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Experimental Investigation on Advanced Stove

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Abstract*: Improving the thermal as well as emissions performance of biomass cookstoves has been of interest to researchers for a long time. Despite there being a vast literature on the subject, several technical issues remain unresolved with a variety of data and opinions being presented. The present article aims at bringing together literature spanning over three decades that addresses technical aspects of biomass stoves, i.e., their design, analysis and testing. Literature on various design principles, features which determine the stove performance and different methods of performance prediction have been reviewed. Different cookstove testing protocols have been compared and various issues related to cookstove testing are critically discussed. The results of laboratory and field studies on cookstoves by various researchers are presented. Literature on health impact of cookstoves, their dissemination and adoption has also been included. The focus has been on critically analyzing the findings presented by various researchers over the past 3–4 decades in the backdrop of the advancement of the state of knowledge in the area. Wherever conflicting findings were encountered, efforts have been made to reconcile the same using the understanding of the fundamental phenomena.*

Keywords: Advanced Stove

I. INTRODUCTION

The term ‘stove’ refers to a device that generates heat from an energy carrier and makes that heat available for the intended use in a specific application. Advanced stoves are made to transfer the generated heat to food, with the purpose to get it cooked, refined etc. and therefore edible for human consumption. Thus a ‘stove’ features the combination of heat generation and heat transfer to a cooking pot if the food is cooked in a liquid, or a griddle, plancha etc. if the food is baked on a hot surface or roasted without liquid.

Globally, approximately 40% of households rely on solid fuels—including wood, dung, grass, coal, and crop residues—for cooking. The 2010 Comparative Risk Assessment of the Global Burden of Disease attributed 3.6 million deaths yearly to the harmful byproducts of solid fuel combustion for cooking and an additional 0.3 million deaths from contributions of household air pollution to ambient air quality. While the proportion of households using solid fuels appears to be declining, the absolute number using these fuels has remained fairly constant. (1)

Most efforts to mitigate this health burden have focused on providing biomass-burning stoves that vent pollution outdoors and/or improve combustion efficiency to reduce emission rates. Increasingly, some are focused on providing access to clean energy for cooking—including electricity or liquefied petroleum gas. Several conditions must be met if household energy interventions are to improve health:

continuous access to a low-emissions energy source for cooking, (3) sustained usage of this energy source, and discarding of the more polluting traditional stoves.

Mixed use of clean and traditional stoves—dubbed stove “stacking”—can mask or negate any potential benefit of an intervention. Stacking is well- documented through surveys, (4-7) though little objective continuous monitoring of usage of multiple cooking appliances during intervention studies has occurred to date.

In Palwal District, Haryana, we provided a fan- assisted, advanced cookstove, with modifications to improve combustion efficiency (not just improve fuel efficiency or vent pollutants outdoors), to pregnant women via local antenatal healthcare system workers.

Preliminary research evaluating potential interventions and describing this community has been published. (8) During this initial work, we identified the stove selected for this study—the Philips HD4012—as suitable, despite requiring

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access to power for battery charging and the need to chop the biomass fuel into small pieces. Among other goals, this study evaluated the use of the intervention and primary traditional stoves over time and investigated predictors of usage. Monitoring usage and adoption of intervention stoves traditionally relied on simple metrics obtained through interviews or by a trained observer. Such practices introduce the potential for bias—due either to recall bias or to the influence of an outsider in the home (the "Hawthorne effect"). Recent work in Rwanda, for example, highlighted that usage estimates obtained from surveys were biased upward relative to objective measures from electronic sensors. (9, 10) These biases have been well described in water and sanitation studies, including recent evidence showing significant effects of structured observation on behavior (11) and attempts to address these issues using simple data-logging sensors. (12) Previous studies (6, 8, 13-15) of household energy identified Maxim IC's iButton technology as an objective, field-validated Stove Use Monitor (SUM). iButtons are small, coin-shaped thermometers that log time-resolved instantaneous temperatures at the surface upon which they are mounted. Properly placed, iButtons offer both an objective measure of stove usage and a relatively unobtrusive way to monitor interventions over time. Specific sensor characteristics are described elsewhere. (8, 15)

This paper describes time-trends in usage of the intervention and primary traditional stoves in rural Indian homes.

We examine how well short-term measures (1, 2, and 7 day mean measurements) of stove use predict study means, with the goal of optimizing sampling times and strategies for monitoring household energy interventions.

We believe the data set described in this paper is the longest and deepest data set of measured stove usage generated to date, spanning over 15 months of monitoring at 10 min intervals on both intervention and primary traditional stoves in 200 homes (~21 million data points).

Measuring multiple stoves required creation of new metrics to characterize shifts in usage patterns over time. Our secondary focus—on reducing total monitoring duration for assessing use, without compromising data quality—informs strategies to optimize the conflicting goals of precise measurements and efficient fieldwork

II. LITERATURE REVIEW

[1] initially we search overview information from internet wed sides from some apps

Websites & Apps

- https://e.n.m.wikipedia.org
- Google
- Youtube

III. ADVANCED STOVE

nzone of oxidation, resulting in very small amounts of tar. Verhaart [30] discussed the use of downdraft gasification in cookstoves, both in forced as well as natural draft modes. Xiansheng [76] developed the Biomass Domestic Gasifier Cooking Stove (BDGCS) system in China. The efficiency of this gasifier stove was found to be 35% with fuel burning rate of 4 kg/ h. Belonio and Bhuiyan [77] developed a downdraft gasifier stove cum power generation device using rice husk as a fuel. Sutar et al. [84] developed a laboratory version of downdraft gasifier cookstove with a specially designed partially aerated burner. The thermal efficiency of the cookstove was about 35% at 5 kW fire power, and the gasification air–fuel ratio was about 1.6–1.9. Vitali et al. [85] reported a design of natural draught rice husk cookstove. Fuel burning rate of the cookstove was 1 kg/h and water boiling efficiency of the stove was about 18% at fire power of 4.1 kW. Different versions of community size cross draft type gasifier stoves have been developed by Bhattacharya et al. [79]. The main advantages of these designs are that they have simple construction, operate on natural draft mode, use briquettes made from crop residues as fuel, and have moderate efficiencies of the order of 25%.

he gasifier cookstoves which became popular in the field areessentially those of the TLUD kind. In this type of cookstove, thebiomass is lit at the top where a charcoal bed is formed and pyrolysis occurs below this bed. The primary air required for gasification is supplied at the bottom of the cookstove whereas the secondary air required for combustion is supplied at the top,

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ADVANCED STOVE

While traditional fire monitor systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control and an onboard camera. Thereby allowing the user to operate it from a safe distance.

The system makes use of 2 x Motors coupled with a powerful sprayer motor with piping system and onboard wireless streaming camera to run this system. The 2 motors are used to control the nozzle direction movement.

The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives users commands and operates the motors to achieve desired motion. Also the receiver operates the pump motor to start and stop the spray.

The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve a 360 Degree water spray coverage

Components:

- Metal drum
- Metal sheet
- Cement
- Dust
- Breaks powder
- Air blower
- Metal rods

Applications:

- In household use for cooking

Advantages:

- Low cost
- Easy to transport.
- Locally builtable.
- Accepted technology, particularly in Terai

IV. RESULT

Learnt how to increase the efficiency of cook stoves. Fuel requirement is decreased by the ues of this stove . this helps in reducing the pollution as a result health problem are also reduced

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