

### Combined Systems with Tankless Water Heaters

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March 7, 2012 Boston, MA



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

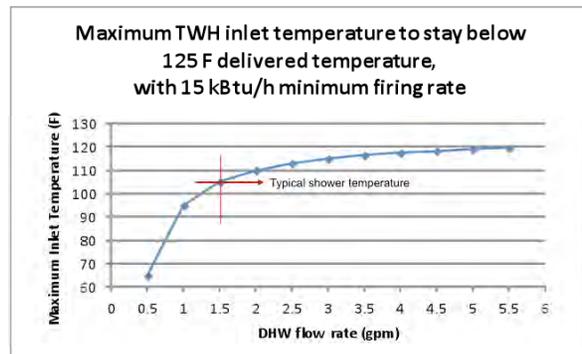
- Endless hot water
- Helps HERS Index
- Space saving

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### Problem with elevated TWH inlet temperature

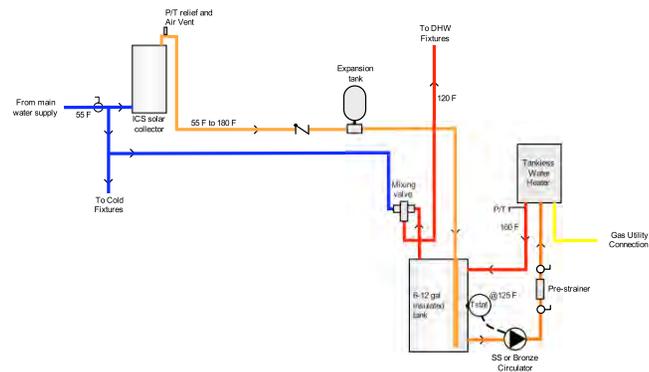


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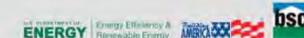


### Small, insulated, buffer/manifold tank between solar pre-heat and TWH



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

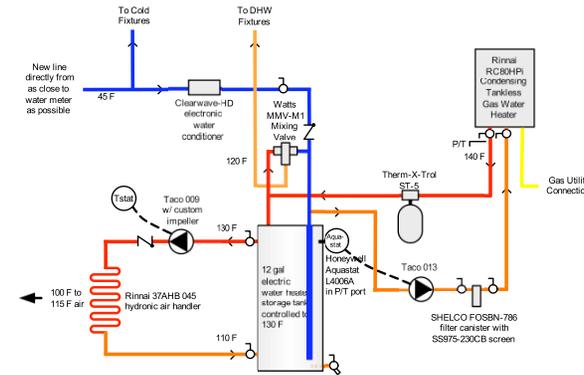
- ❑ No capacity or DHW priority issues, as there are for lower capacity storage type water heaters
- ❑ Space saving
- ❑ If there will already be a condensing TWH, then:
  - ❑ a TWH combination heating system with a buffer tank, as described here, costs about \$350 more than a condensing furnace heating 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

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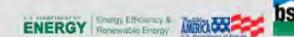


**Combination heating system with small, insulated, tank between water main and TWH**



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

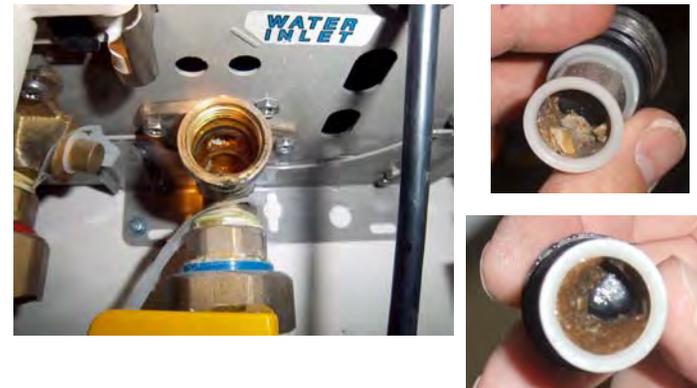


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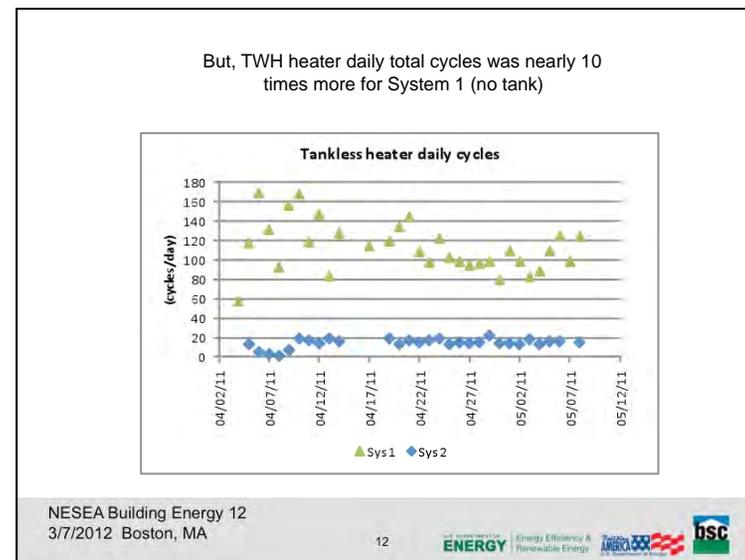
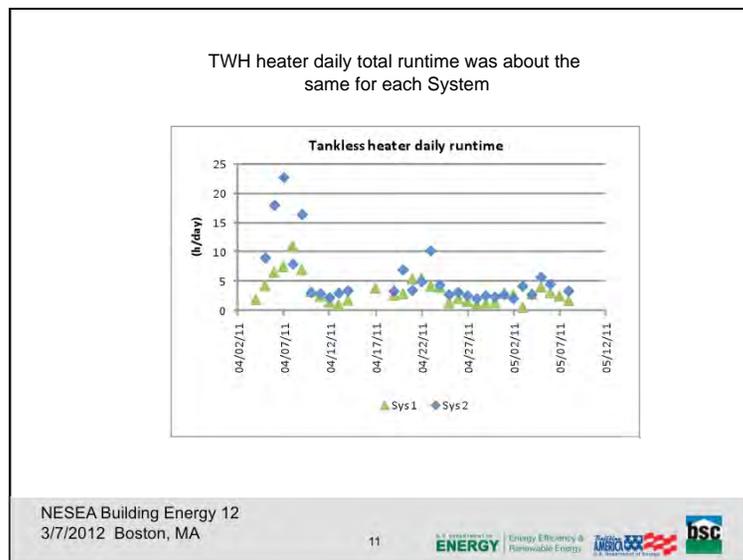
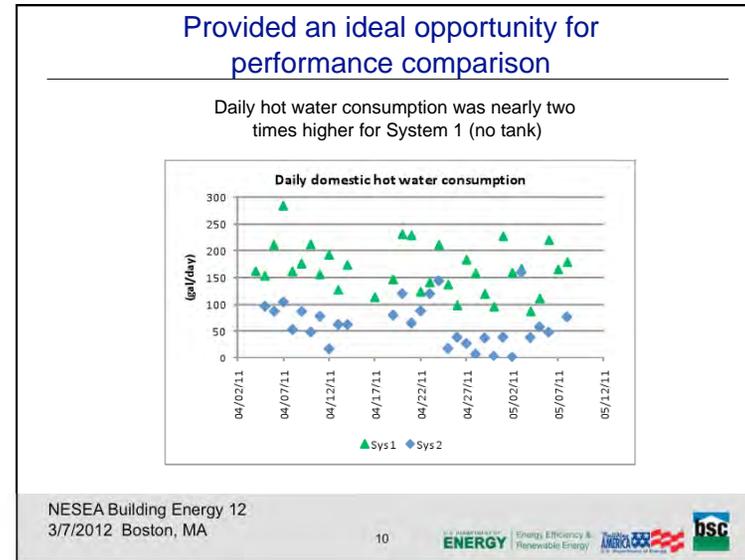
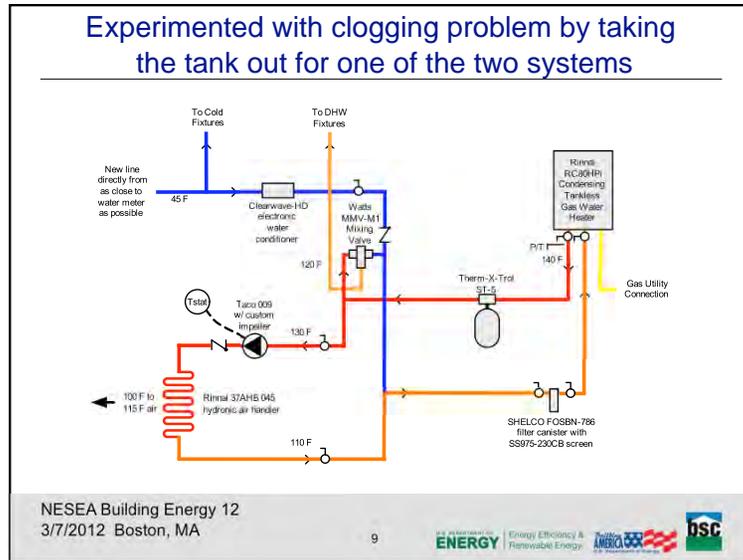
**Worked well for 3-weeks then the TWH inlet strainer started clogging**



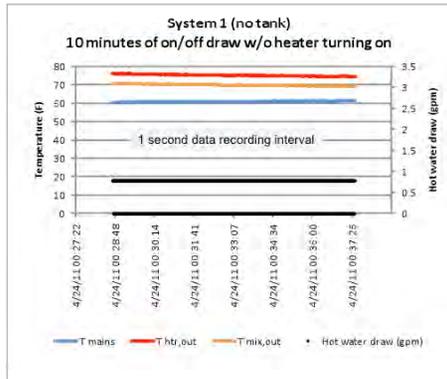
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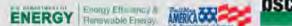


The System 1 TWH frequently did not fire before the DHW draw was over, such that room temperature water was commonly delivered during short, low draw rates

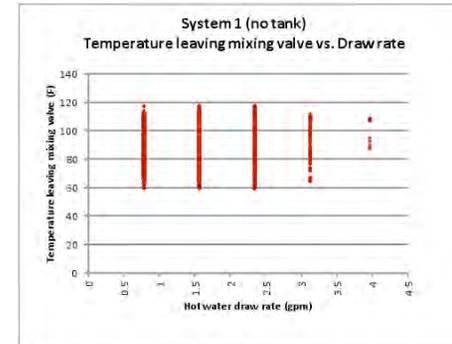


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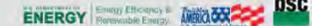


Because DHW delivery temperatures were often so low, System 1 occupants ran water longer and at higher flow rates while waiting for hot water

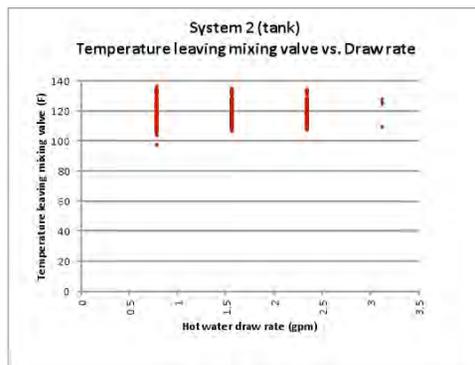


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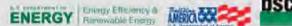


System 2 delivered hot water consistently and in a tighter range

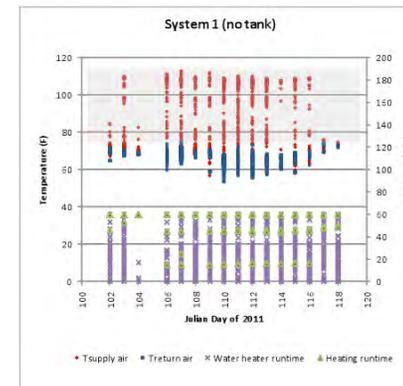


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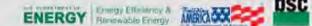


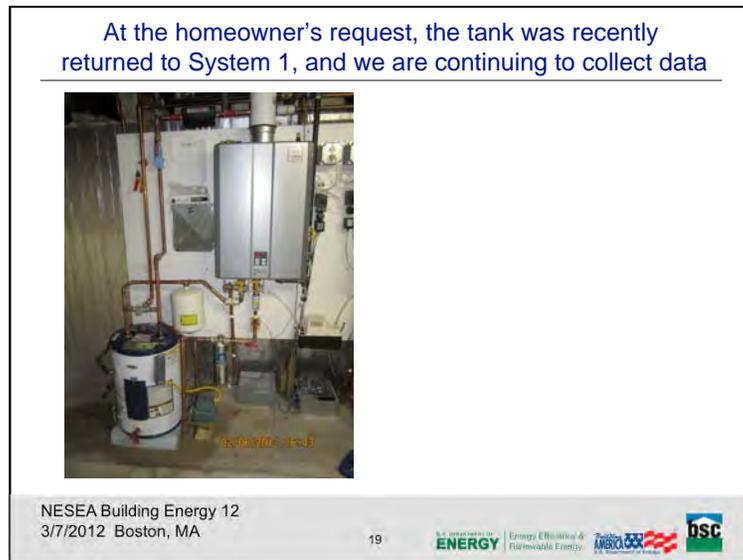
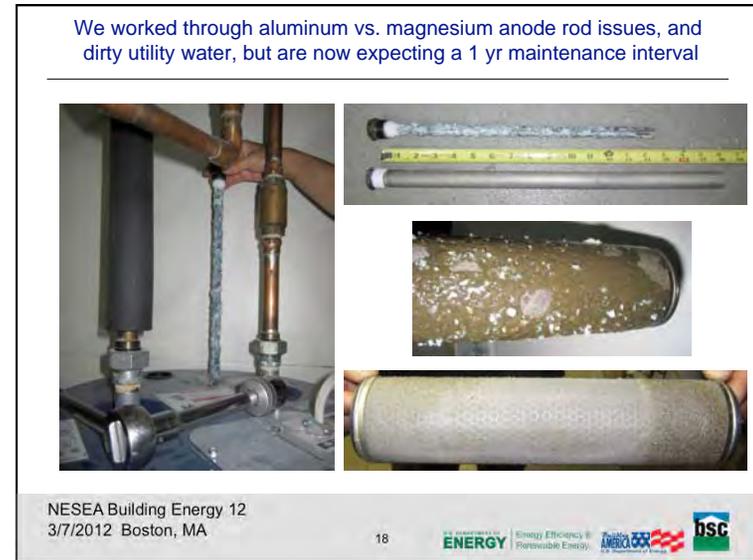
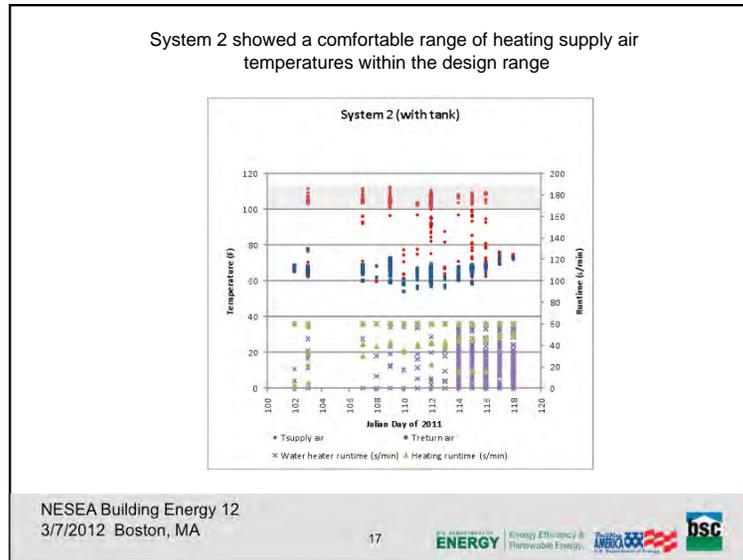
System 1 also had a wide and uncomfortable range of heating supply air temperatures



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- ### 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
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