Project Gaia: Commercializing a new stove and new fuel in Africa

Harry Stokes[1] and Bengt Ebbeson[2]

1. Stokes Consulting Group, 22 Mummasburg Street, Gettysburg, PA 17325 USA
Telephone: +717 495–4274; Fax: +717 334–7313; Email: hstokes@blazenet.net
2. Dometic AB, Zurcherstrasse 239, CH-8500 Frauenfeld, Switzerland
Telephone: +41 52 720 66 44; Fax: +41 52 720 66 50; Email: bengt.ebbeson@dometic.ch

Project Concept – A stove *and* a fuel

Project Gaia first appeared in *Boiling Point* No. 43 in 1999 when the concept, pioneered in discussions with the Government of India in 1995, was taken to governments and development practitioners in Central America, the Caribbean and Africa.

The concept involved bringing alcohol-powered appliances, available in Europe and North America, to the developing world, powering them not only with ethanol, when available, but also with methanol, an alcohol produced worldwide on a vast scale from natural gas primarily for sale into world chemical markets.

The opportunities driving this concept were several-fold:

- Availability of high quality alcohol appliances adapted for use in the developing world
- Some 35 million tonnes of methanol are produced annually around the world, principally from natural gas. Much more methanol will be produced as countries and multilateral development agencies such as the World Bank find ways to reduce the flaring of natural gas associated with the exploitation of oil in developing countries like Nigeria and Bangladesh, or seek to commercialise gas fields that exist in countries like Ethiopia and Afghanistan.
- Methanol can be produced much more cheaply than ethanol or kerosene, and in theory could be sold to the consumer at a lower price. Initial research showed that it could be marketed at about half the cost of non-subsidized kerosene and in most instances on a par with or under the cost of subsidized kerosene.
- Where methanol can be produced in a country that has to import petroleum products but nevertheless possesses natural gas, the imported products could be replaced by indigenously produced fuels.
- Eventually methanol, like ethanol, could be produced from a biomass crop, through gas synthesis rather than fermentation. Methanol, unlike ethanol, would come from the inedible portion of biomass crops, lignin and cellulose, rather than from the starches and sugars required for ethanol.

The response we invariably received from policy makers and consumers, was: 'We like the stove, but how do we know there will be fuel to run it?' Thus we learnt that to prove the stove, we would have to prove the fuel, particularly the availability of the fuel. In any market where we wished to introduce the stove, we would have to develop a fuel source, fuel packaging and transport, and fuel retailing – in short, a supply chain for an entirely new fuel (Figure 1).

Figure 1 Project Gaia poster

The Production of alcohols in Africa

Ethanol is known because where it is produced it is usually produced within the economy, at a local distillery or at the sugar mill. Small amounts of it enter the local economy for beverage and medicinal use. Molasses distillation plants exist in such countries as South Africa, Mozambique, Tanzania, Zambia, Zimbabwe, Malawi, Kenya, Angola, Uganda, Egypt, Ethiopia and Mauritius. Although there are only two methanol producers in Africa, over twice as much methanol is produced in Africa than ethanol. This is a tiny fraction of Africa's potential capacity. Almost all of Africa's ethanol and methanol are exported.

Natural gas can be converted by synthesis to methanol, handled at room temperature like ethanol or kerosene, through a simple and inexpensive process – less than 4US cents per litre. Once accepted as a household fuel, methanol can be delivered to market, as a liquid, for sale in small quantities. Conversion to methanol makes it possible for natural gas sourced in Africa to remain in Africa and be put to use by the peoples of Africa – the process is cheap and easy, requiring no costly and complex infrastructure. In contrast, ethanol produced by distillation will vary in cost between 12 and 25 US cents.

Current projects

The project is not like traditional stove projects as it deals with new fuels and stoves supplied on an industrial scale. Though fuel may ultimately be

derived from biomass, it is an improved liquid fuel, virtually unknown for household energy use in Africa. Can it address the problem of scarcity and poor quality household fuels on a scale equal to the size of the problem? Is this achievable? How to get it started?

Key questions for commercialisation

Dometic is an appliance manufacturer that has recently started looking at markets in the developing world and is currently developing partnerships with those with capacity to supply fuels. Studies are under way in Ethiopia, Nigeria and South Africa

A key output for the Shell Foundation (which is supporting a pilot project in Ethiopia) is a business plan that will create the blue print for the commercialization of the Origo alcohol stove (the 'CleanCook' stove) and its fuel in Ethiopia. A key purpose of the pilot study is to map opportunities and problems, and advance as far as possible prior to crafting business agreements and commitment of investment capital. Fundamental questions seek to determine: 'Are these suitable stoves/ suitable fuels for the environment in which they are to be placed?'

Case study: The project in Ethiopia

In 2003, Dometic was granted Shell Foundation funding for matching funds for a pilot study with 1000 stoves. Dometic teamed with the ethanol producer, Finchaa Sugar Factory, and a local metal goods manufacturer, Iacona Engineering, which has an interest in making alcohol stoves.

At the time of writing, the Ethiopian pilot study has been running for 10 months – some important lessons have been learned and milestones achieved. Four hundred stoves are to be installed in homes in Addis Ababa and 400 additional stoves are ready for placement in institutional settings (offices, hospitals, clinics, shelters, refugee camps).

Field staff were recruited from Addis Ababa University, with quality control staff members who are Masters graduates to lead the field team (Figure 2) . The team has been trained in the use of the stoves and the fuel, mainly by the quality control staff, particularly in safe handling and operation. Key partners have been involved in the implementation: district administrators from the Addis Ababa city government; representatives from the City's environmental works office; a stove commercialization expert from the Ethiopian Rural Energy Development and Promotion Center; a technical agency of the government; a former the head of Ethiopia's Science and Technology Commission; a plant manager of Finchaa Sugar Company; the general manager of Shell Ethiopia.

Selection of 500 homes in which to place study stoves was accomplished in close collaboration with the city administrators to provide a representative sample of lower and middle income homes. Selecting from the whole city population has promoted the stove widely and encourage more people to buy the stove once it becomes commercially available.

Baseline studies of each home involved an extensive survey questionnaire with the family and also by personal observation in the family home – this delicate process requires respect for the family and its privacy. Next steps include introduction of the stoves with the fuel to the households. This will be an exciting moment in the project, the central focus of this project – that it is not simply a stove project, but a stove *and* fuel project.

Stoves will be monitored and safety training given. After four weeks of free fuel delivered to the home at a rate of seven litres per week, the fuel will be sold to the study participants at cost price. Later, a selling price for the fuel will be charged, allowing project staff to observe how much fuel is consumed when purchased rather than given.

The field staff will conduct consumer research which will answer our questions about the readiness of the stove, the fuel and the fuel distribution system, and provide data on marketability of the stove and fuel.

Though several ministries within the federal government have been helpful and supportive, the government itself appears hindered by conflicting regulation and policy that inhibit investment in Ethiopia. However, relationships have been forged with district government officers, with the UN High Commission for Refugees to place stoves in two refugee camps which they manage (Figure 4), with the Ogaden Welfare and Development Association to place stoves in both villages and displaced persons camps, and there are discussions with a charity mission for placing stoves in their 14 orphanages spread throughout Ethiopia.

Figure 2 Field monitoring team with Project Gaia shirts and caps

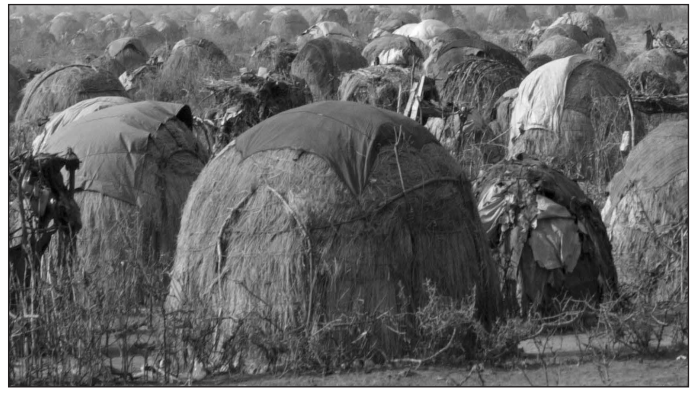

Figure 3 Refugee camp into which the Ogaden Welfare and Development Association is introducing stoves

These projects provide valuable lessons, and have a commercial objective that could make the difference for this project. If a market involving institutional users is developed as a consequence of the pilot study, these institutional buyers with their larger orders and ability to pay could justify a business start up that otherwise might seem too risky with only the consumer market.

The pilot study is scheduled to be concluded by June of 2005 with a business plan in place to guide the establishment of a commercial project. The likelihood of a commercial project and what form it will take are still too early to predict.

South Africa

Dometic had been encouraged to test its alcohol stove in a small consumer study in South Africa in the year 2001 by Mr Sten Danielsson, a visionary South African entrepreneur who saw the need for improved stoves that could be powered by methanol. The positive outcome of consumer study, conducted by NOVA Institute – a small NGO specializing in household energy, led to the emergence of a working group comprising the entrepreneur, methanol producer, the consulting NGO, and interested agencies within the South African government. Now 300 stoves are in South Africa awaiting funding for a full-scale pilot study.

Dometic has created a technology partnership with the world's leading small-scale gas synthesis process company, HydroChem, a division of Linde AG – the leading supplier of small, modular gas synthesis plants worldwide, and has developed a modular methanol plant with a capacity of 50 or 100 tonnes per day.

Nigeria

Dometic and HydroChem went to Nigeria to seek opportunities to address gas flaring in the Niger Delta. They teamed up with a local Nigerian NGO experienced in biomass stoves and household energy issues, the Centre for Household Energy and Environment (CEHEEN). This team approached the Nigerian federal government, and state and local governments in the Delta. Delta State is the most productive oil state in Nigeria with the largest impact from gas flaring. Ninety eight percent of its people are completely or partially dependent on traditional biomass fuels, and of those who use improved fuels, most use kerosene in cheap wick stoves on an occasional basis.

A 'mini-pilot' study of 20 stoves, assisted by Winrock International's Nigeria office, was conducted in Delta State in 2003. A study of 300 stoves is soon to begin in Delta State, funded by the Government of Delta State and the U.S. Environmental Protection Agency Partners for Clean Indoor Air (PCIA) programme. The project in the Delta demonstrate to policy makers that Nigerian energy resources can be put to use in rural communities using appropriate appliances with methanol fuel.

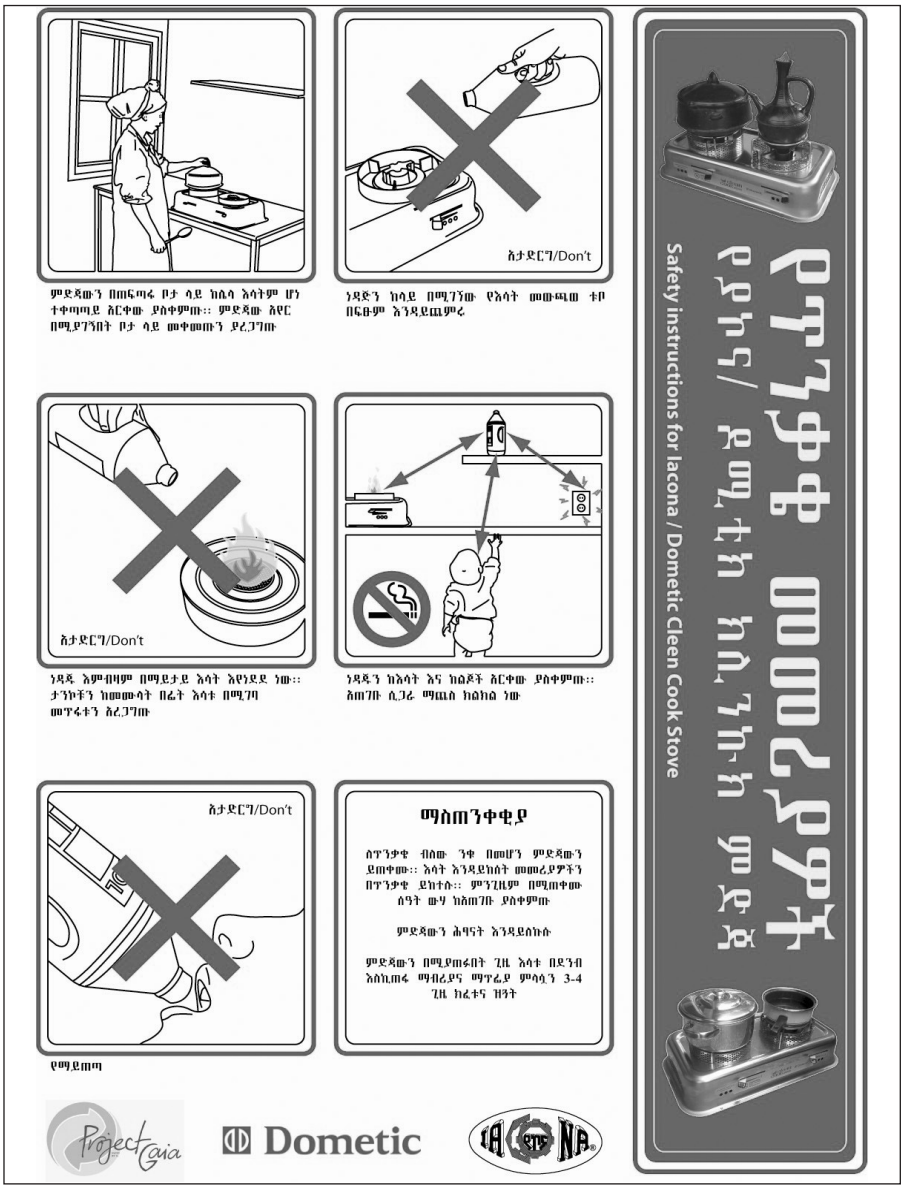

Figure 4 Safety manual in Amharic language (photo: Project Gaia)