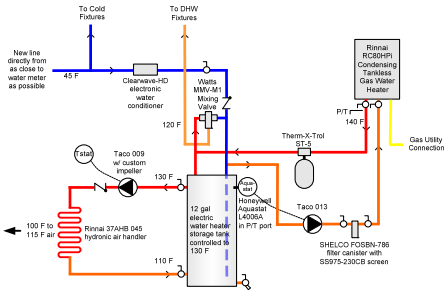

Combined Systems with Tankless Water Heaters

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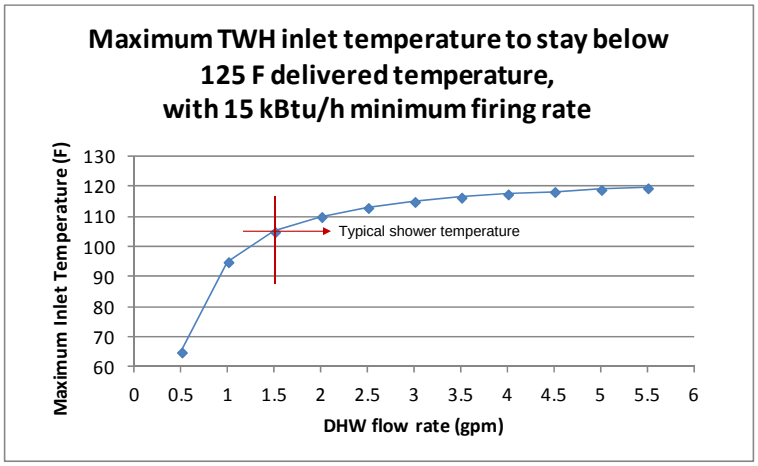
Residential Energy Efficiency Stakeholder Meeting
2/29 – 3/2/2012 Austin, Texas

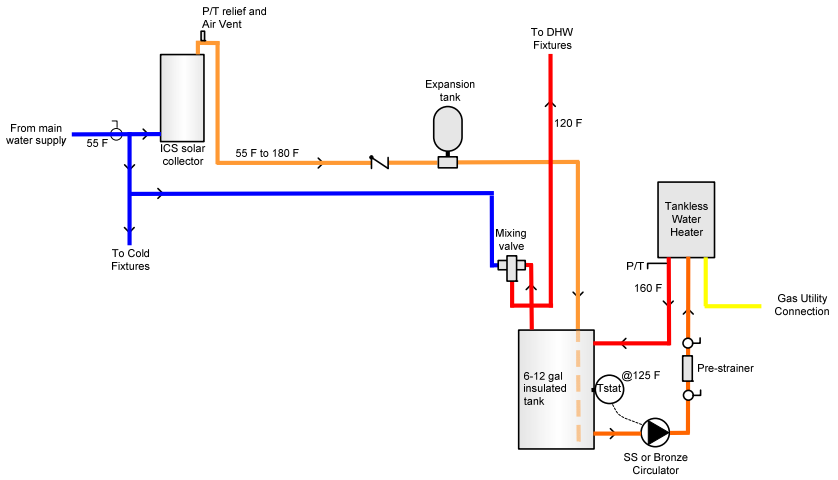
More builder's wanting to use gas-fired tankless water heaters, and with solar pre-heat

- Endless hot water
- Helps HERS Index
- Space saving

Problem with elevated TWH inlet temperature



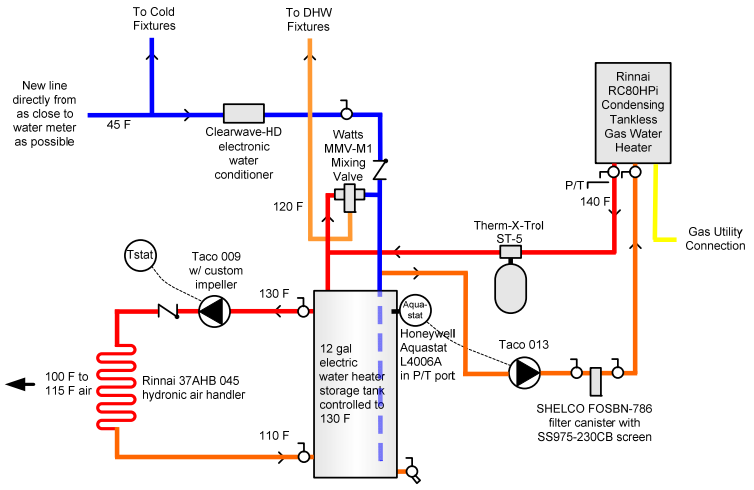
Small, insulated, buffer/manifold tank between solar pre-heat and TWH



If the TWH is a builder choice, what about using it for space heating as well?

- No capacity or DHW priority issues, as there are for lower capacity storage type water heaters
- Space saving
- If there will already be a condensing TWH, then:
  - a TWH combination heating system with a buffer tank, as described here, costs about $350 more than a condensing furnace heating system
  - a TWH combination heating system without a buffer tank costs about $400 less than a condensing furnace heating system
  - a TWH combination heating system with a buffer tank is $2000 or more less than a combination system using a boiler and indirect water heater
- Operating costs may be similar
- The difference really comes down to the question of DHW satisfaction without the buffer tank

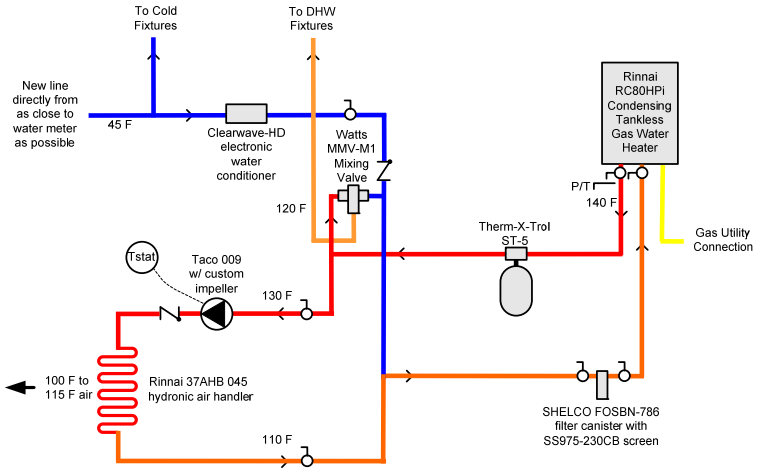
Combination heating system with small, insulated, tank between water main and TWH



Two-family Combination System with
Rinnai RC80 HPI ODH Tankless Water Heater
Rinnai 045 AHB Hydronic Air Handler (ECM fan)

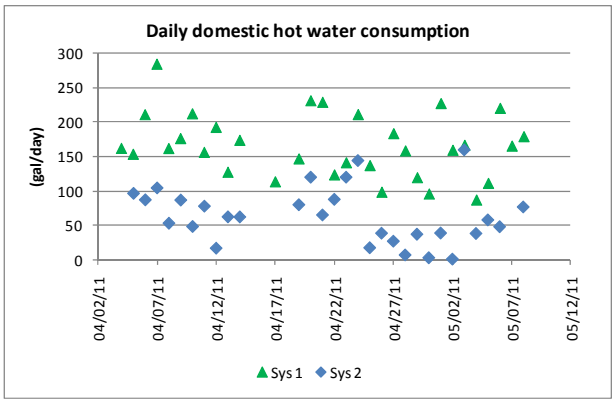
Worked well for 3-weeks then the TWH inlet strainer started clogging

Experimented with clogging problem by taking the tank out for one of the two systems

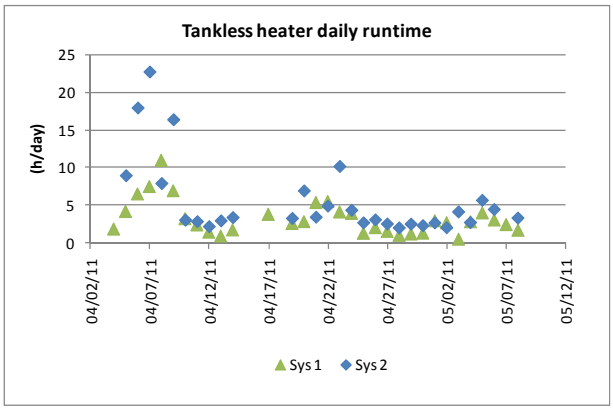


Provided an ideal opportunity for performance comparison

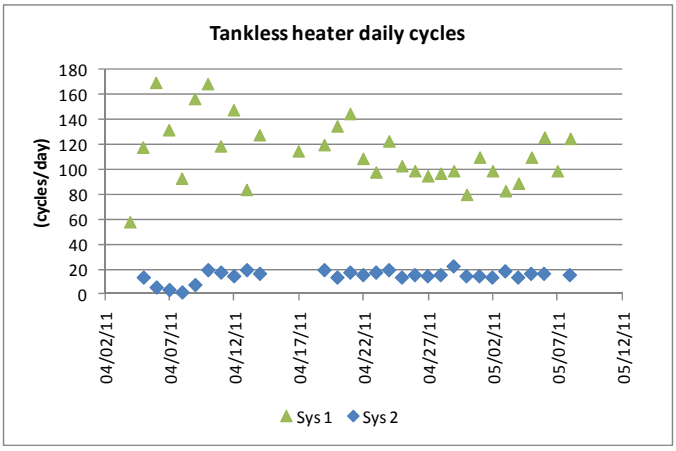
Daily hot water consumption was nearly two times higher for System 1 (no tank)



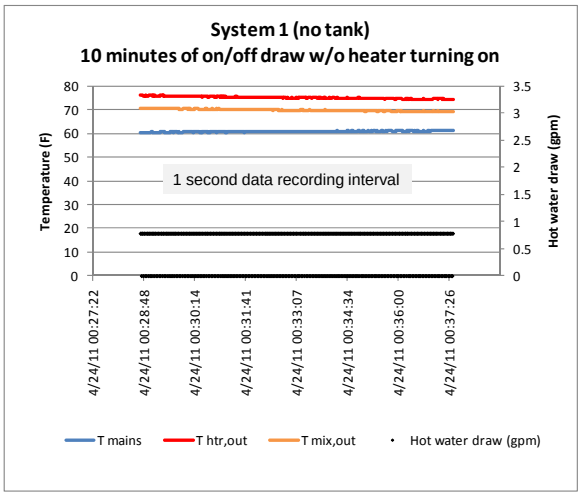
TWH heater daily total runtime was about the same for each System



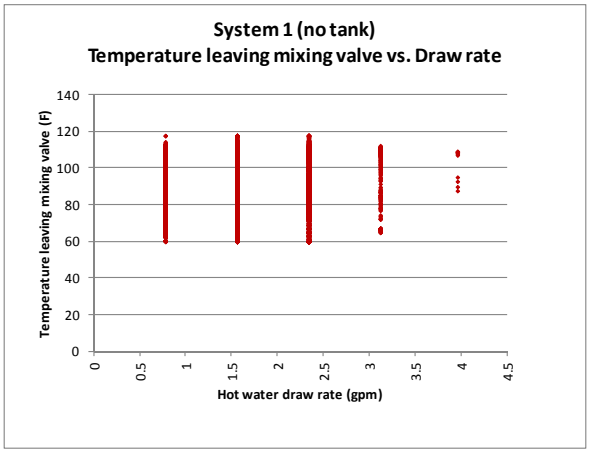
But, TWH heater daily total cycles was nearly 10 times more for System 1 (no tank)



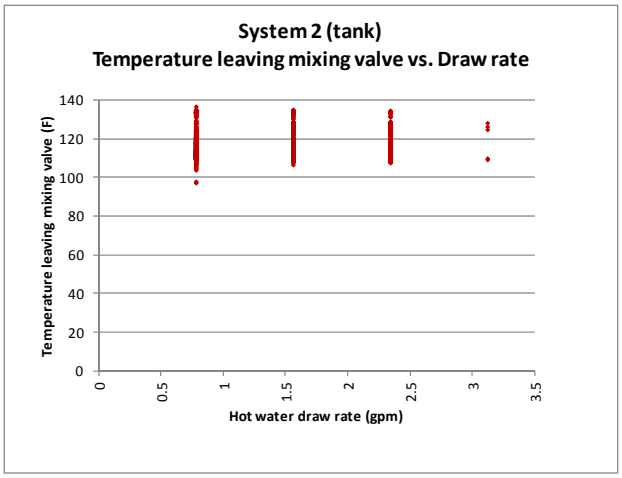
The System 1 TWH frequently did not fire before the DHW draw was over, such that room temperature water was commonly delivered during short, low draw rates



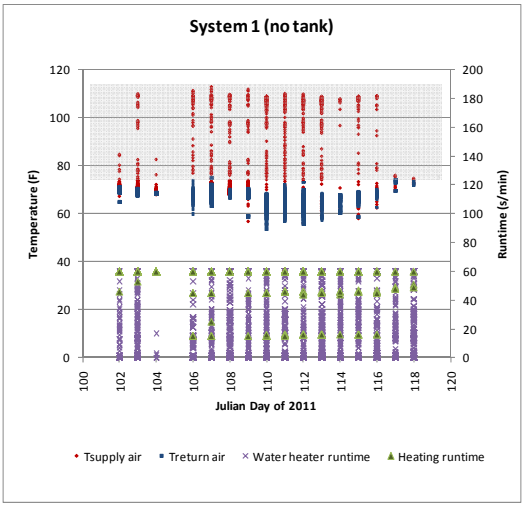
Because DHW delivery temperatures were often so low, System 1 occupants ran water longer and at higher flow rates while waiting for hot water



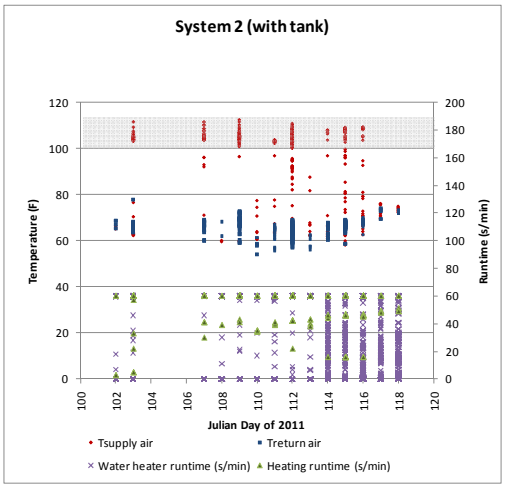
System 2 delivered hot water consistently and in a tighter range



System 1 also had a wide and uncomfortable range of heating supply air temperatures



System 2 showed a comfortable range of heating supply air temperatures within the design range



We worked through aluminum vs. magnesium anode rod issues, and dirty utility water, but are now expecting a 1 yr maintenance interval

At the homeowner's request, the tank was recently returned to System 1, and we are continuing to collect data

Gaps, Barriers, and Future Work

- ✓ Determine whether there is a significant DHW and space heating delivery performance difference between TWH combination heating system with and without an active buffer tank
- ✓ Work through prototype design and application, and TWH inlet strainer maintenance issues, continue to monitor that
- Need for further cost reduction through application of smaller buffer tank, less expensive circulator, and less expensive pre-strainer
- Use field data to gain a better understanding of occupant behavior to compensate for the difference in performance with and without a buffer tank
- Use field data to gain a better understanding of actual DHW and space heating efficiency