Household Energy in Developing Countries: A Burning Issue

Key Findings

- **Worldwide, more than three billion people depend on traditional solid fuels (wood, dung and agricultural residues) to meet their basic energy needs, contributing to levels of indoor air pollution well above international standards.**
- **Exposure to indoor smoke doubles the risk of pneumonia and acute lower respiratory infections in children and chronic obstructive pulmonary disease in adults, resulting in an estimated 1.6 million annual deaths, mostly among women and children.**
- **Globally, the daily demand for cooking fuel is estimated to be more than 2 million tonnes of biomass. In ecologically fragile areas where fuelwood is in short supply, the cutting of live trees for household energy leads to soil erosion and desertification.**
- **Black carbon (soot) emissions from the burning of traditional biomass for household cooking are responsible for an estimated 18 per cent of global GHG emissions.**
- **Switching to cleaner fuels (such as LPG or ethanol), and more efficient stoves for cooking would lead to significant health and environmental benefits. However, this transition has stalled in many developing countries; the number of households relying on traditional biomass for cooking is due to increase in the coming years.**
- **Improved analysis of the household choice of cooking fuels and stoves can inform policies and improve the design of cooking stove and fuel programmes, leading to relatively low-cost interventions to address the health, socioeconomic and local and global environmental impacts of cooking with traditional biomass.**

A major public health issue for the world's poorest

The global debate on climate change and energy security sometimes obscures an energy crisis that is just as serious in its health and environmental impacts—namely, that more than 3 billion people (half of the worlds' population) have little or no access to modern energy services. The energy access problem is particularly acute in sub-Saharan Africa and South Asia where rural and peri-urban populations often rely exclusively on traditional biomass (wood, dung and/or agricultural residues) for their energy needs (see Figure 3).

In the Least Developed Countries (LDCs), traditional biomass often accounts for 90 per cent or more of total household energy demand. Traditional fuels are typically burnt in open fires or inefficient stoves, resulting in high levels of indoor air pollution. Measurements reveal that typical 24-hour levels of Particulate Matter with a diameter of up to 10 microns (PM_{10}) range from 300 to 3,000 micrograms per cubic metre, which is significantly higher than international ambient air quality standards, exposing poor women and children to a major public health hazard (WHO, 2006). There is now consistent evidence that biomass smoke exposure increases the risk of childhood acute respiratory infections (ARIs), particularly pneumonia, which is the main cause of death in children less than five years of age worldwide.

Woman and child exposed to indoor air pollution while cooking (WHO, 2006)

Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary disease (COPD) than women who cook with electricity or gas (WHO, 2006). Indoor air smoke was estimated to be responsible for 1.6 million deaths and 2.7 per cent of the global burden of disease in the year 2000 (WHO, 2007). Most of these deaths occurred in sub-Saharan Africa and South Asia (see Figure 4).

In addition to the act of cooking itself, the task of gathering fuelwood also falls mainly on women and children. There are significant socio-economic impacts due to the opportunity costs of spending several hours per day gathering fuelwood. Where fuel is purchased, the expenditures are significant due to the low efficiency in use, which severely constrains household budgets (see Figure 1).

Environmental impacts and co-benefits potential

It is estimated that cooking with traditional biomass contributes to 18 per cent of current global GHG emission (Bond, 2007). Unlike greenhouse gases such as carbon dioxide, which has an atmospheric lifetime in the order of 50-100 years, black carbon (soot) remains in the atmosphere for only a few weeks. Thus, reducing black carbon would diminish its warming effect on the atmosphere relatively quickly. Readily-available and relatively low-cost commercial products such as improved or smokeless stoves are among the technologies capable of reducing black carbon emissions.

In areas with sensitive ecological systems or degraded lands, reliance on traditional biomass also creates additional pressures on the local resource base. There is significant potential for achieving public health and local resource co-benefits by incorporating climate measures as upstream elements of energy systems and adaptive response mechanisms. For developing countries dependent on traditional solid fuels for cooking and heating, there appears to be a high degree of co-benefit effectiveness for targeted interventions in the household energy sector (Smith and Haigler, 2008).

More research is needed to understand the health and climate impacts of traditional biomass use for cooking and to identify interventions that can address both issues. Of the generally accepted categories of interventions identified by the WHO, "source" interventions, that is, solutions which address the immediate source of the indoor air pollution are likely to bring about the most significant health and climate co-benefits (WHO, 2002).

Satellite image showing brown cloud over South Asia (NASA)

A project is currently underway in selected villages in rural India to replace traditional biomass burning stoves with clean cooking stoves. The initiative will monitor the impact of the intervention on levels of black carbon and carbon dioxide and document the reduction in IAP exposure levels and the associated health impacts (Ramanathan *et al*, 2007). There is growing interest among governments and donors in conducting a similar programme in Sub Saharan Africa. The success of such programmes will greatly depend on the level of acceptance of the new technologies by the local population; it is essential that careful consumer analyses are conducted to determine the factors influencing household choice of cooking technologies.

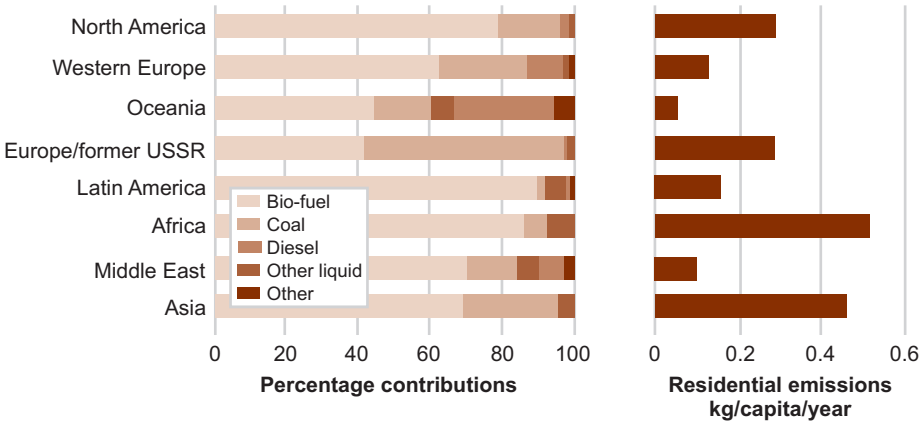

Figure 1: Sources of black carbon emission from residential fuel consumption (Bond *et al* 2004)

Building on over 30 years of experience with household energy in developing countries

SEI and its predecessor, the Beijer Institute, led the way in the field of household biomass research in developing countries, with ground breaking studies conducted on stove use, household energy, health and environment. The thematic focus on household energy continues today with research aiming to address key knowledge gaps in this field while supporting ongoing regional policy processes for scaling up energy access. In 2008, SEI conducted a household choice analysis in Addis Ababa Ethiopia to investigate the role and relative importance of both product specific and socioeconomic factors, for household level choice of cooking fuels and stoves. The study showed that to accurately identify the target market for improved stoves and fuels, a range of factors influencing household choice must be considered and that it is not sufficient to focus only on socioeconomic determinants of stove and fuel choice such as income, age and gender (Takama *et al*, 2009). Product-specific attributes such as perceived safety and smokiness must be addressed in order to effectively design programmes and interventions. A further study applying the same methodology will be conducted in Tanzania in September, 2009 and will be led by the newly established SEI Africa Centre in Dar es Salaam. SEI is an active partner in a number of international networks focusing on household energy issues including the Household Energy Network (HEDON) and the Partnership for Clean Indoor Air (PCIA), and cooperates with partner NGOs and governments to ensure the continued relevance and practical focus of the household energy research conducted.

Links to Policy and the Millennium Development Goals

While there is no Millennium Development Goal (MDG) specifically related to energy, the Millennium Project emphasizes the central role of energy services for development and it is clear that energy access is vital for achieving the MDGs. The Millennium Project has called for adopting the following target to prepare the way for achieving the MDGs:

> *By 2015, enable the use of modern fuels for 50 percent of those who at present use traditional biomass for cooking. In addition, support (a) efforts to develop and adopt the use of improved cook stoves, (b) measures to reduce the adverse health impacts from cooking with biomass, and (c) measures to increase sustainable biomass production (UNDP, 2006).*

Meeting such targets is a considerable challenge given the current trends in traditional biomass use in developing countries (see Figure 2). However, the issue is urgent given the serious health and environmental impacts of high reliance on traditional biomass. Moreover, there now exists an unprecedented opportunity for developing countries to reap multiple benefits in terms of development, health and resource management by addressing local energy access gaps through national and regional programmes that can also have a positive climate impact.

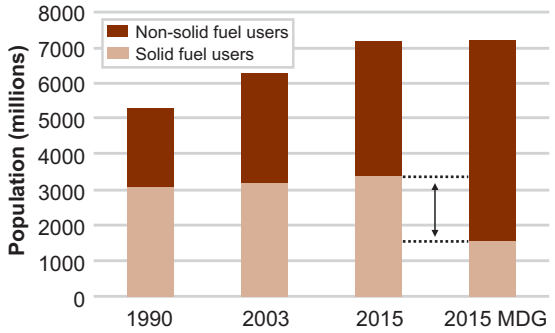

Figure 2: Trends in solid fuel use

(Boiling Point, No. 52, 2006)

Low income woman using ethanol fuelled cooking stove in Addis Ababa (Fiona Lambe, SEI)

The content of this publication has been drawn largely from Johnson, F., Lambe, F., *Energy Access, Climate and Development*, a paper contributed to the report of the Commission on Climate Change and Development, 2009, Closing the Gaps: Disaster risk reduction and adaptation to climate change in developing countries. Full report available at www.sei.se/publications.html?task=view&catid=2&id=1236
The household choice study referred to in the box, above (Takama *et al*, 2009) is pending publication and will be available shortly at www.sei.se.

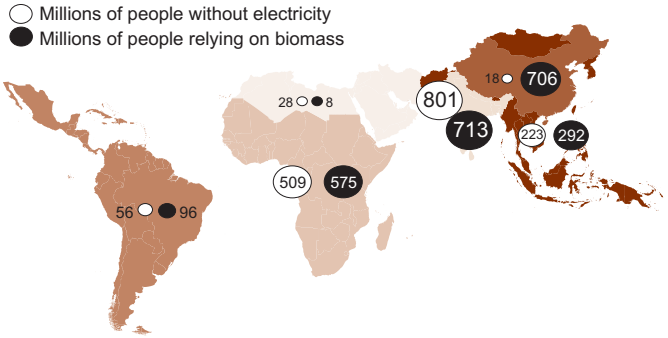

Figure 3: Regional geography of energy and electricity access (IEA, World Energy Outlook, 2002)

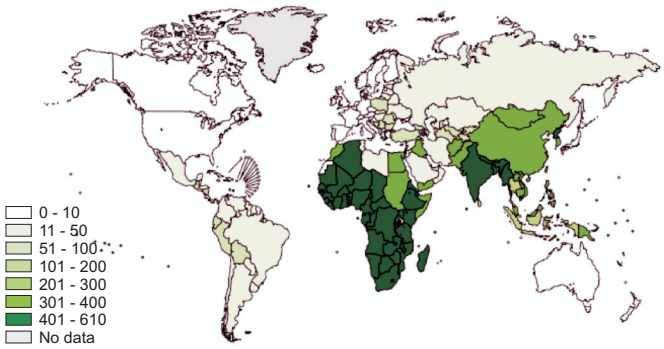

Figure 4: Estimated deaths per million for 2000 from indoor smoke from solid fuels

(Adapted from Haines et al, 2007)

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Recommendations

In order to reach the Millennium Project target on household cooking, clean cooking fuels and more efficient cooking technologies should be promoted and scaled up as alternatives to traditional biomass burning.

More research is needed to measure the health and climate impacts and co-benefit potential of household energy interventions in regions of high dependence on traditional biomass for household energy, especially in sub-Saharan Africa.

Consumer choice analyses should be used by policy makers and stove programme designers to formulate strategies for identifying the markets for improved stoves and fuels, designing more effective programmes and for tailoring the products accordingly.

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