

# CLEANER COOKSTOVES: Combating Indoor Air Pollution

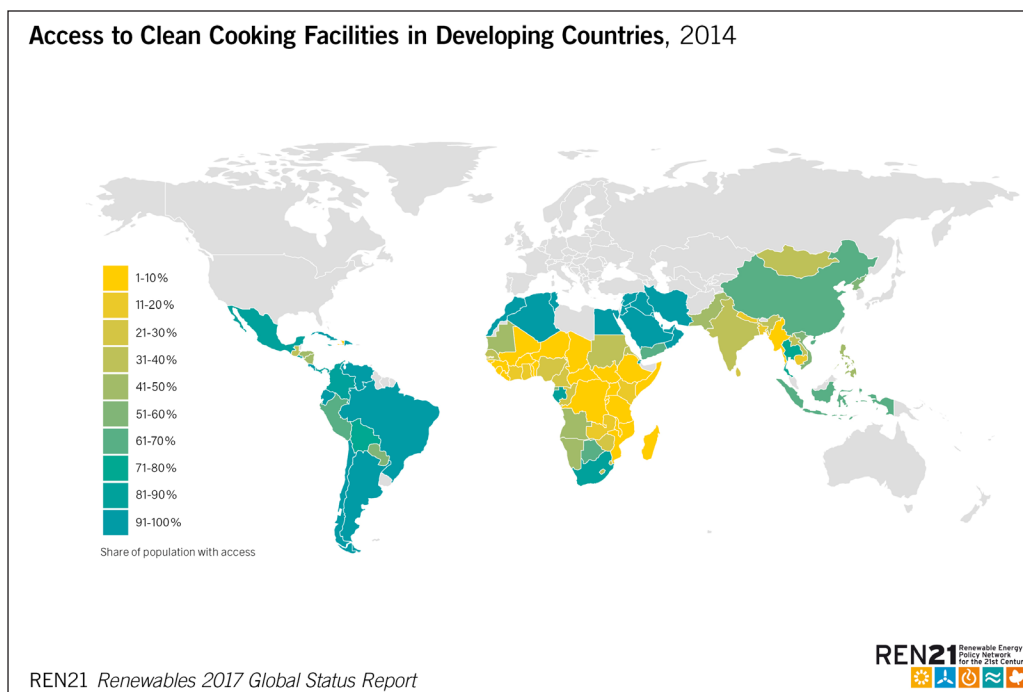
case study | air pollution unit

Imagine if one of the most dangerous things you did each day was to cook your family a meal. For close to half the global population, this scenario is not so far-fetched. Over 3 billion people worldwide rely on wood, charcoal, dung, or crop remnants for cooking, burning the fuels in traditional stoves or open fires inside the home, which exposes families to dangerous air pollution. The World Health Organization estimates that household air pollution contributes to 4.3 million premature deaths each year, mostly of women and children who spend the most time inside the home.<sup>1</sup>

Fortunately, there are alternatives. Improved cookstoves burn fuel more efficiently and emit fewer dangerous particles and gases into the home. They offer what researchers call a triple dividend: improvements to health, environmental quality, and climate.<sup>2</sup> Over the last 40 years, aid programs have delivered millions of cleaner cookstoves to low-income people in countries around the world. So why aren't more people using them? The answer is complicated.

## Food is cultural

What did you eat for dinner last night? For most of humanity throughout history, this question was answered based on what was readily available, affordable, and, importantly, what your mother fed you and what her mother fed her, going back generations. Food is cultural. If you grew up in India eating roti flatbread cooked in a clay oven heated by dung and firewood, that is likely the type of food your children will eat as well. Same with the Nepali family eating boiled rice in a large metal pot. The mothers in the Peruvian Andes who boil potatoes over wood burning in a clay-walled pit will teach their daughters to cook the same way. And that will look very different from the Guatemalan mother toasting tortillas over an open flame or the Kenyan mother preparing ugali (maize meal) in a pot.



There is no single stove that will work for all of these families. Yet early stove distribution aid efforts failed to account for such cultural differences. The result: the new stoves sat unused. Or in some cases home cooks did use the new stoves but also continued to use their old stoves anyway and, thus, did not benefit from improved air quality. Traditional practices and habits are hard to change.<sup>3</sup>

## The burden of dirty fuels

**Indoor air pollution** from cooking fires is a major killer. It is the number one environmental cause of death and disability, "causing more premature deaths than HIV/AIDS, malaria, and tuberculosis combined," according to the World Bank.<sup>4</sup> Exposure to the smoke and small **particulate matter** from cooking fires increases the chance of cardiovascular disease, respiratory illnesses, and lung cancer. It also can lead to cataracts and blindness. Surveys in sub-Saharan Africa find headaches and eye irritation are also widespread complaints. Even exposure to the emissions before birth is harmful, linked to higher risk of stillbirth, lower birthweight, and hampered cognitive development.<sup>5</sup>

Burns from the hot stoves or open fires are common; small children are highly at risk. Children in households cooking with polluting fuel also bear a large part of the burden of fuel collection, spending over 2.5 hours each day, on average, gathering fuel. In some countries, children spend closer to 5 hours each day collecting fuel and water, with most of the work falling to girls. This is time taken away from school, studying, work, and play.<sup>6</sup> It also leaves the collectors, who often leave home in pre-dawn hours and travel miles alone, vulnerable to violence and rape. For both children and adults, hauling large quantities of firewood and water can lead to physical injuries and fatigue.<sup>7</sup>

In urban areas, charcoal (which is derived from wood) may be more common than self-harvested fuelwood. Monthly expenditures can be high, reaching up to 25 percent of monthly income in urban slums.<sup>8</sup>



Indoor air pollution: the "silent killer in the kitchen."

charcoal is produced. Places where wood collecting pressures are particularly high tend to be densely populated, for instance in Ethiopia, Nigeria, Pakistan, Sri Lanka, and Uganda. Charcoal is a major cooking and heating fuel in many sub-Saharan African countries, as well as in Haiti, Myanmar, the Philippines, Cambodia, Bangladesh, Pakistan, Indonesia, and parts of Central America. In some of these countries, communities are surrounded by a growing ring of degraded woodlands, increasing the traveling distance to find fuel.<sup>10</sup>

## Environmental concerns

Traditional cooking methods also damage the environment. **Biomass** burning increases localized air pollution. Wood stoves and open cooking fires are responsible for up to a quarter of **black carbon** emissions globally, contributing to **global warming**. The emissions also include **greenhouse gases** like **carbon dioxide**, which resides in the atmosphere for decades, trapping heat from the sun.<sup>9</sup>

Collecting wood to burn directly or to turn into charcoal can contribute to forest degradation or loss. Fuelwood gatherers generally target dead and dried wood, which can be important wildlife habitat. For charcoal production, live trees, often from public land, are cut to stumps and turned into charcoal in kilns that burn 4 to 12 times as much wood by volume as

## Better alternatives

Fortunately, there are alternatives. Improved cookstoves may use **biofuels** that communities are used to, but they are designed to get the same amount of heat with less fuel. For example, the Jikokoa stove produced in Kenya by the U.S.-based organization BURN can cut charcoal use by 45 percent over a local competitor, saving users about \$200 over a year, five times the \$40 purchase price. Over 90 percent of improved stoves sold in Kenya are this model.<sup>11</sup>

An older U.S.-based company, Envirofit, has sold over 1 million cleaner cookstoves in 45 countries. Its facilities in China, India, Nigeria, Kenya, Honduras, and Mexico can together churn out 100,000 stoves each month.

They reduce fuel inputs, whether wood, crop waste, or other biomass, by 60 percent and produce 80 percent less smoke and harmful gases, and cut cooking times by up to 40 percent compared to traditional three stone open fires. In India they are sold for as low as \$15 each, and save up to \$75 in wood expenses.<sup>12</sup>



Image by Romana Manpreet for Global Alliance for Clean Cookstoves

A woman in India uses a clean cookstove in her home.

## An inspiring case

Meet Irma. At the age of two, Irma fell into her family's open cooking fire in their rural home in Guatemala. Her hands were burned shut, until 2004—16 years later—when a traveling volunteer medical team conducted the “miracle” operation that opened her hands. Nancy Hughes of Eugene, Oregon, already past typical retirement age, was the medical group's volunteer cook. She watched Irma thank the volunteers and witnessed the long lines of other community members requesting help at the clinic. People with respiratory infections. Children whose throats were so coated with creosote that they could not be intubated. Others with hernias caused by carrying large loads of fuelwood. And more burns. Nancy realized that the majority of the clinic's visitors were seeking medical help for ailments directly caused by their regular cooking methods. She wanted to help them, a decision that led her to create StoveTeam International.<sup>13</sup>

StoveTeam International uses donations and Rotary Club funding to assist local entrepreneurs to establish stove factories in communities with high demand for improved stoves. It now has factories in El Salvador, Guatemala, Honduras, and Mexico. The group invented a small portable stove, called the Ecocina, which they say cuts **carbon emissions** by 68 percent and particulate matter by over 86 percent.<sup>14</sup>

Importantly, the organization is trying to learn from past development aid failures. Their stoves are adapted to fit within local cultural cooking practices. They also are always locally manufactured, which creates jobs in impoverished areas and ensures that there is nearby expertise for repairs. Teams are trained to follow up with customers to check that the stoves are in use and working well. And their users are indeed customers; experience has shown that when people pay for the stoves, even at a discounted price, they tend to value them more than handouts.<sup>15</sup>

## Recommended practices

Most improved cookstoves in circulation, like the models described above, are much cleaner than their traditional alternatives but still fail to meet **World Health Organization** standards for indoor air emissions. To get there, stoves would likely need to burn gas or run on electricity, both of which are out of financial reach for many poor households and can be difficult to come by in many rural areas. Even if the cost were surmountable, the cultural challenges remain.

Solar cookers, which have zero fuel needs and zero emissions, are another option. Culture also is a sticking point with these. Though there are models that can cook some foods well, most current designs are not practical for many people, particularly for cooking inside, at night, or for certain food items.

Thus moving from open fires or inefficient stoves to cleaner cookstoves is seen as an important step toward achievement of a number of the **United Nations Sustainable Development Goals**. Improved stoves can help reduce poverty and hunger and improve health and well-being. Using less wood is better for forests and for economic development. Less time spent harvesting wood leaves more time for productive activities, such as employment for women and schooling for children, both of which help to reduce gender inequality. And cutting the black carbon emissions from dirty cooking methods is a relatively cheap and rapid climate mitigation win; unlike carbon dioxide that resides in the atmosphere for decades, black carbon lasts less than two weeks. Clean cookstoves might be that needed stepping stone on the way toward affordable and clean energy for all.<sup>16</sup>

Author: Janet Larsen

---

<sup>1,6</sup> World Health Organization (WHO), (2016). *Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children*. Geneva, Switzerland. [http://apps.who.int/iris/bitstream/10665/204717/1/9789241565233\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/204717/1/9789241565233_eng.pdf)

<sup>2</sup> Lewis, J. and Pattanayak, S., "Who Adopts Improved Fuels and Cookstoves? A Systematic Review," *Environmental Health Perspectives* 120:637–645 (2012). <http://dx.doi.org/10.1289/ehp.1104194>

<sup>3</sup>The World Health Organization talks about this as "fuel-stove stacking." They note that "even after gaining access to LPG [liquid petroleum gas], members of a household might continue to cook or heat their homes with an open fire or with a traditional wood-burning stove. Or they may continue to use kerosene lamps in certain rooms to supplement electric lights, even after being connected to the grid." WHO [http://apps.who.int/iris/bitstream/10665/204717/1/9789241565233\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/204717/1/9789241565233_eng.pdf)

<sup>4,7,8,9,10</sup> ESMAP, (2015). *The State of the Global Clean and Improved Cooking Sector*. The World Bank Group. <https://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdf>

<sup>5</sup> Martin, W., et. al. (2013, June 4). Household Air Pollution in Low- and Middle-Income Countries: Health Risks and Research Priorities. *PLoS Med*, 2013 Jun; 10(6): e1001455; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3672215/>

<sup>11</sup> Gunther, M. (2016, October 31). Cleaner, Healthier Cookstoves May — At Long Last — Be Catching On. *Enzia*. <http://ensia.com/features/cleaner-cookstoves/>

<sup>12</sup>Urmee, Tania and Gyamfi, S. (2014). A review of improved Cookstove technologies and programs. *Renewable and Sustainable Energy Reviews*. Vol. 33. 625–635; Luoma, J. (2010, March 8). World's Pall of Black Carbon Can Be Eased With New Stoves. *Yale Environment* 360. Retrieved October 23, 2017 from [http://e360.yale.edu/feature/worlds\\_pall\\_of\\_black\\_carbon\\_can\\_be\\_eased\\_with\\_new\\_stoves/2250/](http://e360.yale.edu/feature/worlds_pall_of_black_carbon_can_be_eased_with_new_stoves/2250/)

<sup>13,14,15</sup> Stoveteam International Information from <http://www.stoveteam.org/home>; <https://nonprofitchronicles.com/2016/10/25/a-woman-of-a-certain-age-nancy-hughes-is-improving-thousands-of-lives/>; <http://encore.org/purpose-prize/nancy-sanford-hughes/>; <http://www.pbs.org/newshour/bb/building-cleaner-cookstoves/>

<sup>16</sup>Global Alliance for Clean Cookstoves. *Delivering on the Sustainable Development Goals Through Clean Cooking*. Retrieved October 23, 2017 from <http://cleancookstoves.org/feature/delivering-on-the-sustainable-development-goals-through-clean-cooking.html>