nol plant where methanol is made cheaply from gas. This gas synthesis plant is efficient, reliable, and affordable. Gaia is also working with the NEPAD Pan-Africa Cassava Initiative and others to encourage development of small-scale and microdistilleries to make fuel from industrially-grown cassava. To stimulate alcohol fuel demand, Project Gaia has introduced the CleanCook stove to Nigeria. A 2007 pilot study in Delta State showed that households **strongly prefer the CleanCook to kerosene stoves**.

PROJECTS & STUDIES: BRAZIL

In 2006–7, the CleanCook stove was tested in urban and rural households in Minas Gerais State, where ethanol is plentiful. Study families include small-scale cane growers and employees of a sugar mill. After six months of weekly monitoring by Gaia teams, the communities reported that the **CleanCook was easy to use, handle, and clean, cooked faster** than their LPG stove, and was **much safer**.

- Families reported saving an average of 30 minutes' cooking time each day.
- The stove felt safe particularly for those with children.
- Fuel could be bought in small quantities, important for low-income households.
- Wood fuel is banned in some areas. Households valued the stove because ethanol was coming from the community and would be less likely to increase in price.

Microdistillery Model Community-owned and -operated microdistilleries can be used to supply fuel in rural areas. **Small, efficient units** can produce a few hundred or thousand liters/day. A unit can be **operated by a single family** or group of families and represents a **modest capital investment**. By linking microdistilleries with stoves, a **dependable market for ethanol** is created, and thereby a reliable supply of fuel for the stoves. **No middleman** is needed. Project Gaia works with USI (Usinas Sociais Inteligentes) and seeks to bring this Brazilian technology to Africa.

OTHER PROJECTS & STUDIES WORLDWIDE

We've conducted studies in South Africa and Malawi. Currently, we are investigating alcohol markets throughout Africa.

JOIN THE PROJECT GAIA TEAM

We're interested in associating with **partners who embrace our mission** of developing clean, safe alcohol fuel for cooking and other household energy uses in order to provide ample food, clean water, shelter, and energy for families across the Global South. We seek:

- Ethanol manufacturers to help us build newer, bigger markets for ethanol
- Metal goods manufacturers who can build a quality stove
- SMEs who can build a stove and a fuel supply business and manage carbon credits
- Investors or owners who are interested in producing alcohol fuels from wasted or underutilized resources
- Technology partners who have a good technology or appliance that can put alcohol fuels to work

If you'd like to join our Project Gaia team, we hope you'll contact us.

In my country, more than 56,000 people—mostly women and children—die every year from respiratory disease caused by smoky fires and polluted indoor air. We have the capacity to produce a clean, liquid biofuel—ethanol. With ethanol, women can cook cleanly and safely, and children will be healthy. A simple change in the way we cook can make us leaders in solving climate change.

Milkyas Debebe
Gaia Association, Ethiopia

There are 250 million cell phones in sub-Saharan Africa. That tells us that 250 million clean-burning ethanol stoves in Africa is an achievable goal.

Harry Stokes
Project Gaia, Inc.

Project Gaia

PROJECT GAIA

BRINGING AN ENERGY REVOLUTION TO THE DEVELOPING WORLD

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Project Gaia is a global initiative for the development of clean-cooking fuels, especially the simple alcohols. We seek to establish and promote use of alcohol fuels for household energy for all people, especially those in energy poverty.

THE PROBLEMS WITH SMOKY STOVES

Health Indoor air pollution is responsible for almost three percent of global illness and nearly **two million deaths per year**, with nearly 800,000 of those among children under age five. Many of these deaths occur in Africa.

Environment Overharvesting of wood for cooking and charcoal manufacture leads to **deforestation** and **desertification**. High gas and **soot emissions** produce **greenhouse gases** and **black carbon** in the atmosphere, adding to **global warming**.

Safety Women and children **face harassment, abuse—even rape—while gathering firewood**. Kerosene and LPG are prone to flare-up and explosion; many cases have been documented of **children poisoned by drinking kerosene**.

THE PROMISE OF THE SIMPLE ALCOHOLS

Alcohol fuels are **safer and less polluting** than petroleum fuels. They are benign if spilled in the environment. Alcohol **fires are easily extinguished** with water. Well-designed alcohol stoves produce **no harmful emissions** and could be powerful generators of **carbon credits**. Alcohol fuels are **produced locally, from wasted or underutilized products**, such as molasses, agricultural residues, or even flare gas. Ethanol is the **least toxic of liquid or gaseous fuels**; methanol, the other simple alcohol, is toxic, but its toxicity can be managed. Both are successfully denatured with a bitter agent, color, and odor. Today ethanol is produced for **less than half the cost of kerosene**, methanol for **less than half the cost of ethanol**.

THE CLEANCOOK STOVE: AN IDEAL APPLIANCE

Manufactured by the Swedish company Dometic AB, the CleanCook stove has been adopted by Project Gaia as the best available technology because of its **power, safety, performance, and durability**. Project Gaia is working with Dometic AB and partners in the Global South to transfer the stove technology to markets where alcohol is being or can be produced as a substitute for fossil fuels.

WE HAVE THE TECHNOLOGY, WE CAN CREATE THE MARKET

Domestic ethanol markets are ideal markets. The highest value and best use of locally produced ethanol is **not for export** but for vital domestic needs, such as cooking, heating, lighting, even refrigeration—in short, **for energizing the household**. Ethanol for cooking and small appliances also has advantages over fuel blending. Not only is blending ethanol with gasoline technically challenging, the ethanol must be dehydrated and costs are high. Car engines must be new or properly adapted. In contrast, **stoves are easily and cheaply disseminated in the market**. They run best on hydrous ethanol and can even run with higher water content. The **market for cooking fuel is many times larger than for all other uses**, including fuel blending. Why not **put the cleanest fuels in the household**?

Project Gaia seeks to develop local facilities for fuel and appliances. We are collaborating with local companies to make stoves. We are working to introduce efficient micro-distilleries in Nigeria and Ethiopia. In Nigeria we are seeking to introduce a process to transform flare gas into methanol for domestic fuel use.

PROJECTS & STUDIES: ETHIOPIA

Commercialization in Addis Ababa With help from the USEPA and Partners for Clean Indoor Air (PICA), Gaia Association is helping to commercialize the ethanol stove. Ethiopia currently produces eight million liters of ethanol per year; by 2012, they plan to produce 130 million liters with molasses residue available from the sugar industry. **Stove fuel will be the largest market** for this ethanol. **Stoves can be sold cheaply** to low-income families if financed with **carbon credits**.

Ethanol stoves in displaced communities In 2005 Gaia Association forged a partnership with the UNHCR and the Ethiopian government to **distribute ethanol stoves in refugee camps**. Before receiving the CleanCook, women walked up to eight hours to gather firewood. Once-wooded areas around the camps are now barren; local communities struggle to safeguard the few remaining trees. CleanCook stoves are now being used by 3,400 Somali families who no longer have to collect firewood for cooking. The **stove is their most prized possession**.

Award Winning Gaia Ethiopian projects **have won awards** from both Energy Globe and Ashden Awards for Sustainable Energy.

PROJECTS & STUDIES: NIGERIA

Gas-flaring pollutes air, water, soils, vegetation—even physical structures—across the Niger Delta. Despite the area's oil and gas wealth, most people cook with wood. The only improved fuel available for cooking is kerosene, which is mostly imported because local refining capacity has been shut down. Used in cheap, dangerous wick stoves, this kerosene is dirty and volatile—known locally as **"killer kerosene."** Burns and deaths from accidental fires are common.

HydroChem Linde, Gaia's technical partner, has developed a **small-scale gas-to-metha-**