Point-of-use Solutions for the Remote Plumbing clusters

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Here in the desert southwest, energy and water conservation efforts sometimes conflict with one another. On a macro-scale, this has been referred to in literature as the Energy-Water Nexus. Sandia National Labs has done some work in this area (e.g., embodied energy in water production and delivery, and water required to produce energy). Not much has been done at the micro-scale, and indeed, the home performance industry seems mostly uninformed about this.

One obvious example is the use of evaporative coolers. Another example is the use of circulation pumps for hot water lines. The City of Sierra Vista and the larger Subwatershed authority now require circulator systems or point-of-use solutions for new construction. For some reason, the market has opted for circulators, which are expensive to install, waste significant energy, and if not used properly, fail to eliminate water waste.

For my net-zero eco-village project, I will combine clustered plumbing with a single remote point-of-use solution (typically in master bath, depending on floor plan). At the remote point-of-use, I will use a small Ariston (Bosch) water heater (http://tinyurl.com/4go4n2). It's small enough to fit under the sink and plugs into standard 120VAC outlet. The Ariston isn't tankless, but instead has a small super-insulated tank with virtually no standby loss. The model I plan to use holds about 4 gallons and costs about $275 installed, dramatically less than a tankless water heater. These are mainly targeted at bathrooms for small office buildings.

Since the small tank can't handle shower loads, I'll plumb the Ariston in-line with the hot water line from the primary water heater. By the time the Ariston runs cool, the hot water will have time to arrive from the primary heater. The connecting line will be well-insulated and will be run through the walls rather than through the attic or slab. This approach not only minimizes wasted water but requires no pumps or controls, uses very little energy, and costs substantially less to install than a circulator system.

An on-demand pump works almost as well as the Ariston approach, but costs a little more. When you push a button, a high-speed pump shoots hot water to the fixture in a matter of seconds. A sensor shuts the pump off when it detects a big temperature jump. This makes this system very efficient as well as convenient. You can hear the pump shut off, signaling the arrival of the hot water. Some people report that having to push a button creates awareness and they quickly break the habit of turning on hot water at the tap even when it's not needed. Here's an example of an on-demand pump: http://www.chilipepperapp.com/howit.htm

The point-of-use approach has the disadvantage of only serving a single location or cluster. However, one pump or point-of-use heater is usually adequate for most homes. Here’s why: Laundry rooms and rarely used baths or lavatories can usually be ignored. Two-person households (dominant in my market) need only be concerned with kitchen and master bath clusters, but even then, one or the other is often close to the water heater. Even if two point-of-use systems are required, the installed cost would likely be less than a circulator system. Keep in mind the biggest cost with a circulator system is the special plumbing, not the pump. An on-demand pump works with standard plumbing because it uses the cold water line for the return path.

Another big advantage of either point-of-use approach is the ability to be installed in existing homes, which is virtually impossible with a circulator type system. The main issue is gaining access to a 120VAC outlet.

By the way, activation by motion detectors is not a good idea for any pump-based system from an energy standpoint because it typically creates many false triggers. Also, hot water can take several minutes to arrive with a conventional circulator system, making motion activation rather inconvenient. (Circulator pumps are much slower than on-demand pumps.)

Point-of-use isn't the best solution in all cases. But even families with three high-use plumbing clusters located remotely from the water heater (less common than you may think) would be better off with point-of-use since the additional first-cost would easily be offset by energy savings. More importantly, water savings is reliable.

A lot of energy is wasted by circulators. More importantly, anecdotal evidence suggests that many people end up unplugging these pumps when they realize the impact on their gas bills. Those who use try to use timers end up with a compromise because hot water needs cannot always be predicted. Either way, water is wasted. Moreover, even a timer set for short 30-minute run-times will waste considerable energy via pipe losses.

My current home has a circulator pump. I use a wireless pendant button to activate the pump (available from Radio Shack), but this is not particularly convenient because it takes 3 or 4 minutes for hot water to arrive at our master bath (even longer in the winter). More importantly, my wife seems to always forget to turn off the pump. I plan to resolve this by installing an Intermatic 15-minute wind-up wall timer, available at Home Depot. But from a water conservation standpoint, this approach is less reliable than point-of-use approaches.

The definitive study on this issue was published by Bob Wendt et.al. at Oak Ridge National Labs. Although the focus is on the huge energy waste associated with circulation pumps, the Oak Ridge study also addresses water savings for the various approaches. The full report can be downloaded here:

http://www.ornl.gov/~webworks/cppr/y2001/rpt/122464.pdf