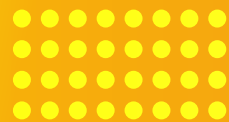




UNDERSTANDING MARKET-BASED SOLUTIONS AND ACCESS TO FINANCE OPTIONS FOR CLEAN-COOKING TECHNOLOGIES IN BANGLADESH



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Graphic design and Illustration by M. Inamul Shahriar

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ACKNOWLEDGMENTS

The financial and technical support of the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged. ESMAP is a partnership between the World Bank and 19 partners to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions.

ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7) to ensure wide access to affordable, reliable, sustainable and clean energy for all. It helps to shape WBG strategies and programs to achieve the targets of the WBG Climate Change Action Plan.

This report is a joint effort between the Clean Cooking Alliance (herein "the Alliance") and the Bangladesh Clean Cooking Program, co-funded by the World Bank and the Green Climate Fund (GCF) and implemented by Infrastructure Development Company Limited (IDCOL) as part of the Rural Electrification and Renewable Energy Development II (RERED II) Project. The report summarizes findings from an assessment of the current clean-cooking market in Bangladesh and identifies strategies and interventions to facilitate clean-cooking solutions. Innovision Consulting Private Limited was tasked with this assignment to capture findings from past research and from the experiences of different clean-cooking programs in Bangladesh. Subsequently, Jichong Wu (Consultant, World Bank) led the editing work, with inputs in the report based on secondary research, interviews, and field visits. This report amalgamates those findings and provides recommendations on scaling up clean cooking in the country and strengthening the market mainly through the IDCOL Improved Cookstove (ICS) Program.

Inputs from Ms. Salima Jahan (Member, Sustainable and Renewable Energy Development Authority (SREDA), Bangladesh) helped to explain SREDA's vision on possible development pathways for achieving clean cooking and contextualizing the findings from this assessment.

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TANUJA BHATTACHARJEE
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On behalf of Bangladesh Clean Cooking Program, RERED II

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Together with air pollution, exposure to smoke from open fires during the burning of inefficient fuels – the primary means of cooking and heating for nearly three billion people in the developing world – causes almost 4 million premature deaths annually and contributes to a range of chronic illnesses and other acute health impacts such as early-childhood pneumonia, emphysema, cataracts, lung cancer, bronchitis, cardiovascular disease, and low birth weight.

About 82 percent of Bangladesh's population relies on traditional mud stoves and solid fuel such as wood, coal, dry leaves, and crop residue for cooking. The burning of plant or animal material used as fuel (biomass) leads to environmental degradation from increased pressure on natural resources and forces people, especially women and children, to spend many hours every week collecting wood and other biofuel materials. Additionally, inefficient cooking produces greenhouse gas emissions, such as carbon dioxide and methane, and aerosols such as black carbon, contributing to adverse climate change. The burning of solid fuel also puts a strain on animal life in the region and on other natural resources.

Women and young children spend a significant amount of time near cooking areas, inhaling pollutants from traditional stoves. Women who use traditional stoves are particularly vulnerable to high levels of exposure to household air pollution (HAP): they are twice as likely to develop chronic obstructive pulmonary disease (COPD) than women who use cleaner stoves.

Given the severity of the health and environmental problems associated with the overuse of biomass, several development partners and donor organizations have been working in Bangladesh with the government to promote cleaner, more efficient cooking solutions. Initiatives date back to the Bangladesh government's efforts to develop improved cookstoves (ICSs) during the 1970s and 1980s. Subsequently, NGOs such as Village Education Resource Center (VERC), German Corporation for International Cooperation (GIZ), and Grameen Shakti started to popularize ICS technology and other clean-cooking solutions such as biogas. These efforts gained further momentum when Infrastructure Development Company Limited (IDCOL) launched its "ICS Program" in 2013.

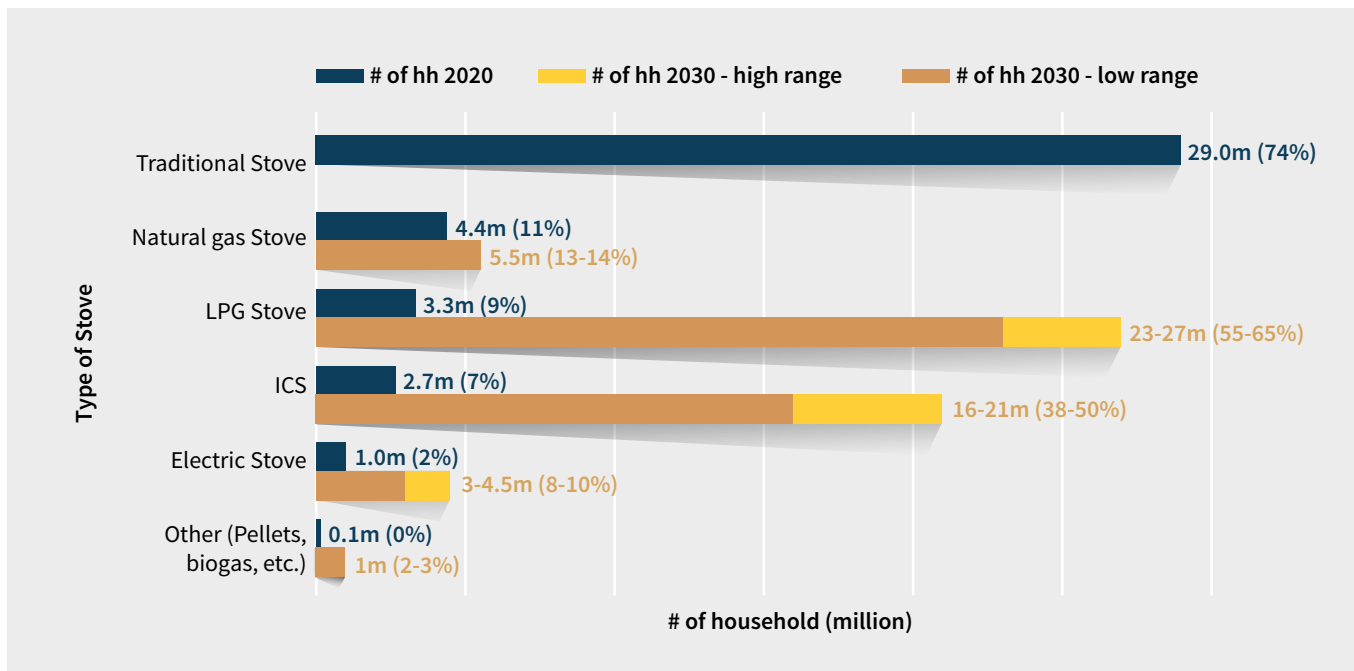


Figure A: Bangladesh cookstoves and fuels market overview, present vs 2030 targets

The Clean Cooking Alliance (CCA) has been active in Bangladesh since 2012. In 2013, they convened stakeholder consultations to develop and launch the Bangladesh Country Action Plan for Clean Cookstoves (CAP) led by the Power Division of the government's Ministry of Power, Energy and Mineral Resources. In May 2018, the government held a CAP review workshop to ensure the realignment of CAP 2013 with the new changes and developments in Bangladesh. As a result, a renewed CAP – the National Action Plan for Clean Cooking (2020–2030) – was launched with the goal of achieving 100 percent clean-cooking adoption throughout Bangladesh by 2030 (SREDA 2019).

This assessment brings together learning from recent studies and experiences and expects to help CCA and the World Bank look at prospective strategies with a focus of access to finance and incentive options for scaling up

clean cooking in Bangladesh. The market assessment examined clean-cooking solutions across the technology spectrum, including natural gas, liquefied petroleum gas (LPG), and ICSs given their popularity among Bangladeshi households. Other solutions include biogas, solar cookers, and electric stoves, including induction stoves, rice cookers, and electric pressure cookers.

Today, 74 percent of the total population of Bangladesh still rely on traditional stoves, followed by natural gas (11 percent), LPG (9 percent), ICSs (7 percent), and electric stoves (2 percent). Considering the higher costs and the need to further develop the supply infrastructure of other clean-cooking technologies, ICSs have the largest market potential and should be prioritized for policy makers.

Recent studies have found that 74 percent of ICS-adopter households are simultaneously using other stove

and cooking technologies. This common practice of stove and fuel stacking also makes ICSs a good option in the transition to cleaner stoves and fuels because most rural households, which account for 80 percent of Bangladesh's population, will continue to rely on biomass as their primary fuel for cooking.

ICS distribution is projected to grow from its current level of 2.7 million households to 16–21 million in 2030. LPG stoves, the second-largest potential market, is estimated to increase from 3.3 million to 23–27 million households in the new National Action Plan for Clean Cooking 2020–2030.

Despite a smaller market share, electric stoves, including induction cookers, rice cookers, and pressure cookers have a good opportunity because of their convenience and high popularity among consumers. With Bangladesh very close to 100 percent electricity coverage, it will not be a surprise if the adoption

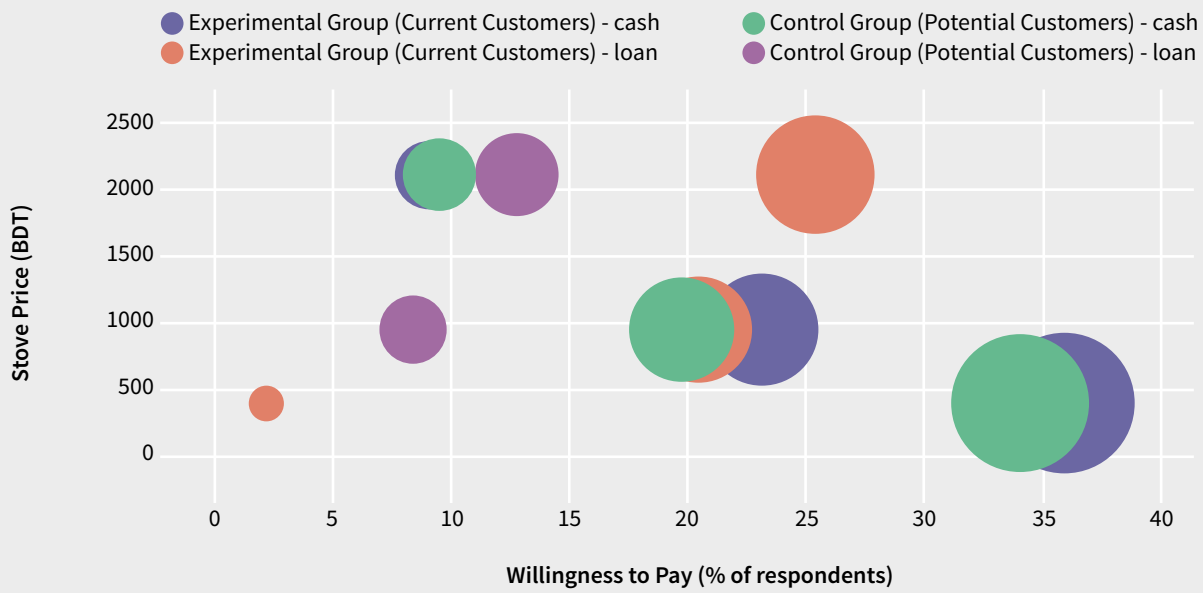


Figure B: ICS Consumer Willingness to Pay Analysis

of electric stoves rises sharply. It may even extend well beyond projections because the availability and reliability of the country's power supply continues to improve, and electric stoves prices are expected to drop over the next decade.

The World Bank-funded ICS program implemented by IDCOL

is the country's largest. As of Dec 2020, over 2.46 million cookstoves have been distributed under the program. It has successfully attracted the involvement of 61 partner organizations (POs) in the cookstoves sector, generating employment in decentralized stove production facilities in 300 upazilas (subdistricts) of Bangladesh so far.

The POs promote IDCOL-approved ICSs to the rural community, and the program reimburses the POs for their marketing and promotional costs.

Technological progress has been impressive. At the start of the IDCOL ICS program, in 2013, the thermal efficiency of most available stoves

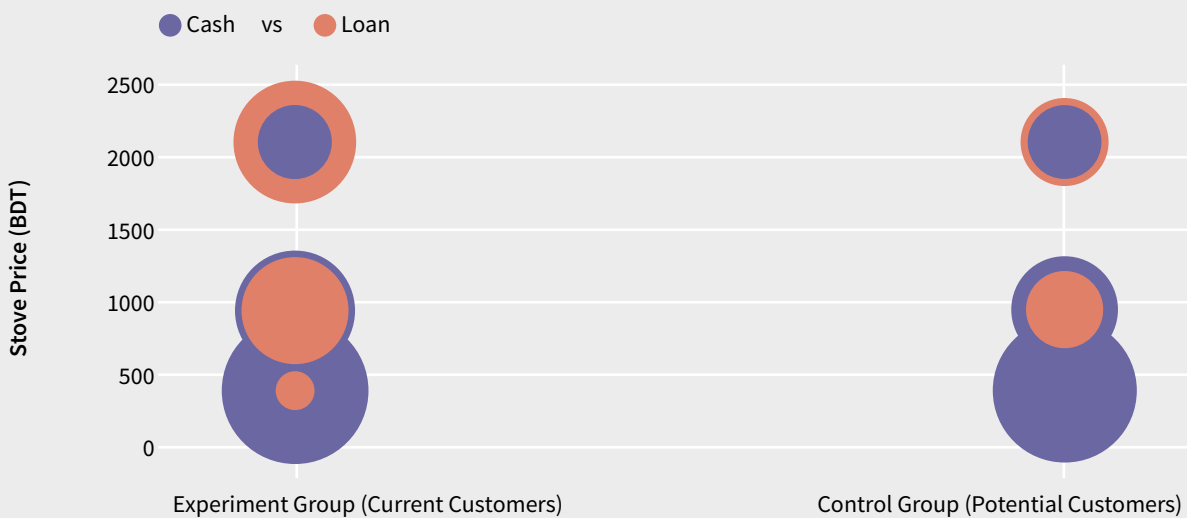


Figure C: Bubble chart of payment preferences, cas vs installment loans

in Bangladesh was Tier 1. With a total tax incidence of more than 58 percent, the high prices of Tier 2 or better stoves from abroad put them out of reach for many. But through IDCOL's committed R&D, the efficiency of the program's stoves has impressively risen from Tier 1 to Tier 3 in a matter of seven short years.

Furthermore, the engineering design of these stoves is straightforward

enough that they can be manufactured in decentralized subdistrict level production centers using local resources. Prices vary from BDT 375 to BDT 1600 (USD 4 to USD 19), offering a wide range of affordability.

With new joint funding from the World Bank and the Green Climate Fund (GCF), a four-year clean-cooking program is underway. It

aims to provide access to clean-cooking solutions to 5 million additional households by 2023 in part fulfillment of the country's new 2030 target of universal adoption of clean-cooking technologies.

Consumer segmentation is a helpful tool to better understand customer preferences and market potential so that tailored marketing and intervention strategies can be

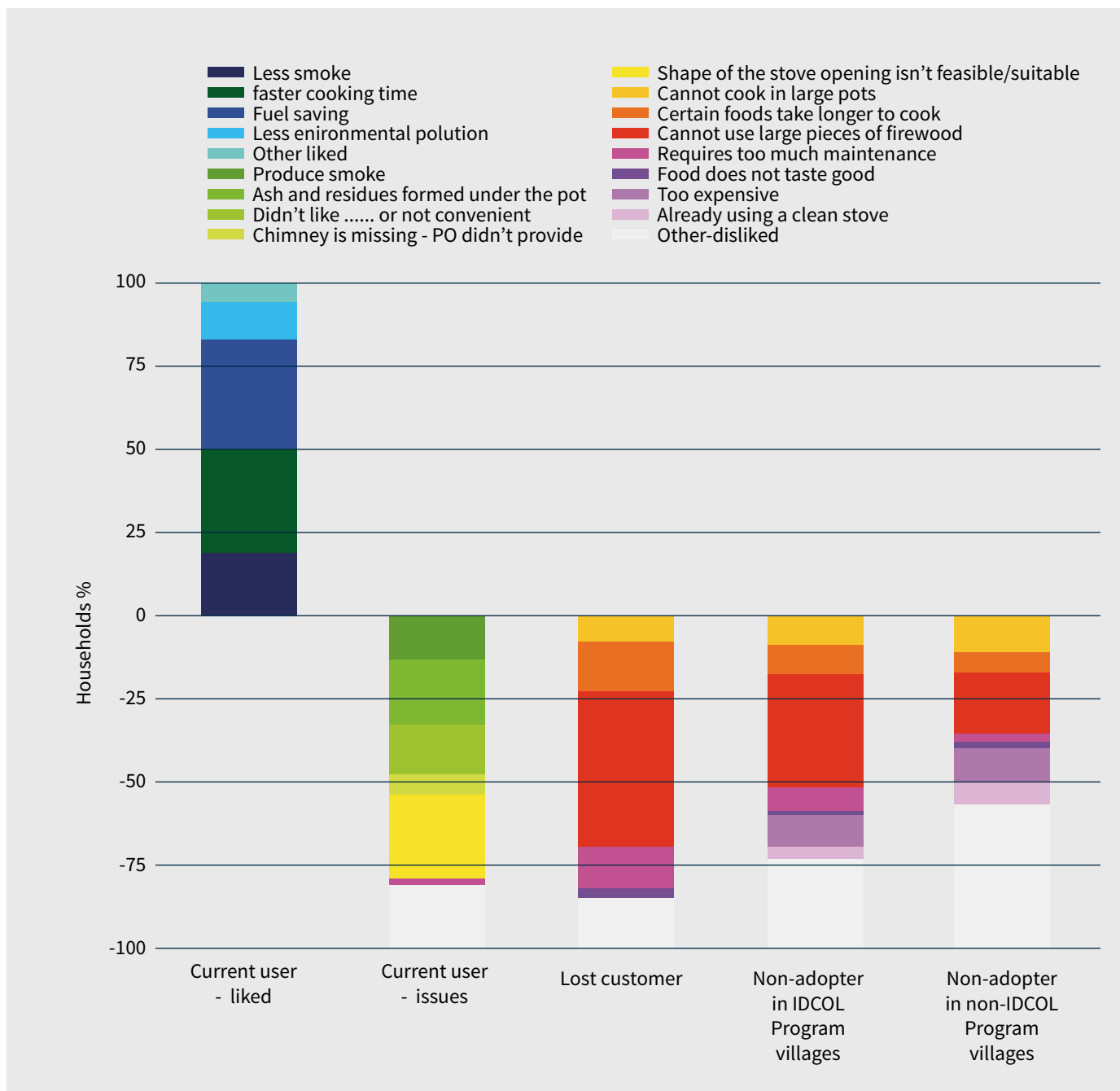


Figure D: Consumer feedback of the problems of ICSs (by consumer group)

developed to effectively drive sales and adoption, and scaled up in other regions. Using consumer data from recent studies, households have been grouped into current ICS users and potential customers in a bubble-chart analysis, below. The size and position of the bubbles represent customers' purchasing power and interest in selected stove products. The data can help businesses develop pricing strategies and identify financing and incentive options.

To understand customers' willingness to pay, we looked at a baseline survey undertaken by IDCOL. The trend of preferring cash payment for portable single-mouth ICSs was similar within the survey's treatment and control groups. The highest percentage of willingness to pay in installments was for high-end ICSs for both the treatment and control groups. For example, this chart below shows clearly that for a more expensive stove model, surprisingly, both ICS-adopters and non-ICS adopters favored an installment payment plan to buy it (top line, orange circle size larger than blue circle) while for cheaper stoves they all preferred paying with cash. Similar data should be collected on a large scale; this will provide useful insights for policy makers to develop consumer financing mechanisms for the clean-cooking sector.

On user and potential customer feedback, among current ICS users, fuel-saving (32 percent) and timesaving (32 percent) were the top-two "most liked" options for using ICSs with the most positive feedback, followed by less smoke (19 percent) and health benefit (6 percent). "Can't use large piece of firewood" was a common complaint across all four consumer groups, across potential customers within IDCOL's ICS Program village coverage (34 percent), and across potential

customers outside IDCOL's ICS Program village coverage (18 percent). Other common complaints and issues included "can't cook with large pot," "longer cooking time," "ash residues after cooking," and "require too much time on maintenance." Stove businesses should collect more of these data and use the findings to address product design defects.

On marketing and promotional activities, door-to-door (90.9 percent), word-of-mouth (84.5 percent), billboards or posters (61.1 percent), and brochures (60.5 percent) were the most effective marketing strategies that have convinced ICS purchasers (among ICS-adopters), while word-of-mouth, billboards or posters, and brochures were the top-3 most effective marketing activities for potential customers, the so-called control group in this study.

Based on a literature review and the latest data, four consumer segments were identified with high market potential, and specific intervention strategies were provided for each, including stove and fuel product and segment characteristics. Echoing the above-mentioned conclusion, ICS has the largest opportunity, and middle-class rural households form the largest market size, representing 7 million households.

Six recommendations were provided as following:

1. Call for greater clean-cooking ambitions and a shared vision of universal adoption by 2030 across the entire sector.

2&3. Recognizing the "stove and fuel stacking" phenomenon and prioritizing ICS in the transition to higher economic development stage and a cleaner future of household energy use.

4. Strengthen awareness building and marketing interventions.

5. Build a reliable and sustainable ICS supply chain in rural Bangladesh.

6. Develop a diverse and innovative financing ecosystem for the clean-cooking sector to enable community-driven market penetration at scale.

Access to finance is the biggest challenge hindering large-scale distribution of clean-cooking technologies and products. On the supply side, manufacturers and dealers/suppliers/distributors are reportedly experiencing a cash crunch and working capital deficits because their payments from IDCOL take around three months to realize. POs of IDCOL with high upfront investments are also facing liquidity crisis. The increase of raw material prices over the past year has made things even worse. The typical financing options available in rural household markets are often unattractive to commercial banks and microfinance institutions because of the low loan amounts and high transaction costs. Some financial institutions even do not believe in the clean-cooking business model.

A lack of financing would affect the long-term sustainability of the sector, so there is a great need for financing mechanisms designed particularly for this sector, and supported by donors and the government both for stove businesses and for consumers.

A number of innovative financing mechanisms were suggested by this report including liquidity facilities, advance payments for cluster network expansion, and a loan guarantee scheme for businesses. Consumer financing option considered in this report included a free trial program for

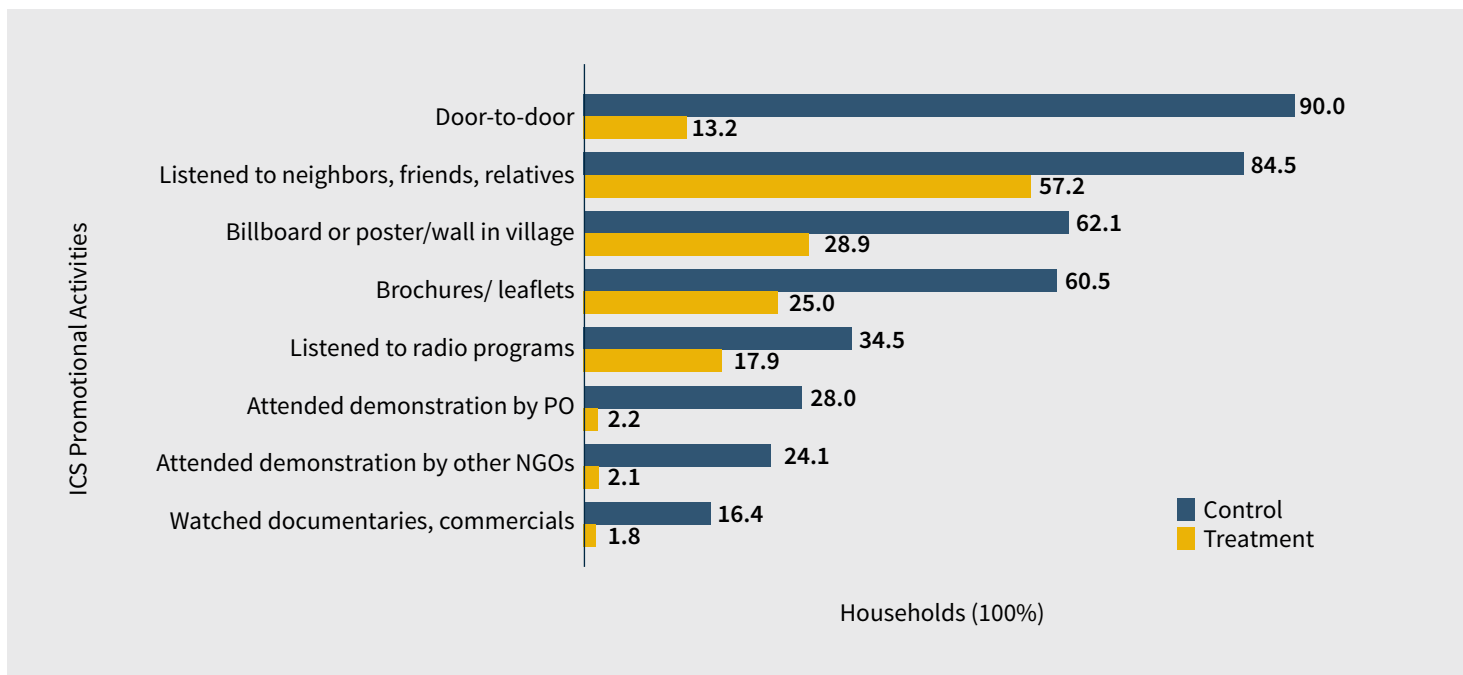


Figure E: ICS Promotional Activities

products, cash vouchers, trade-in programs, microfinance loans, and a pro-poor strategy for lower-income households.

Beyond these, we also recommend increasing capacity-building support for businesses and launching nationwide consumer-facing awareness campaigns on the ICS concept.

Community engagement is central to driving the adoption clean-cooking practices, and recommendations were mentioned under the awareness section. One example was to create entertaining videos screening “Uthan boithok” community engagement courtyard meetings to disseminate what

community members are saying about their experience with ICSs. In addition, promotion and educational programs at school can influence parents when students come home and talk to their parents about what they have been learning about.

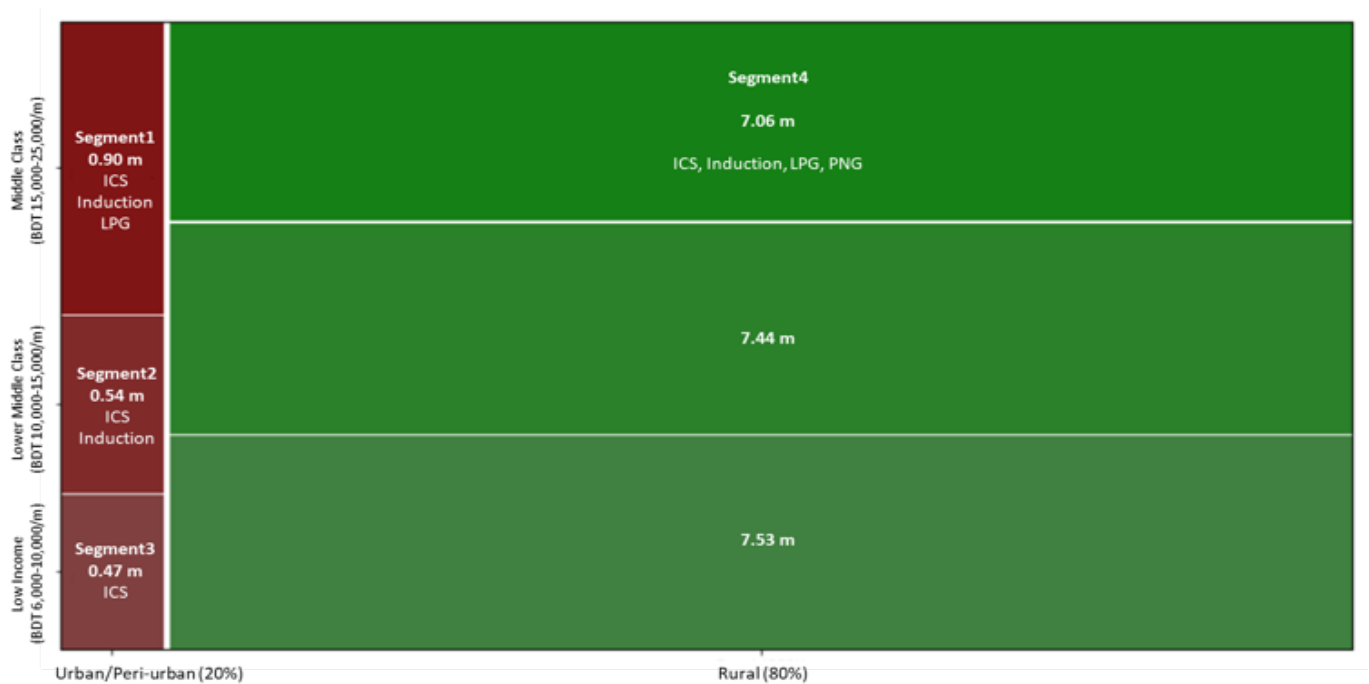


Figure F: Mekko chart of cooking market sizes by income thresholds and urban-rural divide





STRUCTURE OF THE REPORT

In chapters 1 and 2, the report first reviews the current state of the clean-cooking market in Bangladesh, covering a variety of fuels and technologies based on the significance of market penetration in Bangladeshi households, including natural gas, LPG and Improved Cookstoves (ICSs). Other solutions discussed in the report include electric/induction stoves, solar cookers, and biogas. The chapters also present distribution data on the total number of households by type of solutions.

Chapter 3 discusses the stakeholders who played important roles in moving the 2013 Country Action Plan forward, the consumer segmentation, and the prevailing culture of stove stacking within the segments. It also maps the graduation process evident in consumers' stove usage patterns against their socioeconomic standing. The chapter concludes that, even though it is a transitional technology, ICS still has an important role to play, given the current economic realities of the country.

The subsequent chapters (chapters 4–6) then explore strategies and business models in which ICSs can be distributed across the country following a market-based approach through IDCOL's ICS program, with a focused discussion on access to finance and community engagement. Finally, chapter 7 puts forward specific recommendations to address ways in which the IDCOL ICS program can be improved and optimized.

Regarding the Terms of Reference, this report is intended to focus on analyzing the IDCOL ICS program. Other clean-cooking solutions or other ICS distribution programs are therefore beyond the scope of this study.

1

INTRODUCTION

1

INTRODUCTION

1.1 BACKGROUND

Traditional cookstoves and open fires are the primary means of cooking and heating for nearly three billion people in the developing world. Exposure to smoke from such means of cooking and heating contributes to some four million premature deaths annually, of which 106,900 occurs in Bangladesh every year. More than 80 percent of the Bangladesh population relies on solid fuel for their household cooking and heating needs. Women and young children are the prime victims of household air pollution (HAP) from the use of solid fuels, which causes more than 7,000 child deaths in Bangladesh every year (CCA n.d.).

The Bangladesh Clean Cooking Program, financed by the World Bank, is aimed at supporting a sustainable market for the adoption of improved cookstoves (ICSs). Infrastructure Development Company Limited (IDCOL) has been implementing the ICS program as part of the household energy component of a larger World Bank program called the Bangladesh Rural Electrification and Renewable Energy Development II (RERED II), approved by the International Development Association (IDA) in 2012. The IDCOL ICS program under RERED II aims to support a sustainable market for adoption of ICS that will contribute to the improved well-being of people living in rural Bangladesh by reducing GHG emissions and the impact of HAP. This program also aims to support the achievement of 100 percent adoption of ICSs throughout the country, a target under Bangladesh Government's Country Action Plan for Clean Cookstoves, by strengthening the supply chain and creating demand for ICSs in rural Bangladesh.

Beyond Bangladesh, the World Bank and the Clean Cooking Alliance have been working together globally as partners to advocate for clean-cooking solutions. The Alliance is also supporting the World Bank to strengthen the ongoing Bangladesh Clean Cooking Program. As a part of the collaboration between the World Bank and the Alliance, a Secondary Research and Market Assessment Needs has been conducted by Innovision Consulting Private Limited (ICPL) to develop strategies and interventions for an inclusive market-based approach to promoting the distribution of clean-cooking solutions in Bangladesh.

1.2 OBJECTIVE

Developed in consultation with the Alliance, the World Bank and IDCOL, the report brings together:

- Findings of past studies, assessments, and resources on consumer segmentation, preferences, and willingness to pay – to identify the optimal strategy to target various market segments in Bangladesh
- A comprehensive sector mapping and recommendations from sector players about future strategies
- A range of clean-cooking solutions and their business models in Bangladesh, and
- Suggestions that IDCOL to consider for scaling up clean cooking in Bangladesh, and a roadmap for future strategies.

1.3 METHODOLOGY

The consulting team devised this assessment approach by leveraging the knowledge that the Alliance, its partners, and other actors have acquired by working on clean cooking issues over the years. The following research tools and analysis approaches were undertaken to ensure a deep understanding of the barriers and opportunities of the market (figure 1):

a. SECONDARY RESEARCH

The consulting team has rigorously reviewed previous studies, assessments, and resources that are available on consumer segmentation, preferences, and willingness to pay in order to identify the optimal strategy to target various Bangladesh market segments. Resources available on impact, multiple technologies, business case studies, standards, and so on, have also been

reviewed to arrive at a comprehensive overview of the global and Bangladesh clean-cooking sector. These materials include reports shared by the Clean Cooking Alliance and by IDCOL, but also publicly available reports.

b. IN-DEPTH INTERVIEWS

The team conducted in-depth interviews with IDCOL and their partner organizations (POs), cookstoves manufacturers, LPG companies, distributors and retailers, relevant government officials, and development partners in Bangladesh. The interviews helped fill in the literature review gaps and provided updated information during the secondary studies. They also helped the team to conduct comprehensive sector mapping, understand current tax and tariff implications for the sector, and assess recommendations offered by major sector players on the best strategies.

c. ANALYZING FINDINGS AND GAPS AND IDENTIFYING STRATEGIES

The consulting team used their understanding of market-based approaches to identify information gaps, data, and so on based on the secondary research and interviews. This helped the team to suggest recommendations for scaling up clean cooking in Bangladesh and outline a roadmap for future strategies for IDCOL to consider.

1.4 LIMITATIONS

The limitations of the assessment include:

- Contradicting data within the literature review
- The fact that the number of households in Bangladesh with access to different clean-cooking solutions is based on data from different sources, and the accuracy of data cannot be verified.



Figure 1: Steps in methodology

2

THE COOKSTOVE MARKET IN BANGLADESH

2

THE COOKSTOVE MARKET IN BANGLADESH

To better understand the current status of the cookstove market in Bangladesh, the following analyses were conducted: consumer segments, clean-cooking initiatives implemented to date, the cookstove and fuel options currently available on the market, and a mapping of key stakeholders that are critical to driving the development of a clean-cooking market in Bangladesh.

2.1 MARKET OVERVIEW

The total number of households currently in Bangladesh is estimated at about 39 million. According to the National Country Action Plan for Clean Cooking 2020–2030 (CAP), 81 percent of the population rely on biomass for cooking. Of these, 29 million households use traditional stoves and 2.7 million use ICSs. Piped natural gas and LPG stoves have the second- and third-largest consumer bases, totaling 4.4 million and 3.3 million, respectively. Electric stoves, including induction cookers and rice cookers, have a relatively small market share – 1 million households, or 2 percent – but present great potential for growth as Bangladesh achieves universal electricity access. Pellet stoves and stoves fueled by biogas currently have the fewest users – a combined total of only 100,000. The Government of Bangladesh has launched a goal of achieving universal adoption of clean-cooking solutions by 2030. In the blueprint, LPG stoves and ICSs are the top-two options, with an estimated growth target of 23–27 million households and 16–21 million, respectively. Electric stoves also have a promising market outlook, with a projected growth of 2–3.5 million households in the next decade (SREDA 2019).

The adoption of LPG, natural gas, biogas, electric stove, and pellet stove technologies is constrained by price and infrastructure development. By comparison, it is evident that ICS is the low-hanging fruit and has great scaling up opportunity to achieve clean cooking for all in Bangladesh by 2030.

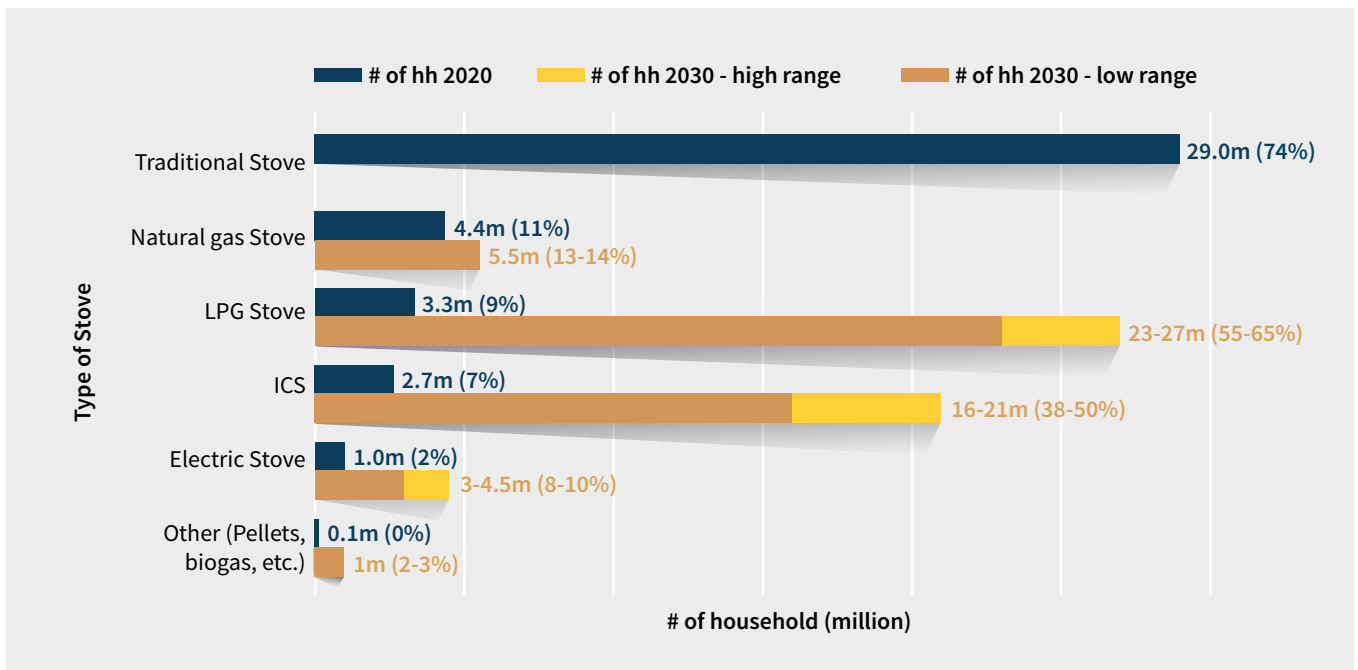


Figure 2: Bangladesh cookstoves and fuels market overview, present vs 2030 targets

2.2 CLEAN-COOKING INITIATIVES

Recognizing the scale and severity of the health and environmental problems associated with the overuse of biomass, several donor organizations and development partners have been working alongside the Bangladesh Government to promote cleaner and more efficient cooking solutions. Notable initiatives include early government efforts to develop improved cookstoves during the 1970s and 1980s. NGOs such as Village Education Resource Center (VERC), German Corporation for International Cooperation (GIZ), and Grameen Shakti have also launched programs to deploy ICS technology and

other clean-cooking solutions such as biogas to Bangladeshi households.

In 2013 the Clean Cooking Alliance (formerly the Global Alliance for Clean Cookstoves) convened a group of key stakeholders to develop and launch the Country Action Plan for Clean Cookstoves (CAP). These efforts gained further momentum when IDCOL launched its “Improved Cook Stove Program” in 2017, and eventually led to the development of a new CAP in 2019. Table 1 summarizes key milestones of the clean-cooking sector in Bangladesh.

The upcoming sections will examine clean-cooking solutions currently employed in households and the extent to which they have played a role in Bangladesh’s pathway toward a clean-cooking future.

Table 1: Major events in the history of clean cooking in Bangladesh

Year	Key Events
1976–1987	<ul style="list-style-type: none"> • Bangladesh Council for Scientific and Industrial Research (BCSIR) initiated working on ICSs • Clean-cooking initiatives started with the Government of Bangladesh introducing ICS • VERC launched its ICS program • EnDev launched its ICS program

Year	Key Events
2004–2006	<ul style="list-style-type: none"> • Grameen Shakti started its ICS program • Bangladesh Bondhu Chula Foundation started its ICS program
2010–2012	<ul style="list-style-type: none"> • GIZ/EnDev introduced concrete-made ICS by GIZ/EnDev • Inauguration of IDCOL's Improved Cookstoves Program • Clean Cooking Alliance started operations in Bangladesh • Country Action Plan for Clean Cookstoves launched • LPG sector liberalized; a number of LPG companies started bottling and marketing LPG gas in cylinders
2017	<ul style="list-style-type: none"> • One million ICSs distributed by IDCOL
2019–2020	<ul style="list-style-type: none"> • Electricity coverage throughout the country nearly complete (95 percent) • National Action Plan for Clean Cooking 2020–2030 launched, with a new target of achieving 100 percent clean-cooking adoption by 2030 • IDCOL launched a new target of distributing 5 million ICS by June 2023.

Source: SREDA 2019

2.3 NATURAL GAS AND LIQUEFIED PETROLEUM GAS (LPG)

Natural gas has for long been a popular cooking option with Bangladesh's urban dwellers, but has recently gone beyond urban households and is becoming a choice among peri-urban and rural households.

2.3.1 NATURAL GAS

Piped Natural Gas (PNG) is offered to households in the capital city and a few other urban cities in Bangladesh. Bangladesh is one of the few countries in the world that provides PNG connections in homes for cooking. About 4.1 million households are connected to PNG in Bangladesh (Khan, M.F.R. 2018, Rahman, M.M. 2018).

Figure 2 illustrates the consumption of natural gas by sector in fiscal year 2018–19. Currently, the highest consumption of natural gas is in power production (43.28 percent), followed by industries (15.79 percent). Domestic consumption (household consumption), at 15.25 percent, is the third-largest share of natural gas usage (Petrobangla 2019).

Over the last decade, there had been a steady increase in natural gas production (figure 3), but during fiscal year 2016–17, production fell by 2.4 billion cubic foot (bcf) to 971.6 bcf. This shortage led the government to prioritize industrial use over household in 2019. The State Minister

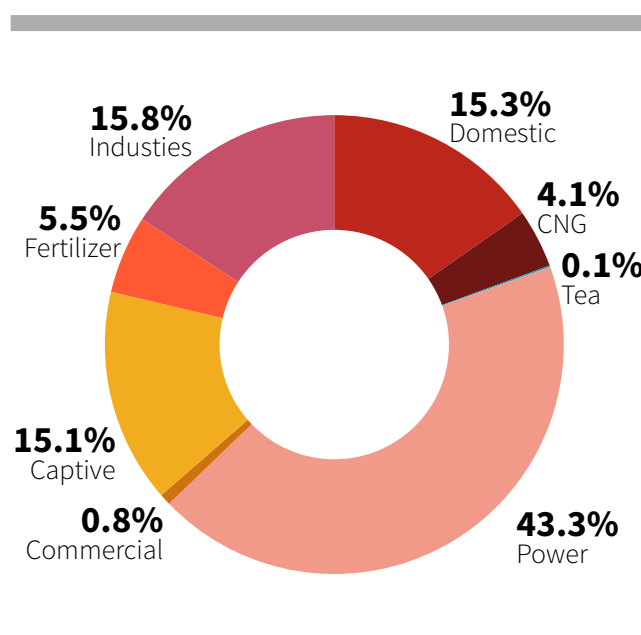
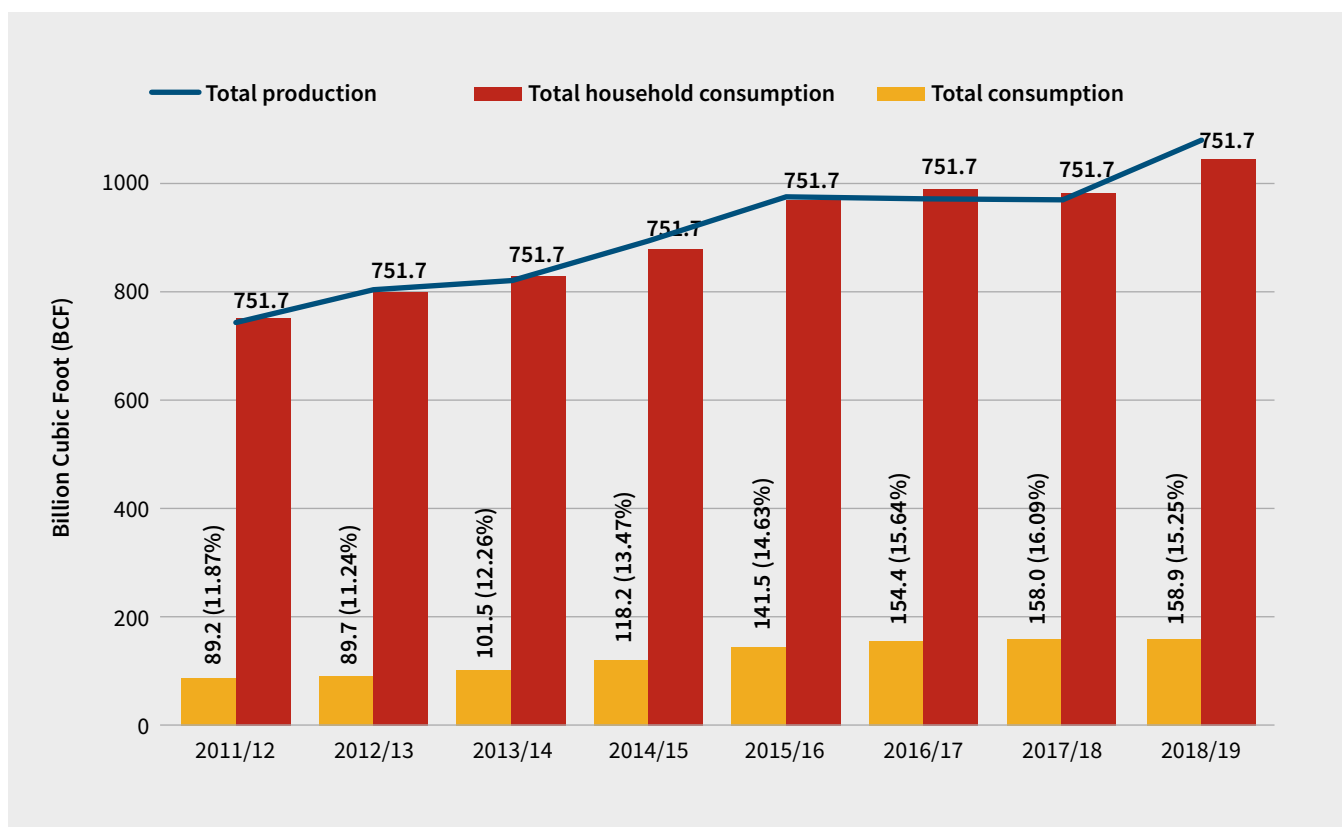


Figure 2: Gas consumption by sector in Bangladesh (fiscal year 2018–19)

for Power, Energy and Mineral Resources, Nasrul Hamid, announced that homes would no longer be provide with any gas connections (Tribune Desk 2019). Fiscal year 2018–19 was the third consecutive fiscal year of reduced production but it had 116 BCF gas from regasified LNG (RLNG).



Source: Petrobangla 2019

Figure 3: Bangladesh natural gas production, total consumption, and household consumption, 2011–2019

If the government were to attempt to fulfil the national demand for clean cooking just by using natural gas, it would require significant spending on importing liquefied natural gas (LNG) and extensive infrastructural sunk costs to build pipelines. Importing LNG and building the necessary infrastructure has already started, which makes natural gas a costly solution for clean cooking. In line with the government’s longer-term vision, urban usage of natural gas for cooking is not expected to increase.

2.3.2. LPG

Liquefied Petroleum Gas (LPG) is a flammable gas consisting of propane, butane, or a mixture of both. LPG is obtained from natural gas processing or oil refining facilities, then liquefied through pressurization. LPG is one of the cleanest energy sources: LPG burners fall in tier 4 on the International Water Association (IWA) performance indicator (Putti et al. 2015).

The government’s suspension of households’ PNG supply starting fiscal year 2016–17 has led to an increase in demand for LPG consumption in order to meet daily cooking needs. As a result, the LPG market grew more

than fourfold from 2015 to 2019 (tables 2 and 3).

LPG bottles or cylinders have been available for sale since the 1980s, supplied by the state-owned Bangladesh Petroleum Company. However, this was done on a limited scale. Currently, the LPG sector is import-dependent and dominated by large private companies. Importers of LPG need an import permit from the Bangladesh Energy Regulatory Commission. Companies then import LPG, package it in bottling plants, and distribute through their nationwide network.

Based on information gleaned from the private sector, LPG-importing companies obtained permits to import a total of 1,216,000 metric tonnes (MT) for the financial year 2018–2019. During the same period, the actual import quantity recorded by the National Board of Revenue (NBR) was 760,920 MT. This indicates that over 20 percent of the stipulated import quantity remained unutilized. There is a decelerating trend in LPG import permit provision. In the year 2018–2019, the permit for LPG imports increased but only by a modest amount of 26 percent, whereas the rate of increase in the previous year was 107 percent (table 3). The deceleration of permit provision by the Bangladesh Energy Regulatory

Table 2: Annual LPG import permit data obtained from BERC (MT)

No.	Company	2015–2016	2016–2017	2017–2018	2018–2019
1	Bashundhara LPGL	68,500	150,000	150,000	300,000
2	Jamuna	30,000	30,000	130,000	100,000
3	Omera	100,000	100,000	100,000	100,000
4	BM	0	30,000	180,000	310,000
5	Laugfs	40,000	40,000	80,000	80,000
6	Total	50,000	50,000	50,000	50,000
7	Beximco	0	36,000	36,000	36,000
8	Sena	0	30,000	30,000	30,000
9	G Gas	0	0	30,000	30,000
10	Navana	0	0	30,000	30,000
11	Orion	0	0	80,000	80,000
12	Petromax	0	0	40,000	40,000
13	Eurogaz	0	0	30,000	30,000
Total		288,500	466,000	966,000	1,216,000

Source: Rahman. M.M 2018

Table 3: Import permits for LPG given by BERC vs. quantity of LPG imported

Financial Years	Import Permit of LPG given by BERC (MT)	Percentage increase in import permit of LPG given by BERC (compared to previous financial year)	LPG Import Quantity by NBR (MT)	Percentage increase in LPG import quantity by NBR (compared to previous financial year)	Percentage of import permit of LPG given by BERC remaining unutilized
2015–2016	288,500	–	246,846	–	14%
2016–2017	466,000	62%	439,243	78%	6%
2017–2018	966,000	107%	760,920	73%	21%
2018–2019	1,216,000	26%	–	–	–

Source: Innovision analysis

Commission (BERC) may suggest that the LPG companies have captured the easily accessible demand for LPG in the market but are struggling to capture the secondary markets – price-sensitive rural households and businesses.

From our field visits, we found that an average 5-member household using only LPG for cooking uses approximately 18 kg (1.5 cylinders, 12 kg each) a month. Currently, each cylinder costs around BDT 1,200 (USD 14,

retail price). In total this household would need to spend BDT 1,800 (USD 21) per month on cooking fuel. These costs are incurred in addition to the initial fixed costs, roughly equal to BDT 3,500–7,000 (USD 41 – USD 83) for a cylinder, full tank of gas, a stove and accessories.

According to “Bangladesh Modern Kitchen Marketing and Behavior Change Strategy” (Global Alliance for Clean Cookstoves, WASHplus, 2015) the urban and peri-urban middle class, with an average monthly income of BDT

17,000 to BDT 25,000 (USD 201 to USD 295), use LPG for all or some cooking. To help consumers with fuel expenses, the Government of Bangladesh proposed the rationalization of duty and VAT in the financial year 2016–17.

Information from the field further indicates that households that using LPG burners alongside mud stoves tends to prolong the use of an LPG cylinder by up to 2 to 6 months. Such households limit their usage of LPG to warming food and occasional cooking. Though LPG is now widely available in Bangladesh it remains an expensive option for rural populations, especially those living in extreme poverty.

As Bangladesh’s economy continues to grow, over time more and more households are likely to graduate to higher-income segments, leading to more households opting for LPG as a primary or secondary source of fuel.

2.4 THE IMPROVED COOKSTOVE (ICS)

Chimney stoves are among the best-known and commonly used ICSs in Bangladesh. Such stoves include Bondhu Chula, Unnatho Chula and IDCOL ICS. The Bangladesh Council for Scientific and Industrial Research (BCSIR) has worked on promoting improved cookstoves since 1970s and the early 1980s. The BCSIR ICS is made with an iron grate and a chimney to channel emissions out of the house through an opening in the roof. In research conducted in 2012, the BCSIR improved stove had a mean PM2.5 of 1.38 (mg/ m³) while the mud stove’s mean was 1.92 (Chowdhury et al. 2012). Similarly, the BCSIR stove had a mean carbon monoxide (CO) concentration of 2.97 mg/m³, compared to 4.90 mg/m³ for the mud stove. This shows improvement compared to mud stoves, but not significant enough to be considered one of the best solutions.

GIZ and Grameen Shakti both started their ICS initiatives in 2006. The two organizations operated the largest ICS programs in the country and are projecting further growth in the years to come. Both GIZ and Grameen

Shakti promoted Tier 1 efficiency ICSs developed by BCSIR.

IDCOL entered the clean-cooking market relatively late, in 2013. By 2013, about 1 million improved stoves were estimated to be in use, indicating a 3 percent market penetration rate (Bangladesh Ministry of Power, Energy and Mineral Resources 2013). As of 2018, over 2 million ICS have been distributed; by 2023, IDCOL expects to have increased this number to 5 million (IDCOL 2018). IDCOL also started the program with BCSIR-developed ICS stove models that followed a tier-based system. IDCOL appointed the Department of Chemical Engineering of Bangladesh University of Engineering and Technology (BUET) to develop affordable higher-tier stoves that can be manufactured using local raw materials. As a result, several Tier 3 stove models were introduced under the program. These stoves were significantly more affordable compared to similar quality stoves available worldwide (BDT 375–BDT 1,600/USD 4 – USD 19).

According to the “Country Paper on Improved Cooking Stoves” by IDCOL Grameen Shakti had monthly average sales between 15,000 to 18,000 and as of 2010, had achieved a total distribution of 630,289 ICS stoves. Of these, 579,547 (92 percent) were made of concrete, the rest of mud. Grameen Shakti also provided after-sales services, including maintenance and repairs and sending their technicians to consumer’s kitchens for regular monitoring of ICS stove performance.

GIZ has been operating its ICS program since 2005 distributing BCSIR ICS stove models. GIZ has worked with more than 200 partner organizations (POs); each PO managed their own manufacturing and selling of ICS stoves, with training support from GIZ. As of July 2013, GIZ had installed about 600,000 ICS stoves in Bangladesh (IDCOL 2013). GIZ later supported the formation of Bangladesh Bondhu Foundation (BBF) to promote Bondhu Chula ICSs in the market. BBF operates in partnership with 5,000 partners/entrepreneurs across the country and is currently implementing an ICS program supported by the Republic of Korea through a Clean Development Mechanism (CDM) project which aims to scale up Bondhu Chula significantly in the market.

Table 4: Total ICS Installation from 2014–2018 (IDCOL and BBF)

	2014	2015	2016	2017	2018	Total
IDCOL	7,453	231,363	729,905	436,723	244,216	1,649,660
BBF		154,765	190,034	105,509	82,508	532,816

In 2014, IDCOL signed an agreement with BUET to redesign their existing models to achieve Tier-3 efficiency (see annex for details on IWA and ISO standards and the tier system). Our field studies reveal that IDCOL POs have developed variations of the three major ICS models, according to market needs: single-mouth portable stove, single-mouth chimney stove and double-mouth chimney stove. Both single-mouth and double-mouth chimney stoves have two different submodels based on the mouth diameter of the stove. The thermal efficiency of the stoves was verified by metrics used in a Clean Development Mechanism (CDM program monitoring report in December 2020 as part of the validation and verification process of the United Nations Framework Convention on Climate Change (UNFCCC). The results showed that the efficiency of the portable stoves was 35 percent, and the efficiency of single-mouth and double-mouth chimney stoves ranged between 30 and 39 percent. Stoves being tested had a duration of use between one to three years, all with continuous operation since their installation (UNFCCC 2020).

2.5 OTHERS

Besides ICSs, there are a few other cleaner-cooking solutions available on the market, including biogas, electric cooking solutions such as rice cookers, induction stoves, and solar cookers. This chapter will provide a brief overview of those solutions.

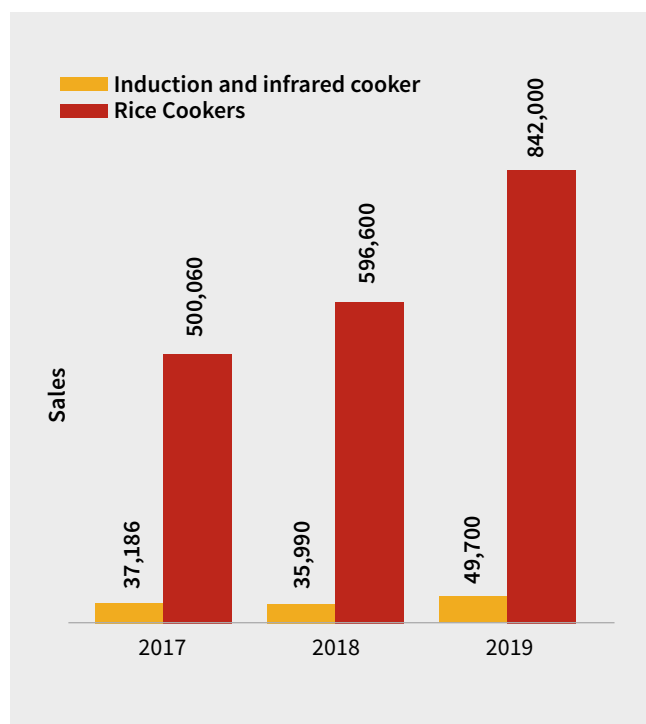
2.5.1 ELECTRIC STOVES

With a growing working population, electric rice-cookers are becoming more and more popular in both urban and rural households in Bangladesh. It also provides an alternative cooking method when the supply of gas or other fuels is unavailable or irregular. Electric rice-cookers are made to cook short-, medium-, or long-grain rice with little intervention from the cook (Hexa Research 2018). Depending on the heating method, the electric rice-cookers use simple-coiled electric heating or induction heating.

High-income urban households in particular prefer induction stoves to LPG or natural gas because of unpredictable and irregularly piped natural gas (PNG), although the situation has improved after LNG importation started. The frequency of power outages and shortages has dropped significantly compared to ten years ago. In rural areas, electricity is now available for increasingly longer hours. This indicates that the national electric grid is becoming more reliable over time. There has been a rapid growth in electricity production, from 3,268 megawatts (MW) in 2009 to 13,792MW in April of

2021., with April 27 witnessing the highest electricity generation in Bangladesh's history so far. Generation capacity has increased to 25,227 MW in 2021. Today, 99 percent of households are connected to the power grid according to the government (Bangladesh Ministry of Power, Energy and Mineral Resources 2021), and recent studies indicate that 3–4 percent of households have installed solar home systems (SHSs) (Hossain and Azreen 2020, Practical Action 2017). The government is close to achieving its target of universal access to electricity by 2021.

Recent studies (Bhattacharjee 2021) show that, as of 2019, about 891,700 households have adopted electric-cooking technologies, including induction cookers, infrared cookers, and rice cookers. There has been a significant upward trend in induction and infrared cookers, based on sales data from five local electronics retailers who represent a large share of the market for these electric-cooking products. Their combined sales increased from 37,186 in 2017 to about 50,000 in 2019 and are expected to reach 80,000 in 2024. Rice cookers have a considerably higher baseline of 500,000 in 2017, leaping sharply in 2018 and bringing total sales to 842,000 in 2019. Again, based on sales data from leading local retailers, rice cookers are projected to reach 1.67 million in 2024 if the current rate of market growth persists.



Source: Petrobangla 2019

Figure 3: Bangladesh natural gas production, total consumption, and household consumption, 2011–2019

Table 4: Biogas methane yield according to biomass utilized

Biogas source	Feedback per year	Biogas methane yield per year (nm ³) ⁵
1 cow (milk)	20 m ³ liquid manure	500
1 cow (beef)	2–11 tons solid manure	42–168
100 chickens	1.8 m ³ dry litter	242

Source: IRENA 2017

In addition to electricity availability, reliability and affordability also play critical roles in clean-fuel switching. As seen, households' inclination to use electricity for cooking depends to a large extent on the consistency and reliability of the supply. If households are ensured only a few hours of electricity a day, or they perceive electricity rates as high, then they are likely to limit electricity usage to the most important home applications – for example, lights, fans, or charging phones. Such households will choose to use firewood or other traditional, lower cost fuels for cooking.

Depending on the brand, a single burner induction cooker currently costs BDT 3,000 – 6,000 (USD 35 – 71). A typical family of five in Bangladesh uses approximately 6 units (kWh) of electricity per day for cooking, or about 180 units (kWh) per month. The average price of electricity for a typical household is BDT 6.02 (USD 0.07) per unit (kWh). Hence the cost of electricity to use an induction cooker would be around BDT 1,083.6 (USD 13) per month. Depending on household income and electricity availability, this could be an affordable option for many urban and rural consumers. Also, consumers' rising concerns over the safety of LPG cylinders may help create a gradual market shift toward induction cooking.

The current rate of electricity access supports the widescale distribution of electric cookstoves as a clean-cooking solution especially for the peri-urban and higher-income rural populations. At present, electric cooking has a small penetration in remote areas and at the bottom of the pyramid (BOP) markets. Further cost reductions as well as behavioural change interventions are needed to address these segments.

2.5.3 BIOGAS

Biogas is one of the most environmentally friendly clean-cooking fuel options (Putti et al. 2015). It is primarily a mixture of carbon dioxide and methane. Biogas is produced through the anaerobic digestion of biodegradable organic material such as manure, food-processing residues, energy crops, and wastewater treatment sludge (IRENA 2017).

There are two types of biogas digesters available in Bangladesh: fixed-dome digesters and prefabricated fiberglass digesters. In Bangladesh, biogas is mainly produced from cow and chicken manure. The table below shows the annual biogas methane yield from each source (table 4).

Biogas stoves are similar to LPG stoves or natural gas stoves. Stoves are connected to the digesters with plastic pipes. Biogas combustion produces emissions at a similar level to LPG. Since the first installations in the mid-1990s by the Bangladesh Council for Scientific and Industrial Research (BCSIR), 102,808 biogas digesters have been installed in the country as of 2018. Total biogas production capacity is estimated to surpass 400,044 m³/day; this can potentially serve 200,022 households (Rahman 2018) (table 5). This is equivalent to 800 MWh of electricity production, assuming 0.5m³/KWh for electricity production.

Besides BCSIR, several other organizations have worked to install biogas digesters for clean cooking. IDCOL

Table 5: Total number of biogas digesters installed and their capacities⁶

Total Number of Installed Units	Total Biogas Production Capacity (m ³ /day)	Equivalent Electricity that can be produced from the biogas (MWh)	Equivalent Number of households can be connected for cooking
102,808	400,044	800	200,022

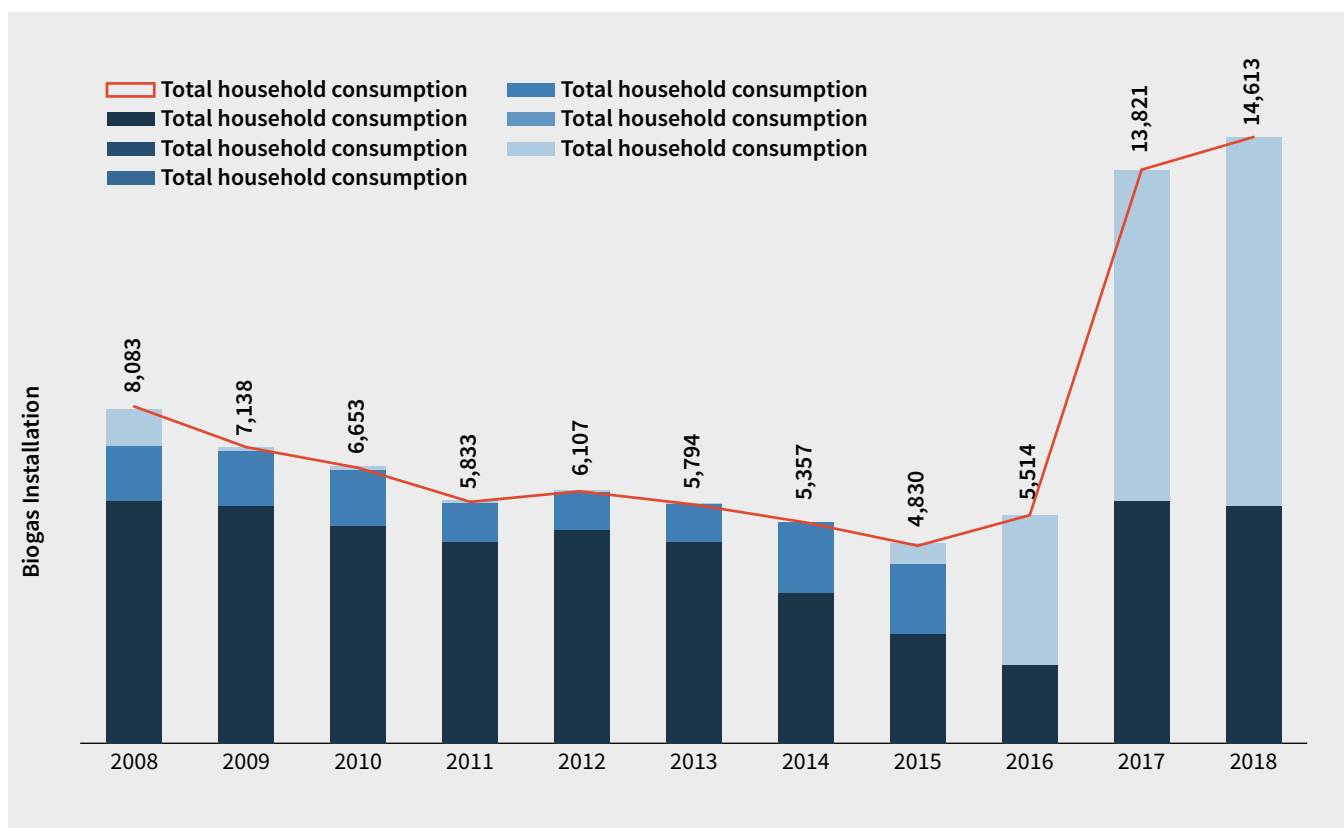


Figure 5: Biogas installations by organization, 2008–2018

has helped its partner organizations (POs) to develop end-user microfinance schemes to make biogas more affordable to households.

Local private companies such as Rahman Renewable Energy Co. have installed more than 500 household biogas digesters. NGOs such as BRAC and Proshika have also worked on biogas technology development in Bangladesh. This indicates that established development organizations with a strong rural presence are both interested and involved in the sector.

Figure 5 shows the number of biogas installations by different organizations from 2008 to 2018. IDCOL has installed the highest numbers of biogas digesters. Out of 85,410 biogas digesters, IDCOL accounts for more than 60 percent of installations, with a total number of 51,444, followed by the Department of Youth Development (DYD) installing 24,971 biogas digesters (Rahman 2018).

Setting up a biogas plant costs about BDT 30,000 to 35,000 (USD 354 to USD 413, The Daily Star 2011). Given that Bangladesh has a significant number of low-income households with monthly incomes ranging from BDT 6,000 to 10,000 (USD 71 to 118), biogas for cooking remains beyond the reach of many households. Therefore, the scale-up of this technology is still under way.

2.6 KEY STAKEHOLDERS

After adopting the country action plan in 2013, several stakeholders played a crucial role in implementing the action plan and ensuring rapid dissemination of ICSS within the households. A brief on a few key stakeholders has been compiled to understand their actions and contributions better.

Household Energy Platform: The Household Energy Platform (HEP) was established in 2016 to bring all government stakeholders, donor agencies, and NGOs together on a single platform. It is a public-private partnership hosted by The Sustainable Renewable Energy Development Authority (SREDA) and functions as per the sector's changing needs, based on the broader understanding and interest OF the stakeholders. HEP has facilitated the Country Action Plan (CAP) 2013 review process in past years and is currently supporting SREDA to develop the new National Action Plan for Clean Cooking 2020–2030. They have worked with the Bangladesh Council of Scientific and Industrial Research (BCSIR) to establish a lab capable of testing cook stoves as per ISO standards. HEP organizes workshops for different stakeholders of the sector to understand the prospects and challenges of clean cooking. They are currently

researching developing biomass-briquettes on a larger scale in the country.

IDCOL (IDCOL ICS Program): The Infrastructure Development Company Limited (IDCOL) started its ICS program in 2012. Currently the program has 61 POs to work with ICSs in 300 Upazilas of the country. Over the years, the program has successfully achieved its mandate on dissemination of ICS targets, sometimes even ahead of schedule. As of December 2020, more than 2.46 million improved cookstoves have been distributed. IDCOL has come a long way in improving its stoves in terms of efficiency. They have upgraded their ICSs from Tier 1 to Tier 3 in thermal efficiency, and they have recently introduced a tier 4 thermal efficiency cookstove in the program. IDCOL is playing a big role in helping the country to meet its vision of clean cooking for all by 2030.

GIZ: GIZ is a German organization that implements projects to promote sustainable economic development on behalf of the German Government. Its ICS program has been running since 2004. Its current “Bondhu Chula” model focuses on supporting around 100 NGO partners and more than 5,000 sanitary shops to manufacture and sell stoves. These NGOs and SMEs are trained and supported by GIZ. They are using a more robust concrete version of a BCSIR model.

Bangladesh Bondhu Foundation: The Bangladesh Bondhu Foundation (BBF) was established as a nonprofit organization in 2015 to promote renewable energy technologies, especially improved cook stoves. It started its journey as a GIZ/EnDev initiative to promote improved cookstoves designed in 2012–2014, under the project “Market Development Initiative for Bondhu Chula.” The project aimed to create 5,000 entrepreneurs who will

produce, sell, and install Bondhu Chula stoves as a part of their business. So far, they have distributed over 2 million cookstoves. As one of the earliest contributors in the sector, BBF has played a significant role in popularizing different types of ICS to various families in both rural and semi-urban areas.

Grameen Shakti: Grameen Shakti was established in 1996 to empower Bangladesh’s rural population with green energy and income access. They targeted 20 million cookstoves to be distributed by 2015, including 2 million biogas plants. Under the program, the customers were provided with affordable financing options instead of subsidies. Grameen Shakti is currently working as one of the partner organizations of IDCOL.

Clean Cooking Alliance: The Clean Cooking Alliance works with a global network of partners to build an inclusive industry that makes clean cooking accessible to the three billion people who live each day without it. Established in 2010, the Alliance is driving consumer demand, mobilizing investment to build a pipeline of scalable businesses, and fostering an enabling environment that allows the sector to thrive. Bangladesh is one of the focus countries of the Alliance, which has been active in the country by supporting demand creation, strengthening supply chains, and creating an enabling environment.

SMC: A recognized leader in behaviour change communication (BCC), social marketing, and community mobilization in Bangladesh, the Social Marketing Company (SMC) has worked in the past with USAID in social marketing campaigns related to reproductive health. In collaboration with Purplewood, a top SBCC consulting agency, SMC developed an extensive 1.5-year campaign in 2017–2018 with support from the Alliance.



3

UNDERSTANDING CLEAN-COOKING MARKET CONSUMERS

3

UNDERSTANDING CLEAN-COOKING MARKET CONSUMERS

Understanding consumer characteristics and preferences is central for demand creation, especially for developing tailored, bottom-of-the-pyramid (BoP) market strategies. The upcoming chapters will look at consumer segmentations, consumers' preferences in clean-cooking solutions, and the fuel-switching pathways needed to achieve the target of universal access to clean cooking codified in the new National Action Plan for Clean Cooking in Bangladesh (2020–2030).

3.1 CONSUMER SEGMENTATION

The following segmentation conclusions were drawn from a review of the market segmentation analysis literature on Bangladesh household incomes and the market for cookstoves and fuels (Power and Participation Research Centre 2016, Bangladesh Bureau of Statistics 2018, Global Alliance for Clean Cookstoves 2015). Six consumer segments were identified by household income level and the urban-rural divide:

- Middle-class segment (urban/peri-urban)
- Middle-class segment (rural)
- Lower-middle-class segment (urban/peri-urban)
- Lower-middle-class segment (rural)
- Low-income segment (urban/peri-urban)
- Low-income segment (rural)

With an average monthly income of BDT 17,000–25,000 (USD 201–295), the middle-class segment of urban and peri-urban area prefers to use LPG for a portion of their cooking. Many of them own electric rice-cookers to bring down cooking time and the level of supervision needed.

With an average monthly income of BDT 11,000–17,000 (USD 130–201), the lower-middle class of the urban and peri-urban areas segment cook their meals with traditional clay stoves using purchased biomass fuel from wood sellers (wood, wood chips and sawdust). Some of the households in this segment also have access to piped natural gas.

With an income level of BDT 6,000–10,000 (USD 71–118), the low-income population in the urban and peri-urban areas are often found using traditional stoves for cooking.

With an average monthly income of BDT 17,000–25,000 (USD 201–295), the middle-class segment of the rural areas mainly uses traditional stoves complemented with Bondhu Chula, two-pot chimney ICSs, portable IDCOL ICSs, electric stoves and LPG stoves.

The lower-middle-class and low-income households in rural areas are identified as non-target segments for market-based interventions, given their lower level of willingness-to-pay and the habit of using free biomass from their surroundings. It is not very likely that they will make the switch to cleaner fuels or ICS in the short term.

The assessed market segments and the essential findings of the segment profiles are summarized in figure 6.

The consumer segmentation from the “Bangladesh Modern kitchen Marketing and Behaviour Change Strategy” is indicative of the great potential for ICS promotion in the Bangladeshi market. In the lower-middle-class segment, we see an inclination toward the traditional stove. In those households, there is scope for introducing inexpensive ICSs.

Installation of relatively inexpensive ICSs, such as the portable IDCOL Chula, can bring much needed fuel

efficiency and savings. LPG can also be introduced as a fuel for selective usage, for example, warming up food or making light snacks.

The low-income urban and peri-urban households have major economic constraints. As a result, they continue to use wood fuels. Low-cost portable IDCOL Chula stoves could be introduced to this segment. With this option they would be able to cook with less fuel and also reduce HAP exposure. Similar options are available for middle-class rural consumers (figure 6).

In the long run, as consumer spending patterns evolve with sustained economic growth, it is expected that LPG will become the primary cooking fuel in Bangladesh.

Currently, many rural households are adopting LPG as their secondary fuel, while biomass stoves remain the mainstay. These households often use LPG cylinders to reheat food or cook dishes that do not require a lot of time. This is because they cannot afford LPG for full-time cooking. This segment of consumers can gradually shift to full-time use of LPG. Even if prices remain the same, there is the possibility that the segment will gradually be more receptive to LPG, thanks to increases in real income stemming from broad-based economic growth.

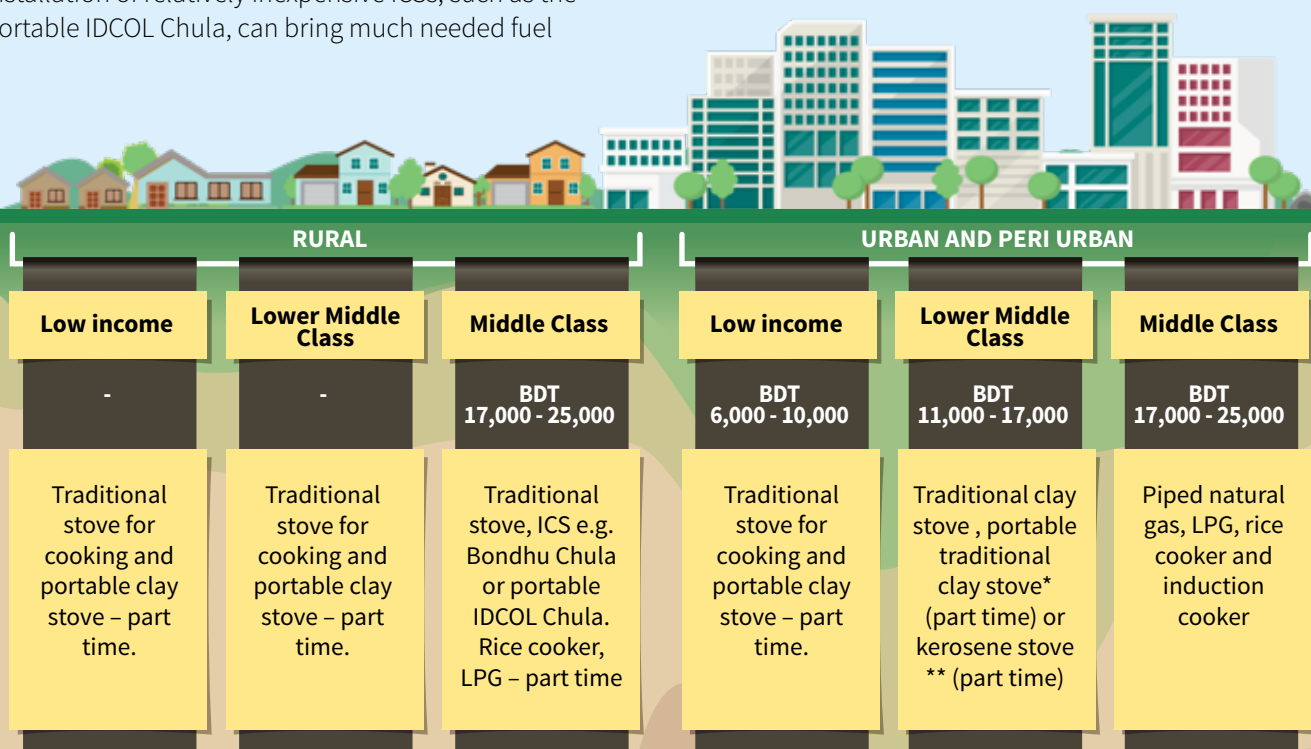


Figure 6: Bangladesh Consumer Segments by Household Income Threshold and the Urban-Rural Divide

Table 6: Percent distribution of the household population by wealth index quintile, 2019

	Wealth Index Quintile					Total	# of households member
	Poorest	Second-poorest	Middle	Second-richest	Richest		
Total	20.0	20.0	20.0	20.0	20.0	100.0	260.959
Urban	6.0	6.8	11.4	21.7	54.0	100.0	56,700
Rural	23.9	23.6	22.4	19.5	10.6	100.0	204.259

Based on their purchasing power, the lower-middle-class of the rural areas can be introduced to ICS solutions such as chimney stoves and the portable IDCOL Chula.

For the lower socioeconomic category of rural consumers, their dependency on firewood cannot be reduced in a short time. However, they can be introduced to low-priced portable IDCOL stoves, which can

effectively reduce the amount of firewood they require and hence the amount of emissions they are exposed to.

Using the wealth index and household percentages from the 2019 Multiple Indicator Cluster Survey (Bangladesh Bureau of Statistics and UNICEF Bangladesh 2019) (table 6), table 7 shows a summary of clean-cooking consumer segmentation with information on market size,

Table 7: Cookstoves and fuels consumer segmentation

Income Thresholds + B2...	Urban Peri-urban (100%)	Rural (100%)
Middle Class BDT 17,000-25,000/month (USD 201-269/month)	Segment 1 (11.4%) traditional stove + ICS + purchased wood PNG LPG electric cooker <ul style="list-style-type: none"> Living in areas with easy access to schools and local market areas Well educated and well informed Have bank accounts but not always familiar with MFI loans Experience of buying consumer products using loan and installments Highly influenced by community opinions Own TVs and computers Subscribe to newspapers and magazines Display high willingness to invest on premium and durable products Aspire to improving lifestyle and social status 	Segment 2 (22.4%) traditional stove + ICS + free biomass (primary) + purchased wood electric cooker (partially) LPG (partially) <ul style="list-style-type: none"> Can afford to buy LPG for part-time usage Living in own house with sufficient space around the house Earning and decision-making members of the family are fairly educated and informed Have bank accounts and small investments in a local bank and have experience with microfinance institution (MFI) Own appliances such as TVs, radios, refrigerators etc. Are willing to invest in premium and durable products
	Lower Middle Class BDT 11,000-17,000/month (USD 130-201/month)	Segment 2 (6.8%) purchased wood + traditional clay stove portable traditional clay stove (partially) kerosene stove (partially) <ul style="list-style-type: none"> Living in clusters of rented houses, with easy access to school and local market areas Have migrated with family and young children to urban/peri-urban areas Have membership in a recognized savings group/MFI/NGO Highly influenced by opinions of their relatives, friends and neighbors Own appliances like TVs and/or radios and subscribe to local newspapers Display slight willingness to invest in premium and durable products

Income Thresholds + B2...	Urban Peri-urban (100%)	Rural (100%)
Low Income BDT 6,000-10,000/month (USD 71-118/month)	Segment 3 (6.0%) traditional stove + free biomass (primary) + purchased wood clay stove (partially) <ul style="list-style-type: none"> • Living in housing cluster in informal or illegal settlements • Rely on easy access to central market areas • Have membership in registered savings groups and NGOs • Highly influenced by community opinion 	Segment 6 (23.9%) traditional stove + free biomass

income threshold, current cooking technology in use, and segment characteristics. Marketing and intervention strategies can be developed based on this and will be discussed in chapter 7. Also, a more in-depth consumer analysis on ICS users will be elaborated in chapter 4 when the focus turns to the IDCOL ICS program and the ICS markets.

3.2 GRADUATION PROCESS

According to Schlag and Zuzarte (2008), many researchers use the “energy ladder” model, in which various fuel types each represent a step in the ladder. The assumption is largely that as a household gains

socioeconomic status, it starts moving up the ladder to cleaner and more efficient forms of energy.

In the ladder model, there are three stages of fuel choice (figure 7). In the first stage, households are dependent exclusively on solid biomass fuels and derive energy from firewood and animal waste combustion. In the intermediate stage, the households move toward fuels that burn more efficiently but still have significant emissions, for example, charcoal, kerosene or coal. In the last step, the households start using the cleanest forms of energy available to them, for example, LPG or electricity. The crucial issue with the “energy ladder” is that it assumes a perfect substitution of one type of fuel for another – in other words, it assumes that households will not mix fuel types (Schlag and Zuzarte 2008).

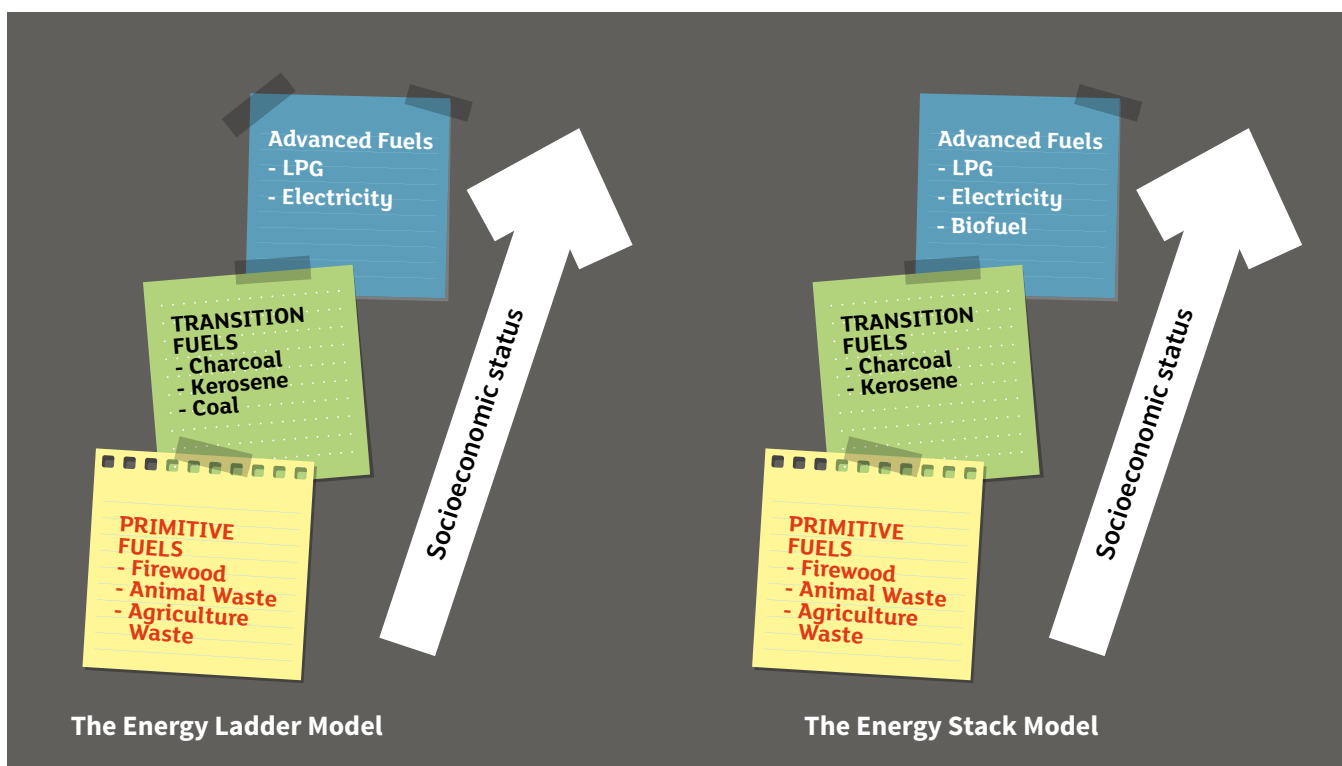


Figure 7: Energy Ladder (perfect one-to-one substitution) vs Energy Stacking (overlapping)

Although the “Energy Ladder” model assumes that households do not mix fuels, empirical data shows that “fuel substitution” is not perfect. Households often use multiple fuels simultaneously. Many researchers have replaced the model with what is known as the “energy stack” model, proposed by Masera et al. (2000), shown in figure 7.

The “Energy Stack” model suggests that households do not – at least not right away – completely abandon inefficient fuels in favor of efficient ones. Instead, modern fuels are integrated slowly into their energy usage pattern, resulting in the simultaneous use of different cooking fuels and gradual substitution. The assumptions of this model include the notion that affordability is a uniquely important factor in determining a household’s fuel/cookstove choice. This model is supported by empirical data presented by Masera et al. (2000) and has also been confirmed by further studies of fuel-switching dynamics (IEA 2002; Pachauri and Spreng 2003).

This discussion is relevant because a similar pattern has been noticed in Bangladesh. Field research has shown that Bangladeshi households do not move away from one type of stove to another in perfect substitution. Instead, they use different types of fuel stoves as they advance in socioeconomic status (figure 8). A recent study by Bangladesh Institute of Development Studies

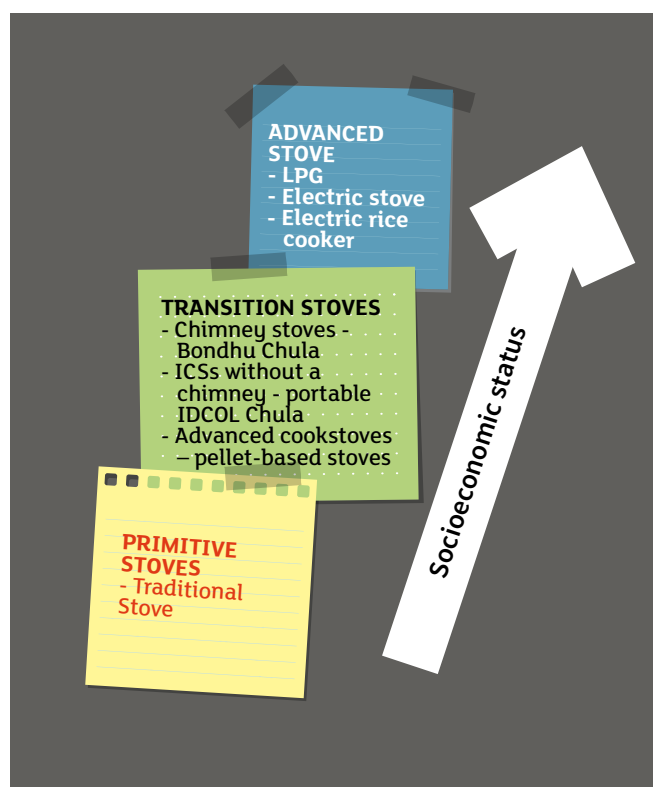


Figure 8: Stove stacking

(BIDS 2020) shows that, out of 1,000 surveyed ICS customers, over 71 percent were simultaneously using other stoves, and that, besides ICS, traditional mud stoves (74 percent), gas stoves (29 percent) and rice cookers (8 percent) were their top-three complementary fuel choices (Hossain and Azreen 2020).

ICSs are playing an important transitional role in the lead-up to universal clean-cooking adoption in Bangladesh. While households are moving toward advanced stoves, they can either use ICSs as a substitute for traditional stoves for the interim period until they can afford advanced fuels and stoves; or use it alongside cleaner stoves as a stove-stacking choice. This gives lower-income households an intermediate clean-cooking solution. They do not need to be stuck with traditional means of cooking until they can afford an advance stove and fuel. ICSs, including the Bondhu Chula and various types of IDCOL Chula, allow them to move to an efficient solution as an intermediate step.

Even when households move from traditional to advanced cooking technologies, they often start with limited or controlled usage of advanced stoves such as LPG and electric stoves. Full-time usage of LPG or electric stoves is often a gradual process, depending on the increase in their purchasing power. During this transition, households should be provided with the option to choose ICSs for their regular cooking activities. Given the importance of ICSs, it is crucial to have a look at the extent to which ICSs are accepted and absorbed by consumers in terms of their lifestyle and taste.

3.3 CONSUMER WILLINGNESS TO PAY AND BASELINE SITUATION

The baseline survey of the second phase of the IDCOL project was conducted in 2017 by Bangladesh Institute of Development Studies (BIDS), with 2,000 respondents belonging to the treatment group and 1,000 to the control group. Treatment group signified “potential users of the improved cooking stove,” and the control group signified “nonusers.”

The portable single-mouth ICS garnered the highest willingness to make cash payments for both the treatment group (35.9 percent) and the control group (34 percent). Only 2.2 percent of the treatment group, and an even lower percentage (0.02 percent) of the control group respondents, reported preferring paying in installments (table 8). Meanwhile, for the double-mouth

chimney stove, willingness to pay (WTP) in cash dropped, compared to single-mouth ICSs, by more than 10 percent for both the treatment group (23.15 percent) and the control group (19.7 percent).

Willingness to pay in installments increased significantly (20.41 percent) for treatment group but increased only 8.42 percent for the control group (table 9). This shows an overall increase in willingness to pay within the treatment group (+5.46 percent) and decrease for the control group (-5.9 percent) for the double-mouth chimney stove.

Hence, the willingness to pay in cash was found to be inversely proportional to the price range of ICSs; the lower the price of ICSs, the higher the willingness to pay in cash. However, preference for installments is proportional to the price of the ICSs; the lower the price of ICSs, the fewer the number of people willing to buy it on installment.

Several private organizations are manufacturing advanced ICS models that use pellet fuel. In most cases, the cost of acquiring an advanced ICS is equal to the cost of buying LPG (table 10). The monthly recurring fuel cost is also close to current LPG prices.

Table 8: Willingness to pay for Portable 8” with insulation and lining cookstove

Types of Payment	Portable 8” with insulation and lining cookstove; Price– BDT 300–500 (USD 3.5–6)	
	Treatment	Control
Willingness to Pay (cash payment)	35.90%	34%
Willingness to Pay (payment within 6 months at an interest of 1% per month)	2.20%	0.02%
Total	38.10%	34.02%

Source: Bangladesh Institute of Development Studies 2020

Table 9: Willingness to pay for double-mouth chimney stove

Types of Payment	Double-mouth chimney stove; Price– BDT 900–1000 (USD 11–12)	
	Treatment	Control
Willingness to Pay (cash payment)	23.15%	19.70%
Willingness to Pay (payment within 6 months at an interest of 1% per month)	20.41%	8.42%
Total	43.56%	28.12%

Source: Bangladesh Institute of Development Studies 2020

Table 10: Price comparison between Advanced ICSs and LPG

Advanced ICSs		LPG	
Initial cost of buying pellet-based ICSs	BDT 2500–3400 (USD 29–40)	Initial cost of cylinder and first month’s fuel cost	BDT 3000–3500
Monthly fuel cost (2kg of pellet every day, per kg price of the pellet is BDT 15/USD 0.2)	BDT 900 (USD 11)	Monthly fuel cost	BDT 1100–1200 (USD 13–14)

Source: Bangladesh Institute of Development Studies 2020

Apart from the price, there are additional steps in using advanced ICSs to optimize performance and efficiency:

- Ignition: putting the pellet in the pellet chamber and spraying kerosene in order to ignite a fire.
- Heat control: electricity is needed in order to fan the flames and get the pellets to burn properly.
- Disposing of the spent pellet: once burnt, pellets have to be extracted (from inside the hot metal chamber), cooled with water, and disposed separately.

In addition to the extra steps mentioned above, the other challenge of using pellets is that supply in Bangladesh is very limited. A few years back the only pellet-producing company stopped production following internal management strife. Some pellet-based ICS producers have advised their customers to use wood chips instead of pellets since then.

Recently, the trading company Rahimafrooz has initiated plans to set up a pellet-production plant to meet the demand from current users of their pellet-based ICS model. But the company has not started operations yet. Compared to pellets, despite similar costs for end-users, the LPG distribution network is much more extensive to build, even though it covers most rural areas. Pellets and advanced stoves, of course, have two advantages: pellets being a renewable source of energy and the positive health impacts compared to other biomass stoves; but success and sustained usage ultimately depend on the availability and affordability of pellets.

From the baseline survey by IDCOL, respondents expressing a willingness to pay are fewest in the case of expensive (pellet-based) ICSs. On the other hand, the highest percentage of respondents willing to pay in installments for both treatment (25.53 percent) and control groups (12.77 percent) was seen for high-end ICSs, compared to the two other types of ICS previously discussed (table 11).

Plotting these data on a willingness-to-pay (WTP) analysis chart (figure 9), the vertical axis measures stove price and the horizontal axis shows the WTP response rate. Bubbles are colored by treatment/control and their preference on cash vs installment; bubble size indicates the proportion of households with that choice – the larger the bubble, the more households. For the portable 8” stove and double-mouth chimney stove, both treatment group (ICS adopters) and control group (ICS nonadopters) are in favor of cash payment (blue and green bubbles), as the blue and green bubbles are far away from the purple and orange bubbles on the right.

The first key message from this visualization is that for all three ICS stove models, despite the bubble size difference, the blue (ICS adopters – cash) and green bubbles (ICS nonadopters – cash) overlap, which indicates a small difference and likely homogeneity when purchasing. This means that those ICS nonadopters would likely make the same purchasing choices as those ICS adopters for all three stove models, and should be targeted with tailored interventions to create a clean adoption shift.

The second thing to notice is the orange bubble (ICS adopters – loan). In the portable 8” stove horizontal corridor, the size of the orange bubble on the left is much smaller than the green/blue bubble on the right, indicating the unpopularity of installment for this stove type even for ICS adopters. For the advanced ICS stoves (the top horizontal corridor), however, interestingly the majority households are in favor of taking a loan program to purchase (the orange bubble on the far right is the largest bubble) and this is also true even for the ICS nonadopters (purple bubble is larger than green bubble in the top horizontal corridor). Microfinance programs and interventions could be designed for this segment group to promote clean adoption.

Table 11: Willingness to pay for Advanced ICSs (pellets-based)

Types of Payment	Agni Shikha/Shikha Chula, Shakti Chula, Life Cookstove, Venus Solar Burner, Muspana; Price– BDT1800–2400 (USD 21–28)	
	Treatment	Control
Willingness to Pay (cash payment)	9.10%	9.50%
Willingness to Pay (payment within 6 months at an interest of 1% per month)	25.43%	12.77%
Total	34.53%	22.27%

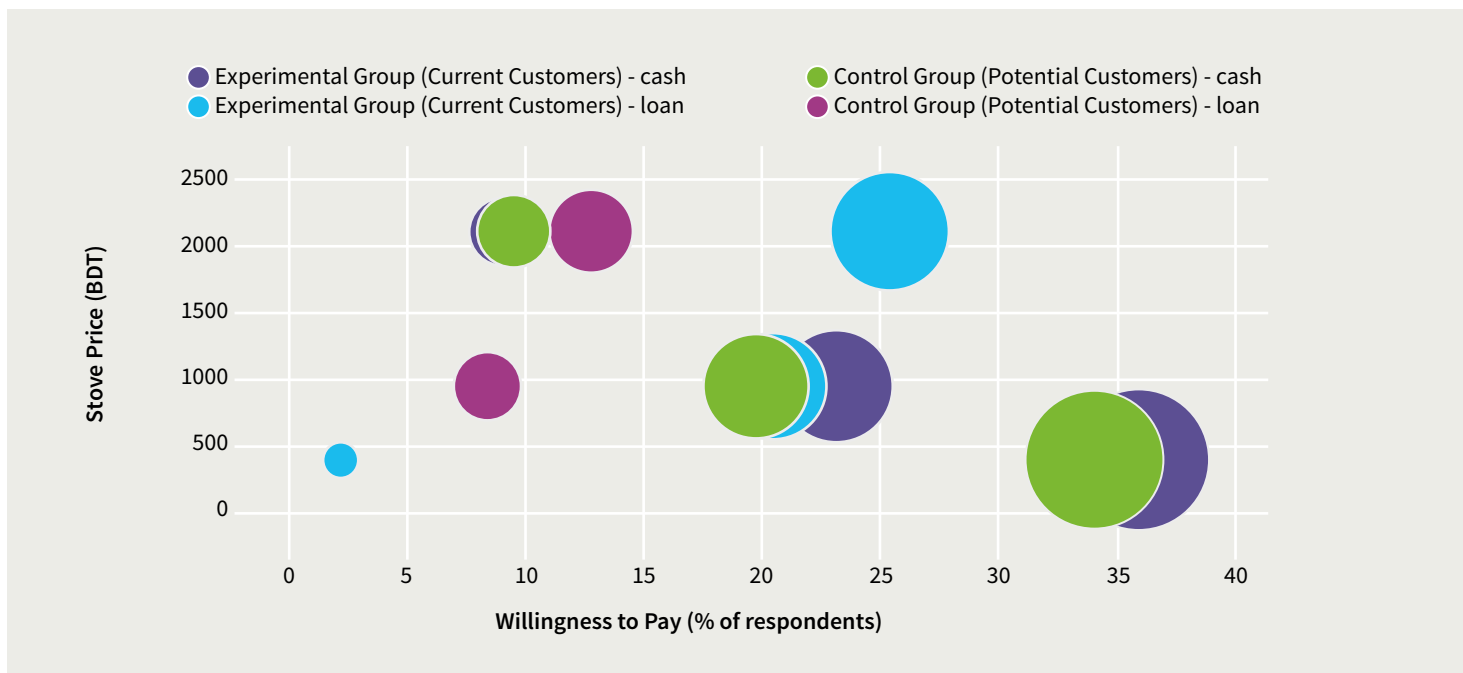


Figure B: ICS Consumer Willingness to Pay Analysis

3.4 ECONOMIC AND TECHNICAL FEASIBILITY

Currently, popular stove choices on the market are split between the spectrum’s two extremes, consisting of the traditional stoves and LPG. There are a significant number of households who largely depend on traditional stoves. Most such households include lower-middle-class and low-income segments of urban and rural areas.

To design an inclusive approach to ensure the involvement of the most vulnerable segments (lower middle-class and low-income segments of urban and rural areas), ICSs are a very important component, especially for the long-run transition to cleaner-cooking solutions.

Given the stove-stacking tendency of households, it is likely that people will move toward cleaner solutions on their own, once the dependency on the inefficient traditional stove is weakened. Moreover, the BIDS baseline survey indicates that once consumers are introduced to the ICS solution, there is a higher likelihood that most of them will continue to use the solution than abandoning it altogether. Though price sensitivity remains a major challenge, organizations such as IDCOL are working to provide promotional grants and sales training to overcome these barriers.

As we analyze the forecast figures estimated by Omera and Bashundhara LPG in table 2, the robust growth potential of LPG becomes evident. However, the growth

rate might drop because the LPG sector appears to be turning into a red ocean from a blue ocean. While LPG companies target untapped demand, LPG adoption will keep on growing. Additionally, with the rising income levels of the rural middle class, more of them will acquire LPG for their energy needs.

To tap even into untapped segments, LPG companies are investing heavily in physical distribution to make LPG available in the most remote regions. Our field visits uncovered the fact that many dealers are selling both ICSs and LPG together in their shops. It is because LPG is not seen as a natural but a complementary alternative to ICSs. Instead, households have been keeping both LPG and ICSs to meet their cooking needs as most rural households use LPG as a secondary source of energy.

ICSs are still relevant to prevent traditional stoves from persisting in the households as a primary source of energy. Most importantly, based on the Energy Stack model and consumer segmentation, stove stacking is inevitable and in fact quite common during market transformation and nationwide economic transition. ICSs currently have the largest market share and can be a short-term solution during this transition to cleaner stoves and fuels. In addition, given the financial constraints and local fuel availability of rural households where traditional and ICS stoves are dominant, while other solutions such as LPG and induction stoves should be promoted too, ICSs present the greatest opportunity to rural households, which is the largest market segment given the strong dependence and preference of traditional stoves they have.

4

**IDCOL ICS
PROGRAM**

4

IDCOL ICS PROGRAM

The IDCOL Improved Cook Stove (ICS) Program was inaugurated by the Honourable Prime Minister of Bangladesh in May 2013 with the aim of creating a sustainable market for higher efficiency cookstoves in the country. The initial target of 1 million ICSs installed by 2018 was achieved by IDCOL in January 2017 and since then, a total of 2.09 million ICSs have been installed as of December 2020 (table 12). IDCOL now aims to distribute 5 million ICSs by 2023 in support of achieving the 100 percent ICS coverage target by 2030 in the Bangladesh Country Action Plan for Clean Cooking 2020–2030. This ICS program is also registered under the Clean Development Mechanism (CDM) and is certified to earn emission reduction credits issued by the UNFCCC.

To elaborate on the IDCOL ICS program, the assessment team has dived into the types of ICS sold by the POs, the business model they are following, and their capacity to promote and sell ICSs effectively.

Table 12: Total ICSs Installed in Phase 2 of the IDCOL ICS Program, 2017–2020

Year	Installation (Tier 1)	Installation (Tier 2)	Installation (Tier 3)	Installation
2015	228,335	10,481	–	238,816
2016	517,013	20,331	192,561	729,905
2017	–	8,498	428,225	436,723
2018	–	5,501	238,715	244,216
2019	–	8,942	353,028	361,970
2020	–	9,518	441,607	451,125
Total	745,348	63,271	1,654,136	2,462,755

4.1 COOKSTOVES

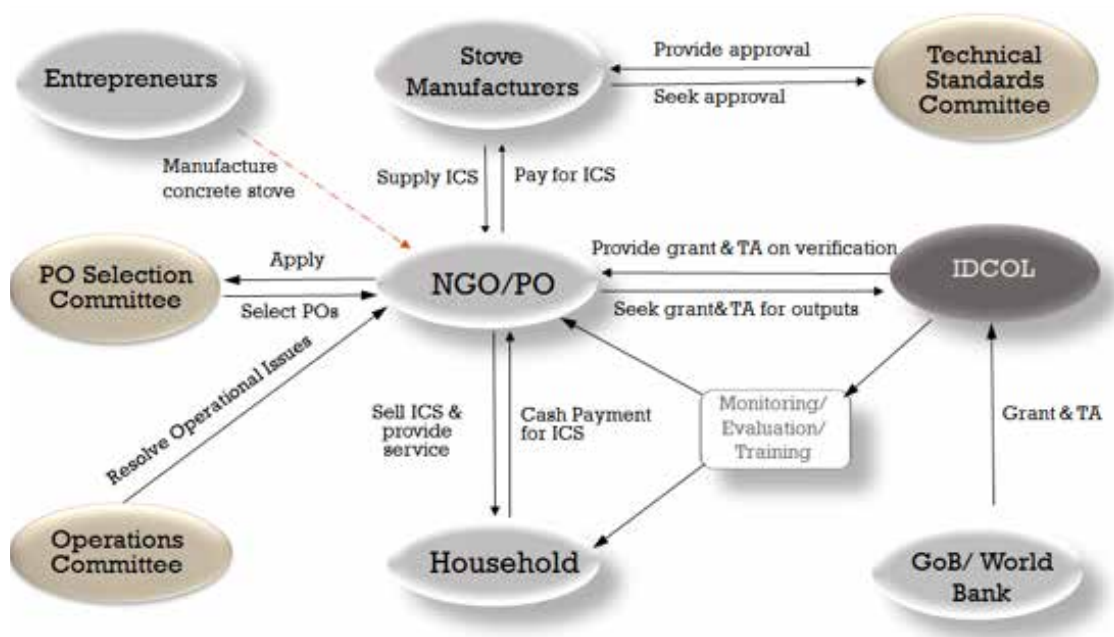
IDCOL's POs sell three main types of ICS. Those are "Single-mouth portable", "Single-mouth Chimney stove" and "Double-mouth chimney stove." The prices of these ICS stoves are in table 13. From the consultation workshop held with the POs, we learned that 95 percent of the ICSs sold account for "Single-mouth portable" ICS stoves. The other two types are not popular because of their relatively high prices. These issues will be detailed in upcoming chapters.

Table 13: IDCOL ICS stove models

<p>Single-mouth portable</p>  <p>BDT 375 (USD 4)</p>	<p>Double-mouth chimney</p>  <p>BDT 1450 (USD 17)</p>	<p>Single-mouth chimney</p>  <p>BDT 1350 (USD 16)</p>
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4.2 BUSINESS MODEL OF THE POs

IDCOL has 61 POs working on promoting ICSs in 300 Upazilas of the country. IDCOL selects POs through a tendering process, where interested nongovernment organizations and private sector stakeholders have to submit proposals. Once selected, the POs start working on the production and marketing of ICSs, using the starting capital provided by IDCOL to establish manufacturing plants and set up initial distribution networks. From our field research at Jhenaidah, Satkhira and Barisal, we found that the selling price of ICSs differs among different POs.





Source: IDCOL

Figure 11: ICS Selection Process of IDCOL ICS Program

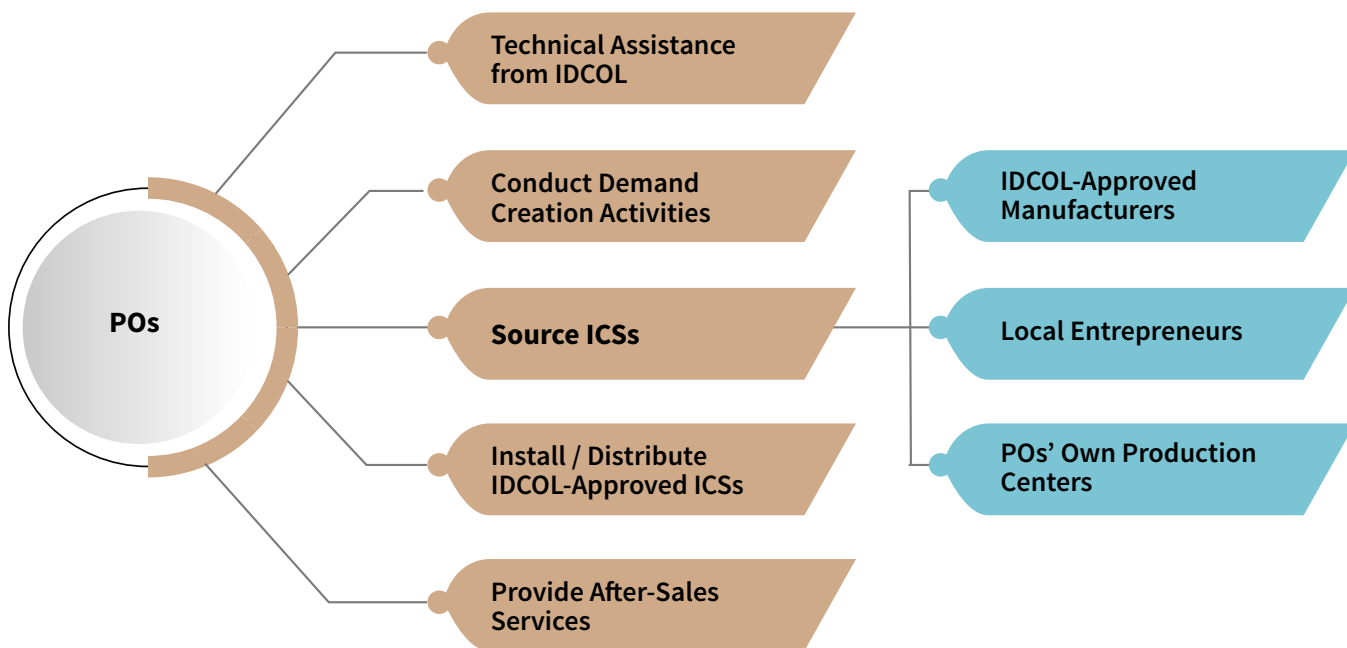
Among the various districts where IDCOL POs operate, Dinajpur, Rangpur, Bogura, Jhenaidah and Bagerhat have many ICS installations. About 150,000 to 175,000 ICSs have been installed in each of these districts to date, whereas Mymensingh, Netrokona, and Jamalpur districts have a very low number of ICSs installed. Therefore, there is huge scope for further investments and interventions in several districts where the traditional stove is still the norm, and ICSs are not yet popular.

4.2.1 INTERACTION BETWEEN IDCOL AND POS

A core support that IDCOL provides to its POs is training of different kinds. These include sales training and stove manufacturing training. Enhanced capacity lets POs improve their production and marketing processes. IDCOL also organizes regional consumer awareness campaigns, giving POs the window to follow up on initial leads. POs leverage such initiatives from IDCOL to manufacture stoves according to IDCOL’s specifications and then market them to customers.

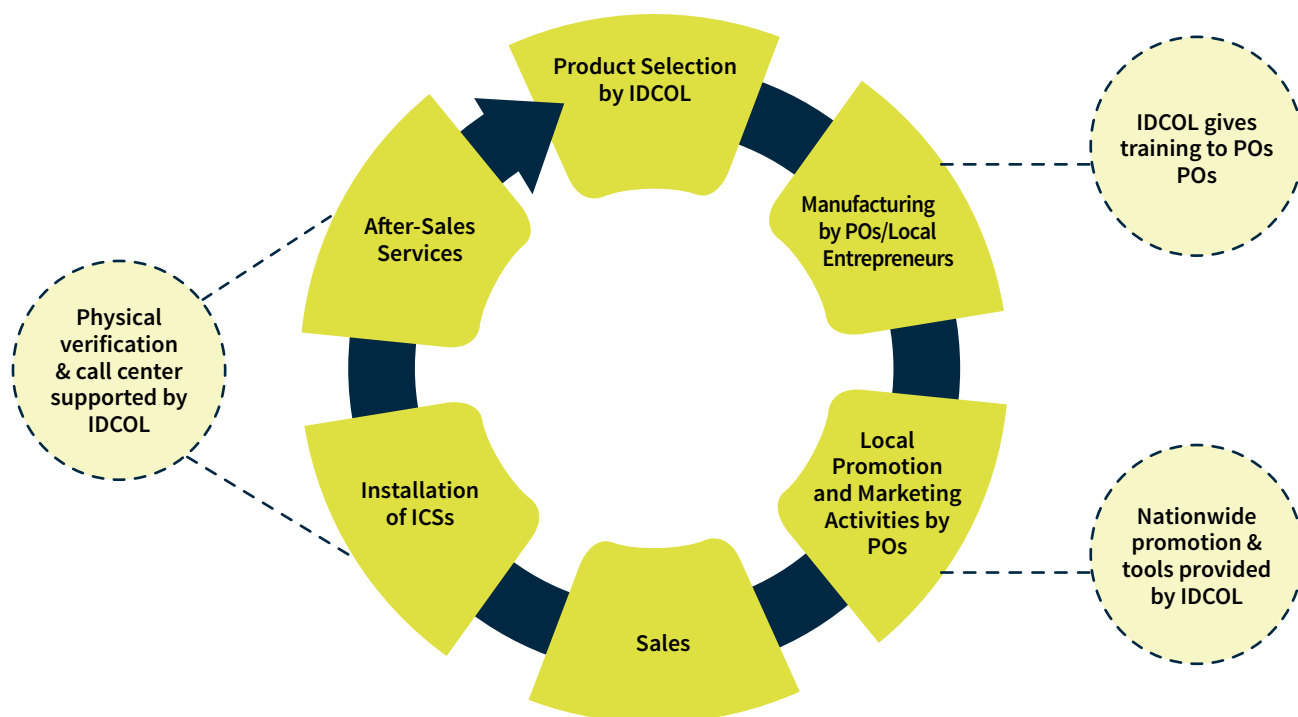


Figure 12: Total time from production to reception of grant



Source: IDCOL

Figure 13: PO activities under the IDCOL ICS Program



Source: IDCOL

Figure 14: Distribution and supply chain in the IDCOL ICS Program

It takes about a month for a PO to complete the production process for one batch of ICSs. ICSs produced in a particular month are then prepared for sale in the following month. It takes about 20 to 30 days for a PO to sell the batch of ICSs produced. After dissemination, they submit to IDCOL their sales data and corresponding bill for a “promotional grant”. At this point, a monitoring team from IDCOL performs random checks by visiting the customers. This process takes about 15 to 20 days or longer. Once the bill is approved, it takes another month to process and disburse the invoice amount. IDCOL withholds a certain percentage from the invoice amount to ensure that the dispensed ICSs are in continuous use.

However, the time lag in receiving a “grant for promotion” often leads to a liquidity problem in the POs’ production process because they sell almost at production cost (figures 12 and 13). According to the POs, this makes them dependent on the IDCOL grants to reach break-even point or realize a marginal surplus. IDCOL’s approved price was derived by considering the maximum cost of making each type of stove. The production cost decreased over time owing to increased volumes, economies of scale, and improved labor efficiency.

4.2.2 COMPETITION IN ICS MARKET

There are a few viable competitors to the ICS that IDCOL markets. The Bondhu Chula is available at a lower price: BDT 600 (USD 7) for the double-mouth version with a chimney. Customers often prefer the Bondhu Chula over other solutions because of its lower price. The POs say they often find it hard convincing consumers to choose the higher-priced IDCOL ICS models because the outward appearance of the two stoves is similar and consumers do not have much awareness about higher efficiency. Given the availability of LPG cylinders and the social status attached to it, consumers with more purchasing power often opt for LPG cylinders, though they may not use it as their regular cooking solution.

Besides the IDCOL ICS and the Bondhu Chula, several private companies and manufacturers have developed various improved and efficient cookstoves, some of which have been approved by IDCOL. These manufacturers sell stoves through their own distribution networks. The consulting team interviewed and reviewed assessment reports of five such ICS manufacturers: Venus BD, Luxur Green Energy, Rahimafrooz Renewable,

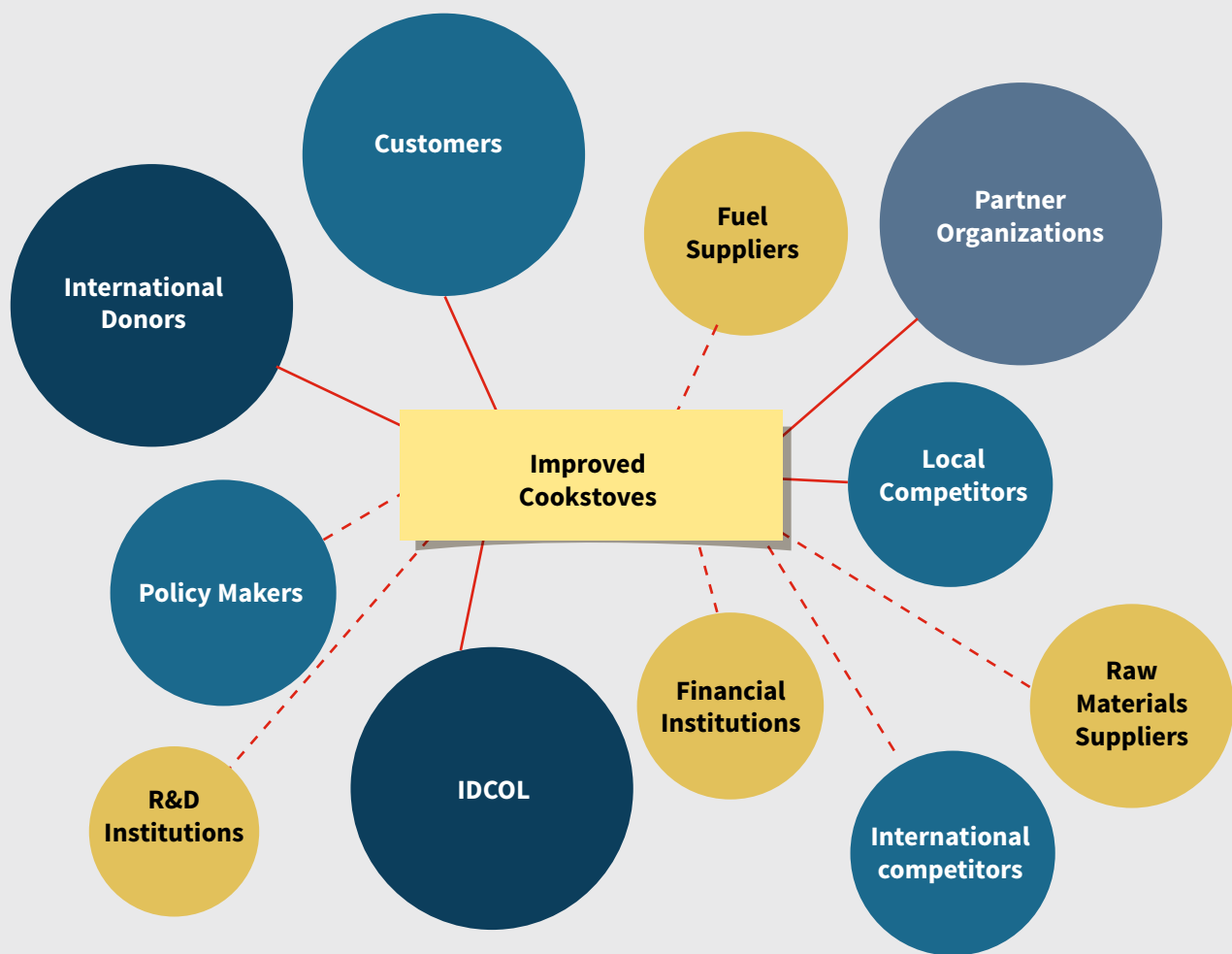


Figure 15: Stakeholder Map for ICSS

Filament Engineering and BD Vision. However, none of them has yet succeeded in creating a viable business.

4.2.3 IDENTIFYING KNOWLEDGE GAPS OF IDCOL POS

Consumer Market Segmentation

The field study discovered that, because of IDCOL’s cluster-based approach, the POs approach the market using only geographic segmentation and do not target households based on their needs and/or their socioeconomic backgrounds. They took the cluster-based approach because it reduces distribution costs and makes service provisions less costly.

In our observations, the PO staff approached potential customers and households with fundamentally the same or similar sales pitch and offer, without tailoring the approach to the particular customer.

4.2.4 STRENGTHENING THE SUPPLY OF IDCOL POs

Given that the POs are heavily dependent on grant money from IDCOL to produce and sell their cookstoves, there is a need to diversify the portfolio for the POs and help them develop sustainable business models. For IDCOL to achieve the goal of installing 5 million cookstoves by, it is essential that the POs value cookstoves as a viable business rather than just depending on donor grant money.

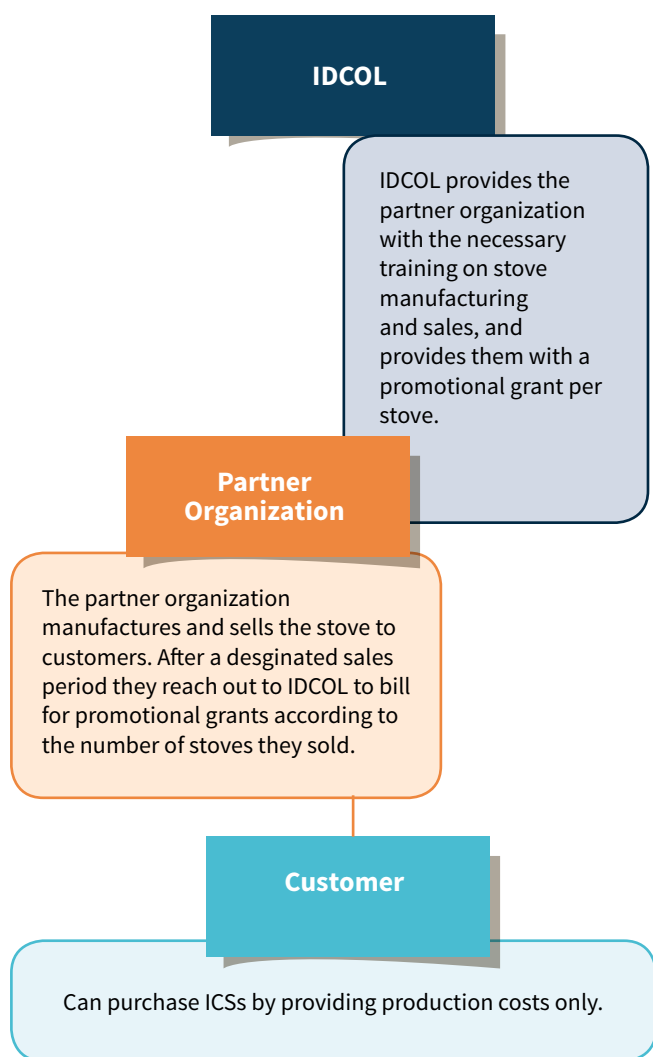


Figure 16: Benefit trickle-down map of IDCOL-PO-customer

4.3 CREATING SUSTAINABLE DEMAND FOR ICSS

4.3.1 Awareness Creation and Behavior Change

To create a sustainable demand for improved cookstoves, awareness building among end consumers is essential. Behavior change communication (BCC) is a key factor for creating sustainable demand for such cookstoves in the market. The partner organizations we visited during the fieldwork also emphasized the power of behavior change. With support from IDCOL, POs arrange several awareness-raising activities throughout the year, such as courtyard meetings, school programs, leaflets distribution, street plays, and advocacy meetings.

However, all the POs interviewed expressed their need for support from the donors on this matter. The Alliance worked with the Social Marketing Company (SMC), a recognized leader in BCC, social marketing, and community mobilization in Bangladesh, and with a top Social and Behavior Change Communication (SBCC) consulting agency, Purplewood, to develop an extensive 1.5-year campaign in 2017–2018. That campaign aimed to increase awareness of the entire category of cleaner cooking solutions and used the brand “Modern Stoves” which intended to tap into a rapidly developing country’s ambitions. The big idea was, “Times have changed; change your stove.”

The campaign used radio, print, billboards, interpersonal communications (IPC), rickshaw branding, community theatre, movie screenings, and fairs to spread its message. Bulk SMS, a helpline, and geo-targeted social media marketing were also used. The campaign is estimated to have had an outreach of at least 1.6 million people, and evaluation results showed that it increased awareness 25-fold among the target population.

Another crucial way ICSs get exposure to new customers is by “word of mouth”, that is, experiences customers share with their friends and extended families. POs reported several incidents when there was an increase in demand from new customers who had been introduced to clean-cooking products by their neighbors, families and friends. People who have been using ICSs for a certain period become accustomed to the ICS and prefer not to return to traditional stoves. These loyal customers actively spread positive reviews of ICSs and help build awareness and change behavior.

Recent studies, summarized in figure 17, indicate that door-to-door (90.9 percent), word-of-mouth (84.5 percent), billboards and posters (61.1 percent) and brochures (60.5 percent) are the most effective marketing strategies that have successfully led to the purchase of an ICS (for ICS-adopters), while work-of-mouth, billboards and posters, and brochures are the top-3 most effective marketing activities for potential customers, or the so-called control group in this study (Hossain and Azreen 2020).

Recommendations from POs on good awareness-building programs include:

- Engaging health workers in explaining the health issues related to traditional stoves and alternative solutions (ICSs)
- Celebrity endorsement of ICS issues
- Local government involvement in awareness-building and distribution

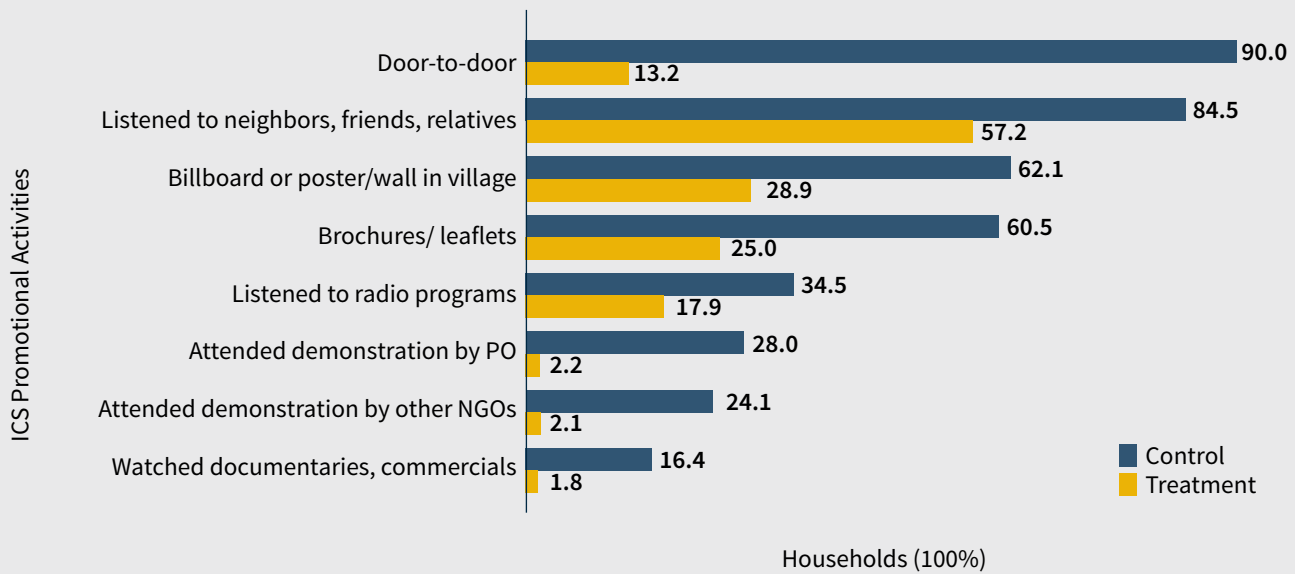


Figure 17: ICS Promotional Activities

4.3.2 CONSUMER SATISFACTION

Our analysis based on fieldwork indicates that most consumers are on the whole satisfied with the performance of their ICS. They typically consider basic criteria such as time spent on cooking, stove price, fuel cost and maintenance. Positive customer feedback include:

- Customers believe that less fuel is needed with an ICS
- More heat is generated compared to the traditional stoves
- The stoves with chimney efficiently keep smoke out of the house
- The portable stove is reasonably priced
- Less cooking time is required with an ICS

To understand the mindset of different consumers, the study team also interviewed several respondents who were aware of ICSs but not yet willing to invest in one. The two key problems mentioned were:

- **Design of the cookstoves:** The depth of the ICS, especially the portable one, is quite shallow. For this reason, the fuel needs the constant supervision of the cook because the fuel burns out more quickly than in a

traditional stove.

- **Upgrading to a better product:** Some current customers are happy with the portable ICS but want to upgrade their stove to a single/double-mouth with a chimney. Unfortunately, they cannot upgrade to the newer/better version of the ICS with the current price, which is significantly higher than in previous years. Moreover, POs do not receive a promotional grant for selling multiple stoves to the same household. Therefore, if a household wants to buy a second ICS, the price offered would be significantly higher.

Studies from BIDS, displayed in figure 18, reveal more detailed numbers. The left column above the x axis in figure 18 are features liked by ICS users, fuel-saving (32 percent) and time-saving (32 percent) are the top two followed by less smoke (19 percent) and health benefit (6 percent). “Can’t use large piece of firewood” is a common complaint across all four consumer groups and potential customers outside the IDCOL ICS Program village coverage (18 percent). Other common issues include “can’t cook with large pot,” “longer cooking time,” “ash residues after cooking,” and “require too much time on maintenance.”

Taking out of the “likes” by current ICS users and focusing on the problems, figure 19 look at this problem from another angle by grouping the feedback by issue. Colors

represent different user groups and bar height indicates the seriousness of the problem – the higher the bar, the more households with that issue.

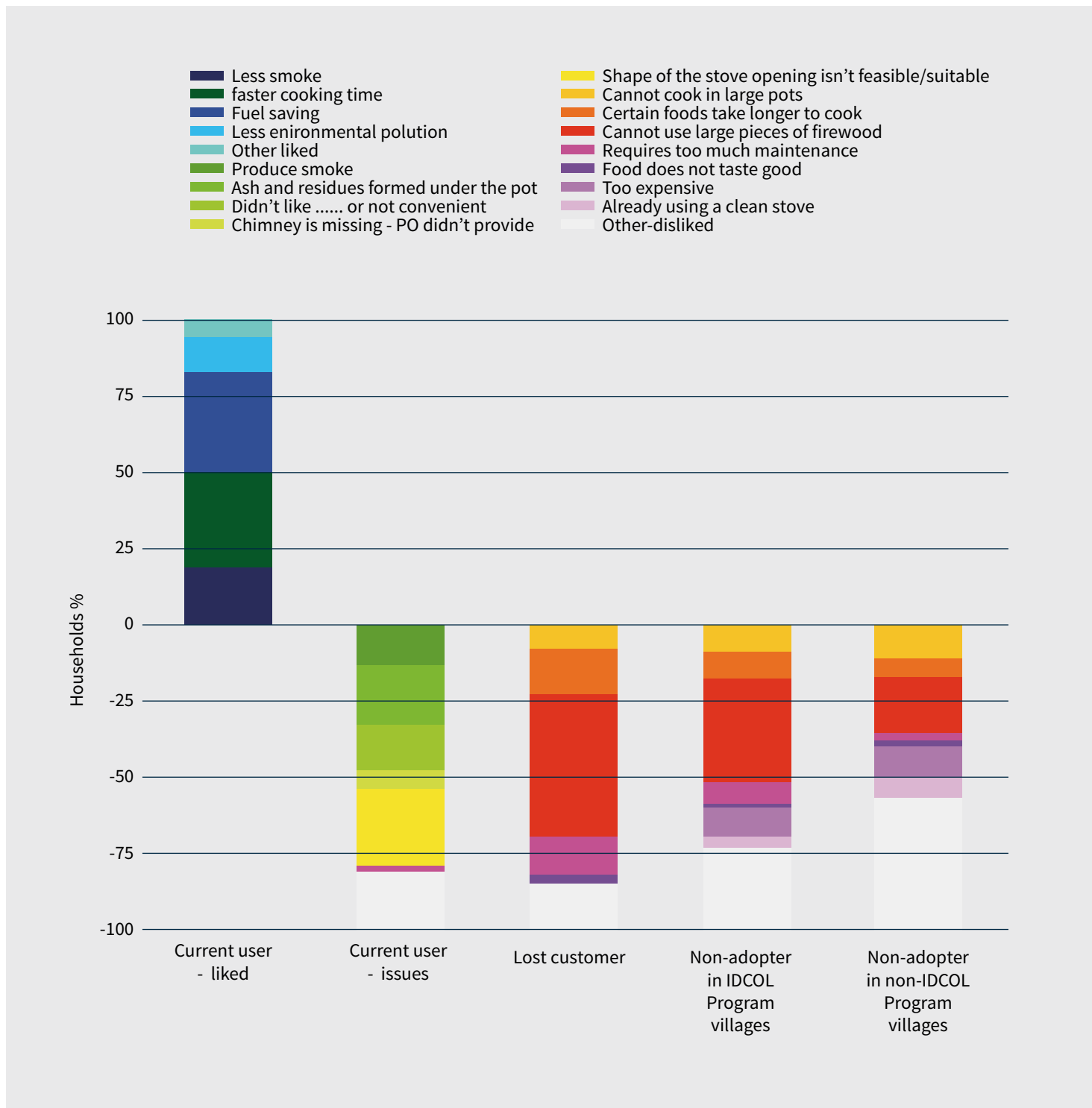


Figure 18: Consumer feedback of the problems of ICSs (by consumer group)

5

ACCESS TO FINANCE

5

ACCESS TO FINANCE

5.1 INVESTMENT AND RETURNS FOR HOUSEHOLDS

According to POs and IDCOL regional field managers, many consumers using an ICS for the first time do not permanently make up their mind and choose it over a traditional mud stove until about 2–3 months of using it. The reason is that, with regular ICS use, customers start noticing a considerable reduction in the amount of fuel required for daily cooking. Using a traditional stove, each household needs about three maunds (120kg) of firewood per month. Annually that amounts to about 36 maunds. The cost of firewood is about BDT 200 (USD 2) per maund (table 15).

Table 15: Annual fuel cost using traditional mud stove with 15 percent thermal efficiency

Cost of stove	None
Firewood needed per month (kg)	120 kg to 160 kg
Cost of firewood per month (BDT 5/ USD 0.06 per kg)	BDT 600 to 800 (USD 7 to 9) per month
Cost of firewood per year	BDT 4,200 to 9,600 (USD 50 to 113)
Total annual cost	BDT 4,800 to 10,400 (USD 57 to 123)

Table 16: Annual fuel cost using a single-mouth portable ICS with 30 percent efficiency

Cost of Stove (2 years lifetime)	BDT 300 to 375 (USD 3.5 to 4.2)
Firewood needed per month (kg)	1.5 to 2 maunds, or 60 kg to 80 kg
Cost of firewood per month (BDT 5 per kg)	BDT 300 to BDT 400 (USD 3.5 to 4.7) per month
Cost of firewood per year	BDT 2,100 to 4,800 (USD 25 to 57)
Total annual cost (Stove + Firewood)	BDT 2,250 to 4,950 (USD 27 to 58)
Amount saved (including per year depreciation) compared to traditional mud stove	BDT 1,950 to 4,650 (USD 23 to 55)

Given the 15 percent efficiency of traditional stoves, by burning 120kg to 160kg firewood a month, the energy that households obtain is actually equivalent to burning 18kg to 24 kg firewood with 100 percent thermal efficiency. To get the same amount of energy using a single-mouth portable ICS with 30 percent efficiency, households would need to burn only 60kg to 80 kg firewood a month, representing a 50 percent reduction in the amount of firewood required (table 16).

However, in rural Bangladesh most households cook with free biomass and do not buy all their firewood. Hence in many cases consumers do not immediately realize the cost savings due to the reduction in fuelwood usage. Additionally, the IDCOL stoves, while high in efficiency, are still quite low in emissions reduction, so households are unlikely to realize any long-term health benefits.

It needs to be noted that for the purpose of calculation, we estimated the full cost of firewood. In reality, many households either do not have to pay for firewood or other biomass or pay a partial amount for the fuel required for their traditional mud stoves. In rural areas, people have various types of trees from which they collect branches, twigs and dry leaves, dry dung from cows, and use these as fuel. So the actual out-of-pocket fuel expense for households is quite low when using traditional mud stoves.

5.2 ACCESS TO FINANCE NEEDED FOR BOTH HOUSEHOLDS AND POs

Access to finance remains a major bottleneck for both households and POs. Many extremely poor families cannot afford ICSs, and several POs have closed down or slowed down their business to cope with low sales and the liquidity crisis.

Extremely low-income families still cannot afford to buy ICSs: From discussions with the POs, it has been learned that health problems caused by the use of low-efficiency stoves are still not a primary concern for the most vulnerable consumer segments, the extremely poor, who do not earn more than BDT 5000 to 6000 (USD 59 to 71) per month (BDT 250 to 300 or USD 3 to 3.5) per day). This is due to a couple of reasons:

- Price sensitivity is very strong in this consumer segment. Spending BDT 300 to 375 (USD 3.5 to 4.4) requires them to spend a full day's income or more on a stove. Given that they are used to constructing cost-free stoves from mud and using free biomass as fuel, ICSs are not yet an appealing investment for these households.



- It has also been learned that this consumer segment is not sensitized to the health-related risks of traditional cooking. Traditionally their forefathers used mud stoves and they continue to do the same. In their opinion, they did not see any immediate harm from using mud stoves.

Liquidity crisis for POs in running production, dissemination, and promotional cycles: POs run into short-term liquidity crises until they receive grants from IDCOL. Breakeven or marginal surplus for POs are realized only when they receive grants from IDCOL. It takes three months for them to receive the grant from the date of production, compelling them to run operations with their own funds. Hence, if a PO wants to start production, they have to ensure liquidity for three to four months in advance for smooth operation.

A significant portion of the money is typically spent on regular expenses. It is sometimes difficult for the POs to source raw materials in bulk or even pay their field workers on time. Some POs struggle to pay the salaries of their sales representatives due to this liquidity crisis, leading to demotivated sales teams.

5.3 CARBON FINANCE

Carbon finance has been a common and popular source of funding for cookstove projects, especially in recent years as the prices of carbon markets have started coming back up. The IDCOL ICS Program has been registered as a Clean Development Mechanism (CDM) program of activities (PoA) under UNFCCC since 2019. Following CDM methodologies, each ICS under the IDCOL program will save 1.54 tons of biomass fuel and reduce CO₂ emissions by 1.22 tons per year. This means a reduction of 6.1 million tons of CO₂ emissions per year in the lead-up to 2023 if the 5 million ICS target were to be achieved, and a reduction of CO₂ emissions by 36.6 million tons per year by 2030, if 30 million ICSs are distributed by then (UNFCCC 2019).

To address low-income households, the Results-Based Finance (RBF) plus carbon finance approach that the World Bank recently launched in Rwanda has set a successful model. Under the Rwanda Energy Access and Quality Improvement Project (EAQIP), the World Bank Clean Cooking Fund (CCF) will provide \$20 million for developing a sustainable market for affordable clean-cooking solutions in Rwanda, with \$10 million provided as a grant and \$10 million extended as a loan. The project targets 2.15 million people, leveraging an additional US\$30 million in public and private sector investments. The carbon facility Carbon Initiative for Development (Ci-Dev) Trust Fund will purchase certified emission reductions (CERs) from two Rwanda stove companies, Inyenyeri and DelAgua (World Bank 2020).

Leveraged by this effort, the Development Bank of Rwanda Plc (BRD), in partnership with Energy Development Corporation Ltd (EDCL), has also launched a Clean-cooking Results-based Financing (CC-RBF) subsidy scheme, designed to address the affordability of clean-cooking technologies through the reduction of system prices and aiming to reach to the lowest-income population in Rwanda (Rwanda Energy Group 2018).

5.4. CHALLENGES FOR ACCESS TO FINANCE

Difficulty in acquiring bank loans: In Bangladesh, government-owned banks offer loans at an annual interest rate of 9 percent. However, loan officers tend to discard loan applications for ICSs as they consider them an unsustainable business. The result is that most POs are unable to avail themselves of bank loans. Given the thin profit margin of ICS production and promotion, accessing loans from private banks is not an option because of the high annual interest rates (generally 12 to 14 percent).

Cash sales vs credit sales: POs have a hard time following up on credit sales of affordable single-mouth portable ICSs. It has been difficult for them to target low-income families and set installments of BDT 100 (USD 1) for three months. Customers too tend to get upset or annoyed when repeatedly being asked for a very small amount of money and sometimes ask POs to take back the ICS instead. POs have also expressed difficulty in managing collection or recovery costs, especially if the cheaper ICS is the model bought. In the case of the one-mouth chimney and two-mouth chimney ICSs, sales are relatively low. Several POs reported that these two types of ICS accounted for only 5 percent of their sales.

COMMUNITY ENGAGEMENT

Most of the POs deploy a similar distribution model for various customer segments. Some POs engage in “Uthan Boithok” courtyard meetings as part of their community level engagement.

Similar distribution models for all segments of consumers:

IDCOL POs do not have a different marketing model for different customer segments. Instead they employ a one-size-fits-all, blanket distribution model for all segments. From discussions with POs from different regions during our field study, it was clear that door-to-door sale is still the primary method across the board. In a few cases, POs have tried to use “multi-level marketing” (MLM) mechanisms to encourage existing customers to refer others. However, this has accounted for a very small percentage of sales.

Uthan boithok–Courtyard meetings:

In addition to door-to-door sales, arranging “Uthan boithok” (courtyard meetings) act as a “push factor” to introduce a “community-based approach” to inform customers and increase sales. As reported by POs, the initiative has been effective in increasing sales. Typically, the local sales team visits several household clusters with low sales rates, and seeks permission from the households for an “Uthan boithok” session. If they agree, a date is set according to their convenience. Usually the portable single-mouth ICS is demonstrated because it can be transported easily. The sales team demonstrates the usability of ICSs and discusses the benefits. In most Uthan boithok’s, about 20 participants and the team can generate about one to three instant ICS sales per session.



RECOMMENDATIONS

7.1 Calling for greater clean-cooking ambition. Despite strengthened momentum and actions at the individual level, the current levels of clean-cooking ambition are still far from achieving the goal of 100 percent clean-cooking adoption by 2030. The cooking sector in Bangladesh needs to agree on a shared 2030 vision for universal access and adoption of clean-cooking solutions and take a coordinated, inclusive and holistic approach among key stakeholders to inspire action and drive widespread adoption. An increase in ambition must be accompanied by increased support to develop or improve scalable clean-cooking initiatives, including the successful IDCOL ICS Program.

7.2 Recognizing the “stove stacking” phenomenon. Cookstove and fuel stacking, a terminology for households that use different combinations of old and new technology at the same time, is a worldwide common practice, particularly in developing countries, to meet different cooking purposes and minimize risks from fuel price fluctuation and the reliability of supply. As mentioned in the “energy ladder” vs “energy stacking” discussion in chapter 3, this is certainly the case for Bangladesh as well. As the choice of cooking solutions gradually evolves with economic growth, households rarely switch instantly, or completely, from one stove-fuel combination to another. Consumers’ need for, and practice of, stove and fuel stacking should be recognized as they move upwards the clean-cooking ladder. The mixed usage of multiple cooking technologies, including traditional and primitive ones, because of costs and supply challenges during this transition is a pressing development challenge but the reality.

Studying local cooking culture and habits, understanding consumer needs and preferences by segment, and developing tailored technological solutions to addressing product design deficiencies that limit the use of modern cookstoves are all temporary solutions to the stacking issue, if the economic factors of households remain unchanged. Ideally, if a cookstove can be designed to meet various cooking needs and is within an affordable range, the reliance on using multiple stoves and fuels would be reduced.

7.3 Prioritizing ICSs during the transition to higher economic levels and to cleaner stove and fuels. Applying consumer segmentation to target high-potential markets that have large shares of population and developing tailored product and marketing interventions, constitute an effective way of

promoting widespread clean-cooking adoption. Based on the segmentation analysis from chapter 3, four household segments (segments 1–4) were identified as the “lower hanging fruit” target and suggested stove and fuel solutions were provided. Projecting them to a Mekko chart, where each segment size is measured proportionally by its relative area of the box, provides an intuitively clear picture of market potential. The middle-class rural segment, which has the largest population, close to 7.06 million households, relies primarily on biomass cookstoves and partially uses induction and LPG stoves. This group has demonstrated its purchasing power and should be the top target market for clean-cooking transformation, including ICS and induction stoves. The three segments in the urban/peri-urban area also represent great clean-cooking adoption opportunities, given their location and education level, and ICSs have a big market potential among them.

In terms of specific stove models, according to the latest data from POs and IDCOL, single-mouth portable ICS accounts for about 95 percent of all sales. The success of scaling up the sales of this stove model is key to reaching IDCOL’s target of 5 million households by 2023 (2.5 million have thus far been reached). This means that, within the next two years, POs will need to sell 1.4 million ICSs, or 85,000 each month, to reach the target. Current

sales stand at 40,000 ICSs per month. Companies should focus on the single-mouth portable ICS and leverage its popularity to increase sales.

A market-based approach might not work for the other two segments in the rural areas, given their low willingness-to-pay and low awareness level of HAP impacts. A different approach, for example, the pro-poor model, is needed for these families.

7.4 Strengthening awareness building and marketing interventions. As mentioned in chapter 4, given the low level of awareness of household air pollution (HAP) impacts, especially in rural Bangladesh, strengthened awareness-building programs are needed to popularize ICSs, and there is great demand from POs for support on awareness raising and marketing activities. Below are some ideas and recommendations based on our field studies and interviews with POs:

- **Launch a nationwide awareness campaign:** The IDCOL project provides grants to POs for promotional activities based on ICS sales. Most POs sponsor some low-cost events to promote ICSs. However, in recent times, there has been no national awareness campaign to promote ICSs. A well-thought-out nationwide awareness-raising event or promotional

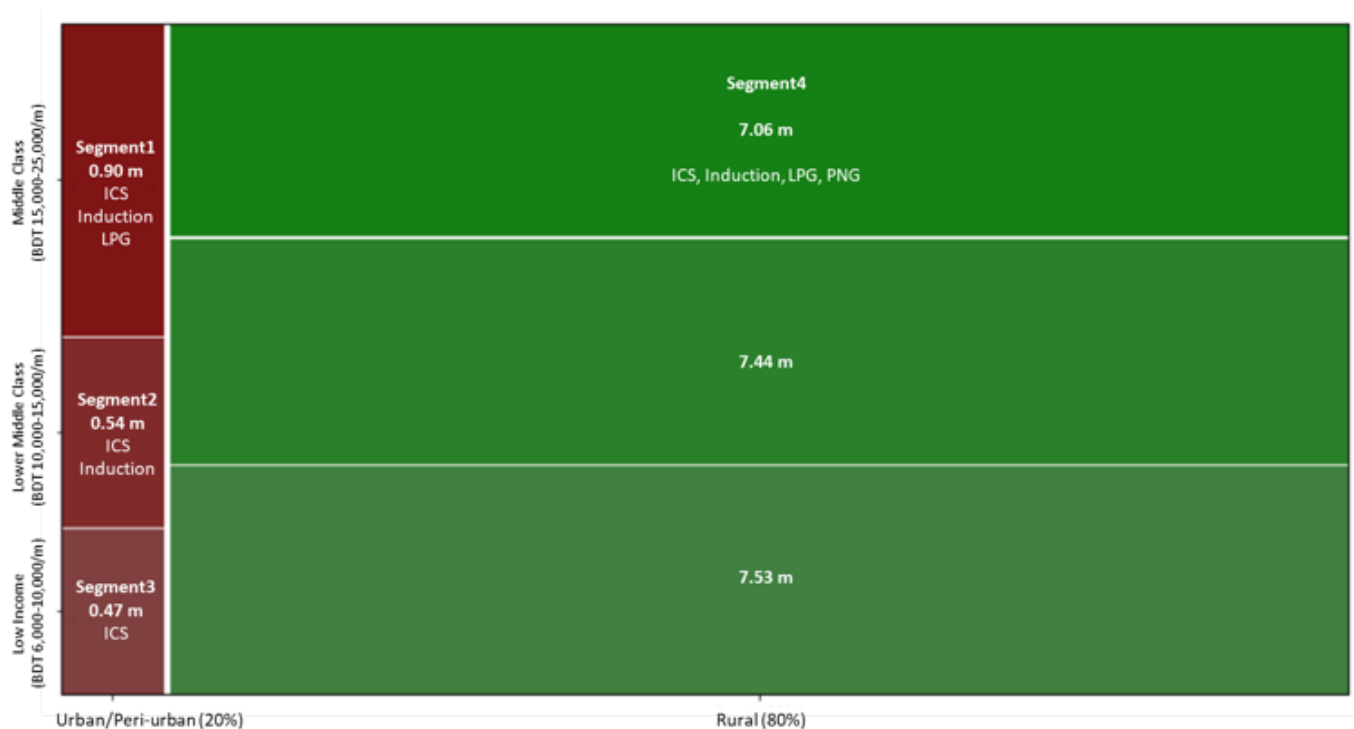


Figure 20: Mekko chart of cooking market sizes by income thresholds and urban-rural divide

activity could play a major role in changing customer mindsets about ICSs and make POs' work more effective. For example, Bondhu Chula has used media communications, including celebrity endorsements, to promote their stoves. Learning from the Social and Behavior Change Communication (SBCC) activity by SMC and Purplewood can provide key insights on Do's and Don'ts in launching such a national awareness campaign.

- **Uthan boithok – Courtyard meetings with promotional video screening:** As previously mentioned, POs typically arrange “Uthan boithoks” (courtyard meetings) as a push-selling strategy at the community-level. POs have suggested using entertaining videos and drama to better engage the audiences. Presenting visual messages to large groups of households at clusters is often effective in increasing sales. IDCOL could produce such promotional videos for POs to use in their Uthan Boithoks, or provide the financial support for making such videos.
- **Local marketplace mobilization:** The mobilization undertaken at the courtyard level needs to be replicated in other public spaces as well. For example, the videos shown at Uthan boithoks could also be shown at local market places as part of an overall community-based promotional strategy.
- **Clean-cooking education at school:** Knowledge gained by children at school can influence their parents through daily conversation. Time-specific rallies, sponsored games, school debates, and contests can be arranged with schools and other education institutions.
- **Recruiting local volunteers for referral sales:** To conduct successful referral sales, local volunteers could be hired to demonstrate ICSs and distribute promotional materials autonomously in return for a small commission. Village-level housewives could play the role of volunteers. Currently, referral marketing does not account for a significant amount of sales for the POs. If strategies to recruit dedicated volunteers could be put in place, that might be a game changer and enhance effective community engagement.
- **Partnering with health workers for joint ICS advocacy efforts:** Local social groups can be engaged to facilitate district-level and Upazila-level discussion sessions and promote the health benefits of ICSs. This can also be duplicated by arranging workshops in clubs and NGOs working on health issues. Microfinance institution (MFI) offices could be another avenue. Accessing group meetings of the

MFI could also create awareness and boost sales. POs are struggling to acquire such contacts. This can be changed if there is a coordinated approach by the government, IDCOL or other development partners to make such connections and pursue this strategy at an organizational level.

7.5 Building a reliable and sustainable ICS supply chain in rural Bangladesh.

- **Revisiting IDCOL's cluster-based approach:** The current cluster-based approach tends to lead POs to assume that all the households that live in a cluster are homogeneous and can each be approached with the exact same marketing strategy. However, households in a cluster can be very diverse in their income levels, preferences, cooking needs, and family size. There is an urgent need for POs to take a more differentiated and tailored approach to meeting households' unique needs. This will also allow POs to better understand the market potential within each cluster. Tailored pricing strategy, promotional activities, and aftersales service based on consumer segments should therefore become more demand-driven than program-driven. After years of operations, it might be a good time to revisit the cluster-based approach with a view to updating and improving it.
- **Performance incentives for the POs:** IDCOL is providing grant support based on the stove categories and minimum sales units. To expedite the growth of ICS sales, a second layer of performance incentives could be introduced for the best-performing POs. Such performance-based incentives would spur competition among the POs from time to time. They could be based on overall sales performance, categories of product sold, and other factors.
- **Developing a more diverse supplier base for raw materials:** It was learned that several vital raw materials, including rock wool and metallic sheet, are sourced from only a handful of selected traders who work out of specific locations in the Chittagong and Dhaka areas. In the case of the IDCOL ICS Program, the metallic sheet is available only in Bogura and Rangpur and produced by Rangpur Foundry. The associated transportation costs, and the capital tied up in stocking raw materials, create a financial challenge for POs. Since POs order in bulk to minimize transport costs, a considerable amount of capital is invested in raw material procurement. In addition, raw materials costs have significantly increased over the past year (2020). Developing new suppliers of key materials in major business clusters could help reduce the upfront costs for POs. This way, POs do not need to stock up because the suppliers' locations would be closer.

IDCOL could support the effort of strengthening the raw material supply chain by providing match-making support between POs and raw materials suppliers.

- **Strengthening capacity and talent building for ICS businesses:** Skills trainings can be provided to ICS business and POs on market segmentation and development of sales strategy to better serve the complex ICS markets. Sales can improve significantly if businesses focus on potential customers who can be convinced to try ICS technologies. As households are usually well connected with the local community, local PO staff can maintain a master data sheet to map the potential households and regularly reach out to them. The capacity of POs to ensure successful expansion into these untapped market segments is crucial. In such circumstances, successful POs can be encouraged to expand their operations to other regions, instead of focusing only on a particular geographic cluster or Upazila.

The scarcity and high turnover rate of skilled human resources, especially technicians, was the other major challenge of the ICS sector. In addition to arranging training to develop skilled staff and technicians, businesses and project developers should also create career development programs and explore how to inspire and retain talented staff who have substantial experience. It would also be worthwhile exploring partnership opportunities with schools and higher education institutions (HEIs) for providing clean-cooking related curricula to both students and working practitioners. This would be not only a talent-development effort but also an awareness-raising opportunity among the younger generation.

7.6 Developing a diverse and innovative financing ecosystem for the clean-cooking sector to enable community-driven market penetration at scale. Chapter 5 mentioned that it typically takes three months for POs to receive grants from IDCOL from the time production starts, which often causes severe liquidity challenges. For both the demand and the supply sides, providing access to finance is a key factor in enabling household-level purchasing of modern cooking energy devices, especially among lower-income and poor families. However, the financing options typically available in these markets are often not attractive to commercial banks and microfinance institutions (MFIs) because of the low loan amounts and high transaction costs. Some financial institutions do not even believe in the clean-cooking business model. The clean-cooking sector therefore needs its own financing mechanisms that can be supported by donors and the government for both stove businesses and consumers.

Enterprise financing

- **Launching a clean-cooking liquidity facility to provide short-term loans to address liquidity and production costs:** The liquidity struggle faced by stove businesses and POs could be eased by introducing a short-term, interest-free loan program that applies only to businesses that are in liquidity crisis. Applicants would have to submit the required financials for validation. Once approved, disbursements would be provided during this cash crisis and loans allowed to be repaid within a mutually agreed period of time. Similarly, a “raw materials loan” could be created to help businesses offset some of the price fluctuation risks of raw materials.

In partnership with the government and international development agencies, a Liquidity Facility for the clean-cooking sector could be created to run and manage the above-mentioned loan programs. In addition to stove producers and distributors, the facility could also finance loans to targeted end-user segments by income level.

- **Advance payments for cluster network expansion:** Making advance payments to distributors and POs for expanding to new clusters could create monetary incentives for them to broaden their distribution channels and increase their ICS sales. The amount and terms of advance payments could be determined by proposed distribution business plans and based on the track record of the applicant.
- **A three-way partnership loan guarantee scheme:** Donor agencies or the government could, as a third party, provide a credit guarantee to credible service providers, for example IDCOL, to enable them to provide upfront capital to POs and stove businesses. In the event of a failure of the PO or stove business to pay off the loan, the third party would inherit the debt obligation. The guarantee could be either limited or unlimited, making the guarantor liable for only a portion or for all of the debt. Guarantee mechanisms for loans could also help build relationships and trust between cookstove businesses and banks.

Consumer financing

- **The product “Free Trial” program:** In our consumer analysis in chapter 3, we observed that many consumers who are using an ICS for the first time take some time to decide and do not permanently switch to it until after 2–3 months of trying it. To capture this group of customers, businesses and POs can create

“free trial” programs that allow customers to use an ICS or clean-cooking product for a short period for free (for example one week). At the end of this period, customers have the option to return it at no cost, pay in full to own it, or pay for it in installments. The risks and costs of customers not returning the stoves should be minimal and manageable, and could be covered by the financing programs mentioned above. One advantage of a free trial or 100 percent money back guarantee program is that customer frequently choose to simply keep the item because of the sheer inconvenience of packaging it up and returning it to the place of purchase. The larger or heavier the item, and the most steps required in assembling it, the less likely that it will be disassembled and returned.

- Cash voucher program:** Design a program where households can earn cash vouchers to purchase certain clean-cooking products including ICSs; eligible voucher-earning activities can be creative and require partnerships with other organizations. Government, donor agencies, or IDCOL could organize clean-cooking related income-generation programs, where participants can earn can vouchers for ICS purchase or gain knowledge and skills they can apply in their future careers. Recent studies show that only 0.3 percent of surveyed households reported being involved in ICS-related businesses (Hossain and Azreen 2020), which is much lower than in many other

developing countries. Trainings and employment opportunities can be provided to households for ICS-related jobs such as sales agent, stove engineer, and installation technician. This would give participants the opportunity to make income by working in the clean-cooking sector.

- Stove trade-in program:** Households can bring in their eligible old stove (which does not have to be an ICS) if it is in workable condition for credit toward a new ICS or more advanced stove. Current ICS users trading in an old ICS stove would get higher credit.
- Working with MFIs to provide installment options for targeted consumer segments:** Back in the bubble charts analysis in chapter 3, this time let us focus on consumer preference between cash vs loan by treatment and control groups. The visualization shows clearly that for the advanced ICS, both treatment (ICS adopter) and control (non-ICS adopter) groups have a larger orange circle (in favor of installment) than blue circle (in favor of paying cash), meaning that installment might be a real option for both ICS-inclined users and potential customers even though it is often widely believed that this segment in rural Bangladesh has a low purchasing power and would not take installments. As previously mentioned, a consumer segmentation approach should be adopted and more data should

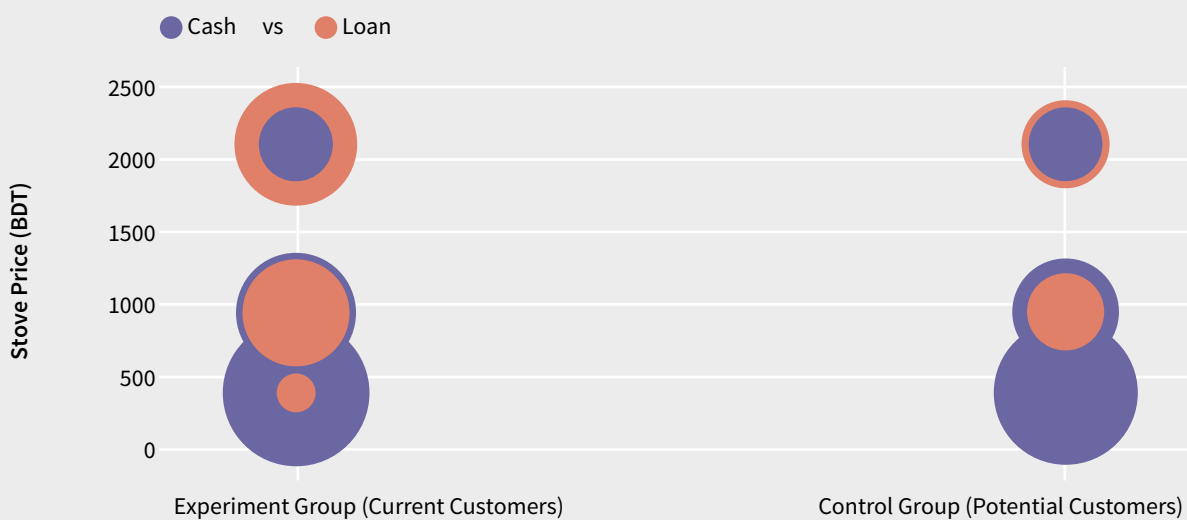


Figure 20: Bubble chart of payment preferences, cash vs installment loans



be collected to identify matched financing tools to unlock clean-cooking adoption potential. The results may bring opportunity for pellet-based technologies and products if consumers are interested and would accept taking loans to buy the more expensive pellet ICSs. Installment loan programs can be created in partnership with microfinance institutions (MFIs).

The project baseline report also supports the conclusion that some consumers prefer installment payments for more expensive ICSs and cash payment in case of cheaper ones. However, the other issue reported by POs is the installment collection cost due to low sales of expensive ICSs. An inexpensive collection method should be developed. One solution is to pay installments using mobile banking services with follow-ups over the phone instead of in-person with salesperson involved. This will save the salesperson's time and reduce transaction costs when there is little on transportation expenses.

It can also create opportunity for pellet-based solutions as these are relatively expensive and the system can achieve its market potential if installment mechanisms are introduced for consumers.

- **Developing a pro-poor program for clean cooking to engage the low-income segment:** While many of the market-based interventions will likely not work for the rural poor segment, a pro-poor strategy and program can be created to cover the last mile and ensure no one is left behind.

Based on literature review (Ministry of Local Government, Rural Development & Cooperatives, June 2020; OECD, 2008), there are four elements in a pro-poor program strategy framework: (1) Develop an operational definition of hard-core poor households who are eligible to participate; (2) define a basic minimum service level; (3) identification and organisation of the poor households; and (4) development of the subsidy-based pro-poor mechanism. The product or ICS stove will be 100 percent subsidized by the pro-poor program, participating consumers will need to pay a small Operational and Maintenance fee (O&M) for the community or contribute by labor services. Microcredit support, capacity building support, and priority of employment opportunities are other benefits of this pro-poor program provided by the organizer (normally the government).

7.7 Supporting market research for better understanding target markets and developing effective policies and business strategies:

A major challenge and limitation of this report was the substantial research gap on clean-cooking market intelligence and consumer data in Bangladesh. Despite progress in currently available studies, there is a strong need for more up-to-date data and consistent data collection methodologies within the research community. As figure 21 shows below, good data on customer profiles and preferences are the first step in the intervention chain, and the key to success in identifying appropriate finance incentives and options for policy makers and stove businesses. Grants should be provided to catalyse market research and consumer studies.



CONCLUSION

A significant number of Bangladesh's population are still using traditional stoves, it is very important to formulate a strategy that will lead to a sustainable transition toward 100 percent adoption of ICSs by 2030 in Bangladesh.

With economic growth and the increased purchasing power of households, demand for clean-cooking energy will continue to grow over time. However, till that future arrives, Bangladesh would do well to keep pushing consumers to move toward cleaner stove and fuel options, especially in view of the cultural tendency for stove stacking. Change in consumer perception is very important if we are to decrease the dependency on mud stoves and free fuel, which would lead consumers toward cleaner cooking solutions.

Once convinced of clean-cooking conveniences, consumers might slowly move toward part-time usage of advanced fuel such as LPG and electric stoves. To turn this vision into a reality, the market-enabling mechanisms would require significant improvement in financing, awareness building, and supply chain and a coordinated approach among key stakeholders is needed to mobilize more coherent and sustainable actions.

There is no doubt that the IDCOL ICS Program has been a huge success and has been able to achieve high penetration among rural households. However, more needs to be done to close the gap in order to achieve IDCOL's 5 million target by 2023, and Bangladesh's goal of clean-cooking for all by 2030. Provided customized options of access to finance is the centerpiece of the challenge of reaching the clean-cooking sector, getting more data on a large scale from both consumers and businesses will help decision makers to develop the right tools and policies. Given the complexity and fragmentation of this sector, building a financing ecosystem that (i) includes difference mechanisms that serve different demographic groups, are (ii) appropriate for customers who are developmentally at different economic stages, but (iii) complement each other as a single ecosystem, is worth continued research and discussion.



ANNEXES

Annex 1: IWA guidelines and ISO International Standard

In February 2012, through a collaboration between the Clean Cooking Alliance and the International Organization for Standardization (ISO), more than 90 stakeholders from 23 countries came together to form a support group for an International Workshop Agreement (IWA) – a technical document developed through a workshop meeting outside the normal ISO committee process. The 2012 publication worked as a set of interim guidelines to assess cookstove performance on thermal efficiency, total emissions, indoor emissions, and safety and to define the parameters of what constitutes a clean cookstove. It was a significant way forward in the development of international standards for clean cookstoves.

The document contains recommendations for laboratory testing and cookstove performance evaluation, with performance tiers proposed for products tested in both high- and low-power modes. safety (table 13).

As IWA guidelines have helped define “cleaner cookstoves,” the lessons learned have been used to develop an international standard for the assessment of cookstove performance (CLASP 2019). In 2018, ISO released ISO International Standard 19867-1 and ISO Technical Report 19867-3, which provide harmonized standards for testing cookstoves, and voluntary performance targets that governments and other programs can apply or adapt when formulating requirements for small-scale residential cookstoves (table 14) (CLASP 2019).

In comparison with the IWA guidelines, the ISO standard has 5 tiers instead of 4 and includes testing for durability. It has improved testing for efficiency and emissions across firepower. The ISO standard contains improved harmonization of testing protocols, which has facilitated the process of comparing results across laboratories. It also applies to a wider range of stoves and fuels. However, it does require an upgrade in procedures, equipment and quality assurance (CLASP 2019).

Table 21: Cookstove high-performance criteria

	Tier	Carbon Monoxide (CO) Emissions		2.5 microgram particulate emissions		Indoor emissions		Fuel use efficiency		Safety
		High power (g/MJd)*	Low power (g/min/L)**	High power (mg/MJd)***	Low power (mg/min/L)	CO (g/min)	PM2.5 (mg/min)	High power efficiency (%)	Low power efficiency (MJ/min/L)	Scale of 0-100)
Better Performance ↑	4	≤8	≤0.09	≤41	≤1	≤0.42	≤2	≥45	≤0.017	≥95
	3	≤9	≤0.10	≤168	≤2	≤0.49	≤8	≥35	≤0.028	≥88
	2	≤11	≤0.13	≤386	≤4	≤0.62	≤17	≥25	≤0.039	≥75
	1	≤16	≤0.20	≤979	≤8	≤0.97	≤40	≥15	≤0.050	≥45
	0	>16	>0.20	>979	>8	≤0.97	>40	<15	>0.050	<45

*g/MJd is gram per mega joule delivered to the pot.

**g/min/L is grams per minute per liter at (near) minimum energy use.

*** mg/MJd is milligrams per megajoule delivered to the pot.

Source: WBA (2016); Alliance (2016a); CLASP (2019)

Table 21: Cookstove high-performance criteria

	Tier	Thermal efficiency (%)	Emissions		Safety (score)	Durability (score)
			CO (g/MJ _d)	PM _{2.5} (mg/MJ _d)		
Better Performance ↑	5	≥50	≤3.0	≤5	≥95	<10
	4	≥40	≤4.4	≤62	≥86	<15
	3	≥30	≤7.2	≤218	≥77	<20
	2	≥20	≤11.5	≤481	≥68	<25
	1	≥10	≤18.3	≤1030	≥60	<35
	0	<10	>18.3	>1030	<60	>35

*g/MJd is gram per mega joule delivered to the pot.

**g/min/L is grams per minute per Liter at (near) minimum energy use.

*** mg/MJd is milligrams per mega joule delivered to the pot.

Source: WBA (2016); Alliance (2016a); CLASP (2019).

REFERENCES

“National Action Plan for Clean Cooking 2020–2030”: Is there a citation for this?

http://bangladeshcustoms.gov.bd/beta/trade_info/duty_calculator (HS Code:73211900, Cooking Appliances) ←link not found on Google]

M Azizur Rahman

Bhattacharjee, Utpal. 2021. Market Mapping of Modern Cooking Appliances, Bangladesh. Report. London: Modern Energy Cooking Services. <https://mecs.org.uk/wp-content/uploads/2021/03/Market-mapping-of-modern-energy-cooking-appliances-Bangladesh.pdf>.

Bangladesh Bureau of Statistics (BBS). 2018. Household Income and Expenditure Survey 2016–2017. Last modified September 19, 2018. <https://catalog.ihsn.org/index.php/catalog/7399>.

Bangladesh Bureau of Statistics and UNICEF Bangladesh. 2019. Progotir Pathey, Bangladesh Multiple Indicator Cluster Survey 2019. Survey Findings Report. Dhaka, Bangladesh: Bangladesh Bureau of Statistics (BBS) https://mics-surveys-prod.s3.amazonaws.com/MICS6/South%20Asia/Bangladesh/2019/Survey%20findings/Bangladesh%202019%20MICS%20Survey%20Findings_English.pdf.

Bangladesh Institute of Development Studies. 2020. “Impact Assessment of Solar Mini-grid, Solar Irrigation and Improved Cooking Stove Projects of IDCOL”.

Chowdhury, Zohir, Leah Thi Le, Abdullah Al Masud, Karen C. Chang, Mohammad Alauddin, Mahmood Hossain, A.B.M. Zakaria, et al. 2012. “Quantification of Indoor Air Pollution from Using Cookstoves and Estimation of Its Health Effects on Adult Women in Northwest Bangladesh.” *Aerosol Air Qual. Res.* 12, no.4 (August): 463–475. <https://doi.org/10.4209/aaqr.2011.10.0161>.

CLASP. 2019. Building a Foundation for Cookstoves Standards Implementation in Bangladesh: Recommendations. Can’t find a reference for this. I did come across:

“The presentation will be given by Jim Jetter at the WHO (World Health Organization) stakeholder consultation entitled “Building country capacity for adoption and implementation of standards and voluntary performance targets for clean cookstoves and clean cooking solutions” in Kathmandu, Nepal on December 10-14, 2018 and at an associated CLASP (Collaborative Labeling and Appliance Standards Program) workshop entitled “Building a Foundation for National Cookstoves Standards Implementation in Bangladesh - Final Recommendations and New ISO Standards” in Dhaka, Bangladesh on December 8, 2018.” https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=345165.

Clean Cooking Alliance (n.d.). Bangladesh website. <https://www.cleancookingalliance.org/country-profiles/focus-countries/6-bangladesh.html>.

Clean Cooking Alliance. 2016b. “Cookstoves and Fuels”, United Nations Foundation. <http://carbonfinanceforcookstoves.org/about-cookstoves/cookstoves-and-fuels/>. Not clear what this citation is referring to. It does not appear that there is a group or website linked to the name carbonfinanceforcookstoves.org or .com.

Global Alliance for Clean Cookstoves, WASHplus. 2015. Bangladesh Modern Kitchen Marketing and Behavior Change Strategy.

Hexa Research. 2018. Electric Rice Cooker Market Analysis, Market Size, Application Analysis, Regional Outlook, Competitive Strategies and Forecast, 2016 To 2024. Retrieved from: <https://www.hexaresearch.com/research-report/electric-rice-cooker-market>.

IDCOL. 2018. CAP Review Data Info Report. <I could not find this online.

Hossain, Monzur, and Karim Azreen. 2020. Final Report: Impact Assessment of Solar Mini-grid, Solar Irrigation and Improved Cooking Stove Projects of IDCOL. Dhaka, Bangladesh: Bangladesh Institute of Development Studies (BIDS). https://bids.org.bd/uploads/research/completed_research/FINAL-IDCOL.pdf.

IEA, 2002. World Energy Outlook 2002. International Energy Agency (IEA), Paris IRENA. 2017. Biogas for Domestic Cooking: Technology brief, International Renewable Energy Agency. Technology Brief. Abu Dhabi: IRENA (International Renewable Energy Agency). https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Dec/IRENA_Biogas_for_domestic_cooking_2017.pdf.

Masera, Omar R., Saatkamp, Barbara D., Kammen, Daniel M., 2000. From linear fuel switching to multiple cooking strategies: a critique and alternative to the energy ladder model. *World Development* 28 (12), 2083–2103

Khan, M.F.R. 2018. BPC Study Report. Can't find this on Google. The Basic Principles Committee (BPC) seems to be associated with Pakistan rather than Bangladesh.

Shonali Pachauri & Daniel Spreng, 2003. “Energy use and energy access in relation to poverty,” CEPE Working paper series 03-25, CEPE Center for Energy Policy and Economics, ETH Zurich. Practical Action. 2017. Poor People’s Energy Outlook 2017: Financing Practical Energy Access: A bottom-up Approach. <https://infohub.practicalaction.org/bitstream/handle/11283/620677/PPEO%202017%20Web%20PDF.pdf?sequence=1>.

Petrobangla. 2019. Annual Report. http://petrobangla.org.bd/sites/default/files/files/petrobangla.portal.gov.bd/annual_reports/f734b418_c1fc_4913_8197_35f2db29cff1/2021-01-10-14-49-fd5f00a3f1babfa8f051d2d335c045b7.pdf.

Power and Participation Research Centre (PPRC). 2016. Bangladesh 2016 – Politics, Governance and Middle Income Aspirations: Reality and Challenges (An Empirical Study).” <file:///C:/Users/Franklyn/Downloads/policy%2520brief.pdf>.

- Power Cell, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh. 2021. Bangladesh Power Sector at a Glance. Last updated June 3, 2021. <http://www.powercell.gov.bd/site/page/d730f98d-8912-47a2-8a35-382c4935eddc>.
- Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh. 2013. Country Action Plan for Clean Cookstoves. <https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000/235-1.pdf>; or <https://policy.asiapacificenergy.org/sites/default/files/CAP%20for%20clean%20cookstoves.pdf>.
- Putti, V. R., M. Tsan, S. Mehta and S. Kammila. 2015. "The State of the Global Clean and Improved Cooking Sector". ESMAP (Energy Sector Management Assistance Program). Technical Paper No. 007/15. World Bank. Washington, D.C. <https://openknowledge.worldbank.org/handle/10986/21878>
- License: CC BY 3.0 IGO
- Rahman, M.M. 2018. Collection of information and data to support the revision of the Bangladesh Country Action Plan for Clean Cookstoves (CAP) Can't find this on Google.
- Rwanda Energy Group (REG). 2018. "Clean Cooking Results Based Financing." REG: What We Do. <https://www.reg.rw/what-we-do/rbf-programs/rbf-clean-cooking>.
- Schlag, Nicolai and Fiona Zuzarte. 2008. Market Barriers to Clean Cooking Fuels in Sub-Saharan Africa: A Review of Literature. Working Paper. Stockholm: Stockholm Environment Institute (SEI). <https://www.sei.org/publications/market-barriers-clean-cooking-fuels-sub-saharan-africa-review-literature>; or https://mediamanager.sei.org/documents/Publications/Climate/market_barriers_clean_cooking_fuels_21april.pdf.
- Sustainable and Renewable Energy Development Authority (SREDA), Ministry of Power, Energy and Mineral Resources, Government of Bangladesh. 2019. The Draft of the National Country Action Plan for Clean Cooking in Bangladesh. http://www.sreda.gov.bd/sites/default/files/files/sreda.portal.gov.bd/download/0789a502_44ee_4c0a_9a8d_e95a11be2e57/2020-06-02-16-47-e5a8d4e255f55235e6173ab2659cba8.docx.
- The Daily Star. 2011. "IDCOL to Install 1.5 Lakh Biogas Plants: Biogas Week Begins with a Call for Clean Fuel." Business Report. The Daily Star December 19, 2011. Last accessed June 16, 2021 www.thedailystar.net/news-detail-214675.
- Tribune Desk. 2019. "Nasrul Hamid: No More Household Gas Connection." Dhaka Tribune, April 25, 2019. <https://www.dhakatribune.com/bangladesh/2019/04/25/nasrul-hamid-no-more-household-gas-connection>.
- UNFCCC. 2019. PoA 10512: IDCOL Improved Cook Stove Program. https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/TDF17CHYRMOLQ368IJN9GZE2S4UB5A/view.
- UNFCCC. 2020. Monitoring Report Form for CDM Program of Activities. https://cdm.unfccc.int/PoAIssuance/mon_db/poamon842566228/viewMR.
- World Bank. 2020. Rwanda Improved Cookstoves Project. Last updated October 30, 2020. <https://projects.worldbank.org/en/projects-operations/project-detail/P158411>.

