

ULTIMATELY RENEWABLE FUEL

Pennsylvania woodworkers tap trees for lifestyle and heating fuel too

SPECIAL TO CONTRACTOR

FOSSIL FUEL GUZZLING has fallen out of favor. Alternative fuels and energy efficiency are in demand, especially when the source of energy is wood, the ultimately renewable resource. Even more appealing is when the wood fuel is a byproduct of the facility it's heating and is burned in an eco-friendly fashion.

"Wood is our lifestyle, our bread n' butter, and is at the core of everything we do," says Merv Wenger, owner of Wenger Woodworks in Manheim, Pa. Merv and his son Travis operate their cabinetry and furniture business from the family homestead, a small farm in rural Lancaster County with Amish farms nearby.

Unlike most cabinetmakers who order kiln-dried hardwood from suppliers, Merv and Travis build wood furnishings, cabinets and entire kitchens from scratch, starting the process in the forest, traveling more than 100 miles in any direction while towing a portable "WoodMizer" sawmill.

They cut, mill and dry all the wood themselves, a process that creates mountains of waste in the form of slab wood and sawdust. But where most millworks throw away the waste, the Wengers turn it into burnable energy.

More waste is created when rough-cut lumber is machined into finely finished products. But they harvest those Btus, too, through an efficient system

that supplies heat for the home, shop and apartment while warming water for all cleaning and bathing, as well.

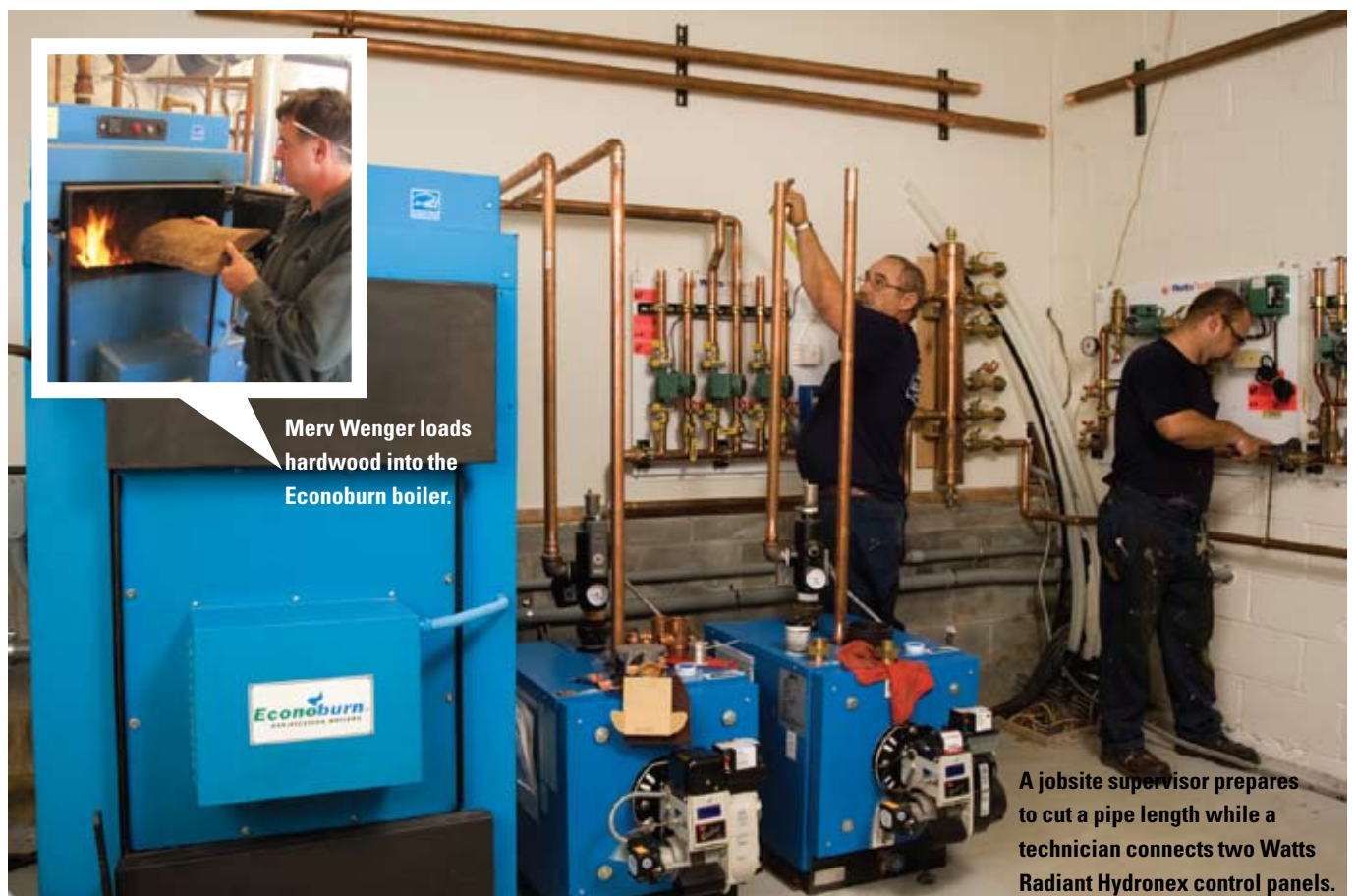
Until the fall of 2009, the Wengers burned all the cast-off slab wood in an old woodstove, the only source of heat for the shop. But with the installation of a high-tech, eco-friendly "gasifica-

tion" wood boiler and extensive radiant heat system, the wood waste now supplies heat for all three buildings on the property.

"It's the ultimate in renewable fuel for us," says Merv. "Sure, there are others doing the same, but few who scrub Btus as well as we do, and with as small

a carbon footprint. We decided from the outset that we were going to make this happen the right way.

"Last winter, the new wood waste-burning system improved our comfort while saving thousands of dollars in fuel oil," continues Merv. "It's also a lot safer. The shop's old woodstove



Merv Wenger loads hardwood into the Econoburn boiler.

A jobsite supervisor prepares to cut a pipe length while a technician connects two Watts Radiant Hydronex control panels.

was surrounded by sawdust and wood scrap. It was an accident waiting to happen.”

All in the family

The Wenger’s woodshop is located on a 26-acre property with a 100-year-old farmhouse, Merv’s home, and a 1940s cinder block garage that gradually morphed into an apartment. As Merv explains it, the extensive heating overhaul led to home and apartment remodeling, improvements that the Wengers did entirely on their own.

In fact, the old garage is now a radiantly heated newlywed suite for Travis and his wife, Rachel, married in May. For several months, Merv, Travis and Rachel, along with her parents, friends and relatives, labored away on the building, turning it into two-bedroom, 1,200-sq.ft. living space complete with new kitchen, a vaulted ceiling and spacious laundry room.

At the heart of it

At the heart of the Wenger’s mechanical system is a 300,000 Btuh Econoburn wood gasification boiler made by Alternative Fuel Boilers in Brocton, N.Y. The boiler uses European-styled gasification technology that scrubs and reburns exhaust gasses, heating water to meet the Wenger’s space and domestic water needs.

The Econoburn Boiler is a pressurized wood gasification boiler rated at 87% thermal efficiency. Its high efficiency is attained by not only burning the wood, but also the wood gases and smoke in a secondary chamber.

According to Mark Odell, vice president sales & marketing for Econoburn, two-thirds of the wood energy is in the form of wood gas and smoke that traditional wood burning boilers allow to escape out the chimney as wasted energy and pollution.

“The wood boiler is connected to a vertical 800-gal. storage/buffer tank,” explains Dave Yates, president of York, Pa.-based F. W. Behler Inc., hired by the Wengers to assemble the mechanical heating system. Three inches of closed-cell polyurethane spray foam provide an R-18 insulation value.

“The giant buffer tank is the wood boiler’s ‘thermal target’ — a huge heat reservoir for all space heating on the property,” adds Yates.

An aquastat on the big tank tells the wood boiler when it needs heat. As long as the Wengers are there to stoke the wood boiler, hot water is supplied to the buffer tank. From there, it moves out to an extensive array of pumps, valves and control panels that temper

the water and send it on its way, underground, to the home, woodshop and apartment.

If the Wengers aren’t there to fuel the wood boiler, two standby oil boilers (each, 150,000 Btuh) are at the ready; though, when they’re active, heat goes directly into the system, bypassing the buffer tank. The oil burners draw fuel from a new underground, 500-gal., double-wall tank supplied by Highland Tank.

“Last winter we went away for a long weekend, and left with a strong fire in the boiler,” says Merv. “The buffer tank had enough thermal mass to heat all three buildings until we returned. The oil boilers never kicked in.”

By the same token, 12 hours is needed to bring the tank up to temperature from a cold start. In the summer months, the big tank, once at peak temperature, will provide the property with enough heat for domestic hot water (via indirect water heaters) for about five days.

Underground PEX

To transport hot water to the house, apartment and shop, the Wengers installed 500-ft. of 1-1/4-in., insulated Uponor EcoFlex tubing, buried 4-ft. underground — including one 25-ft. section that was tunneled under the driveway to feed the farmhouse. The product provides both supply and return lines centered in a flexible, corrugated pipe filled with foam insulation.

According to Yates, a series of Watts Radiant Hydronex panels and a cus-

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tom-crafted, all-copper hydroseparator they built for the main mechanical room receive heat from the buffer tank, or directly from the standby oil boilers. Combined with programmable controls tied to outdoor reset sensors and interior thermostats, these panels parcel-out heated water in varying temperatures to supply the following:

Btus to feed an injection panel for the home’s high-temperature baseboard heaters and an 80-gal. Bradford White indirect heater to satisfy domestic water needs; also to the downstairs where 2,000 lineal feet of 3/8-in. Onix EPDM

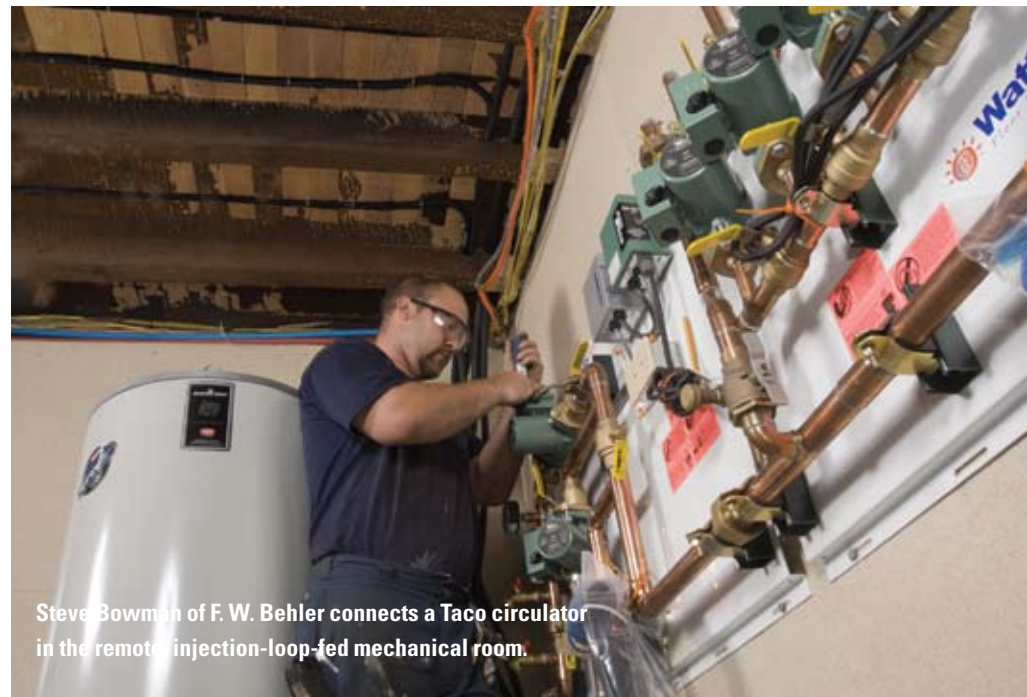
rubber tubing is stapled and insulated to provide low-temp radiant heat.

Heat for the apartment (just a few feet from the main mechanical room), where baseboard heat and another Bradford White indirect water heater receive high-temperature water; and where low-temperature water supplies warmth for the master bath (more Onix staple-up), and the vaulted great room and kitchen where above-floor

The zone control panel for the apartment can either do injection or direct pumping by simply turning on-off valves conveniently located on the panel.

Barn, shop

With the downstairs converted into a cabinet shop, an old bank barn is where Merv and Travis turn logs into fine cabinetry. The upstairs serves as



Steve Bowman of F. W. Behler connects a Taco circulator in the remote injection-loop-fed mechanical room.

tubing was used, just below the surface of a new, floating laminate floor.

Warmth for the woodshop, where another Watts Radiant injection panel and Taco variable-speed, Delta-T pump send heated water through a network of 3/4-in. Onix tubing to several fan coil units ranging in size from 50,000 to 150,000. Fin tube baseboard and cast iron radiators are also found here.

“Merv could have used smaller lines for the underground, EcoFlex ‘highway,’ adds Yates, “but over-sizing the pipe kept overall pressure down, allowing us to use smaller pumps to circulate system fluids.”

The workshop area included three zones piped directly from the zone control panel using telestats.

“Rather than installing a bypass pressure relief valve with that added expense, and running a circulator at full power no matter what the load is, we chose to have the Taco Delta-T circulator stand in for components that would have been necessary for a conventional on/off operation,” explains Yates.

For the home, Yates used injection pumping so the injection pump could operate without needing to sense the changing flow rates for radiators, baseboard, radiant zones or the Bradford White indirect tanks.

storage for kiln-dried wood and shop space for a large planer and moulder. The heated area is roughly 2,600-sq.ft. and includes three zones for the main shop floor, office, and spray booth. The office receives heat from fin tube baseboard, and the main shop floor has two large fan coil units hanging from the ceiling.

“We had to get a little creative when it came to heating the spray booth area,” explains Merv. “With the spray gun running on one side of the booth, and other projects drying on the other, we couldn’t afford to have air movement interfering with the ventilation system.” To solve the problem, three cast iron hot water radiators, once used in the house, were installed in the spray booth.

The farmhouse

The 2,250-sq.ft. farmhouse was like most turn-of-the-century homes with smallish rooms and central hallways up and down. Merv and Travis gutted the house room-by-room, tearing out horsehair plaster and staircases while also eliminating a few non-weight-bearing walls to open up and enlarge living areas. With a revamped floor plan, new hardwood staircase, tile flooring, and a new, luxurious kitchen featuring their own custom cabinetry,

the old house was ready for a new heating system.

Previously, an oversized, cast iron sectional oil-fired boiler and the now-recycled radiators heated the house. The boiler and the 275-gal. oil tank that fed it were disassembled and pulled out of the basement piece by piece.

The apartment

The detached apartment, just 60-ft. from the house, shares a wall with the

Merv Wenger attaches Watts Radiant Onix tubing to rigid insulation.



mechanical room. Next to that stands a 2,000-sq.ft. equipment garage that Merv plans to remodel and heat with a simple extension to the existing system.

"We stubbed-out a feed line for a fan coil unit last year; that's what I'll use to heat the big garage," Merv says.

A 60-gal. indirect Bradford White water heater supplies domestic hot water for the apartment. Like the larger one in the home, it receives its heat from the wood-fired boiler.

Last winter the Wengers burned seven cords of firewood to heat the house, apartment, and cabinet shop.

"Looking at old heating bills, it was easy to see that we saved between \$8,000 and \$10,000 last winter alone,

and we were a whole lot more comfortable than ever before," says Merv.

"That number will rise with energy prices," adds Travis, who has already cut and stacked 50 cords of firewood a short distance from where the boiler stands. At a hardwood average of 20 million Btus per cord, that's a billion Btus in storage, or an equivalent to 7,200-gal. of fuel oil.

A work in progress

As part of the garage heat conversion, Merv plans to change the wood kiln's electric heat source to draw heat from the new hydronic system. "When we do that," adds Travis, "the heat conversion will be complete."

But before that, Travis and Merv will

Travis and Merv Wenger uncoil and prepare underground installation of 500 lineal feet of Uponor Ecoflex insulated supply and return tubing.



pull the siding off the apartment and hang 2-in. polystyrene foam insulation on the exterior. Then, both the house and the apartment will receive an "insulation overhaul," as Travis likes to refer to it.

Both buildings — which lack ductwork — will receive air conditioning for the first time. The Wengers will install 15.0 to 18.0 SEER, multi-zone Fujitsu ductless heat pump systems in the apartment and the house.

"We focused on heating needs for lots of reasons, but we didn't want to ignore the need for year-round comfort, and it gets awful hot and humid here," concludes Merv. "I have a feeling we'll be a lot more comfortable in years to come." 