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# Hot Water Recycling or Grey Water Heat

There Are Options! James Domanski Kaity Tang

We change the way people use energy<sup>™</sup>

# Agenda

- The Issue
- The Options The Results



# Energy Usage by End Use



#### **Household Site End-Use Consumption by Region**

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#### Water Usage by End Use



#### The Options

- Shower Recycling
  - Built-in water treatment
  - New application for indoor water re-use
  - Easier retrofit application

- Whole Home Water Recycling
  - Larger waste heat and graywater re-use potential
  - Indoor and outdoor water reuse applications

- Shower recycling
  - Manufacturer claims: ~80-90% water savings
  - \$3,000-\$5,000





- 3-step filter process + pasteurization
- Cold water line connection
- 0.8 gal fresh on startup



- Micro + nano purification capsule filters
- Contamination concentration sensor
- Higher flow at shower head
- 1.3 gal startup





https://orbital-systems.com

- UV lamp + filter
- 0.8 gal start-up
- Higher flow at shower head
- No built-in heater
  - Rely on incoming hot water line



https://www.hamwells.com/refresh-cycles

#### Nexus eWater





## Nexus eWater

# NEX heater

- Efficiency
  - COP 4+
  - EF TBD
  - FHR TBD
- Storage Capacity
  - 80 gallons
- HP Heating Capacity
  - 3160w (Average)
  - Input Power 400-790w
  - Electric Resistance
  - 2500w



# How it Works (Heat Loop)

3. After absorbing heat from the grey water, the warmer refrigerant returns to the compressor where it can start the loop again.



Plate HEX (Evap.)

2. Leaving the jacket HEX, the cooler refrigerant gas is pushed through an expansion valve and into the evaporator, which is submerged in grey water. The HEX is in direct contact with the grey water. 1. Hot refrigerant gas leaving the compressor enters the Jacket heat exchanger (HEX). Heat is directly transferred from the heat exchanger to the steel tank wall, which in turn, transfers heat to the mains water.



#### How it Works (Energy Balance)



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# Early Applications

- Several sites: Northern California, UC Davis, Sea Cliff
  - Currently data is not readily available, but is being gathered
- Northern California Home
  - Sporadic information because it is not regularly occupied
  - NEXheater and whole eWater system
- UC Davis Solar Decathlon Home
  - Still in the gathering process
  - NEXheater and whole eWater system
  - Additionally grant applications like UC Davis coming in now and projects will continue to have installations throughout the year
- Sea Cliff homes are being sold to new occupants





# Early Applications

- Mostly new construction but they are moving into some retrofit applications this year
  - Next May there will be more substantive data at that point.
- New as of 2/22/2016
  - Gary McDonald homes will be installing the nexus systems in their new development in Fresno
  - 44 homes
  - 12 will have the full system
  - 32 will be recycle ready and have a system purchase cost of \$7,500





#### **Combined Effects on Estimated Total Household Hot Water Savings**





- \*Based off of manufacturer's claims of 80% water savings based
  - Does not account for pump, backup heating
- \*\*Assuming COP of 4



le\_grain\_of\_table\_salt\_(electron\_micrograph).jpg

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#### Codes/Standards

- NSF/ANSI Standard 350
  - Onsite residential water reuse treatment systems
  - Water quality requirements
  - Restricted indoor re-use, unrestricted outdoor re-use
- NSF/ANSI Standard 53
  - Filtration for drinking water through adsorbent media



States that allow graywater reuse

States that lack a graywater regulation or do not allow graywater reuse

Image from "Treatment, Public Health, and Regulatory Issues Associated with GW Reuse By Sybil Sharvelle et. al. for WERF

# Thank You