BY TED CUSHMAN

Heat Pump Water Heaters

Photos by Ted Cushman

Heating domestic water accounts for more than 15% of a typical American household's energy consumption, according to Department of Energy statistics. And while home-heating-and-cooling energy consumption has declined in recent decades as a result of improved construction methods and gains in equipment efficiency, water-heating energy use has stayed flat, or even increased slightly. So water heating is one of the big remaining slices of the home energy pie for which advancing technology offers an opportunity to shave consumption.

Heat-pump water heaters are two to three times more efficient than conventional electric resistance water heaters at turning electricity into heat. And depending on the source of the electricity, they can be the lowest-cost way to heat domestic water over the lifetime of the equipment. Heat pumps are a complicated technology, and the up-front cost of a heat-pump water heater is many times the price tag of a basic electric resistance water heater. But some of that cost is offset by rebates in many areas, and heat-pump water heaters are continuing to make inroads in the market. In February, *JLC* went on site with master plumber Dan Leonard from ReVision Energy in Maine to learn more about heat-pump water heaters.

Brandon Bernard, a system design specialist for ReVision Energy, ticks off three reasons customers may approach him about a heat-pump water heater. The top reason is just that their existing equipment—an electric resistance water heater, a gas water heater, or a tankless coil in the oil heating boiler—needs to be replaced. Second on the list is energy cost: The customer is spending too much money to heat water year-round (typically with fuel oil) and wants to pay less. Finally, some customers are concerned about the environment and want to reduce their fossil-fuel use and carbon emissions.

Going solar. In the last case (where the customer wants to switch to clean energy), ReVision can offer a package of photovoltaic panels, mini-split heat pumps for house heat, and a heat-pump water heater for domestic hot water. Pairing heat pumps with PV pencils out as the solution with the lowest lifetime operating cost, especially if the long-run price of fossil fuels rises, says Bernard: "You pay for the panels, and they put out free power for 40 years." But the practicality of that approach

PV panels on this small house **(1)** are sized to carry much of the home's annual load, including heat and hot water. ReVision Energy master plumber Dan Leonard cuts a water line serving the existing boiler **(2)**, tightens down the plate on the tankless coil so the gasket won't leak **(3)**, and patches in the water line for topping up the boiler's hydronic loops using a solderless compression fitting **(4)**.

depends on the household's total water needs. For high-volume hot-water users, like large families with young athletes to raise, or homes with jetted tubs, thermal water-heating panels with a fossil-fuel backup offer output that a heat-pump water heater can't match. But the heat-pump water heater is a good fit for families who might expect to use less than 100 gallons in a morning or evening, like the retirees in the house shown above; ReVision calculated a five-year or six-year payback for these PV panels coupled to heat pumps for heat and hot water.

Getting off oil. Unlike most of the United States, where oil barely figures in the home-heating fuel mix, about 25% of the heating energy in the Northeast is oil. Maine is the extreme example: 64% of Maine households heat with oil. In many of those homes, a tankless coil in the oil boiler heats the domestic water. That's a very inefficient method of heating water, not least because it requires a boiler that's sized to provide ample heat in the dead of a Maine winter to stay hot all summer long just to keep water ready for the occasional shower or dishwashing session.

The job shown on this page is a classic example of the best case for a heat-pump swap-out: The tankless coil in a boiler is being disconnected and decommissioned, allowing the boiler to run less in winter and to shut down altogether as soon as the weather moderates enough to allow the air-source heat pumps to handle the home's full heating load. The boiler is being "unloaded" except when it's needed to heat the home during the coldest hours of winter (the continuous-run scenario when the boiler operates at its highest efficiency)—and photovoltaics will supply the juice.

The heat-pump water heater being installed here is a top-of-the-line Stiebel Eltron Accelera "E" unit, ReVision Energy's go-to choice. It comes with a 10-year guarantee and uses a low-voltage direct-current circuit, rather than a sacrificial anode, for corrosion protection. ReVision Energy's Brandon Bernard speaks highly of the equipment, but he acknowledges that heat-pump water heaters have limitations and aren't right for every situation. The units work by pulling heat out of the room air where they're located, so they need at least 800 cubic feet of space around them—and when they're operating, they can cool that surrounding space by as much as 5°F to 10°F. The heat-pump motors are noisy (although not as loud as a typical high-mass oil boiler). And the coils collect condensate that has to be drained somewhere—but the upside, at least for basement locations, is that the units dehumidify the space whenever they're running.

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