CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Alexander Fung

Project Title

Shower Drain Water Heat Recovery through Submersive Heat Exchanger

Abstract

Objectives/Goals

The purpose of this experiment was to determine the practicality of using warm shower drain water to preheat the cold water supply through a submersive heat exchanger, thereby reducing the amount of hot water needed and thus saving energy.

Results

All tests involved simulating the conditions of a 40 deg C and 2.5 gallons/min (9.5 liters/min) shower. Three heat exchangers were built:

1) An externally wrapped model utilizing a copper line wrapped around a metal P-trap: The warmed water output was routed to the shower cold water inlet. An energy savings of 3.6% was achieved. This represents an annual cost savings of $5.10 for a typical family (assuming four 8-minute showers per day and natural gas price of $1.3418 per therm).

2) A submersive model utilizing a straight copper line submerged in warm shower drain water in an acrylic box: The warmed water output was routed to the shower cold water inlet. An energy savings of 7.5% and an annual cost savings of $10.65 were achieved.

3) A submersive model utilizing a coiled copper line: Three tests were conducted by routing the warmed water output to the shower cold water inlet and/or the water heater. The best test yielded an energy savings of 17.1% and an annual cost savings of $23.60.

Conclusions/Discussion

My experiment has shown that a significant amount of energy can be recovered from the shower drain water. Future models should aim for higher efficiencies by using tighter copper coiling and concentrators to channel drain water to maximize heat transfer.

Summary Statement

My heat exchanger saves energy by transferring heat from shower drain water into a cold water supply via submersion.

Help Received

My father taught me to use power tools, and helped in constructing the wooden display. My mother helped me make the display board.