

# Field Performance of Hybrid Gas Water Heaters

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# Sponsors and Partners

- NorthernSTAR - A DOE Building America Research Team
- Sustainable Energy Resources for Consumers Grants



- Center for Energy and Environment
- Minnesota Division of Energy Resources





# Outline

- Water heater description
- Field study introduction
- System performance
- Efficiency
- Cost
- Savings



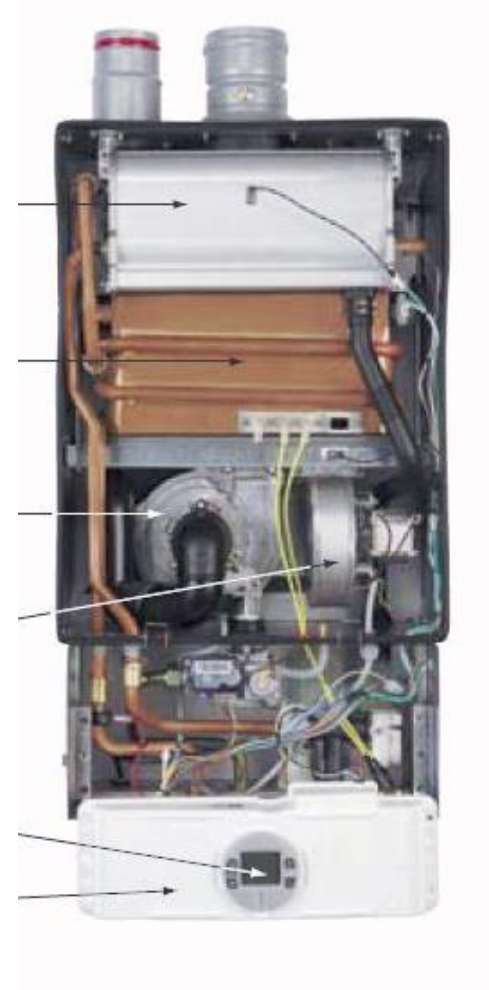
# Water Heater Types

- Storage
  - High stand by loses
  - Can “run out” of hot water
  - Dead-band of water temperatures
  - + Water starts hot
  - + Consistent water temperature  
for an event



# Water Heater Types

- Tankless
  - + Energy efficient
  - + No stand by loses
  - + small footprint
  - Delay at start up
  - Cold water sandwich
  - High install cost



# Water Heater Types

- Hybrid
  - Energy efficiency of tankless
  - Water delivery of storage
  - Smaller burner to reduce cost



# Hybrid Gas Water Heaters

<b>Brand</b>	<b>Model</b>	<b>Thermal Efficiency</b>	<b>EF</b>	<b>Input Rate</b>	<b>Volume</b>
				<b>Btu/hr</b>	<b>gal</b>
Navien	NPE-240A	n/a	0.97	19,000 - 199,900	0.5
Eternal	GU120	96%	0.94	18,000 - 120,000	2
	Pre-commercial	n/a	0.96	100,000	12
Rinnai	RH180	80%	n/a	59,500 - 91300	40

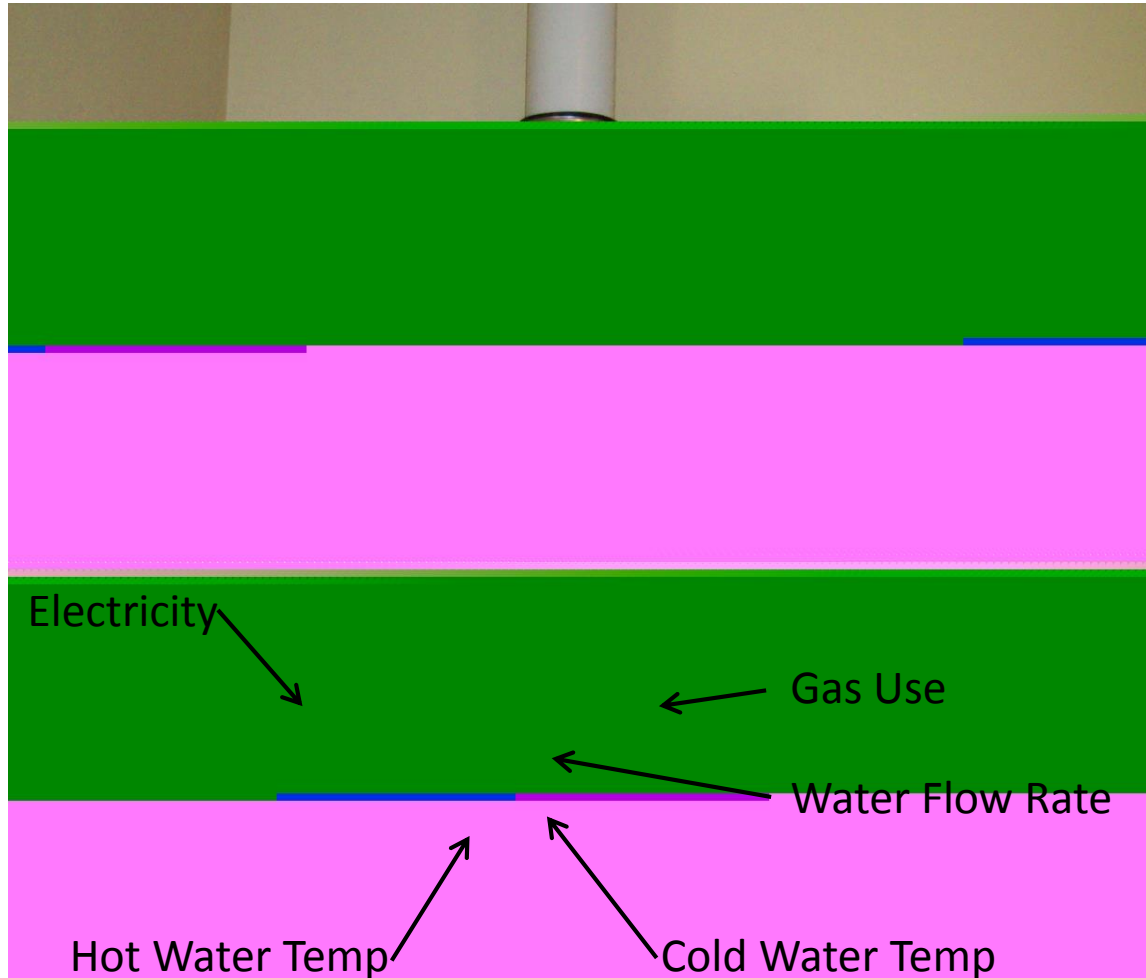


# Natural Gas Water Heater Field Studies

- Four projects that included detailed water heating field data in last 5 years
  - 28 natural draft storage water heaters
  - 8 non-condensing tankless water heaters
  - 9 condensing tankless water heaters
  - 9 condensing storage water heaters
  - 6 condensing hybrid water heaters
  - 1 non-condensing hybrid water heaters
  
- 61 different water heaters in 34 different homes!



# Installation



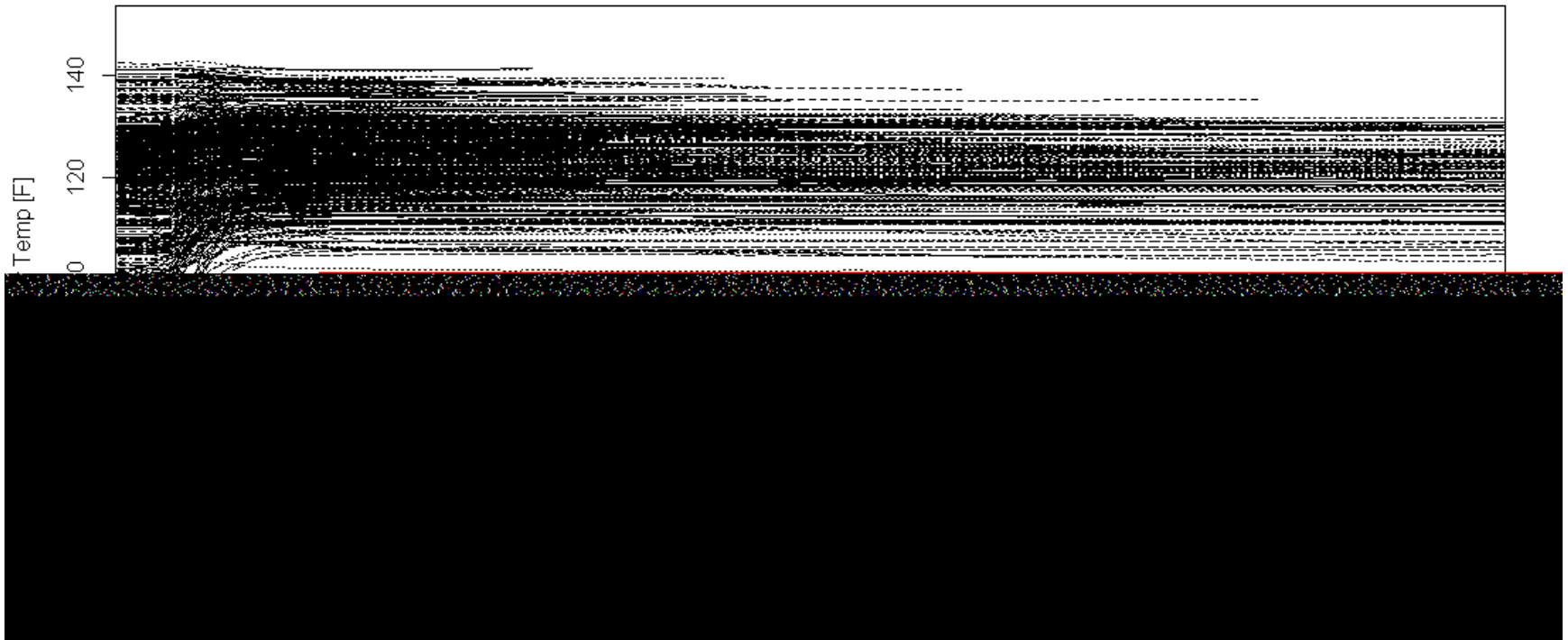


# Appliance Characterization

- Can hybrids provide consistent water temperatures?
- Can hybrids meet biggest residential loads?
- Can hybrids provide the energy efficiency desired?
- Can they do all this with lower install costs than other high efficiency water heaters?

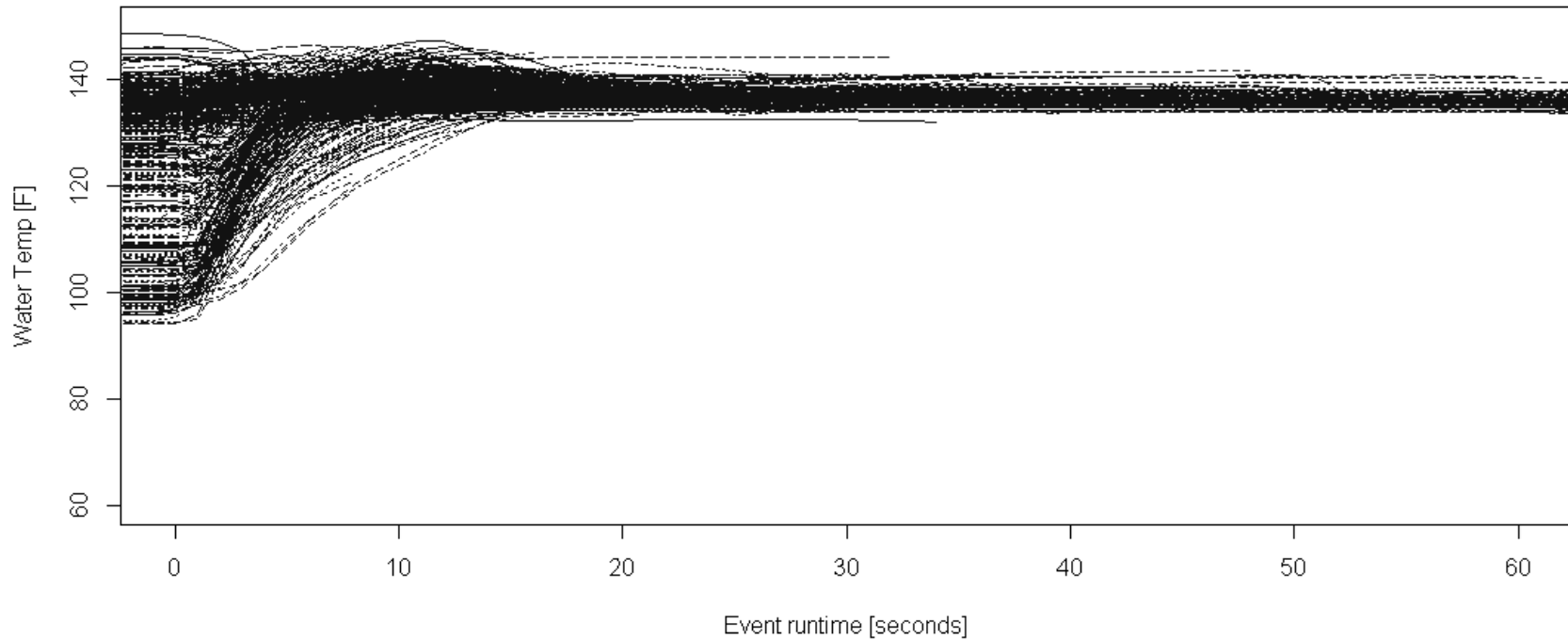
# Water Temperature

- Natural draft **storage** water heater



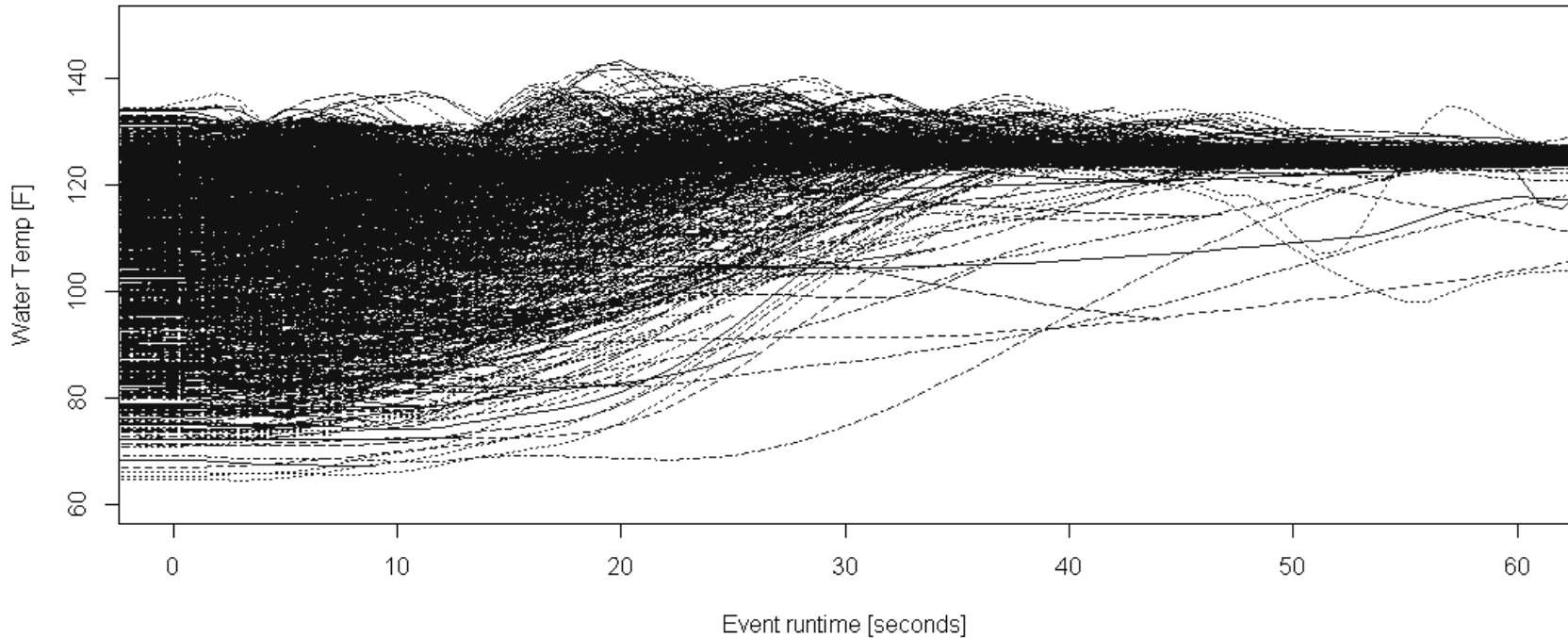
# Water Temperature

- Condensing **storage** water heater



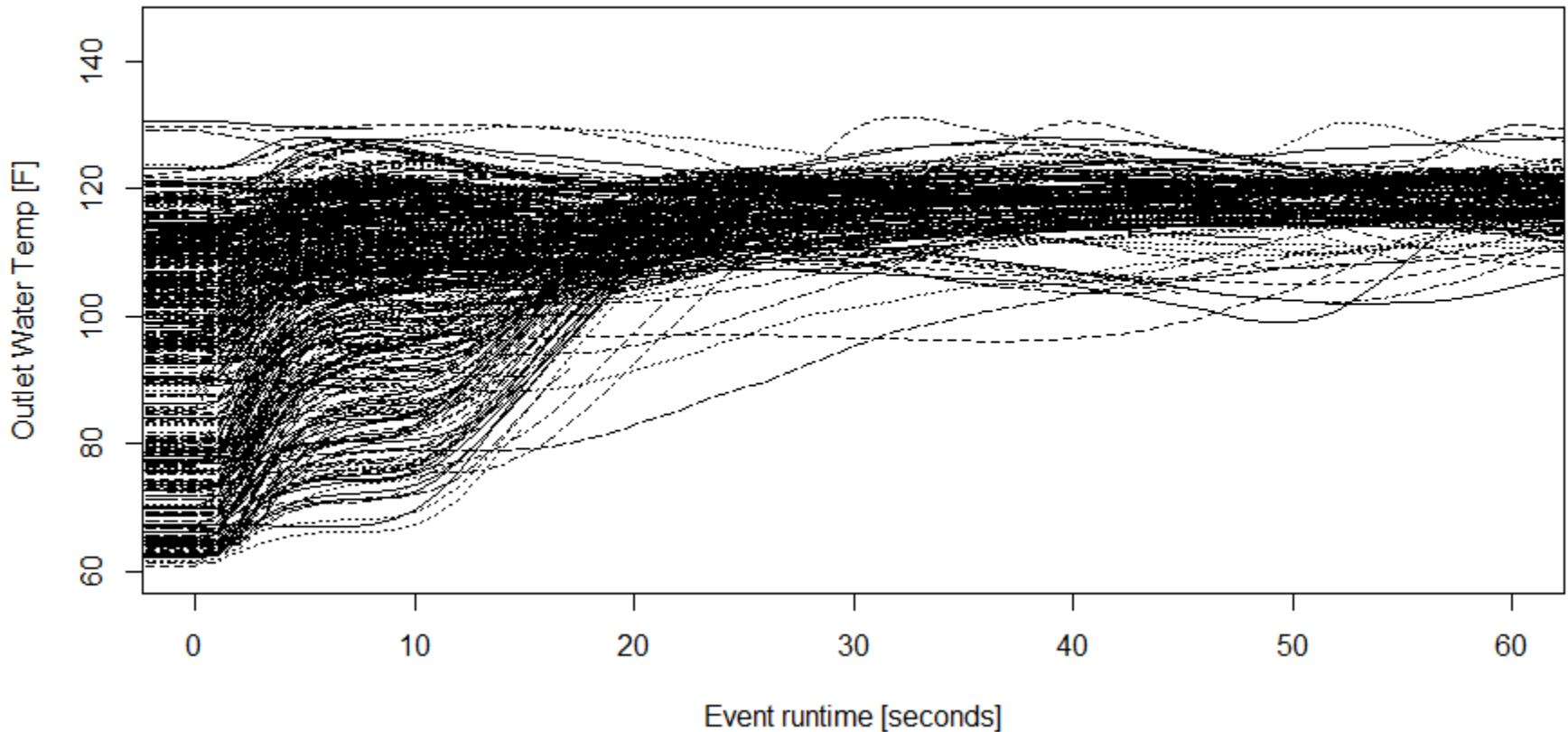
# Water Temperature

- Condensing **tankless** water heater



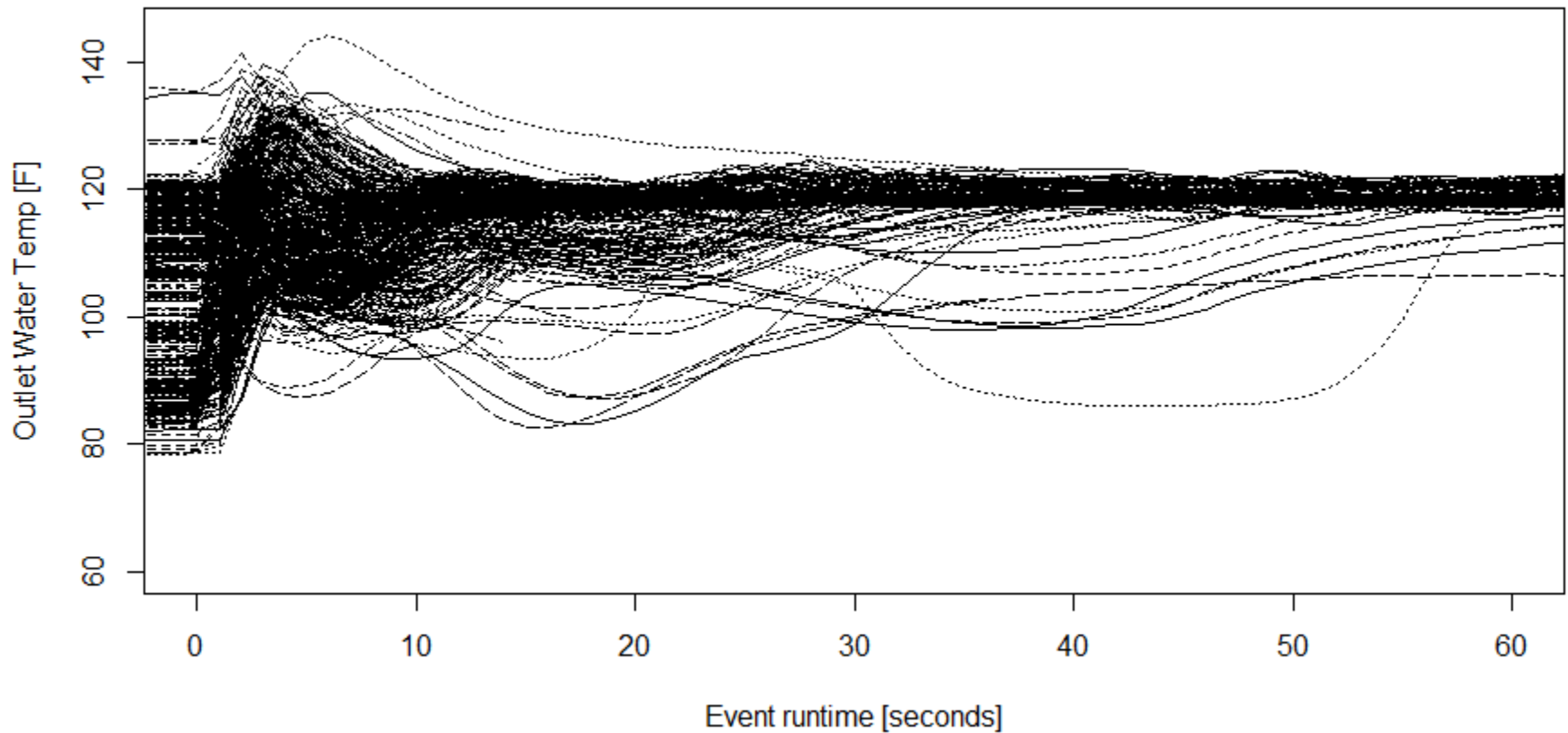
# Water Temperature

- Condensing **hybrid** water heater
  - ½ gallon & up to 199,000 Btu/hr



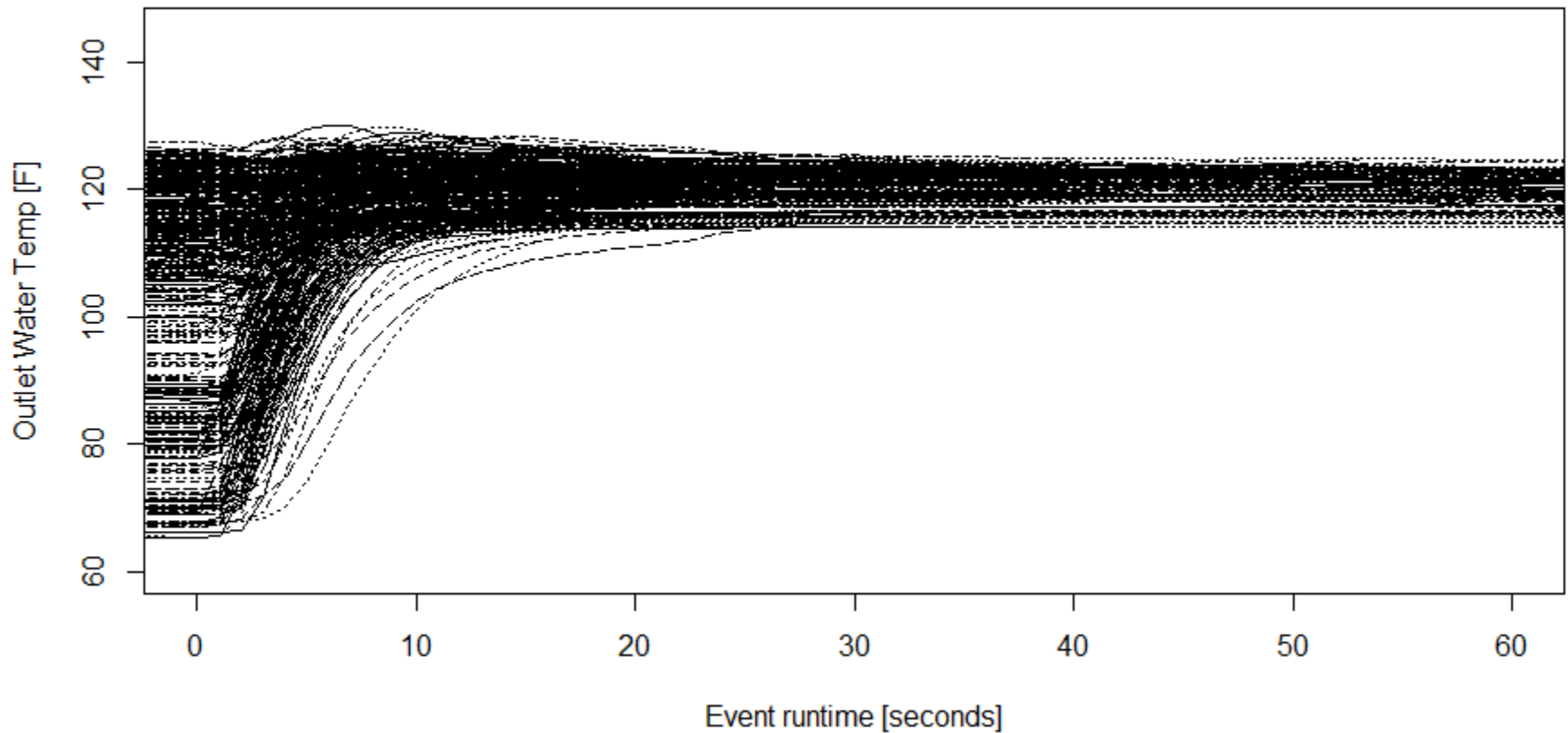
# Water Temperature

- Condensing **hybrid** water heater
  - 2 gallon & up to 120,000 Btu/hr



# Water Temperature

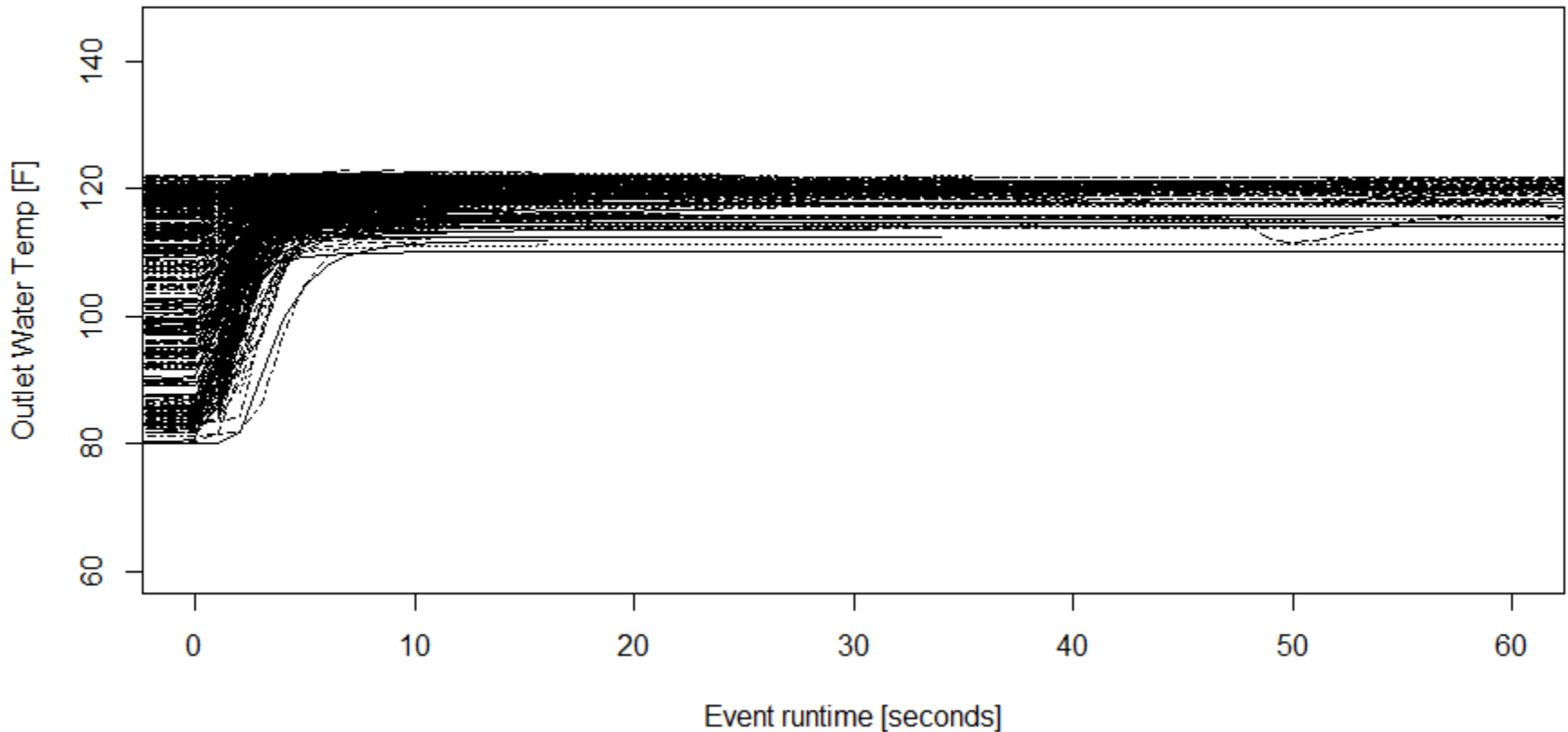
- Condensing **hybrid** water heater
  - 12 gallon & 100,000 Btu/hr





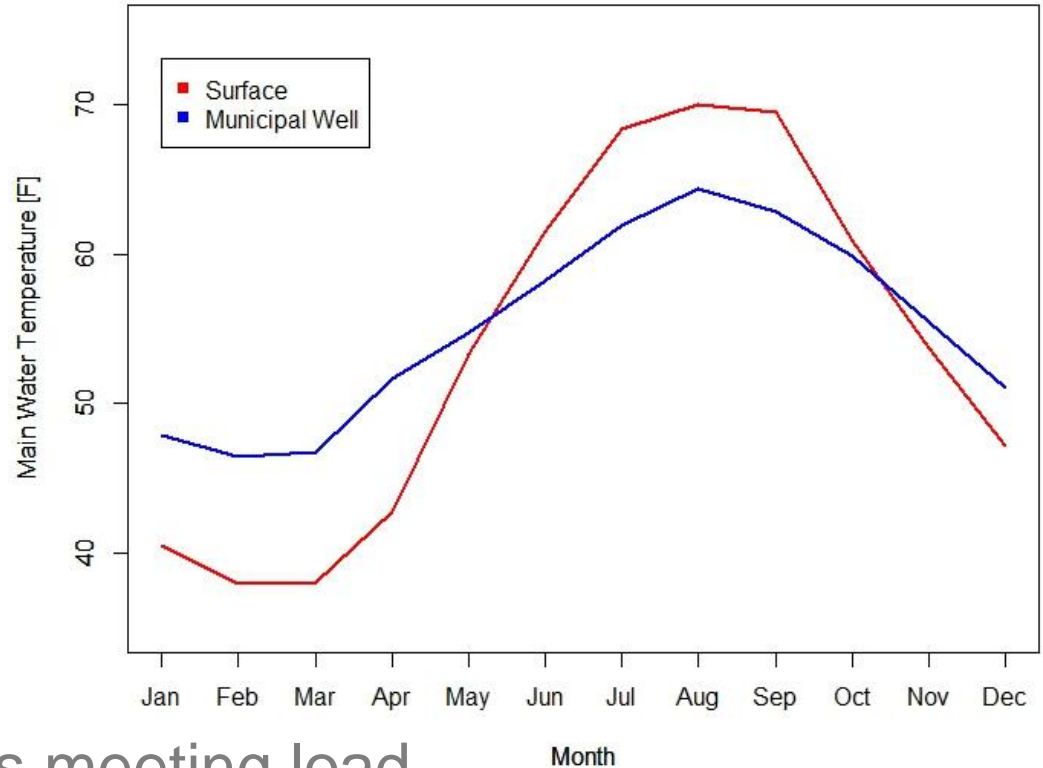
# Water Temperature

- **Hybrid** water heater
  - 40 gallon & up to 95,000 Btu/hr



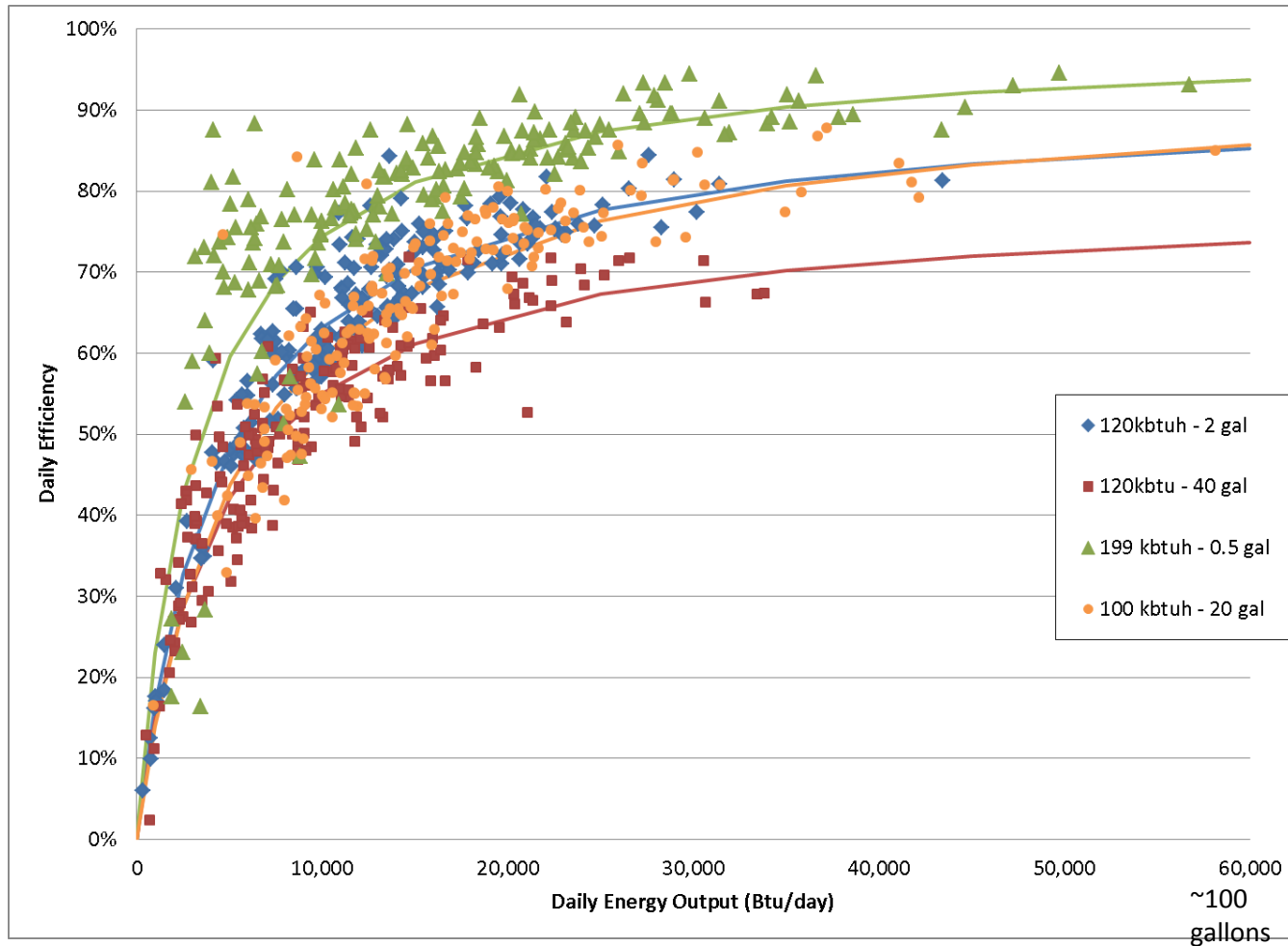
# Seasonality Impacts

- Winter Shower:
  - 67,000 Btu/hr
- Summer Shower:
  - 40,000 Btu/hr

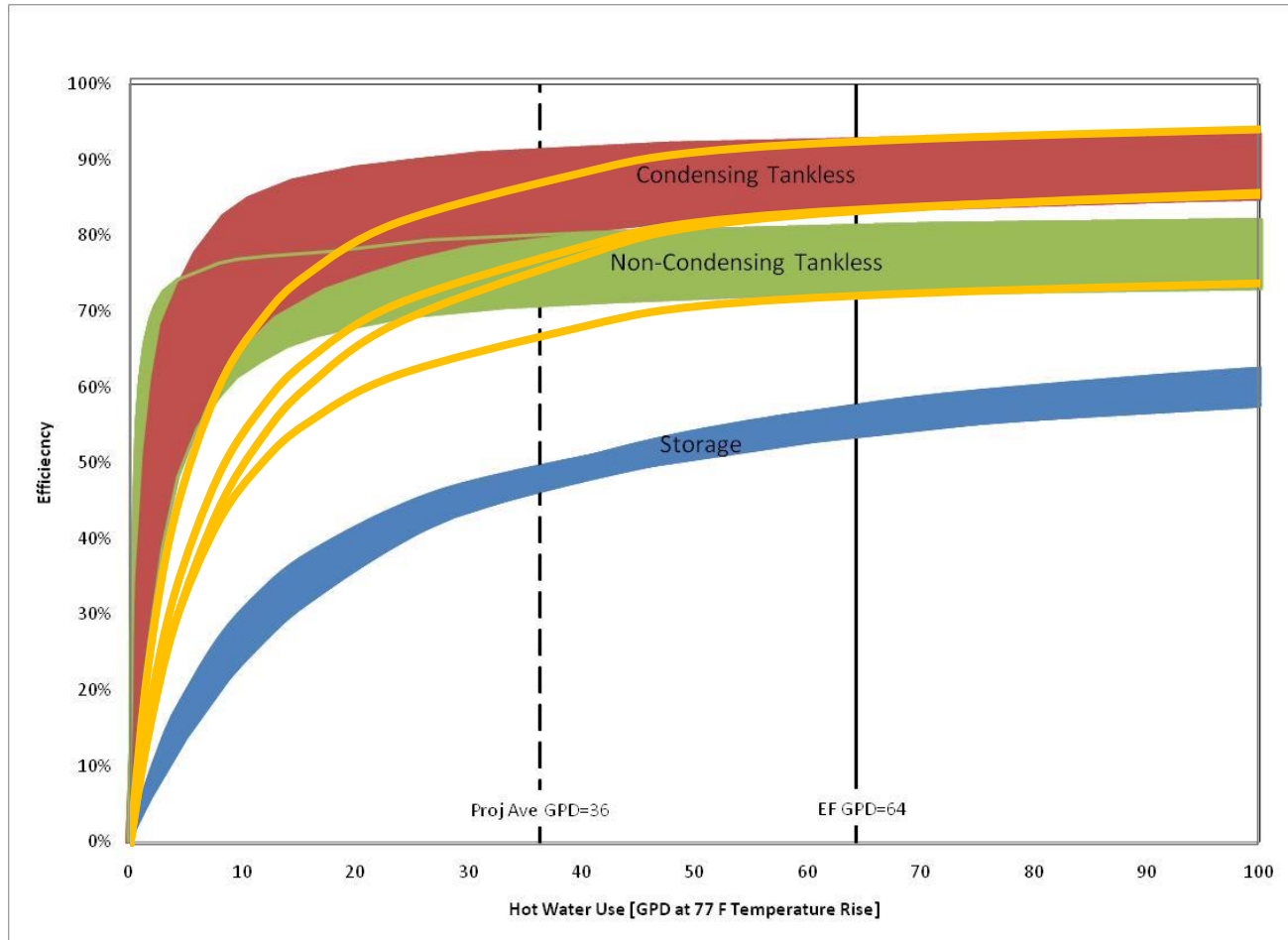


- Units had no issues meeting load
- None of the hybrid WHs fired at over 100,000 Btu for more than 10% of the time

# Efficiency

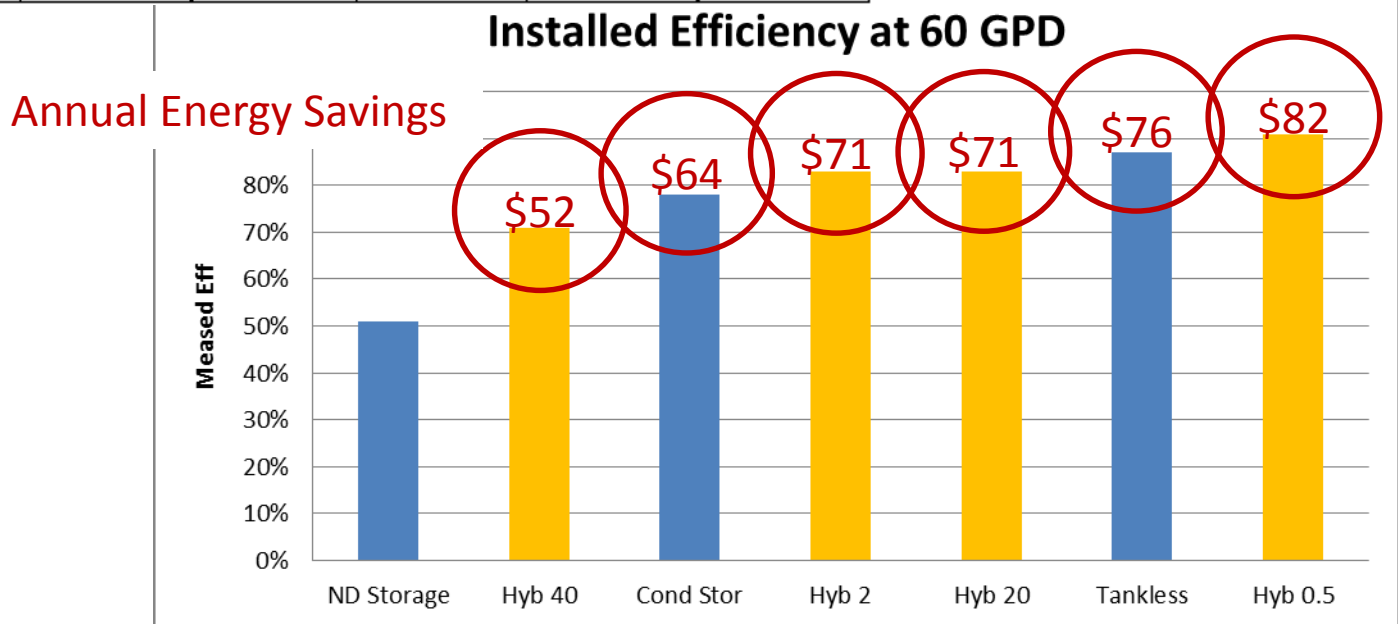


# Compared to other gas products



# Annual Performance Summary

	Input Rate	Volume	Them Eff	EF	Eff at 30	Eff at 60
	Btu/hr	gal			GPD	GPD
Hybrids	19,000 - 199,900	0.5		0.97	0.84	0.91
	18,000 - 120,000	2	96%	0.94	0.74	0.83
	100,000	20		0.96	0.73	0.83
	59,500 - 91300	40	80%		0.64	0.71
ND Storage	40,000	40		0.59	0.4	0.51
Tankless	19,000 - 199,900	0		0.95	0.84	0.87
Cond Stor	120,000	50	96%		0.65	0.78





## Costs

- Equipment cost similar or less than other condensing products.
- Eliminated all gas line upgrade costs
  - ~\$500-\$800 average reduction in incremental cost compared to tankless
- Still had incremental costs of venting
- 80% efficient had no incremental cost for installation
  - ~\$1000 reduction over other models



# Conclusions

- Hybrid units are able to meet loads
- Hybrid WHs provide consistent and quicker hot water
- Hybrid WHs are more energy efficient than standard, with some units showing the highest gas WH efficiencies
- Retrofit designs reduce install costs
- Economics are improving, but paybacks still long

THANK  
*you!*

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