Darfur Cookstove Project

Zam Zam, Abu Shouk, and Assalam North Darfur IDP Camps

analysis of wood availability and appropriate fuel efficient cookstove technologies

Lawrence Berkeley National Laboratory
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Personal Security and Food Security

The LBNL Darfur Cookstove Project was funded on the initiative of USAID/OFDA to reduce the need for women to collect firewood for cooking, thereby reducing the personal security threat they face while collecting.

There is no “proper” wood in this area.

There is no such thing as “agricultural waste.”

The scarcity of biomass fuel means that, as a practical matter, relatively few IDPs collect cooking fuel.

Personal Security and Food Security

The cooking fuels that *are collected* consist of oushar, tundup, makhet, and straw from sorghum and millet.

These shrubs have low caloric value as fuel. It takes a full headload of tundup or makhet to cook one meal.

It takes twice as much oushar as "proper" wood to prepare a meal.

Straw yields even less cooking heat and is typically used as a fuel of last resort.

Oushar is noxious when burned, and has a toxic, milky sap when cut.

Personal Security and Food Security

IDPs who collect oushar, tundup, and makhet spend 6-10 hours a day, and usually travel far from the safety of the camps.

They report security threats from local farmers, soldiers, police, and bandits. They no longer collect in areas they believe to be patrolled by Janjaweed.

Areas near the camps have been denuded. Even roots have been taken, eliminating any chance of regeneration.

Most IDPs travel to Golo, where they report feeling more secure.

Personal Security and Food Security

Most IDPs we interviewed *buy* wood for cooking, spending SD 200 - 300 per day, on average.

Most IDP families require one full *karba* (bundle) of wood, costing SD 100, to cook one meal.

Most families sell food rations to buy wood.

The families we spoke with miss, on average, 3 meals per week when they *have* food but *do not have* wood.

Personal Security and Food Security

We believe the shortage of firewood has essentially become a food security issue.

Collecting any kind of wood-like fuel is not practicable for most IDPs

Purchasing wood is expensive

Most families sell food to buy wood

Missing meals for lack of wood is commonplace

The Economics of Firewood

Most of the wood in El Fasher and the surrounding IDP camps comes from forests near Dobo, Omsidar, and Hamada.

Truckers pay SD 150,000 per load.

They pay approx. SD 1,600 in “taxes” to the SLA along the way.

They pay approx. SD 30,000 per load in taxes to the Department of Forestry.

We have no data on average transportation costs.

They sell each load for approx. SD 300,000.

The Economics of Firewood

IDPs buy wood in *karba* of 3 - 4 sicks, weighting 1.6 - 2.1 kg, for SD 100 each. Most families burn one *karba* per meal.

Larger *karba*, costing SD 500, are available, but there is generally no cost savings by purchasing in this quantity.

Wood can be purchased at a SD 20 per *karba* discount at the “pre-tax” market near Zam Zam, mostly for resale.

Families eating three meals per day will spend SD 300 on wood.

The Economics of Firewood

Woodcutters from Omsidar also deliver wood to Abu Shouk and Assalam; and those from Hamada deliver to Zam Zam.

They sell each *karba* for SD 100 in the camps.

It is a 150 km, seven day journey to the northern camps by horse cart. They pay SD 3,000 SD to the Department of Forestry and SD 600 in “taxes” to soldiers at checkpoints.

It is three days’ travel to Zam Zam by horse cart. They pay SD 1,000-1,500 to the Department of Forestry.

They carry 130-150 *karba* per trip.

The Economics of Firewood

Some IDPs with donkeys are able to scavenge wood from their burned-out, abandoned villages within a day's ride of the camps.

This is not a secure practice, but the wood collected is "free."

Fuel Efficient Cookstoves

Practical Action (formerly ITDG) initiated a program, instituted by many NGOs, to teach IDPs to build fuel efficient mud stoves ("FES").

The "FES" design uses locally available clayish-mud, donkey dung, and water.

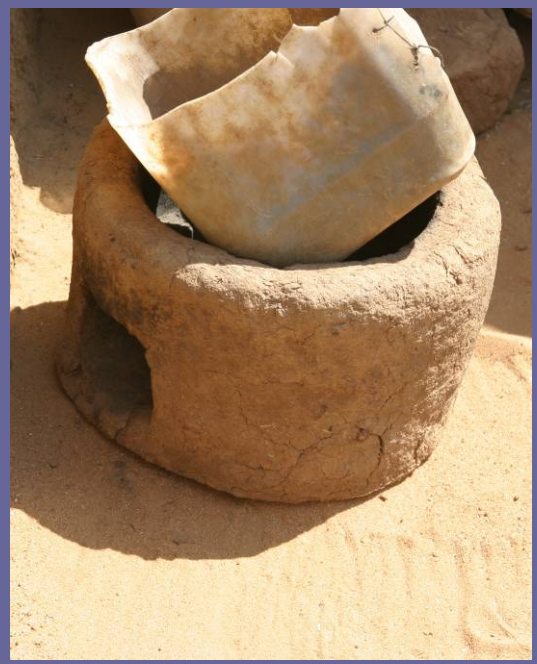
The cost of materials per stove is approx. SD 1000, according to Practical Action. We have not calculated other program costs: trainer salaries, tools, incentives, and overhead.

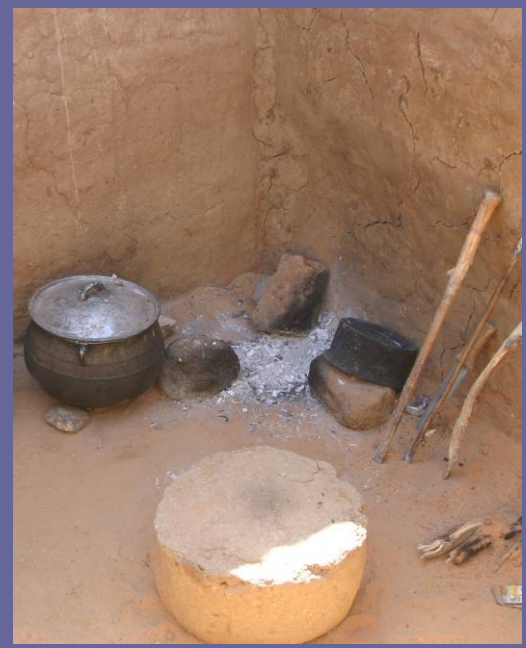
Practical Action claims a 50 -60% reduction in wood use and a large reduction in harmful smoke exposure. Neither claim is supported by data.

Fuel Efficient Cookstoves

Only a small percentage of IDP families have the “FES”.

We observed only three “FES” in IDP encampments:
(1) used in addition to a 3-stone fire, even though it fit no pot in the household, (2) never used since it “did not work”, and (3) used as a *bambur* (cooking stool).





Fuel Efficient Cookstoves

The “FES” has some benefits and, if used properly, will use less wood than a 3-stone fire for most cooking uses.

By surrounding the pot, the FES has good heat transfer efficiency (once warm, and if properly fit to the pot).

It is relatively inexpensive and utilizes local materials.

Its low height is ergonomically suited to the low stools (*bambur*) used by cooks in Darfur, and its massive, low center of gravity and pot-embracing shape give needed stability.

Fuel Efficient Cookstoves

The “FES” also has major design flaws, and is quite difficult to use properly.

The combustion chamber is poorly aerated and ill-proportioned, causing incomplete combustion and requiring considerable tending.

The high-mass stove body sucks heat from the fire until it is warmed-through.

The opaque stove body and low fuel port make it extremely difficult to monitor the status of the fire and to tend properly.

It is a one-stove, one-pot solution.

Fuel Efficient Cookstoves

Though the materials are locally sourced, they are not readily available to the IDPs.

Collecting and trucking in the mud requires the logistical capacity of NGOs. Donkey dung is an increasingly valuable commodity.

Camp managers are concerned about the quantity of water diverted to “FES” programs.

Some NGOs have raised health concerns about the handling of dung in stove production.

Fuel Efficient Cookstoves

Implementation of FES programs have under-emphasized quality control and user training, resulting in poor performing stoves and poorly skilled fire-builders.

Little attention is given to the critical dimensions of (a) the gap between pot and stove or (b) the height of the combustion chamber.

We observed few, if any, FES that fit its pot acceptably.

We met no IDPs who understood the basic techniques for building efficient fires. NGO trainers were equally uninformed.

Fuel Efficient Cookstoves

Alternatives

There are a number of well-designed efficient cookstove alternatives. A number of prominent research institutes have been working on the design of efficient stoves for years.

The trick is finding one that is right for the conditions in Darfur, the needs of the IDPs, and the programmatic constraints of the implementing NGOs.

Fuel Efficient Cookstoves

Alternatives: good designs ruled-out

The Rocket Stove is probably the most efficient naturally drafting, wood-burning stove yet developed. Its components can be assembled locally, well within existing capacities. We have ruled it out because:

- its center of gravity is too high, and pot supports too insufficient, for the stability necessary to withstand the vigorous, high-levered mixing of *assida*, which is the cornerstone of the Darfur diet.
- its 310 steel components are somewhat expensive. (Because of its efficiency, the combustion chamber experiences extremely high temperatures, causing softer steel to fail relatively quickly.)

Fuel Efficient Cookstoves

Alternatives: good designs ruled-out

The Baghalaxmi is the product of India's 13-year National Fuel Efficient Stove Development Program. Its cast concrete body allows easy production by beneficiaries and consistent reproducibility of the design specifications. It provides acceptable multi-pot use. We have ruled it out because:

- concrete is extremely expensive in Sudan, outside of Khartoum.
- if concrete is mixed with sand (as is ordinarily done), rather than with crushed stone (which is not locally available), it will crack under use.

Fuel Efficient Cookstoves

Alternatives: things we are considering

The Avi incorporates the existing construction techniques of the ITDG “FES” stove and efficiency-enhancing engineering.

The Avi provides demonstrably better fuel efficiency and easier usability than the “FES” by supplying combustion air from below and specifying critical dimensions, such as pot-to-stove gap and combustion chamber height.

The Avi uses the same amount of mud-dung-water as the “FES”, but adds SD 100 of locally available steel rod for its grate.

Fuel Efficient Cookstoves

Alternatives: things we are considering

The Avi shares the implementation challenges seen in the existing “FES” stove programs.

Quality control is impossible in the current training model, where IDPs make their own stoves under the guidance of “qualified” trainers. Without careful attention to the critical design specifications, stove performance will suffer, even to the point of worthlessness.

We are developing programmatic recommendations to address these issues.

Fuel Efficient Cookstoves

Alternatives: things we are considering

The Abunejma is a simple, multi-pot design, adapted from proven engineering, in response to the specific environmental conditions and cooking practices observed in the IDP camps of Darfur.

The steel stove body can be quickly and inexpensively stamped, and can be assembled locally by metal-workers. We made three prototypes in El Fasher for SD 2,000 each. The ultimate price may be half that.

The Abunejma is both fuel efficient and user friendly. It is easy to tend well.

Program Implementation Strategies
Training-of-Trainers

The current approach, focusing on training-of-trainers, is not achieving the stated program objectives.

Most of the stoves being made are of low quality.

Instructional skills and methodologies vary widely among the trainers.

Beneficiaries are not teaching others to make the stoves.

Livelihood aspect of the program has not been observed.

Program Implementation Strategies

Training

Training IDPs about the best, most efficient ways of using the stoves is critical. The fire-building techniques they now use – and have used all their lives – are not geared to saving wood. Stove technology is only *one* factor in the fuel efficiency equation. Proper fire-building and cooking techniques can save nearly as much wood as good stove design.

The current training program teaches the IDPs to *make* stoves. The new focus should be to teach them to *use* them.

Recommendations

A full report and recommendations will be prepared shortly, after consultation with our Lawrence Berkeley National Laboratory team members who conducted similar studies in South Darfur.

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