Energy for Sustainable Development 24 (2015) 86–87

Contents lists available at ScienceDirect

Energy for Sustainable Development

Editorial

The World Health Organization has spoken — Improved cookstoves are not clean enough

Improving the performance of cookstoves that burn solid fuels (e.g., wood, charcoal, crop residues, and dung) is a major theme of this journal. Generally, improvements are focused on one or more of the following objectives:

- improving stove efficiency (i.e., output of useful heat per unit of fuel consumed);
- decreasing emissions of outdoor air pollutants of local, regional, or global concern, and
- decreasing the serious respiratory problems caused by indoor air pollution.

What constitutes a sufficient improvement to meet these objectives is controversial. Some have argued that replacing solid fuels with gas or electricity is the most practical strategy; although doing this for the roughly three billion people who rely on solid fuels is a daunting task.

The World Health Organization (WHO) has now settled the matter (at least tentatively) of how clean a stove should be to meet indoor air quality standards for particulate matter ($PM_{2.5}$) and carbon monoxide (CO). It finds that:

> "…for several important health outcomes, including child acute respiratory infections, exposure to the key pollutant — fine particulate matter, or $PM_{2.5}$ — needs to be brought down to low levels in order to gain most of the health benefit" (that is, decreasing emissions from high to moderate levels is not good enough); and"…most of the solid fuel interventions promoted in recent years have not even come close to these [low] levels when in everyday use…."

The report, "WHO Guidelines for Household Air Quality — Household Fuel Combustion" (WHO, 2014), is an essential reading for anyone concerned with the dismal health impacts of burning solid fuels indoors.

Previously, WHO issued air quality guidelines (AQG) for outdoor and indoor air quality. The guidelines most pertinent to the present report are 10 μg/m^3 (annual average) for $PM_{2.5}$ (WHO, 2006) and 7 mg/m^3 (24 hour average) for CO (WHO, 2010).

WHO modeled the relationship between stove emission rates and indoor air concentrations using ranges of values for key parameters. The mean values were 15 air exchanges per hour, a kitchen volume of 30 m^3, and 4 h of stove use per day. One implication here is that user behavior, such as increased ventilation and decreased stove usage time, can help to mitigate indoor air pollution.

WHO notes, however, that decreasing the use of stoves is often impractical and may be offset by users' compensatory actions. Traditional stoves often provide useful light and space heat that improved stoves might not provide. While indoor air pollution from kerosene lamps is generally less serious than pollution from cookstoves, WHO's air quality guidelines are often not met when kerosene lamps are used. Moreover, improved stoves may not be compatible with large or wet pieces of fuel that can be used in traditional stoves.

The major accomplishment of the WHO report is that it establishes emission rate targets (ERTs), designed to meet its air quality guidelines in 90% of kitchens. For unvented cookstoves, the ERT for $PM_{2.5}$ is 0.23 mg/min and the ERT for CO is 0.16 g/min. Targets for vented stoves are about 3.5 times greater, although moving pollutants to the outside creates its own set of problems, including the re-introduction of polluted air into houses.

The report notes that "… given the current evidence on the performance of so-called 'improved' solid fuel stoves in everyday use (Review 6), widespread and near-exclusive use of clean fuels will be required to achieve air quality in and around homes that meets the WHO AQG for $PM_{2.5}$".

Because the nearly universal adoption of "clean fuels" (gas and electricity) is not a practical short-term goal, WHO sets intermediate ERTs (IERT), intended to allow 60% of solid-fueled stove users to comply with indoor air quality standards. For CO, the IERT is about two times the ERT. For PM2.5, an interim concentration standard of 35 μg/m^3 is applied and the resulting IERT is about eight times the ERT. If the AQG of 10 μg/m^3 were applied, the IERT would yield $PM_{2.5}$ compliance in less than 10% of kitchens. The upshot is that, in the long run, solid fuel stoves might never yield acceptable indoor air quality.

WHO's essential message is "Action to address this problem has historically been slow, under-funded, and marked by many ineffective and/or unsustainable interventions". The matter of unstable interventions is of particular concern to this journal. Papers reporting results of only the first year or so of an intervention often overestimate the success of a program. Follow-up field surveys show that, within a couple years, users often resume use of their old stoves, even after initially reporting that their new improved stoves were highly prized.

WHO goes on to state, "Efforts to implement interventions to improve use of household energy have a history extending back for at least 30–40 years. However, much of the emphasis was on reducing biomass fuel consumption, fostering local economic development and supporting the role of women, rather than on measures to directly improve health". Much of this history has been documented in this journal. See, for example, the June 2007 special issue on the Household Energy and Health Project (ESD, 2007) and MacCarty et al. (2010) "Fuel use and emissions performance of fifty cooking stoves in the laboratory and related benchmarks of performance."

http://dx.doi.org/10.1016/j.esd.2014.12.006

Many of the shortcomings of past cookstove improvement programs that WHO highlights are evaluated by Simon et al. (2014) in their summary of the 2013 biannual meeting of the Global Alliance for Clean Cookstoves. We now know a lot about what we don't know and we know a lot about what has failed. Thoughtfully applied, that knowledge, we hope, may lead to some good papers being submitted to this journal and eventually to clean cooking becoming the norm everywhere.

References

ESD. Energy Sustain Dev 2007;XI(No. 2).
MacCarty N, Still D, Ogle D. Fuel use and emissions performance of fifty cooking stoves in the laboratory and related benchmarks of performance. Energy Sustain Dev 2010; XIV(No. 3):161–71.
Simon GL, Bailis R, Baumgartner J, Hyman J, Laurent A. Current debates and future research needs in the clean cookstove sector. Energy Sustain Dev 2014;20:49–57.
WHO. WHO air quality guidelines global update 2005: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. Copenhagen: World Health Organization, Regional Office for Europe; 2006 [2006. EUR/05/5046029].
WHO. WHO guidelines for indoor air quality: selected pollutants. Bonn: World Health Organization; 2010 [http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf, accessed 17 July 2014].
WHO. WHO guidelines for indoor air quality: household fuel combustion. http://apps.who.int/iris/bitstream/10665/141496/1/9789241548885_eng.pdf, 2014. [accessed 10 December 2014].

Daniel B. Jones