Shower Heat Exchangers

IAPMO 2010 Emerging Technologies Symposium

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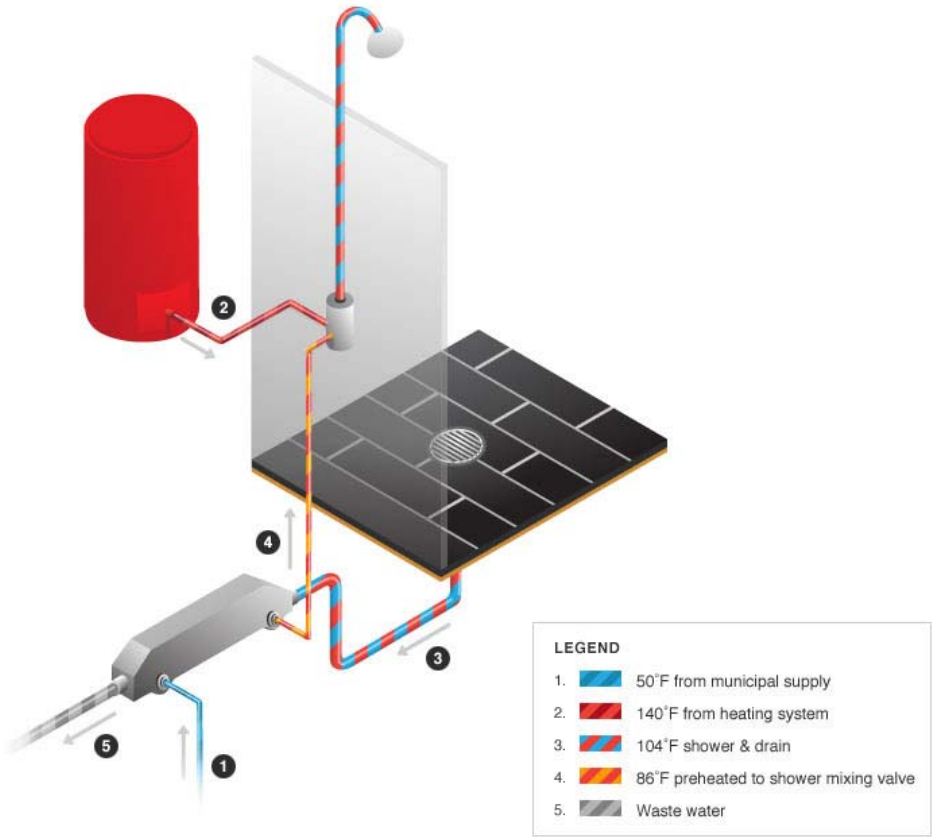
Agenda

- What is it?
- Why use a shower heat exchanger?
- How does it work?
- How much energy can be saved?
- What are the code and standards implications?
- Government and utility rebate programs.

What Is It?



Heat exchanger in shower drain, recaptures waste heat to preheat cold fresh water.

Why Use It?

How Does It Work?

Cold fresh water entering system is preheated by hot waste water leaving system.

Ideal for simultaneous flow of fresh water and grey water.

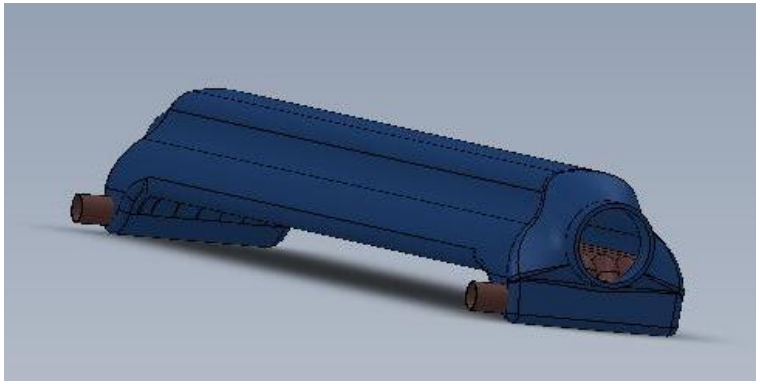
Ex. Shower

Not ideal for batch flow, which has a delay between usage and draining of hot water.

Ex. Bath

Installation Set-Up

- Preheated cold water connected to:
  - Configuration A – Water Heater Only.
  - Configuration B – Water Heater and Cold Side of Shower Valve.
  - Configuration C – Cold Side of Shower Valve Only.



Factors That Impact Savings

Water Temperature.

Factors That Impact Savings

Usage:

Showerhead Flow Rate.

Shower Length.

Users Per Shower.

Factors That Impact Savings

Type of Water Heater.

Design Considerations:

For Tank Water Heater, Capacity is typically less than tank size because as tank is drained, cold water fills tank and reduces temperature of hot water still in tank.

For Tankless, Water Heater must be capable of adjusting as preheated water at increasingly higher temperatures is fed into device.

Factors That Impact Savings

Cost of Energy.

Factors That Impact Savings

Heat Exchanger Length.

Factors That Impact Savings

Pressure Drop.

Factors That Impact Savings

Cold Water Flow Rate.

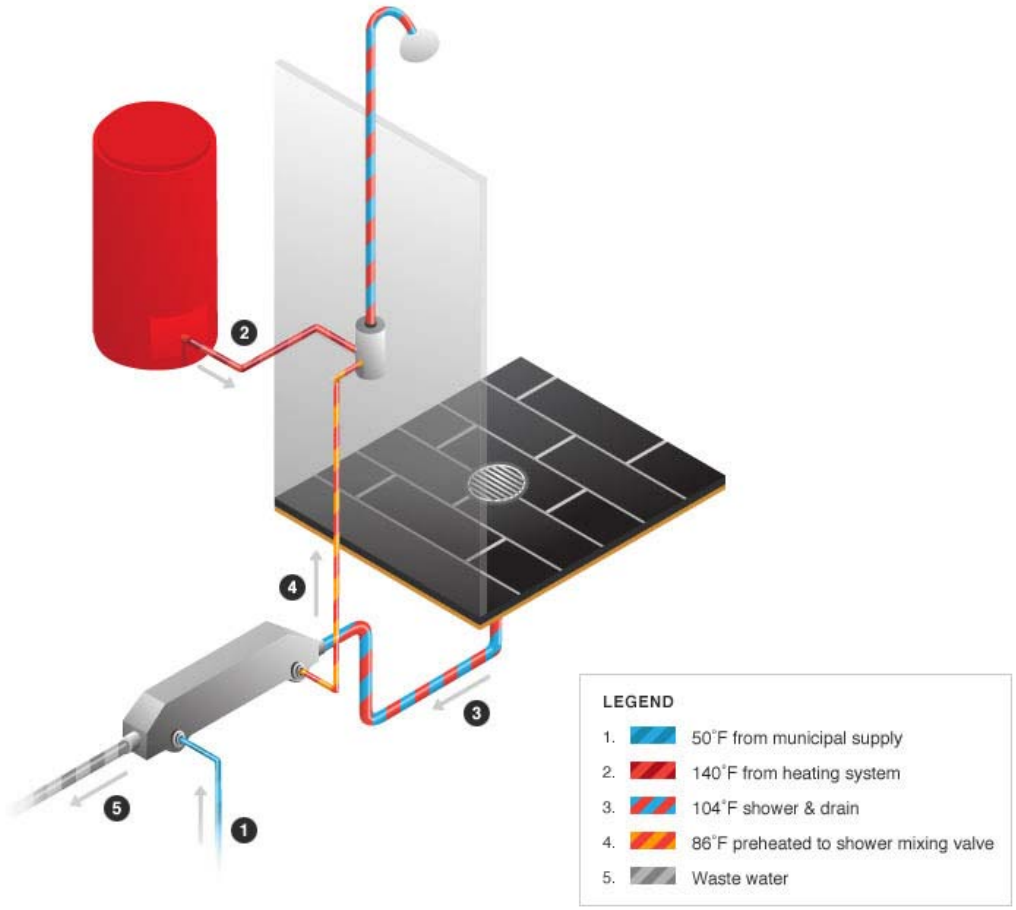
Cold Water Flow Rate

- Higher cold water flow rate will result in greater savings and lower temperature rise.
- Governing Equation: $$Q = m * Cp * \Delta T$$
- If m is per second, then Q is in Power units
- If m is not a function of time, Q is in Energy units
- Cp is specific heat capacity, constant for fluid within a given temperature range.

Efficiency

- Efficiency
  - Varies based on cold water flow rate

$$e = \frac{t_4 - t_1}{t_3 - t_1}$$



Savings

Savings and Effectiveness vs Temperature Rise				
	Units	Before	After	
Exchanger Length			46``	72``
T_{heater}	F	131	131	131
F_{heater}	GPM	2,09	1,44	0,94
T_{cold}	F	44,6	91,4	103,1
F_{cold}	GPM	0,55	1,20	1,70
T_{shower}	F	113	113	113
F_{shower}	GPM	2,64	2,64	2,64
Hot Water Savings			31%	55%
Heat Exchange Effectiveness			68%	86%

Note: data is for preheated water going to cold side of shower valve only. As cold water temperature rises, ratio of hot and cold water in shower changes.

Savings vs Flow

Savings vs Cold Water Flow Rate									Savings per shower			Savings per year	
Cold Water Flow (GPM)	M (lbs/s)	Tin (F)	Tout (F)	Q (kW)	Shower Length (min)	Q (kJ)	Q (kWh)	Q (therm)	Electric	Gas	Showers per year	Electric	Gas
2,64	0,4	41	84	16,72	10	10032	2,79	0,095	0,35 $	0,12 $	700	246,40 $	85,77 $
1,32	0,2	41	103	12,02	10	7210,5	2,00	0,068	0,25 $	0,09 $	700	177,10 $	61,65 $
1 Therm	0,90 $												
1 kWh	0,12 $												

Water Heater Efficiency	
Gas	0,70
Electric	0,95

Codes And Standards

- IAPMO PS-92-2008
- UL listing
- CSA standard; work in progress.

Government Grants

- Canada – EcoEnergy Program
  - $165 grant for heat exchanger with efficiency above 42%

Utility Rebates

- Gaz metro – Quebec $400 per unit
- SaskEnergy – Saskatchewan $150 per unit
- Minnesota Power - $400 per unit


THANK YOU.
For questions or comments, please email dvelan@ecodrain.com.