GLOBAL ALLIANCE FOR CLEAN COOKSTOVES

ASSESSING THE CLIMATE AND HEALTH CO-BENEFITS OF CLEAN COOKING

WORKSHOP REPORT

JULY 16-17, 2015 / WASHINGTON, DC

- Clean cooking solutions **can help address deforestation and forest degradation** while reducing soot deposits on glaciers.
- There is solid evidence that cooking with clean cookstoves and fuels **improves public health by reducing harmful emissions of particulate matter and black carbon**.
- Clean cooking solutions **reduce emissions of major climate forcing agents** including both greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs).

In July 2015, the Global Alliance for Clean Cookstoves (Alliance) and the Environmental Defense Fund (EDF) brought together a team of the world's leading experts in air pollution exposure, health, and climate science to share the most recent evidence on 1) the relationships among traditional cooking practices, climate change, and public health; and 2) the benefits clean and efficient cooking can provide to public health and climate change. Experts also discussed the best strategies for measuring and evaluating climate and health co-benefits to inform critical policy decisions.

STATISTICS

#4	Household air pollution is the fourth biggest health risk in the developing world
4.3 million	Number of people who die prematurely each year from exposure to household air pollution
Up to 25%	Percentage of black carbon emissions attributed to residential cooking
20%	Percentage of the planet's warming attributed to black carbon emissions

EXPLORING THE CONNECTIONS BETWEEN CLEAN COOKING AND CLIMATE CHANGE

The Alliance and EDF convened this meeting to promote a more integrated understanding of which pollutants should be measured in order to evaluate both health and climate benefits of scaling up clean cooking solutions. Scientists from the health and climate communities shared the latest evidence on the relationship among cooking emissions, health, and climate impacts, determined which pollutant measurements would best address both health and climate benefits, and discussed shared goals and future research needs. The presentations and discussions addressed the following questions:

- **Which cookstove pollutants are the most effective predictors of health impacts?**
- **Which cookstove pollutants are the most effective predictors of climate impacts?**
- **What is the feasibility, cost, and ideal scale of measuring health and climate forcing pollutants in clean cooking programs, and what are the resource constraints?**

DESCRIPTION OF SESSIONS

Session	Highlights
Measurements for Estimating Health Impacts Household air pollution causes up to 4.3 million deaths per year worldwide, attributed to particulate matter air pollution from household solid fuels and is a substantial contributor to ambient air pollution in many communities. Public health impacts are driven by the exposure to smoke, not emissions from stoves. There are many different approaches to estimating human exposures to cookstove exhaust, including direct measurements, modeling, and estimation from biomarker levels.	• Exposure to fine particulate matter, $PM_{2.5}$, is strongly and consistently associated with health impacts. There is increasing evidence that black carbon (BC) is associated with health impacts after controlling for exposure to fine particulate matter. Carbon monoxide (CO) is also of concern for some fuels, stoves, and cooking environments. • Polyaromatic hydrocarbons (PAH) may be important drivers of health outcomes, but are difficult to measure in the field, as are elemental carbon (EC) and organic carbon (OC).
Cookstove Impacts on Climate There is a wide range of pollutants emitted from solid fuel cookstoves, which impacts individual and household health, community air quality, and climate change. There are trade-offs between interventions for health and those for climate change. Diverse technologies are required to meet local needs – there is not one solution.	• Solid fuel cookstoves emit a variety of pollutants, and these pollutants have different consequences for climate change. • Pollutants such as BC have strong adverse effects for climate, but other emissions from cookstoves (such as OC) may mitigate these effects. • BC emissions from household cooking and heating has the strongest climate effects in areas where it results in *absorption* of solar radiation rather than *reflection* (such as in the Himalayas). • Changing to cleaner cooking technologies does not necessarily improve the climate impacts of solid fuel burning. These impacts need to be evaluated locally due to differences in stove technologies, fuels, and stove use. • New laboratory stove testing strategies are being developed, but more work is needed to better simulate field use conditions.
Science and Policy-Relevant Approaches There are many methods - both measurement and modeling - for estimating the relationship between household cookstove use and ambient air pollution. These estimates have global impacts for both the estimation of health outcomes and for the design and implementation of policies and programs.	• Emissions to ambient air are dependent on stove technologies, fuel use, and cooking practices, including cooking location (indoors or outdoors). • Estimates of particulate pollution at varying geographic scales have been modeled based on routinely collected sources of data. • By comparing this pollutant measurement data to ambient $PM_{2.5}$ measurements in communities, scientists can estimate how much of local particulate pollution is due to household solid fuel use.

KEY FINDINGS

Fine particulate matter and black carbon are of greatest concern for both health outcomes and climate forcing, with organic carbon and carbon monoxide also of interest for climate.

Several cookstove pollutants are effective predictors of health impacts.

- $PM_{2.5}$ has shown the strongest and most consistent relationships with human health outcomes, and the scientific literature spans several decades.
- There is mounting evidence that BC is associated with human health effects. Some researchers attribute these associations to the PAH content of soot.
- CO has been associated with cardiovascular disease and adverse pregnancy outcomes for many years.
- Levels of CO measured in households using unprocessed biomass are typically quite low, but cooking with charcoal can lead to dangerously high levels.

Cookstove pollutants are the most effective predictors of climate impacts.

- BC, which absorbs solar radiation, is a powerful positive climate forcing agent resulting from incomplete combustion of biomass and is of greatest concern.
- CO is a pollutant that affects methane, carbon dioxide, and tropospheric (lower atmospheric) ozone. It thus plays a role in both air pollution and climate change.
- OC, which reflects solar radiation, can reduce the climate impact of cookstove emissions.

There are feasibility, cost, and resource constraints to measuring these pollutants in the field.

- CO is very inexpensive to measure with simple instruments.
- $PM_{2.5}$ and BC are relatively easy to measure and are already routinely measured for many health studies.
- EC and OC are difficult to measure in remote field studies as sampling and measuring requires sophisticated equipment and controlled conditions.
- Measurement of PAHs requires specialized equipment and sophisticated laboratory analysis. While direct–read instruments exist, they capture only the particle phase PAH.

While clean cooking offers overall net climate benefits (largely due to reduction in emissions of black carbon), there are some important issues to consider when making the case for scaling up clean cooking to address climate change.

- The ratio between BC and OC in cookstove emissions (and how it varies depending on stove and fuel type) is an important indicator of the impact of clean cooking programs on climate.
- Location matters: BC emissions in a snowy area have more climate forcing potential than black carbon emissions in a forested area.
- While the time horizon for achieving climate benefits remains unclear, the public health benefits can be assured in the short- and long-term.

The workshop gave leading experts in pollutant exposure and atmospheric science a chance to discuss areas of common interest and ways to maximize the benefits of clean cooking programs.

"The Alliance has played a very valuable role in increasing our understanding of the benefits of clean cooking to human well-being, *both by strengthening our knowledge of the emissions from cookstoves and helping develop tools to assess the benefits at the scales where decisions are made."*

Drew Shindell, Professor of Climate Sciences, Duke University

"Efforts that increase the use of efficient and clean cooking systems among the world's poor is a smart thing, not only for the local community where action is taken, but also for the rest of us. *The pollution from traditional cooking no doubt disturbs climate on a regional and global scale."*

Kristin Aunan, Senior Researcher, Center for International Climate and Environmental Research

"The Alliance is unique in its focus on cookstoves and the important role they play in global health impacts and climate-forcing emissions. ***This is a drastically under-appreciated problem where solutions have enormous potential to provide meaningful, cost-effective health and climate benefits."***

Michael Brauer, Professor, School of Population and Public Health, University of British Columbia, Canada

"The workshop helped push forward the critical need to consider the landscape of optimized solutions for climate change, air quality and health. *The opportunity, indeed the responsibility, exists to provide new insights into the true costs of alternative energy solutions that improve people's health. I look forward to continued leadership from this group on this issue."*

Bryan Bloomer, Director, National Center for Environmental Research, US Environmental Protection Agency

"The workshop brought together top scientists in the field to discuss an important topic for both science and development. *The high quality presentations and in-depth discussion will inform future research."*

Shu Tao, Professor and Dean of Department of Environmental Sciences, Peking University

List of Participants

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UKaid from the British people

CCAC CLIMATE AND CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Presentations from the workshop can be found at **www.cleancookstoves.org/co-benefits-workshop**

GLOBAL ALLIANCE FOR CLEAN COOKSTOVES

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work

The Global Alliance for Clean Cookstoves is a public-private partnership hosted by the United Nations Foundation that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions.The Alliance's 100 by '20 goal calls for 100 million households to adopt cleaner and more efficient cookstoves and fuels by 2020. The Alliance is working with its public, private and non-profit partners to accelerate the production, deployment, and use of clean cookstoves and fuels in developing countries.

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EDF is a science-based environmental advocacy organization that brings together scientists, economists, lawyers, and policy experts to develop long-lasting and practical solutions to environmental problems. EDF is fighting climate change by supporting a clean energy economy; using non-partisan approaches to create and protect lower-emissions energy policy; partnering with top companies to promote environmental measures that save money; and implementing global incentives to curb pollution and deforestation. EDF communicates climate change information to a variety of audiences and strives to be at the cutting-edge of science.

More information is available at http://www.edf.org