

Approaches for Water Heating with Combi Systems

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Agenda

- Experiences
- System types
- Performance
- Best Practices



Background

- 2013-2015: MN research and pilot program to use combi systems in low income weatherization
 - ~100 installs of combined systems
- 2016-2017: MN research project on residential hydronic heating



System Types

- Boiler based
 - Indirect storage tanks
 - Integrated DHW
 - Small storage
 - Low mass heat exchanger
- Water heater based systems
 - Storage tanks
 - Tankless
 - Other WHs

Boilers with Indirect Tanks

- Majority of combined systems in MN
- Until this year MSP metro prevented use of single wall
 - Limited design options



Indirect Tank

Boilers with Integrated DHW

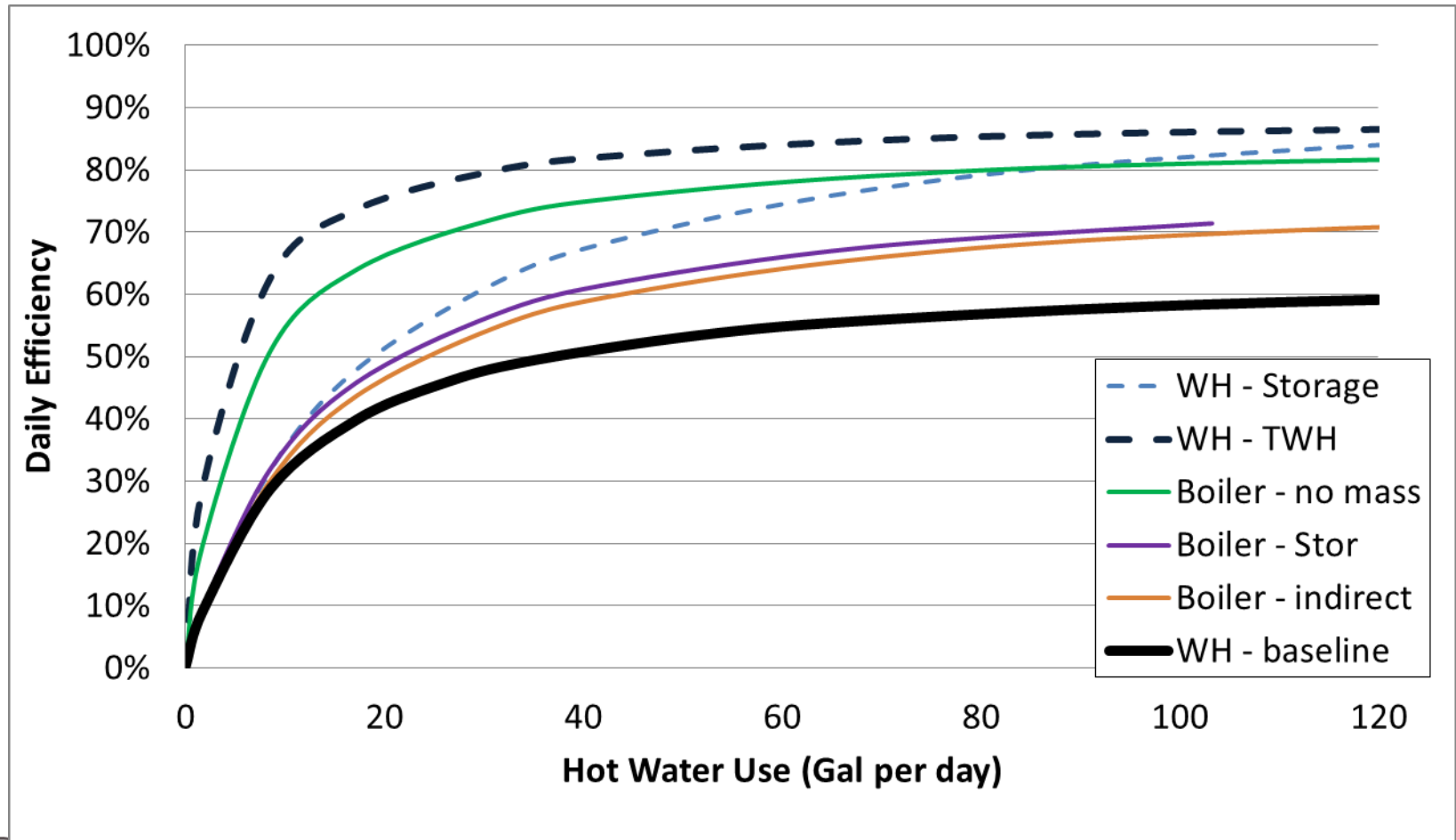


Water Heater Based Combi Systems

COMBINED WATER AND SPACE HEATER
USING STORAGE WATER HEATER



Typical installed performance



Savings

	Baseline	Condensing Water Heaters		Condensing Boilers		
	Fed Min	Storage	TWH	Low mass HE	Internal Storage	Indirect
Annual Efficiency	54%	73%	83%	77%	65%	63%
Energy Use (therms/yr)	220	163	142	154	183	189
% Saved over base	na	26%	35%	30%	17%	14%

At 55 gallons of hot water per day



Room for improvement

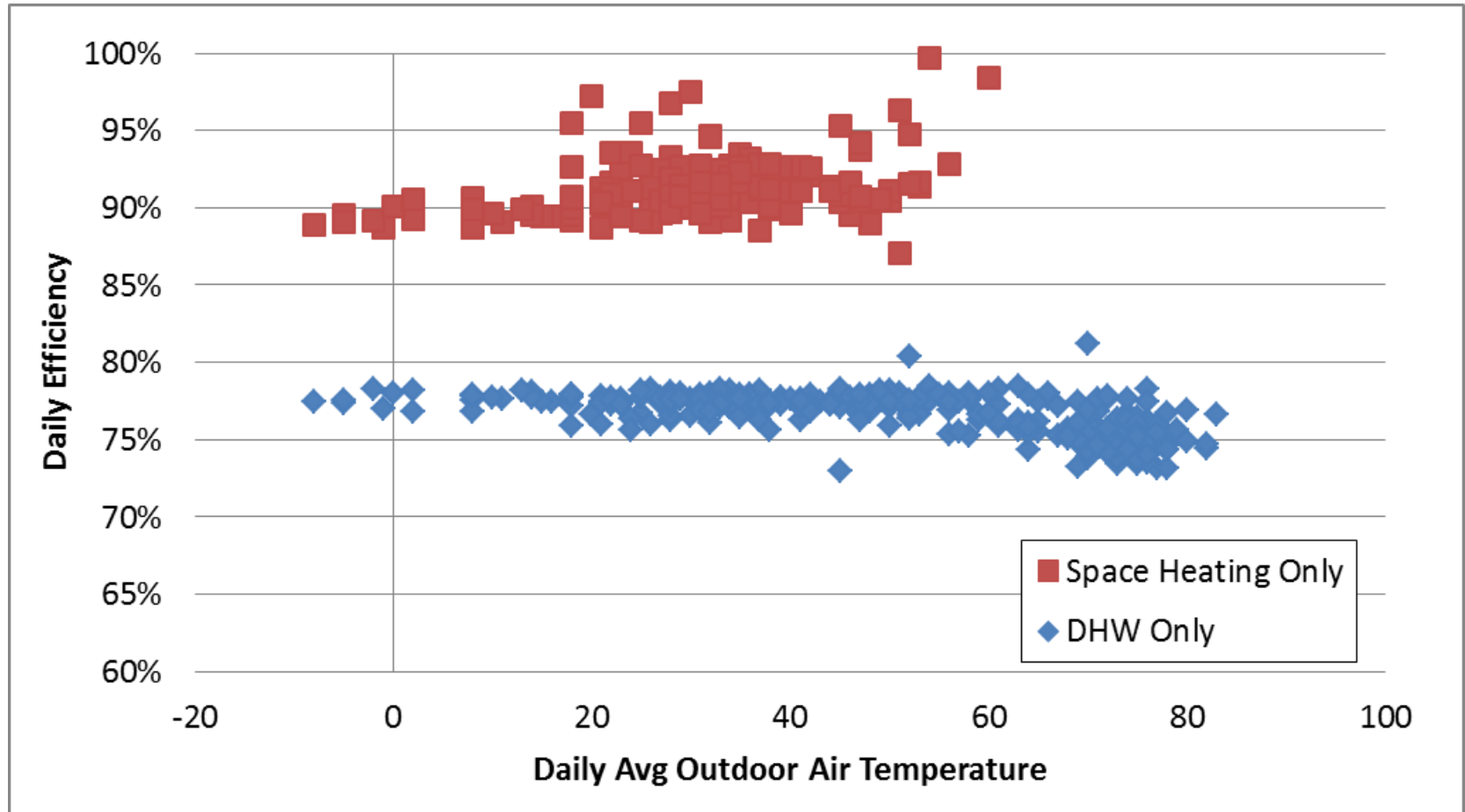
- What optimization is possible?
 - Controls?
 - Equipment?
 - Other?

• Example: Indirect

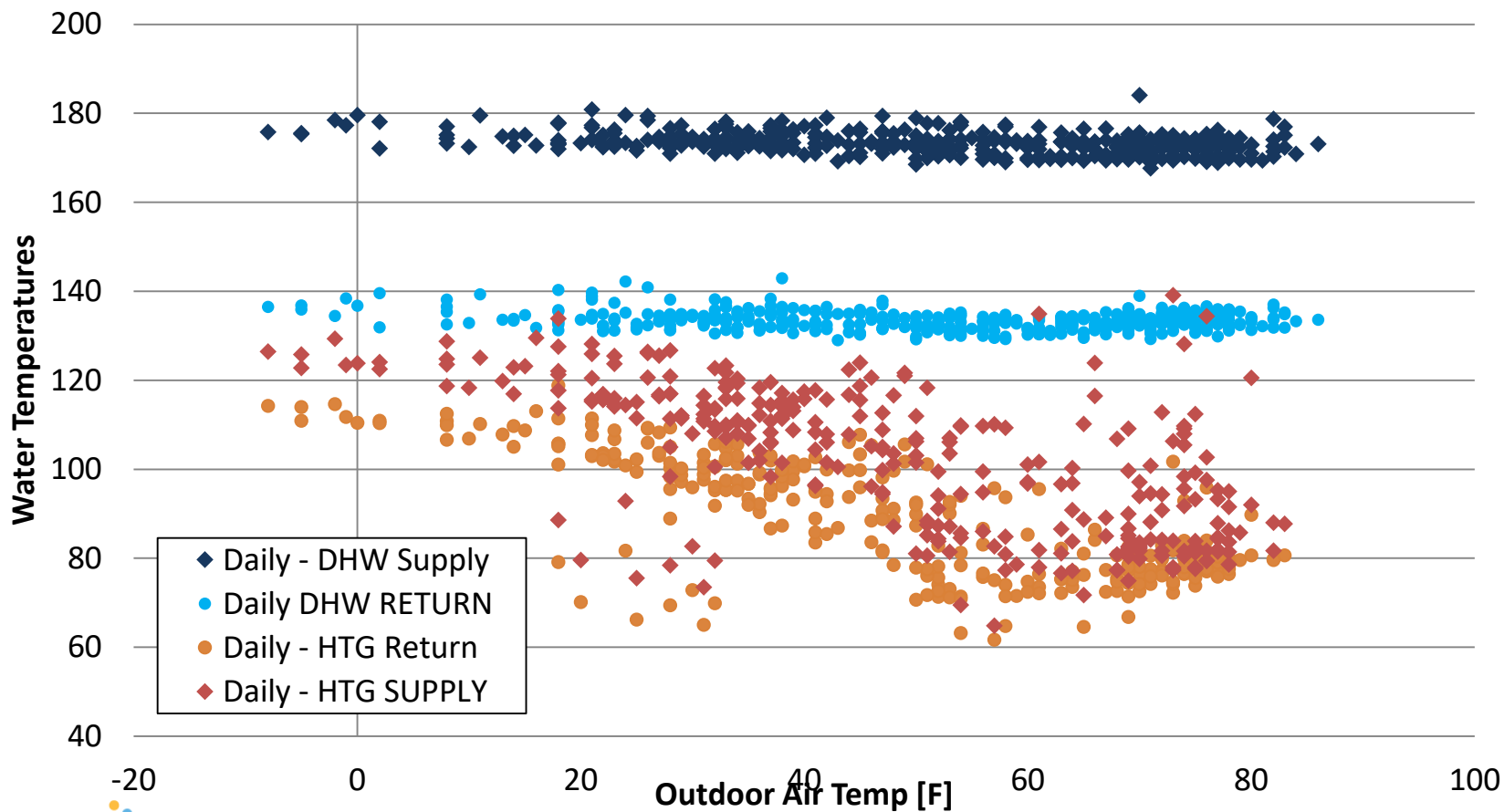
- Boiler and indirect water heater
- 6 Cast iron radiators
- 41 Gal WH set at 130°



As Found Daily Efficiency

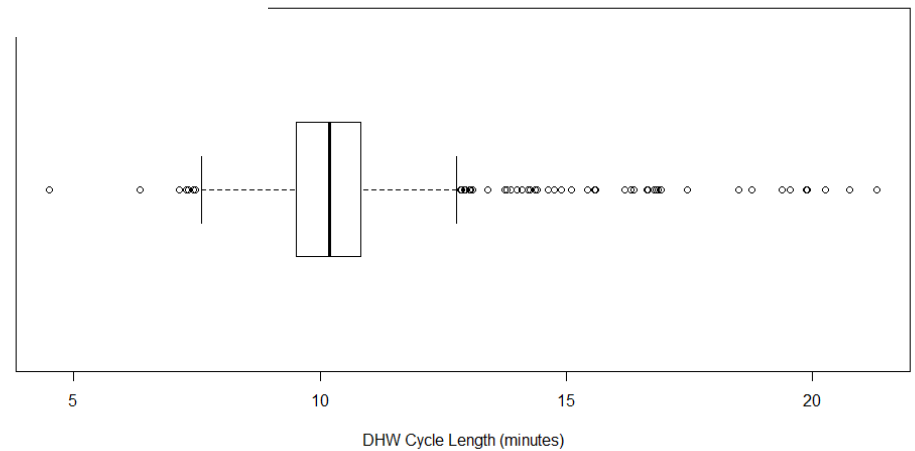
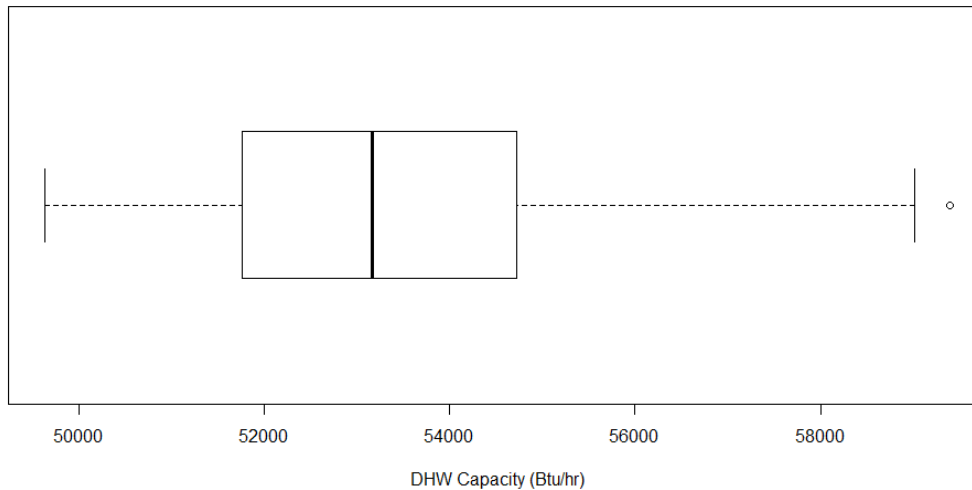


Water Temperatures



DHW Optimization

- Does the current DHW capacity meet or exceed load?

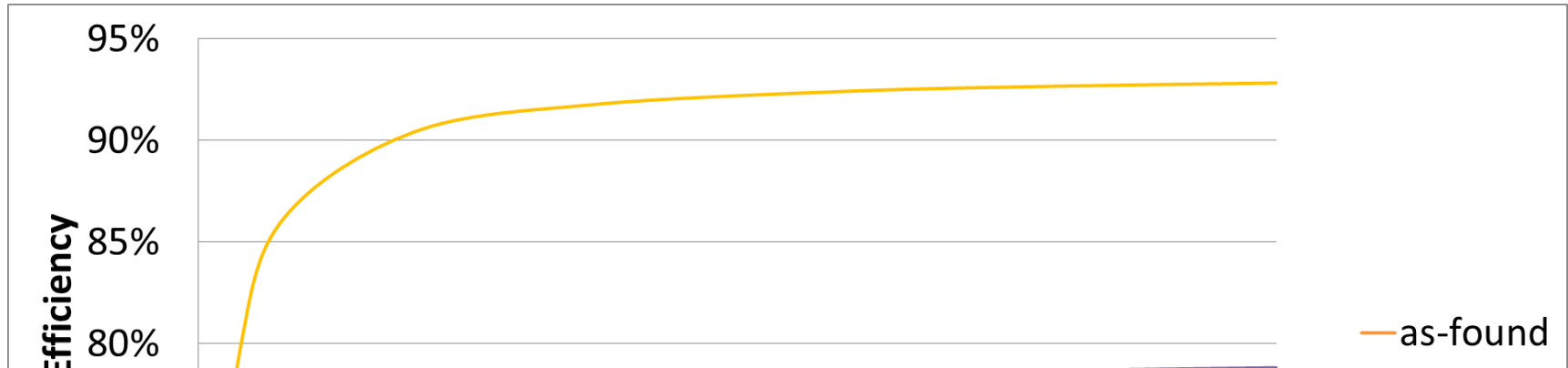




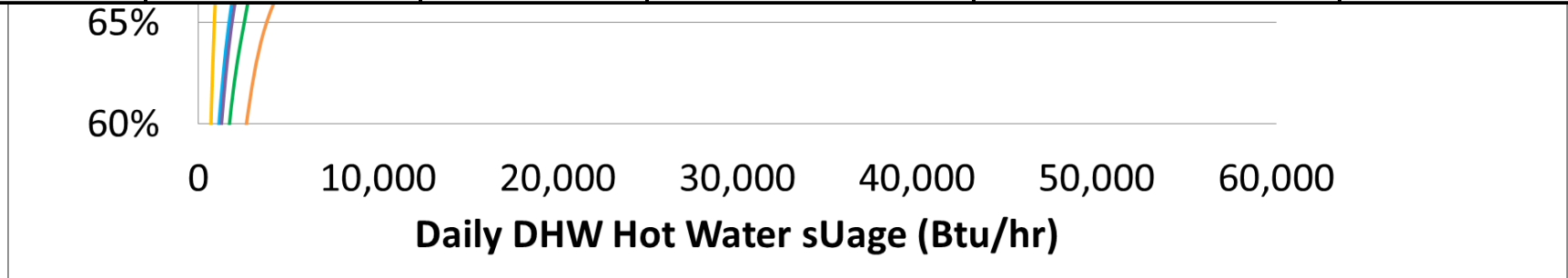
Optimization

- Minimize the supply water temperature
 - Many older boilers fix the DHW temperature
 - Occasionally the case on condensing, but less frequently
- Minimize the DHW loop flow rate
 - Manual pump adjustment
 - Or boiler settings

DHW Optimization Results



	Pump Speed	DHW GPM	Return Water T	Capacity (Btu/hr)	Avg Eff
As-Found	High	2.8	133	53,100	76.1%
Opt_1	Med	2.5	131	49,300	77.3%
Opt_2	Low	2	129	45,500	77.9%

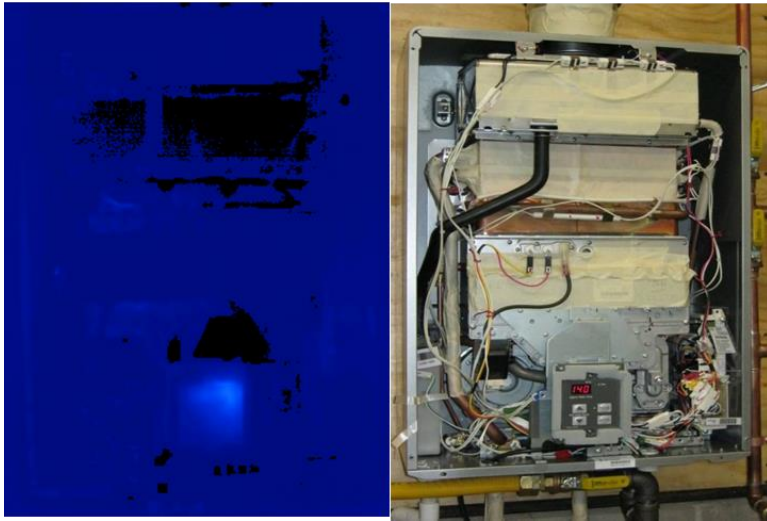




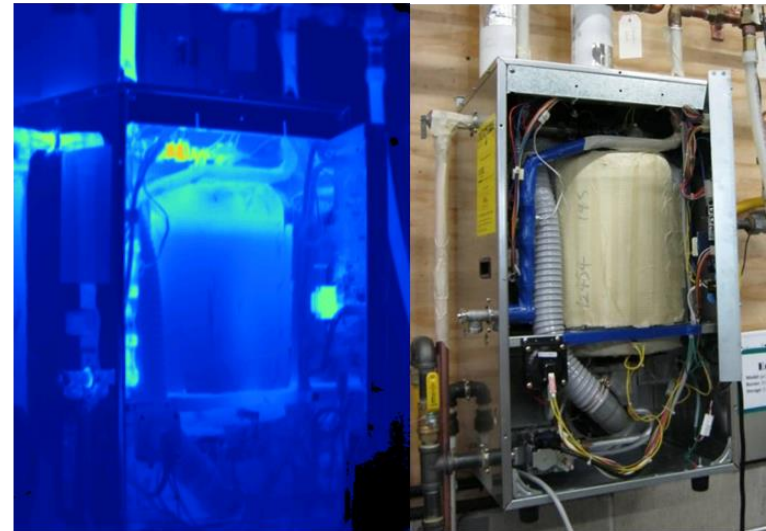
Indirects

- Water heating has room for improving efficiency
- Equipment used in typical installs limits efficiency
 - Due to the
 - heat exchanger effectiveness
 - other plumbing designs

Boilers with Integrated DHW



Low mass



storage



Recommendations

- In general DHW systems are designed to maximize capacity at the expense of efficiency
- For indirect WHs look to single wall tanks and improved heat exchange
- For integrated boilers low mass direct heat exchange systems have the best performance



DHW Integration Conclusions

- DHW performance is not rated for most combi equipment
- Best performance from boilers with low-mass integration
- Other types have potential for same performance, but current practices prevent it
- Indirect WH performance is more aligned with Power vented water heater than condensing
 - Not recommending unless cost competitive with power vent
 - Integrated tanks in combi units were more cost competitive
 - Signal wall and/or active heat exchange may improve

THANK!
you!

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