

Section 1



**Household
Energy, Indoor
Air Pollution
and Health**

Household energy: three billion left behind

"The health of the people is really the foundation upon which all their happiness and all their powers as a state depend."

Benjamin Disraeli, British statesman and writer (1804–1881)

Cooking as an enjoyable pastime and passion for a privileged minority – on an electric range or a gas stove in a stylish kitchen in New York, Paris or Tokyo. Cooking as a chore and threat to the lives of the great majority – on an open fire in a shabby hut in rural Africa, south Asia or Latin America.

Worldwide, more than three billion people depend on solid fuels, including biomass (wood, dung and agricultural residues) and coal, to meet their most basic energy needs: cooking, boiling water and heating (Figure 1). Opening the door to their homes makes for a hazy welcome: thick grey smoke fills the air, making breathing unbearable and bringing tears to the eyes. The inefficient burning of solid fuels on an open fire or traditional stove indoors creates a dangerous cocktail of hundreds of pollutants, primarily carbon monoxide and small particles, but also nitrogen oxides, benzene, butadiene, formaldehyde, polyaromatic hydrocarbons and many other health-damaging chemicals. Day in day out, and for hours at a time, women and their small children breathe in amounts of smoke equivalent to consuming two packs of cigarettes per day. Where coal is used, additional contaminants such as sulfur, arsenic and fluorine may also be present in the air.

Yet, these families are faced with an impossible dilemma: don't cook with solid fuels, or don't eat a cooked meal. Being poor condemns half of humanity to dependence on polluting household energy practices. With increasing prosperity, cleaner, more efficient and more convenient fuels are replacing, step-by-step, traditional biomass fuels and coal. Climbing up the energy ladder tends to occur gradually as most low- and middle-income households use a combination of fuels to meet their cooking needs (Figure 2).

The problem of indoor air pollution has been around since the Stone Age, yet international development agendas still fail to recognize that missing out on clean energy equals missing out on life.

Figure 1: Energy poverty in people's homes
Percentage of population using solid fuels (Millennium Development Goal indicator 29), 2003 or latest available data

Reproduced with permission from: © Myriad Editions

- 0%–25%
- 26%–50%
- 51%–75%
- 76%–100%

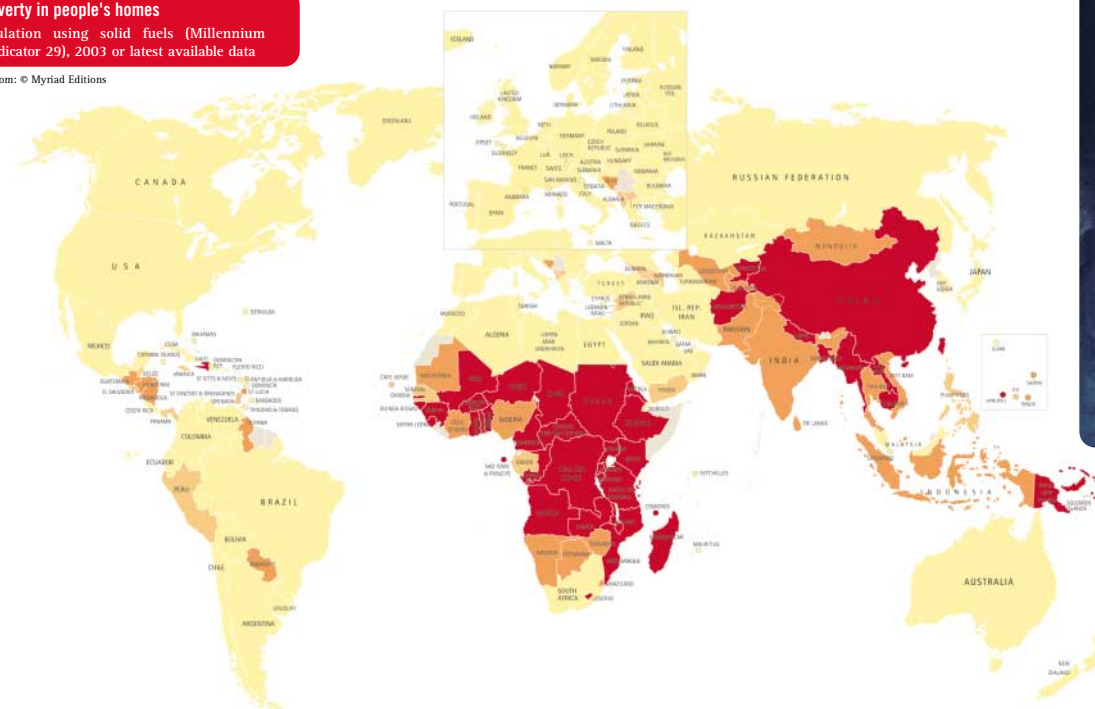
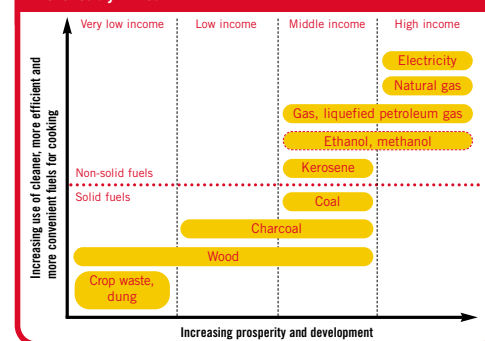


Figure 2: The energy ladder: household energy and development inextricably linked



Health at the heart of the matter

Black soot covers the walls of the dwelling. It is the pollutants in this black soot, as well as many invisible pollutants in the air, that women and children breathe in for many hours every day. Small particles (with a diameter of up to 10 microns (PM₁₀)) are the most widely used indicator of the health hazard of indoor air pollution. Fine particles (with a diameter of up to 2.5 microns (PM_{2.5})) are able to penetrate deep into the lungs and appear to have the greatest health-damaging potential. It is known that these particles can cause inflammation of the airways and lungs and impair the immune response, yet the precise mechanism by which exposure to indoor air pollution translates into disease is still unknown.

Burning solid fuels produces extremely high levels of indoor air pollution: typical 24-hour levels of PM₁₀ in biomass-using homes in Africa, Asia or Latin America range from 300 to 3000 micrograms per cubic metre (µg/m³). Peaks during cooking may be as high as 10 000 µg/m³. By comparison, the United States Environmental Protection Agency has set the standard for annual mean PM₁₀ levels in outdoor air at 50 µg/m³; the annual mean PM₁₀ limit agreed by the European Union is 40 µg/m³. As cooking takes place every day of the year, most people using solid fuels are exposed to levels of small particles many times higher than accepted annual limits for outdoor air pollution (Figure 3). The more time people spend in these highly polluted environments, the more dramatic the consequences for health. Women and children, indoors and in the vicinity of the hearth for many hours a day, are most at risk from harmful indoor air pollution.

Since the mid-1980s, epidemiological studies have been investigating the impacts of exposure to indoor air pollution on health. The results of these studies have recently been reviewed by WHO (Table 1). Inhaling indoor smoke doubles the risk of pneumonia and other acute infections of the lower respiratory tract among children under five years of age. Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary disease (COPD), such as chronic bronchitis or emphysema, than women who cook with electricity, gas or other cleaner fuels. And coal use doubles the risk of lung cancer, particularly among women.

Moreover, some studies have linked exposure to indoor smoke to asthma; cataracts; tuberculosis; adverse pregnancy outcomes, in particular low birth weight; ischaemic heart disease; interstitial lung disease, and nasopharyngeal and laryngeal cancers. New research is needed to shed light on how exposure to indoor smoke contributes to this long list of health problems (see also Box 1).



Figure 3: Smoky streets, smoky homes
Typical 24-hour mean levels of small particles (PM₁₀) in micrograms per cubic metre (µg/m³), early 2000s

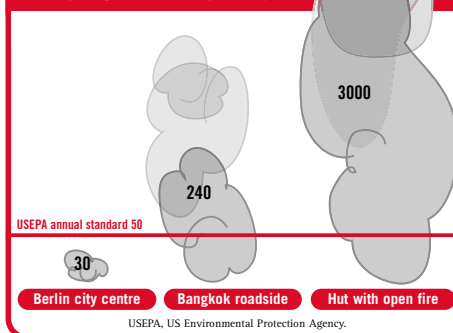


Table 1: Health impacts of indoor air pollution

Health outcome	Evidence ¹	Population	Relative risk ²	Relative risk (95% confidence interval) ³	
Acute infections of the lower respiratory tract	Strong	Children aged 0–4 years	2.3	1.9–2.7	S U F F I C I E N T
Chronic obstructive pulmonary disease	Strong	Women aged ≥ 30 years	3.2	2.3–4.8	
	Moderate I	Men aged ≥ 30 years	1.8	1.0–3.2	
Lung cancer (coal)	Strong	Women aged ≥ 30 years	1.9	1.1–3.5	
	Moderate I	Men aged ≥ 30 years	1.5	1.0–2.5	
Lung cancer (biomass)	Moderate II	Women aged ≥ 30 years	1.5	1.0–2.1	I N S U F F I C I E N T
Asthma	Moderate II	Children aged 5–14 years	1.6	1.0–2.5	
	Moderate II	Adults aged ≥ 15 years	1.2	1.0–1.5	
Cataracts	Moderate II	Adults aged ≥ 15 years	1.3	1.0–1.7	
Tuberculosis	Moderate II	Adults aged ≥ 15 years	1.5	1.0–2.4	

¹ Strong evidence: Many studies of solid fuel use in developing countries, supported by evidence from studies of active and passive smoking, urban air pollution and biochemical or laboratory studies.

Moderate evidence: At least three studies of solid fuel use in developing countries, supported by evidence from studies on active smoking and on animals.

Moderate I: strong evidence for specific age/sex groups. Moderate II: limited evidence.

² The relative risk indicates how many times more likely the disease is to occur in people exposed to indoor air pollution than in unexposed people.

³ The confidence interval represents an uncertainty range. Wide intervals indicate lower precision; narrow intervals indicate greater precision.

Box 1: Better household energy practices to mitigate the HIV/AIDS crisis?

Winning the battle against HIV/AIDS calls for effective prevention and treatment. But it also requires that people maintain their energy levels and physical fitness. Household energy plays a crucial role in keeping patients and their caregivers going: It is indispensable for cooking safe, nutritious meals and for boiling water to ensure its safety for drinking. It is essential for preparing hot compresses, heating water for bathing and sterilizing utensils for patients. And it provides warmth for those who are ill and suffering.

In Africa, wood tends to be scarce where collected and expensive where purchased. The incomplete combustion of biomass fuels indoors produces dense smoke, a major contributor to respiratory problems – even more so among immunocompromised HIV/AIDS patients. Therefore, more efficient, cleaner household energy practices can help families affected by HIV/AIDS as well as those not affected by the disease to live a healthier life.

Adapted from:

Gebert N. *Mainstreaming HIV/AIDS: Participation or exclusion? Actors in the context of HIV/AIDS and project-induced measures (GTZ) for the optimized utilization of subsistence resources.* German Technical Cooperation Programme for Biomass Energy Conservation in Southern Africa (GTZ ProBEC), in press. Available at: <http://www.probec.org>

The killer in the kitchen

"Are we to decide the importance of issues by asking how fashionable or glamorous they are? Or by asking how seriously they affect how many?"

Nelson Mandela,
South African statesman and winner
of the Nobel Prize for Peace (1918-)

Malaria, tuberculosis, HIV/AIDS and many other diseases compete for newspaper headlines – and the attention of the public. How should decision-makers prioritize one health problem against another?

The burden of disease combines years of life lost due to death with the years of life lost due to disability in a single measure that applies across diseases and health risks. WHO investigates the contribution of a range of risk factors, such as malnutrition, smoking and lack of physical activity, to the burden of disease. The results for the year 2000 unveiled cooking as a dangerous undertaking and indoor air pollution from burning solid fuel as one of the top ten global health risks. The "kitchen killer" turned out to be responsible for 1.6 million deaths and 2.7% of the global burden of disease. In poor developing countries, only malnutrition, unsafe sex and lack of clean water and adequate sanitation were greater health threats than indoor air pollution.

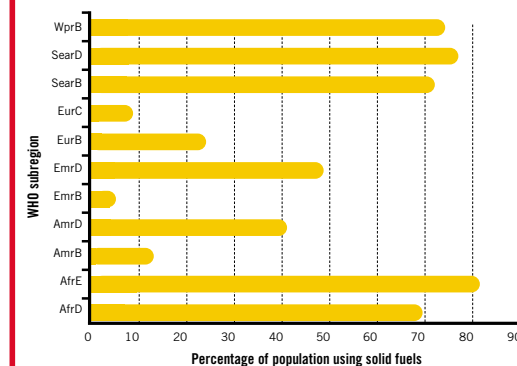
This wake-up call placed indoor air pollution on the international public health agenda for the first time. Yet, the most recent and more accurate estimates show practically no change. Globally, 1.5 million people died from diseases caused by indoor air pollution in the year 2002. This figure includes children who died from pneumonia and adults who died from chronic respiratory disease and lung cancer – only those diseases for which current evidence for a link with indoor air pollution is sufficient (see Table 1). What if indoor smoke also turns out to contribute to low birth weight and tuberculosis?

Reliance on polluting solid fuels (Figure 4) and inefficient household energy practices varies widely around the world, as does the death toll due to indoor smoke (Figure 5). In 2002, Sub-Saharan Africa and South-East Asia led with 396 000 and 483 000 deaths due to indoor smoke, respectively. Widespread use of biomass and coal in China plays a key role in chronic respiratory diseases among adults, and was responsible for a large share of the 466 000 deaths in the Western Pacific in 2002. Although the majority of the population in Latin America and the Caribbean, the Eastern Mediterranean and Europe use gas and other cleaner fuels for cooking, the health burden disproportionately falls on the poorest countries in these regions, and on the poorest members of society among whom solid fuel use is still common (see Figure 6 and Trapped by energy poverty).

Indoor air pollution continues to ravage rural communities and poor urban dwellers. And it continues to be largely ignored by the world community.

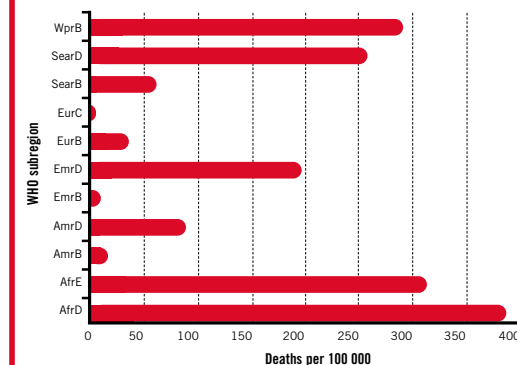


Figure 4: Widespread solid fuel use ...
Percentage of population using solid fuels, by WHO subregion¹, 2003 or latest available data



¹ WHO distinguishes between the following geographical regions: African Region (Afr); Region of the Americas (Amr); Eastern Mediterranean Region (Emr); European Region (Eur); South-East Asia Region (Sear); Western Pacific Region (Wpr). WHO also differentiates between the following mortality strata: very low child, very low adult (A); low child, low adult (B); low child, high adult (C); high child, high adult (D); high child, very high adult (E).

Figure 5: ... translates into respiratory deaths
Deaths attributable to indoor air pollution per 100 000 population, by WHO subregion¹, 2002



¹ WHO distinguishes between the following geographical regions: African Region (Afr); Region of the Americas (Amr); Eastern Mediterranean Region (Emr); European Region (Eur); South-East Asia Region (Sear); Western Pacific Region (Wpr). WHO also differentiates between the following mortality strata: very low child, very low adult (A); low child, low adult (B); low child, high adult (C); high child, high adult (D); high child, very high adult (E).