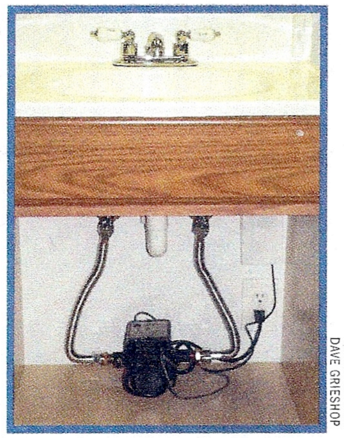
Demand-Controlled PUMPS

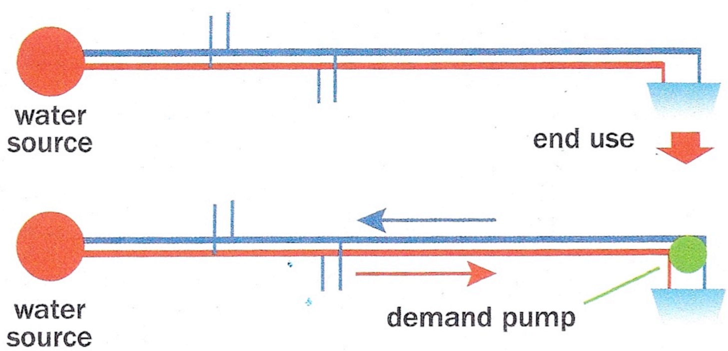
Sticker Shock Versus Value

Everyone can relate to the feeling of sticker shock. (Remember walking into that new-car showroom and seeing the manufacturer's suggested retail price?) Luckily for car dealers, that price becomes digestible once it's translated into monthly payments. Unfortunately for businesses that sell demand-controlled water pumps for plumbing systems, that same monthly payment system is not possible. Plus, homeowners aren't often equipped with sufficient information to translate sticker price into monthly payments, and furthermore, into long-term value.



An installed demand-controlled pump.

Over the years in plumbing supply houses, I have watched several potential customers for demand-controlled recirculation pumps experience sticker shock—and walk away when they see the price. This is a shame, because once homeowners come to see and appreciate a demand-controlled pump as a good investment in their personal infrastructure, the initial purchase resistance fades. Plus, once they actually enjoy the benefits—the ultimate utility savings, convenience, and water conservation—users (like myself) often become proponents and wish they had adopted their system sooner. (For information about demand-controlled pumps for multifamily buildings, see "Resolving the Circulation Dilemma in Multifamily Buildings," p. 22.)



(top) Figure 1. An example of how water flows in standard plumbing systems. *(bottom)* Figure 2. An example of how water flows with the introduction of a demand-controlled pump.

This resistance holds true for both new residential construction and the (much larger) existing residential market. I will discuss the cost factors involved for both markets, but first, let's revisit demand-controlled pumps to understand their operation and advantages vis-à-vis standard plumbing systems.

Old Versus Better

The vast majority of homes in the United States have standard plumbing systems with separate hot and cold water main trunk lines. You know the drill: Turn on the hot water and wait and wait and wait and finally be "rewarded." Figure 1 shows why it takes so long.

The ambient water in the hot-water line is replaced by hot water from the water heater (WH) flowing to the specific water fixture, plus the transitional flow of more water going from warm to hot. All of this is wasted, as shown in Figure 1 by the red arrow. Think of it: All water in the trunk line had to be replaced, plus the water in the branch line to the faucet, plus several feet of water in the trunk line while going from warm to hot—just so you could wash your face or clean a pan.

Now contrast standard plumbing with demand-controlled plumbing. The homeowner needs hot water and makes a "demand" by activating the pump wherever a demand button is located in the home. (Think of it as priming the hot-water trunk line from the WH to the most distant fixture.)

The introduction of a demand-controlled pump (green dot in Figure 2) at the most distant fixture from the WH connects the hot and cold lines. When a demand for hot water is made, the pump senses the current wate

Table 1. Energy and Water Savings from Demand-Controlled Pump Installation in New Residential Construction

Water Heater Type	Electric	Natural Gas
Pump system plus installation	$575	$575
Pump mortgage expense/yr	-$48	-$48
Pump energy savings/yr	$103	$55
Water and sewer savings/yr	$37	$37
Total savings/yr	$140	$92
Net cost avoidance/yr	$92	$44
Water saved/yr (gal)	6,100	6,100

temperature at the pump (or at the remote sensor, if one is installed) and pulls hot water at a high flow rate from the WH. The displaced ambient water is returned to the WH via the cold-water line until the water temperature rises 5–10°F at the pump's sensor. Then the pump shuts off. The hot water is now just a few feet from the fixture itself.

A comparison between standard plumbing and plumbing that incorporates a demand-controlled pump is dramatic in terms of both water and energy savings. In the article "Benefits of Demand-Controlled Pumping," (HE Sept/Oct '06, p. 18), the authors cite several references that show annual water savings ranging from 3,000 to 12,000 gallons per year per residence. Annual energy savings ranged from 400 kWh to 1,600 kWh. These savings translate into real dollars.

Crunching the Numbers for New Construction

Now let's look closer at the water and energy savings in both new and existing residential construction. In new construction, let's assume the homeowner opts to include the cost of the demand-controlled pump in the new mortgage itself. Sticker shock becomes monthly payments.

A defensible budget estimate for a new pump, three hardwired-activation mechanisms using Cat V wiring, and installation is $575. Using a 15-year fixed mortgage with an interest rate of 3.1% per annum would add $48 per year to mortgage payments, or $4 a month. The 2010 Energy Information Administration reports national averages for electricity and natural gas as $0.116/kWh and $1.20/therm, respectively. Because state and local energy taxes vary across the country, for our purposes we'll assume an additional 10% for taxes.

Other cost factors are water and sewage rates. Using a national combined rate of $6 per 1,000 gallons and a net reduction in wasted water of 6,100 gallons per year when compared to standard plumbing, a water and sewage cost avoidance of $37 per year is realized. And the associated annual energy reductions attributable to the pump are 805 kWh or 42 therms, yielding savings of $103 and $55, respectively.

The information above is shown in Table 1. Figures shown for energy and water savings are compared to standard plumbing.

Obviously, installing a demand-controlled pump in new residential construction is a no-brainer. The incremental pump expense included in the new mortgage is more than offset by the incremental energy and water savings the pump provides; the new homeowner is ahead from day one. This is a classic case of life cycle costs trumping lower initial building costs. This is investing in your personal infrastructure at its best, with convenience included at no extra charge.

Some municipalities, in their quest to reduce wasted water, have mandated dedicated hot-water recirculation loops in new residential construction. Had those communities mandated demand-controlled pumps instead, the dedicated return loop system expense would offset the pump and installation expense while dramatically lowering the homeowners' annual energy expenses.

We may even see the introduction of municipal plumbing codes that require demand-controlled pumps in all new construction—because the building trades are slow to change and consumer education can do only so much. The new EPA WaterSense home certification program is a step in the right direction.

Crunching the Numbers for Existing Homes

Now let's examine a pump installation in an existing residence with standard plumbing—a retrofit. One of the great advantages of adding a demand-controlled pump to an existing residence is that it does not require any plumbing work behind drywall or on inaccessible interior pipe. The biggest difference from a new-construction installation is the use of wireless activation mechanisms, whether they are activated by a push button, a motion sensor, or a combination. Electricity is required where the pump is installed (normally under a sink), so it must be wired in if it doesn't already exist. Assume a worst-case scenario: An electrician charges $200 to bring power to the distant location and a plumber charges $125 to install the pump. Total paid is $325 just for the installation. (Many installations lend themselves to a do-it-yourself one- or two-hour project.)

We'll assume the homeowner charges the $360 pump cost on his or her credit card with a 15% annual rate for a demand-controlled pump with a receiver and three wireless transmitters. If the homeowner pays off the charge in one year, the total payments will be about $390. The total cost for the retrofitted home is $715. (See Table 2.)

A simple calculation of the all-in pump system cost divided by the total savings per year shows a 5.1-year payback for the electric

Table 2. Energy and Water Savings from Demand-Controlled Pump Installation in a Retrofitted Residence

Water Heater Type	Electric	Natural Gas
Pump system w/ interest plus installation	$715	$715
Pump energy savings/yr	$103	$55
Water and sewer savings/yr	$37	$37
Total savings/yr	$140	$92

water heater and a 7.8-year payback for the gas water heater. Remember, these are worst-case paybacks. Not surprisingly, the payback results are dramatically different from the new-construction results. The retrofit installation incurs the entire out-of-pocket expense in the first year, which means that the reason to install the system has to be more intrinsic.

So why do people install demand-controlled pumps in existing homes? Simple—the convenience the pump provides, as mentioned earlier! Most households do not realize that they make between 5,000 and 7,000 demands per year for hot water. The wait for hot water occurs many times a day, every day of the year. When the annual reduction in wasted water (6,100 gallons) is extended over many years, it too has value—especially in desert and drought-prone environments.

Because there are 78 million owner-occupied homes in the United States, the demand-controlled pump has significant potential to reduce wasted energy and water. Until states and municipalities, as well as energy and water utilities, begin to cooperate and introduce rebates for this class of pumps, changing existing homeowner behavior is going to be slow—even when the results are in the best interest of all concerned.

There is another type of retrofit opportunity wherein the homeowner has a dedicated hot-water return line and uses a timer pump to deliver hot water when needed. While the convenience of hot water is realized, the energy costs associated with this system can be significant. When the timer pump fails and the homeowner replaces it with a demand-controlled pump, the cost can be recovered in less than one to three years, depending on how the homeowner has used the timer/loop system and energy source for the WH.

Value Can Trump Sticker Shock

With luck, this article will help readers in the building trades to better appreciate the value of demand-controlled pumping in new residential construction, and will also explain why they are advantageous to those homeowners. Funding these pumps via the mortgage instantly eliminates the sticker shock while simultaneously reducing monthly homeownership expenses. Retrofitting existing homes with these pumps makes sense in the long term while providing almost instant and constant convenience to homeowners.

–Dave Grieshop

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For more information on Reality LLC, visit www.reality-llc.com.

To learn more about demand-controlled pumps, visit any of the following web sites: www.gothotwater.com, www.taco-hvac.com, or www.uponor.com.