collection (annual) Spent time for cooking (per day) Spent time in other household activities (per day) Earnings Education level Household decision making Property ownership Awareness about available technological options Who cooks and who decides on buying new stoves Priorities of man and woman 	HH survey
Access to credit	<ul style="list-style-type: none"> Existence of Local COs, MFIs, banks Availability of credit Access to credit for men/women Who makes decisions about credit? 	Focus group discussion, local MFIs
Adoption of stove	<ul style="list-style-type: none"> Key motivating factors to use improved stove (aesthetic value, health, push factor, etc.) 	HH survey and focus group discussion
Health	Incidence of illness (respiratory related), health cost (money and time loss)	Local health posts, HH survey
	Health effects of household smoke	Literature, local health posts

Indicators and Information Source Related to Players in the Market Chain of Cookstoves and Cooking Fuel Industry

Headings	Indicators	Information source
Institutions active in household energy	<ul style="list-style-type: none"> Number of companies and entrepreneurs in stove business in complementary business Support organizations like NGOs, project involvement The local government's budget allocation, priorities, and plan in household energy 	Secondary source, stakeholder mapping, stakeholder meetings

Headings	Indicators	Information source
Status	<ul style="list-style-type: none"> Total number of entrepreneurs, technicians, promoters, and distributors involved in the market chain of improved cookstoves and fuels (gender disaggregated information) 	Secondary source, stakeholder meetings
General background of enterprises	<ul style="list-style-type: none"> Type of cookstove they produce or distribute and expected life of the stove Years in cookstoves and fuel business Motivation to get involved in this business Total investment (capital and running cost) Annual production and sales volume Number of employment (gender disaggregated) Main customers and methods of reaching customers Guarantee and follow-up services 	Interviews with entrepreneurs, technicians, promoters, and distributors
	<ul style="list-style-type: none"> Production/distribution channel and involvement of women in each stages 	Market chain mapping in participation of entrepreneurs
Socio-economic background	<ul style="list-style-type: none"> Size of families, education level , training, and occupation Annual income and expenditure Saving and investment, assets holdings 	Interviews with entrepreneurs, technicians, promoters, and distributors
Financing	<ul style="list-style-type: none"> Availability for enterprise financing/credit Availability of subsidy and other support from the government and donors Existence of local COs, MFIs, banks Insurance What are main financial barriers to scaling up production? 	Interview with entrepreneurs, technicians, promoters, and distributors, local MFIs
Socio-cultural aspects	<ul style="list-style-type: none"> Social norms hindering and encouraging women entrepreneurs in each points of stove production and market chain 	Interviews with women entrepreneurs
Livelihood impacts	<ul style="list-style-type: none"> Annual income and expenditure (profit) Socio-cultural issues/constraints Opportunity cost Visible livelihood changes after getting involved in stove business (confidence, social and economic status, and access to resources) 	Interviews with entrepreneurs, technicians, promoters, and distributors
Access to support services	<ul style="list-style-type: none"> Training Access to finance Access to information Support from line agencies 	Interviews with entrepreneurs, technicians, promoters, and distributors

Headings	Indicators	Information source
	<ul style="list-style-type: none"> Membership of groups 	
Marketing strategies	<ul style="list-style-type: none"> Effective promotion tools and methods that help them creates awareness about clean cookstoves Used marketing strategies Which strategies work best to influence purchase decisions of consumers and which strategies are least effective? 	Interviews with entrepreneurs, technicians, promoters, and distributors
Gender	<ul style="list-style-type: none"> Advantage and disadvantage for engaging females in the cookstove market chain Impact on adoption rate after women's involvement Possibility of recruiting women, present practice, challenges, and opportunities including impact on sales and productivity Institutional process for involving women Whether marketing is aimed at women or men Are women involved in the development of the marketing if it is aimed at women? 	Entrepreneurs and institutions involved in stove business
	<ul style="list-style-type: none"> Women's involvement in stove design process: how are they involved, and is it sufficient, or could this be improved? Women take active roles in production and selling of household cooking stoves and fuels Improved networking skills following self-awareness 	Stakeholders' interviews and literature review
	<ul style="list-style-type: none"> Number of women owned and run enterprises Number of women in project management teams and in community forums Extent to which women's opinion is heard and acted upon 	Secondary information and key informant survey
	<ul style="list-style-type: none"> External funding support or investment in cookstove and fuel sector in order to empower women Number of women in local and national energy management bodies 	Institutions involved in stove business
	<ul style="list-style-type: none"> Status of existing Laws, policies and plans on gender and energy issue (particularly household cooking) Ease of doing business 	Literature review, institutions involved in stove business
Policies	<ul style="list-style-type: none"> Gender and energy access prioritized in PRSP and national budget Transparent and accountable multi-stakeholder processes used in energy policy formulation 	Stakeholders' interviews and literature review

Instrument 1 Household Questionnaire

Note to interviewer:

This questionnaire is divided into three parts:

Part A: General Background

Part B: Health Impact

Part C: About Stoves

Please do not write in the grey areas. If a question is not relevant to a particular household, please insert a dash (—).

PART A: General Background

Date of interview: ----- **HH number** -----

County: ----- **District/state** ----- **Village**-----

Type of settlement: urban peri-urban rural

Name of interviewer: -----

Name of respondent: ----- Age ----- Sex: -----

Relationship to head of household ----- Number of persons in HH: -----

Households in the survey will be selected to represent socio-economic categories in the villages (such as the 'poor,' 'medium poor,' and 'better-off' households). Likewise, 75% of the respondents will be clean cookstove/fuel users, and 25% respondents will be traditional stove users. Efforts will be made to include at least 5% female-headed households.

A.1 Household Characteristics

Identification Code	Name of Family member (Note: Start with HH head)	Sex	Age	Time spent near* stove yesterday (whole day)	Education Status	ONLY ASK THIS QUESTION FOR CHILDREN 6-14 YRS		OCCUPATION (ADULTS)	
		Male = 1 Female = 2	Completed years		Completed years of schooling <i>Use code: 0 Illiterate 99 Literate, but never completed primary school</i>	Is child currently studying Yes =1 No =2	If not studying, reasons Never studied =1 Must work at home =2 Cannot afford =3	Agriculture = 1 Works overseas = 2 Business = 3 Industry = 4 Services = 5 Student = 6 Wage labor = 7 Other (specify) = 8	
								Primary	Secondary
1	HH head:								
2									
3									
4									
5									
6									
7.									
8.									

Note: * In this case, "near" is defined as being within approximately 3 meters from the fire.

H2_1 Where do you cook mostly?		In summer:	
		In winter:	
a. In a room used for living or sleeping b. In a separate building used as kitchen c. In a separate room in same building used as kitchen d. Outdoors—open area e. Outdoors—roof covered f. Other (specify)			
H2_2 If you have school-age children, where do they usually do their homework?		In summer:	
1- In the kitchen 2- In another part of the house 3- Outdoors 4- Another house or building 5- No specific place, or homework not done		In winter:	
H2_3 How many rooms are there in your house?			
H_3 Types & uses of household fuel			
H3_1 Using the fuel list below, what types of fuel/energy source do you use for the following purposes? (List in order of importance using numbers shown below)			
1- Wood	5- Charcoal	10- Grid electricity (electric heater)	
2- Dung	6- Kerosene (paraffin)	11- Batteries	
3- Agricultural residues	7- Bottled gas (LPG)	12- Wax candle	
4- Other residues	8- Solar cooker	13- Bio gas	
	9- Solar electric (solar PV)	14- Other	
If 'other' fuel used, please specify fuel	Other fuel =		
	Most used fuel	Second most used fuel	
H3_1_1 Cooking (including boiling water for drinking)			
H3_1_2 Making tea/coffee			
H3_1_3 Lighting			
H3_1_4 Room heating			
H3_1_5 Heating water for other purposes			
H3_1_6 Spirits brewing for self-consumption			
H3_1_7 Cooking food/drink for selling			
H3_1_8 Cooking animal feed			
H3_1_9 Other task 1 (specify below)			
H3_1_10 Other task 2 (specify below)			
H3_2 If stove is used for another type of household task, please specify task (s)		Other task 1 =	
		Other task 2 =	

C Cooking Energy Needs

C.1 What types of cooking devices do you use?

S. No.	Type of stoves *	Number of stoves	Fuel	If you have it			Used for cooking meals (write 'C'), preparing tea and snacks (T), for room heating (H), for making/preparing animal feed (F), cooking for sale/business purpose (B), other purpose (O)	What are the best features about it?	What features do you not like about it?
				Cost per unit stove	Year of purchase	Condition of stove: 1=poor condition 2=fairly good condition 3=very good condition (as observed or as reported)			
1 st									
2 nd									
3 rd									
4 th									

CODE for stove types

LPG gas stove & cylinder = 1; Kerosene stove = 2; Improved cookstove (ICS) (for fuelwood) = 3; Coal/briquettes chula = 4; Rice cooker = 5; Electric heater = 6; Iron tripod/three stone (traditional) = 7; Mud chula (traditional) = 8; Rocket stove = 9; Biogas = 10

* Note: For biogas, please also include size of the biogas plant.

C.2 If you or your family gather/process fuel for cooking, please use the table below to say about how long, on average, each collection trip takes (in hours and minutes) at each time of year and who usually collects it. More than one person can be listed for collecting the fuel, but put the person who spends the most time first.

*Woman =1; Man = 2; Girl = 3; Boy = 4

	In which season it is mainly collected? Put	Source		Annual collection quantity	Who mostly gathers it? Include

<i>Fuel type (wood, cow-dung, briquette, agri. residue, coal, etc.)</i>	in order of most time spent to least.		Time for round trip including collection and processing (hrs & mins)	Unit	Quantity	Kg per unit	more than one if necessary (main 1 st)*
Wood			___hr___ min				
Cow dung			___hr___ min				
Agriculture residue			___hr___ min				
			___hr___ min				

*Note: Here, school-going children below the age of 15 years are referred to as boys and girls, and above 15 years old are referred as men and women.

C.3 If you purchase, quantity and cost of fuel:

S. No.	Fuel	Average time spent to purchase per visit	Annual visits (times)	Who goes to purchase normally (men/women/boys/girls**)	Mode of transporting the fuel	Purchase		
						Unit	Unit price (in Rs)	Annual purchase (in Rs)*
1	Fuelwood							
2	LPG							
3	Kerosene							
4	Coal							
5	Electricity							
6	Agricultural wastes							
7	Animal dung cake							
8	Others (specify)							

* Note: If difficult for respondent to make annual calculation, the enumerators are asked to take note and put calculated figure here.

**Here, school-going children below the age of 15 years are referred to as boys and girls, and above are referred as men and women.

C.4 Cooking sessions yesterday—24 hrs. (start from early morning)

Times when cooking started: please write "no cooking" in each box where cooking did not take place (for example, if there were only two lots of cooking done, please mark the remaining three with "no cooking" in each box).

Cooking sessions	What was cooked?	Which stove did you use?	How long was the cooking session?		Who cooked? (woman, man, boy, girl)*
			hrs	mins	
1st					
2nd					
3rd					
4th					
5th					
6th					

*Note: Here, school-going children below the age of 15 years are referred to as boys and girls, and above 15 years old are referred as men and women.

Fuel type (Code)

No cooking = 1	Other residues = 5	Solar cooker = 9
Wood = 2	Charcoal = 6	Grid electricity = 10
Dung = 3	Kerosene = 7	Other = 11
Agri-residues = 4	Bottled gas (LPG) = 8	

H6.1 Efforts to reduce indoor smoke

H6.1 Do you think smoke from cooking is a problem that should be solved?	Y / N		
H6.2 Have you made any effort to reduce smoke in your kitchen?	1=Yes 2=No (go to section 7)		
H6_2.1 If yes, what are they (more than one can be selected)?	Using improved stove with chimney = 1 Using improved stove without chimney = 2 Using smoke hoods = 3 Kitchen ventilation system has been improved = 4 Changed the fuel from dirty to clean fuel (using LPG, electricity, etc.) = 5 Using dry fuel only = 6 Other = 7		
H6_2.2 If "other," please describe the changes.			
C.6.3 Has the cook received any training on kitchen and energy management? a. Yes b. No			

HA. Household Assets and Income Status

HA.1 Type of household items

Items	Yes/No
TV	
Electric fans/room heater	

Items	Yes/No
Water filter	
Pressure cooker	
Radio	
Mobile phone	
LPG cylinder	
Mixer/grinder	
Motorcycle	
Two wheeled moped/scooter	
Livestock	
Type of roof of the house	Thatch/tile or sheet/RCC
Land holding	Landless/irrigated land/non-irrigated land

HA.2 Type of indebtedness

- i. Daily consumption purposes from informal sources (friends, relatives, or money lenders)
- ii. For production purposes from informal sources (friends, relatives, or money lenders)
- iii. For other purposes from informal sources (friends, relatives, or money lenders)
- iv. Borrowing from institutional agencies
- v. No indebtedness

G. Gender

G.1 Who does following tasks mostly? (men/women/boys/girls)*

Who carries out the following activities?	Mostly	Sometimes
a. Purchasing of daily household items from the market		
b. Selling agricultural and livestock products		
c. Attending community/NGO/group meetings		
d. Visiting agri. service center or veterinary for advice		
e. Collecting fuels		
f. Purchasing fuels—making payment		
g. Fetching LPG cylinder		
h. Cooking		
i. Cooking feed for animal (if any)		
j. Making food and drink for sale (if any)		
k. Fuelwood processing (cutting, drying)		
l. Fetching water		
m. Carrying out farming activities		
n. Getting updated information by watching television, listening to radio, or reading newspaper		
o. Visiting banks and MFIs		

*Note: Here, school-going children below the age of 15 years are referred as boys and girls, and above 15 years old are referred as men and women.

G.2 Who makes the following decisions? (Men/women/boys/girls)*

Who makes decisions on the following activities?	Mostly	Sometimes
a. Children's school		
b. Stove and fuel		
c. Foods for family		
d. Health check-ups and treatment		
e. Purchasing of kitchen utensils		
f. Purchasing of assets/lands		
g. Taking out loans		

*Note: Here, school-going children below the age of 15 years are referred to as boys and girls, and above 15 years old are referred to as men and women.

G 3. Current household investment priorities of family members (in existing situation)

Priorities	Top 5 priorities	
	For male members	For female members
1 st		
2 nd		
3 rd		
4 th		
5 th		

SG: Social Capital

SG 1. Do you or any of your household members belong to formal/informal/traditional groups related to energy use and access, and women's empowerment? If yes,

Name of family member	Name of group	His/her role in the group	Activities of the group

Part B Health and Well-being

W1 Well-being and health of family members during last 12 months: Limit the question to long-term respiratory illness—chronic cough, chronic obstructive pulmonary disease, asthma, lung cancer, tuberculosis, pneumonia, and other lower respiratory tract illnesses; long-term discomfort in eyes including cataracts; burns from stove fire; chronic back related issues linked to carrying fuelwood; chronic headaches, etc.

W1 – General well-being and health													
	Name	Age	Gender	Smoker (Yes/No)	Symptoms?	Where did you receive advice for treatment? 1 - Health post or center 2 - Hospital 3 - Private health practitioner 4 - Local healer 5 - Treatment at home 6 - Did nothing 7 - Others (specify)	How much did you pay for advice? (Rs)	How much did you pay for treatment and medicine? (Rs)	How much did you pay for travel? (Rs)	List other expenses related to treatment. (lodging, food, etc.)	If not treated, why? 1 - No money 2 - No medical facility close by 3 - No medicine/doctors in health facility 4 - No one to provide transport 5 - Others	Patient days loss due to illness (working, schooling, etc.)	Days loss of care takers?
1													
2													
3													
4													
5													

Part C About the Stove
Traditional stove users only

TS – Traditional Stove Use			
TS1 Why are you still using a traditional stove?	i. Don't know about negative impact of indoor smoke ii. Improved stove/clean fuel not easily accessible iii. Can't afford iv. Don't want to change traditional practice v. It is not priority of other family members vi. Traditional stoves better fits to our need vii. Others (list)	
TS2 Are you happy with the existing stove, or do you want to switch to another type of stove?	1 = Happy with the existing stove 2= Want to switch to another type of stove		
TS3 If you want to change, what is the main reason (one only)?			
TS4 If you want to switch, what type of stove is your preference?			
TS5 What is the maximum amount you are willing to pay for the new stove?			

Improved stove or clean fuel users only

SH – Improved stove Use			
SH1.1 What type of improved cooking stove/fuel are you using mostly?			
SH1.2 How did you know about the improved stove/fuel? Who motivated you to install improved stove? (could be multiple answers, but put in priority order)	i. Project staff (NGO activity) ii. Cooperative iii. Neighbors/relatives iv. Manufacturers/promoters v. Self vi. Others (list)	
SH1.3 From its installation/purchase, how many days have you been using it?	1= All the time 2 = Most days 3 = Half the time 4 = Less than half the time		

	5 = Very few days		
SH1.3.1 What were the reasons for not using it every day (select as many reasons as required)?	1 = Prefer to use traditional stove 2 = Not comfortable to use 3 = Not seen any benefits 4 = Other reason(s)		
SH1.3.2 If "other reason" was selected, describe the other reason(s) here .			
SH1.4 When using the improved stove, did you often use another type of stove at the same time?	1 = All the time 2 = Most of the time 3 = About half the time 4 = Less than half the time 5 = Only occasionally 6 = Not at all		
SH1.5 Why did you use another stove at the same time?	1 = It is our culture/habit 2 = Because it is quicker 3 = For space heating 4 = Because I wanted to cook two different foods at the same time 5 = Other reason		
SH1.6 If other, please explain.			
SH2.1 What is the condition of the improved stove?	1= Good 2 = Ok 3 = Worse		
SH2.2 How is the improved stove compared to your traditional stove?	1 = Much better 2 = A bit better 3 = About the same 4 = A bit worse 5 = Much worse		
SH2.3 What aspects of the stove made it worse than your traditional stove?			
SH3.1 Compared to traditional stove, cooking with improved stove...	1 = Takes much more time 2 = Takse a bit more time 3 = About the same		

	4 = A bit less time 5 = Much less time		
SH3.2.1 If time saving with improved stoves, how many hours per day?			
SH3.2.2 If time is being saved, how is it used?	1 = Give more time to children's care 2 = Started to do income generating activities 3 = Able to attend community meetings 4 = Meet friends and relatives 5 = Others (specify)		
SH3.3 Compared to traditional stove, the improved stove creates ...	1 = Much more smoke 2 = A bit more smoke 3 = About the same 4 = A bit less smoke 5 = Much less smoke		
SH3.4 Is there a cleaning problem?	1 = Yes 2 = No		
SH3.5 If no, how are you cleaning it?			
SH3.6 If yes, how can we solve the problem?			
SH3.7 Is your improved stove in right condition?	1 = Yes 2 = No		
SH3.7.1 If not, what are the problems?			
SH 3.8 How easy is it to cook using an improved stove?	1 = Very easy 2 = Easy 3 = Ok 4 = A bit difficult 5 = Very difficult		
SH3.8.1 If difficult, why was it difficult to use for cooking?			
SH3.9 How safe (injury to children) the improved stove?	1 = Very safe 2 = Safe 3 = Ok 4 = Not safe 5 = Very unsafe		
SH3.9.1 Why do you feel it is unsafe to use?			

SH4.1 What are three main positive impacts for your family of improved stove use?	1. 2. 3.		
SH4.2 What are three major problems with the improved stove or qualities you don't like, if any?	1. 2. 3.		
SH4.3 Have you made any modifications to the new technology to suit your needs since you acquired it?			
SH4.4 Have you been visited by the manufacturer/supplier/promoter since you acquired the improved stove in order for them to check it?	1 = Yes 2 = No		
SH4.5 If yes, how many times?			
SH4.6.1 Are you using the stove for any productive use/earning an income in any way?	1= Yes 2 = No		
SH4.6.2 If yes, how? Explain.			
SH4.6 Are you happy with the existing stove, or do you want to switch to another type of stove?	1 = Happy with the existing stove 2 = Want to switch to another type of stove		
SH4.7 If you want to switch, what type of stove is your preference?			
SH4.8 What is the maximum amount you are willing to pay for the new stove?			

Observations of the enumerator or reported

O.1 How is the kitchen ventilation (window size, door, eave space, etc.)?	Very good = 1 Good = 2 Okay = 3 Bad = 4 Worse =5		
O.2 Type of roof in the kitchen (just of kitchen, not whole house)			
Mud = 1 Ferro-cement = 2 Wooden tiles = 3	Thatch = 4 Tiles = 5 Other = 6		
O.3 Permanent ventilation <i>in roof</i> of kitchen	None = 1		

Small holes or gaps (less than 10 cm in diameter) = 2 Large holes and gaps (more than 10 cm in diameter) = 3		
O.4 Kitchen Size Much larger than average size = 1 About average = 2 Much smaller than average = 3		
O.5 Smoke/soot levels in kitchen (write based on observation)	High = 1 Medium = 2 Low = 3	
O.6 Condition of the mostly used stove and chimney	Very good = 1 Good = 2 Okay = 3 Bad = 4 Worse = 5	
O.7 Other observation (if anything important)		

Instrument 2 Focus Group Discussion (FGD) Questionnaire

(Traditional Stove Users and ICS Users)

<p>Location and date</p> <p>Region: _____, District: _____, City/Village: _____</p> <p>Date: _____</p> <p>Name of the facilitator: _____</p>

NO.	QUERY CHECK LIST	NOTES
1	Is indoor air pollution a big environmental health problem or not in your home? Please explain with reasons.	
2	What factors contribute to deciding where the cooking is done? Who makes the decision?	
3	What type of fuels and stove do you use most often for cooking, space heating, and baking?	– Fuel: – Stoves:
4	Are you happy with the fuel/stoves you are using?	–
	4.1 What are positive aspects? Please explain (with particular reference to health, economics, comfort, availability, etc.).	–
	4.2 What are negative aspects? Please explain (with particular reference to health, economics, comfort, availability, etc.).	–
	4.3 Do you wish to switch stove/fuel in near future? Please explain, giving reasons.	–
	4.4 What do you consider the best stove/fuel that you wish to obtain for your households in near future?	–
	4.5 Please list the first, second, and third choices (with reasons).	

NO.	QUERY CHECK LIST	NOTES
5.	What are the main types of food cooked in your household? – Most frequently cooked food – Most common cooking pattern	
6.	Does anybody in the village cook to sell also? If yes, what and what type of stove/fuel is used for that?	
7.	Have the number of trips to the forest reduced, increased, or remained the same over the past 3 years? How much was the increase/decrease? Why?	
8.	Has the distance to collect fuelwood increased or decreased over the past 3 years)? How much was the increase/decrease?	
9.	Do you face any problems while collecting fuelwood, related to the collection, processing, or use of fuelwood?	
10.	If you use other fuels, like LPG, etc., is there problem for refilling the gas?	
11.	What are the repair/maintenance needs? How is repair/maintenance carried out, and who does it?	
12.	Is there time saving with the improved stove? If yes, how are you using the saved time?	
13.	With the new device, has there been any changes in what you cook and how?	
14.	Is there anybody using the improved stove for any purposes other than cooking home meals? If yes, explain.	
16.	Are there any other issues you want to raise about your cooking needs and the alternative fuels/stoves you saw?	
17.	Are women involved in making the stove/fuel choice? If not, what are the limitations in stove/fuel selection?	
18.	Are there any other issues you want to raise about gender equity?	
Stove Business		
19.	Is there any stove entrepreneur or distributor or promoter or technician in your village? If yes, how many? Among them, how many are women?	Promoter/technician..... totalmalefemale Entrepreneur totalmalefemale

NO.	QUERY CHECK LIST	NOTES
		Distributor..... totalmalefemale
Women-owned stove business		
20.	Are there any local community groups in the village or elsewhere producing or selling stoves or components?	
21.	What is the composition of the group? Does the group have both women and men, or only one gender?	
22.	Are there any challenges in women/men participating in the group?	
23.	Are there stove entrepreneurs in your village? How many are owned by male? Female?	
24.	Are there any other organizations/individuals that are involved in stove production or distribution? Explain.	
25.	Are there any women in your village/vicinity who are involved in some kind of business? Scope them out, and ask them if they would be interested (and can invest in) stove businesses, and what support they would need to get going.	

List of participants

1.
2.

Instrument 3 Key Information Interview Questionnaire – Entrepreneurs and Distributers

Investigator's Name: _____

A. Area identification

Region	
District	
City/town	
District	
Village	

B. Background of the entrepreneur

Name of institution	
Formally registered or not	
Type of enterprise (producer/distributor)	
Name of entrepreneur	
Male/female	
Age	
Education	
Main occupation	
Secondary occupation	
Phone	

1. When was your enterprise established (year, month)?

2. What is the form of business organization (private, PLC, share company, other)?

3. What was your initial investment, and how did you raise the initial funds to start the enterprise?

4. What percentage of time you are able to dedicate to the business?

5. Do you have other sources of income? If yes, please explain.

6. How many stoves have already been sold, including type of stoves?

7. Type of produced stoves, their price, and main customers:

8. How many months does the factory operate in a year? Please list monthly production and sales of stoves (in the last 12 months).

#	Month	Stoves (quantity/month)	
		Production	Sales
1			
2			
3			
4			

9. What is your gross income, expenditure, and net income by manufacturing and selling stoves per year?

10. Have you received any support from external organizations? (training, material, financial support, etc.)

11. What support do they need to enhance your stove business?

Capacity building:

Financing:

Testing and standardization:

12. What is the quality assurance mechanism of your stove? Has it been tested in lab or in field? If yes, what is the result?

13. Are you happy with your business? Explain.

14. What are the main barriers for you to expand your business?

Raw materials:
Manpower:
Financing:
Others:

15. How many men and women are working in your organization in stove manufacturing and supply process? What is their monthly income?

	Male		Female	
	Number	Average income per person/month	Number	Average income per person/month
Stove production				
Stove installation				
Stove marketing				
Finance and administration				
Total				

16. Has there been an increase in the number of women working in your organization in the past few years? If any change, what are the reasons?

17. Are there proactive strategies to recruit and promote women in your organization?

18. Could women or men equally carry out stove production? If not, how can we make both equally productive?

19. What are positive and negative aspects for getting women involved in this activity? Are there any particular areas women are good at?

20. Are there any gender policies in your organization? Are there flexible work arrangements? Is there a maternity and paternity leave policy, child-care, and dependent care leave policy?

21. Other relevant issues:

22. How difficult or easy is this job for you? Please explain.

23. Are there any socio-cultural restrictions for you do this job? Please explain.

Distribution Channels

24. What are your stove supply/distribution channels? Please explain, including the role of women in different stages.

25. What are the major challenges to distribution of/selling your stoves?

26. What is the profile of person involved in the distribution channel? What percentage are women and men?

27. Who could be your partner for increasing access for wider distribution channels?

Financing

28. What happens to the profits from the business?

- Reinvestment in business
- Use for household needs
- Others:

29. Who decides how to use the money (profit)?

30. Have you tried for a loan? If yes, where and how easy was it for you to access the financing? What were the difficulties for you in accessing financing?

- Lack of collateral
- Procedures of MFIs and SACCOs are difficult to understand
- Need husband's consent
- Money used for other purposes rather than repaying the loan
- Others (specify):

31. What form of guarantee or collateral is used by you to access the financing?

32. How did you acquire information of the financing channels?

33. What was the credit amount given to you? Was there any limitation on the credit amount? If yes, why?

34. In whose name is the loan secured, and who decides what it is used for?

35. What is the average repayment period and interest rate for loans acquired for the business, if any?

36. What is your plan for up-scaling? How will it impact the roles/employment of the current staff by gender?

----- THANK YOU -----

Instrument 4 Key Information Interview Questionnaire for Stove Promoters and Technicians

Investigator's Name: _____

C. Area identification

Region	
District	
City/town	
District	
Village	

D. Background of the technician/promoter

Name of the technician/promoter	
Male/female	
Age	
Education	
Main occupation	
Secondary occupation	
Phone	

37. From when are you engaged in this job (year, month)?

--

38. How many stoves have already been sold, including type of stoves?

--

39. How many months do you work in a year? Please list monthly sales of stoves (in the last 12 months).

#	Month	Stoves (quantity/month)
1		
2		
3		
4		
5		
6		
7		

40. What is your stove distribution channel? Please explain, including the role of women at different stages.

41. What are the major challenges to supply/distribution of your stoves?

42. What is the quality assurance mechanism of your stove? Has it been tested in a lab or in the field? If yes, what is the result?

43. How difficult or easy is this job for you? Please explain.

44. Are you happy with your profession? Explain.

45. What percentage of time you are able to dedicate to this job?

46. Are there any socio-cultural restrictions for you to do this job? Please explain.

47. Other relevant issues:

48. What is your gross annual income and expenditure?

49. What happens to the profits from the business? Reinvestment in business

Use for household needs Others

50. Who decides how to use the money (profit)?

51. Are you working independently or in group? If working in a group, how many women and men are in the group?

52. Have you received any support from external organizations? (training, material, financial support, etc.)

53. What are the main barriers for you to expand your business?

Raw materials:
Manpower:
Financing:
Others:

54. What support do you need to improve your stove business?

Capacity building:
Financing:
Testing and standardization:

Financing

55. Have you tried for a loan? If yes, where and how easy was it for you to access the financing? What were the difficulties for you in accessing financing?

56. What form of guarantee or collateral did you use to access the financing?

57. How did you acquire information about the financing channels?

58. What was the credit amount given to you? Was there any limitation on the credit amount? If yes, why?

59. In whose name is the loan secured, and who decides what it is used for?

Instrument 5 Interview with Key Stakeholders

Name of organization	
Detailed address (telephone, fax, email, web address, P.O. Box, etc.)	
Type of organization	Multilateral organization, bilateral organization, donor nation, INGO, GO, NGO, manufacturer, installer, producers' association, consumers' association, others (for consulting firms and institutions, another data sheet should be used)
Sector(s) of involvement	Biomass stove/biogas/others
Sub-sector(s)	
Nature of involvement	Financing, R&D, manufacturing, installation, O&M, others
Organization's vision	
Organization's mission	
Organization's strategy	
Local partners	
Target groups	
Program/project/business implementation/promotion modes and linkages	
Geographical coverage (working areas)	

Financial resources -

Funding sources of current projects (source name, year, and amount)	
--	--

Number of staff involved in clean cooking technology promotion:

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

Percent of Female Staff (involved in clean cooking technologies)-

Status	Technical staff		Administrative staff			Remarks
	Professionals	Technicians		Senior	Junior	
		Office	Field-based			
Permanent						
Temporary						
Part-time						

Target and Achievements

Fields of operation	Last year's target and achievement				Fields of involvement
	Target last year	Achievement	Budget allocated	Amount spent	
Biomass					
Improved Cook-stove					
Biogas					
LPG					
Briquettes					
Others					

Publications on stoves (study reports, books, journals, articles, leaflets, pamphlets, etc.)	
Do you think this activity is benefiting to women?	
Do you think this activity is useful to the poor? If yes, how? Also, are there ways to further improve this effort?	
Gender concerns	
Institutional level	
Does your organization have a written gender policy that affirms a commitment to gender equity and equality? Was gender taken into account during strategic planning for organizational activities?	
Policies and plan for gender inclusion	
Has there been an increase in the representation of women in the past few years in the stove program/project?	

What are specific interventions already done to increase the number of employed women (efforts to mainstream gender at institutional level)?	
In projects/programs	
Is the integration of gender equity in programs/projects mandated in your organization?	
Model used to engage women at project level	
Are gender equity goals and objectives included in program/project design?	
Does your organization use participatory methods to incorporate the views and preferences of both male and female community members in project design?	
For each program/project, is there a needs assessment, including an analysis of gender roles and responsibilities in the targeted community?	
Does the implementation plan for programs/projects include activities that strengthen skills and provide women with equal access to services and training?	
Do your project implementation strategies and plans take into account existing gender roles and interests of both male and females participants?	
Are there any particular tasks in the market chain of stoves that women are particularly good at?	
Are there any particular tasks in the market chain of stoves that men are particularly good at?	
Do female beneficiaries of my organization's programs/projects value and see our programs/projects as beneficial to their lives?	
What are the gender issues, opportunities, and challenges in your projects/programs? Are there social-cultural barriers women have to overcome?	
If you have adopted measures to address this, what are they and what are the results?	
What are other issues, opportunities, and challenges in your clean cookstoves projects/programs?	
Major Lessons Learned	

Future Plans	
Suggestions on existing government policy, rules, and regulations	
What are potential areas of cooperation with the government? If already coordinating what improvements are required?	
Future Strengthening Needs	
1. For your organization	
2 For this sector	

Note: If some of your information cannot be contained in these points, please attach separate sheets for those.

ANNEX 7 LIST OF KEY INFORMANTS

Nepal

- 1 Mr. Rudra Bhattarai, General Manager, Sana Kisan Bikas Kendriya Sangh, Nepal Agriculture Cooperative Central Federation
- 2 Mr. Nawa Raj Dhakal, Assistant Director Alternative Energy Promotion Centre
- 3 Ms. Karuna Bajracharya, National Adviser, Alternative Energy Promotion Centre/National Rural and Renewable Energy Programme
- 4 Mr. Subarna Kapali, Deputy Director Training and Project Management, Centre for Rural Technology, Kathmandu, Nepal
- 5 Mr. Damodar Karki, Regional Co-ordinator, Centre for Rural Technology, Kathmandu, Nepal
- 6 Mr. Gyanendra Sharma, Acting Deputy Director Training and Project Management, Centre for Rural Technology, Kathmandu, Nepal
- 7 Mr. Gokul Gautam, Regional Coordinator, Regional Service Center, Resource Management and Rural Empowerment Center (REMREC)
- 8 Mr Himal Panth, Sindhuli Stoves
- 9 Mr. Sushil Gyawali, Managing Director, Himalayan Naturals Pvt. Ltd. Chyasaal-9, Lalitpur
- 10 Ms. Sushila Bhatta, Installer/promoters, Dhading
- 11 Ms. Ambika Shrestha, Installers/Social Promoters, Dhading
- 12 Mr. Sher Bahadur, Local Organizations, Dhading
- 13 Mr. Sanjay Gorkhali, GIZ Nepal
- 14 Ms. Usha Maskey, MiErgy, Pvt td Nepal

Bangladesh

- 1 Mr. A.K.M Anowar Hossain Mollah, Senior Specialist, ICS, Catalysing Clean Energy in Bangladesh
- 2 Ms. Laila Akter, ICS Program Coordinator, Village Education Resource Center (VERC)
- 3 Mr. Dipal C. Barua, First Zayed Future Energy Prize Winner, President, Bangladesh Solar and Renewable Energy Association Founder and Chairman, Bright Green Energy Foundation
- 4 Mr. Khondkar Morshed Millat, Deputy General Manager, Green Banking and CSR Department, Bangladesh Bank
- 5 Mr. Sukamal Sinha Choudhury, General Manager, SME & Special Programmes Department, Bangladesh Bank
- 6 Mr. Siddique Zobair, Senior Advisor, Sustainable Energy for Development Program, GIZ
- 7 Mr. Iqbal Mahmud, Deputy Secretary, Power Division, Ministry of Power, Energy & Mineral Resources
- 8 Mr. Dr. ENg. M. Khaleq-uz-Zaman, Senior Advisor, Sustainable Energy for Development Program, GIZ

Odisha, India

- 1 TERI (BBSR and field offices)—Stove Promoter/Entrepreneurs
- 2 Unimax—Manufacturer/Distributor
- 3 Aditya Solar—Manufacturer/Distributor
- 4 IMMT—Developer/Manufacturer/ Research organization
- 5 DULAL, Mayurbhanj—NGO promoting ICS at the grassroots
- 6 RRDO, Mayurbhanj—NGO promoting ICS at the grassroots
- 7 SRUSTI, Keonjhar—NGO promoting ICS at the grassroots
- 8 Gram Vikas—NGO promoting ICS at the grassroots

- 9 Akshaya Patra Foundation—NGO promoting ICS at the grassroots
- 10 Nandi Foundation—NGO promoting ICS at the grassroots
- 11 OREDA—Government organization/Manufacturer/Developer/Distributor
- 12 Odisha Forest Sector Development Programme (OFSDP) —Government program sponsored by Japan fund
- 13 OTELP Odisha government's livelihoods program. Promoting use of ICS at the grassroots
- 14 Traditional artisans of 'Ulkudar' of Jashipur, Mayurbhanj—Developer
- 15 Surendra Patra—Individual Entrepreneur

Karnataka, India

- 1 Lalitha Bai—Stove Entrepreneur
- 2 Katyayini—Stove Entrepreneur
- 3 S D Natraj—Stove Entrepreneur
- 4 Manjunath—Stove Technician
- 5 Chetan V. —Stove Technician
- 6 Bal Murugan—Stove Technician
- 7 Kumudaksha—Stove Technician
- 8 Mr. S. Babu, Sustaintech India Pvt. Ltd.
- 9 Mr. Pradeep, Distributor of Chulika Stove

Himachal Pradesh, India

- 1 Dr. Sushil Kumar, Chief Medical Officer, Kullu
- 2 Ms. Kajol, Gas Agency, Kullu
- 3 Mr. Ram Prasad, Pashupati Steel and Metal Work
- 4 Mr. Vinay Tandon, Forest Department
- 5 Mr. Anil Sharma, Forest Department
- 6 Mr. Harish Kumar, CURE, NGO
- 7 Mrs. Vandana Thapliyal, WWF, Himachal Pradesh
- 8 Ms. Madhu , Mahila Vikas, NGO
- 9 Mr. Hans Mathiesen, Tandoor Fabricator
- 10 Ms. Sarla Shashni, Scientist, GB Pant Institute, Kullu
- 11 Ms. Meera Sharma, Forest Department
- 12 Dr. Prashar, PHC, Bhutti, Kullu
- 13 Mr. Hardev Singh, Monitoring Officer, Government Hospital, Kullu
- 14 Mr. Rajeev, Gas Agency, Kullu
- 15 Mr. Ram Singh, Gas Agency, Bhuntar
- 16 Ms. Yiting Wang, Yale University, USA
- 17 Ms. Devyani Singh, UBC, Canada

ANNEX 8 LIST OF FOCUS GROUP DISCUSSIONS

Table 8.1 Focus group discussions in Odisha, India

S. No.	Place (village /habitation)	District	Date	Number of participants		
				Male	Female	Total
1	Kurudamba	Gajapati	25.09.2013	4	8	12
2	Pradanisahi	Gajapati	24.09.2013	2	12	14
3	Majhisahi	Gajapati	24.09.2013	3	13	16
4	Raibada	Gajapati	25.09.2013	4	7	11
5	Adendungri	Balangir	25.09.2013	6	11	17
6	Bhanpur	Balangir	26.09.2013	3	7	10
7	Chheliamal	Balangir	27.09.2013	1	5	6
8	Khaliapali	Balangir	15.09.2013	8	14	22
9	Suliamal	Balangir	27.09.2013	6	13	19
10	Hillpatna slum	Ganjam		0	7	7
11	Gahamasikhar	Kendrapada	06.09.2013	4	11	15
12	Gobardhanpur	Kendrapada	05.09.2013	3	8	11
13	Hariharpur	Kendrapada	06.09.2013	0	7	7
14	Kathuaganda	Kendrapada	06.09.2013	0	11	11
15	Talachua	Kendrapada	07.09.2013	0	12	12
16	Rajapatna	Kendrapada	07.09.2013	0	9	9
17	Batapalasa	Mayurbhanj	15.09.2013	4	12	16
18	Bausadiha	Mayurbhanj	13.09.2013	6	14	20
19	Bhaliaguda	Mayurbhanj	15.09.2013	2	9	11
20	Dhalabani	Mayurbhanj	15.09.2013	4	8	12
21	Tato	Mayurbhanj	13.09.2013	3	7	10
22	Saliasahi slum	Khordha	25.09.2013	0	6	6
Total (22 FGDs with villagers)				63	211	274

Table 8.2 Focus group discussion in Karnataka, India

S. No.	Place	District	Date	Number of participants		
				Male	Female	Total
1	Aralaguppe	Tumkur	05/07/2013	0	30	30
2	Kasarkod, Honnavar	Uttara Kannada	27/07/2013	11	15	26
3	Gulganji koppa	Gadag	19/9/2013	10	12	22
4	Hulegondi Kadur Taluk	Chikkamagalur	7/10/2013	3	24	27
5	Shivasandra Gubbi taluk	Tumkur	6/11/2013	6	16	22

Table 8.3 Location and number of participants in FDG in Himachal Pradesh, India

Panchayat	Users	No. of participants
Rujak	ICS	19
Tandari	ICS	28
Jestha	TCS	24
Bhilyani	ICS	34
Telang	TCS	18
Bhalan 1	TCS	23
Total		146