

# FUEL OIL NEWS

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# Ultimately Renewable Fuel

Pennsylvania woodworkers tap trees for lifestyle and energy, too

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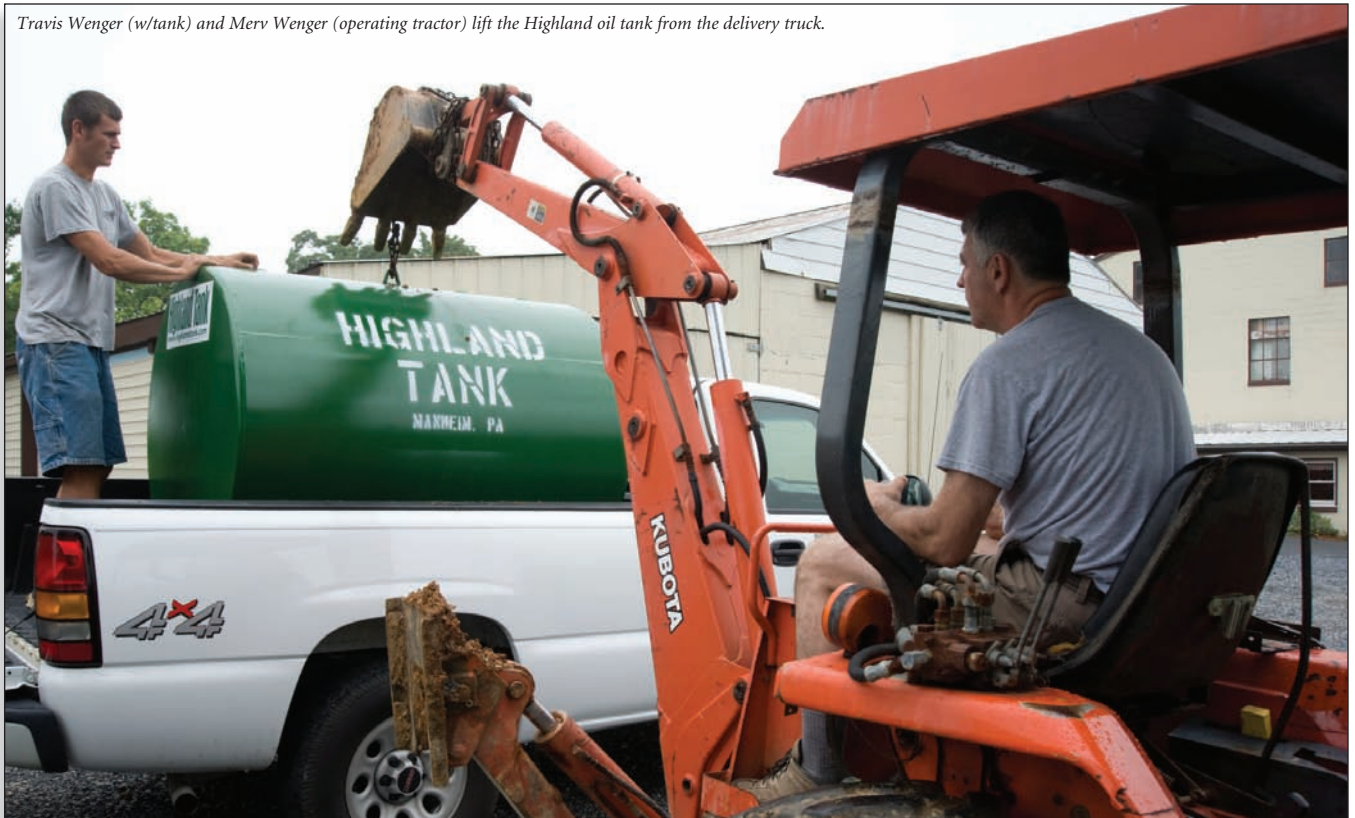
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# Ultimately Renewable Fuel

Pennsylvania woodworkers tap trees for lifestyle and energy, too

BY JOHN VASTYAN

*Travis Wenger (w/tank) and Merv Wenger (operating tractor) lift the Highland oil tank from the delivery truck.*



**F**OSSIL FUEL GUZZLING HAS FALLEN OUT OF FAVOR. ALTERNATIVE fuels and energy efficiency are in high 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, eliminating nearly all environmental impact.

“Wood is our lifestyle, our bread n’ butter, and is at the core of everything we do,” said 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 cast-off 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 unusually 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 ‘09, 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 “gasification” wood boiler and extensive radiant heat system, the wood waste now supplies BTUs for all three buildings on the property.

“It’s the ultimate in renewable fuel for us,” added 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,” continued Merv. “It’s also a lot safer. The shop’s old woodstove 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 farm house, Merv’s home, and a 1940’s 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 do 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-square-foot living space complete with new kitchen, a vaulted ceiling and spacious laundry room.

## SYSTEM, AT THE HEART OF IT

The Wenger’s mechanical system is a stingy BTU machine. At the heart of it is a super-clean, 300,000 BTU Econoburn wood gasification boiler made by Alternative Fuel Boilers in Brocton, New York. The boiler uses European-styled gasification technology that greedily scrubs and re-burns 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 percent 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 of 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- gallon storage/ buffer tank,” explained 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 provides an R18 insulation value across its entire surface area.

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

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# Where the heat goes

## 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 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. 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,” explained Merv. To solve the problem, three cast iron hot water radiators, once used within the home, were installed in the spray booth.

## HOUSE

The 2,250 sq. ft. farmhouse was like most turn-of-the-century homes with central hallways, above and below, with smaller rooms. 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 Wenger kitchen, the old house was ready for a new heating system.

Previously, the home was heated by the old (now recycled) radiators connected to a greatly-oversized, cast iron sectional oil fired boiler. It, and the 275-gallon fuel tank that fed it, were disassembled and pulled out of the basement piece by piece.

## APARTMENT

The detached apartment, just 60 feet from the house, shares a wall with the mechanical room. Next to that, a 2,000 s.f. equipment garage that Merv plans to remodel, then 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.”

The apartment’s domestic water needs are met by a 60-gallon indirect water heater from Bradford White that, like the larger one in the home, also receives its heat from the wood-fired boiler.

## ALL UP IN SMOKE, MINUS THE SMOKE; DOLLARS SAVED

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 eight and ten thousand dollars last winter alone, and we were a whole lot more comfortable than ever before,” said Merv.

“That number will rise with energy prices,” added 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 gallons 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 BTUs from the new hydronic system. “When we do that,” added Travis, “the heat conversion will be complete.”

But before that, Travis and Merv will soon pull the siding off the apartment and hang two-inch styrofoam insulation on the exterior. Then, both the house and the apartment will receive an ‘insulation overhaul,’ as Travis likes to refer to it.

Before year’s end, both buildings—which lack ductwork—will receive air conditioning for the first time. The Wengers will install 15 to 18 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,” concluded Merv. “I have a feeling we’ll be a lot more comfortable in years to come.” **I F O N**

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 MBH) are at the ready; though, when they’re active, heat goes directly into the system, bypassing the giant buffer tank. The oil burners draw fuel from a new underground, 500-gallon, 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,” said Merv, “The buffer tank had enough

thermal mass to heat all three buildings until we returned. The oil boilers never kicked in.” On the same token, 12 hours is needed to bring the tank up to temp from a cold start. In the summer months, the big tank, once at peak temperature, will provide the property with enough BTUs to heat domestic hot water (via indirect water heaters) for about five days.

## BTU HIGHWAY

To transport hot water to the house, apartment and shop, the Wengers installed 500 feet of 1-1/4-inch, insulated Uponor EcoFlex tubing, buried four feet underground—including one 25-foot section that was tunneled under the driveway to feed the farmhouse. EcoFlex provides a supply and return line centered in

a flexible, corrugated pipe filled with foam insulation. The lines move heat invisibly to all locations.

According to Yates, a series of Watts Radiant Hydronex panels and a custom-crafted, all-copper hydroseparator they built for the main mechanical room receive heat from the buffer tank, or directly from the stand-by boilers. Combined with programmable controls tied to outdoor reset sensors and interior thermostats, these panels parcel-out heated water in varying temperatures to supply:

- BTUs to feed an injection panel for the home's high-temp baseboard heaters and an 80-gallon, Bradford White indirect heater to satisfy domestic water needs; also to the downstairs where 2,000 lineal feet of 3/8-inch 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-temp water; and where low-temp water supplies warmth for the master bath (more Onix staple-up), and the vaulted great room and kitchen where above-floor Onix 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-inch Onix tubing to several fan coil units ranging in size from 50 to 150 MBH. Fin tube baseboard and cast iron radiators are also found here.

"Merv could have used smaller lines for the underground, EcoFlex 'highway,'" added 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 Watts Radiant 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," explained Yates.

For the home, Yates used injection pumping so that they could more easily sip the energy required at varying flow rates while the injection pump could operate without needing to sense the changing flow rates for radiators, baseboard, radiant zones or the Bradford White indirect tanks.

The zone control panel for the apartment also incorporates the flexibility to either do injection or direct pumping by simply turning on-off valves conveniently located on the panel. | **FON**

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