

TEAM REPORT

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I. PROJECT DESCRIPTION: WHAT IS NEEDED

“Thus far, it appears that the Chorkor smoker is the best option for an improved fish smoker for Efut Inwang. Before we commit to a design, let's review the fish smoker designs, looking for better options or improvements to the Chorkor smoker that could be applicable to our situation.” – Andrew Parker

II. RESEARCH RESULTS

The Chorkor Smoker Design

- Developed in 1970 with the help of a FAO project in Chorkor, a small village on the outskirts of Accra, the capital of Ghana.
- Rectangular; about twice as long as wide
- A dividing wall in the middle, two stokeholes in the front, and a fire pit in each chamber.
- The walls are made of clay mud, cement, or clay blocks.
- The top of the walls must be level so that the wooden frames can rest snugly against them.
- The oven should be low, but the fire ought to be at least 60 cm below the lowest tray.
- The wooden frames of the drying trays rest on the edge of the oven walls and therefore do not catch fire.
- The trays effectively form a chimney above the fire in which heat and smoke constantly circulate.



Figure 23 Chorkor oven being used for bonga at Bonfi (Conakry, Guinea)

Benefits of the Chorkor Smoker

- Long life
- Low construction cost
- Easy to build
- Low firewood consumption
- Capacity is large; up to 18 kg of fish can be smoked on each tray and as many as 15 trays can fit in an oven
- Small and medium fish may be smoked whole or split; large fish are cut into fillets
- Yields a product with 10-15 percent moisture content and may require from 2 hours to 2 days
- Fish smoked with Chorkor smoker can be stored up to 9 months in the tropics if the trays are tightly covered with plastic
- Less tedious with use of trays
- Uniformly smoked product (because of plywood cover) results in better quality in terms of colour, shape, and taste.
- Handling of fish greatly reduced
- Product acquires higher market value
- Proven to be more efficient in terms of cost and energy utilization than other designs.
- There are training material available for it in English and French

Known Problems with the Chorkor Smoker and Potential Solutions

Problem 1: Health and Environment

- While the Chorkor smoker is an improvement over the traditional smoker by reducing the fuel wood consumption to some extent, it does not solve the problems of smoke inhalation or fire wood scarcity
- Trees are cut daily for fish smoking, contributing to depletion of wood stock, and women, often with babies slung over their backs, inhale volumes of smoke into their lungs. The vicinity where they operate is engulfed in smoke, affecting other people as well as the environment.
- Fish processed using traditional methods do not meet international standards and can only be marketed locally at low prices
- Women who currently use fuel wood for fish smoking are subjected to long hours of smoke inhalation. The women are faced with dwindling wood supplies, low returns from the sale of low-quality smoked fish, and environmental as well as health hazards.

Proposed Solution: Clean Fuel - The “Fish Smoker” Design from GRATIS

- The GRATIS project is introducing a new hygienic smoker that meets the requirements of both the Ghana Environmental Protection Agency (EPA) and the Ghana Standards board (GSB), as well as international standards.
- The LPG smoker is an improved smoker that depends solely on gas (LPG) for fuel
- Offers an acceptable, clean energy-efficient and environmentally friendly fish-smoking technology. The LPG-fired fish smoking oven is constructed from aluminum sheets and equipped with smoke generators neatly embedded at the rear. Smoke is generated by burning crushed sugar cane, coconut husks or any approved agricultural waste.
- Operating costs are slightly less than for the traditional smoker (according to the women, they use about 30,000 Cedis worth of fire wood to smoke 50 crates (one ton) of fish. The new smoker uses 28,000 Cedis worth of LPG gas to smoke the same quantity.
- The fish smoker project grew out of persistent requests by women entrepreneurs and women’s groups in four rural fish smoking communities in the Greater Accra Region who asked for assistance from GRATIS in improving the traditional smoking process.
- **Key references:** http://www.undp.org/energy/publications/2001/files_2001a/04_Ghana.pdf
<http://allafrica.com/stories/200210140685.html?page=1>

Problem Two: Bulk Processing of Bonga

- The Chorkor oven has a serious limitation for bonga smoking: the standard tray of the Chorkor oven can take only 30 kg of wet bonga (Bonfi, Guinea). With this capacity, it cannot replace the banda for the bulk processing of bonga. The banda can take up to 940 kg wet weight or a tonne when stacked by a well experienced processor. The Chorkor can only be effective in smoking a relatively large quantity when the bonga is laid flat on numerous trays. Otherwise the fish will get squashed by the trays above when the bonga is packed as on the bandas - side by side in rows belly-down. Therefore, the Chorkor oven is not suitable for large quantities of bonga smoking when the fish are supposed to be closely packed in the banda style.

Proposed Solution: The “Improved Chorkor Oven” design from Gambia

- In The Gambia a closed banda oven has been developed with partition walls inside (see Figure 22). In order to ensure that the traditional bonga smoking methods are improved to reduce fuelwood consumption and create a better environment for the processors the appropriate technology is required. A fire box (smoking chamber) that can be closed to reduce heat loss and conserve fuelwood and a fixed grill or wire mesh platform for stacking large quantities of bonga for smoke-drying is needed. The appropriate technology was achieved in The Gambia through consultation with the smokers and it is called the "Improved Chorkor Oven".



Figure 22 "Improved Chorkor oven" in Kafountine (Senegal)

- This oven is built with fire bricks, cement, or mud clay blocks. It stands at 1 m high with a metal fixed rack at a height of 0.8 m. It usually measures about 8 m long, 1 m high, and 1.5 m wide with 12 stoke holes (each 0.5 m wide). The smoking houses have four of these ovens.
- The unwashed bonga is stacked on the oven as described for the open banda in Section 3.2.2. The product undergoes 3 or 5 fires of unequal duration according to fresh-dry or hard-dry requirement.
- A metal grill is fixed on top of a red brick or mud block walled oven with stoke holes for fuelwood delivery and fire control. Each oven has up to six openings and can take up to 800 kg of wet bonga per smoking session. Smoking 4 days' storage to five fires for—periods (fires) range from three fires for 3 up to six months' product storage. The technique, which combines the efficiency of the Chorkor oven with a large capacity, is the bonga smoking technology of the future for West Africa. It has already been emulated in neighboring Senegal (Kafountine and Diogue) and has also attracted the attention of the IDAF programme in Cotonou, Benin.
- **Key Reference:**
 - UTILIZATION OF BONGA (*Ethmalosa fimbriata*) IN WEST AFRICA
 - http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/T3536E/T3536E00.HTM

III. RECOMMENDATION

The team would suggest we:

- Further explore the “Improved Chorkur Smoker” from Gambia if the village of Efut Inwang is in need of a model that supports bulk processing of Bonga fish (about one tonne [940 kg] of fish at a time).
 - UTILIZATION OF BONGA (*Ethmalosa fimbriata*) IN WEST AFRICA
 - http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/T3536E/T3536E00.HTM
- Further explore the GRATIS design of the Chorkur Smoker that uses clean-burning fuel (LPG gas) and smoke from agricultural biproducts. This solution is better for the health and environment for the people of Efut Inwang because it eliminates harmful smoke, reduces time to gather firewood, and decreases the deforestation of the mangroves.
 - http://www.undp.org/energy/publications/2001/files_2001a/04_Ghana.pdf
 - <http://allafrica.com/stories/200210140685.html?page=1>

IV. QUESTIONS

- **Batch Processing of Bonga:** Is the village of Efut Inwang interested in bulk processing of Bonga fish? Would a Chorkor Design that better supports this be more appropriate?
- **Alternative Drying Techniques:** Could Efut Inwang benefit from new drying techniques, such as solar dryers, that use even less fuel than the Chorkur smoker? What about salting? Is smoke flavor a required aspect of the final product?
- **LPG (Gas):** What is the availability and overall cost of LPG (gas)? Would it be cost effective and possible to acquire for a gas-burning design?
- **The Community:** Are women the primary smokers of the Efut Inwang village?
- **The Process:** When smoking the fish, how do the smoker turn the fish over? Or do they not turn them over? Would you get a better quality of fish if you had a design that supported this more easily?
- **The Market:** Does the village of Efut Inwang sell their fish on the market? How big is this market and who are buyers?