World Health Organization

UN environment

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

THE EQUATION IS SIMPLE.

Household air pollution accounts for 3.8 million premature deaths, particularly in low- and middle- income countries.

+

Black carbon is a key component of household air pollution and the second most important climate change pollutant after CO_2.

=

Reducing household emissions can slow near-term climate change and reduce air pollution health risks, a real win-win particularly for the world's poorest populations.

BREATHELIFE

Clean Air. Healthy Future.

HEALTH IMPACTS

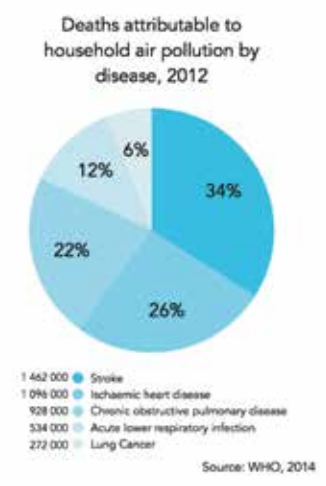
1

Household (indoor) air pollution is one of the biggest risks to health in low-income countries today.

An estimated 3.8 million premature deaths are attributed to household air pollution, primarily due to stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and pneumonia.

Household air pollution is estimated to cause one-third of all premature deaths from COPD and over one-half of all childhood under-5 pneumonia deaths.

The effects of household air pollutions are highest among society's most vulnerable groups. Some 60% of all premature deaths from household air pollution globally are among women and children. The same groups most at risk from household air pollution also tend to have heightened risks from other factors such as smoking and poor diet, making them even more vulnerable to non-communicable diseases (NCDs).



WHAT CREATES THESE RISKS?

Inefficient coal and biomass stoves

According to a new WHO report, *Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children*, nearly 3.1 billion people, or 43% of the global population, still rely on polluting fuels (i.e. biomass, coal, kerosene) and technologies for cooking - a major source of household air pollution.

Photo: Practical Action

Household combustion of polluting fuels releases large quantities of health-damaging pollutants, such as particulate matter (PM), carbon monoxide and volatile organic compounds. Ambient levels of $PM_{2.5}$ (fine particles smaller than 2.5 micrometres in diameter) have been shown to be as much as 100 times higher than WHO-recommended levels in households with open-burning and unvented solid fuel stoves. The burning of unprocessed coal releases a toxic mix of substances,

such as arsenic, lead and mercury. Household coal and biomass stoves emit high levels of carbon monoxide (CO) and nitrogen oxides (NO_x). Carbon monoxide decreases blood oxygen levels; acute CO exposure can be fatal, while chronic NO_x exposures can exacerbate a range of respiratory ailments.

Household fuel combustion is a significant source of the short-lived climate pollutant black carbon. Household combustion is estimated to produce 25% of global emissions of black carbon, which is the second largest contributor to climate change after carbon dioxide (CO_2) and a major component of particulate matter. Since black carbon particles remain airborne for only a few days to a week, reducing their emissions can also slow near-term climate change as well as reducing a significant health risk.

Photo: Global Affairs Canada

Kerosene

The use of kerosene as a household fuel in unvented wick cookstoves or kerosene lamps generates high levels of carbon monoxide, nitrogen dioxide, and sulfur dioxide. Studies of kerosene used for cooking or lighting indicate that its emission impair lung function and increase risks of tuberculosis, asthma and cancer. Kerosene use also can result in burns and poisoning particularly among children. Kerosene emission of $PM_{2.5}$ are primarily composed of black carbon making it a major concern for climate change.

THE CONTRIBUTION TO AMBIENT AIR POLLUTION

Household emissions are a major contributor to ambient (outdoor) air pollution. From cooking alone, household air pollution is estimated to be responsible for close to 500,000 of the 3.9 million premature deaths each year from ambient air pollution.

In addition to $PM_{2.5}$ household coal, kerosene and biomass combustion emits significant NO_x, Volatile Organic Compounds (VOCs) and methane. These compounds interact with other outdoor air pollutants contributing to the formation of ground level ozone, an SLCP, which can drift over many kilometres, also polluting rural areas. High ozone levels increase the risks of chronic respiratory disease, decrease crop yields and alter local weather patterns. Worldwide, some 150,000 deaths annually are attributed to ozone exposures.

3

As their name implies, SLCPs only remain in the atmosphere for weeks to decades, compared to CO_2, which persists for over a century. If SLCP emissions are reduced, their effects can soon be reversed, a gain for both climate and public health.

THE HEALTH EQUITY IMPLICATIONS

The poorest households in the world typically use the most polluting fuels, and the adoption of cleaner energy sources is closely linked to poverty reduction more generally. Fuel sources progress from the open burning of dung/crop waste, to the use of wood, charcoal, kerosene, and finally, cleaner fuels such as LPG or natural gas, biogas or ethanol, and/or electricity.

Women experience high exposure to air pollution due to their greater involvement in household activities such as cooking, sometimes with infants or children in close proximity. However, reliance on polluting fuels and technologies imposes a burden well beyond the smoke inhaled. Drudgery, injuries, safety risks and time loss are just some of the negative impacts. In the WHO *Burning Opportunity* report, an analysis of 30 countries found that girls in households that cook mainly with polluting fuels lose a significant amount of time – 15 to 30 hours each week – collecting wood or water, a higher time-loss burden than for boys. In the process of gathering fuel, sometimes with a weight 40kg or more, women and children can suffer ongoing cumulative physical strain and chronic discomfort. Women may also be at risk for threats of physical and sexual violence.

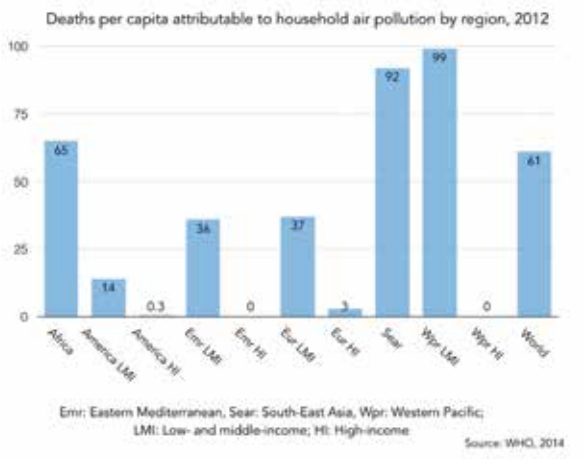
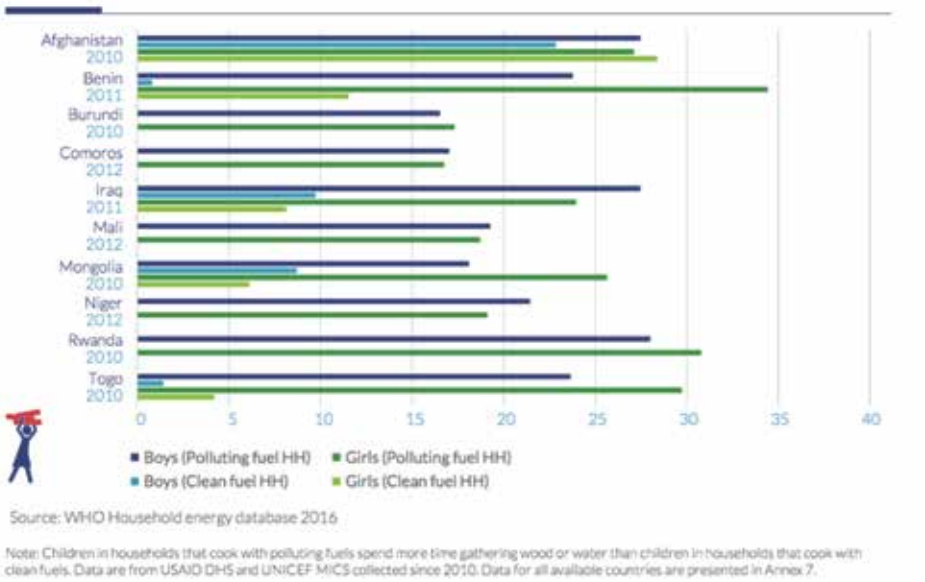


Photo: Reuters/Daniel Eclai

Savings in terms of avoided sickness and illness, and associated healthcare costs, are among the most immediate and direct impacts of household pollution reductions. Since illness can be catastrophic for poor families, this is also important to poverty reduction. By switching to clean energy, women and children can also suffer fewer health risks from collecting heavy loads, while also having more time to put towards other productive activities.

Photo: REUTERS/Andreea Campeanu

Top ten countries for average number of hours spent collecting wood or water in the past week among boys and girls who collect wood or water, disaggregated by household cooking fuel:



Source: WHO Household energy database 2016

Note: Children in households that cook with polluting fuels spend more time gathering wood or water than children in households that cook with clean fuels. Data are from USAID DHS and UNICEF MICS collected since 2010. Data for all available countries are presented in Annex 7.

REDUCING HOUSEHOLD EMISSIONS

Strategies to reduce household air pollution emissions include: phasing out unprocessed coal and kerosene as household fuels; transitioning to clean fuels such as biogas, ethanol and LPG, as well as to more efficient biomass cookstoves, with appropriate venting. Improving household ventilation and energy design is also critical.

Cleaner Technologies

Dramatically increasing access to cleaner household energy fuels, such as LPG, biogas, ethanol, and electricity should be a key development priority, according to the WHO *Guidelines for Indoor Air Quality – Household Fuel Combustion.*

Electric and electric induction stoves are often the cleanest in terms of absolute indoor emissions –although the pollution

Photo: Reuters/Akhtar Soomro

emitted by power production is a consideration in countries dependent on dirty fuels such as coal. For solar stoves or stoves using renewable fuels such as ethanol and biogas, the climate change and SLCP benefits are even greater.

Along with reducing household air pollution, biogas production has other indirect health benefits. Methane-rich biogas can be produced from human and animal sewage and municipal waste; methane CH_4 is a greenhouse gas, and one of the most powerful SCLPs, so the climate benefits of biogas capture and combustion are very positive. Policies that encourage biogas production can also support improved sewage and waste management in households and communities, and reduce deforestation pressures.

Discontinuing use of Dirty Fuels

The WHO *Guidelines for Indoor Air Quality – Household Fuel Combustion* recommends that unprocessed coal and kerosene be discontinued altogether due to their extremely high emissions of VOCs and (in the case of coal) heavy metals as well as particulates, including black carbon. Kerosene lamps, for instance, produce as much as 270,000 tons of black carbon annually, on a worldwide level. From an overall climate mitigation standpoint, they also are an excellent policy target. It has been estimated that just one photovoltaic (PV) solar lanterns or light that replaces a kerosene lamp can avert the emission of 250 kg of CO_2 emissions from a single 60 watt lightbulb equivalent.

Advanced Combustion Low-Emission Biomass Cookstoves

Switching from open fires or rudimentary stoves to "improved" biomass stoves can reduce black carbon and $PM_{2.5}$ emissions by a factor of 10 or greater, as well as reducing harmful CO emissions. One estimate suggested that the deployment of 150 million advanced combustion "gasifier" stoves in India would result in an annual health savings of 12,500 disability adjusted life years (DALYs) annually, and a reduction of 0.5 megatonnes of black carbon, per million population.

Even so, among the improved biomass cookstoves tested, none so far have met WHO guideline emission rate targets. Since not every 'improved' or 'efficient' stove will result in net health benefits, policymakers need to carefully assess the evidence surrounding a particular technology. Policies should support further research into cookstoves that emit fewer pollutants and are low cost.

Solar Electrification

Some 1.3 billion households worldwide lack access to electricity. Along with replacing kerosene lamps, solar electrification can power other household electronics or appliances, creating additional health and development benefits, such as better communications, refrigeration, and enabling more productive activities to take place after dark.

Photo: REUTERS/Laurence Tan

In many parts of Africa, Latin America and South-East Asia, where the grid is unreliable or non-existent, PV solar installations are becoming economically competitive with diesel generators as a source of small-scale electricity production for lights, household appliances and electronics. These same approaches also are being used to power off-grid health facilities, which suffer from critical power shortages – in surveyed sub-Saharan Africa, for instance, 26% percent of health facilities have no power at all, and only about one-third of hospitals have reliable power. Due to their large and constant energy needs, and the presence of trained staff on site, local health facilities have the potential to become community anchors for solar power generation, as this becomes even more affordable, providing a baseline of renewable electricity for community needs as well.

Household and institutional diesel generators are an important and growing source of air pollution and black carbon emissions in low-income regions – particularly Sub-Saharan Africa. So when solar power replaces diesel generators in households or health facilities, not only is health improved, but black carbon emissions are reduced – and the trajectory of future emissions growth is contained.

Improved Housing Design

Building design measures can significantly improve stove ventilation as well as decrease the amount of heat and power that must be used to meet other essential household energy requirements. Design strategies are particularly important in reducing household pollution and SLCP emissions from fuel-based heating systems, including black carbon, CO and NO_x. More efficient building design can reduce cooling requirements, and reliance on air conditioners which use hydrofluorocarbons (HFCs). HFCs are another class of very potent SLCP – and thus significant contributor to climate change.

At present trajectories, building and energy emissions are set to double or triple in the coming decades. Yet, energy efficiencies of 50-90% have been demonstrated in new buildings as well as those making use of new retrofit technologies (IPCC, 2014).

Design measures also help to keep buildings dry, at a comfortable temperature, and to remove harmful air pollutants. In cold climates, this means creating a thermal envelope (ie. with weather-tight fittings and windows) whilst still maintaining adequate active ventilation to prevent damp and mould, and the accumulation of indoor air pollution.

In warmer climates, energy-efficient building designs encourage passive air flow, and make use of green space and reflective materials to facilitate cooling. Structural additions such as chimneys can be built in to the household to enhance ventilation.

Along with further reducing household air pollution emissions, health benefits of smart building design include a reduction in hot- and cold-related morbidity and mortality, lower rates of damp-

and mould-related illnesses, and reduced transmission of infectious disease through better ventilation, as well as reduced build-up of pollutants from construction materials and furnishings.

Smart urban design that creates compact housing clusters can also improve energy efficiencies, making "district heating" systems based on the co-generation of heat and power more feasible. 'Trigeneration' goes further, providing cooling through chilled water as well as heat and power. These technologies are already widely used in northern Europe.

INITIATIVES

In May 2015, the World Health Assembly (WHA) adopted a resolution on air pollution and health, calling for an enhanced global response to the adverse health effects of indoor and outdoor air pollution. Building on this resolution, a draft road map has been proposed for WHA69, which includes four categories: expanding the knowledge base; monitoring and reporting; global leadership and coordination; and institutional capacity strengthening. One key activity is the development of a clean household energy toolkit (CHEST), which will bring together evidence and recommendations found in WHO *Guidelines for Indoor Air Quality – Household Fuel Combustion to policy-makers and health professions.*

The 2014 WHO *Guidelines for Indoor Air Quality – Household Fuel Combustion* is an important milestone in setting acceptable levels $PM_{2.5}$ and carbon monoxide emissions from household energy sources. They set health-based emission targets for fuel and stove combinations, recommend against the household use of unprocessed coal and kerosene, and support greater access to clean fuels and optimal interim technologies. The guidelines are an important tool for effective policy and planning in energy and health.

WHO's Health in the Green Economy series provides detailed evidence about strategies that can promote health co-benefits through more energy efficient homes, including strategies that reduce SLCP emissions as well as CO_2 emissions. Also forthcoming are WHO guidelines on Housing and Health, which will parovide measurable standards against which housing designs may be evaluated.

The CCAC Household Heating and Domestic Cooking Initiative is working to improve the standards and testing protocol needed to reliably evaluate emissions reductions and co-benefits from interventions to reduce black carbon, PM, and other pollutants. The initiative is in collaboration with the Global Alliance for Clean Cookstoves (GACC), aimed at expanding clean cookstove solutions in developing countries.

RESOURCES

WHO:

Access to modern energy services for health facilities in resource-constrained settings; A review of status, significance, challenges and measurement (2014):
http://www.who.int/hia/green_economy/modern-energy-services/en/

Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children (2016):
http://www.who.int/indoorair/publications/burning-opportunities/en/

Health co-benefits of climate change mitigation - Housing sector; Health in the green economy (2014):
http://www.who.int/hia/green_economy/housing_report/en

Household air pollution and health (2015): http://www.who.int/mediacentre/factsheets/fs292/en/

Indoor air quality guidelines household fuel combustion (2014):
http://www.who.int/indoorair/publications/household-fuel-combustion/en/

Mortality and burden of disease (2014):
http://www.who.int/phe/health_topics/outdoorair/databases/HAP_BoD_results_March2014.pdf?ua=1

Reducing Global Health Risks Through Mitigation of Short-Lived Climate Pollutants; Scoping Report For Policymakers (2015):
http://www.who.int/phe/publications/climate-reducing-health-risks/en/

OTHER

Reducing SLCPs from Household Cooking and Domestic Heating:
http://www.unep.org/ccac/Initiatives/HouseholdCookingandDomesticHeating/tabid/131774/language/en-US/Default.aspx

Global Alliance For Clean Cookstoves: http://cleancookstoves.org/

IPCC: Climate Change 2014: Synthesis Report (2014): http://www.ipcc.ch/report/ar5/syr/

The Lancet: A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a Systematic Analysis for the Global Burden of Disease Study 2010 (2012):
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61766-8/abstract

The Lancet: Public health benefits of strategies to reduce greenhouse-gas emissions: household energy (2009): http://www.ncbi.nlm.nih.gov/pubmed/19942273