Through-the Wall Ovens

Weather-proof ovens that allow access from inside the kitchen

The new South African government announced recently that, along with land redistribution, more than a million new homes will be built for the poor. We believe that serious consideration should be given to building a solar oven into the wall of every one of them. Paul Funk's design as described below is perfectly suited to South Africa's location just south of the Tropic of Capricorn. I recently installed a prototype solar cooker in the south- facing wall of a straw bale house in Mexico. It is now being field-tested and an evaluation is pending. The concept is attractive as were the results of my preliminary working models. This through-the-wall cooker has a hinged door inside the kitchen which allows access to the interior of the oven. This eliminates many hassles such as inclement weather, storage, thievery by people or animals, and wind. To quote a dear friend and source of inspiration and encouragement, "The wall solar oven is the ultimate convenience and my choice whenever I'm not testing other models." - Barbara P. Kerr

On the down side however, the wall solar oven has a distinct disadvantage in that, being attached to your house, it is not able to track the sun. This eliminates the use of multiple reflectors since these would block the light altogether during the morning and afternoon. In order to cook throughout the day, the wall oven must rely solely on the light energy striking its glazed area.

Enhancement is limited to internal reflectors, and possibly one external reflector on the wall of the house. Therefore the wall oven must be robust (not sensitive) to the following changes:

Robust to changes in sun angle: In the design I have applied a simplified form of the compound parabolic concentrator (CPC). It is a concentrator that can reflect both winter and summer sun onto the row of pots. See Figure 1. Note that the house walls in this illustration are thick because it is a straw bale house. The design works as well or better on conventionally built homes.

- **Robust to changes in clearness index**: The wide acceptance angle of the CPC design also collects diffuse radiation more effectively. On partly cloudy days higher relative temperatures have been observed in the CPC oven compared to reflector equipped models. I assume that this means it will also perform well in humid or polluted air.
- **Robust to changes in hour angle**: In the design that I am currently developing I have made the cooking chamber long and narrow along the east-west axis. This is to minimize the effects of morning and evening shadows in the box. This makes the best

use of the sun throughout the day. See Figure 2.

Built into internal surface of the door is an angled surface or "nose" that contributes to the CPC effect and enhances thermal performance by about 10%. It does not interfere with loading pots because the door opening is wide. The nose also forced me to hinge the door on one side. Space is needed in the kitchen for the door to swing into. Preliminary comments on the design include appreciation for the large entry.

Special Considerations

The typical four reflector solar cooker design doubles input energy, resulting in a more forgiving device. This box, with no external reflector, had to be very well built to achieve similar performance levels. It was doubled glazed, well insulated (9 cm of fiberglass) and sealed to prevent infiltration losses and food moisture entrance into the insulation.

Since this cooker is part of someone's home, it had to be attractive and durable. It is built of half-inch outdoor grade A/C plywood, the A side stained and varnished. To resist weather, flashing and caulk were used on the prototype installed in Sonora, Mexico. For privacy and security considerations, the outer glazing was a tough translucent fiber reinforced plastic typically applied to greenhouses.

Conclusions

The wall oven meets a demand for permanence and convenience. The design in its present configuration can only be applied to homes located above the Tropic of Cancer or below the Tropic of Capricorn with a south wall in the kitchen. Results from an evaluation are expected in time for the Second World Conference on Solar Cooking.

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Listen to an interview with Jim Scott talking about his solar wall oven here.