

The Enabling Environment: Global Guidelines and National Policies for Indoor Air Quality

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Indoor air quality (IAQ) is now recognized as a global environmental health hazard, disproportionately affecting the world's poor. The World Health Organization (WHO) reports the following:¹

- An estimated 3 billion people cook and heat their homes using open fires and stoves burning biomass and coal.
- Nearly 50 percent of pneumonia deaths among children under 5 are due to particulate matter inhaled from household air pollution (HAP).
- Women and men exposed to heavy indoor smoke are 2 to 3 times more likely to develop chronic obstructive pulmonary disease (COPD).
- Over 1 million people (primarily adults) die each year from COPD that develops because of exposure to HAP.
- Some 3.5 million people die prematurely from illness attributable to HAP from solid fuel use, a further half million through contributions from ambient (outdoor) air pollution.²
- Additional suspected health risks include burns, asthma, tuberculosis, cataracts, low birth weight, stillbirth, and cancers, among other risks.³

Past cookstove interventions often emphasized energy and environmental concerns. IAQ policy and household energy guidelines are absent in most developing countries, and few prior national cookstove programs and their interventions are equipped to deliver substantial health benefits or to measure health impacts. National IAQ policies and sector guidelines can enable a more integrated approach that places increased emphasis on health, bringing together guidance on fuels, stove technologies, and ventilation, with the goal of improved IAQ.

Biomass Stove Use

Biomass stoves are a significant contributor to HAP. The use of solid fuels in households in the developing world is most often in traditional fires or inefficient cooking devices. These inefficient stoves placed in poorly vented rooms and buildings produce dangerous levels of HAP. HAP concentrations in

Key Findings

Most national cookstove interventions have emphasized energy and environmental concerns, with modest attention to indoor air quality and the link to health. New WHO guidelines offer health evidence linked to household energy sources and will help drive national indoor air quality policies to bring together energy, health, and environmental resources for cookstove programming.

Key Policy and Research Recommendations

- National IAQ policies are needed to stimulate advocacy and education programs on hazardous air pollution.
- Technology development for cleaner cookstoves must include rigorous emission testing to ensure improved stoves are “cleaner” stoves so that health dimensions help set cookstove standards.
- Funding rigorous health studies is important to better understand health outcomes of interventions and to benchmark “how clean is clean.”

developing countries are known to be far above existing WHO air quality guidelines and to be a significant contributor to the burden of disease.

Incomplete combustion of biomass fuels for cooking and heating produces a range of toxic substances harmful to human health. Most important are particulates, carbon monoxide, nitrous oxide, sulfur oxides, formaldehyde, and polycyclic organic matter, which includes carcinogens such as benzopyrene.⁴⁻⁶

- Particulates—especially PM_{2.5} (particulate matter less than 2.5 micrometers in diameter) and smaller—are extremely hazardous. They can penetrate deep into the lungs and cause bronchial irritation, inflammation, and fibrosis.
- Carbon monoxide binds with hemoglobin to produce carboxyhemoglobin, which reduces the delivery of oxygen to key organs—including in developing fetuses. This may result in low birth weight and increased perinatal deaths.

- Acute exposure to nitrogen dioxide and sulfur dioxide causes acute increases in bronchial reactivity, which causes wheezing and exacerbation of asthma.
- Formaldehyde causes nasopharyngeal and airway irritation, which leads to asthma and increased susceptibility to infections.
- Absorption of toxins in biomass smoke into the lenses of the eyes causes oxidative changes that can lead to cataracts.
- Traditional cooking practices are also a large risk factor for burns and injuries.

Household Air Pollution and Solid Fuel Use (WHO)²

- An estimated 3 billion people cook and heat their homes with biomass.
- Exposure to HAP from solid fuels has been linked to acute and chronic diseases.
- An estimated 4+% of the global burden of disease is the result of burning solid fuels.
- Long-term exposure to HAP may cause cancer and other long-latency diseases.

Cookstoves as a Multidimensional Issue

The cookstove issue is a multidimensional challenge facing developing countries. The health dimension is significant; HAP is linked to 3.5 million premature deaths per year.² In addition, another 500,000 deaths from outdoor air pollution are caused by cooking, with a large share of outdoor pollution in regions like Asia and Sub-Saharan Africa originating from household solid fuel use.² In many developing countries, women bear the burden of collecting the fuel. Women build the fire and spend many hours a day exposed to emissions as they prepare meals over the cookstove. Serious environmental concerns include cookstoves' major contribution to climate change through the release of greenhouse gases (CO₂) and short-term climate forcers (black carbon, CO₄). The unsustainable use of forest products results in erosion and deforestation.

The half dozen national cookstove interventions that exist have placed limited attention on health. Given the burden of disease attributed to HAP, this focus needs to change. Cookstove interventions that integrate energy, climate and environment, livelihood, and health dimensions will be in a position to mobilize more human and financial resources. When health is a defined target of cookstoves programs, the program will have the chance of delivering health benefits.

Policy Options and Consequences

To date, very few national-scale cookstove programs exist, and global guidance on household energy use in developing countries is lacking. These few national cookstove programs

have emphasized energy and the environment as the main program driver. Health dimensions, such as HAP, have been underrepresented. Thus, these programs fail to encourage interventions that deliver substantial health benefits.

International development research and multilateral and bilateral global health and environmental programming over the last 30 years tell us that global guidelines can drive national policies and that policies do indeed matter. Access to clean energy at a national scale is an enormous challenge facing cookstove and household energy program initiatives.

- Policies create an enabling environment. Sound policies are critical for replicating and scaling up pilot efforts and are essential in improving access to clean energy that will affect health. Policies can lead to setting regulations and air quality standards or removing tariffs to stimulate trade in cleaner cookstove technology.
- National policies serve as a stimulus for local government or community action to implement HAP education and cookstove interventions, such as healthy kitchen initiatives.
- A national HAP policy can stimulate national ministries to integrate programs and bring national resources together across energy, environment, climate, and health interests.
- Policies that are strongly supported by government express commitment, articulate priorities, and stimulate the allocation of resources for implementation.
- Policies are important in formulating incentives, such as credits for cookstove manufacturers, financing for carbon offsets, or changes in import restrictions.

Leading National Cookstove Initiatives

National-scale cookstove programs to date have focused on energy efficiency goals to change household energy use patterns. As of 2011, the leading examples of national cookstove programs were found in Ethiopia, Cambodia, India, Indonesia, Peru, and Mexico.⁴ These programs are noted for their national scale and attention to addressing the challenge of providing clean and affordable household energy.

Table 1 presents the characteristics of the leading examples of national-level cookstove programs, identifying institutional leadership, primary drivers, and core program objectives.

These national programs represent these countries' substantial commitment to improve energy efficiency and the health of millions of people who rely on inefficient and highly polluting solid fuels for their household energy. National programs and policies can help countries overcome the many barriers to adopting cleaner cooking practices.⁴ However, few are multidimensional, and the countries with the largest HAP

Table 1. Leading examples of national-level cookstove programs

Country	Biomass Use (%)	Dates and Targets	Lead National Institution	Key Program Driver	Objective(s)
Ethiopia ^{6,7}	95%	2011–2015: 9 million stoves	Ministry of Water and Energy	Energy	Reduce firewood use, create jobs, reduce carbon
Cambodia ⁸	91%	1998–2006: 800,000 stoves	Ministry of Industry, Mines & Energy	Environment	Reduce charcoal use, slow deforestation
India ⁹	60%	1983–1991: 28 million stoves	Ministry of Non-Conventional Energy Sources	Energy, health	Promote energy efficiency, reduce firewood use
		2009–2019: 15 million stoves	Ministry of New and Renewable Energy	Environment, energy, health	Promote energy efficiency, reduce climate impacts and HAP
Indonesia ¹⁰	48%	2007–2011: 50 million stoves	Ministry of Energy and Mineral Resources	Energy	Stem energy imports
China ¹¹	48%	1980–1992: 129 million stoves	Ministry of Agriculture	Energy, health	Protect environment, ecology
		1995–2004: No defined target	Ministry of Health	Health	Promote health, reduce environmental risks
Peru ¹²	36%	2009–2011: 500,000 stoves	Inter-Ministerial Commission on Social Issues	Environment, energy, health	Promote energy efficiency and health education, reduce climate risks
Mexico ¹³	15%	2003–2006: 1,500 stoves	National Forestry Commission	Environment, energy, health	Promote energy efficiency, reduce firewood use, create jobs, promote health education

public health burden are missing a prominent health objective in their programs.

WHO Guidelines as Means of Strengthening Health and Other Policy Dimensions

WHO Guidelines Will Help. WHO is preparing new health-based IAQ guidelines for cleaner household energy use. The guidelines will, for the first time, incorporate health information as guidance for fuels and stove technologies and will address issues such as ventilation to reduce HAP. Draft guidelines are being prepared and are expected to be publicly available in 2013. The new IAQ guidelines will establish a compelling health argument for cleaner household energy; further substantiate the link between IAQ and maternal and child health issues, such as pneumonia; and raise awareness of IAQ’s link to noncommunicable diseases in adults. These global efforts, both the guidelines and the associated advocacy, will guide country-level actions and help raise awareness of the importance of cleaner household energy practices as a core preventive public health measure. These guidelines will link air pollution science and policy with household energy policy and programs in developing countries.

The WHO global IAQ guidelines are expected to drive national interventions that target substantial health benefits, linking selected fuels, such as coal or kerosene, with

health concerns and describe circumstances in which certain fuels should be avoided altogether, such as coal (mainly in China) contaminated with arsenic and/or fluorine.

Integration with New International Organization for Standardization (ISO) Cookstove Emissions Test Standards. The WHO guidelines will feed into the February 2012 ISO initiative that establishes an international working agreement on the methodology to evaluate the emissions performance of cookstoves. Part of the methodology describes how the proposed emissions standards relate to IAQ and personal exposure levels, with a focus on most-at-risk groups (e.g., pregnant women and young children) at different levels of pollution and exposure, as well as evidence on other major health risks (e.g., burns,



Burns and injuries are among the health risks. Children and mothers are most at risk from HAP, as are the aged, who are most often inside the home during cooking. Long-term impacts of HAP are linked to COPD, cancer, and cataracts, among other chronic diseases.

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poisoning, injury). The ISO approach established five tiers of cookstove performance, based on emission rates, along four key performance indicators: fuel use/efficiency, total emissions, indoor emissions, and safety. However, the ISO approach is currently based on emissions characterization, with an approach to estimate the likely reductions in exposure that could result with each higher tier. The WHO guidelines provide the benchmarking needed to transition the ISO approach to a more exposure-based approach, linking it more closely to likely improvements in health.

Conclusions

WHO's global guidance for IAQ for household fuel consumption is well placed and timely. It will provide the benchmarking needed to help transition the current ISO cookstove working agreement to one more closely linked to actual exposures and health reductions.

The best examples of national cookstove programs are important initiatives, yet few of these initiatives focus on health or outline national policies for IAQ or defined health outcomes.

- WHO guidelines offer health evidence linked to household energy sources. This advice to countries will encourage new and expanded interventions.
- National HAP policies can power integrated programs to bring together energy, health, and environmental resources.¹⁵
- Stronger policy and regulatory frameworks will help spur public, private, and nongovernmental organization investment in clean(er) household energy.

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RTI Press publication PB-0003-1312

doi:10.3768/rtipress.2013.pb.0003.1312

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