

COOKING INNOVATIONS IN HUMANITARIAN SETTINGS

How Cooking Technologies and Fuels are Transforming Refugee & IDP Lives and Livelihoods



GLOBAL ALLIANCE FOR CLEAN COOKSTOVES



Photo © GAIA Association

Over 59 million people today are refugees, internally displaced, or seeking asylum. Without access to modern cooking and fuel options, crisis-affected people must risk their health, safety, and sometimes their lives to cook their daily meals. Through interventions with efficient cookstoves, clean fuels, and innovative business models, several organizations have already improved the lives and livelihoods of thousands of refugees and internally displaced people (IDPs) in Ethiopia, South Sudan, Gaza, and Burkina Faso. With further research and resources, these and other effective solutions can be scaled up to change the lives of other crisis-affected populations.

A Word from Radha Muthiah

CEO, Global Alliance for Clean Cookstoves

Far too many people affected by crises must risk their health, safety, and livelihoods to cook a meal for their families. Toxic smoke from cooking fires damages lungs. Walking long distances to gather fuel increases exposure to the risk of gender-based violence. Time poverty limits economic and educational opportunities. However, proven solutions exist that demonstrate that we can and must address these and other related issues today.



This report provides a snapshot of available technologies, existing projects, and current knowledge on what does and does not work in implementing humanitarian cooking interventions. It showcases innovations in the growing sector of humanitarian energy access. Some solutions – such as (B)energy’s biogas backpacks and the Blazing Tube solar cookstove – are promising ideas in the early stages of implementation and testing. Others – such as the Gaia Association’s ethanol stove and fuel program in Ethiopia, or Carbon Clear and Practical Action’s revolving loan fund that enables Sudanese IDPs to switch to LPG stoves – are already improving the lives of thousands of people around the world.

Our partners, the donors who have supported them, and the communities they serve have worked hard to test and perfect these innovations. They know, like we do, that cooking shouldn’t kill. Changes in program design, increases in investments in alternative fuels and cooking technologies, and prioritization of further research and testing will improve health, save lives, reduce costs, and promote safety among crisis affected populations.

As you read, I encourage you to consider ways that you can support this growing sector. Policy makers and donors can emphasize energy access in funding mechanisms and humanitarian policies. Humanitarian staff can incorporate household energy needs into rapid assessments and, where gaps are found, address them within comprehensive programs. The general public can support humanitarian energy access by advocating on social media and donating to humanitarian energy programs.

Together, we can help overcome the humanitarian-development divide, and bring clean cooking solutions to crisis-affected people worldwide.

A black and white image of a handwritten signature in cursive script, which reads "Radha Muthiah".

The Alliance is grateful to all of the organizations who contributed their stories to this publication, and to the donors that supported their work: American Near East Refugee Aid (ANERA), (B)energy, Carbon Clear Limited, the European Commission Humanitarian Aid & Civil Protection (ECHO), the Gaia Association, The Horn of Africa Regional Environment Centre and Network (HOAREC), Oxfam South Sudan, Project Gaia, UK Aid, the United Nations High Commissioner for Refugees (UNHCR), and the Women’s Development Association Network (WDAN).





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More than 59 million people are currently displaced from their homes due to conflict, war, and disaster. They leave home with few possessions, and often, in fear of their lives.¹

While millions of refugees receive food from humanitarian agencies, the food still needs to be cooked before it can be eaten. Yet without access to modern cookstoves and fuels, women and children must risk their safety, health, and sometimes their lives, to search for and collect firewood in order to cook over smoky, polluting open fires that damage health.

Displaced women often must walk for hours to find firewood and carry loads of 20 kg or more back to camp, which puts them at risk for physical and sexual attack, dehydration, and physical injury. A 2014 UNHCR assessment in Chad found that 42% of refugee households experienced incidents of assault, attempted rape, rape, or other forms of gender based violence during firewood collection over a six month period.

Women and children in refugee camps are also exposed to health risks, including respiratory infections from smoke produced by inefficient stoves and fuels. A review in the *Journal of Conflict and Health* in 2010 stated that acute respiratory infections (ARIs) such as pneumonia are the leading

cause of mortality among children under five worldwide. Yet they receive comparatively little attention in humanitarian relief policies despite the fact that in crisis settings the burden of ARIs tends to be exponentially greater than in non-crisis settings.

In Nepal, for example, ARI mortality rates were roughly 10-17 times higher among refugee populations than among those in non-crisis settings. In Burundi, mortality rates from ARI were four times higher among refugees than their non-displaced peers.

Lack of access to cleaner and more fuel-efficient cooking technologies also has direct consequences on food security in crisis settings. In camps in North Darfur, 80% of IDPs reported selling food from their World Food Program ration to buy firewood, and on average they missed 3 meals a week when they had food but lacked cooking fuel.

So what is being done to address these problems?

¹ This article has been abridged and republished from: Muthiah, Radha & Aleinikoff, Alexander, (2015, June 19), "[Millions of Refugees Need Access to Cleaner, More Efficient Cookstoves and Fuels](#)," Global Alliance for Clean Cookstoves.

SECTION I: SCALED SOLUTIONS

The projects in this section feature innovations that have been tested and proven to work on a larger scale. They incorporate multiple innovations working in tandem, including efficient stoves, clean fuels, and innovative business practices. Further support would enable project developers to address ongoing challenges and assess the applicability of these projects in different locations and cultural contexts.

Universal Best Practices for Successful Cooking Interventions

These common themes and best practices are key for ensuring success of humanitarian cooking projects:

- ❖ **Training & Awareness Raising:** Crisis-affected people are more likely to keep and use stoves or alternative fuel if they are educated about the benefits of the product and trained in its proper use and maintenance. Without this component, products are more likely to be broken, discarded, or sold.
- ❖ **Sustained Funding:** Humanitarian projects are typically planned and funded on a short term basis, but this is not conducive to long term change. Sustained, long term financing must be part of the project plan.
- ❖ **Community Investment:** Humanitarian agencies do not have the capacity to deploy staff on long term projects. Engaging local community members ensures that the project is culturally appropriate and increases its chances of continuing in the long term.
- ❖ **Government Cooperation:** Working with the local or national government to develop and/or implement complementary policies grants greater access to crisis-affected communities and increases the chances of the project being replicated.

Gaia Association Turns Polluting Waste into a Life-Saving Clean Fuel Program for Refugees in Ethiopia



Health



Protection



Livelihoods



Environment



Photo © GAIA Association

Ethiopia is home to over 676,000 refugees – the majority rely on biomass for cooking.² Reliance on firewood for cooking has resulted in massive environmental degradation in and around refugee camps, and 33% of refugee households reported one or more violent incidents while collecting firewood over 12 months in 2014.³ Between 2005 and 2015, the Gaia Association provided a combination of stoves and ethanol fuel to over 40,000 refugees in four camps – reducing firewood consumption by 89% among families receiving the support and minimizing the exposure to the risks associated with firewood collection.

The Challenge

Following the collapse of the Somali government and subsequent humanitarian crisis in 1991, thousands of Somali refugees fled their country. Upon arrival in the refugee camps of Eastern Ethiopia, they were provided with basic items and support, but at first, they were not provided with cooking fuel. As a result, these families were forced to rely on firewood, which poses grave health risks when burned over open fires or traditional cookstoves. The resulting acrid smoke causes a range of deadly chronic and acute health effects such as child pneumonia, lung cancer, chronic obstructive pulmonary disease, and other serious conditions.⁴

Over time, the continued reliance on fuel wood created tensions between the refugees and the host communities and caused severe deforestation. The area around Kebribeyah refugee camp, for example, is 99% deforested from 20 years of firewood collection.⁵ Moreover, refugee women spent many exhausting hours each day collecting firewood to cook their meals,

putting themselves at risk for physical attack. The situation was dire and unsustainable.

In 2005, the Ethiopian government faced a different problem – pollution generated by the dumping of raw molasses, a by-product of the local sugar industry. In an effort to address this, the government encouraged producers to instead use the waste to manufacture ethanol. Unfortunately, there was no market for this new fuel.

The Innovation

The [Gaia Association](#), an Ethiopian NGO, saw an opportunity to provide cleaner, safer cooking options to refugee families using ethanol-fueled cookstoves. Working with the [United Nations High Commissioner for Refugees](#) (UNHCR), the organization responsible for the welfare of refugees in the camps, Gaia agreed to purchase ethanol from the Ethiopian government, raised funds to provide stoves to refugee families, and set up a training and support network to educate



Photo © GAIA Association

women on the use and benefits of the stoves. During an initial pilot project in 2005-2006, Gaia provided Swedish-designed CleanCook stoves and ethanol to a few refugee households in Kebribeyah and some non-refugee families in Addis Ababa.

Thanks to the success of the pilot project and sustained funding from UNHCR and Project Gaia, the Gaia Association was able to scale up the project to three additional camps – Awberre, Sheder, and Sherkole. Gaia’s vision for scaling up involves transforming energy provision from a short-term model to a long-term development initiative. One way through which Gaia envisions this change taking place is through a market based approach that localizes stove production and involves refugees in value chain activities.

The Technology

Ethanol is a clean liquid biofuel that can be made from a wide variety of feedstocks including sugary materials such as sugar cane, molasses, sugar beet, or sweet sorghum; starchy materials such as cassava (manioc), potatoes, or maize; or cellulosic materials such as wood, grasses, corn stover and other agricultural residues. In countries like Ethiopia, where the infrastructure already exists to produce it, ethanol provides a clean alternative to biomass fuels like firewood and charcoal.

CleanCook stoves, manufactured by Dometic, are safe and easy to use. Liquid ethanol fuel is absorbed by fiber wadding inside the canister, which prevents dangerous spills, even if the stove is turned upside down. A recent report by the U.S. Environmental Protection Agency (EPA) has determined that the CleanCook stove achieves the highest standard (Tier 4) of the International Organization for Standardization (ISO) [guidelines](#) for efficiency and fuel use, emissions, and indoor emissions in a laboratory context.⁶ Although a comprehensive quantitative assessment of the CleanCook’s health impacts among the

project beneficiaries has yet to be conducted, stoves that reach ISO Tier 4 for indoor emissions are in compliance with the [World Health Organization’s interim guidelines](#) for indoor air quality.

Implementation

The initial response to the stoves in Kebribeyah was overwhelmingly positive. Demand for the stoves was high, and rather than selling the stoves to buy other supplies – as is commonly done with goods provided by humanitarian agencies – the refugees kept and used the stoves. Some initial challenges arose during implementation, such as sufficient and consistent supply of ethanol, and only 20% of refugees were able to buy ethanol from the local market. This was due to the extreme poverty of the refugees. Gaia eventually provided stoves and fuel to all the families of Kebribeyah camp.

“We always eat clean food now,” said a female resident of Kebribeyah. “We no longer have smoke irritating our eyes, and our houses are clean and don’t smell of smoke anymore. So we are thankful to Gaia; we are really pleased with the ethanol stove.”⁷

Gaia drew two key lessons from the pilot study – the amount of ethanol distributed should be proportional to the size of the household, and supply of ethanol to the surrounding host populations should also be considered. Non-refugee residents of Addis Ababa also found the ethanol and stoves highly beneficial, and Gaia received orders for more stoves – enabling them to scale up production and expand provision of the stoves and fuel to the rest of the refugee families in Kebribeyah and other Ethiopian camps.

As of December 2015, **Gaia provided over 7,000 stoves and 3 million liters of ethanol to Somali and South Sudanese refugees in Ethiopia – a total of 40,842 people.**

Successes

The benefits of Gaia’s stove and fuel combination approach have been substantial. In addition to reducing the respiratory health risks incurred by the use of smoky, open fires, the combination of the CleanCook stoves and ethanol fuel resulted in an **89% reduction in firewood** consumption by the assisted families. Gaia estimates that this reduction has **saved 25,985 metric tons of firewood, preventing the deforestation of 346 hectares of land.**

Most importantly, refugee women no longer have to collect firewood outside the relative safety of the camp. This leaves more time for income-generating activities and education, which are critical to the long term wellbeing of the camp residents and their children. Gaia estimates they have saved almost 10 million hours of labor in the elimination of wood gathering and the reduction in cooking times. Moreover, the project has **created 26 full time jobs** and 30 part time jobs as guards, supervisors, community workers, and bottlers – **60% of which employ women.**

“As a result of having the ethanol stove, [the women] have ample time to do some income-generating activities,” said Amare Gebre-Egziabher, UNHCR Environmental Officer in 2014. “Now they even have time to go to the health center, and plus it's reduced the impact on the environment, which means the tensions between the locals and the refugees is reduced.”⁸

By providing an innovative cooking solution, the Gaia Association reduced environmental degradation, turned a country's waste product into a valuable commodity, eased tensions between communities, and improved the lives and livelihoods of refugee women by freeing up time for them to work and attend school.

As the global refugee crisis continues to grow, Gaia remains steadfastly committed to bringing clean cookstoves and fuel to the refugee camps. With the increasing availability of ethanol in Eastern Africa, Gaia hopes to transform cooking for the thousands of refugees living in camps not only in Ethiopia, but across the region.

Learn more at gaiaethiopia.org and projectgaia.com.



Photo © GAIA Association

² United Nations High Commissioner for Refugees, (2015), *Safe Access to Fuel and Energy: Ethiopia Country Strategy*, UNHCR, pp 3-7.

³ United Nations High Commissioner for Refugees, (2014), *Light Years Ahead Project Monitoring & Evaluation System and Baseline and Survey Report: Ethiopia Country Report*, pp 7.

⁴ Global Alliance for Clean Cookstoves, (2016), “*Impact Areas: Health*” from cleancookstoves.org.

⁵ Project Gaia, (2014). “*Ethanol Stoves for Refugee Homes - Ashden Award 2008*”. Vimeo.

⁶ Jetter, James, (2016), *Test Report - CleanCook Model A1 Stove with Alcohol Fuel - Air Pollutant Emissions and Fuel Efficiency*, United States Environmental Protection Agency.

⁷ Project Gaia, (2014).

⁸ Project Gaia, (2014).

Carbon Finance Enables Families to Switch from Biomass to LPG Stoves in North Darfur



Health



Protection



Livelihoods



Environment



Women's Empowerment

Photo © Carbon Clear

Lack of consistent funding is one of the largest barriers to the long term sustainability and success of humanitarian cooking projects. Since 2008, Practical Action, Carbon Clear Limited, and the Women's Development Association Network have collaborated to provide carbon financed loans that enable low-income and internally displaced families in North Darfur, Sudan, to purchase efficient cookstoves and liquid petroleum gas (LPG) for their cooking needs. To date, this model has enabled 9,400 households to switch from charcoal to LPG – reducing indoor air pollution, empowering women, and cutting fuel costs by up to 65% per month.

The Challenge

Biomass fuel –firewood, charcoal, and agricultural waste – comprises over 80% of the total primary energy supply in Sudan. The majority of this is consumed by households, inefficiently burned over three-stone fires or traditional metal cookstoves.⁹ As noted previously, inhalation of the toxic smoke produced by these fuels poses grave health risks, including acute respiratory infection, heart disease, and low-birth weights among children whose mothers were exposed during pregnancy.¹⁰

Dependency on charcoal and firewood has caused widespread deforestation throughout Sudan, which lost over 11% of its forests between 1990 and 2005. In addition to exacerbating global climate change, deforestation negatively impacts the women and children who have to travel farther from home to find firewood or use more of their limited income to buy it.¹¹ In 2005, Human Rights Watch reported that 82% of the rapes treated by Médecins Sans Frontières (MSF) in West and South Darfur occurred when women left the towns and IDP camps in search of firewood and other supplies.¹²

A 2006 study showed that 80% of IDPs interviewed in North Darfur reported selling food from their World Food Programme rations to buy firewood – negatively impacting their nutritional intake. On average they missed three meals a week when they had food but lacked cooking fuel.¹³

Without a clean fuel alternative, the health, protection, and environmental impacts of Sudan's reliance on biomass fuel will only worsen. Addressing this issue in the long term, however, requires an intervention that is both financially and environmentally sustainable.

The Innovation

Between 2002 and 2007, Practical Action successfully facilitated a shift from wood and charcoal to liquid petroleum gas (LPG) in 1,500 households in Kassala State, East Sudan. Drawing on the lessons learned in Kassala, Practical Action partnered with Carbon Clear in 2008 to apply the project model in El Fashir – the urban capital of North Darfur. As of 2010, the population of El Fashir included 198,391 local residents and 29,645 internally displaced people (IDPs). Household income is low, seldom reaching \$30 USD per month.¹⁴

With start-up financing from Carbon Clear, Practical Action established a revolving loan fund that is managed by the Women's Development Association Network (WDAN). Local women who participate in the project receive a loan that covers the upfront costs of LPG fuel and cooking equipment, which they then pay back in installments over time. WDAN's representatives are local community members, which enables them to develop flexible payment plans that meet the specific circumstances of each grantee. As the loans are repaid, the money is invested back into the fund and can be loaned to another woman. The loan fund has "revolved" 20 times in this manner since 2008, enabling long term benefits.

In humanitarian settings, free distribution of products without sufficient training often results in the products being improperly used, broken, or sold – negating their intended benefits. Recognizing this, Practical Action hosts training sessions to educate women about the health and environmental benefits of switching to LPG, introduce the concept of revolving loans, and give women the opportunity to provide feedback on their needs. Those who are interested can then receive further information and are trained in how to safely handle LPG equipment. These activities ensure that the women are fully engaged and willing to invest their own resources in the loan program.¹⁵

The Technology

Liquid petroleum gas, or LPG, is a clean-burning mixture of hydrocarbon gases (propane and butane) that can be used as fuel in heating appliances, cooking equipment, and vehicles. It is a naturally occurring by-product that can either be recovered during the extraction of natural gas and oil from the earth, or produced during the refining of crude oil.¹⁶ Despite being a fossil fuel, LPG produces far fewer greenhouse gas emissions per unit of cooking energy than three-stone fires or traditional stoves. More importantly, substituting LPG for charcoal or firewood drastically reduces indoor air pollution, improving air quality and averting the health risks of smoke inhalation.¹⁷

The LPG equipment distributed to each loan recipient consists of a stove, a gas-filled bottle, and a Kisra (local sorghum chapatti) plate. The majority of the stoves are Yucel O-300 three-burner tabletop cookers from Turkish manufacturer Femas, which are manufactured and assembled in Khartoum. These stoves burn 2-5 times more efficiently than the three stone fires, mud stoves, and metal stoves that families previously used with firewood and charcoal.¹⁸ This results in substantial savings on fuel costs. On average, women in El-Fashir purchase one sack of charcoal per month at 130 SDG. By contrast, refilling their LPG canisters once a month costs about 70 SDG. Financial savings can therefore be up to about 65% per month, which assists the women in paying back their loans for the initial equipment purchase.¹⁹

What is Carbon Finance?

Industrial and service companies can choose to offset their own greenhouse gas (GHG) emissions through the purchase of carbon "credits." Each credit represents one metric tonne of CO₂ equivalent (CO₂e) that is prevented from entering the atmosphere by projects that reduce GHG emissions, and the money paid for credits is used to finance further projects. To qualify for carbon financing, project developers must use an accepted methodology to estimate how much CO₂e would have been emitted without their intervention, and this estimate must be certified by an accredited third party. The Darfur Low-Smoke Stoves project was awarded the Gold Standard for carbon certification in 2012.

While the verification process is complex, carbon financing can enable projects that would not otherwise have been possible. The startup financing from Carbon Clear enabled project participants to overcome the high upfront costs of purchasing LPG equipment – a major barrier that prevents low-income families from switching to clean fuels. For each tonne of CO₂e abated by the project (approximately 4.5 per stove distributed) Carbon Clear sells a credit to organizations willing to outsource all or part of their carbon emissions.²⁰

Implementation

The use of LPG as an alternative to biomass has posed some challenges over the course of the project. El Fashir’s location in a conflict region has occasionally led to shortages in fuel supply. Transport costs additionally increase price of fuel, making it difficult for already-poor families to meet their loan repayments and purchase fuel – though the majority have succeeded. The project team has had to work closely with fuel suppliers to improve access and reduce overall prices. LPG bottles are also heavy and difficult to carry over distances, so refilling centers need to be walking distance in order to prevent women from reverting to charcoal suppliers near their homes. Safety concerns have been addressed by hosting compulsory safety seminars for beneficiaries and enabling them to report any incidents through surveys. No incidents have been reported so far.

Despite these challenges, demand for participation in the project has been extremely high, and the project team is exploring options for scale up.

Since 2008, over 10,900 stoves have been disseminated to El-Fashir households, benefitting an estimated 65,400 people and eliminating the need to collect or purchase biomass fuel. Based on feedback in quarterly surveys, smaller gas-filled bottles have recently been introduced, which are more affordable to refill and easier to carry. The project leaders have also further reduced the upfront cost associated to switching to LPG.

The LPG stove has totally eliminated the smoke and it has also helped families to have a bit more money. LPG gas is cheaper than charcoal – which many families use to cook with as well as firewood. We can use the money we save on other things – maybe for our farming or to buy more food...each family saves about 110 Sudanese pounds a month."²¹

– Randa Fadul Ali, LPG stove recipient in Kafut village, El Fashir

Women’s Empowerment Outcomes

93% of women	Reported having more time to work since buying a stove, generating more income for their household.
63% of women	Reported they have more time to spend with their children.
86.5% of women	Found that their kitchens were cleaner
55% of women	Feel they have a better status within their community
Over 40 individual women from WDAN	Were trained in the principles of micro-credit, efficient management, accounting, bookkeeping, and monitoring. The project is almost exclusively managed by local women trained on a continuous basis.

Successes

The Darfur Low-Smoke Stoves project has proven a success on several fronts. As noted above, the loan program has reached its 20th rotation since its inception, and repayment rates were higher than 93% as of March 2016. This bodes well for the long term continuation of the project. Kitchen surveys reveal that all households acknowledge an average reduction of 54 to 100 SDG per month in their energy budgets, denoting an improvement in livelihoods. Competition between gas companies coming into the area is also leading to improvements for customers, including price reductions on gas. Most significantly, nearly 100% of families using the new cookstoves state that their indoor air quality has greatly increased from the reduction in smoke.²²

Environmentally, the project has saved an estimated 92,628 tons of CO₂e by facilitating the switch from biomass to LPG. While its impact on deforestation has yet to be evaluated, Carbon Clear estimates that one household cooking with traditional stoves consumes 2 tonnes of wood per year – approximately the equivalent 10 trees.²³ By this calculation, the project is preventing the harvest of 75,000 trees per year.

Perhaps the most impressive impacts of the project, however, are the benefits it has produced for women, as shown in the above table.²⁴

Over 40% of percent of surveyed women have also reported that their husbands were interested in cooking activities, counter to traditional customs. “The evidence of men’s support is tangible,” says Hashim Eltayeb, who profiled the project for *Boiling Point* in 2010. “Most of the men support their wives in paying for refilling of gas bottles, and for repaying the loan in installments. Moreover, they participate in project meetings.”²⁵ Finally, switching from firewood to LPG has reduced the need for women to risk their safety by traveling farther from home to collect fuel. Around 46% of households surveyed reported that they could access a supply of LPG at walking distance and another 43% by taking common transportation.²⁶

By combining a cooking intervention with a self-sustaining finance mechanism and community engagement, the Darfur Low-Smoke Stoves project has ensured that its positive impacts on gender, protection, health, livelihoods, and the environment in El-Fashir will continue past the end of the project.

⁹ Practical Action, (2015). “[Energising the Energy Sector in Sudan](#),” from practicalaction.org, pp. 1.

¹⁰ Global Alliance for Clean Cookstoves, (2016).

¹¹ Practical Action, (2015). pp. 1

¹² Human Rights Watch, (2005). [Sexual Violence and its Consequences Among Displaces Persons in Darfur and Chad](#).

¹³ Galitsky, Christina, et al, (2006). [Fuel Efficient Stoves for Darfur Camps of Internally Displaced Persons Report of Field Trip to North and South Darfur, Nov. 16-Dec.17 2005](#), University of California, Berkeley.

¹⁴ Eltayeb, Hashim (2010). Using Carbon Finance to Introduce LPG Stoves into Darfur, Sudan. *Boiling Point*(58).

¹⁵ Practical Action, (2015), pp. 2

¹⁶ World LPG Association, (2016), [Production & Distribution](#), from www.wlpga.org.Eltayeb, (2010).

¹⁷ Eltayeb, (2010).

¹⁸ Carbon Clear, (2016). [Monitoring Report - Darfur Efficient Cook-stove Project](#), pp. 39

¹⁹ Practical Action, (2015), pp. 2

²⁰ Eltayeb, (2010). For more information, visit the Alliance’s carbon finance website at [www.carbonfinanceforcookstoves.org](#).

²¹ Practical Action, (Unknown). [Low-smoke Stoves in El Fashir, Sudan](#), from practicalaction.org

²² Carbon Clear, (2015). “[Cooking Up Change in Sudan](#).”

²³ Carbon Clear, (2015).

²⁴ Carbon Clear, (2016). “[Darfur Low-Smoke Stoves](#)” from safefuelandenergy.org.

²⁵ Eltayeb, (2010).

²⁶ Carbon Clear, (2016), Monitoring Report - Darfur Efficient Cook-stove Project. pp. 39

SECTION II: INNOVATIONS

The following stories present cooking technologies, fuels, and best practices that have shown promising results on a small scale in humanitarian contexts. With more research and funding, these innovations could be scaled up to change more lives.

ALTERNATIVE FUEL



Photo © ANERA



Health



Livelihoods

ANERA's Biogas Digester Project Provides Renewable Cooking Fuel to Gaza Families

Biogas – a methane rich gas produced through anaerobic (without air) digestion – is one of several fuel alternatives being piloted in humanitarian contexts. Because it is derived from waste materials, it provides a simple, practical, and cost-effective source of cooking energy. Biogas can be generated from animal and kitchen wastes and be used directly in conventional low-pressure gas burners. In rural communities, small-scale digesters can provide biogas for single-household cooking and lighting. Biogas can also be derived from human waste, doubling as a form of waste management and a source of cooking energy in refugee camps.

In 2014, American Near East Refugee Aid (ANERA) distributed 15 biogas production units, or “digesters,” to needy rural households in Gaza, and 13 to marginalized Bedouin families in the West Bank. In Gaza, where cooking gas is in short supply, families often wait in long lines to fill gas tanks for cooking, only to be turned away when the supply station runs out. To make do, Mariam Ahmed (pictured above) and her family used to burn wood or plastic sheeting, despite the fact that it produced toxic gases. “It is too smoky,” said Mariam’s son Ibrahim Ahmad. “It hurts our eyes and causes us to cough and choke.”

For families like Mariam’s who live in rural and Bedouin

communities, livestock provides ample waste to produce biogas. Manure mixed with equal parts water is placed in a tank, where it is blended by natural warmth and pressure, resulting in bacterial fermentation. A second tank inverted inside the first captures the methane gas that is produced, usually in two to three weeks, allowing it to be used for household cooking and heating. In winter, Mariam’s family is able to use their biogas-supplied stove an average of 30 minutes to three hours a day.

By producing a clean-burning fuel from available animal dung, families like Mariam’s are not forced to rely solely on purchased fuel, the price of which can rapidly consume their meagre income. Moreover, avoiding the toxic smoke from traditional fuel greatly reduces the risk of serious health conditions such as lung cancer or acute respiratory infection.

“It has eased a huge burden on us,” Ibrahim says. “We use it now for all of our family’s cooking. And, I like the idea that it is a renewable source of energy at no cost.”

With sustained funding to conduct further pilot projects and monitor results, organizations like ANERA could contribute to the growing body of knowledge on implementing biogas in humanitarian settings – reducing duplication and promoting best practices.

Learn more at anera.org.

²⁷ ANERA, (March 12, 2015). “[Biogas Digester Gives Renewable Fuel to Gaza Families](http://www.anera.org)” from www.anera.org

HOAREC's Biogas Backpack Project Provides Renewable Cooking Energy to Refugees in Ethiopia



Access to energy for cooking is a very real issue faced by rural populations across the Horn of Africa. Demand for fuel wood currently outstrips supply, and its use can result in deforested woodlands and tensions between refugee and host communities. To address the energy needs of people in rural areas of Ethiopia, the Sustainable Energy Programme at the Horn of Africa Regional Environment Centre and Network (HOAREC), along with its partners, has initiated a project to make biogas more readily available to communities.

Recognizing the potential of biogas as a social business, HOAREC has partnered with [\(B\)energy](#) – a German company that manufactures mobile biogas technology through local business partners and works to make it available throughout the Ethiopia. Working with UNHCR, HOAREC and (B)energy enable refugees in Bambasi and Assosa camps to either purchase their own biogas digesters, “(B)plants,” or to buy biogas backpacks, “(B)packs,” to transport the fuel from supply sources to their homes. Those who opt to purchase (B)plants have the opportunity to become business owners who run their own system and supply biogas for profit. The producers can be either refugees in the camps or farmers in the host communities. Those who cannot afford to install a digester can either buy biogas in (B)packs or purchase slurry – a by-product of the digestion process – to use as fertilizer.²⁷

(B)energy works with agents who sell the technology, as well as inform and advise potential customers. This includes installation and maintenance services and the potential to partner with micro finance institutions, who provide the start-up investment for the small business owners.

In contrast to common pilot projects, HOAREC does not actively select suitable households for participation. Instead, local entrepreneurs are approached with the idea of establishing biogas businesses among community



Photo © HOAREC

members within and outside of the camps. All technical and financial issues, such as potential gas production from available input substrate as well as the business model for the sale of biogas are explained and discussed.

By providing information about biogas as an alternative source of energy, access to the technology, and financial support, HOAREC and (B)energy are improving the lives of refugees while helping to create livelihoods and reduce environmental degradation from the use of firewood.

Certain challenges must be further researched and resolved, however, before this innovation can be applied on a larger scale. These include competition with programs that distribute firewood, charcoal, or kerosene to refugees for free, duplicative activities by other agencies, and tensions among refugee families on how to share supply.

Katrin Puetz, head and heart of (B)energy, has a few thoughts on how these challenges might be overcome, such as establishing a revolving loan fund that would provide start-up investment to host community members – especially cattle-owners – to become biogas producers.²⁸

²⁸ HOAREC, (Unknown). “[Biogas Transport](#),” from [www.hoarec.org](#).

²⁹ Puetz, Katrin, (2016, May 12). Interview with Kathleen Callaghy, Global Alliance for Clean Cookstoves.



Protection



Environment



Health

Photo © UNHCR 2015

UNHCR Pilots Solar Cooking in Burkina Faso Refugee Camps

Solar cookstoves, often called solar cookers, offer an alternative to the health, environmental, and safety risks posed by biomass fuels, such as charcoal and firewood. Solar cookers have zero emissions and can be used in areas where solar energy is abundant for most of the year – typically between 30 degrees north and south of the equator, where much of the developing world is located. However, they usually require significant changes in cooking practices, and multiple devices to meet a household's cooking needs.

Since 2012, UNHCR and its partners, Caritas Burkina Faso (OCADES) and HELP, have been working to introduce renewable energy for cooking into Saag-Nioniogo, Mentao, and Goudoubo refugee camps in Burkina Faso. One solar-powered cooker, the Blazing Tube, has met with considerable success among the Malian refugees in the camps.

Operation of a Blazing Tube requires approximately 5 liters of vegetable oil. A solar reflector generates heat, which is transferred to an electronic glass tube containing the oil. When heated, vegetable oil becomes more fluid and overflows into a container, into which a cooking pot is placed, creating a bain-marie. At its peak of operation, the vegetable oil can reach 200 °C or more, enabling fry cooking, as well as the ability to cook several different

types of food. A cooking box incorporated into the unit enables heat retention, helping to keep food warm for hours.

UNHCR has been developing and monitoring a step-by-step strategy for introducing solar cookers into the camps since 2013. To date, the strategy has proven beneficial to camp residents, and enthusiasm for the technology among the refugees demonstrates a significant willingness to adopt solar energy as an alternative to firewood.

“Before the introduction of the stove, refugee women had to walk several hours a day to collect firewood...the stove allows them to cook without spending any more time on firewood collection. And, more importantly, it does not produce any smoke - they love it.”

– Olivier Lompo, UNHCR

Because cooking is such a personal activity, successfully scaling an innovation like the Blazing Tube requires multiple pilots to ensure that it meets the individual needs of the people it serves. Sustained funding, further testing, and improved collaboration between aid agencies and NGOs can facilitate this process.

Learn more at safefuelandenergy.org



Protection



Livelihoods

Photo © Oxfam

Oxfam's Fuel Vouchers & Improved Cookstoves Provide a Holistic Approach to Food Security in South Sudan

The potential benefits of efficient cookstoves and alternative fuels may not be realized if cost or consumer preference prohibits them from being used. Innovative distribution models are one way to provide refugees with a greater degree of choice in where and how they obtain energy supplies, enabling them to select the most suitable products for their individual needs.

Lack of fuel to cook food was one of the greatest challenges facing the people housed at the United Nations refugee camp in Juba, South Sudan. There was no source of fuel in the camp, and seeking fuel beyond the boundaries of the camp was risky. Women and children would venture outside the safety of the protected boundaries of the camp to collect firewood or purchase charcoal if they could afford it.

To overcome this life-threatening problem, Oxfam started providing fuel efficient stoves, charcoal, and commodity vouchers to inhabitants of the camp in February 2014, with support from the European Commission for Humanitarian Aid (ECHO). Identifying nine charcoal retailers within the camp – ensuring that the income generated went back to supporting those in need – they distributed charcoal vouchers to camp members, which could be exchanged for six bags of charcoal from the producer of their choice at any time during the month. Previously, most camp

inhabitants had used coiled metal stoves for cooking, which could consume one batch of charcoal for just one meal. To tackle this problem, Oxfam distributed 104 fuel efficient stoves to camp members to explore whether the alternative design would ensure that the charcoal was burned economically and efficiently.

“Charcoal burns slower with this stove...It saves time, as you don't have to keep adding charcoal, and it saves money because you don't have to keep buying charcoal after the vouchers have been used.”²⁹

– Yang Pal, recipient of a fuel efficient stove

In total, Oxfam distributed **4,400 cookstoves and provided charcoal vouchers to 35,626 people monthly**. In addition, 28 IDPs were trained and equipped to produce the stoves locally.

As in so many cases, Oxfam's project relied on short term funding – thus, the project concluded in 2015. With sustained or long term funding, Oxfam or similar organizations might be able to scale and perfect their innovation to improve the lives of more crisis-affected people.

Learn more at oxfam.org.

³⁰ Oxfam, (Unknown). “[South Sudan: A holistic approach to food security](http://www.oxfam.org),” from www.oxfam.org.

JOIN US IN THIS EFFORT

Cooking solutions for crisis-affected people are under-supported in the humanitarian system, but you can help – by recognizing the importance of energy access in ensuring the dignity and safety of refugees.

Policy makers and donors can emphasize energy access in funding mechanisms and humanitarian policies.

Humanitarian staff can incorporate household energy needs into rapid assessments and, where gaps are found, address them within comprehensive programs.

The general public can support humanitarian energy access by advocating on social media, and donating to humanitarian energy programs.

Follow @SafeFuelEnergy, @cookstoves, and @UNHCREnv on Twitter. Research the issue on safefuelandenergy.org and on the [Alliance's](#) and [UNHCR's](#) humanitarian energy pages.



This publication was made possible with the generous support of UK Aid from the UK Government. The views here expressed do not necessarily reflect the UK government's official policies.



The Global Alliance for Clean Cookstoves is a public-private partnership hosted by the United Nations Foundation that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. The Alliance's 100 by '20 goal calls for 100 million households to adopt cleaner and more efficient cookstoves and fuels by 2020. The Alliance is working with its public, private and non-profit partners to accelerate the production, deployment, and use of clean cookstoves and fuels in developing countries.

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