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Community matters: the Southern African experience

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## Community matters: the Southern African experience

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1. Air pollution from coal. About 40% of South Africa's TOTAL particulate load arises from the burning of only 1 million tons of coal in inefficient appliances. This coal is burned primarily in the "Highveld" regions of Gauteng, Free State and Mpumalanga. One of the appliances is the "mbaula", a metal canister of about 25 litres capacity with holes punched in the side, which is filled with – 45 +25mm lump coal, ignited outside and brought inside for cooking and space heating once the smoke has died down.

The other appliance is a cast-iron stove basically of a pattern developed in the 1870's in the US for burning wood. It needs a chimney to provide a draft, and one of the problems is to keep the chimney functional - it corrodes due to the sulphur and other acid products from the coal. It also needs a -25mm+12mm fuel.

I assisted a programme at Qalabotjha in the Free State where we provided a low-smoke alternative to the 6000-strong community for three weeks, while the air quality and other impacts were monitored. The low-smoke fuel, mainly a devolatilised coal, was not a great success because it was too fine (-15+6mm). It had worked well in the laboratory, where the stove had been equipped with a good, 2m high chimney, but in the field, most chimneys were only a metre high and in poor shape. Also, we hadn't allowed for a large coal for the mbaulas. Nevertheless the air quality definitely improved and the number of patients with upper respiratory system problems reporting to the clinics dropped significantly.

We learned a number of things:

- a) The cast iron appliance cost around US\$500. It was one of the first things you bought once you had a toe hold on the economy - it showed you had arrived. There was a flourishing informal credit system to enable this. One of the reasons was that the stove was multipurpose - it gave cooking, water and space heating, rubbish disposal and that most intangible thing, social status. So when people talk of trying to minimize cost, I remind them of our findings - if you truly meet needs, then the cost is almost immaterial.
- b) There was a flourishing coal distribution system. Large (20t) trucks visited coal mines as much as 100km away to collect fuel. In the township, the merchants received a bulk delivery, bagged it and distributed it mainly by cart load (though some was sold by canister or hub-cap volume). The coal had to be relatively high grade - at least B grade, >25MJ/kg, and sized. About 50 jobs were created in the community during winter distributing coal.
- c) The air pollution was appalling, with a wan sun glimmering through at noon on a windless day, but the people were happy - "It shows we are warm!" "A house is not a home unless there is smoke from the chimney!"
- d) Much of the township was electrified but the perceived cost of electricity was too great to convince many to adopt it for anything other than low-current applications such as lighting, radio, television and mobile telephones. Also the multifunctional use of coal gave benefits not easily achieved with electricity.
- e) The mbaula was a real problem amongst the lowest in the local economy, and a huge contributor to smoke. This finding made the Department of Minerals and Energy focus on the problem, and the Basa Magogo ("Fire of the Old Woman") has been the result - instead of lighting the can of coals from the base, and distilling off the volatiles as smoke while the fire burns upwards, you light it at the top. This reduces the smoke emissions by 80%. Nevertheless, the conditions

inside a sheet-iron shack after a night when the temperature fell to -8 deg C were awful - the family slept on the ground round the fire, because that way the air was breathable. The roof over the mbaula was dry, but as you moved across the roof from above the fire, you got to a point where the rising fumes had cooled enough to condense moisture, which rained upon the sleepers. Then, towards the corners of the shack, the air cooled to below freezing and there were icicles. When you stood up, you could scarcely breathe the air without coughing and your eyes watered.

2. Another community project was in a deep rural area that would, in all likelihood, not be electrified because it was too sparsely populated. We did an energy baseline on 500 households. The primary fuel was fuelwood, harvested from rapid-growing species close to the homes. Wood collecting started as early as 2a.m. and finished as late as 11p.m. Each home burned about 50kg/week. The cast-iron stoves were widespread. The household income was about \$120/month (including social support) and around 25% of that went to servicing debt. Every home had a radio, in use for 22h a day, run by battery. Solar pv, mainly using "acquired" cells, was fairly widespread for charging batteries. About 30% of the homes had a butane/propane (LP gas) cylinder used for cooking at celebrations when you needed to show you had risen above the wood fuel level. Recharging the cylinder was expensive as there was no local facility, and transporting it by taxi meant it went as paid luggage. About 30% of the homes had paraffin (kerosene) cookers, which were mainly used when there was insufficient space on the fire. They were recognized as being both dangerous and smelly, but fulfilled a need, and the fuel was readily available locally.
3. A third community project was in Botswana, and involved a sheet-iron stove where the accent was on provision of adequate secondary air to ensure full combustion and minimum emissions. It could be used for wood or coal. The initial results were a great success, but on extended use the sheet metal distorted and much of the functionality was lost. A feature of the stove was that it was adapted to the three-legged cast-iron cooking pots widely used in the community, and this enhanced its efficiency and reduced fuelwood use.

Measurements across a wide spectrum of households and energy sources has indicated that, if only cooking is involved, a minimum energy of around 1000MJ/month is needed. If you have to have space heating as well, it increases to about 2 500MJ/month/household minimum.