Energy Poverty

Robert Bacon discusses definitions of energy poverty and policies to reduce it

What is Energy Poverty?

Globally, energy poverty is extremely widespread, and projections suggest that, without aggressive policies to counter it, the level of energy poverty will remain high for many years to come. A commonly accepted and simple definition of energy poverty is that a household without access to electricity or clean modern fuels is energy poor. However, even in this definition the notion of access differs between users. Access to an energy source is generally understood to mean that the infrastructure to deliver that source exists in the neighbourhood of the house (e.g. there are electricity connections in the village or neighbourhood).

However, data related to this definition are rarely available at a national level and so a narrower definition is normally used. In this latter definition access is understood to mean that the household actually uses the fuel in question (there is an electricity connection to the house, or there is uptake of the fuel in question). On this basis a recent study by the United Nations Development Program (*The Energy Access Situation in Developing Countries*) reported that currently about 1.5 billion people in developing countries lack access to electricity, and for cooking or heating about 2.5 billion rely on biomass and 400 million rely on coal. Forecasts have suggested that, largely due to population growth, absolute numbers relying on biomass are not expected to decline over the next twenty years, while only a small decrease in the numbers without access to electricity can be expected.

A further distinction is made with fuel poverty – a household is fuel poor if it is unable to afford to purchase sufficient energy (although it has access). In the European Union considerable attention has been paid to fuel poverty where low-income households are too poor to purchase sufficient fuel for heating during cold winters. For example, in 2006, it has been estimated that 12 percent of households in England were fuel poor, with comparable levels in some other northern European countries.

Why is Energy Poverty a Special Concern?

In developing countries the dominant use of electricity among poor households that are connected is for lighting, with television being the next commonest use. At higher incomes other appliances using electricity may be purchased (such as fans, or refrigerators). However, it is rarely used for cooking or heating even at relatively high incomes. Without a connection to and use of electricity, households are very limited in the amount of lighting they can use. Kerosene lamps, candles, or torches are then the principal lighting sources, and all give weak illumination. Studies have attributed a number of benefits to having adequate lighting that include education (the possibility of more study time at home), extending possibilities for home production, and improved health (through knowledge gained from watching television).

Generally, studies of the willingness to pay for electricity suggest that, for small amounts of electricity consumption, households value the benefits well above the cost of the energy used. In areas where there is no mains electricity supply, the community will also suffer from a lack of lighting in schools and hospitals, and lack of refrigeration in hospitals. Diesel or petrol generators are often used as substitutes but are considerably more expensive and inconvenient. Fuel poverty, as seen in Europe, is mainly linked to inability to pay for sufficient heating, and this in turn is linked to a number of adverse health effects.

The use of biomass or coal for cooking and heating is extremely widespread and occurs over a very wide income range in developing countries. The alternative fuels for cooking include LPG, kerosene to a small extent, and natural gas in a few countries where there is an urban gas network (such as Pakistan). Electricity is used for cooking and heating only at the highest income levels outside of the industrialised countries. Biomass includes charcoal, firewood, straw, and dung whose use depends on availability and costs (direct and indirect).

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The linking of energy poverty to the use of biomass comes through two aspects. First, the use of biomass for cooking, and coal for heating in those countries where there is a major heating need, is associated with high levels of indoor air pollution. The inefficient combustion of biomass results in the emissions of particulate matter, carbon monoxide, hydrocarbons and other gases. Exposure to these causes bronchitis, emphysema, and other respiratory diseases. Worldwide, about 1.6 million deaths a year are attributed to the effects of indoor air pollution, with women and children being most at risk. Episodes of illness are correspondingly large. Recently, some studies also indicate that incomplete combustion of biomass and coal may be an important source of black carbon that makes a not insignificant contribution to greenhouse gas emissions. The relative emissions of

Table 1: Health Damaging Pollutants per unit Energy Delivered by Fuel: Ratio of Emissions to those of LPG

	LPG	*Kerosene*	*Wood*	*Roots*	*Crop residues*	*Dung*
Carbon monoxide	1.0	3.1	19	22	60	64
Hydrocarbons	1.0	4.2	17	18	32	115
Particulate matter	1.0	1.3	26	30	124	63

Source: Smith, Uma, Kishore, et al. 2000, US Environmental Protection Agency

various sources of biomass compared to those of LPG are shown in Table 1. All forms of biomass are much more polluting than LPG, or than kerosene.

Second, in rural areas biomass is usually collected, again mainly by women and children. Charcoal is a commercial product, and firewood may also be sold. In urban areas biomass is more often purchased, reflecting the lack of freely available supply. The costs of the time and effort to collect the biomass place a burden on families by restricting time available for other activities – particularly education for children. Energy poverty therefore reflects not only a lack of income to purchase modern and convenient sources of energy, but is also associated with adverse effects on the household's health, and the education of children.

Policies to Reduce Energy Poverty

Faced with the widescale incidence of energy poverty, predominantly in developing countries, international aid agencies and multilateral development banks have devoted a great deal of attention (if not financing) to various schemes to alleviate energy poverty. With respect to providing electricity, considerable efforts have been made to increase the level of electrification in rural areas, where the majority of households without access live (in Sub-Saharan Africa only 12 percent of the rural population have access to electricity, while in India 47 percent of the rural population are without access). Rural electrification tends to focus on larger communities that are cheaper to supply, while remote and small communities tend to be neglected.

Even when supply is brought to a village, not all households will choose to be connected. There are two reasons for this. First, the connection charge itself is large relative to the income of many households, and such households are often credit constrained and unable to borrow to finance the lump sum required. Second, the cost of electricity itself may be substantial, particularly in countries where the sector is inefficient or the costs of generation are high (for example, landlocked countries without hydro or fossil fuel resources that have to rely on imports). For low-income households interested to consume only a few kilowatt hours a month, these two factors present a barrier to uptake. For this reason, many governments look to subsidise either the connection charge (by a straight subsidy, or by spreading payments over time), or the electricity consumption of low-income households through a rising block tariff or a volume differentiated tariff (where metering exists), in which small amounts of consumption are subsidised either by larger users or through the government budget.

For villages where there is no distribution system, the total costs of lines and connections to bring electricity may be so large, relative to the ability and willingness to pay, that the total subsidy element would need to be a large fraction of the incremental cost. Where there are few existing high-income customers to help finance through a cross subsidy (paying above the cost of supply) then limitations on the government budget will restrict the rate at which access can be increased.

More recently, considerable attention has been given to off-grid sources of supply that may be better able to reach more remote communities. Suitable methods of generation are likely to be more environmentally friendly, including small-scale hydro, solar, and wind power. Costs will favour these off-grid solutions in certain circumstances, and are increasingly likely to do so as the cost of small-scale renewable declines.

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Policies towards reducing the damage from cooking with biomass do not limit themselves to encouraging households to switch fuel. Increasingly it has been recognised that households will continue to use biomass to cook even at income levels when it might be expected that they would switch to a 'superior' fuel. In particular, encouraging electrification is not likely to make a substantial reduction in the use of biomass because many households that have

Table 2: Use of Biomass as Main Cooking Source and Connection to Electricity Supply (%)

	Cambodia	*India*	*Kenya*	*Pakistan*	*Thailand*	*Uganda*
Use of biomass for cooking	93	70	82	73	37	96
Connected to electricity supply	18	64	18	83	99	11

Source: Bacon, Bhattacharya, and Kojima (forthcoming) World Bank

access to electricity continue to use biomass as their main cooking fuel. Table 2 shows the percentage of households for which biomass was the main cooking fuel in a number of developing countries, as well as the percentage of households that were connected to electricity supply. Even in Thailand, whose per capita income was at least double that of the other countries in the sample, and that had almost universal access to electricity, one-third of the households continued to rely on biomass for cooking.

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There are a number of reasons for this pattern and policies need to address all of them. First, in rural areas where biomass is free, there is a strong incentive to use it. Unless women or children can make a direct financial contribution to household income instead of collecting the free biomass, this is likely to be the preferred choice. Second, cooking indoors with biomass is a demerit good. Women cooking indoors are often unaware of the true health risks from the smoke and do not attempt to reduce it. Third, many households prefer to cook with biomass – the traditional flavour of such cooking is important in many cultures, and households are unwilling to give it up either in part or totally.

There are a number of policies designed to reduce the damage from cooking with biomass.

Reducing the costs of LPG (as the clean fuel substitute for cooking) may encourage some switching towards the use of LPG, but even where families do use LPG they also continue to use substantial amounts of biomass. Indeed, at higher levels of income households may use more of both biomass and LPG.

Encouraging the use of more efficient and cleaner biomass cooking stoves is seen as potentially the most direct way of reducing the damage from the use of biomass. Many cheap and improved stove designs have been tried, but as yet the cost of an effective and durable stove is quite high relative to the incomes of poor households.

Programmes of educating households (women especially) into the dangers of indoor air pollution and ways to reduce the risks may lead to a reduction in the exposure to the pollutants from biomass combustion. Recommendations could include: not cooking in the house; keeping children out of the kitchen; ensuring that there is a chimney and adequate ventilation; and knowledge of which forms of biomass are the most harmful. For higher income households the benefits of improved stoves, or alternative clean fuels can be explained.

The prevalence of energy poverty, and its likely persistence in the absence of policies to intervene in the patterns of household energy use, indicates that efforts to reduce its adverse side effects will be as important as efforts to reduce the level of energy poverty itself.