

Health Impacts of Indoor Air Pollution

At-a-Glance

EAP CLEAN STOVE INITIATIVE KNOWLEDGE EXCHANGE SERIES

INDONESIA



Key Messages

- Approximately 40 percent of Indonesian households continue to rely on traditional biomass (mostly wood) for cooking. Most of these households are in rural areas and are likely to continue using traditional biomass in the near future.
- Household burning of traditional biomass is a major health risk factor in Indonesia. The indoor air pollution caused by the use of traditional biomass is responsible for an estimated 45,000 premature deaths annually, with women and children particularly affected.
- In order to decrease indoor air pollution, Indonesia needs to build on its earlier experiences and scale up access to modern and cleaner methods of cooking. The World Bank is launching the Indonesia Clean Stove Initiative to help increase the access to clean and efficient stoves through capacity building, policy development, and the support of selected government action plans.

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Why is Indoor Air Pollution a Health Issue?

Indoor air pollution (IAP) caused by the burning of solid fuels in traditional stoves is one of the leading risk factors attributed to mortality and burden of disease. For more than half of the world's population, solid fuels, such as wood, agricultural residues, dung, and coal, are the primary source of household cooking and heating fuel. Indoor combustion of solid fuels using traditional stoves releases a large amount of particulate matter (PM) and gaseous pollutants, causing serious health consequences for exposed populations. IAP emission levels generated by solid fuels are often 20–100 times those of clean fuels like liquefied petroleum gases (LPG) as is shown in table 1, and often up to 20 times higher than the maximum recommended levels suggested by the World Health Organization (WHO) guidelines and national standards (WHO/UNDP 2009).

Smoke from cooking fuels accounts for an estimated 2 million worldwide premature deaths annually—more than the deaths from malaria and tuberculosis combined (WHO/UNDP 2009). It is the ninth leading risk factor attributed to burden of disease and the tenth leading cause of global mortality.

Women and children in developing countries are particularly affected by the negative health outcomes associated with IAP from solid fuel use. Women and girls are disproportionately affected because of the amount of time spent cooking. Young children are especially vulnerable since they spend much of their time indoors to be close to their mothers, including while they are cooking.

A meta-analysis of the global studies on the risk of pneumonia in children under 5 indicates that children who are exposed to smoke from solid fuels are more than 1.8 times more likely to contract pneumonia than those who are not (Smith et al. 2010). The analysis also shows that the increase in the risk for contracting the illnesses of acute lower respiratory infection (ALRI), chronic obstructive pulmonary disease (COPD), cataracts, lung cancer, and cardiovascular disease ranges widely—from less than 10 percent to more than double. On average, the chance of contracting previous mentioned illnesses ranges from 78 percent for ALRI in children under 5 to more than 150 percent for COPD in women over 15 (World Bank 2011a).

Table 1. Household Emission Levels by Type of Fuel (per Meal)

	Biogas	LPG	Kerosene	Wood Residues	Crop	Dung
CO	0.1	1	3	19	60	64
PM	2.5	1	1.3	26	124	64

Note: Health-damaging pollutants per unit energy delivered: ratio of emissions to LPG. Data from K. Smith et al. 2000. Source: Smith, Rogers, and Cowlin 2005.

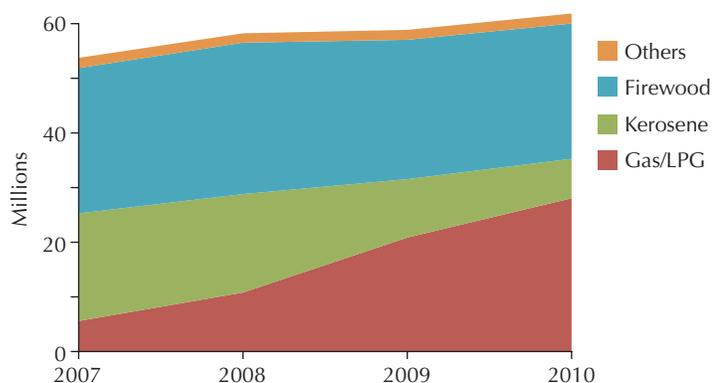
This publication is a product of the collaboration between the staff of the Infrastructure (EASIN) and Health (EASHH) units of the East Asia and Pacific region of the World Bank.

What is the Household Energy Use Situation in Indonesia?

Approximately 40 percent of Indonesian households still rely on traditional biomass (mainly wood) for cooking. Although the share of households using wood has declined slightly in recent years—from 49 percent in 2007 to 40 percent in 2010—as of 2010, approximately 24.5 million households still relied on wood as their primary cooking fuel (figure 1). Wood continues to be the dominant cooking fuel in 18 of 33 provinces. This wide use of wood can be attributed mostly to the lack of access to and affordability of more advanced fuels and stoves (figure 2).

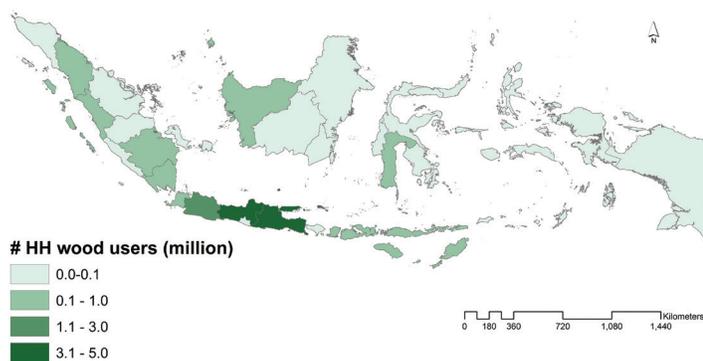
The largest number of households that depend on wood for cooking fuel are in East Java, Central Java, and West Java. In 2007, the three provinces combined had more than 14 million users of wood for cooking, accounting for 53 percent of

Figure 1. Number of Households Relying on Cooking Fuels, by Type, 2007–10



Source: National Socio-Economic Survey, BPS 2008–2011.

Figure 2. Number of Households Relying Primarily on Wood for Cooking, 2010



Source: National Socio-Economic Survey, BPS 2011.

Table 2. Top Three Provinces with Largest Number of Households Using Wood for Cooking (millions)

Province	2007	2008	2009	2010
East Java	5.3	5.5	5.1	4.8
Central Java	5.2	5.3	4.4	4.0
West Java	3.6	3.6	3.1	2.9

Source: National Socio-Economic Survey, BPS 2008–11.

the national total. By 2010, the number was reduced to 11.7 million but these three provinces still represent almost half of the country's wood users (table 2).

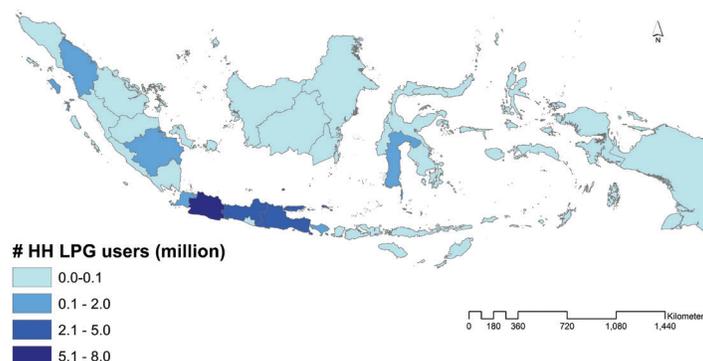
The number of LPG users increased fivefold as a result of the government kerosene-to-LPG conversion program begun in 2007. LPG replaced a large portion of the kerosene market, which has led to the increase of LPG users from 5.6 million in 2007 to 27.6 million in 2010. Consequently, LPG became the dominant cooking fuel in 10 Indonesian provinces, and kerosene users declined to a total of 7 million country-wide. Households that rely on LPG are concentrated on Java Island (figure 3).

What are the Health Impacts Caused by IAP in Indonesia?

Indonesia ranks second among East Asia and Pacific countries in mortality attributed to IAP from solid fuel combustion. IAP caused by the use of solid cooking fuels has resulted in over 45,000 premature deaths in Indonesia annually. In particular, chronic obstructive lung disease is a major contributor to the total number of premature deaths (table 3).

The use of fuel wood for cooking is also linked with an increased risk for asthma, lung tuberculosis, and ARI among children under 5 in Indonesia. A number of studies show that the use of solid fuels in Indonesia, especially by populations in

Figure 3. Number of Households Relying Primarily on LPG for Cooking, 2010



Source: National Socio-Economic Survey, BPS 2011.

Table 3. Annual Number of Premature Deaths Attributed to Air Pollution Caused by Cooking with Solid Fuels, 2007

Pneumonia— Children <5	Chronic Obstructive Lung Disease—Adults >30	Cancer—Adults >30	Total Premature Deaths	Total Premature Deaths per 1,000 People
8,700	36,600	NA	45,300	0.19

Source: WHO and UNDP 2009.

rural areas, is closely related to the high incidence of respiratory diseases. For example, the use of wood compared to the use of LPG or kerosene for cooking increases the risk of asthma by 5.8 times and tuberculosis by 6 times (Aron 2004). Several other studies showed that the practice of mothers bringing children into the kitchen during cooking increases the risk of infants contracting ARI and pneumonia by 2–6 times. A lack of ventilation in the kitchen is likely to increase the incidence of asthma by 6 times and is also linked with a higher incidence of ARI.

What Can Be Done to Alleviate IAP?

IAP exposure can be reduced by using a wide array of technological, housing, and behavioral interventions. A concentration of indoor pollutants depends on a stove-fuel combination (e.g., advanced clean stoves can reduce IAP levels by more than 50 percent), house design (e.g., house size and construction materials, room arrangement, and ventilation condition), and stove-use behavior (e.g., whether or not fuel is dried before it is combusted). In addition to pollution levels, exposure depends on the amount of time spent inside or near a stove, direct participation in cooking tasks, and alternative cooking practices.

Switching to clean fuels (e.g., electricity, natural gas, LPG, and biogas) is the most effective way of reducing IAP and should be encouraged, but most rural households are likely to continue using solid fuels in the near future. Modern clean fuels (e.g., natural gas, LPG, and electricity) are usually more expensive than solid fuels, requiring more costly stoves and delivery infrastructure, particularly more difficult for rural populations to obtain. By contrast, many types of biomass are traditionally and noncommercially collected in rural areas. Therefore, fuel switching will not occur in rural areas on a large scale until rural economies become substantially more developed.

Where the use of solid fuels persists, the most effective remedy is the promotion of improved or advanced stoves that use solid fuels in a cleaner and more efficient way—along with an awareness campaign. A new generation of advanced and more efficient improved stoves are now commercially available worldwide, but they have yet to be introduced in large numbers in Indonesia. There is a pressing need to

develop, promote, and deploy this new generation of advanced stoves that can significantly reduce fuel usage and emissions and thereby improve health. A key part of the promotion should be a campaign to raise awareness about the negative health and environmental impacts of traditional stoves, providing motivation for the behavioral changes needed for local people to adopt the new products (World Bank 2011a).

A Way Forward

Indonesia needs to build on its earlier experiences with stove programs and undertake more effective interventions that simultaneously address energy conservation, health, poverty, and environmental concerns. Indonesia began implementing improved cookstove programs (ICSPs) by a handful of NGOs as early as the 1980s. While there have been some achievements, most of the programs are still in their pilot phases and the total number of cookstoves that have been disseminated remains relatively limited and sporadic.

The Government Kerosene to LPG Conversion Program (2007–12) is making real progress in providing incentives for households to switch from kerosene to LPG. The program has helped to reduce the budgetary cost related to kerosene subsidies. However, the switching program mainly targets kerosene users and has had minimal penetration among biomass users. It is estimated that in the next decade the use of biomass as cooking fuel will continue to be high—and may even increase in some areas if there is no significant policy interventions.

In addition to the positive health implications, scaling up access to clean and efficient stoves would also be an important step toward reducing poverty, improving gender equality, and improving the local and global environment. It is, therefore, the time for Indonesia to build on its previous experiences and accelerate the scale-up of programs that aim to improve the livelihood of people by addressing the above-mentioned concerns in a coordinated manner. Along with the existing programs that promote cleaner burning fuels (such as LPG and biogas), other options should be explored, including the creation of a new generation of innovative, cleaner-burning biomass stoves, the development of better marketing techniques to promote them, and the encouragement of private sector efforts to market and sell this new generation of more advanced biomass stoves.

EAP Clean Stove Initiative

Indonesia Clean Stove Initiative (CSI) is part of the East Asia and Pacific (EAP) Clean Stove Initiative, a follow-up to the Energy Flagship Report, *One Goal, Two Paths: Achieving Universal Access to Modern Energy in East Asia and the Pacific (1G2P)*. EAP CSI focuses on achieving access to modern cooking and heating solutions in East Asia and the Pacific, specifically on scaling-up access to advanced cooking and heating stoves for poor, primarily rural households, which are likely to continue using solid fuels for their cooking and heating needs beyond 2030.

EAP CSI is a multicountry, multiphase program with funding support from Australian Agency for International Development (AusAID). It includes four country-specific programs (China, Indonesia, Mongolia, and Laos) and a regional energy access forum to promote regional collaboration, learning, and knowledge-sharing about access to modern energy at the household level. The EAP CSI takes a three-pronged approach focusing on: (1) strengthening institutional capacity and creating an enabling policy and regulatory environment for scaling-up access to advanced stoves; (2) supporting supply-side market and business development; and (3) stimulating demand for clean and efficient stoves.

Achieving universal access to modern energy services by 2030 is the goal set by the United Nations, which declared 2012 as the Year of Sustainable Energy for All. Indonesia, with a large population lacking access to modern energy services, will have an important role to play in achieving this global goal. To this end, the World Bank is working with the Bioenergy Department of Ministry of Energy and Mineral Resources to launch the Indonesia Clean Stove Initiative (CSI), which aims to help scale up access to clean and efficient cooking solutions in Indonesia through capacity building, policy development, and the support of selected government action plans.

Selected Sources for More Information

One Goal Two Paths: Achieving Universal Access to Modern Energy in East Asia and Pacific:

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World Health Organization:

<http://www.who.int/indoorair/en/>

Global Alliance for Clean Cookstoves:

<http://cleancookstoves.org/>

Indonesia Indonesian Stove Network:

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Photo Credit

Courtesy of GERES, 2011.

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