By Doug Kirk | *GreenPlumbers USA*

Saving Money with Hot Water Recirc

Do the math and choose the type with the best ROI for individual customers' situations

I want hot water and I want it now!

How often do your customers complain they have to wait too long to get hot water?

Does it sound something like, "I have to wait five minutes to get hot water to the master bath shower!"?

How long should we have to wait for hot water is explored in detail in Green*Plumbers* USA's Climate Care class. It is an in-depth study of greenhouse gasses, water heaters and the hot water deliver system.

Perhaps everyone you ask will have a different idea about how long they are willing to wait for hot water. But if, by their definition it's too long, they will either give up and turn the water off or go do something else while they wait for hot water.

Because of differing user behaviors, what people do while waiting will vary. Some of us will stand there patiently waiting, testing the water every few seconds. If on the other hand you really believe it's going to take five minutes, you might decide to use that time to do something else—play with the dog, read the paper, start some coffee…

When the five minutes is up and they return to the shower, what do they have? Hot water, just like they said. Most of us know it really only took a minute or two (which is a LONG time to wait) and what greeted them was steam billowing out of the bathroom. But they did something "useful" will they were waiting.

Another question to ask ourselves, which may be more important is, what's going on while we're waiting? How many systems are involved in getting hot water to fixtures?

If you have a municipal water supply, water is likely delivered through a water meter to the cold water supply. You have the cold system delivering water to the water heater. The hot water the system is making is being introduced to the system at the same time it's pushing water that has cooled off out of the line through the fixture. Then there are the heaters themselves. If the heater is gas it includes its own gas piping system, a venting system and a safety system. If it's an electric water heater sub the electric system for the gas, eliminate the vent but still include the safety system.

Now that all the systems are working together to deliver the hot water, what's happening to the cold water being pushed out of the pipes between the water heater and the fixture and the hot water that starts coming out before the user returns?

It's going DOWN THE DRAIN system. And the longer you have to wait the more is being WASTED. If we are thinking of the entire process we're not just wasting that potable water but also putting it into the sewer system where it will be treated. And how about the energy we used to heat the water that ran down the drain? Add it up. Besides just our wasted time, we likely have water, sewer and energy costs we need to consider.

It has been my experience that most people don't examine what all this is costing them. They glance at the bill, write the check and get on with their lives. When a notice informs them that water and sewer rates are going to increase they complain to anyone who will listen and do nothing to change the situation of all the waste!

Is there a viable solution? Are there things we can do after the fact to improve what we'll call the water use cycle? Most of you have an idea where this is going—hot water recirculation systems would go a long way to overcome the problem of waiting for and wasting all that potable water.

All systems will work but which design will use the least water and energy?

Begin where numbers from the Department of Energy come into play. The basis for water heater energy factor testing is 64.3 gallons of hot water per family per day. Let's round that number to 60 GPD just to make the math a little easier. Multiply by 365 days and you get 21,900 gallons of hot water per family per year.

With an input temperature of 50 degrees Fahrenheit and a storage temperature of 140 F that's 16,438,140 BTUs. If the energy factor of the heater is 0.6 (for a gas storage type) the resulting BTUs would be 27,396,900 BTUs or 274 therms of natural gas. If the cost per therm is $1.41 (2010 US average) the cost for energy for hot water to the average American home would be about $386 a year. Add the water and sewer fees (estimated at 5.00/CCF or about 0.0067/gal) and you have to spend about $532 a year to have hot water supplied in your home.

Let's be conservative for those who have higher groundwater temperatures or don't have as much temperature rise and round the number to $500. A round number makes it easier to do the math.

Assume we waste 10 gallons, or about 16.6 percent, of the water per household per day waiting for hot water. 16.6 percent of $500 is $83.

To make financial sense, whatever solution we come up with has to cost less than $83 a year to operate. I'll suggest trying to achieve not more than half that amount so there will be some return on investment. Assume we are willing to spend $40 per year operating a system that will save $83 in resources.

We are making lots of assumptions and rounding numbers off, so much will depend on what water, sewer and energy fees are in your location as far as accuracy goes, but whatever they are, the concept stays the same. It doesn't make sense to spend more money than it costs to correct the problem unless you're just doing it for convenience.

There are six typical recirculating system designs: thermo-siphon; continuous pump; temperature controlled operation (with an aquastat); timer controlled; time and temperature controlled; and, demand controlled.

What does it cost to operate a circulation loop? From a fairly reliable source we will say 10 percent of the cost is the energy to run the pump and 90 percent of the operational cost is heat loss in the loop (100 percent with a thermosiphon type!). Many factors will affect the heat loss including ambient temperature, how much and how well the piping can be insulated, etc. No matter which circulating system you select the factors affecting heat loss will be the same on the same system.

For sake of brevity let's assume you have system with a 100-foot loop, circulating at 1 GPM and heat loss of 5 F per circuit. When you do the math for the system running 24/7 that works out to about 292 therms for the year in heat loss. At $1.41/therm it just cost $411 to save $83. Add the electricity to run the pump 24/7 and you've got another $40 to $50.

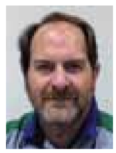
This is clearly not a good return on investment. Go through all the designs for circulating systems and select the one that will cost $40 or less to operate.

At $40/year the pump can not run more than two hours per day. The question then becomes which two hours? The typical household draws hot water less than one hour per day, during several windows of opportunity spread out over the entire day. The actual daily pattern has such large variation that it is practically random.

I'll leave it to you to figure out which system of the six we noted earlier can be successfully operated 2 hours or less per day but clearly only one meets the narrow criteria we have outlined. See the chart on this page and/or attend a GreenPlumbers USA Climate Care class.

I want to thank Gary Klein for his contribution to this article and helping me see that, when you work through the problem in a systematic way, many times the answer is quite apparent. **RJ**

	Recirculation						**Demand Controlled Priming**
	Daily Hours of Operation						
	24	12	8	6	4	2	0.25
Loop Heat Losses							
Natural Gas (therms)	292	146	97	73	49	24	3
Electric (kWh)	6,388	3,194	2,129	1,597	1,065	532	67
Pump Energy(kWh)	438	219	146	110	73	37	8
Annual Operating Costs							
Natural Gas Water Heating	$ 456	$ 228	$ 152	$ 114	$ 76	$ 38	$5
Electric Water Heating	$ 690	$ 345	$ 230	$ 173	$ 115	$ 58	$7



Doug Kirk, a former plumbing contractor with more than 40 years in the trade, is now the senior instructor and director of course materials for GreenPlumbersUSA, a Sacramento-based group with the aim of providing contractors with the practical knowledge they need to implement "green" products, services and techniques. Visit the group on the Web at www.greenplumbersusa.com.