

RE-INVENTING THE SHOWER FOR A CLEANER AND GREENER FUTURE

INTRODUCTION

Imagine that you could take a long, steamy, hot shower on a cold day without the guilt or expense of wasting a lot of water and energy. Better yet, imagine that the showerhead delivers clean water with better showering performance than you experience with low-pressure flow restrictors. This “decadent dream” may soon be possible thanks to a futuristic shower concept that is currently being test-marketed here in California.

BACKGROUND

Showering is an activity that consumes a lot of water and energy resources. According to the U.S. Environmental Protection Agency (EPA), 1.2 trillion gallons of water are used for showering in the U.S. annually. The shower water used by a typical American household (4 persons) in one year costs more than 200 Kilowatt hours (kWh) to process at the local sewage treatment plant and costs 5,300 kWh per year to heat using domestic hot water systems.

In California, low-flow showerheads (certified by EPA guidelines not to exceed 2.0 gallons per minute) are now code mandated to address both water and energy conservation concerns. These devices can save up to 40% of the shower water compared to conventional showerheads which average 3.5 gallons per minute. Low-flow showerheads might be viewed as a “low-tech” measure because they operate by simply restricting the shower water flow rate and cannot recycle the used shower water (i.e. “greywater”). While low-flow showerheads also reduce energy use in proportion to reduced water flow, they are not able to capture any heat energy stored in the shower water. Flow restriction is not popular with many shower users who favor comfort over efficiency. These persons may remove the flow restriction devices installed in their homes. Unfortunately it is true that the lower pressure of low-flow showerheads is achieved at the expense of some user comfort and “cleaning performance.”

ON-SITE GREY WATER RECYCLING FOR SCHOOLS

The average school in the U.S. consumes 22,284 gallons of water per day; most is used for outdoor irrigation, toilets, water fountains, and locker room showers. School gymnasiums with larger communal showering facilities could save significant potable water by installing

off-the-shelf greywater treatment to supply treated recycled water for showers. However, few schools have adopted this shower water recycling probably because of technical, economic, public perception and regulatory barriers. For example, the initial cost of greywater treatment equipment is relatively high, the equipment is often maintenance-intensive, and greywater requires storage before and after treatment because the packaged greywater treatment systems do not process water in “real time.” Most off-the-shelf greywater treatment systems cannot accept shower greywater for treatment until it is cooled which prevents conservation of heat energy. Code requirements and health regulations related to greywater applications are sometimes barriers to greywater recycling projects, especially when human contact with recycled water occurs. Finally public perception issues (the “yuk” factor) are barriers to acceptance of treated greywater due to unwarranted contamination concerns.

HOW RECIRCULATING SHOWERS WORK

State-of-the-Art re-circulating showers have their own self-contained high-tech purification systems which operate in “real time.” The shower water is captured at the drain and pumped through a closed loop system which returns the water to the showerhead at “drinking water standard.” As the process is rapid, very little heat is lost and the recirculated water is reheated slightly by the treatment system to maintain constant temperature. Because most of the shower water is normally recirculated several times during use, these showers can conserve from 70% to 90% of the shower water and up to 40% to 80% of the hot water cost. For example, a 10-minute shower with a conventional showerhead might use 35 gallons of potable water compared to 4 gallons conveyed to sewage for a recirculating shower. From a comfort standpoint, the recirculating shower water comes out the nozzle at higher than average pressure and maintains a very even flow because it is independent of external plumbing pressure fluctuations caused by other water consuming fixtures.

When the shower is over, the recirculated greywater is automatically released into the sewage system. This is where human psychology comes into play. The so called “yuk” factor is greatly mitigated as the user does not shower with treated water which contacted another person.

WHAT ARE THE HIGH-TECH PURIFICATION SYSTEMS USED IN THE RECIRCULATING SHOWERS?

The OrbSys shower, devised by Orbital Systems in Sweden, incorporates a real-time water filtration system which uses a pre-filter (for hair, dirt, sand) and a nano-ceramic filter capable of trapping viruses and 99.9% of other minuscule contaminants. On average, the nano-filter requires replacement once a year (\$100 each) and the pre-filter twice a year (\$25 each).

An Australian engineering firm CINTEP has also developed a patented recirculating shower that uses a real-time purification system similar to the method for heating and purifying milk. A mesh filter removes larger contaminants and a hydrocyclone is used to take out the majority of undissolved solids. A heat exchanger heats the water sufficient to achieve pasteurization without chemicals.

ANNUAL WATER AND ENERGY SAVINGS OF RECIRCULATING SHOWERS

The cost of potable water and energy vary by region. However, the water savings for these systems should be between 5,000 to 10,000 gallons per person per year. At one cent per gallon for water, this amounts to a minimum of \$50 per person per year. At 15 cents per kilowatt hour (kWh), a recirculating shower would save about \$200 per person per year in energy costs. A typical family of four would save a total \$1,000 per year by investing in a recirculating shower, not counting filter maintenance. (Claims by some recirculating shower manufacturers of \$1,000 per person per year appear to be exaggerated based on average utility costs for California.)

MARKETING AND PLUMBING CODE ISSUES

The OrbSys shower by Orbital Systems was originally tested at a coastal bathing house in Sweden where over 1000 bathers every summer swim in water rich with plankton, algae and seaweed before showering. This extreme field test received positive feedback. It is not known whether the CINTEP shower or other brands of recirculating showers have completed the testing phase or are commercially available in the U.S.

U.S. test marketing for the OrbSys shower system is now ongoing; it is now installed in hotels, hospitals and high end homes. The OrbSys shower currently costs about \$5,000-a price which does not appear to

offer an attractive payback scenario for the residential retrofit market. However, based on the \$250 per person annual savings, the OrbSys system would seem a reasonably good investment for the higher end new home construction market targeting an average to large family size. The Orbital Systems distributor calculates that paybacks of 5-7 years are feasible for certain non-residential facilities where each shower unit is normally used multiple times per day, such as school locker rooms, private fitness clubs, hotel pools, college dormitories, military barracks, bathing resorts, and hospitals. It should be noted that recirculating showers represent a promising emerging technology; therefore, the unit price should decline substantially with improved market penetration.

The U.S. distributor for the OrbSys shower (located in California) is currently working with State and local building departments to address potential plumbing code issues which could cause a barrier to mass marketing. However, the recirculating shower manufacturers have reason to be optimistic in California because the trend is that building codes and water safety regulations are likely to be increasingly amenable to treated greywater applications due to the likelihood of continued drought and long-term water shortages.



REFERENCES & RESOURCES

Green Schools Initiative www.greenschools.net
"California drought and why schools should conserve water"

CNN www.cnn.com
"Futuristic water-recycling shower cuts bills by over \$1,000"

Extreme Tech www.extremetech.com
"Recycling closed-loop shower is cleaner, greener, and can save \$1,000 per year"