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Building Technologies Program

Building America
U.S. Department of Energy
Research Leading to Zero Energy Homes

Field Experience with Tankless Hot Water Heaters Used in Combination Space and Domestic Hot Water Heating Systems

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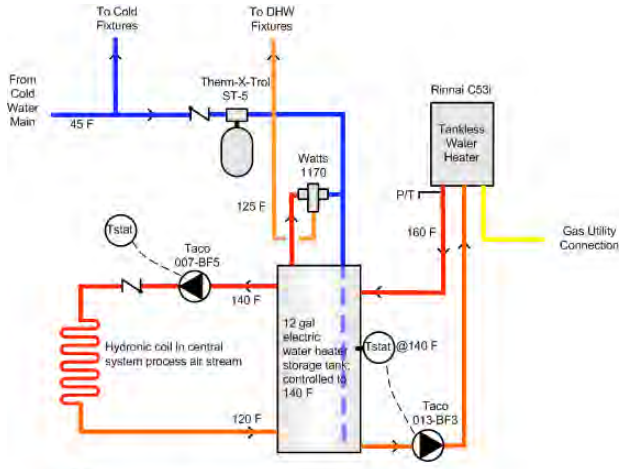
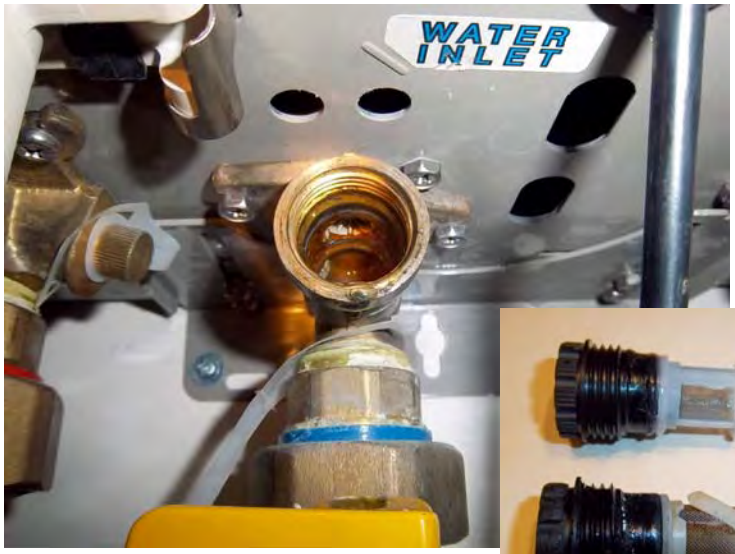
For:
ACEEE/DOE Hot Water Heating Forum
San Francisco, CA
May 12, 2011

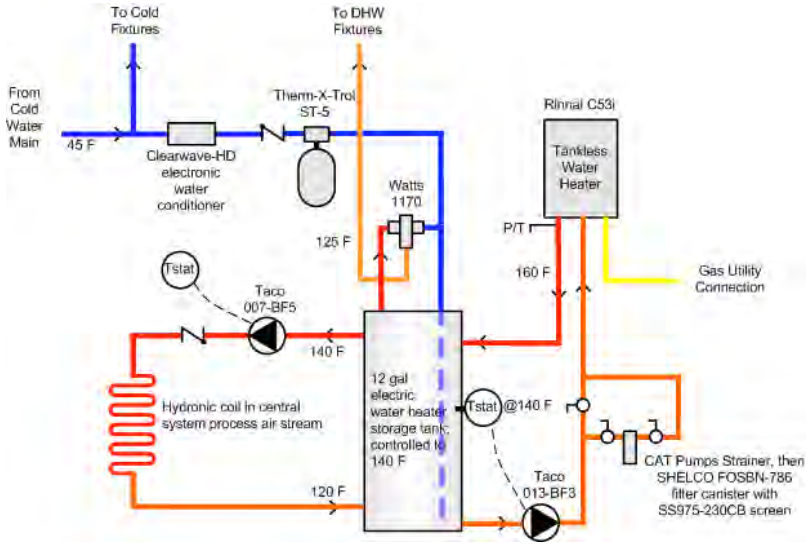


Notes:
1) Thermostat on electric water heater tank is wired to energize the Taco 013 circulator rather than the resistance element.
2) Taco 013 circulator is 1/8 HP and is capable of 5 gpm at 30' head, which is the design pressure loss recommended by Rinnai when pumping through their tankless water heater.
3) Electric water heater storage tank is available from Whirlpool at Lowe's, with all the ports necessary. The tankless water heater loop uses the drain valve and pressure/temperature relief ports. The space heating coil loop uses the available sides ports.
4) This configuration will have the most regulated temperature control at the domestic fixtures, compared to the passive storage system and the system without storage. This system will also have the least short-cycling of the tankless water heater.



Dried mineral precipitate from inlet strainer

Combi system with non-condensing gas-fired tankless heater
(PA installation with tankless heater pre-strainer added)



Wire Screen Mesh versus Micron Comparision Chart							
Mesh	**Micron**						
5	3000						
7.5	1980						
10	1480						
16	975						
20	750						
30	500						
40	375						
50	300						
60	238	Rinnai inlet strainer 60 mesh, Shelco strainer 230 micron					
80	175	CAT Pumps strainer 80 mesh					
100	149						
140	100						
200	74						
250	60						
270	50						
325	40						
400	35						

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$50 solution failed

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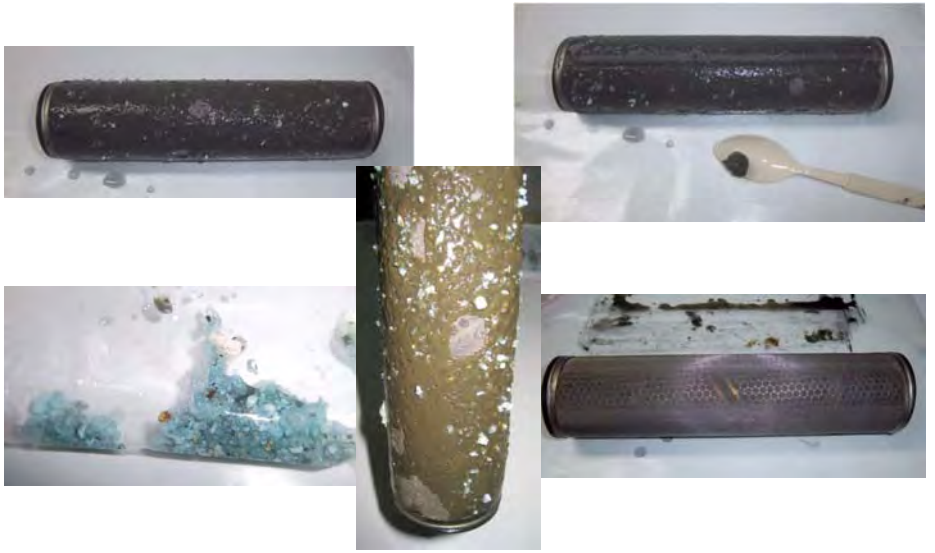
Mineral precipitate and crystals collected on Shelco 230 micron strainer, after about one year. Would have clogged the Rinnai strainer many, many times.



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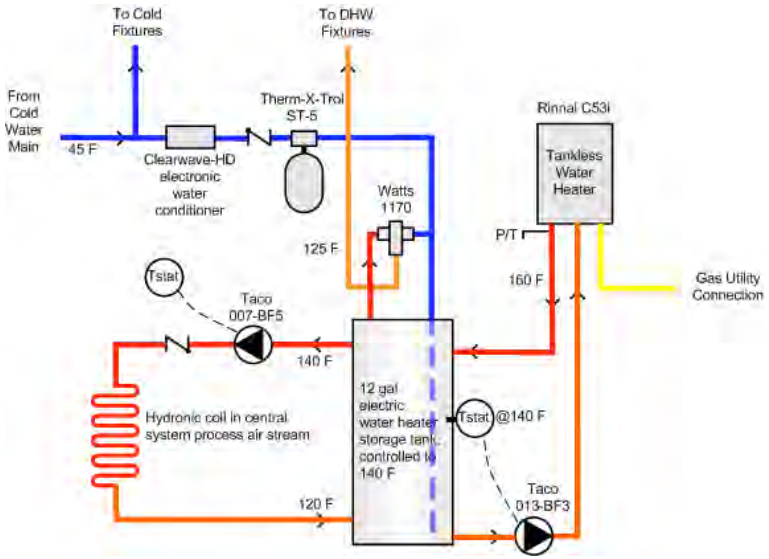
Combi system with non-condensing gas-fired tankless heater
(PA installation with water conditioner added)



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Scale removed from galvanized dielectric union fittings weeks after installation of electronic water conditioner

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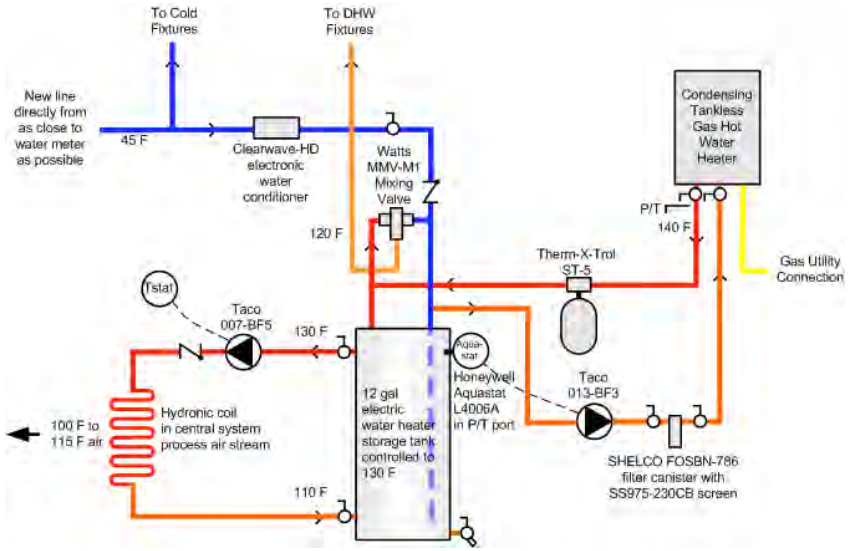
Combi system with condensing gas-fired tankless heater
(Installed in NYSERDA Utica, NY project in Fall 2010)



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Combination space and domestic hot water heating system with tankless gas water heater and small storage/manifold tank. Installed at NYSERDA deep energy retrofit project in a 2-family building in Utica, NY.

Rinnai RC 80 H.P.I O.D.H.

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Rinnai 045 AHB Hydronic Air Handler (ECM fan)

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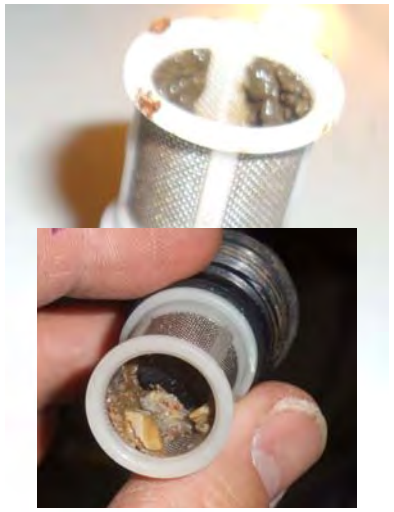
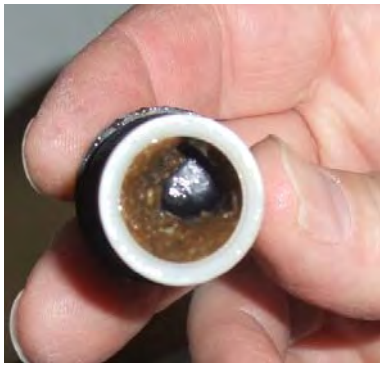
Cost (sealed bid)

Group [A] Heating system
Labor: $1,728 plus Materials: $5,000

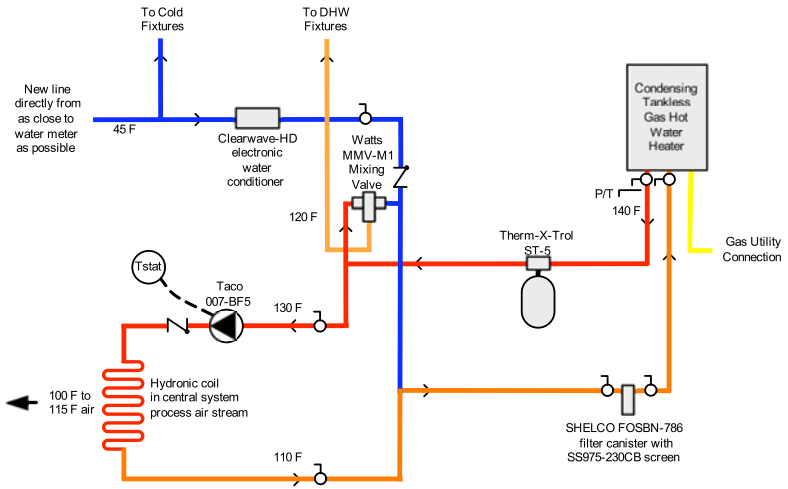
Group [A]
2 Rinnai RC 80 H.P.I O.D.H.
2 plumbing kits
2 termination kits for Rinnai
2 10” vent extensions (polypropylene)
2 whirlpool 12 gallon hot water tanks
2 Therm-x-trol St-5 expansion tanks
2 mixing valves
2 clearwave H.D. electronic water conditioners
2 Y strainers- Watts 351 M (stainless steel)
2 taco Brass 007 Pumps
2 Taco S.S. 013 Pumps
2 Rinnai 045 AHB Hydronic Air Handler
4 Flow check Valves
2 ½” Drain valves
14 ¾ “ ball valves
2 Lex Pro 511 C T-Stat
All copper tubing and fittings to complete install
All electrical wire and boxes, switches, breakers

Same operational problems with inlet strainer clogging, plus more!

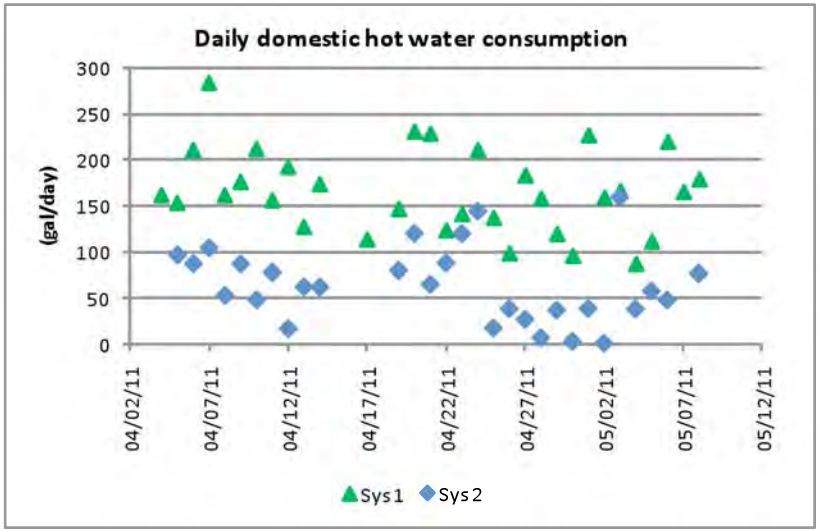




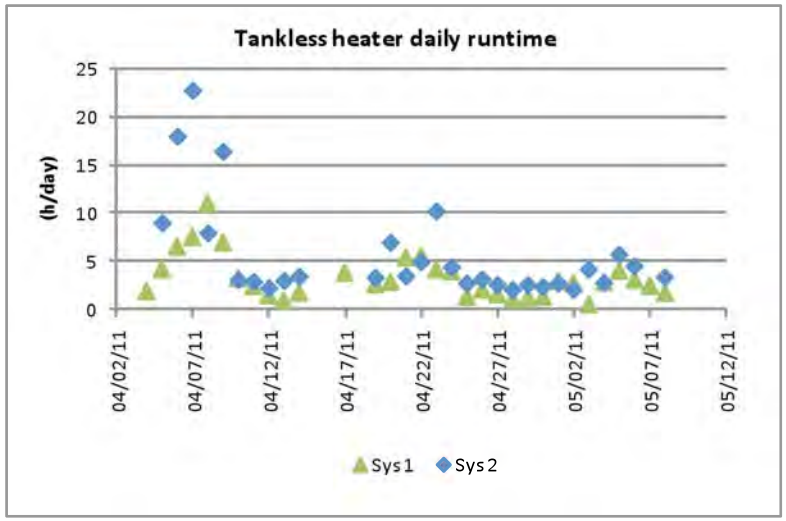
Combi system with condensing gas-fired tankless heater, Small storage tank removed
(modified in NYSERDA Utica, NY project in Winter 2011)



Hot water consumption was higher for System 1 (no tank)



Water heater daily runtime was similar for both systems



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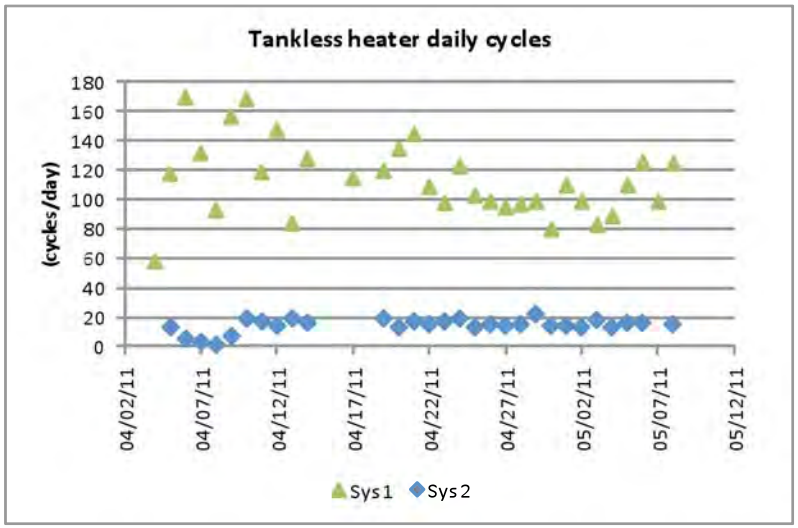
Water heater cycles per day was <u>much</u> higher without the tank



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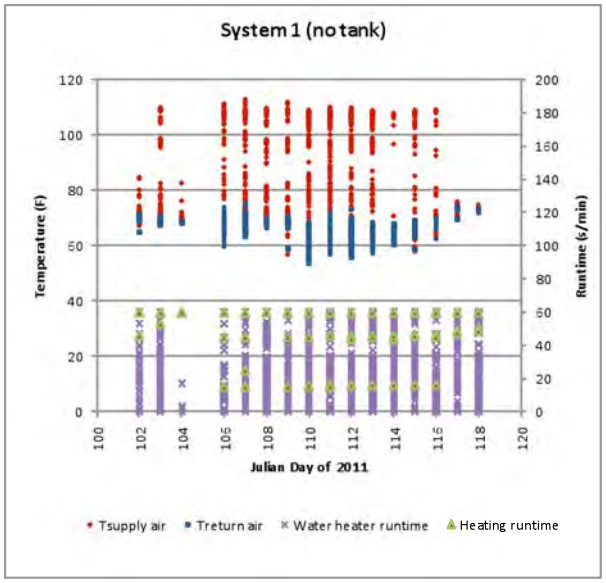
System without tank has wide range of supply air temperature



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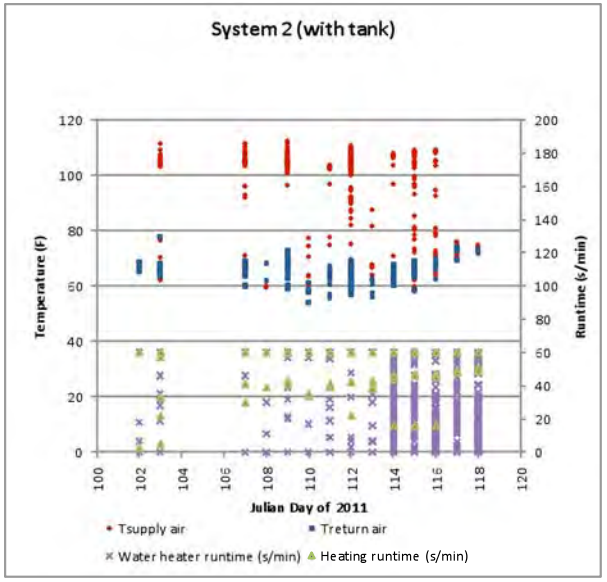
System with tank has narrow range of supply air temperature



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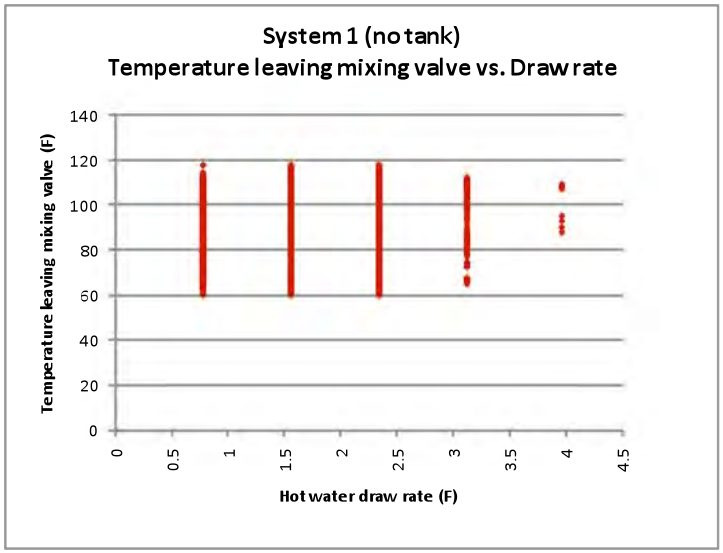

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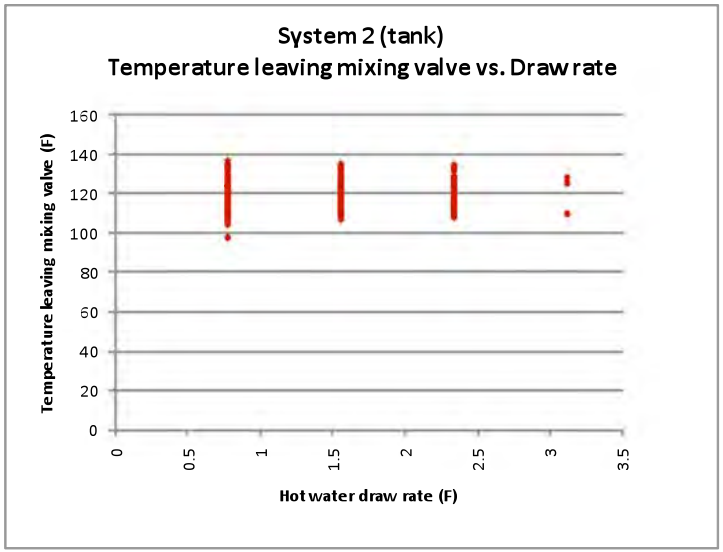

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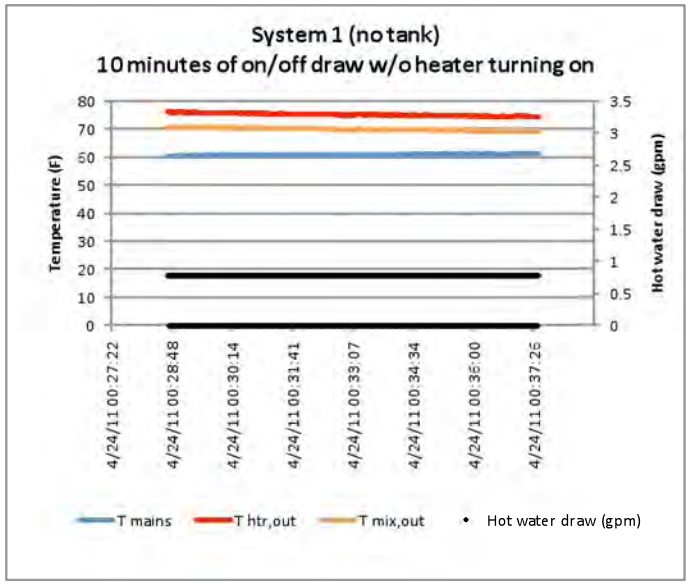
System without tank provides room temperature water at low draw rates



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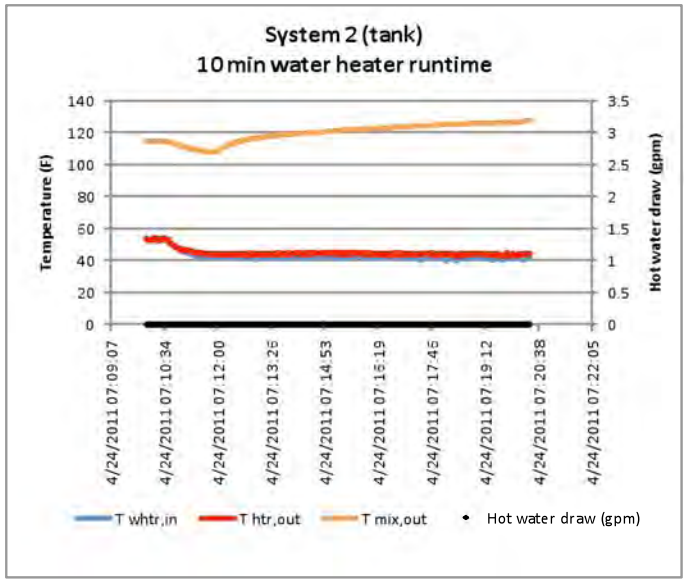
System with tank provides consistent hot water even at low draw rates



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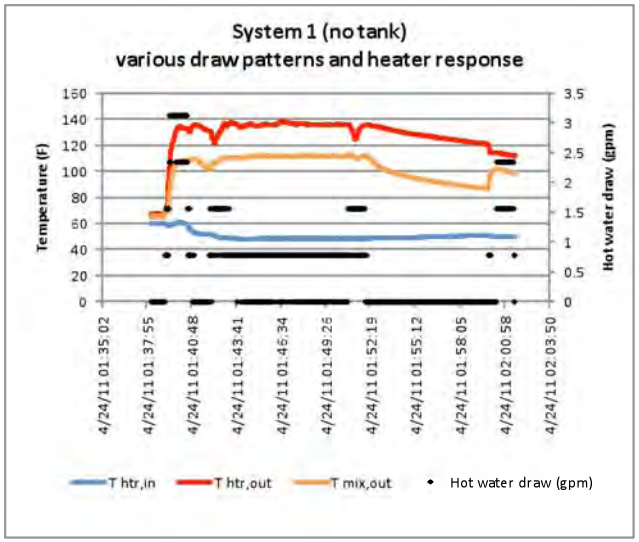

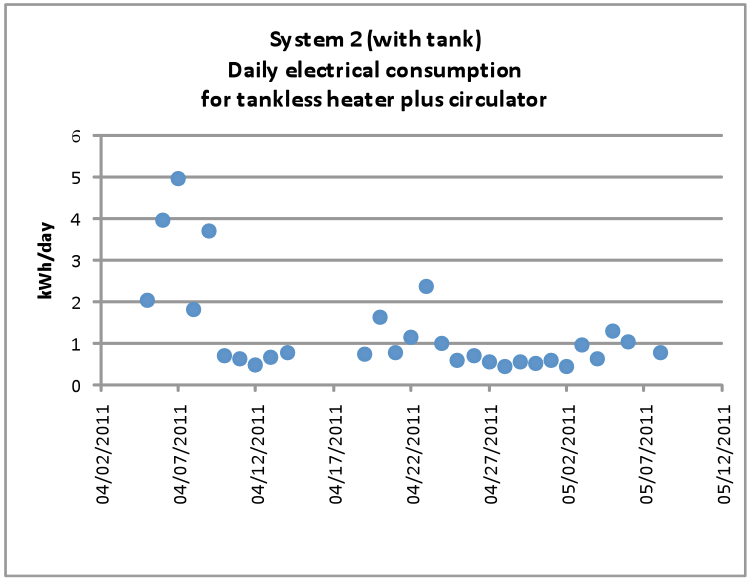

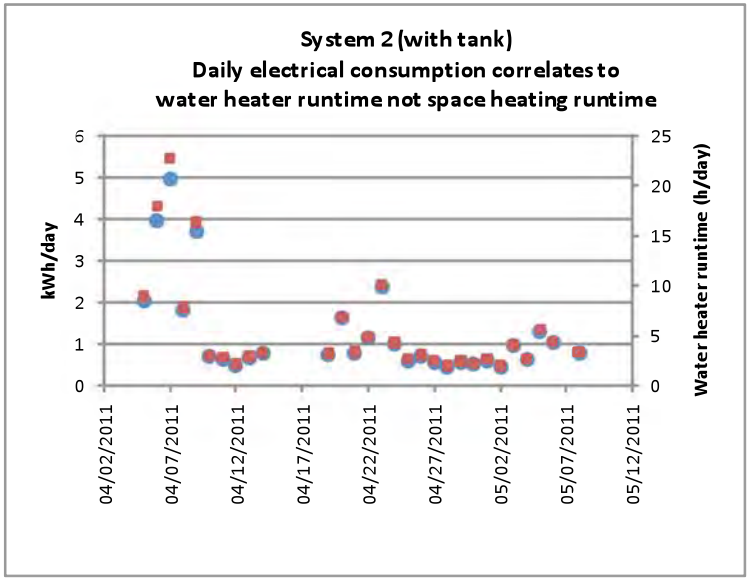

Thank you!

Questions?