

**National Action Plan
For Clean Cooking in Bangladesh
2020-2030**



National Action Plan for Clean Cooking 2020-2030



Sustainable and Renewable Energy Development Authority (SREDA)
Ministry of Power, Energy and Mineral Resources
Government of the People's Republic of Bangladesh



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Acronyms

BCC	Behavioral Change Communication
BCSIR	Bangladesh Council for Scientific and Industrial Research
BSTI	Bangladesh Standard and Testing Institute
BUET	Bangladesh University of Engineering and Technology
CAP	Country Action Plan for Clean Cookstoves
CCA	Clean Cooking Alliance (Alliance)
CCAC	The Climate and Clean Air Coalition
CCEB	Catalyzing Clean Energy in Bangladesh
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COPD	Chronic Obstructive Pulmonary Disease
GACC	Global Alliance for Clean Cooking (now CCA)
GCF	Green Climate Fund
GHG	Greenhouse Gas
HAP	Household Air Pollution
HEP	Household Energy Platform
ICS	Improved Cookstoves
ICDDR-B	International Center for Diarrheal Disease Research – Bangladesh
IDCOL	Infrastructure Development Company Limited
ISO	International Organization for Standardization
IWA	International Workshop Agreement
LPG	Liquefied Petroleum Gas
MOEFCC	Ministry of Environment, Forest and Climate Change
MOHFW	Ministry of Health and Family Welfare
MOPEMR	Ministry of Power, Energy and Mineral Resources
MoU	Memorandum of Understanding
PM	Particulate Matter
PO	Partner Organization
SDG	Sustainable Development Goals
SREDA	Sustainable and Renewable Energy Development Authority
TVC	Television Commercial
UN	United Nations
WB	World Bank
WHO	World Health Organization

Executive Summary

Background

In the year 2013, to develop the Bangladesh clean cookstoves market, the first-ever Country Action Plan (CAP) for Clean Cookstoves was launched by the Power Division, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh. The CAP was developed through involvement and inputs from wider stakeholders of the sector and support from the Global Alliance for Clean Cookstoves (GACC), which is currently known as The Clean Cooking Alliance (Alliance). As per the provision of the bi-annual review of the CAP, in May 2018 a review workshop was held to capture the changing dynamics of the sector.

During the CAP review workshop, the need to revisit of the CAP 2013 was highlighted by the participants, to realign the plan with the changes and developments in Bangladesh and the overall clean cooking sector. The review report also indicates that not all planned activities were achieved as intended and the slow progress suggested that new initiatives should be taken to ensure 100% clean cooking in Bangladesh by 2030. To facilitate the development of the new National Action Plan for Clean Cooking (2020-2030), SREDA formed an 11-member steering committee, involving the relevant government bodies, development partners and program implementers. Unlike the previous CAP 2013, this National Action Plan focuses not only on cookstoves but also on issues related to different fuel options and efficiency.

The National Action Plan for Clean Cooking (2020 – 2030) has been developed for the next decade aligning strategies with the recent shifts in the sector in terms of different economic and social aspects of the country. Targeted milestones and monitoring plan are

also mentioned in this National Action Plan, with proposed names of relevant ministries responsible for different activities.

Clean Cooking Sector

In 2016, household air pollution was responsible for 7.7% of global mortality. It is one of the key health issues in rural areas. Indoor smoke or pollution contains a range of harmful pollutants, such as small particles, carbon monoxide etc. There is consistent evidence that exposure to household air pollution can lead to acute lower respiratory infections in children under five, and ischemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults. Women and children accounted for over 60% of all the premature deaths from household air pollution (HAP) in the year 2012¹.

Despite progress towards universal access to cleaner cooking systems, about 40% of global households (around three billion people), especially in developing countries, are still dependent on traditional cookstove as the primary means of cooking and heating. Up to 34% of all the wood harvested for fuel is unsustainable and contributes to a loss of woody biomass and climate polluting emissions². This accounts for approximately 2% of global emission³.

Given the context, an urgent action to scale up access to clean cooking solutions through policies, financing and technology development is needed to address the issue. Without it, Bangladesh will fall short of achieving Sustainable Development Goal 7 and several other related SDGs, along with its own target of clean cooking for all by 2030.

Current fuel and stove usage in Bangladesh

¹ World Health Organization. Household air pollution is a gender issue. Retrieved from: <https://www.who.int/life-course/news/household-air-pollution/en/> accessed on 11 November 2019

² Khan, M.N., B. Nurs, C., Mofizul Islam, M. et al. Environ Health (2017) 16: 57. <https://doi.org/10.1186/s12940-017-0272-y>

³ Clean Cook Alliance. (2018). Clean cooking critical to addressing climate change.

The energy mix in Bangladesh for cooking mostly comprises of biomass, biogas, liquefied petroleum gas (LPG), natural gas, and electricity. Depending on the socio-economic status of the household, the cooking technology varies. Different types of improved cookstoves (ICS), gas stoves for natural gas, stoves for LPG, electric rice cookers and induction cookers are the regular type of technologies used for cooking. ‘Stove stacking’ is a rather common phenomenon, where more than one cooking technology is used in a single household as needed depending on time, convenience and fuel cost.

There has been a progressive change in the energy mix for household cooking. Since the commercial import of LPG from 2011/12, the cooking fuel scenario in the country has shifted significantly. People from different socio-economic background prefer LPG stoves because of its convenience of usage. However, biomass is still widely used in cooking in Bangladesh, especially in the rural and peri-urban areas using the traditional mud stoves and improved cookstoves. The thermal efficiency of biomass stoves is relatively low, and the emission of CO₂, CO and PM are significantly high compared to other fuel options.

About 4,100,000 households are connected to piped natural gas in Bangladesh⁴. However, the government suspended providing new piped natural gas connections to households since 2016-17, due to the fast-declining natural gas reserve in the country. This led to an increase in demand for alternatives such as LPG to meet daily cooking gas needs⁵.

Biogas is one of the most environmentally friendly and clean cooking fuel options. In this country, most of the biogas is produced from the manure of cows and chickens. 102,808 biogas digesters have been installed in Bangladesh till 2018. However, due to high initial investment cost and other specific requirements, biogas is yet to be the first choice of people for cooking fuel.

Pellet and briquette as fuel are not very popular in Bangladesh yet. Due to multiple factors, including the production and availability of pellets and briquettes, comparatively high cost of stoves, cooking behaviour of people etc. these fuel-based cooking solutions have limited success.

Proposed targets, activities, required funding and monitoring plan

Future targets based on the current situation is mentioned in the table below.

Table A: Targets for Different Cooking Technologies

Cooking Fuel Alternatives	Actual: 2019/20	Target: 2029/30
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⁴ Khan, M.F.R. (2018). BPC Study Report

⁵ <http://www.theindependentbd.com/printversion/details/31325> accessed on 11 November 2019

Type of Fuel	Type of Cooking Technology	Number in situ (million)	Percentage of total households (Total 39 million)	Number in situ (million)	Percentage of total households (Total 42 million)
Biomass	Traditional Stoves	29	74	-	-
	ICS	2.7	7	16-21	38-50
Fossil Fuel	Natural Gas Stoves	4.4	11	5.5	13-14
	LPG Stoves	3.3	9	23-27	55-65
Mixed	Induction & electric stoves	1.0	2	3-4.5	8-10
Other*	Different Stoves	0.1	-	1.0	2-3
	Total	40.5	103%	48.5-59	115- 140%

* Renewable, Pellets/Briquette/ Biogas etc.

This national action plan recommends different types of activities or interventions which will ensure the achievements as per the targets mentioned above. As the terminal year of the plan is 2030, this 10-year period has been divided into three phases:

- 2020-21: Initiation and start-up,
- 2021/22- 2024/25: second and review phase,
- 2025/26-2029/30: third, evaluation and way forward phase

All the action plans under nine thematic areas will be implemented in these three phases. Majority of the activities need to be initiated in 2020/21 and then agreed upon with other implementing partners. The followings are the major activities proposed in this document covering aspects such as enabling an environment for clean cooking, leadership roles, awareness building, sustainability and different the important attributes in the clean cooking sector, brought under 9 thematic areas.

- **Playing Leadership Role** - Achieving clean cooking goal will require strong centralized leadership of a Government body for enacting regulations, guidelines and policies.
- **Building Enabling environment** - Enabling environment required for

addressing clean cooking in all national policies, creating a functional and sustainable national platform and opening up windows for funding of the state-of-the-art facility for testing and certification of ICS etc.

- **Awareness building and dissemination** - Awareness building is essential for convincing households spread out in accessible areas with limited social networking of the many beneficial aspects of ICS.
- **Reducing Household Air Pollution and keeping a national commitment with regard to ICS** - Bangladesh needs to honour the commitment of zero-emission to the international community with respect to climate change, SDGs etc.
- **Sustained Policy Support for LPG** - The sector is poised for a robust growth given the continuation of policy support by the government. The existence of mutually reinforcing demand factors supporting supply-side business development condition lends belief to its sustained growth over the long term. Safe and secured LPG cooking spreads to all areas of

Bangladesh except remote areas unjustified by private sector viability

- **Consideration for Induction Cooking** - Considerations to households' choice of modern induction cooking devices in view of health consciousness, convenience, temperature fluctuation and fine-tuning, cleanliness, space economization as practised in Asian and other countries
- **Reducing Leakages** - Reducing leakages in Natural Gas for Cooking (technical and financial)
- **Supporting present trend of Fuel Stacking (main and alternative fuel usage)** - This trend would continue so long income, the certainty of the source, taste perception level of the households does not reach the level which would allow them sole use of one fuel
- **Data Collection to Strengthen/Modify Other Activities** - Impact assessment for examining whether the reduction in HAP is contributing to reduced health cost or better environment

To support these activities and achieve the set targets of clean cooking in Bangladesh, investments from government, different donor agencies are crucial. In this action plan, an

estimate of required investments has been computed based on consumer financing, institutional investment funding requirements (public and private) and subsidy elements (government and donor financed) for different types of clean cooking solutions. For achieving the clean cooking targets by 2030, the investment required in this sector is between BDT 185.7 – 219.8 billion⁶. In terms of US\$, the total estimated cost is more than US\$ 2 billion over a period of 10 years.

With these innovative targets and planned activities, monitoring of progress will be essential to successfully accomplish the goals. It is recommended that the concerned ministries will hold it's relevant/specific agencies responsible to carry out the monitoring tasks. A detailed monitoring framework will be developed in the initiation phase of the plan focusing on the major agendas, such as goal of leadership role, the role of international commitment, facilitation of LPG propagation by the private sector, showing considerations to households' choice for induction cooking, reducing leakages of natural gas in cooking etc. As the monitoring plan was not strong enough in the previous country action plan 2013, it is essential that this monitoring framework is followed rigorously to ensure the successful implementation of this action plan.

⁶ The estimated cost is dependent on the current prices charged for the stove/device and connection costs, investment costs and subsidy elements.

About this Plan

The first Country Action Plan for Clean Cookstoves (CAP) was launched in 2013, led by the Power Division, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, through involvement and inputs from wider stakeholders of the sector and support from the Global Alliance for Clean Cookstoves (GACC), which is currently known as The Clean Cooking Alliance (Alliance). It addressed necessary steps to kick-start and develop the Bangladesh clean cookstoves market with a provision for a bi-annual review of the CAP to capture the changing dynamics of the sector in terms of technology, consumer preferences, market reach, different prototypes and fuels.

During the CAP review workshop in May 2018, the need of realignment of the CAP 2013 with the changes and developments in Bangladesh and the clean cooking sector was highlighted by the participants involving high-level government officials, private sector and NGOs active in the cooking energy sector. **It is important to know the success or lack thereof of the planned activities to go forward. A review of planned activities under the Country Action Plan 2013 was discussed in the May 2018 report and it was clear that not all planned activities were achieved as intended. The brief review on the interventions mentioned in the Country Action Plan 2013 is presented below. The green highlighted boxes are fully achieved activities from CAP 2013.**

Table B: Interventions in Country Action Plan for Clean Cookstoves 2013 and their implementation status

Intervention Area	Intervention mentioned in CAP 2013	Implementation Status ⁷	Comment/ Observation
Strengthen Supply	Develop a national network of suppliers in order to strengthen their capacity to produce and/or distribute cookstoves and their ability to share best practices, challenges and innovation.	-IDCOL has been working with their network of PO's and to build their capacities to produce higher quality stoves -BBF's network also has been working to produce/distribute stoves -CCEB has worked with private companies/manufacturers	No National Network was formed
	Add improved cookstoves, fuels and other clean cooking appliances to existing non-cooking product distribution / wholesale chains (such as grocery shops etc.).	-CCA funded pilot interventions with RahimAfrooz and SMC -CCEB supported pilot with JITA	The pilots were not scaled up
	Access to finance for clean cooking SMEs.	-Various grant program of CCA in Bangladesh -Cookstoves enlisted in the Green Financing scheme of Bangladesh Bank -IDCOL/BBF's subsidy/grants for their partners	Manufacturers are not able to access finance systematically
	Work with private sector financiers to provide additional financing options.	- CCA hosted workshops with commercial private banks in 2016-2017 to create linkages	No breakthrough was made

⁷ Taken from Report of the Review Workshop on Country Action Plan on Clean Cooking Renaming the CAP as Bangladesh CAP for Clean Cooking (BCAPCC), Mizan R Khan, 2018 (pages 25-42). Comments in the next column are that of NAP consultants.

		with the cookstoves and fuel companies	
	Promote access and utilisation of climate change and carbon funds.	World Bank has received the first GCF funding for cookstoves -BBF previously sourced funds from BCCTF and also carbon funds from Korean KTS	Achieved through the implementation agency work
	Leverage Government fund to finance women-led businesses in cookstove sector.	Ministry of women and Children affairs approached several times.	No fruitful results yet.
	Lobby the Government and international donors to provide additional financing options at lower rates to address gaps in current interventions	GOB funding the Household Energy Platform -Various International donors like World Bank, EnDev, RVO, and GACC (Now CCA) active in the sector.	USAID left clean cooking sector. Grameen Shakti, PKSF stopped their involvement.
	Strengthen after-sales services to consumers by developing guidance for cookstove and fuel suppliers/distributors on warranties, repairs and maintenance etc.	Field partners/ manufacturers/ Partner Organizations provide after-sales service	The support is mostly when programs are active.
	Train producer entrepreneurs on how to improve quality of products, better understand consumer preferences and act on their feedback, attract investment, market their products etc.	Program-specific training provided to partners by CCEB, IDCOL, BBF	
Enhance Demand	Conduct a Bangladesh consumer preference study to determine the technology features and preferences of consumers, understand willingness to pay and identify marketing messages and techniques that may tap into the primary motivating factors (for both men and women) behind cookstove purchases, as well as determine the existing barriers to purchase.	CCEB and CCA conducted consumer preference study with WashPlus and IDE	Achieved
	Launch a national awareness campaign.	- HEP has facilitated through local administration for CHAP project in 16 Upazila of 8 districts - Participated in schooling program of SREDA in 8 districts covering over 70 schools. The programs of HEP were: rally, drama, manuscript reading & art competition, seminar etc. - Advertising in social media - IDCOL's promotional activities including (TVC, school sessions, Upazila level	Sporadic events did not result in a national awareness program

		meeting, surveying own activity- for increasing demand,) -BIDS impact assessment survey -BBF's promotional activities including TV shows -GACC's community level BCC activities -CCEB's promotional activities with manufacturers including a TVC -Various TVC/national campaigns of LPG companies -100% ICS for 3 wards of Satkhira Upazila	
	Create a portfolio of open-source behaviour change and marketing materials (videos, brochures, flip charts, radio and TV commercials, billboards, etc.), as well as guidelines and best practices on effective marketing strategies and techniques, such as household-level demonstrations.		Open-source materials are not available.
	Establish information center at the union level for consumers to learn about ICS, product options, prices and benefits.		Information centers at union level were not established.
Consumer Finance	Develop a series of financial instruments to increase affordability for consumers	CCEB organized a series of workshops with PKSf to introduce consumer finance.	No such mechanism currently available.
	Form a national technical committee on cookstove standards and testing.	A sub-committee under HEP was established.	The committee does not sit regularly
	Establish a national cookstoves testing and knowledge centre	A sub-committee under HEP was established, BCSIR and BUET are both exploring options to establish a national cookstoves and fuels testing lab. IDCOL will be funding BUET as part of their ICS program	The committee does not sit regularly National cookstoves testing and knowledge center is not yet established.
	Develop and enforce a labelling system and/or serial numbers to be used by stove producers to distinguish stoves that meet standards (as certified by the testing centre).		No such labelling system was developed and enforced.
Fuels and Technology	Provide access to national/global technologies and encourage technology transfer.	Not much was done, local manufacturers meet	Sporadic activity

		sometimes to exchange knowledge.	
	Promote research and development on promising new technologies and fuel types	HEP commissioned a handful research. IDCOL (involving BUET) and BBF worked separately for their product R&D.	Sporadic activity
Monitoring and Evaluation	Improving M&E system and develop a national M&E plan	- HEP has established M&E sub-committee -Committee is working on national M&E plan	The national M&E plan is not developed yet.
	Develop incentives for encouraging M&E under the national plan.		No progress
Build the Evidence Base	Commission and disseminate research to build the evidence base on the relationship between cookstoves and health, livelihoods, environment and women's empowerment.	No national level or internationally recognized assessment is done yet. ICDDR, B conducting two separate health studies focused on the benefits of switching from traditional stoves to a clean fuel like LPG.	The research findings are still not publicly available.
Champion the Sector	Establish a partnership with media to prompt discussion.		No effective partnership with media was established.
	Develop an online Bangladesh knowledge portal for collecting and disseminating information on impact based evidence, clean cookstove technologies and fuels.	HEP has its website.	Knowledge materials are not available on the website.
Engage National Stakeholders and GoB	Launch and convene the Household Energy Platform, led by the Power Division	Household Energy Platform under SREDA, led by the Power Division was launched in 2016.	Achieved
	Lobby and sensitize key national and regional political leaders, Government stakeholders and other Ministries on the benefits of clean cooking for health, environment, gender and economy.	HEP has been engaged with various Ministries (MOPME, MoWCA, MOH, DoE, Planning commission), political leaders and Ministers.	Support from other ministries was limited.
	Reduce or eliminate import tariffs for clean cooking technologies that meet Government standards.	HEP and SREDA has been advocating on the tax and tariff issue of the sector MOC/NBR etc.	No concrete achievement so far.
	Link into UN's Sustainable Energy for All initiative and leverage Bangladesh's status as a priority country.	UN's SE4ALL not active in Bangladesh.	The opportunity is not taken advantage of.
	Work with the Climate and Clean Air Coalition (CCAC) through the Ministry of Environment and	DOE has been engaged with CCAC to develop an Action	The action plan is not

	Forests to address black carbon and other climate issues.	plan for Short Lived Climate Pollutants (SLCP's)	implemented yet.
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It was clear from the review of the CAP 2013 that new initiatives must be taken to ensure 100% clean cooking for all in Bangladesh by 2030. CAP primarily covered issues related to clean cookstoves, but other issues related to fuel were largely uncovered. It is, hence required to develop a new plan for the overall cooking sector in Bangladesh. To facilitate the development of the new National Action Plan for Clean Cooking (2020-2030), SREDA formed an 11-member steering committee, involving the relevant government bodies, development partners and program implementers. This committee decided that this new CAP should be named as 'National Action Plan for Clean Cooking' and to include intervention plans for different cookstoves and fuels for the period of 2020-2030, aligning with the national policies.

This document, the National Action Plan for Clean Cooking (2020–2030), has been developed with the vision to ensure clean cooking for all by the terminal year 2030, which coincides with the Sustainable Development Goal (SDG) achievement year. Building on the CAP 2013, a pathway for the next decade has been curved in this document, aligning strategies with the recent shifts in the sector with regards to different economic and social aspects of the country. The National Action Plan also looked beyond cookstoves and discusses different fuel options for clean cooking. In the milestones and monitoring section, the consultants mentioned names of relevant ministries. During the approval process of the National Action Plan, the ministries will assign specific agency to carry out specific duties mentioned in the action plan.

The Clean Cooking Alliance commissioned Innovision Consulting to support SREDA, the Power Division and relevant stakeholders in Bangladesh to develop and launch the National Action Plan for Clean Cooking (2020-2030).

1. Macro Environment

1.1 Demography

Bangladesh is a country with a population of 165.57 million and a poverty rate of 21.8%⁸. This eighth most populated country in the world has on an average 1,116 people per square kilometer, living in 39.42 million households (considering average household size of 4.2). 63.4% of the people in Bangladesh lives in the rural areas. The current population growth rate is 1.09%⁹ and the total population is expected to be 245 million by year 2050, with average life expectancy of 78.9 years.

Table 1: Key Demographic Indicators of Bangladesh

Key Indicators	Values
Population (1 st January 2019 estimate)	165.57 million
Number of Households	39.42 million
Population Growth Rate	1.09%
Sex Ratio (Male: Female)	100.2
Literacy Rate	73.2%
Life Expectancy at Birth	72.3 years
Household Size	4.2
Source of Light (Electricity)	90.1%
Urban Population	36.6%

Source: Compiled from Bangladesh Sample Vital Statistics 2018 and CIA World Fact book, Bangladesh 2018

Bangladesh is currently going through a demographic transition¹⁰, where the average age of population is 27.1 years. The benefit from the increasing proportion of the working age group can be observed in the recent economic developments of Bangladesh. The rural-urban migration is heavily concentrated in the capital city Dhaka. These demographic shifts also affect people's preferences in lifestyle and necessities.

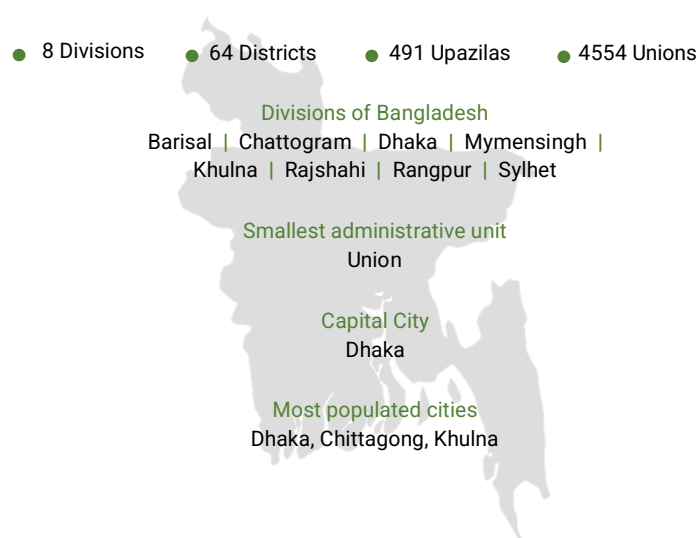
⁸ Bangladesh Bureau of Statistics (2018) Bangladesh Sample Vital Statistics 2018

⁹ CIA World Fact book, Bangladesh (2018) <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html> (accessed on 11 November 2019)

¹⁰ The "Demographic Transition" is a model that describes population change over time.

1.2 Political environment

Bangladesh is a democratic country, with Prime Minister as the head of the government. The local government is widely dispersed and well-presented across the country. Bangladesh is divided in 8



divisions, comprising 64 districts, where all the districts are well connected via roads and highways. With one of the high GDP growth rates in the world in the past decade, the government of Bangladesh continues to invest on major infrastructural projects to achieve higher economic growths in the coming years.

Bangladesh has been widely acclaimed as one of the forerunners in implementing Millennium Development Goals (MDGs). The country made outstanding progress in many

Figure 1: Administrative System of Bangladesh areas, notably poverty alleviation, food security, child mortality rate. Bangladesh has been an active participant in the global process of the preparation of the Sustainable Development Goals and an early starter in implementing the goals. Special attention from the government, in terms of rigorous monitoring and tracking of the achievements against the targets plays a major role in the successful completion of these global goals. The support from the government in this National Action Plan for Clean Cooking will also be essential for conquering the national and global targets.

1.3 Economic development

Over the past decade, the Bangladesh economy has been growing at a constant pace, with a GDP growth rate above 7%. The country is in the process of graduating from the Least Developed Countries (LDC) category and fulfilled graduation criteria for the first time in 2018, as per the United Nations¹¹. The poverty rate in the country has reduced to 21.8%¹², and the extreme poverty rate came down to 12.9%¹³. The GDP per capita of Bangladesh has reached to USD 1,698.26¹⁴(as of 2018) from \$634.98 in 2008.

The three key sectors – agriculture, industries and services provide occupation of 42.7%, 20.5% and 36.9% respectively. Bangladesh has been an agriculture-based nation, but over the years industries and service sector is gaining momentum and service sector is poised to become the largest sector in terms of providing employment to the people. The increased participation of women in the wage earner group in the society has had a positive effect on women empowerment, as well as the overall economy of the country.

¹¹ <https://www.un.org/development/desa/dpad/least-developed-country-category-bangladesh.html> (accessed on 11 November 2019)

¹² CIA World Fact book, Bangladesh (2018)

¹³ Bangladesh Bureau of Statistics. (2017).

Bangladesh Statistics 2017. The ratio of males to females in a given population is usually expressed as the number of males per 100 females. In 2017, survey recorded an overall sex ratio of 100.2 males per 100 females.

¹⁴ World Bank. (2019)

The economic development also has a trickle-down effect on the people's choice and affordability of pursuing clean cooking solutions. With the flourishing industrial sector, families opt for different/modern ways of living to adapt to urban environments. For instance, in the kitchen, families are probed to embrace modern cooking solutions, moving away from the traditional stoves in cities.

1.4 Gender

In Bangladesh, the male to female sex ratio is at 100.2.⁵ Male headed households are still a norm in the country, which is reflected in the high percentage (85.8%). However, the expansion of the Ready-Made Garment (RMG) industry has provided new opportunities for women to find paid work in the urban areas. Even though the value of women's labor or wage rate has risen, the gender inequality is still persistent especially in the workplaces. While in the primary and secondary school enrolment rates are gender balanced, women representation in the higher education is very low. Impediments such as child marriage limits women's access to education and employment. Traditionally in Bangladesh, women do most of the household activities including cooking, collecting firewood, cleaning, etc. Women are exposed to a high level of household air pollution from traditional stoves, because of women's role in food preparation as part of social constructs and norms¹⁵. These women are more than twice as likely to suffer from Chronic Obstructive Pulmonary Disease (COPD) compared to women who use cleaner stoves, as traditional stoves¹⁶ emit much higher volumes of fine particulate matter particles¹⁷. The young children are also exposed to this health risk, since they spend a significant amount of time near their mother/grandmother near the cooking area inhaling toxic fume.

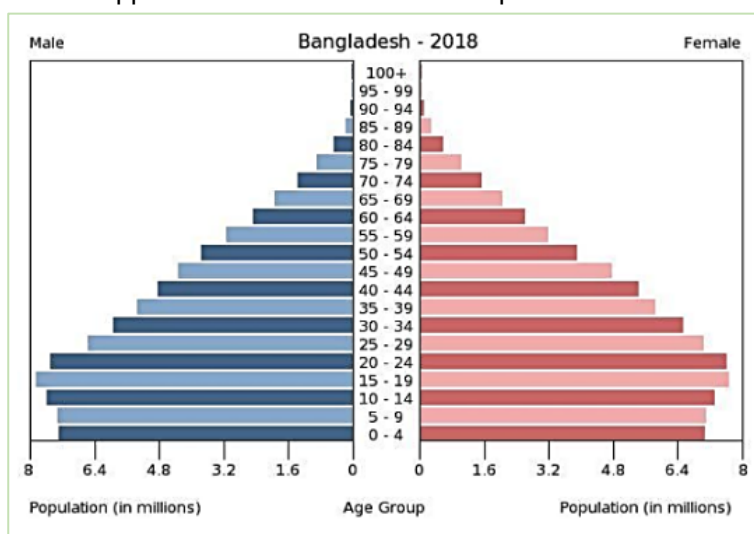


Figure 2: Population Pyramid of Bangladesh, illustrating the age and sex structure of the population
(Source: <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>)

Even though women do most of the cooking in households, and women empowerment is on the rise, but often times, men are the ones making purchasing decisions in general, e.g. cooking fuel and cookstoves, as they are the household heads in the family. In other words, the awareness on the benefits of clean cooking should be infiltrated among the whole family, not just women to ensure a sustainable change. **Clean cooking programs focused on women as the receiver of technology. Women can also be viewed as change agents to promote clean cooking solutions among the neighbors and peers that would likely to increase diffusion.**

¹⁵ World Health Organization. (2018). Household air pollution and health.

¹⁶ The traditional stove is usually a mud-built cylinder with three raised points on which cooking utensils rest and a hole is raised for fuel feeding. Source: IDCOL. (2013)

¹⁷ World Health Organization. (2018). Household air pollution and health.

1.5 Energy

With the steady economic growth, 95% of the total population in Bangladesh have access to electricity with 351 million clients.¹⁸ 81.28% of the people in the rural areas have access to electricity, including off-grid renewable electricity. The government has prioritized its vision regarding electrification of all the households in the country by 2021, with 10% of that electricity coming from renewable sources. In 2018 fiscal year, the per capita electricity generation (on grid) was 382 kWh and the per capita consumption was 336 kWh.

For household cooking, the demand for energy is attributed to different sources, namely biomass, natural gas, liquefied petroleum gas, oil and electricity. About 73.8% of fuel source for cooking in 2018 are met by usage of biomass fuel such as straw/leaf (28.6%), husk/bran (4.0%) and jute stick/wood/bamboo (41.2%)¹⁹. This is a reduction on dependency on biomass fuel reported in the previous Country Action Plan for clean cooking in Bangladesh (90%)²⁰ by 16.2%. The usage of fuel in urban and rural areas and division-wise breakdown as well as data from 2012-2018 is presented below.

Table 2: Source of Fuel for Cooking in Rural and Urban Areas and Different Divisions of Bangladesh in 2018

Source of Fuel (%)	Residence		Divisions								
	Total	Rural	Urban	Barisal	Chattogram	Dhaka	Khulna	Rajshahi	Rangpur	Sylhet	Mymensingh
Straw/Leaf	28.6	43	11.3	22.5	27.4	25.8	24.8	48.2	31.1	13	34.7
Husk	4	4.6	3.3	2.7	4.3	2.5	5.2	4.9	5	2.4	5.7
Jute Stick/Wood/Bamboo	41.2	45.6	36.1	55.1	39	25	53.3	29.3	48.5	46.3	52.3
Kerosene	0.3	0.2	0.4	0.2	0.2	0.5	0.2	0.3	0.3	0.3	0.1
Electricity	1.1	0.1	2.1	0.5	0.6	0.7	0.9	1.2	3.4	0.4	0.2
Gas	24.3	5.8	46.5	18.7	28.2	45	14.4	15.4	11.6	36.4	6.8
Others	0.5	0.7	0.3	0.2	0.2	0.5	1.2	0.7	0	1.2	0
Total	100	100	100	99.9	99.9	100	100	100	99.9	100	99.8

Source: Bangladesh Bureau of Statistics (2018) Bangladesh Sample Vital Statistics 2018

Table 3: Time-series data of fuel usage for cooking from 2012-2018

Source of Fuel (%)	2012	2013	2014	2015	2016	2017	2018
Straw/Leaf	40.2	36.3	36.3	30.7	31.1	30.2	28.6
Husk	4	2.8	3.7	3	3.8	3.5	4
Jute stick/Wood/Bamboo	42.4	44.4	42.8	44.2	42.5	41.3	41.2
Kerosene	0.3	0.3	0.2	0.4	0.4	0.3	0.3
Electricity	0.6	0.9	0.7	1.1	1	1	1
Gas	10.4	13.9	15.1	19.7	20.5	23.1	24.3
Others	1.9	1.3	1.1	0.9	0.8	0.6	0.5

Source: Bangladesh Bureau of Statistics (2018) Bangladesh Sample Vital Statistics 2018

¹⁸ <http://www.powercell.gov.bd/site/page/d730f98d-8912-47a2-8a35-382c4935eddc> (accessed on 11 November 2019)

¹⁹ Bangladesh Bureau of Statistics (2018) Bangladesh Sample Vital Statistics 2018

²⁰ Fuel for Life: Household Energy and Health, WHO, 2006

The energy balance tables for Bangladesh that shows the consumption of all fuels in Bangladesh is presented below. The table shows the energy balance for the year 2015 in energy units. The biomass fuels data are from SREDA's comprehensive assessment of the availability and use of biomass fuels for various end uses. All other data have been collected from either the annual reports or the official websites of the relevant organisations except for the coal data, which has been taken from the World Bank database (World Bank, 2019).

Table 4: Bangladesh Energy Balance for 2015 (in Energy Units - Picojoules)

	Nat ural Gas	NG L	Cru de Oil	Petrol eum Produ cts + LPG	Co al	Electr icity	Total Comm. Energy	Hydro - electr icity	Renew ables (Solar, Wind, etc.)	Biom ass	Total Renew able Energy	Tot al Ene rgy
	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ
	1	2	3	4	5	6	7 (1+2+3+4 +5+6)	8	9	10	11 (8+9+ 10)	12 (7+ 11)
A. Supply												
Primary Producti on	883. 25	19. 95			18. 25		921.45	2.04	1.18	660	663.22	158 5
Import			46. 66	175.55	43. 85	12.17	278.23					278
Export		- 10. 14		-2.08			-12.22					-12
Stock Change s												
Total Primary Supply	883. 25	9.8 1	46. 66	173.48	62. 10	12.17	1187.46	2.04	1.18	660	663.22	185 1
Percent age of Total Energy Supply	47.7 3%	0.5 3%	2.5 2%	9.37%	3.3 6%	0.66%	64.16%			35.66 %	35.84%	100 %
B. Transformation												
Refinery		- 9.8 1	- 46. 66	55.34								-1
Thermal Power Stations	- 357. 16			-46.73	- 18. 25	165.01						-257
Primary Electrici ty						3.22		2.04	1.18			
Losses and Own use	-1.48	- 0.2 0	- 0.9 3	-0.55	- 0.3 6	-22.36						-23
Total Final Supply	526. 06			181.53	43. 49	154.81	905.89			660		156 6
C. Consumption												
Domesti c	118. 97			20.09		79.98	219.04			442.2 0		661

Industrial	299.77			11.09	43.49	51.99	406.34			151.80		558
Commercial	9.98					14.40	24.38			66.00		90
Transport	43.19			112.63			155.82					156
Agriculture				35.80		6.39	42.19					42
Others				2.11		2.04	4.15					4
Non-energy Use	54.14						54.14					54
Total Demand	526.06			181.71	43.49	154.80	906.06			660		1566
Percent age of Total Energy Consumption	33.59%			11.60%	2.78%	9.88%	57.86%			42.14%		100%

Source: A Comprehensive Assessment of the Availability and Use of Biomass Fuels for Various End uses, compiled by Iraj Hossain (2019)

Approximate conversion to physical units:

1 picojoule = 0.99 billion cubic feet (natural gas); 1 picojoule = 0.006 barrels of oil (natural gas liquids); 1 picojoule = 42.70 million tons (crude oil, petroleum product and LPG); 1 picojoule = 27 million tons (coal); 1 picojoule = 0.0036 GWh (electricity, hydroelectricity); 1 picojoule = 1 million tons of biomass

Sustainable Energy for All (SE4All) is a multi-stakeholder partnership between governments, private sector and civil society, UN secretary-general initiative, which has marked Bangladesh as a priority country for promotion of sustainable energy access.²¹ The initiative intends to make sustainable energy for all a reality by 2030.

The shifts in the type of energy use for cooking in Bangladesh (as shown in table 3) also has a positive impact on the way this National Action Plan has been crafted. The movement towards cleaner cooking solution supports the empirical evidences of declining dependency on biomass fuel. It naturally maneuvers the plan towards a clean cooking future.

1.6 Environment and Climate

Bangladesh is a low-lying country with numerous rivers and a tropical monsoon climate. A dominant feature of Bangladesh is the annual cycle of overabundance of water in the monsoon and its scarcity during winter. It is one of the most vulnerable countries in the world to the effects of climate change.²² Every year, a larger number of people lose their land due to effects of flood, river-bank erosion etc. About 40% of the total global storm surges are recorded in Bangladesh with some of the deadliest ones with high number of mortalities.²³ More frequent and severe cyclone and other natural disasters might occur due to increased effects of climate change.

²¹ http://sustainabledevelopment.un.org/commitments_se4all.html accessed on 11 November 2019

²² http://germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf accessed on 11 November 2019

²³ <http://www.who.int/bulletin/volumes/90/2/11-088302/en/> accessed on 11 November 2019

With the climate change and population growth, the number of people affected will continue to increase in the near future.²⁴ Because of the lack of significant urban planning and increasing rural to urban migration, the extremely dense urban areas have deteriorating environment. Moreover, deforestation and burning of biomass are factors continuing to contribute to the climate challenge in Bangladesh. Pollutants such as black carbon and methane have significant consequences for climate. Black carbon is emitted due to the incomplete combustion of biomass²⁵ while cooking. The black carbon particles absorb just about every ray of light that hits them heating up like dark clothing on a sunny summer day and warming the air around them.²⁶ Meanwhile the second largest reason for climate change after carbon dioxide is methane emissions.²⁷ **It should be noted that improved cookstoves helps reduce the emission of greenhouse gases as the thermal efficiency of ICS are much better than the traditional stoves. The comparative assessments of different fuels is provided in section 2.1.**

The Ministry of Environment, Forests and Climate Change of the country developed the 'Bangladesh Climate Change Strategy and Action Plan' (BCCSAP) in 2008, which is treated as a 'living document', revised regularly to incorporate the ever-changing environmental, social and economic situation of the country.²⁸ This strategy document was revised in 2009 through more involvement of relevant stakeholders, among others- the Bangladesh Agricultural Research Council and the Water Resources Planning Organization. The strategy includes 6 broad categories emphasizing on sustainable development, poverty reduction and increased wellbeing of all vulnerable groups with a special focus on gender sensitivity.²⁹

A major aspect of this National Action Plan for Clean Cooking is to contribute positively towards the country's climate change goals. The interventions designed to achieving clean cooking also acknowledge the challenges and the effects of climate changes in people's lives and preferences. By the definition of clean cooking, achieving its goals also lies on the same pathway towards the climate change goals.

²⁴ ADB, (The impact of demographic transition on socioeconomic development in Bangladesh)

²⁵ <http://www.ccacoalition.org/ru/slcp/bs/black-carbon> accessed on 11 November 2019

²⁶ <http://www.climatecentral.org/news/black-carbon-second-only-to-co2-in-heating-the-planet-new-study-15465> accessed on 11 November 2019

²⁷ <http://www.epa.gov/ghgemissions/overview-greenhouse-gases> accessed on 11 November 2019

²⁸ <https://www.adaptation-undp.org/resources/plans-and-policies-relevance-naps-least-developed-countries-ldcs/bangladesh-climate-change> accessed on 11 November 2019

²⁹ Bangladesh Climate Change Strategy and Action Plan 2008

1.7 Government's Policy Framework

The following policy documents related to energy, environment, climate change and women development are relevant for the clean cooking sector in Bangladesh. The Ministry of Health through Directorate General of Health Services developed plans to improve peoples' health by reducing non-communicable diseases where indoor air pollution reduction was identified as one of the priority areas.

National Energy Policy
• Provides a comprehensive outline of the energy issues in Bangladesh, some development options and the policies recommended to address them. This sets the scene for all other energy related policies.
Renewable Energy Policy
• Outlines the context for the establishment of the Sustainable and Renewable Energy Development Authority. Also outlines the aims of the Government in creating an enabling environment and legal support to encourage the use of renewable energy.
National Women Development Policy
• This policy outlines the GoB's intention to improve women's rights in Bangladesh, which aims to provide women's right in every aspect of life, e.g. property, health, education, training, information, inheritance, credit, technology and opportunity to earn etc. and enact necessary laws to put these rights into practice.
Bangladesh Climate Change Strategy and Action Plan
• This strategy document was endorsed by the Prime Minister and describes Bangladesh's plans for the adaptation and mitigation of climate change. It offers a wide-ranging overview of the environmental challenges facing Bangladesh and also outlines the initial six pillars of interventions that have been identified.
Sustainable and Renewable Energy Development Authority (SREDA) Act
• An independent authority to promote the development and use of renewable energy • Custodian of the National Action Plan for Clean Cooking
Energy Efficiency Action Plan
• Government guideline and vision on promoting household and industrial energy efficiency.
Energy Efficiency and Conservation (EE&C) Rules
• Government priorities and regulations on energy efficiency, including household aspects.
National Action Plan for Clean Cooking
• Provides current situation and plans to achieve clean cooking for all by 2030

Figure 3: Relevant policies of Government of Bangladesh related to clean cooking

2. Clean Cooking Sector Scenario

2.1 Defining Clean Cooking

Household air pollution is one of the key health issues in the rural areas. Indoor smoke or pollution contains a range of harmful pollutants, such as small particles, carbon monoxide etc. WHO has set recommended limits for health and harmful concentrations of key air pollutants in both outdoors and indoors. The guidelines by WHO from 2005 cover annual and daily concentrations of fine particulates, nitrogen dioxide, sulfur dioxide, carbon monoxide and ozone. There is consistent evidence that exposure to household air pollution can lead to acute lower respiratory infections in children under five, and ischemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer in adults. In 2016, household air pollution was responsible for 7.7% of the global mortality.

The United Nations defines clean cooking as ‘universal access to clean and modern cooking’³⁰, attributing to WHO’s ‘Guidelines for indoor air quality: household fuel combustion’³¹. According to the definition, any type of combination of fuel-technology is regarded as ‘clean’ as long as the emissions meet the WHO Guidelines. The Clean Cooking Alliance adopted WHO’s definition for clean cooking. The WHO guideline makes strong recommendation that emission rates from household fuel combustion should not exceed the following emission rate targets (ERTs) for PM_{2.5} and CO.

Table 5: Emission Rate Targets from Household Fuel Combustion by WHO

	Emission Rate Targets
PM _{2.5} (unvented)	0.23 (mg/minute)
PM _{2.5} (vented)	0.80 (mg/minute)
CO (unvented)	0.16 (g/minute)
CO (vented)	0.59 (g/minute)

Source: https://www.who.int/airpollution/guidelines/household-fuel-combustion/IAQ_HHFC_guidelines.pdf

The available literature demonstrates the persistence of household air pollution with wood, dung and crop residues.

Table 6: Average Emission Factors for Household Stoves

Broad Fuel Type			Emission Factors (g/Kg)			
			CO ₂	CO	CH ₄	PM
Biomass	Wood	Traditional Unvented	1,610	52.8	8.9	2.5
		Traditional Vented	1,560	23.6	0.6	1.5
		Improved Unvented	1,580	42.4	8.8	2.3
		Improved Vented	1,592	48.8	2.8	3.5
	Dung	Traditional Unvented	1,000.5	42.99	11.63	2.45
		Improved Unvented	1,056	24.6	3.4	3.4
	Crop Residue	Traditional Vented	2,005	68.7	6.2	3.2
		Improved Vented	1,582	133.7	4.5	11

³⁰ <https://sustainabledevelopment.un.org/content/documents/17465PB2.pdf> accessed on 11 November 2019

³¹ https://www.who.int/airpollution/guidelines/household-fuel-combustion/IAQ_HHFC_guidelines.pdf accessed on 11 November 2019

	Charcoal Briquette	Traditional Unvented	2,559	9		4.8
Fossil Fuel	Kerosene	Traditional Unvented	3,180	27.2	0.48	0.29
	LPG	Improved Unvented	2,532	14.2	0.04	0.35
	NG	Improved Unvented	3,440	0.3	0.04	0.16

Source: https://www.who.int/airpollution/guidelines/household-fuel-combustion/Review_2.pdf Pages

16-17

The following table provides information on thermal efficiency of stoves using different types of fuel in Bangladesh:

Table 7: Stove Thermal Efficiency Applied by Fuel for Bangladesh

Fuel Type	Stove Thermal Efficiency
Firewood	13.5%
Charcoal Briquettes from Wood	17.5%
Charcoal Briquettes from Bamboo	17.5%
Non-carbonized Briquettes from Sawdust	29.9%
Non-carbonized Briquettes from Crop Residue	31%
Wood Pellets	53%
Wood Chips	31%
Ethanol from Sugarcane	53%
Ethanol from Wood	53%
Biogas from Dung	55%
LPG	57%

Source: Comparative Analysis of Fuels for Cooking: Life Cycle Environmental Impacts and Economic and Social Considerations, Eastern Research Group, 2016, Submitted to Global Alliance for Clean Cookstoves

Considering the point of use, the current available options which are clean include electricity, natural gas, biogas, ethanol, solar and the highest performing biomass stoves. The improved cookstoves (ICS) are also considered with caution as it includes a wide range of performance in terms of efficiency and emission at the point of use. **Although these options have varying thermal efficiency and emission factors, the health impact of the cook and people who are around are considered while setting clean cooking targets for 2030 (in section 4.4).** In Bangladesh, this global definition for clean cooking can be considered as a base. The adapted definition for the country can be built further on these, by including additional specifications to accommodate the local consumers' need and government targets.

2.2 Global Context

Despite progress towards universal access to cleaner cooking systems, about 40% of global households (around three billion people), especially in developing countries, are still dependent on traditional cookstove as the primary means of cooking and heating. The global access to clean cooking fuels and technology and the scenario of South Asian and selected South East Asian countries is given below:

Table 8: Access to Clean Fuels and Technologies for Cooking in 2016

Country/Region	% of Population
World (2016)	59.363
Bangladesh	17.72
Afghanistan	32.44
Bhutan	52.5
India	41.04
Nepal	27.62
Pakistan	43.32
Sri Lanka	26.33
Maldives	93.83
Myanmar	18
Malaysia	96.3
Thailand	74

Source: <https://data.worldbank.org/indicator/EG.CFT.ACCS.ZS>

Due to exposure to smoke from traditional cookstoves around four million premature deaths occur annually. Women and children accounted for over 60% of all the premature deaths from household air pollution (HAP) in the year 2012³². As many as 400,000 children under the age of 5 died prematurely due to HAP in the year 2016³³. Up to 34% of all the wood harvested for fuel is unsustainable and contributes to a loss of woody biomass and climate polluting emissions³⁴. This accounts for approximately 2% of global emissions.³⁵ **The composition of biomass fuels consumed in 2015 in Bangladesh is – tree residues 19.8%, agricultural residues 69.9% and animal residues 10.2%. Among the biomass fuels available in Bangladesh, agricultural residues are supplied by different crops seasonally and animal residues are supplied by livestock resources on daily basis. Therefore, they are available on regenerative basis. Unlike other countries in Bangladesh major portion (99.7 percent) of tree residues is supplied on a regenerative basis from the trees grown within homestead and 0.7 percent tree residues is supplied from forest lands³⁶ (Section 3.5.3 of Biomass Fuel Report).**

Given the context, an urgent action to scale up access to clean cooking solutions through policies, financing and technology development is needed to address the issue. Without it the world will fall short of achieving Sustainable Development Goal 7 and several other related SDGs.

³² World Health Organization. Household air pollution is a gender issue. Retrieved from: <https://www.who.int/life-course/news/household-air-pollution/en/> accessed on 11 November 2019

³³ World Health Organization. (2018). WHO Social media toolkit for Air pollution and Child Health: Prescribing Clean Air Launch.

³⁴ Khan, M.N., B. Nurs, C., Mofizul Islam, M. et al. Environ Health (2017) 16: 57. <https://doi.org/10.1186/s12940-017-0272-y> accessed on 11 November 2019

³⁵ Clean Cook Alliance. (2018). Clean cooking critical to addressing climate change.

³⁶ **A Comprehensive Assessment of the Availability and Use of Biomass Fuels for Various End uses, SREDA, Table 8.5**

2.3 SDGs related to Clean Cooking

193 countries around the world adopted the Sustainable Development Goals (SDGs) in 2015, to address poverty, inequality and climate change over the next 15 years. Among the 17 goals, ten SDGs can be addressed by ensuring global clean cooking. The use of open fires and solid fuels are major issues in health and environmental problems across the globe, where women and children are disproportionately affected through toxic smoke, time poverty, inter alia. With planned interventions and continuous focus, the clean cooking achievements can support a number of SDGs. The following figure gives a snapshot of how different sustainable development goals are related to clean cooking.



Figure 4: SDGs Related to Clean Cooking

Source: Clean Cooking Alliance

2.4 Clean Cooking Standards

In 2018 the International Organization for Standardization (ISO) published the first international standard for laboratory testing³⁷ of cookstoves. Developed and approved by international experts from 45 countries, the new standard includes protocols to test and report the emissions, efficiency, safety and durability of cookstoves in a lab setting. The standard, which replaces an ISO International Workshop Agreement from 2012, is expected to serve as the basis for national policies and programs on cookstoves, while also incentivizing manufacturers and developers to improve stove quality and performance. An accompanying ISO technical report³⁸ that benchmarks performance to voluntary performance targets, or tiers, and provides guidance on how to understand and interpret lab test results was also approved by member countries of the ISO Committee. This voluntary document provides a framework for organizations, countries and regions to adapt and implement the protocols, metrics, and targets based on their priorities over the coming months and years. ISO standards are reviewed and updated regularly, so these standards can be updated based on future research and on the progress in the cookstove and fuel market.

ISO Technical Committee (TC) 285 also published a technical report³⁹ in May 2018 that provides harmonized definitions to key terms and concepts used within the sector. In addition, the ISO TC 285 has also been developing guidance on field testing, and it is currently open in the final stage of approval and being published. There are 5 indicators covered by the targets: thermal efficiency, fine particulate matter emissions, carbon monoxide emissions, safety, and durability. For each indicator, lab test results are rated along 6 tiers (0: lowest performing to 5: highest performing). Tier 0 represents performance typical of open fires and the simplest cook stoves.

Table 9: Different Tiers of Cook Stoves as per ISO Standards

Tier	Thermal Efficiency %	Carbon Monoxide Emissions (gram/mega joule delivered)	Fine Particulate Matter Emissions (milligram/mega joule delivered)	Safety (Score)	Durability (Score)
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	<=1031	>=60	<35
0	<10	>18.3	>1031	<60	>35

Source: <https://www.cleancookingalliance.org/technology-and-fuels/standards/voluntary-performance-targets.html>

Bangladesh Standards and Testing Institute (BSTI) adopted these ISO standards as Bangladesh standards (**BDS ISO/TR 21276:2019**)⁴⁰ and the adoption of the standards is voluntary.

³⁷ <https://www.iso.org/standard/66519.html> accessed on 11 November 2019

³⁸ <https://www.iso.org/standard/73935.html> accessed on 11 November 2019

³⁹ <https://www.iso.org/obp/ui/#iso:std:iso:tr:21276:ed-1:v1:en> accessed on 11 November 2019

⁴⁰ https://bstibds.com/single_product/4234 accessed on 11 November 2019

3. Clean Cooking in Bangladesh

3.1 Household air pollution in Bangladesh

Household air pollution is a significant public health problem in Bangladesh. It is mostly caused by incomplete combustion of traditional biomass fuels (wood, cow dung, and crop residues) for household cooking and heating. In Bangladesh, a vast majority of the population rely on inefficient traditional stoves to cook their food. Majority of the population still cook with wood (41.2%) or agricultural residues (32.6%)⁴¹ and the rest (26.2%) are currently using LPG, electricity, natural gas or biogas. Household air pollution from cooking with solid fuels contributes to 70,000 premature deaths annually in Bangladesh⁴². Every year, almost 6,000 children under five die from causes attributable to household air pollution⁴³.

During the household cooking process using wood fuel, the major pollutant released are the greenhouse gases (GHGs) like CO₂, CO, PM 2.5 and methane. Besides these, other short-lived climate pollutants (SLCPs), such as black carbon, are also produced while cooking with biomass. Black carbon has been noted to be the second largest contributor to climate change after CO₂. Up to 58% of global black carbon emissions are produced due to the burning of solid fuels for cooking, heating, and lighting in homes.⁴⁴ This also leads to higher household air pollution in forms of particulate matter emissions; in poorly ventilated homes, the quantity of small particulate matter can be more than 100 times greater than WHO recommendations.⁴⁵

3.2 Cooking Technologies and Energy mix in Bangladesh

The energy mix in Bangladesh for cooking mostly comprises of biomass, biogas, LPG, natural gas, and electricity. Solar cooker was tried at a very limited scale without much success so far. Heat retention technologies (like retained heat cooker) were tried by some donor funded projects to improve energy efficiency. The cooking technology varies from household to household, as it depends on the socio-economic status of the households. The common technologies are different types ICS, gas stoves for natural gas, stoves for LPG, electric rice cookers and induction cookers. Presence of more than one cooking technology in a single household (stacking) is also a very common phenomenon. People prefers to keep multiple cooking solutions to use as needed depending on time, convenience and fuel cost. The following table shows how the current cookstove preference changes across different socio-economic segments in the country.

⁴¹ Bangladesh Bureau of Statistics (2018) Bangladesh Sample Vital Statistics 2018

⁴² <http://ghdx.healthdata.org/gbd-results-tool> accessed on 11 November 2019

⁴³ Institute for Health Metrics and Evaluation, 2017

⁴⁴ IIASA GAINS 2017

⁴⁵ WHO, 2014. Household air pollution fact sheet.

Table 10: Stove Choices According to Consumer Segment

Income Level (Monthly)	Segment	Location	Current Stove Choices
BDT 17,000–25,000	Decile 6 to 10 (Middle income)	Urban and Peri Urban	Piped natural gas, LPG, electric rice cooker and induction cooker
BDT 11,000–17,000	Decile 1 to 5 (Lower middle income)	Urban and Peri Urban	Main - Traditional clay stove, Part time - two pot chimney ICS/ portable ICS (in tier-2 cities and peri-urban areas) or kerosene stove–part time (in tier-1 cities like Dhaka where biomass fuel is not easily accessible).
BDT 6,000–10,000	Lower 5%	Urban and Peri Urban	Main - Traditional stove Part time - Portable ICS
BDT 17,000–25,000	Decile 6 to 10 (Middle Income)	Rural	Main - Traditional stove, Part time - ICS e.g. Bondhu Chula or two pot chimney ICS/portable IDCOL ICS, Electric rice cooker, LPG.
Low Income	Decile 1 to 5 (Lower middle income)	Rural	Main - Traditional stove Part Time - Portable ICS or two pot chimney ICS
Low Income	Lower 5%	Rural	Main - Traditional stove Part Time - Portable ICS

Source: Compiled by the consultants based on the income group classification from Household Income and Expenditure Survey, Bangladesh Bureau of Statistics.

In terms of fuel for household cooking, there have been a progressive change in the energy-mix. The commercial import of LPG since 2011/12 has changed the cooking fuel scenario in the country significantly.

Biomass: Biomass is widely used in cooking in Bangladesh, especially in the rural and peri-urban areas using the traditional mud stoves and improved cookstoves. People use wood, branches of tress, crop residue, dry leaves, dried cow dung etc. as biomass for cooking purpose. The thermal efficiency of biomass stoves is relatively low, and the emission of CO₂, CO and PM is significantly high compared to other fuel options.

LPG: Liquefied Petroleum Gas (LPG) is obtained from natural gas processing or oil refining, which is eventually liquefied through pressurization. It is one of the cleanest sources of energy, as the thermal efficiency of LPG stoves are comparatively higher, and the emission levels of CO and PM are at a lower level.

Natural Gas: Bangladesh is one of the few countries in the world to provide Piped Natural Gas (PNG) connections to households for cooking purposes. About 4,100,000 households are connected to piped natural gas in Bangladesh⁴⁶. However, the government suspended providing new piped natural gas connections to households since 2016-17, due to the fast-declining natural gas reserve in the country. This led to an increase in demand for alternatives such as LPG to meet daily cooking gas needs⁴⁷. Also,

⁴⁶ Khan, M.F.R. (2018). BPC Study Report

⁴⁷ <http://www.theindependentbd.com/printversion/details/31325> accessed on 11 November 2019

Liquefied Natural Gas (LNG) is currently being imported by the government and supplied in the national network to meet the increasing demand.

Biogas: Biogas is one of the most environmentally friendly and clean cooking fuels options. It is primarily a mixture of carbon dioxide and methane and is produced through anaerobic digestion of organic material that is biodegradable. In Bangladesh, most of the biogas is produced from the manure of cows and chickens. Since the initiation of biogas digester installations in the mid-'90s by the Bangladesh Council for Scientific and Industrial Research (BCSIR), 102,808 biogas digesters have been installed in Bangladesh till the year 2018. IDCOL runs the largest biogas program in Bangladesh.

Pellet, Briquettes: Pellet and briquettes are compressed biomass and has a much lower emission of greenhouse gases. But Pellet and briquette as fuel is not very popular in Bangladesh yet. There were initiatives in the past to popularize pellet and briquette based stoves, but due to multiple factors (including production and availability of pellets and briquettes, comparatively high cost of stoves, cooking behavior of people etc.) the initiatives saw limited success.

Ethanol: Ethanol gel based stoves were promoted by donor-driven projects, but did not gain popularity so far. Ethanol gel is made from molasses, a byproduct of sugar production. The supply chain of ethanol gel is yet to be established in Bangladesh for cooking purpose.

3.3 Overview of progress made

In the clean cooking sector of Bangladesh, several development partners and donor organization have been working along with the Government to promote cleaner and more efficient cooking solutions. During the 70s and 80s, the Government of Bangladesh initiated developing improved cookstoves. Following the same notion, different NGOs such as VERC, Palli Karma Sahayak Foundation (PKSF), Bangladesh Bondhu Foundation, and Grameen Shakti initiated projects to disseminate ICS technology and other clean cooking solutions such as biogas for the households of Bangladesh. In 2012, the Clean Cooking Alliance (then Global Alliance for Clean Cookstoves) began to engage in Bangladesh and convened stakeholders to develop and launch the Country Action Plan for Clean Cookstoves. The sector further gained momentum through the inauguration of 'IDCOL Improved Cook Stove (ICS) Program' in 2013. The clean cooking sector got momentum when government permitted multiple companies to import and market LPG. Together with the postponement of piped natural gas connection, LPG companies quickly took the opportunity by reaching out to potential customers by developing nation-wide extensive distribution network. However, the efforts are yet to ensure full coverage of clean cooking to the households of Bangladesh.

The Government of Bangladesh has set targets for all kitchens in Bangladesh to be smoke-free by 2030. The following diagram shows the journey and progress in achieving clean cooking through improved cook stoves in Bangladesh.

Table 11: Year-wise Clean Cookstove and Clean Cooking Journey in Bangladesh

Year	Clean Cookstove and Clean Cooking Journey
1976 – 1987	- BCSIR initiated working on ICS - Clean cooking initiatives started by the Government of Bangladesh by introducing ICS - VERC launched its ICS program - EnDev launched its ICS program
2004-2006	- Grameen Shakti started its ICS program - Bangladesh Bondhu Chula Foundation started its ICS program

2010-2012	- Introduction of concrete-made ICS by GIZ/EnDev - Inauguration of IDCOL Improved Cookstoves Program - Clean Cooking Alliance started its journey in Bangladesh - Country Action Plan for Clean Cookstoves launched - LPG sector liberalized, number of LPG companies started bottling and marketing of LPG cylinders
2017	- One million ICS disseminated by IDCOL
2019-2020	- Launch of National Action Plan for Clean Cooking 2020-2030 - Electricity coverage throughout the country nearly complete (95%)
2021-2030	- IDCOL's target of 4 million ICS installation since 2017 - Vision for Bangladesh Government to achieve 100% clean cooking solution by 2030

Source: Compiled by the consultants

In the Country Action Plan 2013, a number of interventions were proposed to fulfill the target for achieving clean cooking in Bangladesh. The initiatives were focused on three major areas: a) enhancing demand, b) strengthening supply and c) enabling environment.

To enhance demand for clean cooking in the country, under the previous CAP, a series of initiatives were undertaken by the Household Energy Platform and different development partners. Activities involving national awareness building campaigns were focused to create demand among the consumers. Campaigns through local government, school programs, TVC, social media etc. were conducted by HEP, BBF, IDCOL for ICS. LPG and other clean cooking solutions were also focused in few activities.

In the clean cooking sector of Bangladesh, to strengthen the supply side, the CAP 2013 focused on involving financial institutions with the current suppliers of different clean cooking solutions. Unfortunately, this sector is yet to observe much success in this regard, as per the intervention mentioned in the CAP. However, a number of initiatives have been put forward by the Household Energy Platform (HEP) and other organizations. For example, HEP has proposed tax reduction on imported materials for ICS production, World Bank has received GCF funding for the sector, BBF is exploring carbon funds options, to name a few.

The enabling environment section of the CAP 2013 focuses on the monitoring and assessment of the sectoral progress. The HEP was mentioned to have the monitoring system for the overall clean cooking sector in the country, for which an outline has been prepared. A web portal was launched by HEP to coordinate and disseminate information countrywide. The ICDDR, B is currently conducting a health study to capture the benefits of clean cooking, moving away from traditional stoves. HEP and SREDA have been advocating the tax issues with relevant ministries for the clean cooking sector in Bangladesh.

Even though many interventions have been carried out as per the Country Action Plan (CAP) 2013, a lot more was left to address. The details of the planned activities in CAP 2013 and its implementation status is given in the annex.

3.4 Success Stories and Learning

Some of the success stories in the clean cooking journey for Bangladesh after the adoption of Country Action Plan in 2013 are given below.

Establishment of the Household Energy Platform:

The success of this sector is dependent on some major ministries and divisions, such as the ministries of power, health, disaster management, environment etc. To bring all these government stakeholders together, along with the donor agencies and NGOs in a single platform, the Household Energy Platform (HEP) was established in 2016. It is a Public-Private Partnership hosted by The Sustainable Renewable Energy Development Authority (SREDA) and functions as per dynamic needs of the sector, based on the broader understanding and interest from the stakeholders. Since its launch, the platform has had over 50 members, mostly NGO's, various government bodies, development partners and few private sector companies. The objectives of the platform are to act as a knowledge hub, bring synergy, coordinate activities among the members etc.

HEP has facilitated the Country Action Plan (CAP) 2013 review process in the past years. They have worked with Bangladesh Council of Scientific and Industrial Research (BCSIR) to establish a lab capable of testing cook stoves as per ISO standards. HEP organizes workshop for different stakeholders of the sector on clean cooking in SDGs and implementation strategies, prospects and challenges. They are currently conducting research on developing biomass-briquettes in larger scales in the country.

IDCOL achievements (IDCOL Improved Cookstoves Program):

The Infrastructure Development Company Limited (IDCOL) started its ICS program in 2012. Currently the program has around 61 POs to work with ICS in 300 upazilas of the country. Over the years, the program has successfully achieved its mandate on dissemination of ICS targets, sometimes even before the timeline. So far, over 1.7 million improved cookstoves have been disseminated during the past six years. IDCOL has come a long way in improving the cookstoves in terms of efficiency. Their ICS has upgraded from Tier 1 to Tier 3 thermal efficiency stoves, and they have recently introduced a tier 4 thermal efficiency cookstove in the program. This institute plays a big role in the country's achievement towards meeting the vision of clean cooking for all by 2030.

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 aim of the project was to create 5000 entrepreneurs, who will produce, sell and install Bondhu Chula 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.

The entrepreneurship model to disseminate cookstoves in different parts of the country, has been a successful venture of GIZ/EnDev. Even though there have been issues with the consistency of the design of few ICS, but the overall response has been very much positive within their targeted areas. The organization currently has 200-unit offices, 68 district offices, 600 staffs and approximately 5000 partner enterprises (including micro enterprises). The contribution of BBF to the clean cooking sector is of significant importance in Bangladesh.

Grameen Shakti

Grameen Shakti was established in 1996, with the vision to empower the rural population of Bangladesh with access to green energy and income. As a part of their vision, they targeted around 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. Technical and financial needs of the consumers were met, and training was provided on operation and maintenance of the biogas plants. For the improved cookstoves, seed capitals for the ICS manufacturers were provided to set up their businesses. The major success of Grameen Shakti was the elimination of dependency on subsidies and introducing financing in the clean cooking sector in the country.

Behavioral Change Communication Campaigns

In 2016, the Clean Cooking Alliance collaborated with Washplus and iDE to develop a marketing and behavior change strategy to increase the purchase of ICS by the consumers in Bangladesh. The strategy identified the consumer segment who were early-adopters for ICS and developed a marketing strategy by using classic marketing “4Ps model – Product, price, place and promotion” for each consumer segment.

This campaign was a pioneer in the clean cooking sector and has been a great example of an inclusive marketing strategy for private sector actors. Such efforts brought two major positive change in the clean cooking sector of Bangladesh. Firstly, this allowed national and global stakeholders to learn the strategic lessons those arrive from the process of mixed-method market research and understand its critical role in developing a marketing strategy with the fundamentals of the marketing mix and human-centered design of it. Secondly, as one of the results from the assessments revealed very low willingness to pay by the consumers, the stove promotion activities in-country were focused on improving locally produced ICS instead of higher-end imported stoves.

Clean Cooking Alliance (CCA) worked with Social Marketing Company (SMC) and Purplewood to implement behavioral change communication program in Barisal division. The people in the area learnt about the bad effects of traditional stoves in cooking and got interested in improved cooking solutions.

Key Learnings

There were also some hiccups along the way in promoting clean cooking in Bangladesh. Although LPG is regarded as one of the cleanest fuels for cooking, and there has been a significant growth in LPG usage in the past few years, the government has imposed Value Added Tax (VAT) on LPG in the 2019/20 budget. This VAT is likely to increase the retail price of LPG and slow down the growth at the household level. There is also a high level of import duty on different types of cookstoves. If these duties are eliminated or at least reduced, the cost burden to the final users will be lower and the adoption of clean cooking solutions will be much faster.

The review of the planned activities from CAP 2013 (Annex 5) shows that many of the activities are either done partially or not done at all. Some of the pilot activities were undertaken, but those were not scaled up. There is no national network of suppliers of clean cooking at place, financial products for the manufacturers and consumers are not available, national awareness on clean cooking is still at a nascent stage, open-source materials are not available, information centers at Union level are not available etc.

Taking these learning and non-action into consideration, the National Action Plan 2020-30 is developed with specific targets, milestones, responsible organizations and monitoring mechanism.

4. Achieving Clean Cooking in Bangladesh

4.1 Structural Transformation of the Economy

Bangladesh is attempting to realize the Vision 2021 and attain the SDG agenda 2030 for building a happy and prosperous nation. The country targets to become a high middle-income country by 2030 and a high-income country by 2041. To this end, successive governments have been considering many fundamental changes bringing about structural transformations in the country. Table below exhibits major changes brought about in the country roughly during last fourteen years (2005/06 to 2019/20)

Table 12: Socio-economic Progression in Bangladesh

Major socio-economic parameters	Unit	Situation as of 2005/06	Current Situation 2019/20
Economic			
Size of GDP	billion US\$	72	302.4
Per capita income	US \$	543	1,909
Investment as % of GDP	%	26	31.5
Debt/GDP	Ratio	44	32
Social and Demographic			
Literacy rate	%	53.7	73.9
Primary school drop-out rate	%	50	18
Percentage of People receiving technical education	%	2	17
Infant mortality	Per 1000 live births	45	24
Life Expectancy	years	65	72.8
Energy and Power			
Power generation capacity	MW	4,385	21,629
People's access to electricity		47	94
Gas Supply	million cubic feet/day	1,443	2,746
Petroleum Product Consumption	Million MT	3.639	6.948
Digitalization			
Internet connection	million	-	90
Digital centers	number	-	5,000

Source: Bangladesh Bureau of Statistics, CIA World Fact book, Bangladesh Petroleum Corporation & Hydrocarbon Unit of MoPEMR

The table above reveals progress materializing in many different sectors of the economy. To note a few, real per capita income has increased 3.5 times over the period and now stands at US\$ 1,909. The size of country's GDP increased 4.5 times to US\$ 302.4 billion. The power generation capacity has increased almost five times to 21,629 megawatts. The share of the population enjoying electricity connection increased from 47 percent to 93 percent. Gas supply increased from 1,443 million cubic feet to 2,746 million cubic feet per day. 5,000 digital centers have been established in all the unions and municipal areas in the country. About 23,500 km optical fiber cable was installed throughout the country to create uninterrupted access to internet. The number of internet users has crossed 90 million. Similar progress is noted for the social and demographic sectors. Community clinics have been established across the country. The poverty rate has dropped from 40 percent in 2005 to 21 percent in 2019. Extreme poverty dropped from 25 percent to 11 percent. Inflation has been kept at a tolerable level despite the sustained high growth rates in the economy. Targets of Millennium Development Goals

(MDGs) have been achieved surpassing the performance of countries in the similar growth paths. Bangladesh has elevated itself from the status of a poor, least developed country to that of a lower middle-income country.

Urbanization Trend

Historically known as a rural-agrarian country, Bangladesh today is experiencing a rapid transformation towards an urban society. However, the style and nature of urbanization are not necessarily similar to those in other countries. There is an extraordinary mix of urban-rural functions and traits in both metropolitan cities and rural towns as well as in villages. More importantly, the urban rural growth differential in terms of the annual exponential growth rates has averaged a sizeable 4.25 per cent in the last 37 years illustrating the transformation of the country towards urbanization at a remarkable pace. For the first time in Bangladesh, the absolute increase in population in the decade 2001-11 was more in the urban areas than that in the rural areas. Now, population growth in Bangladesh is largely an urban phenomenon, and by 2047, 50 per cent of Bangladesh's population is estimated to live in solely urban areas. The share would be much larger if population living in semi-urban, peri-urban, rural growth centers and rural commercial centers are considered.

SDG and Achievements

In Bangladesh, clean cooking has strong inter-linkages with other Sustainable Development Goals. Here inefficient cooking is a root cause of poverty, poor health, gender inequality, environmental degradation, air pollution, and contributes to climate change. Universal access to clean and modern cooking is integral to reducing poverty and advancing human dignity. Progress in clean cooking means simultaneous achievement of SDGs for holistic development of the country.

4.2 Clean Cooking in Emergency Context

During the influx of Rohingya population in the 90s, very little initiatives were taken to meet the demand of cooking fuel and technology for the displaced people. The emergency response organizations supplied some improved cookstoves and briquettes to use with those improves cookstoves to a small number of Rohynga communities and did not continue that effort.

In 2017, over 750,000 Rohingya people fled Myanmar and took refuge in Cox's Bazar, Bangladesh. In the 1990s, over 350,000 Rohingyas were forcibly displaced and living in Bangladesh since then. The Government of Bangladesh and donor communities tried to provide necessary food, shelter and safety to these forcefully displaced people, 55% of whom are children while 42% are adults and 3% elderly. During the initial period, the Rohingyas destroyed a vast area of forest land to meet their shelter and cooking needs by collecting branches and wood from nearby forests. As the available biomass fuel were not enough to serve the need of the large number of people, in addition to the existing demand of the host community in Cox's Bazar, it created enormous tension between the host community and Rohingyas. Government and donor community responsible for the management of the forcibly displaced Rohingyas decided to support the cooking need of Rohingyas by supplying them with LPG cookstoves and cylinders. There are approximately 200,000 Rohingya households in all the camps and so far, the donor community supported 145,000 households with LPG cookstoves and cylinders. In addition to supporting Rohingyas, 45,000 host community households were also planned to be supported with free LPG cookstoves and cylinders. So far, 18,000 host community households received this support. Food and Agriculture Organization (FAO) did a supply-demand assessment of wood fuel for Rohingya and host community and came to the conclusion that use of wood for cooking is not sustainable. United Nations High Commissioner for Refugees (UNHCR), International Organization for Migration (IOM) and other development partners decided to provide LPG cookstoves and six free refills per household per year. Together with this, the donor community provided safety training on usage of LPG cooking set to the beneficiaries. This support helped reduce the use of wood as cooking fuel to a

large extent. The development community has introduced usage of pressure cooker to further enhance energy efficiency. The LPG usage success was possible because LPG companies had the capacity to supply the cookstoves and cylinders immediately and the supply chain was well established. In addition to supporting large number of households with LPG, small initiative from Community Partners International (CPI) is also there to provide pellet and briquette based improved cookstoves. CPI provided 2000 households with pellet and briquette based cookstoves and 25 households with solar cookstoves. They are also supplying pellets and briquettes to the households. There are similar small-scale initiatives for clean cooking by other NGOs like Action Aid, BRAC, Christian Aid etc.

The lessons from the response to Rohingya community after the 2017 influx gives indication for the national guideline for clean cooking in emergency situation. In an emergency response, the following steps should be built in to consider the clean cooking requirement:

- Assessment of the fuel need of the people
- Identify the best possible clean cooking solution based on the available supply strength
- Ensure uninterrupted supply of clean fuel for cooking
- Monitor the behavior of people in using clean fuel for cooking to ensure sustainability in the long-term

Bangladesh as a country faces regular natural catastrophe in the form of flood and cyclone. The Ministry of Disaster Management and Relief has developed commendable plan in disaster preparedness that is visible through relative low loss of life and resources in recent times. But cooking is still not part of the disaster preparedness and response plan. The dry food supplies distributed by the government to the affected families need cooking. The Government can plan to provide clean cooking solution to distressed people in the form of improved cookstoves and cooking fuel (pellet, briquette etc.) or LPG. In addition, the dry rations distributed by the government to the affected families need cooking. So, the relief items can include clean cooking technologies to cook the ration. In addition to providing clean cooking solution during the period of disaster, people also need to be taught on the process and safety aspects in using clean cooking solutions.

4.3 Strategies for Scaling up the Sector

The learning and experience of implementing the previous Country Action Plan for Clean Cook Stoves calls for some new strategies to speed up the adoption of clean cooking in Bangladesh across all consumer segments. Following strategies are considered in drawing-up the country's Clean Cooking Action Plan.

1. **Assigning leadership role to a competent authority**

Achieving clean cooking needs strong national stewardship by a government agency both during planning and implementation period. Currently, Ministry of Power, Energy and Mineral Resources (MoPEMR) assigned SREDA the task of clean cooking under the mandate of developing a sustained and renewable energy source for cooking. SREDA or a different government agency in the future can achieve clean cooking goals through guidance, cooperation and coordination among diverse stakeholders. Further, SREDA as a hub of knowledge on clean cooking can engage in the task of building-on as well as in sharing of knowledge–capital on clean cooking to stakeholders. The desire to scale-up one or more cooking fuels requires an enabling environment. There is need for an enabling environment to create a sustainable market, tackling supply and demand side issues in an integrated manner, awareness building, seeking both technical assistance and financing etc.

2. **Incomplete tasks on ICS and re-formulating the strategy**

Despite long years of improved cook stoves program in the country, there is a lack of awareness building on clean cooking. Awareness of the health hazards and a consequent shift to better fuels and/or renewable energy could reduce such emissions. Implementing clean biomass

cooking solutions can lead to better health, reduce poverty, generate greater gender equality, and create less pressure on the local and global environment. Currently, there are two major players namely Infrastructure Development Company Limited (IDCOL) and Bangladesh Bondhu Foundation (BBF) that implement ICS programs. The target set in 2013 was for 30 million stoves by 2030. As of 2019, 2.7 million stoves have been sold (less than 10% of the target) and actual usage of these stoves is much lower (because of stove stacking nature of people, their preference and convenience).

There are several reasons why experience of ICS programs in Bangladesh is not one of high hope and enthusiasm. Most in the value chain, namely, producers, wholesalers, and retailers are more concerned with sales maximization than actual use⁴⁸. The households cite various design defects on certain kinds of stoves like improper height of the stove (a matter of age of the main cook and habit in the way of cooking); mismatch of the size of the stove-mouth and their pots, non-availability of appropriate type of fuel wood, etc. With availability of LPG-option, households, even the poorest ones desire to have LPGs because of their convenience, cleanliness, compatibility with brick-built cemented housing, economization of space for fuel-storage, peer pressure, social status etc. In the supply-side, the commercial market of all type of ICS is not well established. There are very limited numbers of retail outlets in marketplaces and growth centers even in the districts which are often singled out for ICS-success. Some manufacturers of ICS conceded that competition from LPG have been limiting demand for improved cook stoves. Findings from International Center for Diarrheal Disease Research, Bangladesh (ICDDR, B) show that ICS do not fully control household air pollution. Only impact of ICS in bringing about thermal efficiency is established. In such circumstances, reformulation of the strategy is required for directing the country to appropriate technology and fuel choice.

In view of previous discussions and given the dynamics of economic transformation to a higher income trajectory, development, market forces and availability of modern fuels like LPG and electricity, biomass cooking existing in the lower end of the market will gradually decline. This trend is evident from the experience of neighboring countries like China, India, and Indonesia etc. In the prevailing circumstances, improved biomass cooking will become a dominant mode for achieving thermal efficiency, some control on household air pollution, and improved environment mainly in areas not reached by LPGs, natural gas, electricity and other options in the long run. Specifically, ICS will persist in remote and inaccessible areas in chars, coastal islands, mangrove and rainforest areas, hill tracts etc. where fuelwood, tree leaves and cross-residues are abundant and the areas are away from commercial centers for LPGs to exist, because of high transport cost, wide dispersion of households making cost recovery to private dealers and traders difficult. For expanding ICS (basic model) to this market, there is need for concerted efforts like the following:

Mainstreaming gender. Experience shows that behavioral change is the most critical aspect inhibiting shift to a new technology like ICS especially for rural women. Along with present dissemination drives, there is need for utilizing the experience of housewives who actually use ICS in providing the benefits of using ICS. Secondly, rural housewives indicated that physicians /doctors (especially women), advising on adverse effects of traditional stoves would carry more weight. Therefore, a sustained campaign by Health Ministry/ Directorate General of Health Services etc. in this line is likely to bring fruits.

⁴⁸ Actual usage of stoves is likely to be lower than number currently estimated considering 5/6 years of working life.

Incorporating Health Ministry's Multi-Sectoral Action Plan for **Prevention and Control of Non-communicable diseases** (2018-25)⁴⁹ for reduction of household air pollution. The activities would include:

- working within SREDA's multi-sectoral national coordination mechanism for a whole of government, private sector, Civil Society Organizations (CSO), and NGOs;
- institutionalizing public/private/NGOs' awareness, prevention and control program;
- advocating media coverage of news on health hazards of traditional cooking stoves,
- advertisements on TVs, radios, roadside and hospital, civil surgeon office advertisement, leaflets, dramas and role plays for a sustained national campaign.

One obvious and significant use of ICS would be in **humanitarian and philanthropic cases**. Refugees, migrant and floating people (disaster affected populations etc.) usually rely on firewood for cooking and heating. This results in large scale deforestation in surrounding areas. The relief materials that are distributed to such type of populations do not include firewood, forcing the refugees to cut down trees from government forests. Supply of ICS to these groups will reduce the trend towards deforestation.

Government's **Test Relief (TR) and Food for Works Program** entitled "Kabikha" (*Food in exchange for Work*) is a potential area of introducing ICS. Under the program Government is constructing houses for the hardcore poor (around 800sft brick-built with tin roof) along with attached kitchen and toilets. For 2019, around 22,000 houses are planned to be built and the target for next 5 years is 450,000. Discussions with Ministry of Disaster Management revealed that there are prospects of installing ICS in the kitchens provided cemented floor is not affected by the heat and smoke is flown out of the house through chimneys. Although distribution of ICS through the relief programs might distort the market, this support will be mainly for the poor rural households unable to possess LPG. Subsidy to this segment is thus justified for the sake of clean cooking.

3. Ensuring Level Playing Field for LPG

Government patronage in terms of lower tax rate on LPG plants, tax holidays etc. combined with vibrant private sector desiring to fully exploit the potential of the newly emerged market and sustained demand, has driven LPG to attain a robust growth. LPG attained extraordinary growth in its initial years and now has stabilized with around 8-10% annual growth. One impact of LPG intrusion has been reduction in use of biomass specially crop residues in cooking implying, wood relatively preferred fuel than crop residues are still being used at old levels⁵⁰. Only further LPG expansion can reduce further use of wood as fuel. ICCDR'B study on comparing health effects of LPG based cooking and ICS reveal that the former has significantly lower household air pollution levels in terms of CO and PM. Only thermal efficiency of ICS has been scientifically proven, but health impacts of ICS are insignificant, according to studies conducted by ICDDR, B and all known international research. The poorest households were observed to reveal their preferences for LPG than ICS. The reasons cited by the women belonging to the poorest households in favor of LPGs were user-friendliness, convenience, economy of space, cleanliness, women empowerment, peer pressure etc. They expressed their desires to procure these cooking devices once these are within their purchasing capacities.

Household income in real terms is likely to reach nearly three times higher by 2030. Moreover, LPG supply chain is characterized by longstanding business relationships between importers, distributors and retailers posing LPG as one of the most potential cooking fuel for Bangladesh.

⁴⁹ Developed by NDCP program of DG Health. "Multi-sectoral Action Plan for Prevention and Control of Non-communicable diseases (2018-25)", NDPC, Directorate General of Health, 2018

⁵⁰ UNDP (2019) A Comprehensive Assessment of the Availability and Use of Biomass Fuels for Various End uses with Special Attention to Power Generation under SREP Gen Project of UNDP Bangladesh

Also, Bangladesh is experiencing the highest rate of urbanization in south Asia. Available predictions cite that Bangladesh will have around 50% urban population by 2045⁵¹. Considering semi-urban, peri-urban, rural growth centers or commercial centers linked by all-weather roads, this figure would be around 80% by 2045 or 60-70% by 2030⁵². The LPG sector is likely to grow endogenously along with the momentum gathered so far. Government policy should be one of ensuring level playing field and refraining from market distortions, like providing subsidy to competing fuels, directly or indirectly restricting sector growth etc. It may be noted here that LPG penetration in cooking is 95 per cent in Malaysia; 80 per cent in Thailand and 65 per cent in the Philippines⁵³. In India nearly 80 per cent of Indian households now have access to LPGs, although actual use of the fuel is unclear. The country attained 56 per cent growth within a span of three years. Given the similarity of some of the Indian states and Bangladesh, such phenomenal growth is quite possible.⁵⁴ The current focus placed on LPG by no way should downgrade country's commitment for using renewable energy for cooking solution in the long term. Under this mandate, fossil fuel LPG is only a bridging technology for the period 2020-2030

Based on assessment of the present condition of the LPG sector, following need to be achieved as the sector is posed for rapid growth:

- LPG companies need to have inland shipping vessels for carrying LPG to remote Haor, Baor and coastal areas as far as possible
- ZINC Coating and Powder Painting would be required in cylinders for rust proof in the face of humid climate and exposure to rain.
- LP Gas Cylinder need to be made preferably as per the American Standard Specifications (DOT-4BA-240) using quality raw materials ensuring maximum body thickness, optimum safety during transportation and movement.
- LP Gas cylinders during manufacturing process are made to pass through a series of tests like physical, chemical, tensile, burst, x-rays for maintaining best quality of the product.
- Perfect weight should be guaranteed to the consumers
- LPG cylinders are regularly re-tested and run through proper maintenance procedures
- Date and details of maintenance should be engraved on the body of each cylinder to ensure cylinder safety.
- Consumers need to be aware of the safety protocol in using LPG cylinders.

4. Considering Case for Induction Cooking

Increase in health consciousness, technological advancements, rise in disposable income, energy-efficiency of the cook stove / energy consumption, better safety features, need for specialized cookware, and adoption of smart household kitchen appliances are impacting both Bangladesh and the global household induction cook stove market. In China, residential biomass use has been declining 6% per year since 2010, largely replaced by natural gas, LPG and electricity demand especially in urban areas driven by policy efforts targeting clean cooking.⁵⁵ Given that electricity coverage will be attained by 2030 (both in terms of generation, transmission capacity and reliability) facilitated by Ruppur Nuclear Power Plant (expected to be commissioned by 2024/25), general fascination of people for electricity cooking (as evidenced from possession of rice cookers), target for induction cooking level of Bangladesh for 2030 is set in accordance

⁵¹ CUS, DU (2018) Urbanization in Bangladesh: Recent Trends and Challenges, Professor Nazrul Islam, Centre for Urban Studies, Dhaka University

⁵² It may be noted here that the slogan of the present government is "My Village is My Town" ("Amar Gram Amar Sohor")

⁵³ What's cooking? Indonesia's kerosene to LPG conversion program: Abdul Rahim Abu Bakar and Fariza Hashim VOL. 1 NO. 1 2011, pp. 1-9, Q Emerald Group Publishing Limited, ISSN 2045-062

⁵⁴ The Economic Times, May 8, 2018

⁵⁵ Data for these estimates comes from nationally representative census and surveys in the WHO Household energy database, as well as analysis by IEA (WHO 2017 and IEA 2017)

with findings from middle income Asian countries⁵⁶ as well as target of electricity generated through renewable sources. **Approximately 300,000 households carry out electric cooking**⁵⁷. The following table provides information of government's plan for electricity generation and net capacity. The projected demand by 2030 will be 41,890 MW.

Table 13: Electricity generation and Net Capacity

Year	Additional Generation Capacity (MW)	Total Capacity (MW)	Demand (MW)
2018	4485	18961	13,260
2019	5210	24171	15,041
2020	1547	25718	17,015
2021	4066	29784	19,034
2022	5152	34936	21,193
2023	6497	41433	23,417
2024	7871	49304	25,762
2025	6300	55604	28,231
2026	5300	60904	30,765
2027	3710	64614	33,398
2028	2900	67514	36,106
2029	2000	69514	38,946
2030	4545	74059	41,890

Source: Power Planning Cell, Bangladesh Power Development Board and Annual Report 2018-19 of Power Division

The additional net capacity of generated electricity can easily be used for household cooking purpose and more so if it is generated through renewable sources. This will, however, require, targeted promotion among the consumers and incentive to private sector so that the required induction cooker and cooking utensils can reach the consumers easily.

5. Reducing leakages in natural gas for cooking (technical and financial)

The government has a road map for developing the gas sector into a direction where domestic production is maximized, infrastructure is developed, and import is facilitated. However, there are a number of political decisions and uncertainties. Notably, the results of exploration programs are known after about 6-8 years. By 2023/2024, government will likely to have a much deeper knowledge about the gas potential in the country⁵⁸. However, discussions with informed sources reveal that there are high prospects of lifting natural gas from off-shore drilling sites and other locations that would ensure a growth trend nearly similar to that of the past allowing some expansion of piped natural gas connection to the high rise apartments (considered risky for LPG fuel) in urban, semi-urban and peri-urban areas. Along with this marginal expansion, reducing wastage through installation of pre-paid metering and right pricing of the gas (considering high affordability of prospective consumers residing in metropolitan areas) should go side by side ensuring sustainability of this vital clean cooking fuel.

6. Decision-making on multiplicity of factors rather than on singularity

⁵⁶ World bank (2013): Asia Sustainable and Alternative Energy Program: Case of Indonesia and Department of Energy (2016): Energy Statistics of the Philippines

⁵⁷ Practical Action. (2017). Poor People's Energy Outlook 2017: Financing Practical Energy Access: A bottom-up Approach

⁵⁸ MOPEMR (2017) Gas sector Master Plan, Government of Bangladesh

Household selection of cooking fuels is generally determined by affordability, availability, accessibility, reliability, safety, cultural acceptability etc. and less on health or environmental benefits. Additionally, access to cooking solutions is affected by factors such as variations in type, quantity and quality of fuel used, different cooking practices, and the size of the kitchen and the degree of ventilation, number of persons to be entertained, perception on resultant taste of the food cooked by the fuel in question, climate change impact etc. Different cooking practices like time-bound cooking is achieved with rice cooker whereas slow and diminishing temperature cooking is achieved with pellet /briquette etc. Similarly, climate change impacts like continuous rainfall, foggy weather etc. may limit access to LPG refilling. In essence, access to energy for cooking refers to the usability of the cooking solutions in the context of the various attributes and with an emphasis on end users' experience. In such circumstances, national level decisions may be made by balancing of some positive and negative factors, at least as a transitional measure.

7. **Technology options realization**

During the process of shifting to clean cooking fuels, technological progress, Research and Development are essential to reap benefits in diverse set of sectors like health, environment, cleanliness, carbon emission etc. transforming ICS from the basic to advanced model. Transitional options that can provide some health benefits and significant environmental benefits during the interim period should also be promoted. Current experiments with biogas production, use of palette, briquette, solar energy etc. may be continued. Necessary funding may be solicited mainly from development partners for the purpose.

8. **No regret for fuel stacking (simultaneous use of main and alternative fuel)**

In the near to medium term, diverse kinds of fuels and technologies are likely to be simultaneously used specially in the semi-urban and rural growth centers. This trend would continue so long income levels, certainty of the source, taste perception level of the households do not reach the level which would allow them a dedicated use of a single fuel. In such circumstances, accounting of all alternative uses should be made for balancing supply and demand for planning purposes. It may be noted here that the current practice of simultaneous fuel use is essential for deriving maximum benefits out of the present situation marked by income limitation, uncertainty as well as difficulty in easy access to fuel, perception on taste etc.

9. **Ensuring necessary consumer financing for clean cooking interventions**

Access to financing is a major challenge for the consumers as micro-finance institutions and banks do not provide loans for obtaining clean cooking facilities. As demand for LPG, natural gas and induction-based cooking increase, financing options need to be arranged.

Financing options for clean cooking can range from government to multilateral Banks, bilateral donors, Green Climate Funds etc. The fund can be channeled as loan through Palli Karma Sahayak Foundation (PKSF) or IDCOL, grants to Local Government Institutes (Like Upazila/Union Parishad) through Annual Development Plan and to government's Safety Net Programs like TR, Kabikha etc. through budgetary allocations. The funding for clean cooking per se besides stoves/devices will mainly be required for erecting various types of infrastructure like LPG berths and terminals, storage and depots and procuring LPG transport vehicles; construction of gas transmission and distribution lines and connection to households' kitchens; manufacture of ICS and their transportations to distribution centers. The following table summarizes potential funding sources and users for clean cooking in Bangladesh.

Table 14: Funding Source and Users of Clean Cooking

Clean Cooking Financing Mechanism

Funding Source		Funding Users		
Government	Bilateral partners	MOPEMR (Power Division) for electricity generation (renewable and non-renewable)	Clean Cooking direct Loans to households for capital equipment	Clean Cooking Grants to Institutions
Multilateral Development Banks	Green Climate Funding	Funding projects having clean cooking components like TR Kabikha (Food for Works) Ashrayan (Housing) project of the Prime Minister's Office (PMO)	As part of Income Generating Activities mainly for women by Banks and Financial Institutes	Rehabilitation and emergency situation tackling Grants
SME Crowdsourcing Financing	Other alternative source of financing	Funding Other Livelihood project like Char Development Project etc. belonging to different ministries	Loan to PKSF or IDCOL through Partner NGOs	Tracking, Monitoring and Evaluation of plans and programs and Research and Development activities grant

Source: Compiled by the consultants based on discussion with stakeholders

Access to finance has been a challenge for the private sector to avail short term loans from financial institutes. However, existence of a favorable business prospect for LPG sector may induce more private sector financing for the sector. The sustained increase in per capita income is also expected to provide the necessary thrust for households' self-financing of the various types of cooking devices and /or installation / connection expenditures and payment of running costs. The existing result-based donor financing system for ICS may be strengthened by incorporating actual usage of these equipment by rigorous monitoring, evaluation and periodic performance audit.

10. Provision of proper testing facilities and implementation standards

To ensure safety and quality of cooking fuel and cookstoves, making standard, certification and testing compulsory for all stoves (Biomass, LPG, gas, induction) that are sold in the market will be required. The process should start phase by phase without imposing too much restraint on the current growth momentum. Currently, BSTI does not have proper testing facilities for cookstoves and cooking fuel, but BCSIR has a plan to develop an ISO standard testing facility that BSTI can use through an inter-government agency collaboration. Bangladesh University of Engineering and Technology (BUET) is also likely to be supported from World Bank/ IDCOL project to set up another ISO standard laboratory that can also ensure maintaining of quality standards for cookstoves and cooking fuels.

4.4 Targets and Goals

Strategies detailed out above have implications for targets. The major elements of the strategies are discussed below and accordingly targets are set for alternative cooking systems like ICS, natural gas (piped) connections, LPG, Induction equipment etc. The targets are set for the terminal year of national

action plan that is 2030 and also broken down year-wise and phase-wise (see Annex 4). The baseline data refers to 2019 obtained from relevant organizations.

ICS: ICS target set for 30 million stoves for 2030 (set in CAP 2013) is not achieved. Up to 2019, 2.7 million (less than 10% of the targets) stoves are estimated to be in-situ, actual usage being much less. Several reasons are cited for the failure, most supply-chain activities, which are subsidized, are geared towards sale promotion rather than actual usage by the target population. There are design defects which lacked rectification owing to lack of interest by suppliers as well as the users (as these are not much used). Moreover, with opening of LPG sector, ICS is facing significant competition with LPG. In view of the above developments, ICS sale is planned to be expanded in areas where relatively higher usage rates were achieved in the recent past and secondly these to be spearheaded by NGOs and Partner Organizations identified as successful. Additionally, ICS coverage will include areas excluded by LPG because of profitability considerations (remote, inaccessible, low density households, hard core poor status etc.). Besides, emergency, philanthropic and humanitarian cases as well as households under Government's Test Relief and "Kabikha" program will be attempted to bring under ICS coverage. Considering the overall situation with respect to other cooking options, target of **ICS expansion has been re-fixed to around 16-21 million for 2030** and yearly and phase-wise targets have been set (consistent with "s" pattern growth over the period 2020 to 2030). In ICS promotion, the lifetime of one cookstove needs to be considered (which is 4/5 years) and proper arrangements need to be made for replacements when necessary.

Natural Gas: Natural gas sector is presently besieged with uncertainty regarding supply from existing and potential sources, gas potential from existing and already explored drilling sites and more importantly as its sustainability as a cooking fuel. As such, new gas connection depends on the political decision. In view of the sporadic attempts by government in the past to connect newer urban residential areas, there remains possibility of connecting high rise apartments with piped gas, because of the riskiness of lifting cylinders to higher floors and for obtaining political synergies by reducing grievances of new generation of urban middle class. This possibility is likely to be attained with right pricing of natural gas and simultaneous reduction in system loss through pre-paid metering system, a process which is already underway. Accordingly, piped gas connection is projected to increase in a manner so that present status quo is maintained in the ratio of households with piped gas connection. **The resultant gas connections become 5.5 million in 2030.** This modest expansion in the domestic gas connections should be accompanied by reduction in system loss (0.25% annually) through installation of pre-paid metering system, strong monitoring activities and a performance audit ensuring accountability of the gas supplied.

LPG: LPG is poised to be the main cooking fuel of the country in view of the prevailing conditions both within Bangladesh and globally. National policy makers have expressed publicly in favor of LPG. The main reasons for depending on LPG seem to arise from (i) uncertainty regarding sustainable supply of locally available natural gas, (ii) existence of private sector that established strong supply and value chain in importation, distribution and retailing and (iii) its' user-friendliness, accessibility, financial affordability, economy of space, cleanliness and reduction of household air pollution, women empowerment capacity, peer pressure elements etc. In view of the above-mentioned favorable demand, supply factors and government policy support, the sector is currently expanding at around 8-10% annually. Given that household income in real terms is likely to reach nearly three times higher by 2030 and that households living in urban, semi-urban, peri-urban, rural growth centers or commercial centers linked by all-weather roads is likely to be around 60-70% by 2030, **LPG target for 2030 is set at 23-27 million which is around 55-65% of total households at that time.**

Induction Cooking: People, especially those from the rural areas are found to exhibit preference for rice cookers. It is a common sight in Bangladesh that migrant laborers when returning from abroad bring rice cookers along with other things. This is in sharp contrast to the past when they used to bring blankets. Rice cookers are also widely available, even in the rural markets. Preference for rice cookers and for induction cooking equipment has increased sharply with nearly 94% electricity coverage in the

country including those in the rural areas. Induction cooking is allowing rural women to devote more time for care of the family members because of their automated nature. Other reasons favoring a shift towards induction cooking were rise in disposable income, better safety features, smoke-free environment and increase in health consciousness, etc. Given that quality electricity coverage will be attained by 2030 facilitated by Ruppur Nuclear Power Plant (expected to be commissioned by 2024/25) and that 10% of electricity generation will be from renewable sources by 2021, **induction cooking target is set at 7.5% of households for 2030.**

A linear trend line of different fuel for cooking based on data from 2012 to 2018 from Sample Vital Statistics Report of Bangladesh Bureau of Statistics also generates very similar projection up to 2030.

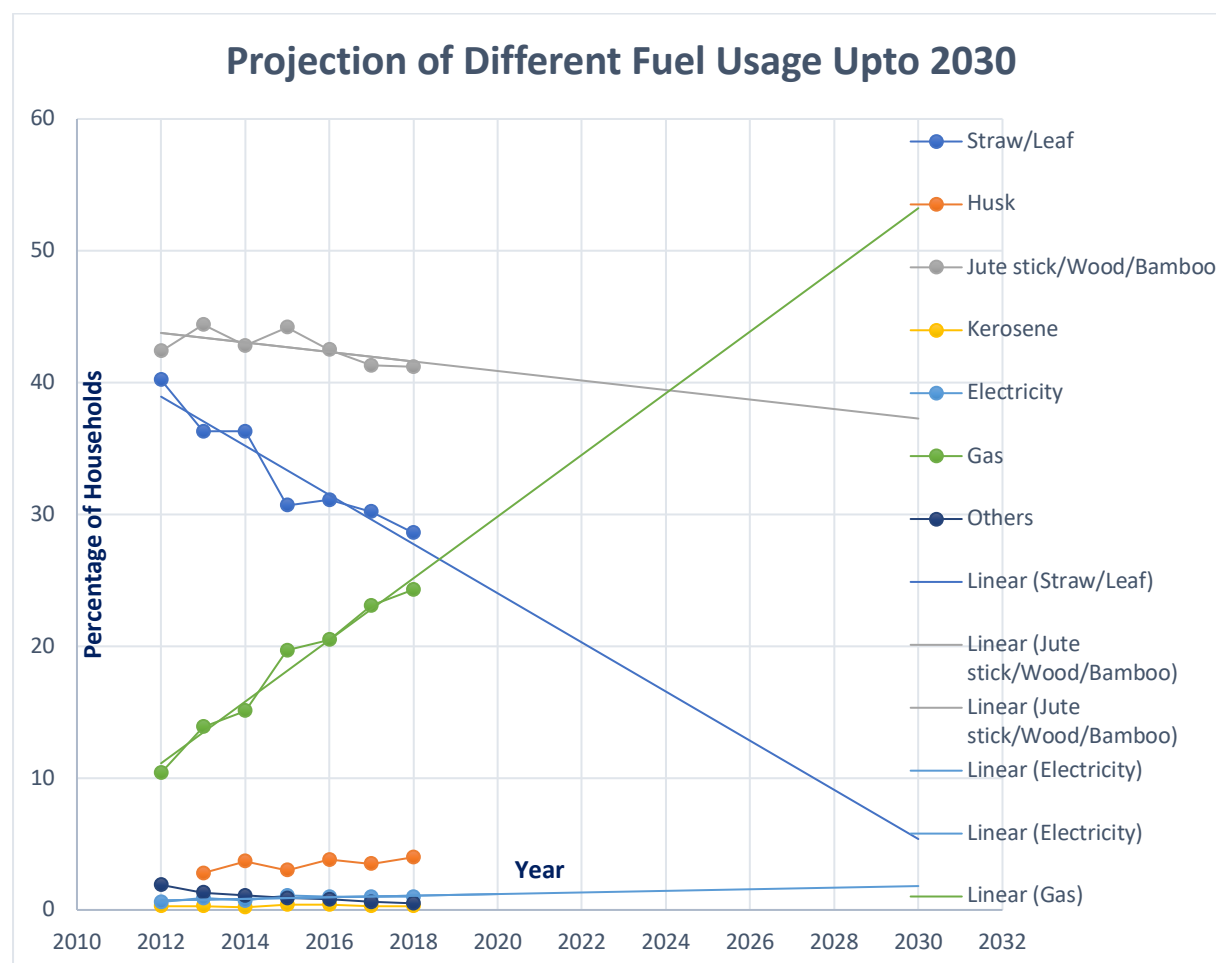


Figure 5: Projection of Different Fuel Usage using Linear Trend line

Based on the implications of the strategies detailed out above, targets for different clean cooking technology are chalked out considering the overall achievement of clean cooking in Bangladesh by 2030 in line with SDG target and Government of Bangladesh aim. Following section shows targets and goals for terminal year i.e., 2030 showing the nature of transition year and phase-wise. The year-by-year target from 2020/21 to 2029/30 is provided in the annex.

Table 15: Targets for Different Cooking Technologies

Cooking Fuel Alternatives	Actual 2019/20	Target 2029/30
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Type of Fuel	Type of Clean Cooking Technology	Number in situ (million)	Percentage of total households (Total 39 million) 2019/20	Number in situ (million)	Percentage of total households (Total 42 million) 2029/30
Biomass	Traditional Stoves	29	74	-	-
	ICS	2.7	7	16-21	38-50
Other (Renewable, Pellets/ Briquette/Bio gas etc.)	Different Stoves	0.1	-	1.0	2-3
Fossil Fuel (Natural Gas, LPG)	Natural Gas Stoves	4.4	11	5.5	13-14
	LPG Stoves	3.3	9	23-27	55-65
Mixed	Induction & electricity (Rice cooker)	1.0	2	3-4.5	8-10
	Total	40.5	103%	48.5-59	115- 140%

5. Implementation of Action Plan

5.1 Activities to achieve targets of clean cooking national action plan

Terminal year of the NAP is 2030 covering a total of 10 years which has been divided in **three phases** (2020-21: Initiation and start-up, 2021/22- 2024/25: second and review phase and 2025/26-2029/30: third and evaluation cum way forward phase). All the action plans under the nine thematic areas will be implemented in these three phases. Majority of the activities need to be initiated in 2020/21 and then agreed upon with other implementing partners. For implementation, cross cutting issues are addressed under the areas where they fit most. Detailed time plan for implementing the activities is shown in the following table.

Table 16: Description of activities, Time frame /Milestones, Indicator and Organizations Involved

Activity 1: Playing Leadership Role							
Achieving clean cooking goal will require strong centralized leadership of a Government body for enacting regulations, guidelines and policies.							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Assigning Leadership Role	MOPEMR should establish itself as an inclusive multi-sectoral coordination body at national level covering entire government, private sector and non-government agencies	Identifying major player and one or more implementing partners from other sectors in each of the activities of the Action Plan and coming into a MOU or agreement of the role to be played	High	MOPEMR	2021/22	All Agreements/Understanding /MOU between major player in the Action Plan and one or more implementing partners (like with MOH /NDCP for sound implementation of HAP control, use of government doctors etc.in awareness drives, with MOEFCC regarding joint collaboration on carbon rewarding activities, with Ministry of Industries/ Commerce on standards and certification etc.; with Ministry of Ports and Shipping for permitting separate LPG terminals in the forthcoming deep sea port etc.	MOPEMR/ SREDA

	Developing SREDA as a knowledge hub on clean cooking	Developing and regularly updating an inter-operative web portal with information, knowledge and lessons learnt locally, regionally and globally				Agreements /Targets finalized within 2021/22 and monitored accordingly. An Inter-operative Web portal operational having provisions for user feedbacks and recording users.	
Activity 2: Building Enabling environment Enabling environment required for addressing clean cooking in all national policies, creating a functional and sustainable national platform and opening up windows for funding of the state-of-the-art facility for testing and certification of ICS etc.							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Development of an Enabling Environment	MOPEMR to play centralized leadership role for obtaining cross-sector cooperation regarding technology, price and tariff, financing, technical assistance, standards and regulations etc.	Facilitate introduction of new technologies and transfer of existing technologies like carbon reward, pellet/briquette production etc.	High	MOPEMR/MOEFCC			MOPEMR/ SREDA
		Carry out feasibility of bioethanol, biogas production activities in the light of recent experience in neighboring countries.	Medium	BCSIR BUET. Private and NGOs etc.	Every year Mid Plan Review - 2024/25 Evaluation	Clean cooking sector enjoys full cross-sector cooperation, technology transfer, standardization and necessary technical assistance in all important and strategic areas.	
		Start standardization and testing of all types of cooking stoves and Fuel cylinders.			2029/30		

		Establishing cook stove, Fuel cylinder testing and knowledge center for laboratory and field testing	Medium	BSTI, Dept. Of Explosives, BCSIR, BUET			
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Activity 3: Awareness building and dissemination							
Awareness building is essential for convincing households spread out in accessible areas with limited social networking of the many beneficial aspects of ICS.							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priorit y	Organizati ons Involved in Implemen tation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Awareness Building and Dissemination	Sustained and large-scale public awareness campaign involving multiple actors.	Behavioral change is one of the main hurdles towards adoption of ICS and therefore existing users, preferably housewives should be used for dissemination of the cooking stove.	High	MOPEMR/ IDCOL/ BBF/ Other NGOs/PO s	Every year Mid Plan Review - 2024/25	Major impediments of new technology adoption eased: Housewives regularly practicing ICS should be involved in dissemination drives, field-days, role plays dramas etc. held in every Unions twice a year	MOPEMR
		Present study found health benefits to be least convincing to the users. Therefore, Health workers, physicians may directly convince the users about the danger of traditional stoves, especially on the babies and children. Use of posters, leaflets, flyers, role-play dramas etc. ⁵⁹	High	MOHFW/ NDCP, Civil Surgeons and NGOs		Health workers, physicians working in outreach community clinics providing counseling to the women about the health consequences of traditional cooking whenever they come together.	

⁵⁹ Non-communicable Disease Control Program of Directorate General of Health under Ministry of Health and Family Welfare has already developed "Multi-sectoral Action Plan for Prevention and Control of Non-communicable diseases (2018-2025).

		Incentivizing NGO fieldworkers involved in installing ICSs for combating high turn-over Bring about necessary design modifications in ICS already supplied and provide training on maintenance so that there are no aggrieved households. Design a reward system for champions involved in the value chain starting from awareness building, achieving behavioral change, production, retailing, post-sale services etc. in any of the clean cooking areas proposed in the action plan	High High High	IDCOL, BBF. Others and NGOs/POs IDCOL, BCF. Others and NGOs/POs MOPEMR	Evaluation 2029/30 Every year Mid Plan Review - 2024/25 Evaluation 2029/30	Posters are exhibited in district and community satellite clinics, Upazila and district level government hospitals. displaying adverse consequences of traditional cooking Maintenance training provided and design limitations corrected within 2021/22	
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Bangladesh needs to honor the commitment of zero emission to international community with respect to climate change, SDGs etc.							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Vision and Commitment	Existing Smoke Free kitchen by 2030 commitment is fully implemented.	Replace 30 million traditional cook stoves by ICS (Continue mostly in successful areas and remote areas unlikely to be attractive to private LPG sector)⁶⁰ Existing results-based incentives, and a monitoring and verification (M&V) system—supported by institutional strengthening/capacity building and awareness-raising campaigns need to continue by existing and new organizations.	High	SREDA IDCOL BCF Others NGOs/ POs	30 million ICS by 2030	No. of ICS installed @ 10% annual growth initially, then increasing maximum to 25% and later on tempering-off to 8 % following an s-curve pattern (combined effect of per capita income and adoption rate) : 2020/21. 3.0 million 2021/22 3.8 million 2022/23. 4.5 million 2023/24 5.7 million 2024/25. 7.3 million 2025/26 9.5 million 2026/27. 12.0 million 2027/28	MOPEMR/ MOEFCC/ SREDA
	Expansion to various niche markets.	Present carbon reward system needs to be expanded whether done locally or in joint collaborations. Expansion of ICS program in refugee camps, rehabilitation centers of floating population and post-disaster relief centers.			Nonlinear/ Technology Diffusion / s-curve target fixation Target to be achieved by Simultaneous achievement in LPG, Gas and Induction cooking targets		

⁶⁰ EnDev funded Bondhu stoves totaled 2 million by 2019. BBF has a target of 6 million additional stoves by 2024.

						15.5 million	
						2028/29. 17.8 million	
						2029/30 19.2 million	

Activity 5: Sustained Policy Support for LPG							
The sector is poised for a robust growth given the continuation of policy support by government. The existence of mutually reinforcing demand factors supporting supply-side business development condition lends belief to its sustained growth over the long term. Safe and secured LPG cooking spreads to all areas of Bangladesh except remote areas unjustified by private sector viability							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Private sector led Market Propagation	Sustaining existing promotional policy with respect to LPG plants	Covering 55-65% of the households by 2030	High	MOPEMR, Ministry of Commerce, Ministry of Finance, Ministry of Ports and Shipping		LPG growth @ 10% annual growth initially, then increasing maximum to 25% and later on tempering-off to 8 % following as-curve pattern (combined effect of per capita income and adoption rate):	MOPEMR/ SREDA
	Government to ensure overarching environment for a successful private sector led growth without hindrance and distortions of the market.	Ensuring quality control and adherence to standards, verification of results and procedures. 100% coverage by 2030	Medium			2020/21. 3.6 million	
	Removing shipping hurdles and reducing its cost through early establishment of deep seaport along with LPG berthing facility	Shipping cost to be reduced through creation of berthing facility for large sized ships, dedicated LPG landing sites, - Deep sea port by 2024	High			2021/22 4.2 million	
					Every year	2022/23. 5.0 million	
					Mid plan Review 2024/25	2023/24 6.8 million	
				Evaluation	2024/25.		

					2029/30	8.9 million	
						2025/26 11.6 million	
						2026/27. 13.9 million	
						2027/28 18.0 million	
						2028/29. 22.50 million	
						2029/30 23.0 million	

Activity 6:

Consideration for Induction Cooking

Considerations to households' choice of modern induction cooking devices in view of health consciousness, convenience, temperature fluctuation and fine –tuning, cleanliness, space economization as practiced in Asian and other countries

Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Households to use induction cooking	Replacing use of biomass fuel whether traditional or ICS by a set of modern cooking devices including induction cooking. Induction cooking are preferred globally for health consciousness, technological advancements, better safety features, etc.	Covering 2%-3% of households by 2024/25 in accordance to consumer preference and usage in other Asian high middle-income countries. Market should be the guiding factor. Covering 3%-5% of households by 2029/30 in accordance to consumer preference and usage in other Asian high middle income countries. Market should be the guiding factor.	Medium	MOPEMR Ministry of Commerce National Board Of revenue data	2020/21-2024/25-(Review) 2029/30	No. of Induction Cooking devices supplied @ 10% annual growth initially and then tempering-off to 8% following s-curve pattern: 2020/21. 1.1 million 2021/22 1.21 million 2022/23. 1.33 million 2023/24 1.47 million 2024/25. 1.6 million 2025/26 1.7 million 2026/27. 1.8 million 2027/28 1.09 million 2028/29. 2.1 million	MOPEMR/ SREDA

						2029/30 2.2 million	
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Activity7: Reducing Leakages in Natural Gas for Cooking (technical and financial)							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Reducing Leakages of natural Gas in cooking	Reducing wastage of natural gas is needed as the source is non-renewable Right pricing is justified should go side by side for ensuring sustainability of this vital clean cooking fuel.	Present system loss (technical and financial) of around 12-14% for household gas connections should be lowered to 10% by 2029/30 Present system loss (technical and financial) of around 12-14% for household gas connections should be lowered to about 8% by 2029/30	High	Petro Bangla	2020/21-2024/25-(Review) 2029/30	Applicable for all Gas Distribution Companies Reduction @ 0.25% every year	MOPEMR/S REDA

Activity 8: Supporting present trend of Fuel Stacking (main and alternative fuel usage) This trend would continue so long income, certainty of the source, taste perception level of the households do not reach the level which would allow them sole use of one fuel							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Households to possess alternative fuels	Supporting Households' holding of diverse kinds of fuels and technologies simultaneously specially in the semi-urban and rural growth centers.	Full accounting of all alternative uses should be considered for balancing supply and demand for planning purposes. Alternative fuel use is essential for deriving maximum benefits out of the present situation marked by uncertainty of income, difficulty in access to fuel, perception on taste etc.	Low	SREDA	2020/21-2024/25- (Review) 2029/30	Semi-urban and rural growth and commercial centers	MOPEMR/SREDA

Activity 9: Data Collection to Strengthen/Modify Other Activities Impact assessment for examining whether reduction in HAP is contributing to reduced health cost or better environment							
Type of Activity	Detail Activities	Sub-Actions/Milestones	Priority	Organizations Involved in Implementation	Timeline for Implementation and Monitoring	Indicator/ Guideline for evaluation	Organization Responsible for Achievement of Outcome/ Output
Household Air Pollution is addressed	Household air pollution reduction should lead to less diseases and require less time from the health professionals, thus reducing health expenses by households. MOHFW can track this and suggest necessary change in the course of action	Continuous awareness building combined with dissemination of success stories and benefits of clean cooking Tracking the achievement of targets as per the national action plan	Medium	Ministry of Health	Every Five Year	Estimating Percentage reduction in health expenses and time spent on family care by parents	MOPEMR/SREDA

5.2 Investment and Funding Requirement

Investment made by different government, donor and private organizations for initiatives under the Country Action Plan 2013 was not available. We estimated the investment requirement (consumer financing, institutional investment funding requirements (public and private) and subsidy elements (government and donor financed) for different types of clean cooking solutions for the implementation of the National Action Plan in the following table. It includes household expenditure on ICS, LPG cylinders and stoves, gas stoves and cost of piped gas connections, induction cooking equipment as well as dedicated electricity connections by different government companies on transmission and distribution lines on pro-rata basis financed through Government's Annual Development Programme (ADP) and subsidy elements as a part of the household expenditure for ICS. The table shows that total investment requirement for achieving clean cooking target by 2030 is between BDT185.7-219.8 billion in 2019-20 prices. The estimated cost is dependent on the current prices charged for the stove/device and connection costs, investment costs and subsidy elements. In terms of US\$, the total estimated cost turns out to be more than US\$ 2 billion over 10 years.

Table 17: Estimated Cost for Achieving Clean Cooking

Type of Intervention	Estimated Unit Cost (average) BDT	Estimated Additional Number of Units for Installation During Action Plan Period	Estimated Total Cost over Plan period (billion BDT)	Remarks and Source of Financing and Information
ICS (stoves plus installation) IDCOL and BBF	1000	16-21 (million units)	16-21	Private Households and subsidized
ICS manufacturing Plants	1,000,000	1,000 (units)	1.0	Discussion with manufacturers
Natural Gas Connection from secondary distribution lines and Stove etc.	5000	1.1 (million units)	5.5	Public Cost sharing by Households receiving connection from secondary distribution lines.
Cost of Transmission and Distribution Lines	-	-	24.0	Petro Bangla budget estimate (2017-18) segregated for household sector (20%)
LPG Stove and cylinder	5000	23-27 (million units)	115 -135	Private Households
LPG plants, berths, terminals, transport vehicles, inland vessels etc.	2000,000,000	20	40.0	Discussion with private sector importers
Induction Device plus connection and fittings	3000	1-2 (million units)	3-6	Private Households
Other (Renewable)	3000	0.9 (million units)	2.7	Private Households
Grand Total			206.5-233(US \$ 2.4 – 2.7 billion)	Calculated @Tk85 per US Dollar

5.3 Monitoring and Evaluation

Following table will be used for measuring the progress of targets and activities mentioned in the National Action Plan. Detailed monitoring plan following this framework against each of the activities and sub-activities need to be developed in the initiation phase of the plan. The concerned ministries mentioned will give specific agency responsibility to carry out specific tasks. **The monitoring and resulting corrective action were not strong for the Country Action Plan 2013 and it is very important that this monitoring framework is followed to ensure successful implementation of the activities for the achievement of the milestones and targets.**

Table 18: Monitoring Framework of the Clean Cooking National Action Plan

Type of Targets and Goals	Verifiable Indicators	Periodicity of Monitoring/ Time of Monitoring	Organization responsible for submitting report	Organization Preparing Monitoring Report
Goal of Leadership Role	All Agreements/Understanding /MOU between major player in the Action Plan and one or more implementing partners finalized. (number of Agreements/MOUs identified during initiation phase 2020-21 and the content of agreement)	Yearly	MOPEMR	MOPEMR
	An Inter-Operative Web portal operational (Data collection, posting, retrieving activated)	2021/22	MOPEMR	MOPEMR
	Clean cooking sector enjoys full cross-sector cooperation, technology transfer, standardization and necessary technical assistance. (Number of cross sector cooperation, technology transfer, standardization of product, technical assistance identified during initiation phase 2020-21)	2021/22 2024/25- (Review) 2029/30	MOPEMR	MOPEMR
	Awareness campaign launched (Number of TV ads, Newspaper ads, posters, leaflets, flyers	2021/22	MOPEMR	MOPEMR

Type of Targets and Goals	Verifiable Indicators	Periodicity of Monitoring/ Time of Monitoring	Organization responsible for submitting report	Organization Preparing Monitoring Report
	identified during initiation phase 2020-21).			
	Health campaign carried out (identified during initiation phase 2020-21.	2024/25-	Ministry of Health/ DGHS	MOPEMR
	Incentivizing NGO outreach workers for control of high turn-around (Number of NGOs identified during initiation phase 2020-21)	(Review)	PMO	MOPEMR
	Rewarding Champions (Guidelines finalized through stakeholder consultation identified during initiation phase 2020-21 and continued yearly)	2029/30	MOPEMR	MOPEMR
Role of International Commitment	Replace 30 million traditional cook stoves by clean cooking options. Existing results-based incentives, and a monitoring and verification (M&V) system—supported by institutional strengthening/capacity building and awareness-raising campaigns need to continue Present carbon reward system needs to be expanded.	Up to 2029/30	SREDA/ IDCOL/BBF	MOPEMR
Facilitation of LPG propagation by Private sector	Covering 55-65% of the households by 2030 Annual average Ensuring quality control and adherence to standards, verification of	Every year Mid-plan review in Evaluation 2024/25- Every year	Ministry of Shipping/Energy Division/ Private LPG Companies	MOPEMR

Type of Targets and Goals	Verifiable Indicators	Periodicity of Monitoring/ Time of Monitoring	Organization responsible for submitting report	Organization Preparing Monitoring Report
	results and procedures. 100% coverage by 2030 Shipping cost to be reduced through creation of berthing facility for large sized ships, dedicated LPG landing sites, - Deep sea port by 2024	Mid-plan review in 2024/25 Evaluation 2029/30		
Showing considerations to Households' choice for induction cooking	Replacing use of biomass fuel whether traditional or ICS by a set of modern cooking devices including by Induction cooking. Induction cooking are preferred globally for health consciousness, technological advancements, better safety features, etc. (2-3% by 2024/25 and 3-5% by 2029/30)	Every year Mid Plan Review 2024/25 Evaluation 2029/30	MOPEMR/ Private Companies	MOPEMR
Reducing Leakages of natural Gas in cooking	Reducing wastage of natural gas is needed as the source is non-renewable (Loss reduced to 10% by 2024/25) (Loss reduced to 8% by 2029/30) Right pricing should go side by side for ensuring sustainability of this vital clean cooking fuel.	2024/25- (Review) 2029/30	MOPEMR	MOPEMR

Annexes

Annex 1: Methodology

Approach Followed:

Clean cooking as a transitional solution, is attempted to be defined as any improvement in fuel efficiency, emissions, household air pollution, durability, safety etc. than traditional cooking as mentioned in ISO adopted BDS standard. However, improvement in the basic model will continue throughout the action plan period so that a more robust definition of clean cooking can be adopted.

Methodology

Following steps were followed in arriving at the National Action Plan for Clean Cooking: Bangladesh for 2020-2030(Figure 1).

FGD and KII of Households Involved in Clean Cooking
Bilateral meeting with Policy makers in different relevant ministries
Meeting with Suppliers of Clean Cooking Fuel
Bilateral meeting with Health related Organizations
Meeting with agencies connected with retail sale of cooking Fuel
Meeting with Manufacturers of Cooking Stoves
Bilateral meeting with Regulations and Standards Institution
Bilateral meeting with Donor Agencies
Meeting with agencies involved in Technological development and R & D
Meeting with agencies connected with Behavioral change
Sharing of Progress with SREDA and Global Alliance for Clean Cooking
Preparation of Draft Report
Validation of Report
Finalization of the Report

Formulation Process of Country Action Plan for Clean Cooking

FGD and KII with households using various types of fuel, suppliers of fuel, promoters and manufacturers of improved cooking stoves, health specialists, donor agencies, and policy makers belonging to different ministries of the government were done. A checklist was prepared so as to appraise current status, need for improvement and goal to be set for the terminal year of the country action plan namely 2030 was prepared. Feedbacks from the meetings with SREDA were incorporated in the compiled version. The draft report, feedbacks and suggestions were discussed and analyzed in-depth. The draft version of the Country Action Plan was shared with professionals before finalization.

Annex 2: Relationship between Biomass fuel and sale of Improved Cooking Stoves (ICS)

We received data on the installations of Improved Cookstoves by IDCOL and Bondhu Foundation. We got the data for “supply of biomass” from SREDA’s “Compilation of data of total supply and demand of biomass fuels for the base year 2015 and Future Projections up to 2040” report. The data received is presented below.

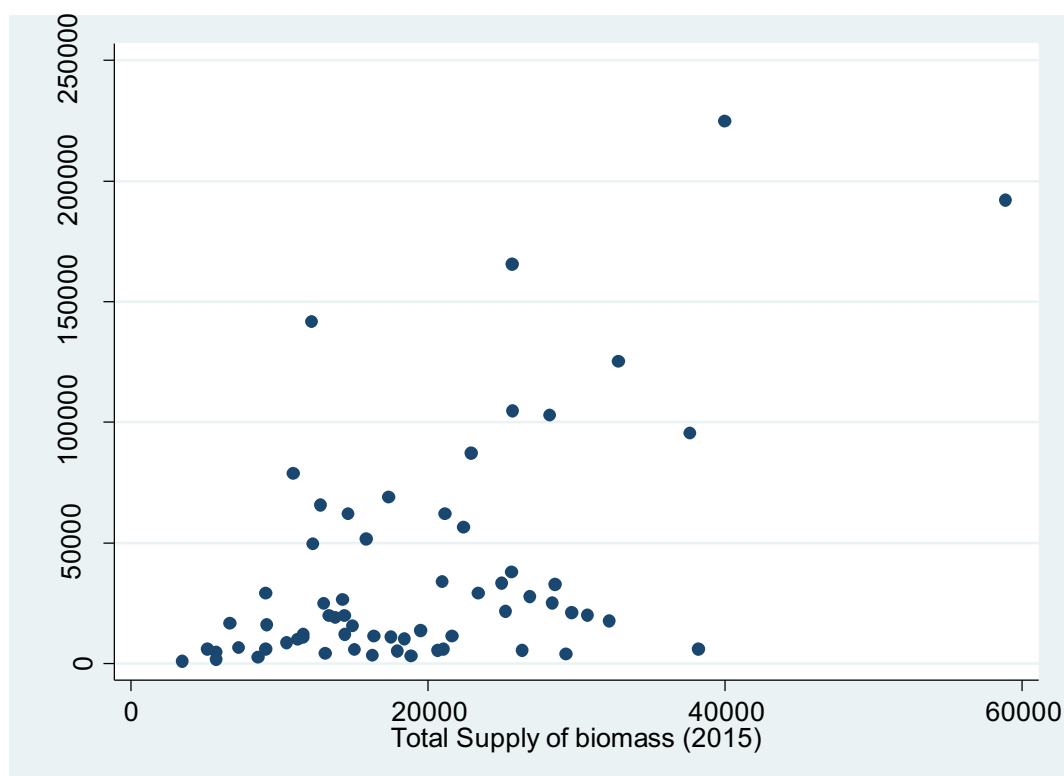
Division	District	Submissions of IDCOL (2015-February, 2019) - Number	Submissions of BBF (2015-2018) - Number	Total of IDCOL and BBF Submissions - Number	Total Supply of biomass in Tera joules (2015)	Total Excess of biomass in Tera joules (2015)
	1	2	3	4 (2+3)	5	6
Barisal	Barguna	23,503	5,394	28,897	9,082	4,212
	Barisal	50,723	11,244	61,967	21,178	9,865
	Bhola	0	10,923	10,923	17,546	9,013
	Jhalakathi	14,465	2,100	16,565	6,680	3,186
	Patuakhali	3,292	6,748	10,040	18,443	10,789
	Pirojpur	9,697	6,156	15,853	9,177	3,460
Chittagong	Bandarban	721	739	1,460	5,770	3,993
	Brahmanbaria	5,837	9,455	15,292	14,957	3,827
	Chandpur	7,949	11,689	19,638	14,385	3,813
	Chittagong	12,354	21,221	33,575	21,007	-5,678
	Comilla	6,294	18,538	24,832	28,423	8,823
	Cox's Bazar	48,763	16,781	65,544	12,821	3,441
	Feni	0	8,604	8,604	10,526	5,286
	Khagrachhari	576	5,784	6,360	7,289	4,321
	Lakshmipur	1,542	8,160	9,702	11,262	3,232
	Noakhali	63	5,605	5,668	15,070	2,383
	Rangamati	0	4,633	4,633	5,780	2,979
	Dhaka	5,756	6,148	11,904	11,632	-23,064
Dhaka	Faridpur	1,932	19,487	21,419	25,261	15,333
	Gazipur	3,576	7,156	10,732	11,656	-4,256
	Gopalganj		12,033	12,033	14,448	8,861
	Kishoreganj	2,232	3,506	5,738	21,070	7,303
	Madaripur	242	3,774	4,016	13,117	7,615
	Manikganj		3,111	3,111	16,312	9,600
	Munshiganj		5,709	5,709	5,178	-1,159
	Rajbari	17,456	7,249	24,705	13,019	7,565
	Shariatpur	925	1,539	2,464	8,566	3,018
	Tangail	19,610	8,103	27,713	26,905	7,415
	Narayanganj	166	672	838	3,503	-8,876
	Narsingdi	27	5,723	5,750	9,088	-711
Mymensingh	Mymensingh		5,896	5,896	38,235	12,492
	Jamalpur	5	3,658	3,663	29,329	15,851
	Netrokona		5,411	5,411	26,406	15,467
	Sherpur	6,629	4,450	11,079	16,381	8,664
Khulna	Bagerhat	124,485	17,128	141,613	12,212	7,912
	Chuadanga	9,790	7,750	17,540	32,262	6,820
	Jessore	82,065	20,806	102,871	28,235	15,227

	Jhenaidah	158,277	7,044	165,321	25,700	10,056
	Khulna	6,801	19,487	26,288	14,256	11,994
	Kushtia	89,190	15,468	104,658	25,752	11,478
	Magura	49,761	12,113	61,874	14,646	4,625
	Meherpur	13,018	65,544	78,562	10,958	3,825
	Narail	8,179	11,587	19,766	13,345	3,740
	Satkhira	23,261	45,525	68,786	17,377	10,714
Rajshahi	Bogra	215,262	9,339	224,601	40,027	19,692
	Joypurhat	39,869	9,450	49,319	12,280	5,803
	Naogaon	82,896	12,467	95,363	37,698	15,500
	Natore	76,721	10,421	87,142	22,955	13,565
	Chapai Nawabganj	37,232	14,242	51,474	15,862	8,495
	Pabna	12,019	9,030	21,049	29,689	13,512
	Rajshahi	48,786	7,465	56,251	22,417	15,514
	Sirajganj	24,959	7,720	32,679	28,568	16,168
Rangpur	Dinajpur	176,156	15,777	191,933	58,957	16,982
	Gaibandha	26,469	11,285	37,754	25,634	14,666
	Kurigram	5,379	5,758	11,137	21,643	11,826
	Lalmonirhat	22,742	6,095	28,837	23,419	6,727
	Nilphamari	23,336	9,733	33,069	25,000	9,626
	Panchagarh	7,844	5,631	13,475	19,547	5,790
	Rangpur	113,262	11,883	125,145	32,852	17,193
	Thakurgaon	14,727	5,276	20,003	30,766	8,086
Sylhet	Habiganj		5,229	5,229	20,707	9,388
	Moulvibazar	14,758	4,068	18,826	13,804	9,288
	Sunamganj	149	2,645	2,794	18,875	9,934
	Sylhet	30	5,086	5,116	17,958	11,943
	Total	1,751,758	648,451	2,400,209	1,232,903	

A correlation was ran to assess the relationship between installation of stoves by IDCOL and BBF with total supply of biomass in 64 districts of Bangladesh. The “Addition of IDCOL and BBF submissions” variable took into account of all the installations by IDCOL from 2015 to February, 2019 and all the installations of BBF from 2015 to 2018.

	additi~s tot~2015	
additionof~s	1.0000	
totalsu~2015	0.5383	1.0000

From the above table, it can be seen there is a moderate positive correlation between “Addition of IDCOL and BBF submissions” variable with “Total supply of biomass fuel” variable. A positive correlation means if Total supply of biomass fuel increases then there is a moderate chance of increase in IDCOL and BBF installments. Similarly, a decrease in biomass supply will lead to a moderate decrease in IDCOL and BBF installments.



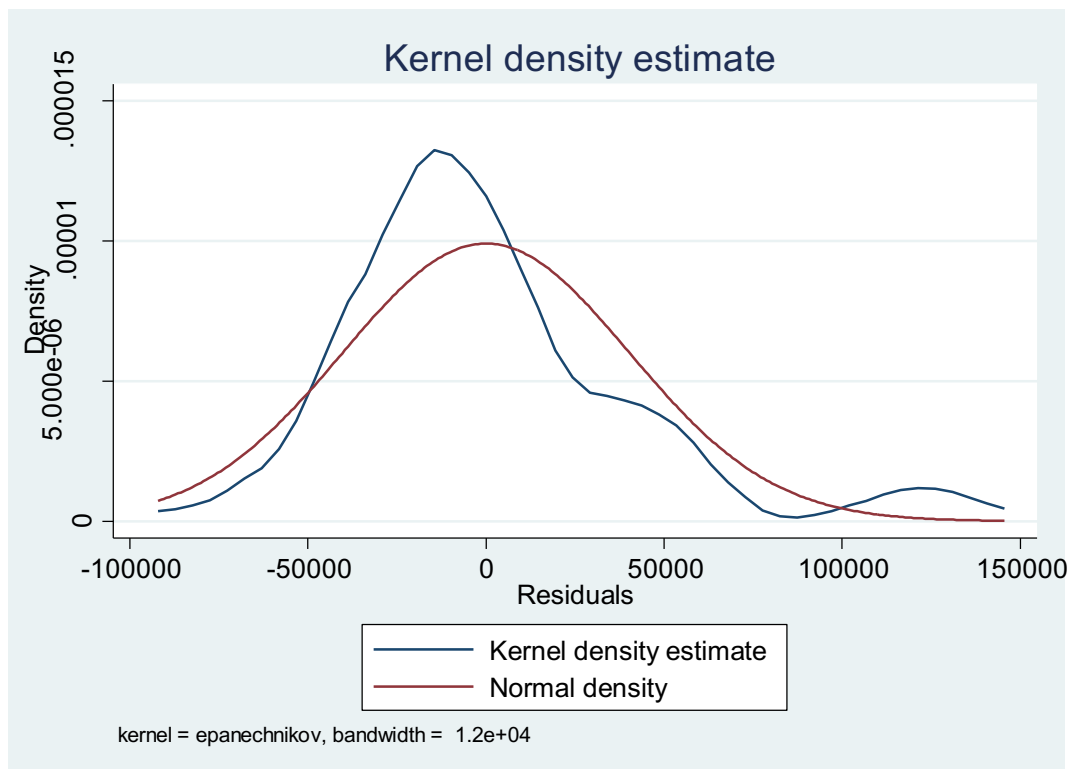
The distribution of the points suggests a positive relationship between Total supply of biomass and IDCOL & BBF installments.

Source	SS	df	MS	Number of obs = 64		
Model	4.1669e+10	1	4.1669e+10	F(1, 62) = 25.30		
Residual	1.0213e+11	62	1.6473e+09	Prob > F = 0.0000		
				R-squared = 0.2898		
				Adj R-squared = 0.2783		
Total	1.4380e+11	63	2.2826e+09	Root MSE = 40587		

additionofi~s	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totalsup~2015	2.566848	.5103654	5.03	0.000	1.546642	3.587054
_cons	-11944.77	11063.56	-1.08	0.284	-34060.52	10170.98

To check the significance between the two variables we ran an OLS regression test with *installments by IDCOL and BBF* as dependent variable and *Total supply of biomass* as independent variable. The coefficient can be interpreted as; ceteris paribus, an increase in 1 Tera joule of total supply of biomass fuel will increase stove installments by IDCOL and BBF by 2.56. As the p-value is less than 0.05 i.e. value of 0.00, it is statistically significant.

The R-square value shows the percentage of the model represented by the regression and the Adjusted R-square values shows the goodness-of-fit model adjusted by numbers of terms. The table shows only 27.83% of the model is explained through this regression.



Normality of residuals is required for valid hypothesis testing. By using *kdensity* command in STATA a normal distribution graph was generated. Although it doesn't actually represent a normal distribution, the residuals follow a close resemblance indicating validation of the hypothesis testing.

	additi~s tot~2015	
additionof~s	1.0000	
totalsu~2015	0.5383	1.0000
	0.0000	

This figure shows Pearson's correlation test between the two variables. Like the previous correlation result, it shows a moderate positive relation between the two variables. The p-value is 0.00, which is below the 5% interval level indicating statistical significance. However, outliers as shown in scatter-plot diagram and missing values due to IDCOL's lack of operations in certain districts might dispute the result of Pearson's correlation test.

Division-wise correlation between stove installments and total supply of biomass fuels

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.389802205	1

Figure: Correlation between installments in **Barisal Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.3434847	1

Figure: Correlation between installments in **Chattogram Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.662209596	1

Figure: Correlation between installments in **Dhaka Division** and Total supply of biomass fuel

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>

Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	-0.999945041	1

Figure: Correlation between installments in **Mymensingh Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.308230447	1

Figure: Correlation between installments in **Khulna Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.226259075	1

Figure: Correlation between installments in **Rajshahi Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
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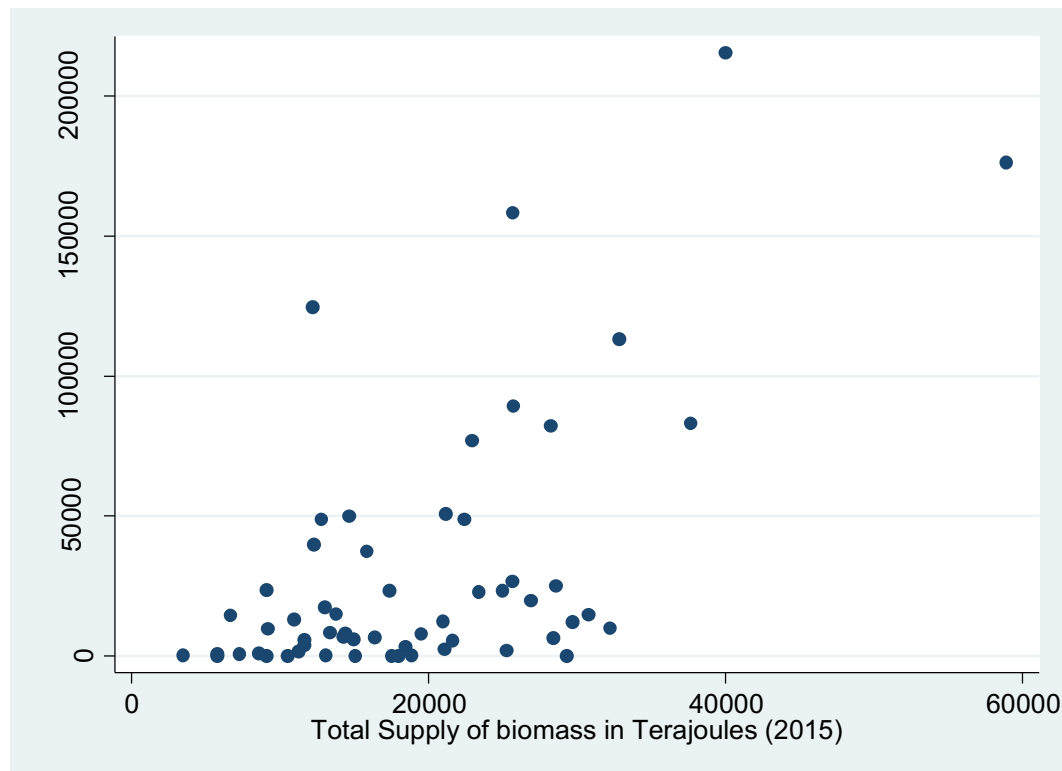
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.722665266	1

Figure: Correlation between installments in **Rangpur Division** and Total supply of biomass

	<i>Addition of IDCOL and BBF Submissions</i>	<i>Total Supply of biomass in Tera joules (2015)</i>
Total of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	-0.999348739	1

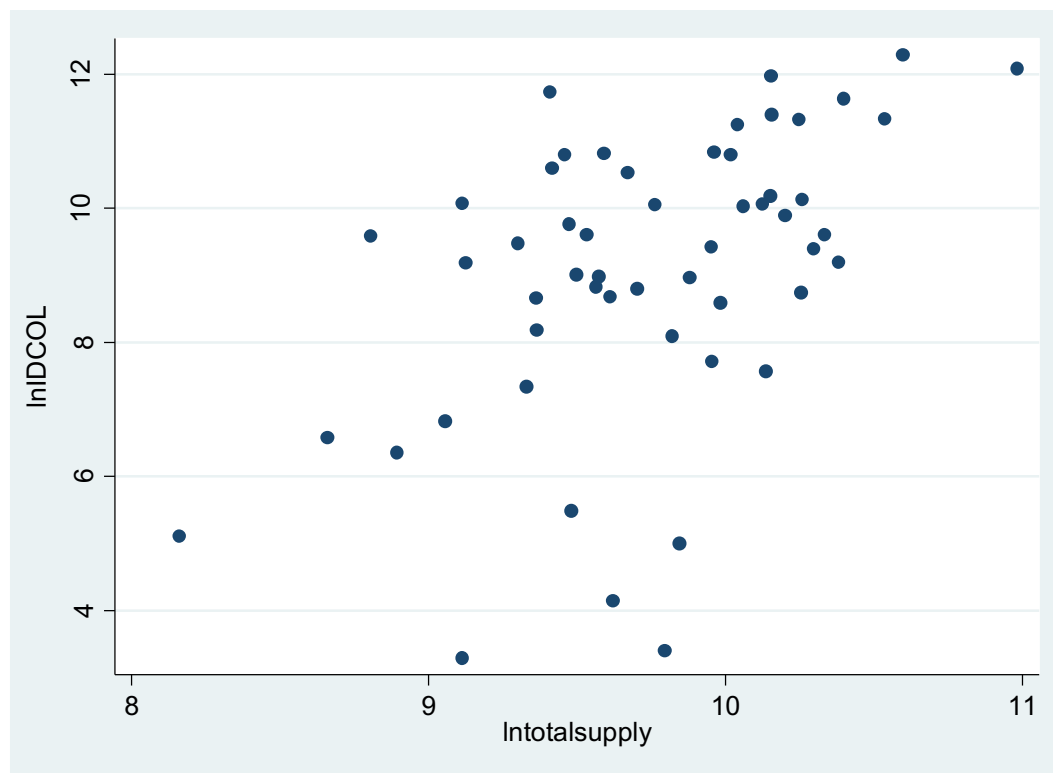
Figure: Correlation between installments in **Sylhet Division** and Total supply of biomass

Analysis between IDCOL installments and Total Supply of Biomass of fuels



	totals~s submi~20	
totalsuppl~s	1.0000	
submissio~20	0.5994	1.0000

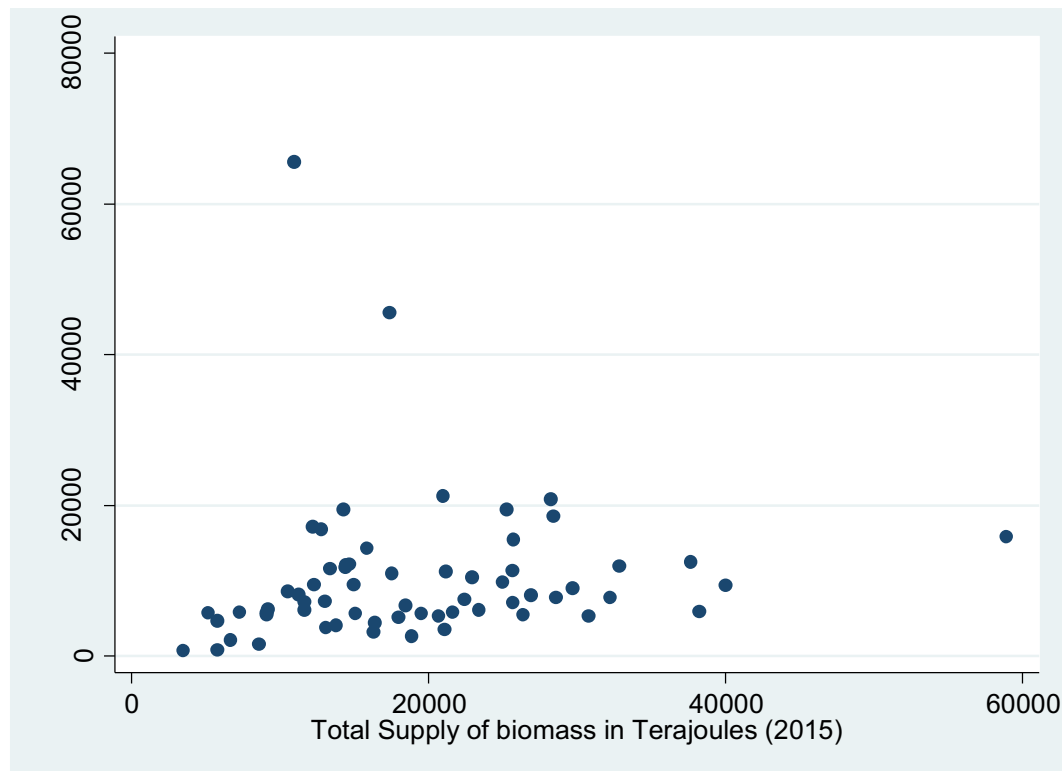
From the scatter plot diagram it can be seen there is a moderate positive correlation between IDCOL installments and Total supply of biomass in districts of Bangladesh. The correlation strength is further reinforced by the correlation test. However, some outliers can be seen in the scatter-plot.



	$\ln \text{IDCOL}$ $\ln \text{Intotalsupply}$	
$\ln \text{IDCOL}$	1.0000	
$\ln \text{Intotalsupply}$	0.5062	1.0000
	0.0001	

In order to curtail the outliers we have taken the log transformation of IDCOL installments and log of Total supply of Biomass. After the log transformation and drop of extreme the outlier, the model still shows moderately strong correlation between Log of total supply of biomass fuel and log of IDCOL installments. It can be interpreted as 1 percentage increase in supply of biomass fuel will lead to increase in percentage of IDCOL connections. After running Pearson's correlation test, it can be observed p value is less than 0.01 so the result is statistically significant.

Analysis between BBF installments and Total Supply of Biomass of fuels



	submis~8	totals~s
sub~20152018	1.0000	
totalsuppl~s	0.0924	1.0000
	0.4713	

From the scatterplot graph it is observed there is a very weak positive relationship between stove installments by BBF and Total supply of biomass fuels. However, 3 extreme outliers can be observed. Looking at the data the outlier districts are Satkhira, Meherpur and Dinajpur. From the Pearson's correlation test it is observed the result is statistically significant.

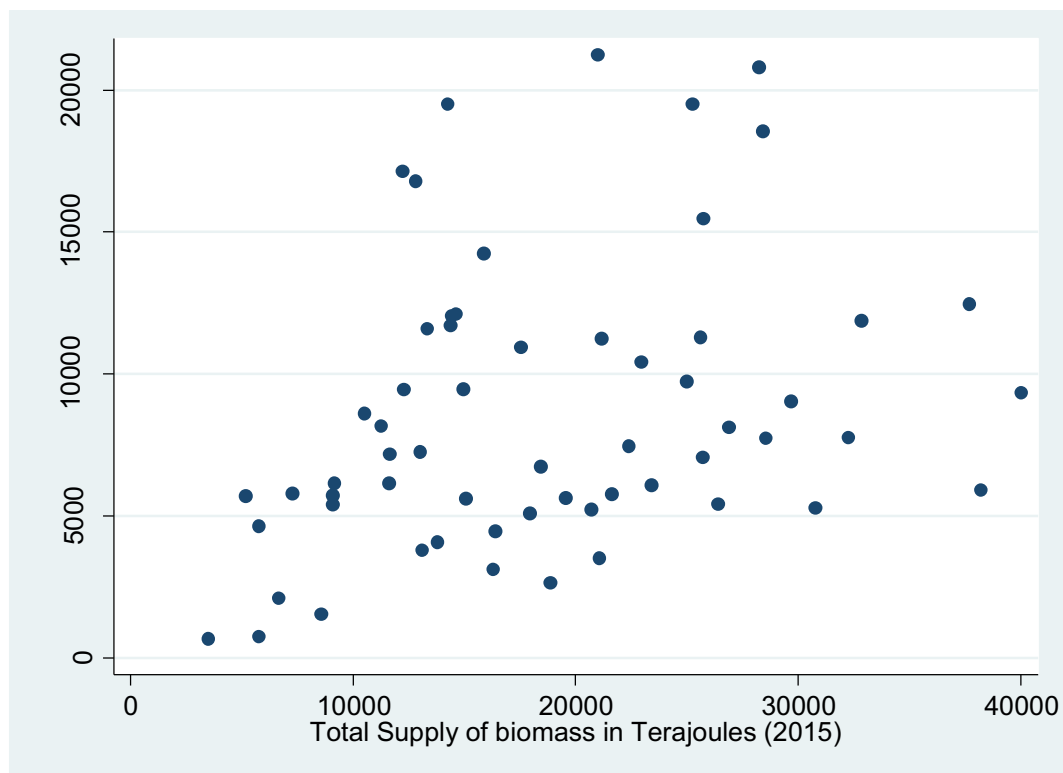


Figure. Scatter-plot between stove installments by BBF and Total supply of biomass fuel

	submis~8	totals~s
sub~20152018	1.0000	
totalsuppl~s	0.3100	1.0000
	0.0159	

After dropping the outlier districts it can be observed, the positive correlation between the two variables increased and the result became statistically significant.

Correlation of stove installments with total supply of biomass fuel in districts with excess supply and deficit supply

	Addition of IDCOL and BBF Submissions	Total Supply of biomass in Tera joules (2015)
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.971969737	1

Figure: correlations between Installations by IDCOL and BFF with total supply of biomass in **districts with deficit supply**

	Addition of IDCOL and BBF Submissions	Total Supply of biomass in Tera joules (2015)
Addition of IDCOL and BBF Submissions	1	
Total Supply of biomass in Tera joules (2015)	0.538299186	1

Figure: correlations between Installations by IDCOL and BFF with total supply of biomass in **districts with excess supply**

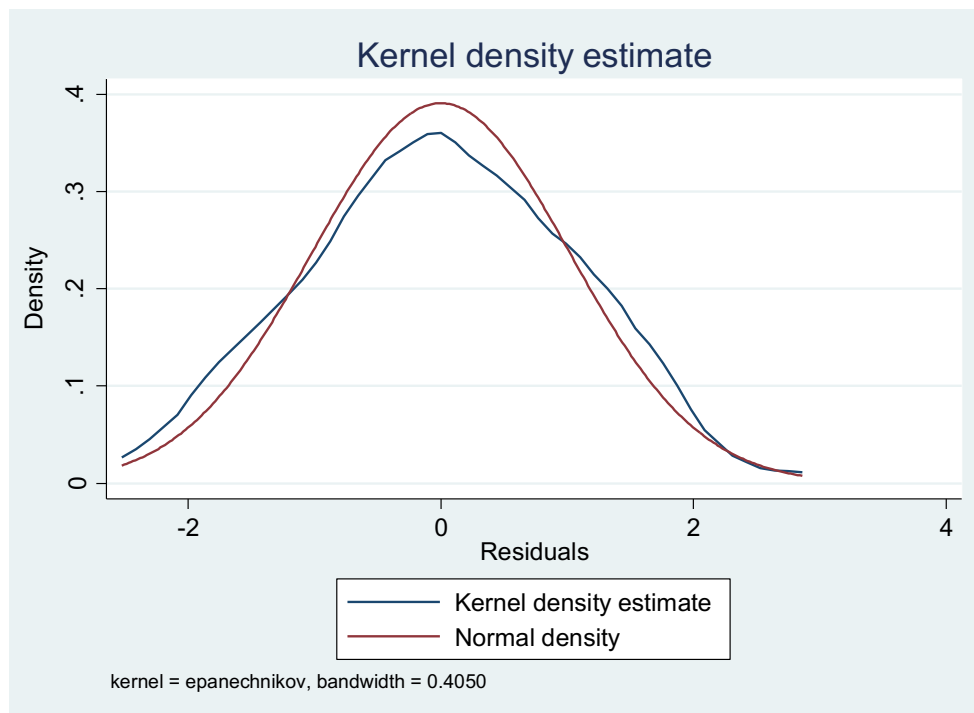
Regression analysis after log transformation

We have taken log transformations of the variables to measure the elasticity between the two variables i.e. total supply of biomass fuels and total installations done by IDCOL & BFF. Afterwards an OLS regression was ran with log variable of total stove installments as dependent variable and log variable of total supply of biomass as independent variable with 60 observations.

Source	SS	df	MS	Number of obs = 60		
Model	25.2514371	1	25.2514371	F(1, 58) =	23.83	
Residual	61.4476386	58	1.05944204	Prob > F =	0.0000	
				R-squared =	0.2913	
				Adj R-squared =	0.2790	
Total	86.6990757	59	1.46947586	Root MSE =	1.0293	

ln totalsins~s	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ln totalsup~y	1.22419	.2507521	4.88	0.000	.7222556	1.726125
_cons	-2.114225	2.43738	-0.87	0.389	-6.993171	2.76472

From the table it can be seen that the relationship between log of total supply of biomass fuel and log of total installments are positively linked and statistically significant. The result can be interpreted as: ceteris paribus, if total supply of biomass fuel increases by one percent then stove installments will increase by 1.22 percentages.



Normality of residuals is required for valid hypothesis testing. The model represents a good fit of normal distribution for the residual values indicating validation of hypothesis testing. Further diagnostic test was run to test for homoscedasticity of the model.

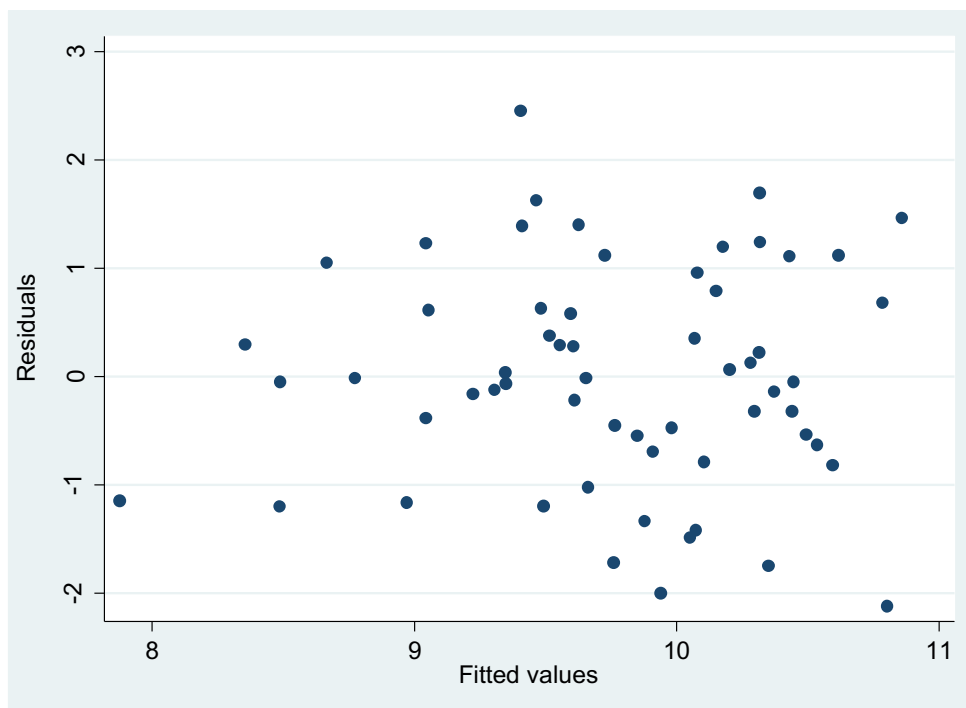


Figure. Rvplot

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Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of lntotalinstallments

chi2(1)      =      0.56
Prob > chi2   =      0.4537

```

From the RVFplot it can be deduced the variances are constant and the model is homoscedastic. Also, from Breusch-Pagan test it can be observed the model is homoscedastic. The p-value is above the 5% confidence interval thus the null hypothesis cannot be rejected; therefore, the model is homoscedastic. Homoscedastic is crucial to test the biasness of the model. As the model is homoscedastic, the standard errors are unbiased so there is no incorrect conclusion regarding the significance of regression coefficient.

Source	SS	df	MS	Number of obs = 51		
Model	56.4119761	1	56.4119761	F(1, 49) = 15.12		
Residual	182.831076	49	3.73124645	Prob > F = 0.0003		
				R-squared = 0.2358		
				Adj R-squared = 0.2202		
Total	239.243052	50	4.78486104	Root MSE = 1.9316		

lnIDCOL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lntotalsup~y	2.068072	.5318717	3.89	0.000	.9992354	3.136908
_cons	-11.14463	5.18136	-2.15	0.036	-21.55697	-.7322989

Figure: Regression between log of total biomass supply with log of IDCOL installations

Source	SS	df	MS	Number of obs = 60		
Model	7.967134	1	7.967134	F(1, 58) = 21.56		
Residual	21.4307571	58	.369495812	Prob > F = 0.0000		
				R-squared = 0.2710		
				Adj R-squared = 0.2584		
Total	29.3978911	59	.49826934	Root MSE = .60786		

lnBBF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lntotalsup~y	.6876334	.1480849	4.64	0.000	.3912094	.9840575
_cons	2.192047	1.439426	1.52	0.133	-.6892774	5.073371

Figure: Regression between log of total biomass supply with log of BBF installations

Variable	Correlation	Remarks
Addition of ICS installation by IDCOL and BBF with Biomass Availability	0.5383	A moderate positive relationship
ICS Installation by IDCOL with Biomass Availability	0.5994	A moderate positive relationship
ICS Installation by BBF with Biomass Availability	0.4713	A weak positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Barisal Division)	0.3894	A weak positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Chattogram Division)	0.3435	A weak positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Dhaka Division)	0.6622	A strong positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Mymensingh Division)	-0.9999	A perfect negative linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Khulna Division)	0.3082	A weak positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Rajshahi Division)	0.2263	A weak positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Rangpur Division)	0.7227	A strong positive linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Sylhet Division)	-0.9993	A perfect negative linear relationship
Addition of ICS installation by IDCOL and BBF with Biomass Availability (Deficit Districts)	0.9719	A perfect positive linear relationship

Results of Analysis: From all the tests done it was observed IDCOL has more strong relationship with the supply of biomass fuel. This was so as the primary sources of fuel for IDCOL stoves are wood, saw dust, tree leaves and bamboos. On the other hand, BBF sells 9 types of products with different source of fuels. E.g. Charcoal, induction, ethanol, solar, feeds, etc. Therefore, the correlation between total supply of biomass and installment amount of BBF was weaker than that obtained by IDCOL. IDCOL's stoves are more reliant on biomass as primary fuel so the relatively stronger positive correlation is to be expected. Needless to say, both organizations' stoves depend on biomass as fuel to a certain extent so the results showing positive correlation are aligning with the logic.

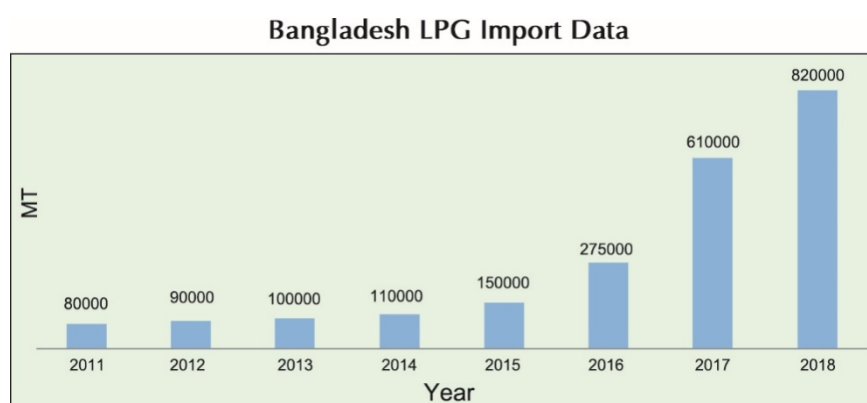
The division-wise correlation, however, has a wide variance and it can be explained by the presence of other variables, i.e. efforts by partners of IDCOL and BBF, availability of competing fuel etc. The almost perfect negative correlation in Mymensingh and Sylhet divisions signifies that the ICS installations are mostly a factor of program and financing availability, efforts from implementing agencies and not necessarily the natural demand of consumers.

Annex 3: LPG Growth

LPG (Liquefied Petroleum Gas) is the most preferred alternative fuel in Bangladesh in household demand for cooking and heating purpose and, in the past few years, there is a significant change to the demand picture with a further rise in consumption. Till now in rural and semi-urban parts of Bangladesh, most of the families depend on traditional fuels like wood, animal and crop waste, and charcoal for cooking and heating. These traditional fuels not only affect human productivity but also very much harmful for the atmosphere. However, Bangladesh government already connected 6% of total population through pipeline of Natural Gas (NG) for household use which consumes about 12% of the total consumption. Nowadays the primary energy shortage is the most discussed issue in Bangladesh and the government already declared that no more NG connection for households. At present, people are getting more aware about using LPG instead of the other conventional fuels as LPG is considered as “Clean Fuel”.

Meanwhile, due to dwindling reserve of natural gas, local industries are gradually shifting towards LPG for uninterrupted supply. LPG also enables expansion of industries in the areas where there is no access or poor access to natural gas. It has transformed from being a choice into a need for Bangladesh and, considering the current and upcoming demand, the existing refilling infrastructure is not sufficient enough.

Bangladesh is one of the fastest growing economies in the world right now having impressive economic growth in the last decade. GDP, per capita income, foreign reserve, industrialization and name any index, Bangladesh achieved laudable successes in recent times. All such successes were not magic, but it all came out of a successful plan. All such development key indices were the result of seamless plan of Energy portfolio behind. Without proper energy sourcing, the development as such would have been dream so far. In 1980, the state-owned BPC (Bangladesh Petroleum Corporation) started the LPG business in Bangladesh and failed to grab the market. It was a hard move to fight against lots of odds, lower income of the people, higher price of LPG, weak distribution channel; considering all aspects, private players have created the LPG market from desert land and educated people about the LPG uses and convinced the customers for it. With this vision twenty years back in 1999, some private sector invested on LPG. Since then, the private sector never looked back. In 2013-14, this business started riding on exponential growth line and lots of investors hit the market. Currently, 24 players are in this field who already invested more than Tk 2,000 crore since the beginning along with reinvestment by the big players.



Bangladesh LPG market now stands approximately at 820,000 MT per year which is forecast to be 2.0 million MT by 2025 and 3.0 million MT by 2030. People's per capita income going high, life style changing, and awareness about clean cooking fuel will push up the number that we have targeted so far. It is a huge support to the government plan to provide clean cooking fuel access to all within the shortest possible time and conveniently as well. Apart from this, use of LPG as Auto gas is another great aspect of LPG usage variation in Bangladesh.

Annex 4: Year and Phase-wise Target Fixation for Cooking Fuel Alternatives

	Target											
	Phase I: Preparation	Phase II: Implementation					Phase III: Mid Plan Review and Implementation					
Type of Clean Cooking Technology /Fuel	Cumulative number of households provided /connected (million)	Annual addition and target finalization with other	Annual addition (no.)	Annual addition (no.)	Annual addition (no.)	MID Term review Year for the Action Plan:	Annual addition (no.)	Annual addition (no.)	Annual addition (no.)	Annual addition (no.)	Annual addition (no.)	Annual addition (no.)
		2020/21	2021/22	2022/23	2023/24		2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Traditional Stoves	29											
ICS (million)	2.7	3.0	3.8	3.45	5.7		7.3	9.5	12.0	15.5	17.8	19.2
Other (Renewable, Pellets/ Briquette/Bio gas etc.)	0.1	0.05	0.06	0.07	0.08		0.09	0.09	0.1	0.1	0.2	0.3
Natural Gas (million)	4.4	4.5	4.6	4.7	4.8		4.9	5.0	5.1	5.3	5.4	5.5
LPG (million)	3.3	0.8	0.8	0.9	1.2		1.6	1.8	2.1	2.7	2.3	3.33
Induction & electricity(Rice cooker)	1.0	0.1	0.1	0.2	0.2		0.3	0.4	0.5	0.5	0.6	0.6
Total	40.5											

Annex 5: List of Members of Household Energy Platform

Serial Number	Registration No:	Name of the Applicant	Address	Contact Person	E-mail ID & Telephone	Type of Business
1	ICS 001	5 Star Cookstoves Bangladesh	43/N (1st Floor), West Raza Bazar, Indira Road, Dhaka-1215	S M M Kamal Bhuiyan	ivdsnars@gmail.com / kamal@5starstoves.com Cell: 01714138430 01722010569	Manufacturer of Cookstove
2	ICS 002	Rural service Foundation(RSF)	Maanco House, 116, Arjat Para, Mohakhali, Dhaka-1215	Khandaker Saiful Islam/Md. Mostafizur Alam	ics@rsf-bd.org or saif@rsf-bd.org Cell: 01769005577 01755688751	Distributor Of Cookstoves
3	ICS 003	Sustainable Energy for Development(SED) GIZ	Road # 90, House 10/A, Gulshan 2, Dhaka-1212	Al Mudabbir Bin Alam Programme Manager, SED	david.hancock@giz.de Cell: 01766667390	Manufacturer of Retained Heat Cooker
4	ICS 004	Nature Conservation Management	House-19, Rd-12 Block-F (flat-A 1) Niketan, Gulshan, Dhaka-1212	Rashiduddin Ahmed	rashed71@gmail.com Cell: 01713129947	Manufacturer & distributor of Cookstove
5	ICS 005	Palli Gram Unnoyan Kendra	Sheb Para, Parbatipur, Dinajpur	Md. Mostakim Sarkar	msarkarpbt@gmail.com Cell: 01716640069	Distributor of Cookstoves
6	ICS 006	Integrated Village Development Society	17, Azim Villa (1st floor), Khanpur Main Road, Narayanganj	Farzana Mofiz	ivds@rocketmail.com Cell: 01974138430	Manufacturer of Cookstoves

7	ICS 007	Human Welfare Organization(H WO)	103,Alpona, Shibganj, Sylhet	Dr. Suromani Shingha	singhahwo@gmail.com Cell: 01710995055 01970995055	Distributor of Cookstoves
8	ICS 008	Infrastructure Development Company Ltd (IDC)OL	UTC Buildg. 16th floor, 8 Panthopath, Kawran Bazar, Dhaka 1215	Wahidur Rahman A F M Shahed	ics@idcol.org Sahed: Cell: 01727348978	Implementing IDCOL ICS Programme
9	ICS 009	Future Carbon Ltd.	House # 42(5th floor),Road-1, Block-A, Niketan Gulshan-1,Dhaka	Md.Mosharraf Hossain	mosharraf@futurecarbon.co.uk Cell: 01717629904	Manufacturer of ICS
10	ICS 010	Venus International Co	73, Siddeswari Circular Road(1st floor), Malibagh,Dhaka-1217	B M Raja	venusintl.co@gmail.com Cell: 01914392434	Manufacturer of Cookstoves
11	ICS 011	Paractical Action Bangladesh	House-28/A, Rd-5, Dhanmondi R/A. Dhaka-1205	Uttam Kumar Saha Md. Arifur Rahman Talukder	uttam.Saha@practicalaction.org.bd Cell:01556323066 arif.talukder@practicalaction.org.bd 01914141413	Distributor of Cookstoves
12	ICS 012	Women development Programme	Vill: Badinar Para, Saghata, Gaibandha	Farid Ahamed	farid.wdp@gmail.com CeLL:01716665896	Manufacturer of Cookstoves
13	ICS 013	Bangladesh Bondhu	Road-8, House12,	Ms. Suchitra Hajong	suchitra.hajong@gmail.com Cell:01833104100	Manufacturer of Cookstoves

		Foundatuion(B BF)	Block-B,Lalmatia,Dhaka- 1207	Md. Kamal Hossain (Deputy General Manager)		
14	ICS 014	Voice of Bangladesh	Kashem Manzil,75(8) Khanjahan Ali Road, Dashani,Bangerhat.	Md. Shahidul Islam	shahidulvosb@gamil.com Cell:01749070845	Distributor of Cookstoves
15	ICS 015	Luxur Green Ltd.	33,Shaheed Faruque Road,Tony Tower(5th Floor),North Jatrabari,Dhaka	Md. Shah Alam MD, luxur	luxurmd@yahoo.com Cell: 01816347991	Manufacturer/Distrib utor of Cookstoves
16	ICS 016	Village Education Resource Center (VERC)	b-30,Ekhlauddin Khan Road,Anandapur,Savar, Dhaka-1340	Md.Masud Hassan	masudhassan@vercbd.org Cell: 01713017064	Manufacturer/Distrib utor of Cookstoves
17	ICS 017	BHOMISTO	Shaheed Siraj Sharani,Katia- Satkhira - 9400	Ms. Parvin Akhter	bhomisto98@yahoo.com Cell: 01711788988	Manufacturer/Distrib utor of Cookstoves
18	ICS 018	Institute of Energy,Dhaka University	Khondker Mokarram Hossain Biggan Campus,Energy Park,Dhaka Univrsity	Saiful Haque	saifulhq@yahoo. com Cell: 01911340058	Research/Testing on ICS
19	ICS 019	Jaklen Muoi Tuyen Foundation(JM TF)	H-82,Road-19, (First floor),Sector 11 Uttara Model Town,Dhaka-1230	Mohammad Shahid	Shahid_un@ yahoo.com, shahidexunicef@gmail.com Cell: 01711344674	NGO working for Mother/Children on CRC n CEDAW
20	ICS 020	Desh Gori Improve Cookstoves	Sharif manzil,Kashipur(opp Social Forestry Off) Barisal-8205	Md. Shahidul Alam Sabuj	ngodeshgori@yahoo.com Cell: 01712796464	Manufacturer and distributor Cookstoves
21	ICS 021	Shapla Shamaj Unnayan Sangstha(SSU S)	H-82,Road-19, (First floor),Sector 11 Uttara Model Town,Dhaka-1230	Ms. Asma Banu	asmabanu@hotmail.com hossainahsanul@yahoo.com Cell: 01718568265	Manufacturer and distributor Cookstoves

22	ICS 022	Projonmo BM Ltd.	Talipara, Panchagoarh Road, Thakurgaon Sadar, Thakurgaon	Mst Tahera Begum	Projonmo.bml@gmail.com Cell: 01712987770	Distributor
23	ICS 023	Welfare Association for Development Alternative(WA DA	2,Cross Road, Dashani,Bagerhat Sadar,Bagerhat, Bangladesh	Nilufa Akter lty,Md. Moinul Hossain	wada@wadabd.org Cell: 01713419957 01722334399	Plan to work in future
24	ICS 024	Development Organization of Coastal Area People	Golap Plaza(2nd floor) Bazar Road,Barguna 8700,Bangladesh	Md. masud Alam	docapbd@gmail.com Cell: 01715548070	Manufacturer of Cookstoves/distributor
25	ICS 025	Purpllewood	Apt # 201,H-10, Rd-6, Gulshan - 1, Dhaka-1212	Shahidor Rahman	shahidorr@gmail.com Cell: 01713018333	Interested to work in ICS sector
26	ICS 026	Bangladesh Association for Social Advancement(BASA)	Rd-6, H-113 New DOHS, Mohakhali, Dhaka-1206	AKM Shirajul Islam	islambasa@gmail.com Cell: 01711528281 02 9893485	Manufacturer/distributor
27	ICS 027	Chicks & Feeds	H -8, Rd- 14, Dhanmondi R/A, Dhaka-1207	Shahed Khan	shahedkhan@cknfeeds.com Cell: 01713278184 02 9121205	Sell Pallet making plant
28	ICS 028	Aid Organization	Jaifia Plaza, Battola, Nabagram Road, Barisal, Bangladesh	Md. Moniruzzaman	aid.org.bsl@gmail.com , aidorgbd@gmail.com 0431-64337 01718665198 / 01856444271	Manufacturer of Cookstoves
29	ICS 029	BRAC	RED Division 15th Floor, 75,Mohakhali, Dhaka-1212	Dr. Nepal C. Dey	nepal.cd@brac.net Cell: 01714091310	Research on ICS

30	ICS 030	Grameen Shakti	Grameen Bank Building (19th floor), Mirpur-2, Dhaka-1216	ABM Muostafizur Rahman	g_shakti@grameen.com mostafizgshakti@gmail.com Cell: 01787840080	Manufacturer/Distributor of Cookstoves
31	ICS 031	BARAL Foundtion for Environment & Sustainable Development	Banwarinagar, p.o: Banwarinagar, PS Faripur, Pabna	Md. Ali Ashraful Kabir	ashraful.kabi@gmail.com Cell: 01842177796 01783725872	Manufacturer/distributor
32	ICS 032	BD Vision	House-27, Road - 10, Block-C Nishat Nagar, Turag, Dhaka-1230	Md. Abdur Rashid	rashid@bdvision.com.bd bdvision1965@gmail.com Cell: 01919066077	Manufacturer of Cookstoves
33	ICS 033	Dept. of Chemical Engineering, BUET	BUET, Dhaka-100	Md. Mominur Rahman, Assistant Professor	mrrahman@che.buet.ac.bd mrrahman.rahman@gmail.com 01711-949357	Research & Development of Cookstoves & fuel
34	ICS 034	Christian Commission for Development in Bangladesh (CCDB)	88, Senpara Parbata, Mirpur-10, Dhaka-1216	Mahbubul Islam	mailccdb@gmail.com Cell: 01711452190	Manufacturer of Cookstoves
35	ICS 035	JITA Social Business Bangladesh Ltd.	Oriental Arcadia, Rd-44 H-27 (Level -2) Gulshan, Dhaka-1206	Ridwan Rahman	ridwan.rahman@jitabangladesh.com Tel: 9892972	Manufacturer of Cookstoves
36	ICS 036	UNICEF	BSL Office Complex, 1, Minto Road, Dhaka-1000	Md. Shofiqul Alam	shalam@unicef.org 01762172217 556668088 Ext7172	Support partners engaged in Cookstove business
37	ICS 037	Prakoushali Sangsad	H-4, Rd-6, Block-C, Banani, Dhaka-1213	Asma Huque	Psldhaka2@gmail.com Cell: 01713018942 9894023	Just like be partner with HEP

38	ICS 038	Esho Jati Gori(EJA)	Housing Estate,Goalchamot,Fari dpur	Ms. Nazma Akter	ashojatigore@ yahoo.com	Manufacturer/distributor of Cookstoves
39	ICS 039	Filament Eneineering Ltd.	H-469,Rd-32,New DOHS Mohakhali, Dhaka-1206	Md.Atiquir Rahman Sarkar	md.muspana@gmail.com 01817181440	Manufacturer of Cookstoves
40	ICS 040	Life Engineering Ltd	70/D,Purana Paltan Lane, Anowara Kunjo(3rd floor),Dhaka-1000	Md. Zahurul Islam	lcsbd_ics@yahoo.com 01971144901	Manufacturer of Cookstoves
41	ICS 041	Eco Stories	126/3,Monipuri Para, Old Airport Road, Tejgaon,Dhaka.	Muhymin Chowdhury	muhymin.chowdhury@gmail.com	Manufacturer of Briquettes N pallets
42.	ICS 042	UDAYAN, Bangladesh	VIP Road, Kharder, Bagerhat Sadar, Bagerhat, Bangladesh.	Md. Asaduzzaman Sheikh, ED	udayanbangladesh12@gmail.com	NGO ,Distribute Concrete Cookstove
43	ICS 043	United Development Foundation	Rahbar Tower,Flat # 8/A(7th floor), 75-76, Ring Road, Adabor,Dhaka-1207	Khondoker Taufiq Alam	udf99@yahoo.com 9115362,9115377 01712406335,01971264625	Manufacturer of cookstove/ partner of Bhumisto.
44	ICS 044	Kheya(Somaj Unnayan Sangstha)	Magura(Mill Bazar), P.O: Benerpara, Upozilla: Satkhira Sadar, Satkhira	Ms. Josna Ara	kheya3@yahoo.com 0174 564 8521	Manufacture and Distribute Retained Heat Cooker(RHC), Partner: Glz
45	ICS 045	Social Dev. Organization of Bangladesh (SDOB)	Adorsho Housing Society (4 th Floor) Mohipal, Feni	Didarul MD	<u>sdobbd@yahoo.com</u> 01744282677	Manufacture of Grihini Unnoto chula

46	ICS 046	Dishari	Mulbarihat, sonatola, Bogra	M Rahman Sagor	dusbogra@yahoo.com	Distributor of Dishari chula Partner of IDCOL
47	ICS 047	Hoshto kutir shilpo proshikhon o kollan kendro (SHPK)	Hokali, kholeya, kotuyali, Rangpur	Doctor. Nikhil Ray	drnekhilray@gmail.com	Manufacturer of Concrete metal stoves Member of MCC-bangladesh, JDPC
48	ICS 048	Energypac Electroincs	Tejgoan, Dhaka	Imam Hasan Shahriar	shahriar@energypaceelectronics.com 01709667160	Partner of IDCOL
49	ICS 049	Orbit Solar Energy	66/13, West Rajabazar ,Indira Road, Farmgate, Dhaka	Md. Abdul Majid	abdul.mozid@ueechbd.com	Producer of solar cookstoves
50	ICS 050	Sundarban Foundation	Mill gate, satkhira, sodar, Satkhira	SK. Afzal Hossain	sundarban_foundation@yahoo.com 01713902285	
51	ICS 051	Ektota somaj Kollan ,	Lalmonirhat		01615686664	
52	ICS 052	Shinew Green Energy Limited	Dhaka	Merina Hossain	01710072830 merinahussain@yahoo.com	

53	ICS 053	Enargion Bangladesh Ltd	7/33 F Eastern Plaza, Hatirpool, Shahbag, Dhaka	Md. Monirul Alam, Fuel	Enargion.bdl@gmail.com Cell:01737282677, 01558866984	Fuel, Distributor
54	ICS 054	SDOB Cookstoves	2/2, R.K Mission Road, 1 st floor, Motijheel, Dhaka	Kamrul Islam	01814726658 sdobcooksu@gmail.com	ICS manufacturer
55	ICS 055	Supti Mohila Unnayan Sangstha (SMUS)	Alia Madrasha Road, Mithapukur par, Bagherhat Sadar	Jhimi Mondol	01716352246 jhimi.smus@gmail.com	ICS Distributor
56	ICS 055	Simi Bangladesh Limited	House#682, Road#21, Bolck# F,6 th Floor, Bashundhara RA, Dhaka	Md. Abdul Malek Azmi	01711679003 mail@simibangladesh.com	Manufacturer of ethanol-based cookstoves
57	ICS 056	Jano Shasthya Unnayan Sangstha (JSUS)	Adamighi, Bogra	Md. Kaosar Ali Chairman	01716029761 Ed.jsus.nog@gmail.com	Po of Idcol, Cookstoves
58	ICS 057	Society for People's Action in Change and Equity (SPACE)	695/A (2 nd Floor) Road-11, Baitul Aman Society, Adabor, Dhaka-1207	H.M.Solaiman Kabir (Executive Director)	skabir.ed.space@gmail.com 01710863436/02 9138772	ICS distributor, (Po of IDCOL)
59.	ICS 058	Daridra Samaj Unnayan Sangstha (DSUS)	381/11 Purbasheri, Sherpur.Sherpur town, Sherpur-2100	Md. Iman Ali	dsus.1995@gmail.com 01717355207	
60		Atmabiswas	Biswas Tower, Cinema Hall Para, Chuadanga-7200.	Managing Director Md. Akramul Haque Biswas	atmabiswas_assl@yahoo.com Cell phone: 01714090402	ICS distributor and manufacturer

