Climate Change Mitigation through installing Improved Cooking Stoves (ICS) in Bangladesh

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Abstract: The study envisioned to explore the role of Improved Cookstoves in mitigating climate change through exploratory research. By installing around one million cookstoves at household level, Bangladesh could save approximately 1,084 thousand metric tons of CO2e per year in which each cookstove could save over one million metric tons. The amount would be double or triple if the international standard models of cookstoves are developed, promoted and installed. By 2030, the country would save over three billion tons of CO2e through implementing the priority areas stated in Country Action Plan for Clean Cookstoves. The extra amount of CO2, moreover, would be absorbed by living tree as ICS saves over 50 percent of fuel wood. The contribution of ICS not only limited to climate change mitigation, it also has the impact to reduce indoor air pollution, save cooking time, save money used for fuel purchasing and so on. Thus, the ICS would work as a real-life changer in mitigating climate change effect, reducing health hazards and ameliorating socio-economic status as well.
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1. Introduction

Bangladesh is the 6th most densely populated country with 150 million people living, where 28 percent were living under the poverty line. Average 1,050 people live per square km and approximately, 72% population lives in rural areas (BBS, 2011). The country is one of the most vulnerable to climate change among all other countries. Climate change is already affecting the country by increasing and intensity of extreme weather events such as heat waves, draughts, floods and cyclones in recent decades. From 1980 to 2000 nearly 60 percent of worldwide deaths from cyclones occurred in Bangladesh alone (PD, 2013).

Two major human activities like deforestation and burning of biomass continued to contribute to climate change in Bangladesh (PD, 2013). Traditional biomass burning produces greenhouse gases (GHGs) – carbon dioxide, carbon monoxide, methane - and black carbon, contributing to climate change (SEI, 2013 and Rosenthal 2011). Solid biomass used for cooking and heating is estimated to contribute over 25% of black carbon emissions globally (SEI, 2013). In a study of IPCC, it was found that between 1975 and 2004, global greenhouse gas emission was increased by 70 percent due to human activities. The global per capita carbon dioxide emission is 0.3 metric tons per year (GACC, 2013) while for Bangladesh the rate is 0.27 tons per person. (HC, 2007) and total emission was 37.9 MtCO2 annually.

In particular, some of these pollutants, such as black carbon and methane, have short life spans but significant consequences for the climate. Black carbon, which results from incomplete combustion, is estimated to contribute the equivalent of 25 to 50 per cent of CO2 warming globally (PD, 2013). Other than carbon dioxide, the leading contributor is to rising global temperatures is black carbon, accounting for 18%of the increase (with CO-carbon monoxide accounting for 40%) (Rosenthal, 2011). Methane emissions are the second largest cause of climate change after carbon dioxide. It is clear that inefficient household energy use has adverse consequences for the environment, air quality and human health.

In Bangladesh 95% of households including 60% of urban households use biomass to cook all or part of their meals (Winrock and USAID, 2012). The rest percentage use natural gas, LPG and biogas. In rural areas fuel wood, agricultural residues, crop residue, leaves, grass, animal dung are typically used for cooking. In urban areas: Commercial operations (hotels, food shops, bakeries etc.) mostly use wood, rice husk and saw dust briquettes. Street food vendors use twigs, cow dung cake, leafy biomass, briquettes.

Nearly three (3) billion people -- around 40% of the global population (51% in developing countries)-- in the world relied on the traditional use of biomass for cooking and heating (IEA, 2011 and WHO, 2010). Two billion people in the developing world still depend on wood, animal dung, and crop residues for fuel for cooking and heating (WHO, 2010).

At the household level, women who usually cook and the infants and children they care are particularly affected to different diseases by burning the solid fuels in the tradition stove producing indoor air

pollution and health damaging pollutants. The smoke from traditional cookstoves and open fires has been a silent killer in developing countries for far too long (GACC, 2013). In Bangladesh, traditional cookstoves generated smoke and killed 49 thousand people annually.

Nearly 2 million people a year die prematurely in the globe from illness attributable to indoor air pollution due to solid fuel use. Among these deaths, 44% are due to pneumonia, 54% from chronic obstructive pulmonary disease (COPD), and 2% from lung cancer (WHO, 2012). The leading killer of children worldwide is acute respiratory infections (ARI) – accounting for 22% of all communicable child deaths in 2004 (WHO, 2006). The number of people who die prematurely each year from the indoor use of biomass could be expected to increase to over 1.5 million in the New Policies Scenario in 2030. The adoption of clean cooking facilities is expected to prevent the majority of deaths attributable to indoor air pollution (IEA, 2011).

2. Material and Methods

The results of the study had been articulated through exploratory research. The data and the information had been collected both from primary and secondary source. The secondary data and information had been gathered through review of documents e.g. books, reports, online articles, journals and newspaper. The primary data collection process included informal discussion with cookstove user, seller and professionals, who works to promote improve cookstove in Bangladesh. The collected qualitative information were then compiled and analyzed to writer the report. The quantitative information was analyzed using spreadsheets and the figures and graphs were being made to visualize the information.

3. Results

Inefficient cookstove put pressure on human health, livelihood, ecosystem and forest and contribute to global climate change emitting greenhouse gases and black carbons (Nepal et al. 2012 and GACC, 2013). The greenhouse gases in the atmosphere produce global warming, which results in sea level rise through melting snow and ice, and frequent disasters causing declining crop yields; loss of forests; damage to coastal resources; increased outbreaks of diseases; and associated economic losses and human suffering (ADB, 2009). In a study of IPCC, it was noted that Bangladesh and some other small islands would go under water if the average temperature rises by 2 degrees centigrade (3.6 degree F).

Improved cookstoves can work as catalyst to mitigate climate change by reducing carbon dioxide emissions and by lowering emissions from short-lived greenhouses gases and aerosols such as methane, carbon monoxide, and black carbon (GACC, 2013). The improved fuels can also serve as cost effective mitigation options by reducing the requirements of fuel for cooking and heating.

Improved cookstovescould conservatively save one metric ton of carbon dioxide emissions per year under the right conditions, many models can save two to four times that amount (GACC, 2013; SEI, 2013 and Muller, 2011). While, an improved cookstove in Bangladesh can save 1.028 metric tons of carbon dioxide according to the matric established by Eco Securities for the approved voluntary carbon offset project in Bangladesh (Micro Energy Credit) (CCEB, 2012). In 2011, Muller et al reported that including the verification and monitoring costs, the cost of emission of per tCO2e (<5€/tCO2e) is projected at $5 to $8. Some researchers have estimated that potential greenhouse gas emission reductions could exceed 1 billion tons of carbon dioxide equivalent (CO2e) per year (SEI, 2013).

As around three million people of Bangladesh were using improved cookstoves, the country would save over thirty (30) million metric tons of carbon dioxide per year resulting significant reduce the effect of climate change. Besides, the country is holding a potential improved cookstove market of 29 Million stoves (Winrock and USAID, 2012), which have the greater impact through reducing the emission of GHGs. This effort could also save biomass, protect environment and forest; reduce the likelihood of health hazards etc.

The improved cookstoves are more environmentally sustainable and energy efficient than the average biomass cookstoves used in developing countries. These cookstoves can ensure efficiency in the use of traditional fuels (WEC, 2005 and IEA, 2011). In a study of Washplus 2013, the user told that the improved stove used less fuel than their old stove and majority (85%) of them told the ICS produce less smoke. It saved up to 60 percent of the wood they would have used in a traditional wood burning stove per cooking session. Besides, World Energy Council, 2005, invented during cooking tests of different models of down-draught stoves, the CO concentration varies from 0,08% to 0.27%, compared with more than 1% for traditional stove. Smoke emission reduced (86.4%) and soot production dropped (89%) due to using ICS (Nepal et al, 2012).

Of the total fuel used for cookstoves, around 50 percent comes from wood (PD, 2013). As over 50 percentfuels had been saved by ICS, haft of the living trees would sustain that could absorb extra amount of

CO2 from the atmosphere and maintain the ecological balance by providing the sanctuary of wild animals and realizing extra amount of oxygen. The forest herbs species in the oak and pine forests belongs to 21 families. The total number of species present in the oak forest and pine forest was 32 and 41, respectively.

According to Country Action Plan for Clean Cookstoves of Bangladesh, 2013, about one million Improved Cookstoves are thought to be used in Bangladesh, a penetration rate of 3 % (PD, 2013). Information demonstrated that very less percentage of households were using ICS, while 97 percent had the access of improved water facilities and over fifty percent household used the inproved sanitation facilities (PD, 2013 and NIPORT, 2011). There were large number of people, who were out of these services due to lack of awareness on climate change, air pollution and its associates health impacts. The following Figure 1 describe about the uses of improved cookstoove in comparison with other facilities in Bangladesh.

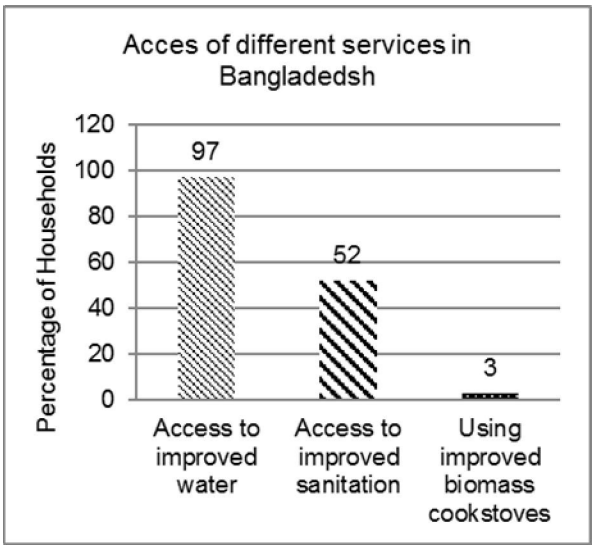

Figure 1. Percent of household have the access of different services

In comparison with other south Asian countries, it has been found that among the eight South Asian countries, Bangladesh used the least percentage of improved cookstoves, while Bhutan was using the highest percentage of ICS. The Pakistan and India had access of 14.7 and 8.3 percent ICS. The Afghanistan and Maldives, however, had no data on ICS. The following figure clearly represented regarding the information of ICS among all countries in the South Asia region.

In Bangladesh, it was evident that improved cookstoves have many benefits even though the only 3% population are using these compared to other countries. Along with the reduction of emission, the improved cookstoves in Bangladesh contribute to sustain energy demand, environmental protection, livelihood improvement, and so on. In one word, improve cookstove is a life changer that save both environment and human being from the adverse effects of climate change. The benefits have been figured out in the following.

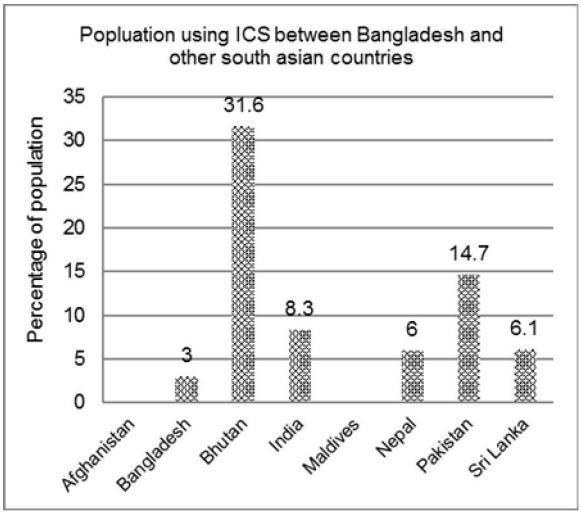

Figure 2. Percent of population using improved cookstoves (ICS) by different countries.

- Save fuel about 50 - 70 percent.
- Reduce GHG and protect environment.
- Save cooking time.
- Produce less smoke and dust particles.
- Reduced health hazards.
- Comfortable cooking.
- Less blackening of the utensils.
- The right nutritive value of the food is maintained.
- Less fire hazard.
- Contribution to maintaining the ecological balance.
- Reduce time and money to obtain fuel.
- Reduce heat in the kitchen.
- Increase scope of work e.g. income generating, education and other activities by saving time.
- Generate employment opportunities, both making and selling ICS.

4. Discussions

Developing countries like Bangladesh is more vulnerable to climate change impact due to its geographical situation and poverty. Over the few decades, disasters like flood, cyclones, drought etc. happened more frequent in Bangladesh, which has the

like with the atmosphere and greenhouse gas emissions. Because of rising temperature, some islands and low lying areas would go under water in the coming decades. Traditional cookstoves were, however, accounted for one of the main culprit to produce GHGs - CO2 and black carbons - and indoor air pollution in Bangladesh as 95 percent of household use biomass for cooking and heating. Admitting the consequences, Improved Cookstoves Program started at mid-70's. The progress, however, was not as good as comparing to other countries in South Asia.

Even though around one million improved cookstoves installed at the household level, there is still opportunity to increase this number up to 30 million by 2030, which could save enormous amount of GHGs to mitigate the climate change impact. Evidence proved that an existing Bangladeshi ICS could save over one million tons of CO2e per year, while many updated models in the world would save one to four million tons a year. The use of ICS not only reduces GHGs but also saves over 50 percent of fuel wood, which would sustain the energy demand of Bangladesh. Furthermore smoke emission, cooking time would be reduced, which could save and improve the life and livelihood of the rural and urban population. As such, the women and children would be more benefited through using ICS.

In 2013, the Government of Bangladesh (GoB) set the goal to achieve the 100 percent clean cooking solution by 2030. In this view, Country Action Plan (CAP) had been developed in 2013 for scaling up the improve cook stoves and it had been targeted to reach 30 million households in Bangladesh by 2030. The dissemination of ICS would reach all level of beneficiaries in the countries in order to create a smoke free kitchen and thus to reduce the indoor air pollution, which would be significant for mitigating air pollution and decreasing the likelihood of diseases.

The Bangladesh Country Action Plan on Improved Cookstoves emphasized for the promotion of improved cookstoves and identified set of priorities accelerate the adoption and market, which would be implemented to achieve the vision and goal of GoB by 2030.

In a joint study titled, "Assessment of the Improved Stove Market in Bangladesh", 2012 by USAID and Winrock International in 2012, the potential market demand had been figured out. A total of 29 million stoves would be disseminated at the household and institution level. Of the total ICS market, 83 % ICS (24 Million) could be installed at the rural household level, while 10% (3 million) would be installed at the urban household level. The institutions, however, would have the capacity to install the rest of the ICS (2 Million).

Besides NGOs, private organizations and donors were working to supplement the effort of GoB. Over 100 NGOs were distributing different models of ICS locally (Rahman et al. 2006). The NGOs included VERC, GIZ, Grameen Sakti, BRAC, Bright Green Foundation, SNV, UNDP- UN-Habitat, Bangladesh Red Crescent Society (BDRCS), Bangladesh Association for Social Advancement (BASA) and so on. The changes in topography, altitude, precipitation, temperature and soil conditions contribute to the diverse bioclimate that results in a mosaic of biotic communities at various spatial and organizational levels. Diversity represents the number of species, their relative abundance, composition, interaction among species and temporal and spatial variation in their properties.

In the meantime, diversified models of cookstoves have been designed and installed at rural and urban community in Bangladesh. The NGOs and entrepreneurs including GIZ, Grameen Sakti, VERC, and so on designed and implemented several models of ICS. The models included both fixed and portable ICS technologies. The stove also varied between single and double mouth with/without filter plate/chimney. Most of the models were designed based the modes developed by BCSIR in 1978.

Apart from the domestic improved cookstoves in Bangladesh, there are also some other international models have been tested as pilot basis in Bangladesh, which could save more energy and reduce less GHG. The models had been designed by the international entrepreneurs and organizations including Envirofit, Prakti, Greenway, EcoZoom and Eco - Chula etc.

Now, the hope is that the formulization of Bangladesh Country Action Plan of ICS would ignite the implementation of ICS priority areas so as to reach the vision of GoB. The NGOs and donors should work with the close collaboration with GoB to reach the goal. The mass people should be involved in awareness rising and knowledge dissemination campaign on the impact of ICS, even then the vision could be achieved. In addition to awareness rising, a viable market should be developed so as to promote the high efferent improved cookstoves, which could reduce less GHGs in the atmosphere and thus to mitigate the climate change impact. Besides, field testing and research should be promoted in the area of health impact, economic impact, livelihood improvement, market promotion etc. to scale-up the impact of ICS.

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