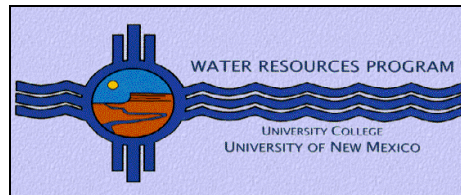


# The Shower Water Conservation System

A newly emerging innovation designed to meet the water and energy efficiency demands of the 21<sup>st</sup> Century

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**This water and energy saving innovation is part of Andrew Funk's MS research, which highlighted the benefits of water use efficient and water harvesting technologies. Executive summary and Professional Project report available at: <https://repository.unm.edu/dspace/handle/1928/2589>**

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## WHAT ARE THE POTENTIAL BENEFITS?

The Shower Water Conservation System (SWCS) is designed to eliminate unnecessary water and energy waste with each showering event. A typical three person single family home loses over **1,400 gallons** down the drain annually waiting for hot water from the water heater to reach the shower head. Also discarded down the drain is the energy that was used to pump that volume of surface and groundwater from its source, treat it for potable purposes, deliver it and to treat it at the wastewater treatment facility. Additionally, the largest share of energy is discarded in homes from heating water to replace the discarded, previously heated, volume of cold/lukewarm water. Therefore, the SWCS eliminates pre-shower water wasting and all the energy demands upstream and downstream of the showerhead including energy for heating.

A model was developed in STELLA 8 to simulate one year of showering events in Albuquerque single-family homes without the SWCS and with the system. Simulation results quantified the annual "Status Quo" water and energy demand and monetary costs associated with using shower water. A series of binary switches was used to simulate the model's policy change -OR- single-family home retrofit and to quantify the water, energy and monetary savings when homes use the SWCS. Simulation results were used with a spreadsheet model to forecast to 2030 the potential savings if 60% of the Albuquerque Water Utility Dept. service area single-family homes are retrofit with the Shower Water

Conservation System. Projected 5 year savings and avoided demands and costs from 2008 through 2012 are shown below:

**WATER SAVINGS:**

**HOMES = ..... 1,438 Acre-Feet**

**ELECTRICITY DEMAND REDUCTIONS:**

**HOMES = ..... 30,755 Megawatt-Hours**

**WATER UTILITY = ..... 1,925 Megawatt-Hours**

**NATURAL GAS SAVINGS:**

**HOMES = ..... 2.45 Million Therms**

**WATER UTILITY = ..... 0.033 Million Therms**

**AVOIDED COSTS:**

**HOMES = ..... \$4,584,357**

**WATER UTILITY = ..... \$99,723**

**WATER & ENERGY SAVINGS TRANSLATION:**

- 1.) HOMES **Water** saved is enough to meet the annual demand of **3,107** Albuquerque single-family homes.
- 2.) HOMES & WATER UTILITY **Electricity** demand reduction is enough to meet the annual demand of **4,611** Albuquerque single-family homes.
- 3.) HOMES & WATER UTILITY **Natural Gas** saved is enough to meet the annual demand of **3,734** Albuquerque single-family homes.

The volume of water used at Thermoelectric Power Plants to generate electricity is not usually considered when analyzing water efficient technologies. However, the quantifiable benefit external to the SWCS is that the system facilitates electricity demand reductions and thus, less demand on water resources to generate electricity. Currently, 46% of Albuquerque electricity is generated by coal largely from the closed loop cooling San Juan Generating Station in the Upper Colorado River Basin. Moreover, about 740 gallons of water are used (some of it consumptively) for every Megawatt-Hour of electricity generated at this facility. Since approximately 40% of single-family homes use electric water heaters, then the volume of water saved from retrofitting Albuquerque household shower stalls with the SWCS translates into less water demand within the Colorado River Basin. Projected 5 year avoided water demand for thermoelectric power generation from 2008 through 2012 is shown below:

**WATER DEMAND REDUCTION:**

**THERMOELECTRIC POWER PLANT = ..... 34.14 Acre-Feet**

The Water and Energy Security benefits above are the estimated outcomes of 60% of Albuquerque single-family homes using water and energy more efficiently by installing the SWCS. These benefits may aid water systems adapting to meet current and future demand in a water scarce environment of drought, climate change and population growth. Moreover, the SWCS may contribute to enhancing energy security in a Nation where both water resources needed to generate electricity and natural gas are increasingly scarce.

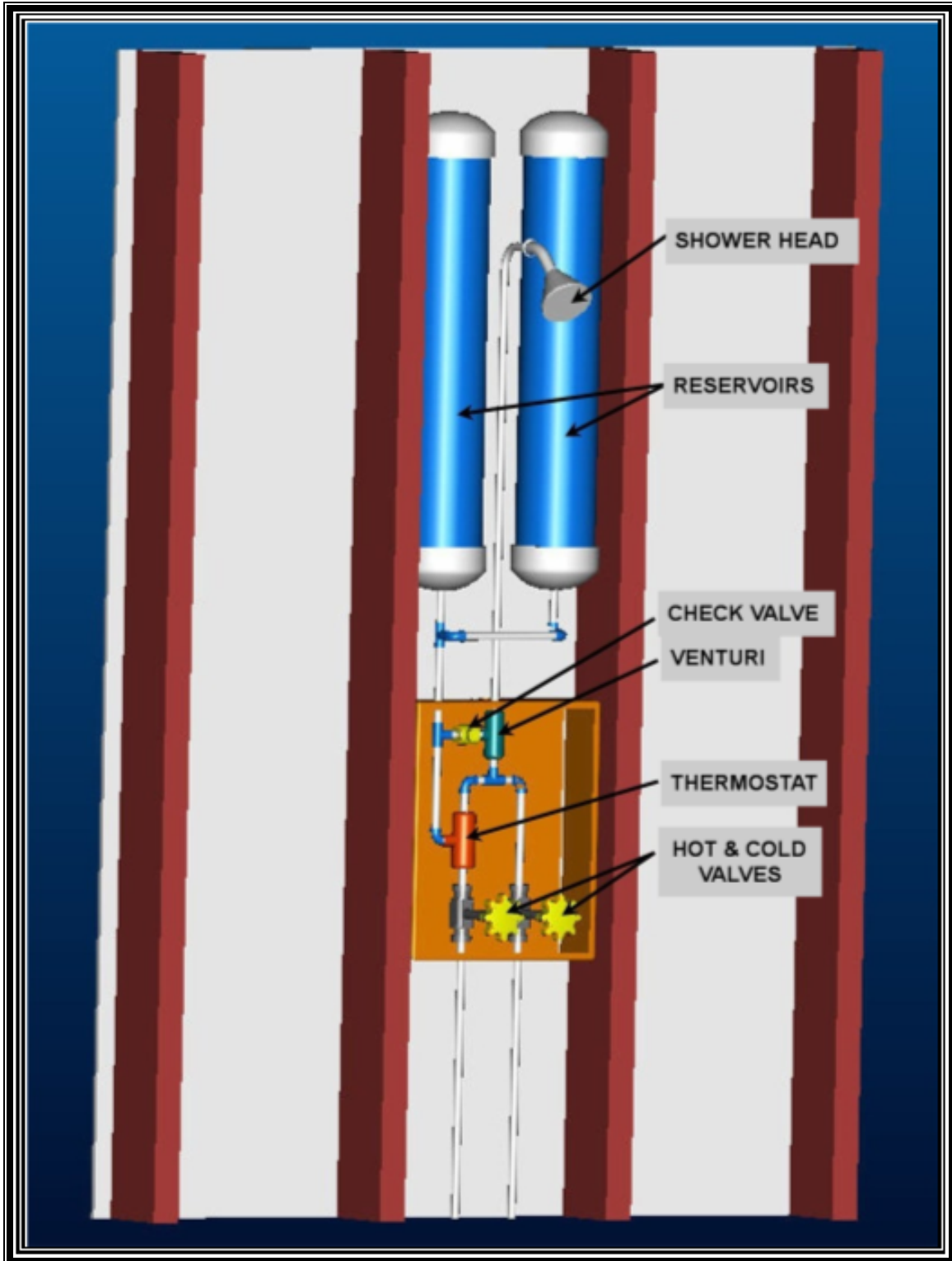


Figure1. The Shower Water Conservation System  
 (U.S. Utility Patent Application Pending)

**HOW DOES IT WORK?**

The Shower Water Conservation System changes how people use hot water with each showering event, without requiring a change in showering behavior. The system functions completely independent of an energy source. It is mounted behind the shower stall between the wall studs and between the faucet and the shower head<sup>1</sup>. The system's main function is to collect cold/lukewarm water before it flows from the shower head (or faucet) and to slowly re-inject it back into the hot water stream flow during showering.

As the hot water valve is opened the initial water temperature may be anywhere from 40°F to 105°F or higher. The average preferred showering temperature is 105°F. Thus, depending on the plumbing between the shower and the water heater, a significant volume of previously heated water is normally discarded down the drain. The SWCS eliminates this unnecessary wasting of water and energy resources in the following way.

When cold/lukewarm water flows through the thermostat (or thermostatic valve), the valve is open and the water is directed to the two reservoirs. When the water reaches 105°F the valve closes and hot water is then redirected toward the showerhead. On its way there it flows through a venturi. The venturi's narrow section is connected to the reservoirs via a one way check valve. Since pressure is at its least in the venturi's narrow section, then the stored cold/lukewarm water, with a greater force due to gravity and some suction, is injected into the hot stream flow. Here the heat energy of the hot water stream flow thermodynamically reheats and absorbs the cold/lukewarm water. Throughout the shower event, cold/lukewarm water is injected at a rate that has a negligible impact on the shower water temperature. Therefore, individual showering events may occur without wasting the initial (previously heated) cold/lukewarm water and the energy resources consumed in pumping source water, potable treatment, delivery, end-use water heating and wastewater treatment.

## MODEL INTERFACE CONTROLS & FRAMEWORK

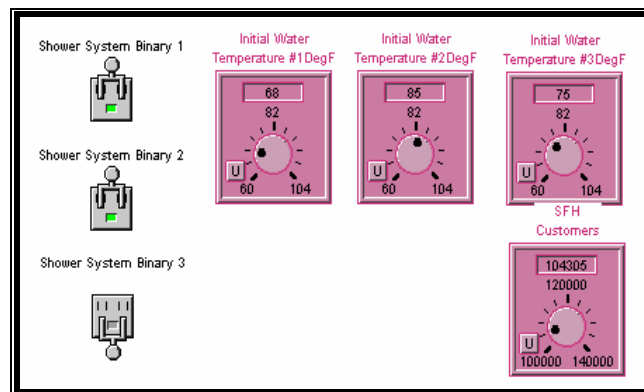


Figure 2. SWCS Model Interface

<sup>1</sup> An external - easy to install - model, which mounts inside an existing shower stall, is currently under design.

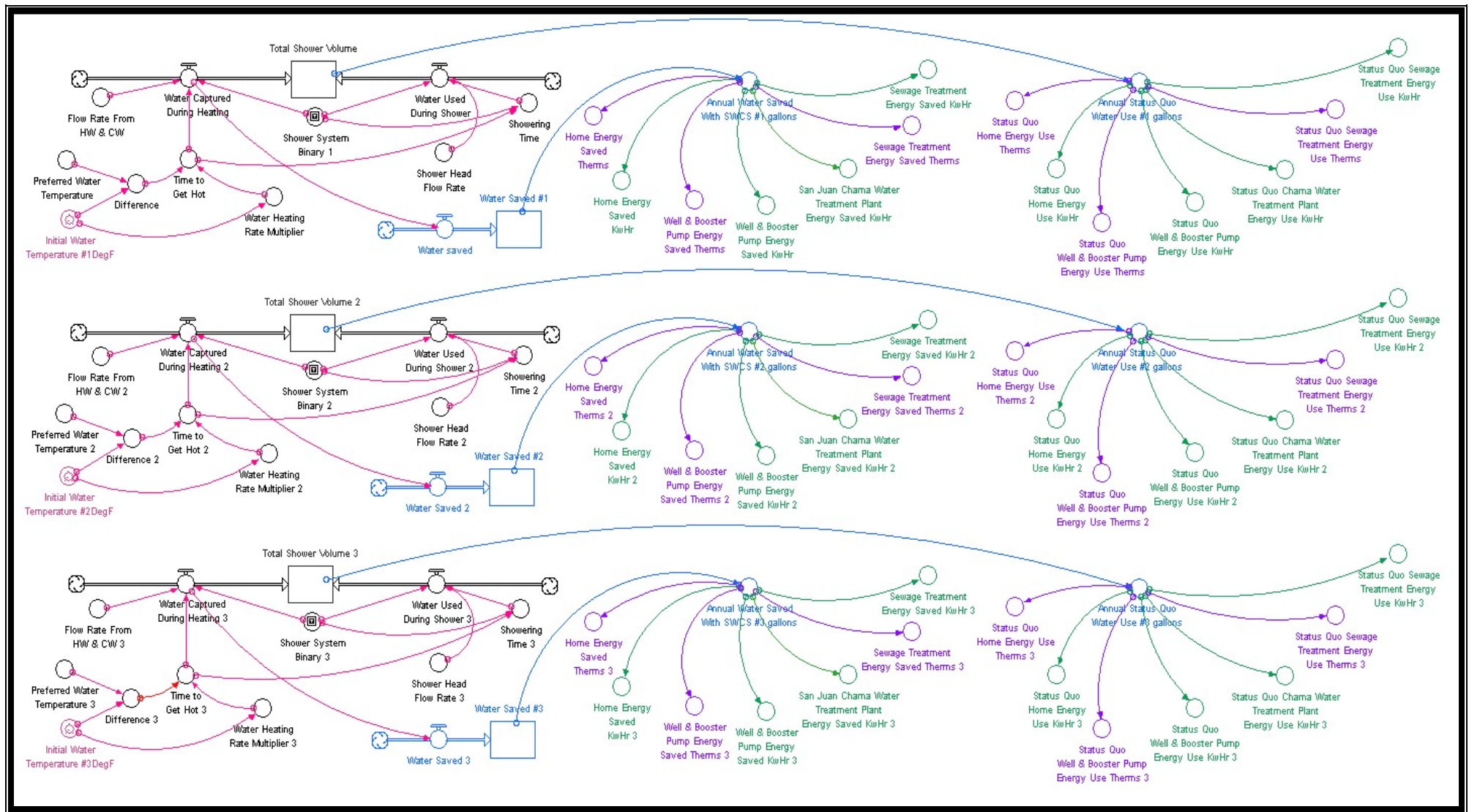


Figure 3. SWCS Model