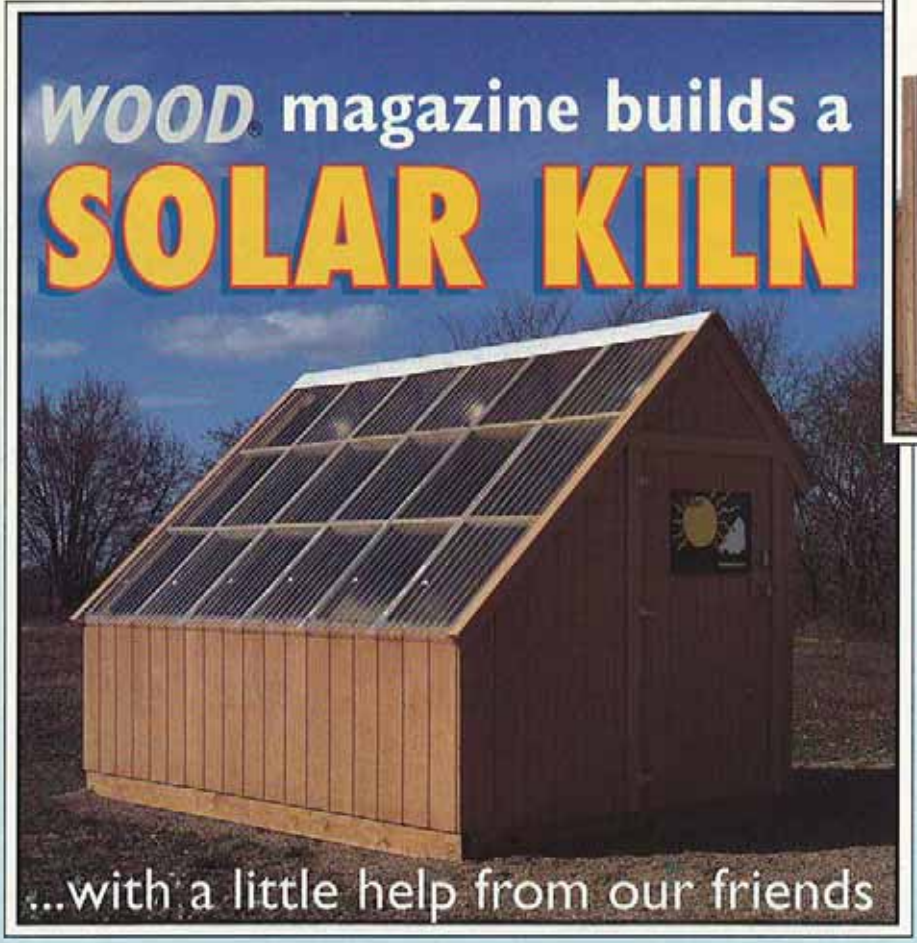
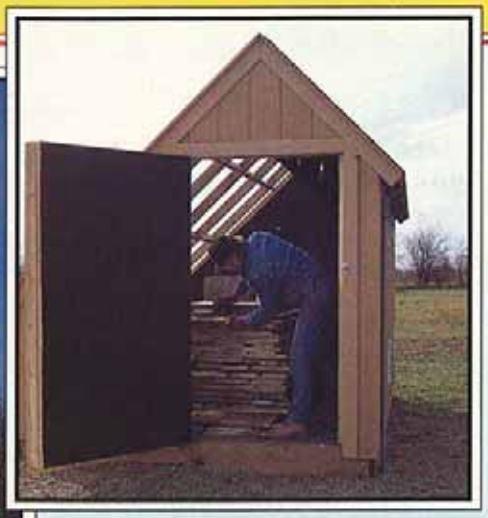
WOOD magazine builds a SOLAR KILN





Above: **According to the thermometer, it was 95° inside WOOD magazine's solar kiln one day last November when editor Pete Stephano checked moisture content. The kiln was newly built, and the air-dried wood had just been stacked. Note the overhead baffle that directs air flow delivered by the fans.**

Left: **The solar panel, made of clear, corrugated fiberglass panels, faces south at a 45° angle.**

In our December 1993 issue, we relayed the staff's experience with logging and sawing our very own pile of woodworking stock. And we promised you that we would follow up with a kiln design to dry that sawn-on-site stack of ash, cherry, and walnut.

Since then, we've consulted with experts, worked with a designer and a builder, and constructed the nifty 8×8×12' passive-solar building you see here. And boy does it work, not to mention save money! Better still, we developed a plan for our kiln so you can build one just like it.

Unless you live in a desert, you'll never air-dry green wood down to six to eight percent moisture content, the preferred dryness for stock destined to become furniture or other indoor projects. That's because the average outdoor relative humidity for most of the U.S. hovers at about 65 percent—equivalent to 12 percent moisture content in a board. But, indoor humidity runs a lot less, so projects for use there must be built from kiln-dried stock in the lower moisture-content range or you'll see lots of wood movement. (For outdoor projects, such as porch furniture, the appropriate wood with a higher moisture content is okay.)

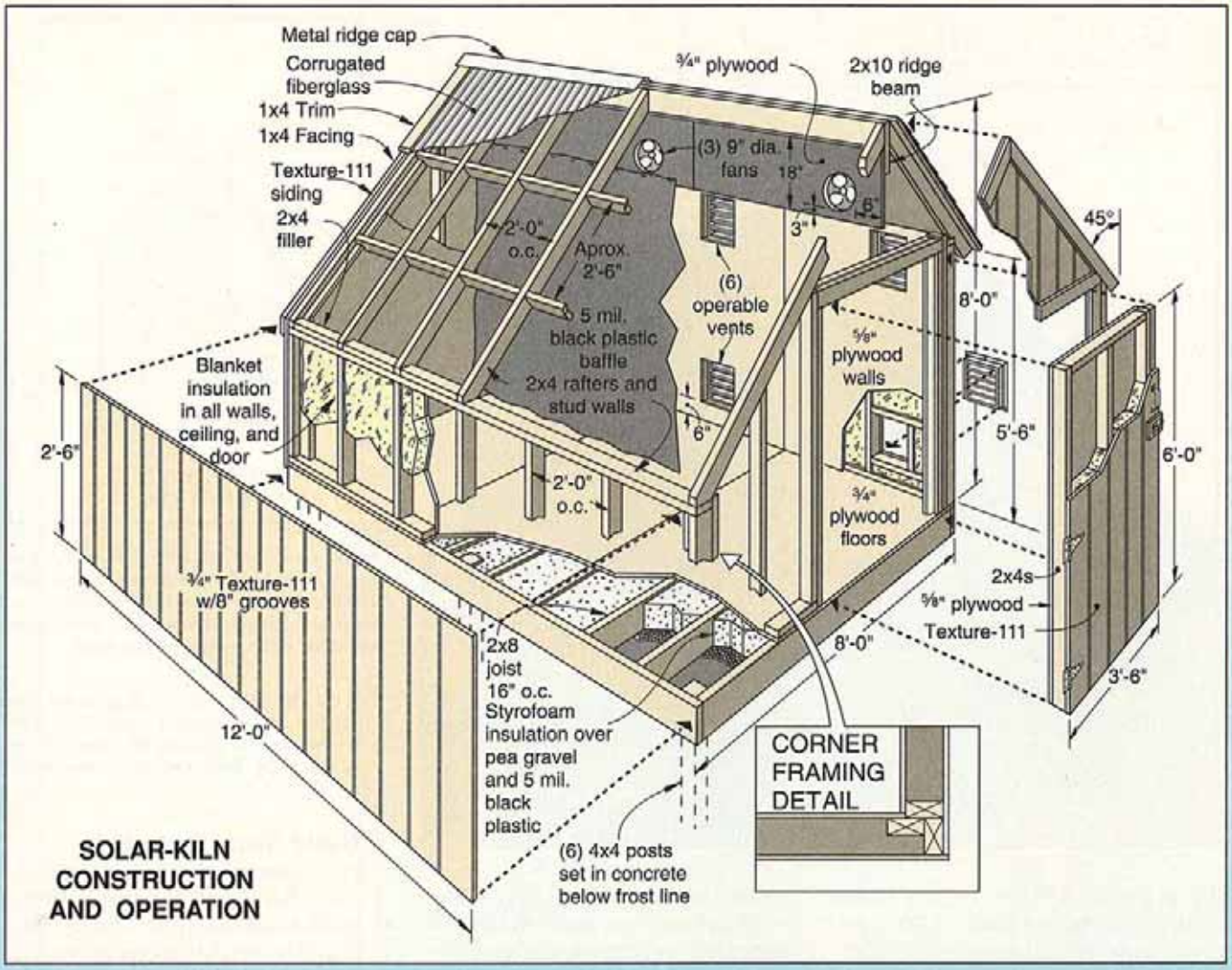
To most woodworkers, though, the technique of do-it-yourself kiln-drying is a mystery. Then there's the cost, and the maintenance involved. Who has the money or the time? That's how we thought, at first.

Dry wood in six weeks!

The lumber industry has kiln-drying down pat. Over the decades, they've learned how to tame even the most stubborn woods and turn them into useful stock. Heavy-duty commercial kilns rely on heat from a furnace or other fueled source. And they often introduce steam to relieve stress in the drying boards. It's all really pretty technical and complicated. Yet, we found that on the do-it-yourself level, it doesn't have to be that way.

In searching for answers, one source often leads to another. And that's how it was when we went looking for some kiln-drying know-how.

At the U. S. Forest Service's Forest Products Laboratory in Madison, Wisconsin, wood-drying expert Sid Boone was most helpful. Besides tips, he handed over rough drawings for two basic solar kilns. One seemed much too involved. The other, a design concept orginally created by University of Wisconsin-Extension forester Eugene Wengert in 1978, was a lot sim-



pler. We chose it as the basis for our kiln because, according to Wengert, the kiln dries fresh-sawn hardwood lumber down to six to eight percent moisture in about six weeks of mostly sunny, warm weather (half that time for most softwoods).

Wengert calls his concept a "semi-greenhouse, solar recirculation dryer." We just call it a passive-solar kiln, yet heeded his advice in building the structure shown on these pages. It cost just about $2,000 plus labor, but will practically pay for itself with the first load. (For example, take our staff-harvested and sawn 614 board feet of ash, cherry, and walnut. At a combined average retail price of $2.95 per board foot, our wood would have cost about $1,800.)

Kiln-construction guidelines

According to Wengert and his associate, Dan Meyer, in their guidelines for a solar kiln of this type, you determine the size of the kiln with the following rule of thumb: Consider the maximum capacity in board feet you want the kiln to hold to be roughly 10 times the solar panel roof area in square feet. We wanted our kiln, for instance, to dry 1,000 board feet per load (no sense drying more than you can use). So the solar panel had to contain 100 square feet. Our solar panel measures 8'6"×12' (102 square feet).

Here's another important guideline. For maximum year-round performance, the kiln's roof (the solar panel) angle should be equal to the latitude of where you live in degrees north of the equator.

In Iowa, with a latitude ranging from about 40°–45°, an angle of 45° works fine, and from a construction point of view, that angle was easier to contend with. In Austin, Texas, though, an angle of 30° will suffice. In North Dakota, a steeper angle, of say 50°, would perform better. There's more, too.

- Use pressure-treated (CCA) lumber for all framing.
- Select exterior-grade plywood for the interior as well as the exterior.
- Insulate the floor with non-water soluble, solid-foam (rigid) insulation. Use blanket-type insulation without a foil facing in the walls and door.
- Seal interior surfaces against moisture while allowing them to absorb the maximum amount of solar heat by applying a base-coat of aluminum- or oil-based paint to

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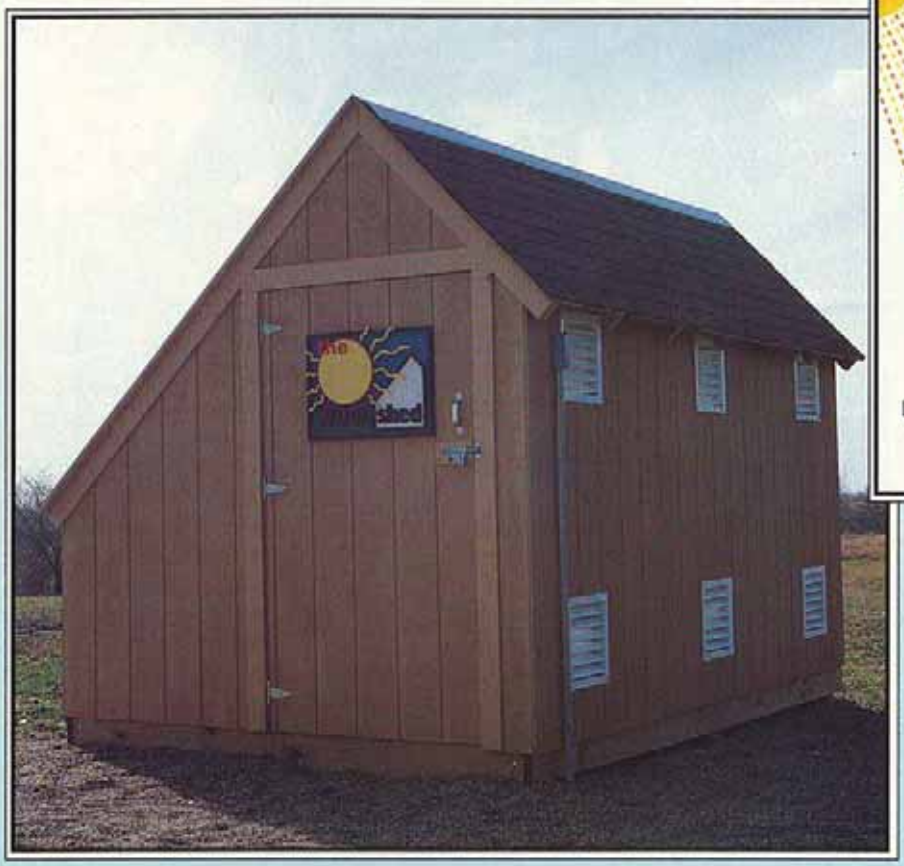
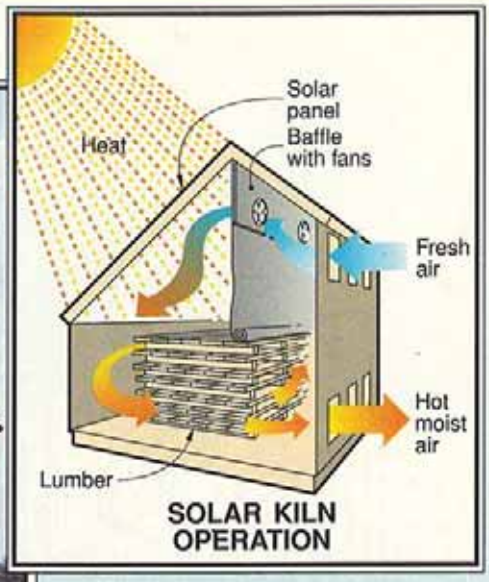
SOLAR KILN





SOLAR KILN OPERATION

Above: **The drawing shows how the kiln works. The stickered green wood dries from the heated air forced down and through the pile by fans in the baffle. Some air exits, some recirculates.**

Left: **On the kiln's north side, vents provide for air entrance and exit. The extra-wide and insulated door allows easy stacking and removal of lumber.**

the walls and floor. Add a final coat of flat-black paint. (To trap even more solar heat, it wouldn't hurt to stain the exterior a dark color, too.)

- Kiln-ventilation fans should not contain plastic parts. Inside temperatures can reach 150° F.

To those guidelines we incorporated the following goals:

- Keep construction simple and as maintenance-free as possible.
- Since the kiln won't operate all the time, it should do double-duty as an attractive storage shed, or a greenhouse, or even a flower-and-fruit dryer.
- For cost-savings and minimum waste, the design uses standard-dimension sheet goods.
- Inside dimensions allow for boards 10' long as well as the stacking and removal of stock by one person. At least 12" of space on all sides of the stack provides for air flow.

Editor's note: The solar-kiln design we used has been built all over the world, in many ways. Our adaptation is admittedly more elaborate than actually needed. A simple version might just have plywood walls and floor and a solar panel made from clear plastic sheeting. It wouldn't be as permanent, but it would still work.

We have also discovered that winter drying is aided by installing clear plastic sheeting *inside* the solar panel to help retain heat.

For more informative tips on drying lumber, see page 80

Build Your Own Kiln

For complete plans and a materials' list for the 1,000-board-foot-capacity solar kiln shown in this article, send your check or money order for $9.95 ppd. (U.S.) to: *Kiln Plans, WOOD® magazine, 1912 Grand Ave., Des Moines, IA 50309-3379.*

Note: Solar-drying isn't the only way to get kiln-dried wood. For manufacturers of other types of drying kilns and kiln kits, see advertisers elsewhere in this issue.

Want to learn more about wood drying?

For a free list of available texts and handbooks covering lumber drying and kiln operation, send a stamped, self-addressed, business-sized envelope to: *Wood Drying, Dept. of Forestry, University of Wisconsin-Extension, 1630 Linden Dr., Madison, WI 53706.*

APA-rated sheathing/siding, American Plywood Assoc.; Pressure treated southern pine lumber, Southern Pine Marketing Council; Stain, Thompson & Formby, Inc.; University of Wisconsin-Extension.

Written by Peter J. Stephano Photographs: John Hetherington Design: David Ashe Illustrations: Carson Ode

The *WOOD*® guys bag some trophy stock

Unloading the solar wood-drying kiln provided some pleasant surprises, and a few lessons, too.

Like fishermen displaying their catch, Jim Downing, Pete Stephano, Larry Clayton, Jim Harrold, and Bill Krier line up their 50% share of the stock.

Time flies by in the publishing business where one issue deadline tails another. So last June, when friend Greg Wood phoned to remind us that we were long past due to unload our wood from the solar kiln (see "*WOOD* Magazine Builds a Solar Kiln," June 1994), we jumped to it. All the staff members who helped log and saw that 614 board feet of ash, cherry, and walnut over a year ago ("The *WOOD* Gang Goes Logging," *WOOD* magazine, December 1993) headed for the kiln site on Greg's farm south of Des Moines. In order to haul the wood back (as the landowner, Greg got 50% of the boards), a couple of us drove our pickups.

Unloading the bone-dry stock (it read an overall 6% moisture content on the meter, with 6–8% being ideal) mostly consisted of pleasant surprises. But we did find out a few things.

Strive for a perfect stack

Unlike stacking a cord or two of firewood, green boards require more than a little extra attention when it comes to building up a pile in the kiln. For instance:

- Fill the kiln to capacity (a smaller load will dry too rapidly), and plan the stack to allow for 12" of air space on all sides.
- Never, never, use green stickers to separate the board layers. We had sawed up a small hackberry log into stickers 1" thick and 1½" wide and long enough to span the expected stack. The green hackberry changed shape in the drying process and probably allowed the boards some movement, too (some beautiful ash had slight cupping). So always use stickers cut from dried hardwood.
- Place stickers as close as possible to the ends of the boards, and coat the board ends with paint (we used latex). With this, our boards had minimal end checking.
- Place the wettest wood (in moisture content) toward the bottom and in the middle of the stack so that it won't dry too rapidly. Our ash was toward the top and outside and displayed practically the only checking and warp we encountered. On the other hand, the walnut boards were on the bottom and turned out perfectly. The denser cherry showed little stress no matter where it was.
- Completely cover the top of the stacked green boards with plywood painted black on the top side, and sticker it, too. Then, *weight* the covering with scrap iron or concrete blocks to keep the top layers from warping.
- To continue storing the dry stock in the solar kiln without damaging it, maintain the kiln temperature at not more than 15° above outdoor temperature (compared to a temperature of 30° above when drying) by covering most of the solar panel and adjusting the vents.

—*Peter J. Stephano, Sr. Editor*

Build your own solar kiln

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Bill Krier, Jim Downing, and Jim Harrold like what they see as Greg Wood passes them ash, cherry, and walnut boards from the kiln to stack in the trucks.