THEME EDITORIAL

Taking Science to Hearth

Crispin Pemberton-Pigott; New Dawn Engineering, P.O. Box 3223 Manzini, MZ200, Swaziland, Southern Africa
Email: crispinpigott@gmail.com

A generation ago Prasad, Sangen and Visser wrote in their book, "Woodburning Cookstoves", that the great majority of stove development work had been done by people, "who have had no benefit of specific technical training." Today, a mountain of new stove work is being heaped up. From top of that pile a new horizon can be seen. It is important to recognise new trends, especially as it takes us from the elusive promise of accessible, improved stoves to their emerging reality. This is the beginning of the age of clean cooking.

Attracting engineering graduates into a new field such as domestic energy is a chick-and-egg problem: which comes first, the new careers or the people who want them? Where would you train and what do you study? Professionalism in domestic energy engineering (DEE) was always needed but without funding for research posts and long term career prospects, it was difficult to apply the vast power of modern science and engineering to the problems of the average domestic cook. Interventions were brief, expectations unrealistic and the result disappointing. Cooking health problems were largely viewed as a poverty issue with the solution being to move the poor 'up the energy ladder'. Meanwhile biomass, though locally produced, widely distributed, requiring no foreign exchange and supporting local employment was invariably dismissed as dirty, smokey and unhealthy. Non-biomass kerosene received similar treatment in every major article. But the problem was not the fuels, it was the devices!

The first problem we must address is that of stove smoke causing illness in a billion lungs. Stove combustion technologies have to be transformed to drastically reduce emissions. It is the key to saving more than one million lives lost and hundreds of millions more sickened annually by biofuel emissions.

The second problem is the quantity of fuel available. While land clearing for agriculture appears to be the major cause of deforestation, biomass-dependent cooks soon find themselves competing for what is left standing, and being blamed for the shortage. Not many countries have, like Swaziland, a National Energy Policy with a section on Security of Supply to protect the needs of the biomass users who make up 75% of the population.

Figure 1 Testing of a commercially manufactured Rocket Stove from Uganda, at GTZ Technical Workshop in Mulanje, Malawi (*photo: Elmar Dimpl*)

When biomass security of supply is given the same importance as petroleum energy a very different attitude to energy efficiency and afforestation emerges automatically. Without paying attention to this vital, natural, renewable energy source, a situation can quickly develop where the imported petroleum fuel cost of moving the remaining biomass equals the cash value of the fuel being transported. In other words, without replanting forests in the immediate area, foreign exchange for oil is required to access the 'local' energy supply from neighbouring regions. It is surprising that most energy policies do not view biomass as an import-substituting, renewable energy source, most often referring instead to solar, wind and wave power.

Large urban charcoal-burning populations like Maputo, Mozambique earn enough income to pay the rural poor to supply them over 350 tons of charcoal a day from as far as 600 km away. Dakar and other towns in Senegal provide comparable examples. Stove body design must be transformed to greatly increase the heat transfer efficiency and to burn far less fuel per meal. New low cost stoves can save two thirds of the charcoal.

It is only recently that portable scientific instruments capable of determining with accuracy what is emitted by a stove in the home environment have been available. It is most fortunate that just as the technologies arrive to quantify what we breathe and locate where it comes from, the funding to hire the engineers and technicians to operate the equipment is also hitting the bank accounts. This is truly a time

of transformation in the domestic stove industry.

It began with a simple change in focus. For decades stove projects were always 'developing an improved stove'. The stove business was exciting because there was no qualification to enter it. The targets were not demanding; the scale of potential damage, limited. It was the age of the enthusiast and the backyard inventor, frequently using poor quality materials in an artisanal workshop. A generation later, millions of dollars was spent around the world and, frankly, there is very little show for it.

Now major donors, private and public, have started demanding that cooking stove projects begin to deliver an impact 'at scale'. This demand for production volumes directly related to the universe of need requires a transformation of the products, the manufacturing methods and the financial models. The implications are broad and daunting.

With tinkers in Bamako, Mali producing 4000 improved stoves a month from scrap metal, one might expect that 'scaling up' means more tinkers and more stoves - what you might call the Jiko model of expansion. But that scrap metal is not locally manufactured so its supply is quite limited. The idea that half a million improved stoves can be produced per year from scrap metal in Bamako is a non-starter. We need a new approach to materials, production methods and marketing if the masses are to benefit. People will soon treat stoves as another consumer product. They will be more demanding about quality and performance, treating them as they do watches or radios. It is a fact that quality sells. What are we offering?

The donor response to this has been realistic. Modern stove programmes now include professional product designers, marketing expertise, field testing of products for emissions and fuel efficiency, business model advisors, private sector funding agents, materials experts and social scientists. The core capacities for large scale success are accumulating, generating a buzz that can attract the best and brightest with promises of a career that not only demands scientific prowess, but that offers an opportunity to 'really make a difference'. The entry of large numbers of women into the materials and combustion sciences during the last generation may be crucial to defining the new field of DEE. Why? Because gender balance is always transforming. These are career opportunities offering first rate science to their sisters in the kitchen.

For the first time there is a prospect for core funding for permanent stove research institutes. The wave of inventions, both products and processes, emerging from these new initiatives, these continental stove programmes, promises to attract private capital and the entrepreneurship that lies behind it. Opportunities abound.

Today, household brands like BP, Philips and Shell are moving swiftly into the market with a sense of urgency. They can only succeed in their 'Bottom of the Pyramid" ventures if they make products cheap and attractive, functional and worth owning. The poor are very astute buyers who plan carefully before investing in an appliance. With the corporate financial power to bring the cost of technologies down by an order of magnitude, it may not be long before a 'ballpoint pen' of stoves is seen in every home.

Have you ever pondered why there is no 'appropriate technology' ballpoint pen, or an 'appropriate technology' cell phone? It is because the genius and wealth of human experience has been applied to solving those problems comprehensively, and at scale. It takes only eight seconds to make a cell phone circuit board. Why should it take two or three days to make a stove?

When it comes to combusting biomass cleanly, safely, on demand and in the home, these are 'early days' but there is still much to talk about. In this issue of Boiling Point we present a number of domestic energy technologies that are already working. Some of them incorporate high-tech ideas or components. Appropriate technologies are not really about being low tech, they are about being right for the customers, wherever they may be.

Many of the most recent developments in stove technology involve new materials like advanced ceramics and fuel treatment like densification and gasification. It will be noted by the reader that these cooking technologies fall into two categories: those that use processed fuels and those that do not (apart from cutting and splitting). Processed fuels like charcoal, biogas and gasifiers offer an opportunity to greatly increase the stove performance and greatly reduce emissions. If the fuel is predictable, it is far easier to make a stove that performs well when burning it.

The other major use of domestic energy is for lighting and this has not been ignored in these pages. The price of light emitting diodes has been dropping even as their brilliance has increased. Now is the perfect time to combine electronic and biofuel technologies. On that new horizon are novel water purifiers. We are offered stoves that produce enough electric power to charge batteries and operate electronic equipment. Bio-gasifiers are able to use a range of agro-wastes that have previously not been considered to be viable domestic fuels. Dr AD Karve noted that in India alone, 550 million tons of bio-fuels suited to gasifiers and charcoal production lie unused each year.

As you read these articles, watch for the application of the basics: energy efficiency, combustion efficiency, heat transfer efficiency and getting the smoke out of the room. Here are described some of the many imaginative and practical technologies making their grand appearance as we confidently take science to hearth.

Profile of the author

Crispin Pemberton-Pigott has been working in the field of Appropriate Technology for 30 years, in particular rural water and manual production equipment. He has also been making stoves for 25 years, and was the winner of the Design Institute of South Africa Chairman's Award 2004 for the Vesto Stove, described by Agnes Klingshirn as the first new stove in 20 years. He is also the owner of New Dawn Engineering in Swaziland, a manufacturer of labour-based production systems for rural employment and co-founded the Renewable Energy Association of Swaziland. He is the Regional Technical Advisor for ProBEC and active on the boards of the Sustainable Energy Society of Southern Africa (SESSA), the Association for Renewable Energy Cooking Appliances (AFRECA) and a member of South African Bureau of Standards technical committees for paraffin and gel fuel stoves. For more information visit: www.newdawnengineering.com