



## Current debates and future research needs in the clean cookstove sector



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### ABSTRACT

The international clean cookstove sector has undergone considerable growth over the past decade. We use this critical juncture – where program priorities and strategies are formalized and converted into institutional norms and practices – to review current debates and areas for future research. We focus our review on four important areas and suggest industry participants expand and refine efforts to (i) balance technical stove performance with implementation needs and stove user compatibility; (ii) understand the trade-offs associated with local and imported production methods; (iii) determine a suitable role for direct subsidies for purchasing stoves and indirect subsidies for research, institutional development and distribution of stoves; and (iv) develop an appropriate finance strategy to support dissemination amidst carbon market uncertainties. Given the complex and interdisciplinary nature of the clean cookstove sector, we hope our appraisal of these four issues will inform innovation and invite new insights.

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### Introduction

The Global Alliance for Clean Cookstoves (Alliance) is a public-private partnership facilitating the creation of a thriving global market for clean and efficient household cooking solutions. Launched by the United Nations Foundation in 2010, the goals of the Alliance include promoting the adoption of 100 million substantially improved stoves globally by 2020 with hopes of universal adoption by 2030. In March 2013, the Alliance held its first Global Forum in Phnom Penh, Cambodia continuing a trend of biannual cookstove meetings initiated by the Partnership for Clean Indoor Air in 2003. The purpose was to convene various stakeholders in one location to review sector achievements, describe current challenges, detail emerging developments, and articulate pressing needs moving forward. This essay presents a description of significant debates that emerged at the Alliance Forum and outlines areas for future research.<sup>1</sup>

In many ways, the Forum's timing was appropriate. *The Lancet* recently published the updated Global Burden of Disease Report, which ranked household air pollution (HAP) as the fourth leading contributor to the global disease burden, behind only high blood pressure, alcohol and tobacco (Lim et al., 2013). Moreover, the

*Journal of Geophysical Research* released a paper just before the Forum specifying black carbon (an HAP) as the second most important climate-forcing human emission behind carbon dioxide (Bond et al., 2013). These reports alongside other sobering trends – such as the persistent reliance on solid fuels (i.e., biomass and coal) by nearly 3 billion people (Bonjour et al., 2013) – underscored the gravity and urgency of the Forum.

While it would be easy to view the Forum as simply a response to mounting unpropitious news, the event was equally motivated by the Alliance's considerable achievements; particularly in the areas of awareness raising, technology innovations, sector investment growth, international partnership generation, mobilization of research funds, and market capacity development (GACC, 2012). The Forum thus provided Alliance members an opportunity to share accomplishments and establish collaborations across the sector. Participants included representatives from national governments, community-based organizations, cookstove designers and manufacturers, impact investors, corporations, and academic institutions, among others.

Signaling a clear shift in the cookstove community, Alliance Executive Director Radha Muthiah addressed the growing diversity of the Alliance by noting that,

“Many of us have talked about the clean cooking sector being at a tipping point. Well everyone, we've tipped. And we've tipped in the right direction. There is no going back to what used to be a disparate sector of admirable and well-intentioned but non-scalable and

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insular efforts.... The state of the sector is that we are truly together in a way that we never have been before.” (Radha Muthiah, March 18, 2013)

It is in the context of this sector transition that our paper intervenes. In the following pages we review the state of the industry as witnessed during and immediately following the Forum. We begin with a brief description of the household energy sector in the context of numerous programs and activities initiated by the Alliance. We then focus our review on several debates concerning how to (i) balance technical stove performance with implementation needs and stove user compatibility; (ii) understand the trade-offs associated with local and imported production methods; (iii) determine a suitable role for direct subsidies (for purchasing stoves) and indirect subsidies (for research, institutional development and distribution of stoves); and (iv) develop an appropriate finance strategy to support dissemination amidst carbon market uncertainties. In response to these developments we conclude with a brief description of future research needs that should assist sector activities over the next several years. We encourage others to continue this discussion in order to promote the widespread dissemination and adoption of low emission and household appropriate cooking technologies and fuels.

### Clean stove sector under the Global Alliance for Clean Cookstoves

The contemporary international clean cookstove sector includes implementing programs, non-profit organizations, donor agencies, science institutions, investors and governments operating at local, national and global scales. Cookstove testing, certification, financing, marketing and distribution processes are increasingly coordinated between these diverse and international sector participants. The Alliance's diverse membership reflects the multifaceted appeal of clean cookstoves as a hub technology capable of confronting not only the problem of noxious household air pollution, but also a number of other development and environmental challenges (Table 1).

To generate these mutually supported benefits at a large scale, the Alliance has developed a 10-year, three-phase, strategic business plan. Phase 1 began in late 2012 when the Alliance identified six nations – Bangladesh, China, Kenya, Ghana, Nigeria and Uganda – for priority intervention. The Alliance works with stakeholders in these countries to facilitate a range of enabling activities, including collecting and disseminating information on market dynamics, working with governments to create favorable regulatory environments, and generating increased supply chain capacities by improving market access to finance. Meanwhile, the Alliance is collaborating with other national governments, non-profits and community stakeholders to develop country action plans (CAPs) for market scale-up.

Phase 2 will extend these activities by encouraging investments that will bring operations to scale, while Phase 3 aims to establish a self-sustaining clean cookstove market. Fig. 1 illustrates how each phase

coincides with several transformational strategies that are expected to facilitate the distribution of improved stoves to 100 million households by 2020. As dissemination continues to scale-up and a trajectory towards global stove distribution takes hold, influential decisions are being made that will affect how (and what) stoves are disseminated to millions of households. The following section examines several important debates currently facing this fast growing sector.

### Emerging issue and debates

Given this critical juncture – where program priorities, goals and strategies are formalized and converted into institutional norms and practices – we discuss four significant and interrelated issues that emerged during the 2013 Alliance Forum.

#### Issue area 1: stove emissions and efficiency standards

##### Background

Hundreds if not thousands of cookstoves and stove related innovations promote improved efficiency and are commercially available around the world. Unfortunately, many of these stoves provide little or no reduction in harmful pollution emissions or human exposures. Some performed well in controlled settings or immediately after installation, but failed to realize measurable and sustained improvements in homes (World Bank, 2011). Chimney stoves have successfully moved some pollution outside the kitchen and improved household air quality (Armendáriz Arnez et al., 2008). However, without improved combustion efficiency, traditional stoves may do little for climate and, in high-density settlements, shift pollution into neighbors' homes. New epidemiologic evidence indicates a supra-linear relationship between HAP exposure and health outcomes including blood pressure and acute lower respiratory infection in young children (Baumgartner et al., 2012; Smith et al., 2011). This suggests that transitioning away from highly-polluting traditional stoves to cleaner-burning alternatives provides few health benefits unless the very cleanest stoves (e.g., gas or electric models) are used and the household is not ‘stove stacking’ (i.e., using multiple stove models).

Participants at the Alliance Forum discussed the need to develop and manufacture a new generation of very efficient, low-polluting stoves – referred to here as “advanced combustion stoves.” Among these, for example, are gasifier stoves, which convert biomass into a combustible gas using a two-stage combustion process whereby the biomass fuel is heated and converted into a combustible gas in the first-stage pre-combustion (or gasification) chamber and the gas is then completely oxidized in the second-stage combustion chamber (Roth, 2011). Though the combustion process and fuels are quite different, most gasifier stoves contain powerful and adjustable flames akin to liquefied petroleum gas (LPG) stoves, which are viewed by many solid fuel users as an aspirational fuel due to its aesthetic appeal and associated status increase (Smith and Dutta, 2011). Decreasing exposures with low-

**Table 1**

Major issues associated with inefficient and high emitting traditional cooking methods (Adapted from GACC, 2012).

Issue	Description
Gender and development	–Women and girls spend up to 20 hours per week searching for fuelwood in areas with diminishing resources, leaving less time for other tasks and income generating activities. –Fuelwood collection can put women and girls in dangerous and isolated environments far away from home.
Human health	–Inefficient solid fuel combustion produces pollutants that affect health including childhood pneumonia, lung cancer, obstructive pulmonary disease, cataracts and blood pressure. –Traditional stoves with uncontained flames can cause burn injuries, disfigurements, infections and even death.
Forest protection	–Reliance on wood and charcoal for cooking and heating can place pressure on local forests. –Unsustainable harvests can contribute to mudslides, watershed damage, desertification and decreased food security.
Outdoor air pollution	–Solid fuel stoves are significant contributors to, and exacerbate, poor outdoor air quality.
Climate Change	–Inefficient combustion of solid carbon-based fuels contributes to climate change through the release of gases including methane, carbon monoxide and nitrous oxide. –The emission of black carbon aerosols contributes to the net climate-forcing impacts of biomass burning stoves.

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