

Pennsylvania Home Gets an Energy Overhaul

Money Pit Experience Ends Well

In the spring of 2010, federal tax credits for first-time homebuyers fueled the sale of low and mid-range homes. Houses sold in record time. In some cases, it was a race to get offers in ahead of the next potential buyer. A seller's market, for sure.

In the case of one Pennsylvania couple, haste to move on a "move-in condition" bi-level turned into a costly mistake. After dismissing the idea of a home inspection, the buyers quickly found themselves "throwing money into a bonfire."

"It all began with a puddle in the mechanical room," recalled homeowner Tim Slusser. Two weeks later, the home had a new roof. Water that found its way inside had destroyed part of an exterior wall and part of the second story subfloor.

Apparently, a queen bee also took a shine to the little hole where the rain got in. The pest control pro apologized to the homeowners for the large, up-front fee saying, "The nest has been active for a year or two; it's a big one."

Within several months, carpets that hid slicks of cat pee, 80s-era bathrooms and mustard-yellow aluminum siding were all replaced to update the home.



Throughout the remodeling process, the homeowners wanted to boost the home's energy efficiency. The attic, newly free of angry bees, had only four inches of fiberglass insulation.

An additional 30 inches of blown-in AttiCat fiberglass made an immediate improvement. The block walls of the basement were covered in foam insulation, then pine tongue and groove. Some of the windows and doors were also replaced.

"At every turn," added Slusser, "we heard cha-ching, cha-ching." Money was moving into the home at a clip I'd never imagined."

The last remaining project – a job Slusser knew he'd hire a team of professionals to handle – was to replace the home's mechanical system. Although in good condition, the system was designed for a larger, less efficient home.

Leviathan boiler

The home's original mechanical equipment had been replaced in 2006. A 180 MBH, oil-fired New Yorker boiler with an



Dave Yates, owner of York, PA-based F.W. Behler, Inc, and Technician Larry Lawrence begin disassembly of the original oil-fired New Yorker boiler at the beginning of the hydronic system retrofit.

internal DHW coil provided all the heating needs, and then some.

"A manual-J heat load calculation at the 2,200 square-foot home resulted in a 48,000 Btuh heat loss, with an outdoor temp of 10°F and an indoor temp of 70°F," said Dave Yates, owner York, PA-based F.W. Behler, Inc., hired by Slusser to perform the retrofit.

"Using Taco's FloPro Designer software, I learned quickly that the New Yorker was rated for an output nearly three times what the house needed," explained Yates. The boiler was oversized and short-cycling.

"The boiler must've been sized by the 'curb' method, from a block or two away," added Yates with a grin. So, in early 2012, with oil prices hiking, it was time to downsize.

The bees, then the big boiler, were evicted. An old water softener and whole-house UV light – both of which were well past their prime – were removed. Groundwater in southern PA often contains coliform bacteria, high nitrate levels and moderate amounts of scale, so the equipment was ready to go.

Good things, small package

The system Yates chose includes a 64,000 Btuh Burnham MPO-IQ boiler with Beckett Burner and a 75 gallon Bradford

White indirect water heater with on-board electronic anode and thermostatic scald-guard valve to ensure both longevity and bather protection. “We’ve installed Bradford White equipment for years and have never been disappointed.”

Technicians Larry Lawrence and Spence Walker carefully laid out all the mechanical components before lighting a torch. The seven-by-eight-foot area wouldn’t leave room for error. “We had to conserve space on this job,” said Yates.

Yates built his parts list carefully. One of the first, new-generation ECM circulators from Taco – the yellow and black, variable speed BumbleBee – was ordered. “The Slussers removed a bunch of bees from the home months ago, but this was one they were eager for us to find a permanent place for,” quipped Yates.

The ECM circulator provides ideal flow to the upstairs and downstairs zones of the house. At each loop, the system uses a one-watt Taco Zone Sentry zone valve.

According to Yates, the Taco hydraulic separator, mounted directly above the boiler, helps the home’s two heat zones and the Bradford White indirect “play well together.” A 007 circulator is used as the main boiler pump, providing steady circulation within the short loop. Yates included a half-inch Watts RBF (residential boiler fill fitting) to ensure the system stays full, and a Taco 4900 air and dirt separator to keep the fluid pure.

“The BumbleBee is a Delta-T circulator,” said Yates. “So it ramps up to full speed momentarily until it finds the difference in supply and return temperature, then backs down to the perfect flow rate for one or both of the zones.” A digital readout on the face of the circulator flicks between readouts for GPM and electric consumption.



Disassembly of the oversized but functional boiler was completed with care. The homeowner sold the boiler to a neighbor whose old farmhouse is much larger and with a boiler badly in need of replacement.

“On this job, it usually coasts along at six-and-a-half GPM, consuming only 9 watts,” said Yates. “That’s one tenth of the energy that a comparable standard pump would use. Couple that with the two, one-watt Zone Sentry valves and we’re using just 11 watts instead of 174 watts for two circulators! In fact, the ECV (Energy Conservation Value) is \$58.73 in the first year, but when we look at a 20-year ECV with an annual increase in cost for electricity, it shows a savings of \$1,947.87.”

“I fully expect their home to use half, or less, of the heating-oil previously consumed while maintaining optimal comfort,” continued Yates. “And: reduced power-consumption.”

Devils’ in the details

“Access to the inside of a Burnham MPO is convenient,” said Yates. “The door, which is in the front of the boiler, just swings open.”

To help overcome tight space constraints, the Bradford White indirect was placed to the left of the boiler so that the service door could swing in front of the tank. To the right of the boiler, the original Well-X-Trol tank was pushed several inches from its previous position.

The homeowner didn’t want to expose all-new water fixtures to any scale, even if it meant using a dual tank system. So a twin-tank Watts water treatment system was installed; while one tank is recharging, the other conditions incoming water.

No reserve capacity is required to carry the tanks until a recharge can happen. There’s no possibility of the bypass valve opening while one tank recharges. The new Watts system can be used in a timer or metered configuration and when set to meter, will use less salt than the previous, timer-only tank.

When the house was purchased, the 10 year-old central air conditioning system wasn’t working, and hadn’t been run by the previous owners for quite a while. With a quick cleaning of the condensing unit, and a refrigerant charge, the Rheem unit ran flawlessly.

The new 12 GPM Watts whole-house UV disinfection system accompanies a media filter on the wall above the water softener. If power is lost to the house, a solenoid valve closes; no contaminated water slips by the UV light to re-seed freshly-sterilized domestic water.

“The old UV light was a 7.5 GPM model,” said Yates. “I prefer a little more flow capacity to accommodate quick bursts and numerous fixtures running simultaneously.”

A good fit

Aside from the MPO boiler’s inherent efficiency (Yates found 89.6 percent at the flue using an electronic combustion analyzer while adjusting the Beckett burner), it’s equipped with a compact, three-pass cast iron heat exchanger. The boiler also includes the optional IQ panel that allows the addition of features like outdoor reset, low water cutoff and auxiliary high-limit for additional protection, enhanced efficiency, and complies with new 2012 government regulations.

The large-volume indirect tank helped to lengthen boiler run-time while, at the same time, reduce boiler size overall – improving efficiency and promoting a clean burn cycle.

Yates wanted a circulator with an internal flow check on the water heater, so he installed a Taco 00R-IFC to tap the boiler.

The three-speed circulator remains on low, letting supply water take it's time through the big coil inside the tank.

Bradford White tanks can be ordered with a tempering valve on top of the tank so that water exits at safe temperatures. "We can store 140°F - or higher - water while the outgoing supply temp is only 120°F," said Yates.



Yates uses a tablet equipped with Taco FloPro Designer software to enter the correct operating parameters into the Taco Bumble Bee circulator.

The removed New Yorker boiler had a six-inch flue, while the MPO required a four-inch pipe. After sealing up the new flue, Yates covered the oversized terracotta chimney liner with a polished diamond plate ring as a finishing touch.

"We're glad that Bob Coons and Jason Richards from N.H. Yates [manufacturer's representatives for Burnham and Taco based in Cockeysville, MD] were able to stop by on the day the boiler went in," said Yates. "It was good to have quick access to product information."

The ultimate in recycling

It would've been a shame to discard a healthy, six-year-old boiler. The Slussers knew that the top of a scrap heap was no place for it.

Months before Yates and his crew arrived, the Slussers were visiting neighbors who lamented the fast approach of winter, voicing concerns about whether or not their old boiler would make it through another season.

The neighbors' enormous coal-to-oil conversion drank 240 gallons a month at the height of the heating season. The old farmhouse needed an energy retrofit of its own – but at least they'd replaced all the old doors and windows.

While Yates was at the Slusser home taking measurements and completing the heat load calculation several weeks before the install, he visited the neighbor's home at Slusser's request. Twenty minutes later he confirmed the Slusser's suspicion: "Yep, your boiler would be a good fit for their place."

For a yard sale price, Slusser sold the boiler to his neighbor. Along with it, the neighbor received the expansion tank, isolation valves and some perfectly fine Taco 007s.

"We made a two-fer out of it," said Slusser. "What started out as a nasty, money pit problem led to huge improvements here, and for our neighbors, too. We're delighted with the way things turned out."



Going into the project, the installers knew that one of the key challenges would be the mechanical room's small size. Once complete, even Yates was impressed at how beautifully everything fit into the space.