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Transforming household energy practices to reduce climate risks: Charcoal use in Lusaka, Zambia

Improved cookstoves; Charcoal; Household energy; Zambia; Adaptation

Author
Aaron Atteridge
Research Fellow, Stockholm Environment Institute, Kräftriket 2B, SE106 91, Stockholm, Sweden

+46 (0)8 674 7747

aaron.atteridge@sei-international.org

Figure 1: Charcoal production outside Lusaka, Zambia (Source: Aaron Atteridge)

Burning charcoal to service household cooking and heating needs, as is common in urban Lusaka, creates not only direct health and environmental problems but is also closely linked with the ability of communities to adapt to the impacts of climate change. Charcoal production and use directly reduces the availability of mature trees as shade against higher temperatures, which in turn increases surface runoff of precious fresh water resources. Concurrently, climate change is predicted to affect the growth of woodlands that currently supply most of the charcoal, so the fuel itself may become harder to access. Finding ways to reduce charcoal use can therefore reduce the probable impacts of climate change for poor communities. Transforming energy markets for the poor is never easy, as decades of unsuccessful cookstove interventions can attest to. However, by better understanding what households want and need it is possible to identify policy and technical solutions that could change behaviour at scale. These include improved cookstoves that have a greater resemblance to the existing stoves and are locally produced, simple solar water heating devices, and electricity price re-structuring to lower tariffs for the poor.

Introduction

In urban Lusaka, as in many other parts of Africa, charcoal dominates the household energy market. It is the main cooking fuel for most low- and middle-income households, and is also used for water heating and space heating. While rural areas outside Lusaka rely heavily on wood, urban households generally prefer charcoal as it produces less smoke and is easier to transport and handle.

Yet charcoal is problematic in many ways. Its production drives deforestation and inefficient burning is linked to health and economic problems. The government of Zambia included in its 1994 National Energy Policy a goal of reducing charcoal production by 400,000 tonnes by 2010 by promoting more efficient production and use of wood fuel and encouraging alternatives. Similar objectives are included in the 2002 and 2006 Poverty Reduction Strategy Papers, while the National Long Term Vision 2030 document describes an ambition to reduce the share of fuel wood to 40% by 2030 and to achieve a 'productive and well conserved natural resource for sustainable development'.

Concerns about climate change offer new reasons to encourage a shift in biomass use. Zambia's National Adaptation Plan of Action (NAPA) indicates that extended droughts and an increasing prospect of forest fires threaten the country's forests, degrading land and soil fertility and directly affecting low-income families that depend on biomass for cooking and lighting (ROZ, 2007). In particular, growth of the Miombo woodlands – a source of fuelwood or charcoal for more than 80% of households in Zambia – will be jeopardised. This means a changing

Table 1: Important features of an improved stove from user perspective

Highest priority	Fuel efficiency (including protection from wind)
Primary features (i.e. could play some part in influencing decisions)	Enable cooking indoors (hence, minimal harmful gases)
	Greater cooking utility, including fast start-up and greater temperature control
	Mobility
	Contains ash
	Robust (some dishes such as Shima require forceful cooking)
	Must accommodate common pot sizes
Secondary features (i.e. would be appreciated though probably not influence purchase/use decisions)	Enable charcoal to be added without removing pot
	Reduce burning risk
	Enable visual inspection of glowing charcoal (users are accustomed to watching the charcoal as a means of monitoring their cooking)

climate may reduce the availability of biomass as a local energy source.

Household energy use is itself among the main causes of deforestation, which contributes to rising greenhouse gas emissions and also increases rainfall runoff and reduces freshwater supplies. It also removes mature trees that provide shade cover, an invaluable asset against rising temperatures. Charcoal consumption thus has direct consequences for the ability of communities to deal with a changing climate.

As a response, Zambia's NAPA emphasises action to reduce deforestation and to encourage more sustainable fuel use. It prioritises improving charcoal use efficiency and encourages improved stoves to combat the effects of drought; afforestation and reforestation programs; and improved energy access and security including, promotion of energy efficient stoves.

Why is catalysing change so difficult?

There have been a number of initiatives to change energy use patterns in and around Lusaka, typically by introducing improved cookstoves. These include projects supported by the United Nations Environment Programme and by Japanese and German development funds, a stove manual produced by Project Gaia, and a private Clean Development Mechanism project funded by the German company RWE. However, as others have observed (e.g. TSA, 2007), despite 20 years of donor- and government-funded efforts to develop improved stoves for Lusaka, none has managed to gain a permanent market share, much less transform the market as a whole.

Clean-cookstove proponents often explain this failure as resulting from one or both of two factors: lack of awareness among households of the benefits of switching fuels/stoves, and inability to afford the higher purchase price of a more efficient stove. A previous study notes that none of the improved stoves introduced in Lusaka have been able to recoup production costs and deliver a reasonable return on capital, arguing that users refuse to purchase the stoves at high enough prices and that price is the key factor determining uptake of a new charcoal stove (TSA, 2007). However, these assumptions may in fact miss a more fundamental point: that the stoves may meet technical criteria, but fail to meet the social and cultural needs of users; if they did, a viable, sustainable business could emerge and grow without external financial support.

Placing energy users at the centre of the analysis

In late 2010, the Stockholm Environment Institute undertook a study to better understand the opportunities for households in Lusaka to change their existing patterns of charcoal use. We examined the drivers of current energy use practices, the capacity of households to change current practices, and – importantly – what particular needs and wants of users might motivate or work against such a change.

Household energy use is determined not only by technical and economic features, but also social and cultural factors. For example, existing practices may be linked to valued traditions and provide an important basis for social interaction, or food may be perceived as tasting better when cooked with traditional fuels and stoves than with cleaner alternatives.

In order to better understand how trade-offs are made in decisions about energy use, a total of 15 in-depth interview and observation sessions were held with low- and middle-income households in urban Lusaka (approximately an even divide between these two categories, though it must be noted that making such distinctions on the ground is not always clear). These are in addition to the interviews with other local actors (stove makers, charcoal sellers, charcoal producers). In all cases we interviewed women, though in two households the husband was also present and part of the interview process.

We gathered data on the range of emotional, cognitive and physical relations people have to existing practices, as well as information about financial capacities and barriers – including willingness to pay for a more efficient stove. Interviews were often conducted while people cooked, and were hence supplemented with observations of the cooking process and of the surrounding environment.

Understanding household energy use

For interventions to successfully transform charcoal use, they must be framed in terms of the problems that people currently experience and of the key dynamics of household decision-making about cooking and energy use.

The preferences and desires expressed by households represent the space, or opportunity, for catalysing a change in current practices. Reduced fuel consumption and health impacts, greater utility, a preference for cooking indoors, and willingness to pay more for a fuel-efficient stove are all significant. In Lusaka, fuel costs are a significant portion of low-income households' expenditures, and the most pressing problem dictating cooking practices. Although there is a strong cultural attachment to the mbaula stove (Figure 2), it also has many features that users consider undesirable: they consume a lot of charcoal; it is difficult to control temperature during cooking; users often burn their fingers; and when cooking indoors, the smoke causes headaches and the stoves can damage the floor and introduce ash into the home. Of these, however, very few characteristics – essentially only fuel savings – would motivate the purchase of an improved but more expensive stove. Most other shortcomings of the mbaula were willingly accepted as a trade-off for lower fuel costs.

Various material constraints can work against change. There are few alternatives in the energy and stove market – no kerosene for cooking, little or no natural gas, no viable solar cooking option. Also, cost is a major issue: low-income households generally have little ability to take financial risks, which reduces the willingness to buy more expensive stoves whose performance is unfamiliar.

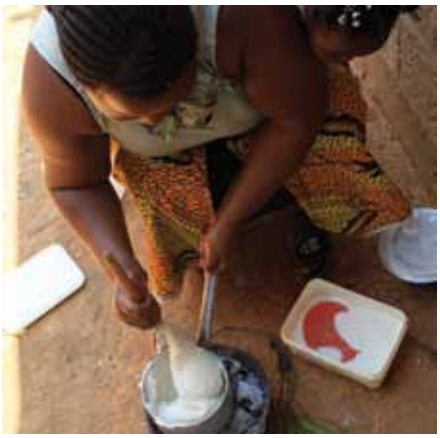

Figure 2: Charcoal use in traditional mbaula stoves (Source: Aaron Atteridge)

There are also normative barriers to overcome. The mbaula is a strong cultural device with generally positive connotations amongst users. Despite its clear and acknowledged flaws, it is not perceived as needing change. Further, user perceptions of what are important stove characteristics are based on the traditional mbaula, so there is a need to create space for learning and transformation of this understanding. Some people feel food tastes better on charcoal stoves than when cooked with electricity, even though few have much experience cooking with alternatives.

Not all barriers described above are likely to be "game breakers". For instance, despite the strong cultural traditions attached to the mbaula, more than 90% of the medium-income and even low-income households interviewed have an electrical connection and have already purchased more expensive electrical cooking appliances which were used favourably when tariffs were lower. Now they are hardly used.

Pathways for transforming energy use

When we place the people using charcoal on a daily basis at the centre of the picture – not just as recipients of a new technology but as the adjudicators of what makes sense and what doesn't – we can see at least three clear opportunities to help transform charcoal use in Lusaka.

First, there is a market opportunity for a stove that more closely resembles the mbaula, but makes notable improvements. Table 1 summarises key features that our analysis suggests would be most valued by low-income Lusaka households.

The typical lifespan of an mbaula stove is only six months to two years, so an improved stove that appealed to buyers could rapidly gain market share. The other key challenge is to make such stoves affordable; most households indicate they have limited cash flow, no access to credit and no mechanism for paying in instalments.

A related issue is how and by whom the new stoves are produced. Mbaulas are made by local tinsmiths, who sell them directly. Tinsmiths also commonly reuse old metal scraps, which conserves resources and provides another livelihood base, collecting metal. By contrast, all improved cookstoves sold so far in Lusaka came from outside these local supply lines. One possibility, thus, would be to engage local tinsmiths in making a redesigned mbaula. Although the technical improvements would be more modest, the overall net benefits may be higher if this encourages more households to switch.

Creating local, neighbourhood-based distribution channels could also help. We encountered several women who conduct business from their homes through informal social networks, for example selling imported shoes. Helping these entrepreneurs to buy and resell improved stoves would create an initial market demand and provide a way for potential buyers to familiarise themselves with the stoves before making a big investment. The women might also be able to set up instalment plans.

Second, part of the demand for charcoal and firewood could be reduced by households installing cheap solar water heating devices. Households use at least some of their fuel to heat water for bathing, and solar heaters on the roof or in the yard could more sustainably perform this function. The fact that many households rent and have concerns over theft would likely prevent them from installing expensive permanent units. However, a cheap, "low-tech", mobile and lightweight solar water heating device could appeal to low-income households. At present there are no such devices in the market.

A third possibility for changing household energy use is lowering electricity prices for poorer households. Technical access to electricity in urban Lusaka is quite widespread (even if reliability can be a problem), and almost all households said they would cook more with electricity if it was not significantly more expensive. In fact, many households said they had bought expensive electrical cooking appliances when tariffs were lower, and reduced their usage when tariffs were raised in 2010.

Electricity price reform is never a straightforward political proposal. However, if made a priority then possibilities exist for revenue-neutral tariff reform, which means lowering prices for low-income households yet raising overall tariff income (in line with the objectives of the government and the needs of the electricity utility ZESCO). Although this requires raising tariffs for other users, most of the current electricity subsidies already benefit higher-income groups rather than the poor (Kalumiana, 2004). A further challenge with this option is that, given problems with network reliability in Lusaka, any significant increase in electricity use for cooking would place further strain on the system. This means investment to upgrade capacity and distribution might be needed. Although challenging, as a means of changing behaviour electricity price reform makes sense from the perspectives of energy users.

Impacts on other livelihoods

It is important to recognise that household charcoal use is part of a broader social and economic network that provides livelihoods for charcoal producers, transporters and various levels of market sellers. Therefore, any success in reducing charcoal use will have wider consequences. These should be borne in mind when devising strategies, since livelihoods form the economic and social basis for, among other things, adaptation to climate change.

Profile of author

Aaron has worked on a range of topics linking energy and climate policy and practice. In addition to the work described in this article, he has also looked at household energy use among low-income households in Northern India, worked with a number of household- and village-level renewable energy projects in Thailand, and on state energy planning and environmental and climate policy in Australia.

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