SKILL GUIDE · WATER & FOOD

Solar Cooking: Box, Panel & Parabolic

The Water & Food chapter's Backup Cooking Fuel item is about not letting one fuel type be a single point of failure for every meal. A solar cooker goes a step further: it needs no fuel at all, just direct sun, making it the one backup cooking method that keeps working even if every stored fuel runs out.

Three real types, a real tradeoff

Type	How it works	Typical temperature	Tradeoff
Box cooker	An insulated box with a clear lid and reflective flaps directing extra sunlight in; a dark pot inside absorbs the trapped heat	200-300°F	Cheapest and most forgiving; slow, more like an oven than a stovetop
Panel cooker	Several flat reflective panels focus sunlight onto a pot sealed in a clear oven bag or under a glass cover	200-250°F	Very cheap and simple to build, but the least effective of the three
Parabolic cooker	A curved dish reflector concentrates sunlight to a single focal point under the pot	Up to about 400°F	Fastest and hottest, closest to real stovetop cooking, but carries a genuine safety hazard, see below

For most households, a box cooker is the right default: cheap, safe, and good enough for slow-cooking grains, beans, and one-pot meals over a few hours of good sun.

Building a box cooker

The classic design nests two cardboard boxes with an air gap between them for insulation: an outer box roughly 28x24x10 inches around an inner box roughly 23x19x9 inches (or as small as 15x15 inches inside, if that's what you have on hand). Line the inside of the inner box, and a separate reflective lid flap, with aluminum foil, smoothed as flat as you can get it rather than wrinkled, since wrinkles scatter light instead of directing it at the pot. Paint the inner box's bottom and a metal or dark tray to hold the pot with flat, non-toxic black paint, flat outperforms gloss because gloss reflects more light away instead of absorbing it. Glaze the top opening with glass, acrylic, or clear polycarbonate sheeting sized about 1.6 to 3.2 inches larger than the box opening so it seats on a lip. Seal the gap between the two boxes with crumpled newspaper or

another insulating filler, and hold the whole thing together with white glue or wheat paste. Finally, put the actual cooking pot inside a clear, oven-safe roasting bag before it goes in the box: the bag traps humidity around the food (which speeds cooking) and keeps condensation off the glazing.

Building a panel cooker (CooKit-style)

A panel cooker is the cheapest and fastest to build of the three: a single sheet of cardboard roughly 4 feet by 3 feet, cut and folded into a pattern of about 11 flat panels that fold around the pot from multiple angles, all reflecting toward one center point rather than one flat surface reflecting in one direction. Join adjoining panels with strips of cloth about 2 inches wide, glued across the fold line as a hinge so the panels fold flat for storage and pop back into shape for use. Glue aluminum foil to the side of the cardboard that faces the pot, smoothed flat the same way as the box cooker's lining. As with the box design, put the pot itself inside a clear oven bag or under a glass cover set on a dark surface. Free, pre-cut CooKit patterns are published by Solar Cookers International if you'd rather trace a proven layout than design your own fold pattern.

How long it actually takes

Solar cooking is slow by design, plan the day around it rather than starting it like a stovetop meal. In good sun, rice takes roughly an hour; dried beans or chickpeas that have been pre-soaked take 3 to 4 hours; most one-pot meals fall somewhere in a 2 to 4 hour range. A parabolic cooker cuts this down meaningfully since it runs hotter, but even it is not a fast-food appliance. Start earlier in the day than feels necessary, and don't count on a solar-cooked meal being ready by a fixed clock time the way a stove lets you plan.

Keeping sun-cooked food out of the danger zone

Slow cooking creates a real food-safety question that a fast stovetop mostly avoids: food sitting between 40°F and 140°F, the bacterial "danger zone," lets bacteria populations double roughly every 20 minutes, and that risk climbs faster on a hot day. Food should pass through that zone in under 2 hours (under 1 hour if the ambient air is already above about 86°F), and should ultimately reach an internal temperature of 165-180°F or higher to actually be safe to eat, not just warm. Because a box or panel cooker can stall on partial cloud cover, check that the food has actually reached that internal temperature with a thermometer before eating, rather than assuming enough time in the sun means it's done.

Keeping the cooker actually facing the sun

None of these designs track the sun on their own, and output drops quickly once the reflector or panel is aimed even a little off-axis. Reposition a box or panel cooker every 30 to 60 minutes to keep it square to the sun. A parabolic cooker's narrow focal point is far more angle-sensitive and needs repositioning every 15 to 30 minutes, sometimes more often near solar noon when the sun moves faster relative to a fixed reflector angle.

A real limitation, stated plainly

A solar cooker only works in direct sun. It doesn't work at night, and it doesn't work well through heavy cloud cover. Treat it as a genuine fuel-free supplement to your stored cooking fuel, not a full replacement for it.

Water pasteurization: a faster, more certain alternative to SODIS

The Water Purification guide's solar disinfection (SODIS) method works by leaving clear water in direct sun in a covered container for a full day, relying on UV exposure and mild heat together. A solar cooker can pasteurize water faster and more certainly, since it can reach and hold the water at an actual measured pasteurization temperature (149°F for a few minutes kills the pathogens that matter) rather than relying on a full day of ambient UV exposure. A WAPI (Water Pasteurization Indicator), a small wax-filled tube that visibly melts once the water has held pasteurization temperature, makes this simple to confirm without a thermometer.

WARNING

Parabolic cookers concentrate sunlight enough to cause real eye and burn injury

A parabolic reflector can redirect over 90% of the sunlight striking it toward a single focal point, concentrating it 50 to 300 times normal intensity and reaching temperatures around 500°F there, meaning a glance at the wrong angle exposes your eye to nearly as much intensity as looking directly at the sun, with a real risk of permanent retina damage. Ordinary sunglasses are not enough protection near the focal point: use dark, UV- and IR-rated glacier-style sunglasses at minimum, and welding-grade eye protection for higher-concentration setups. When you need to reach in near the focal point, position your own body between the sun and the reflector so your shadow falls on the work area, rather than reaching in from an angle that's still exposed to the reflected beam. Solar Cookers International's own safety guidance is direct: never look at the reflector when it's aimed at the sun, and keep children away from the focal point entirely, since it can cause a serious burn

instantly. Box and panel cookers don't concentrate light nearly as intensely and don't carry the same risk; if eye and burn safety around a household with children is a real concern, that alone is a good reason to default to a box cooker.

Sources

- Cooker types, mechanism, and temperature comparisons: HowStuffWorks; SolarCooker.org
- Parabolic cooker eye and burn safety: Solar Cookers International; The AMSI Project
- WAPI and solar water pasteurization: Solar Cookers International; World Health Organization / SODIS Reference Centre solar water disinfection protocol
- Box cooker and CooKit panel cooker construction dimensions and materials: Solar Cooking Wiki; Solar Cooking Wiki
- Realistic solar cooking times by food type: American Solar Energy Society
- Food-safety danger zone for solar-cooked food: Solar Cooking Wiki
- Sun-tracking and repositioning intervals by cooker type: Solar Cooking Wiki