Technical Barriers and Reasonable Price Solutions to Contractor Acceptance in the Field

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Gaps and Barriers in High Efficiency Space and Water Heating

- System Optimization and Improved Installation

What have we achieved so far?

- This presentation will look at laboratory work used to address this gap
- Risks that needed to be managed were a lack of familiarity of contractors and homeowner comfort
- The major benefit of this project is high efficiency space and water heating as well as combustion safety

What is left to achieve?

- The highest priority issue remaining to be solved is to analyze actual installed efficiency and energy savings
- We plan to continue to close this gap by doing a 20 site field monitoring study

What we have achieved so far

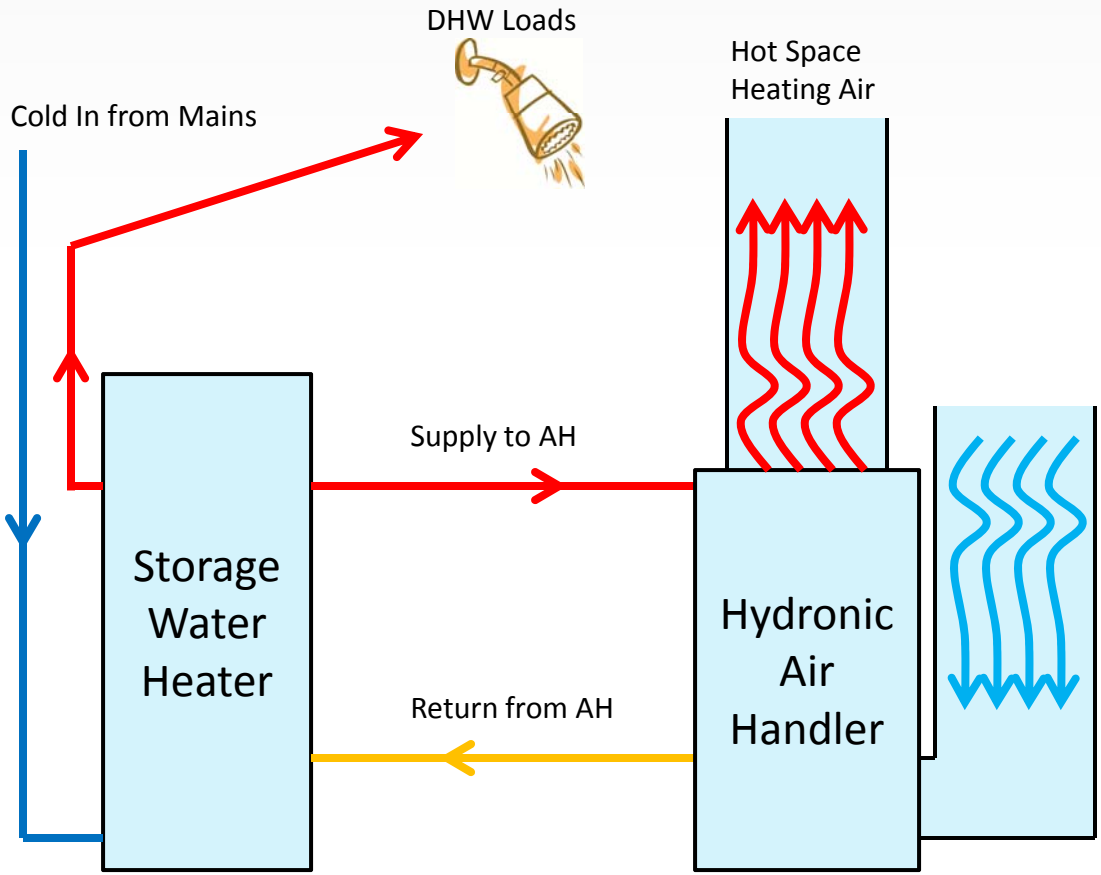
A. Increased Contractor knowledge
B. Performed laboratory testing to determine optimum performance and identify potential areas for equipment improvement
C. Work with contractors to implement knowledge improving performance and reducing costs

What is a Dual Integrated (Combi) System and Why Should We Use it?

+ Provides space heating and water heating from a single heating plant – water heater or boiler

+ Two high efficiency heaters in one package
  - potentially cheaper
  - Simpler, less maintenance
+ Sealed combustion (Direct vent systems)
  - Eliminates combustion safety issues
+ Further reduction in air infiltration
  - Removal of make up air inlets
  - Sealing chimneys

Storage water heater based system



Open Loop

Installation and Sizing

Gaps:

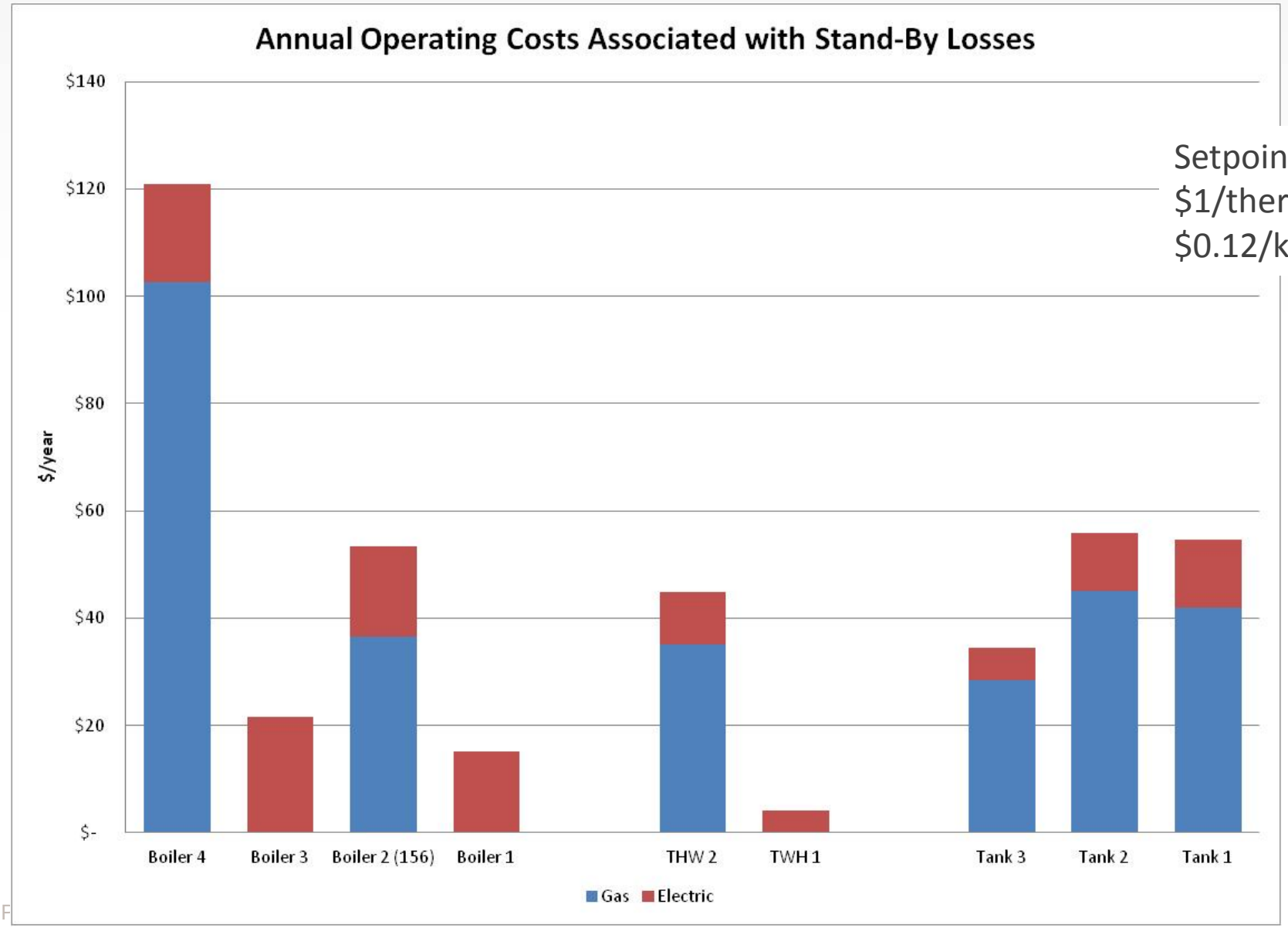
- Some contractor's had little experience
- System schematics often developed on site
- Little or no sizing information provided
- System components came from several manufacturers
- Manufacturer's settings may not lead to best performance

- Decided to design and optimize systems in a laboratory
- Could then provide contractors with more detail installation guidelines


DELL

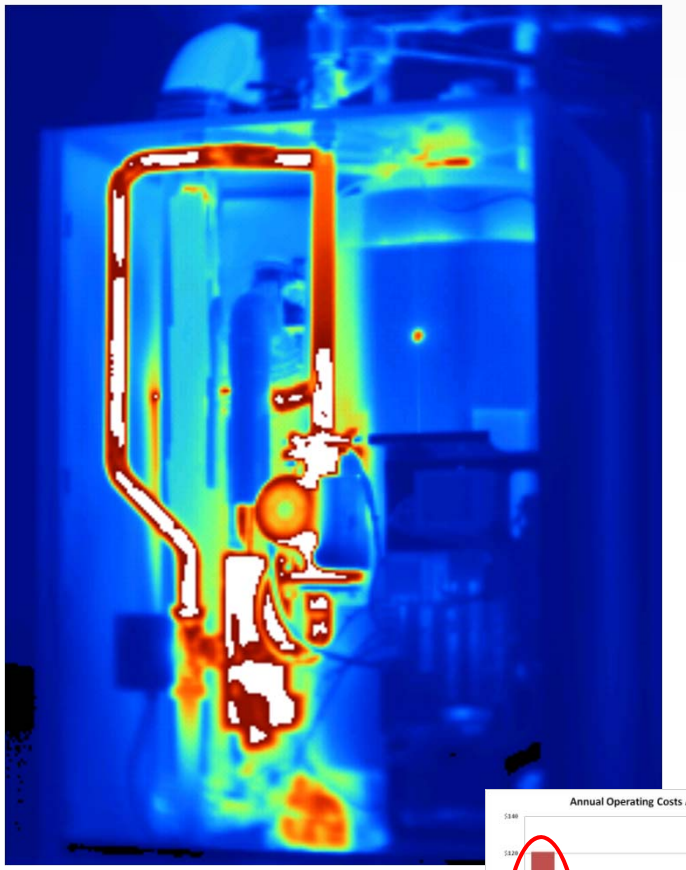
Lab work

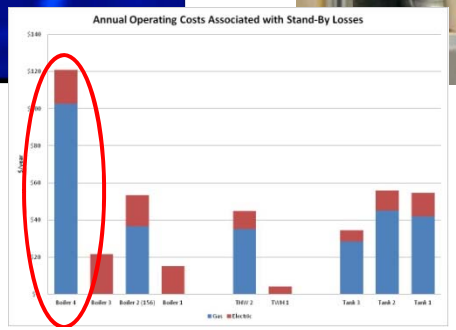
+ Idle losses
+ Steady state efficiency
+ Air handler capacity testing
+ Full system tests

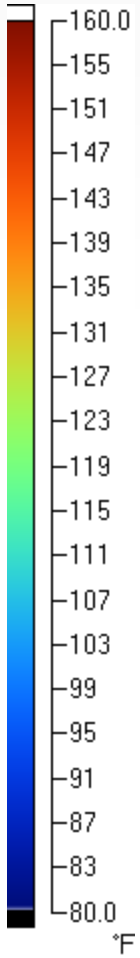


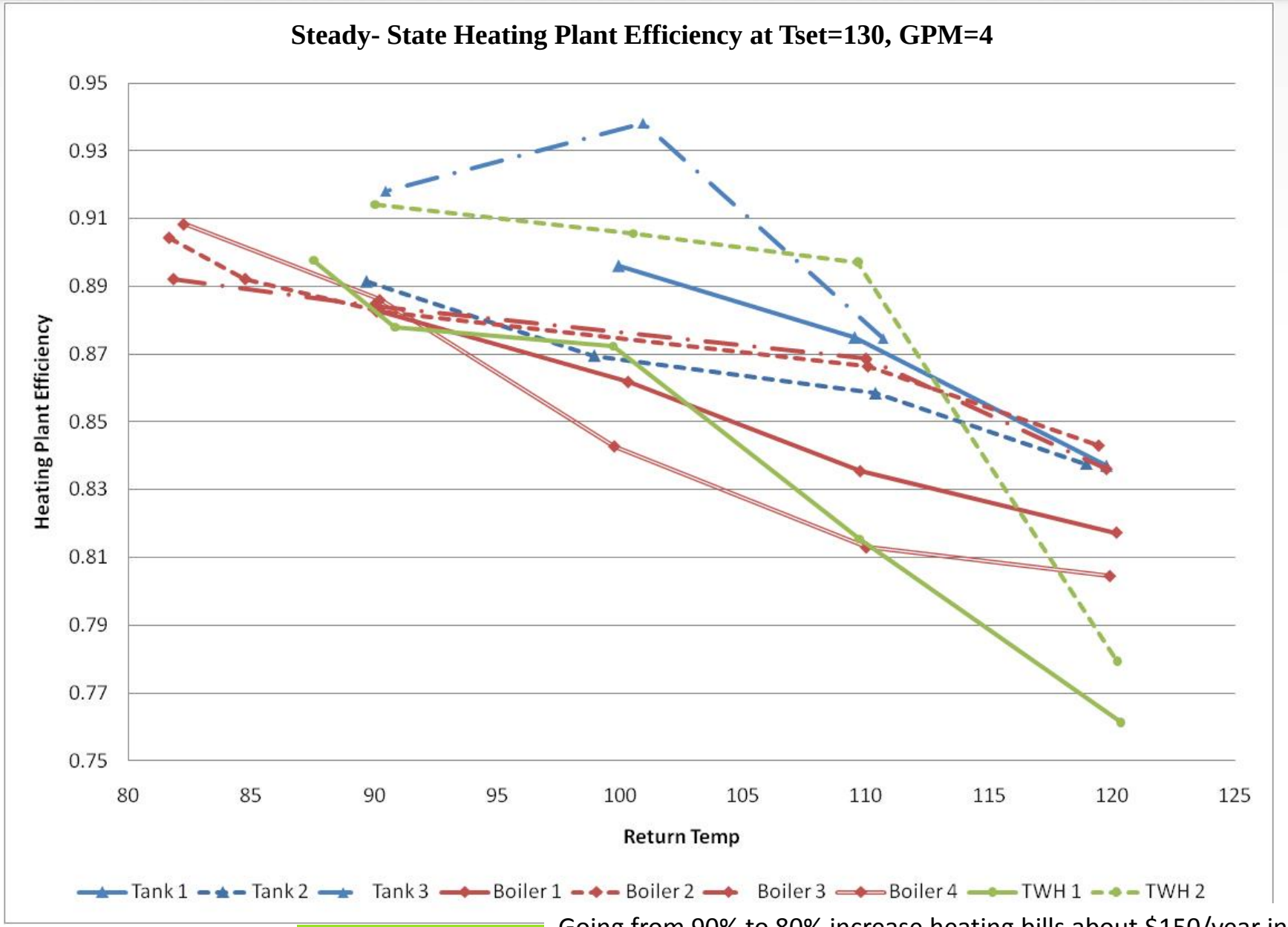
Setpoint = 140 F
$1/therm
$0.12/kWh

Boiler 1 – Combi boiler with 12 gal DHW tank







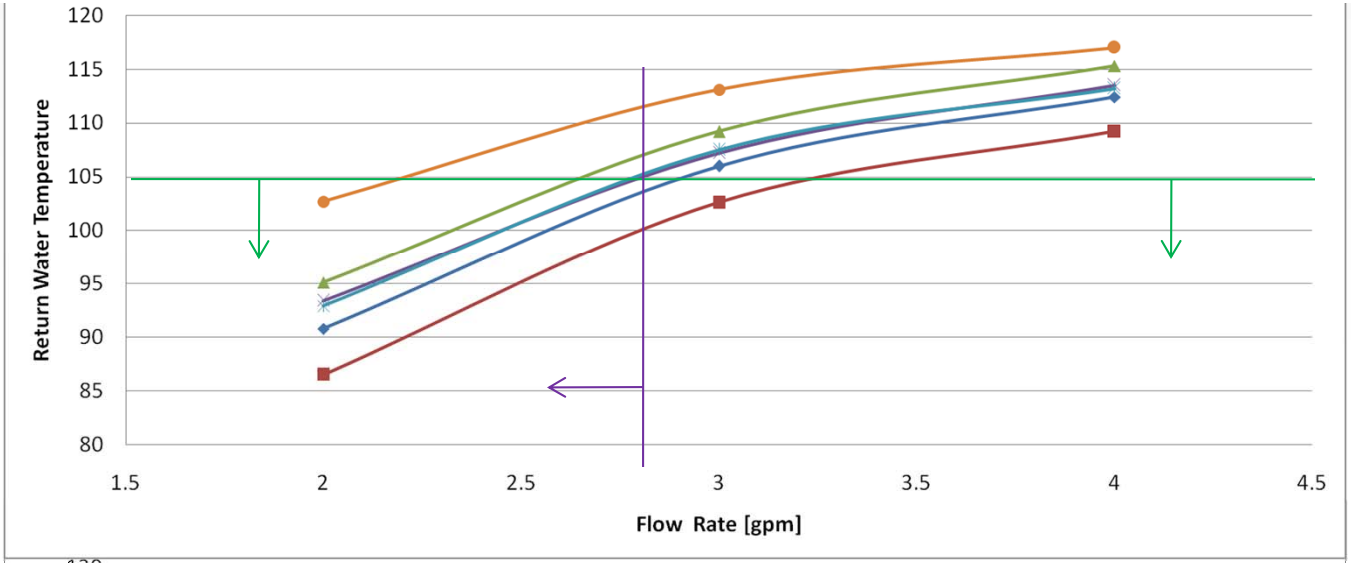


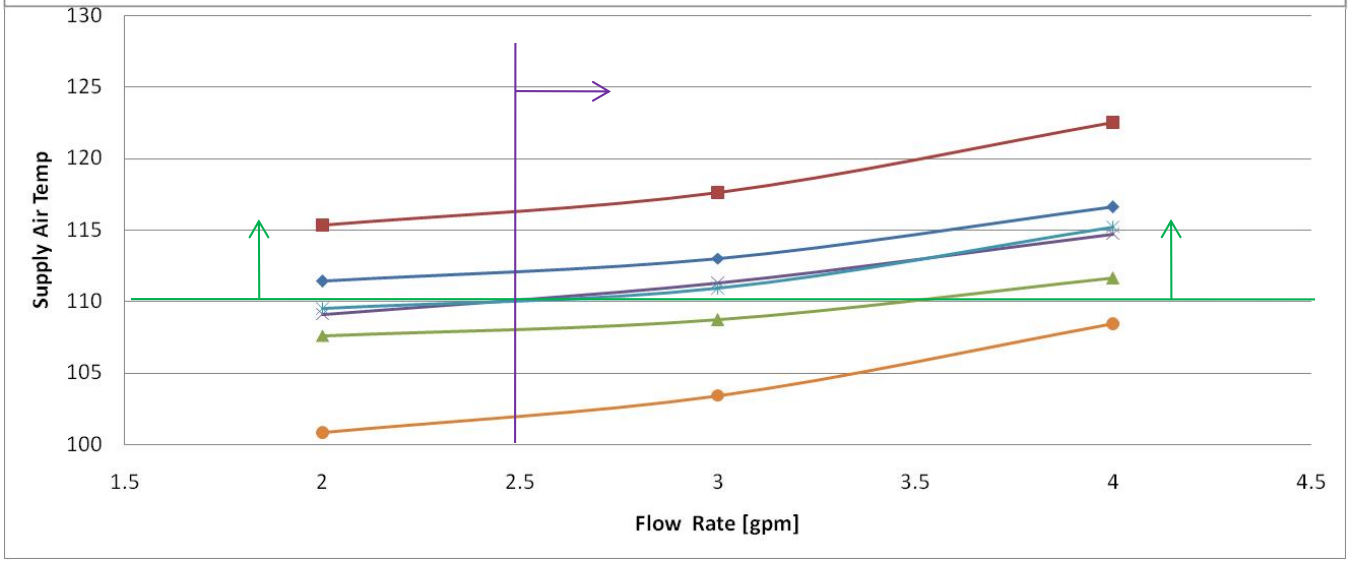
Going from 90% to 80% increase heating bills about $150/year in MN

Air Handler Performance Mapping

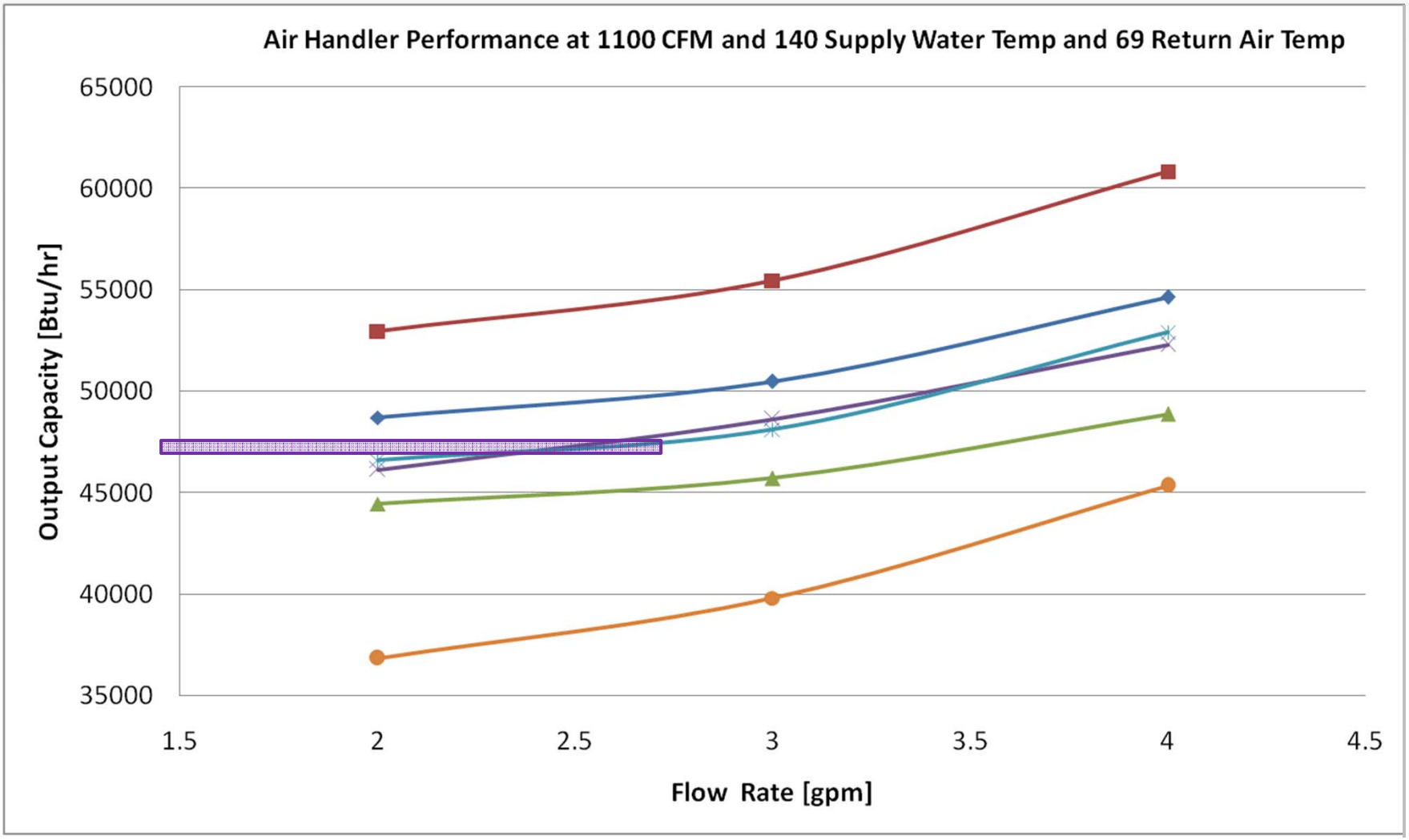
+ Minimum supply air temperature (110 F) for comfort dictates minimum flow rate
+ Maximum return water temperature (105 F) dictates maximum flow rate
+ Coil capacity is bounded by these flow rates

Air Handler Performance Mapping

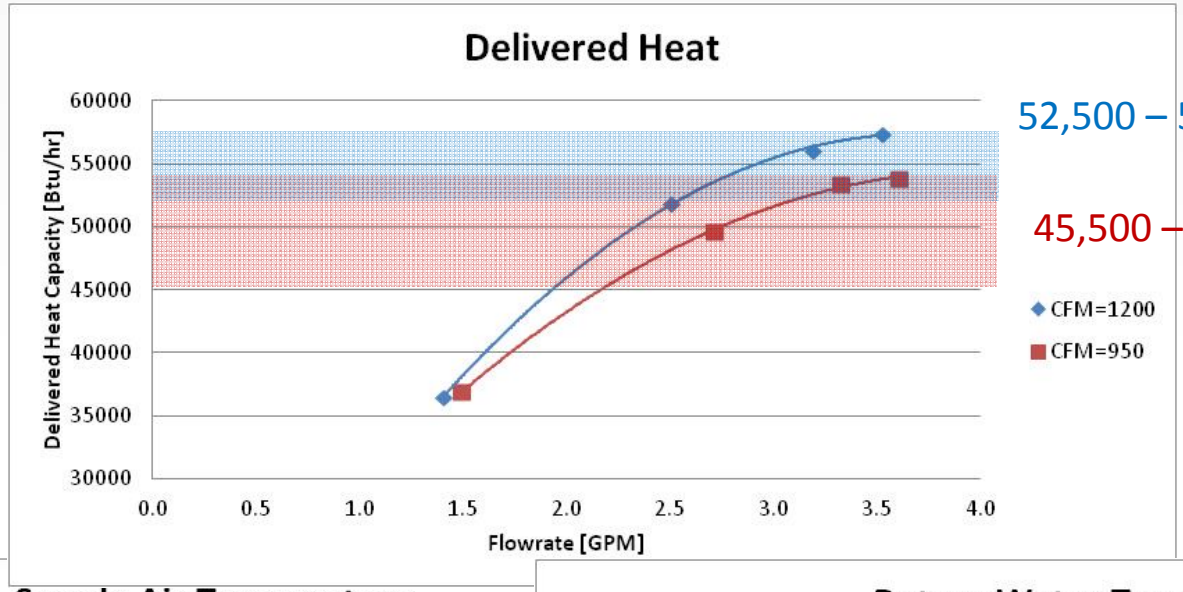




At CFM=1100, Supply Water =140F, Return Air = 70F

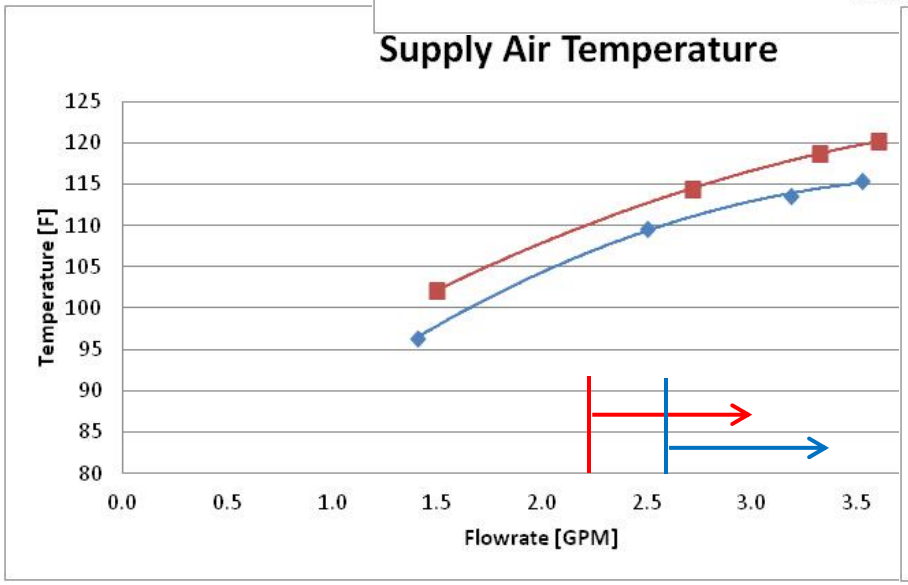

Air Handler Performance at 1100 CFM and 140 Supply Water Temp and 69 Return Air Temp
Output Capacity [Btu/hr]
65000
60000
55000
50000
45000
40000
35000
1.5
2
2.5
3
3.5
4
4.5
Flow Rate [gpm]

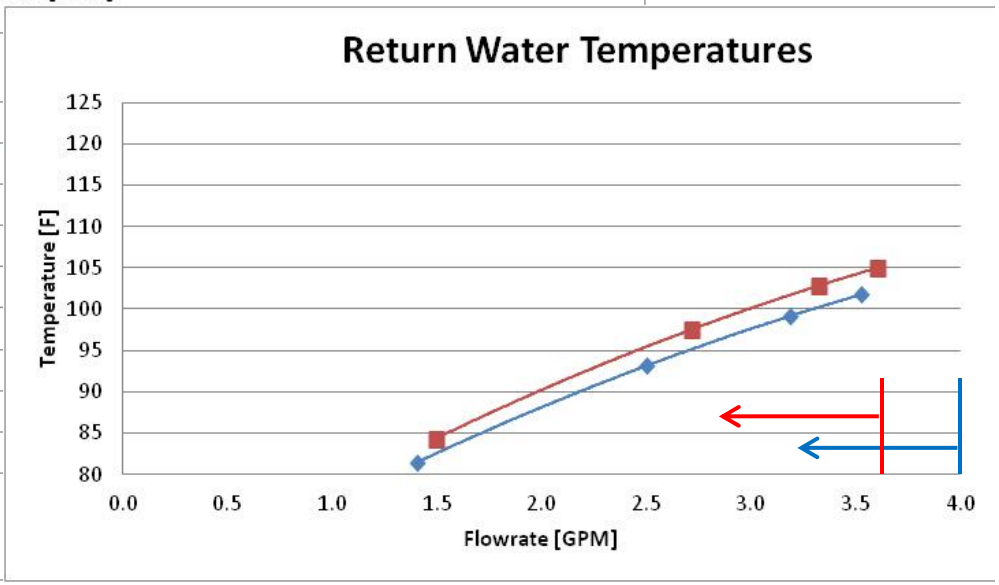
Air Handler Performance Mapping



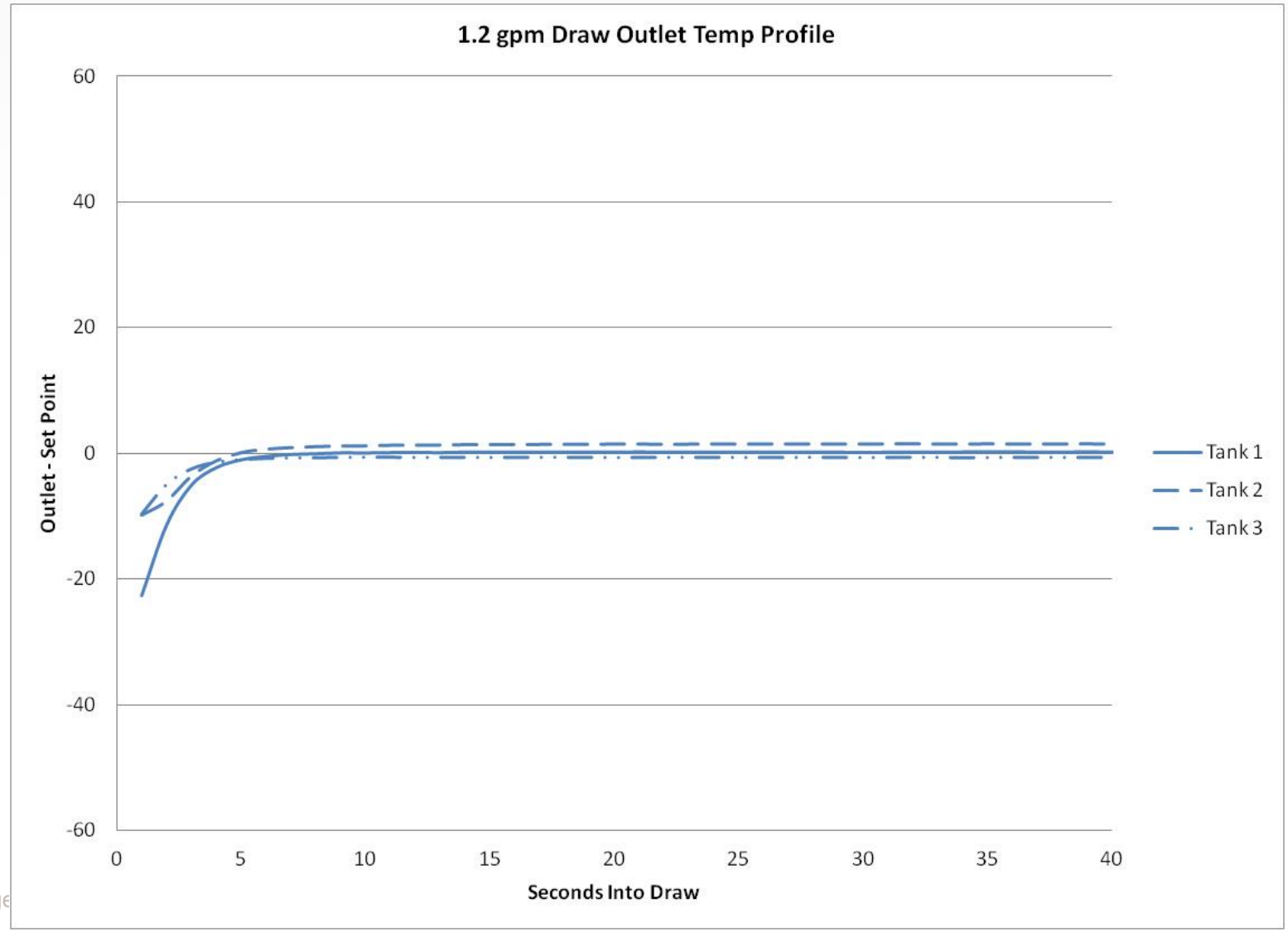
52,500 – 57,000 kBtu/hr

45,500 – 54,000 kBtu/hr





Low Use Transient Performance



Low Use Transient Performance

Low Use Transient Performance

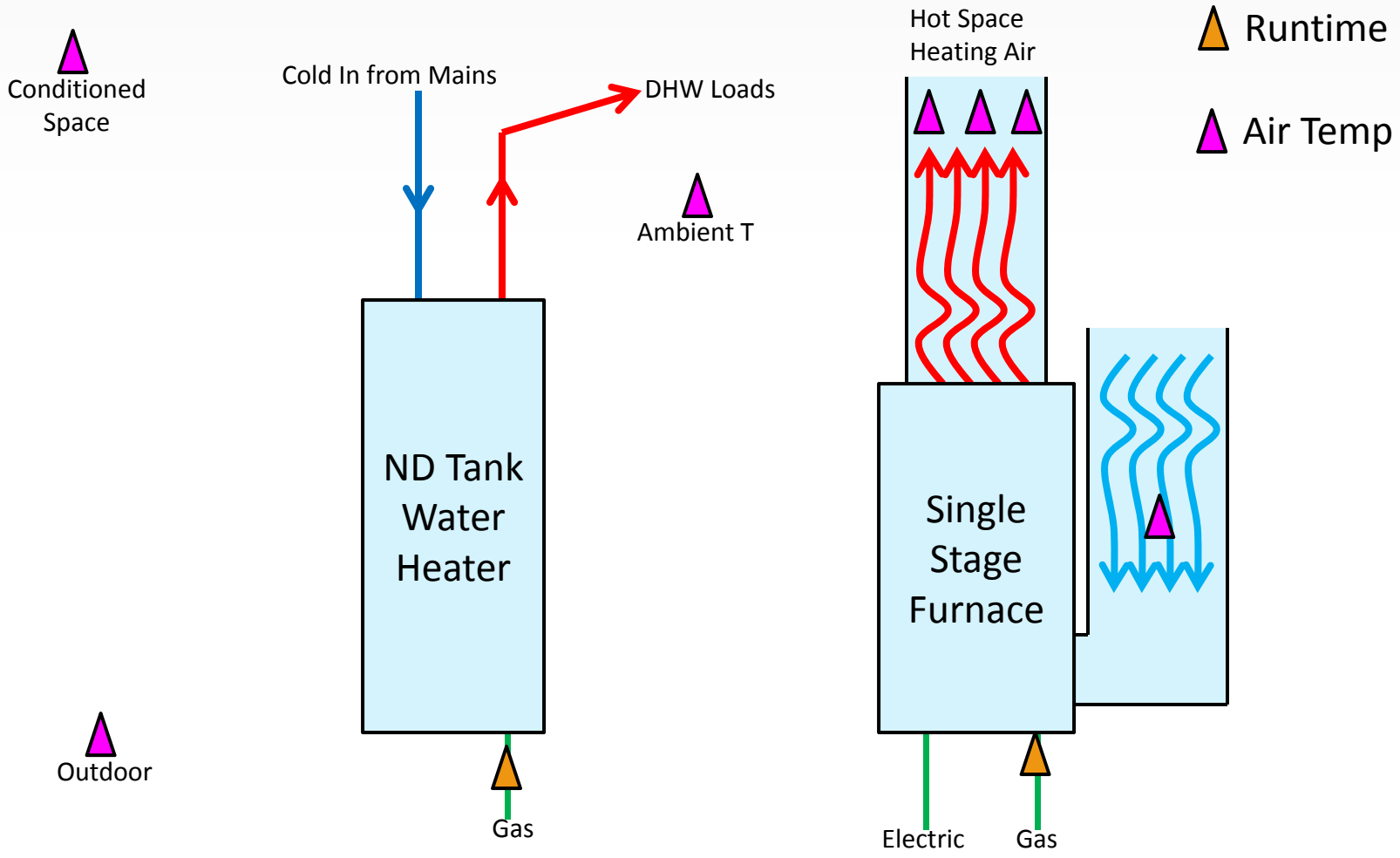
What Gaps and Barriers Remain

A. Examination of actual performance data in real homes
B. Can contractor familiarity drive prices down?

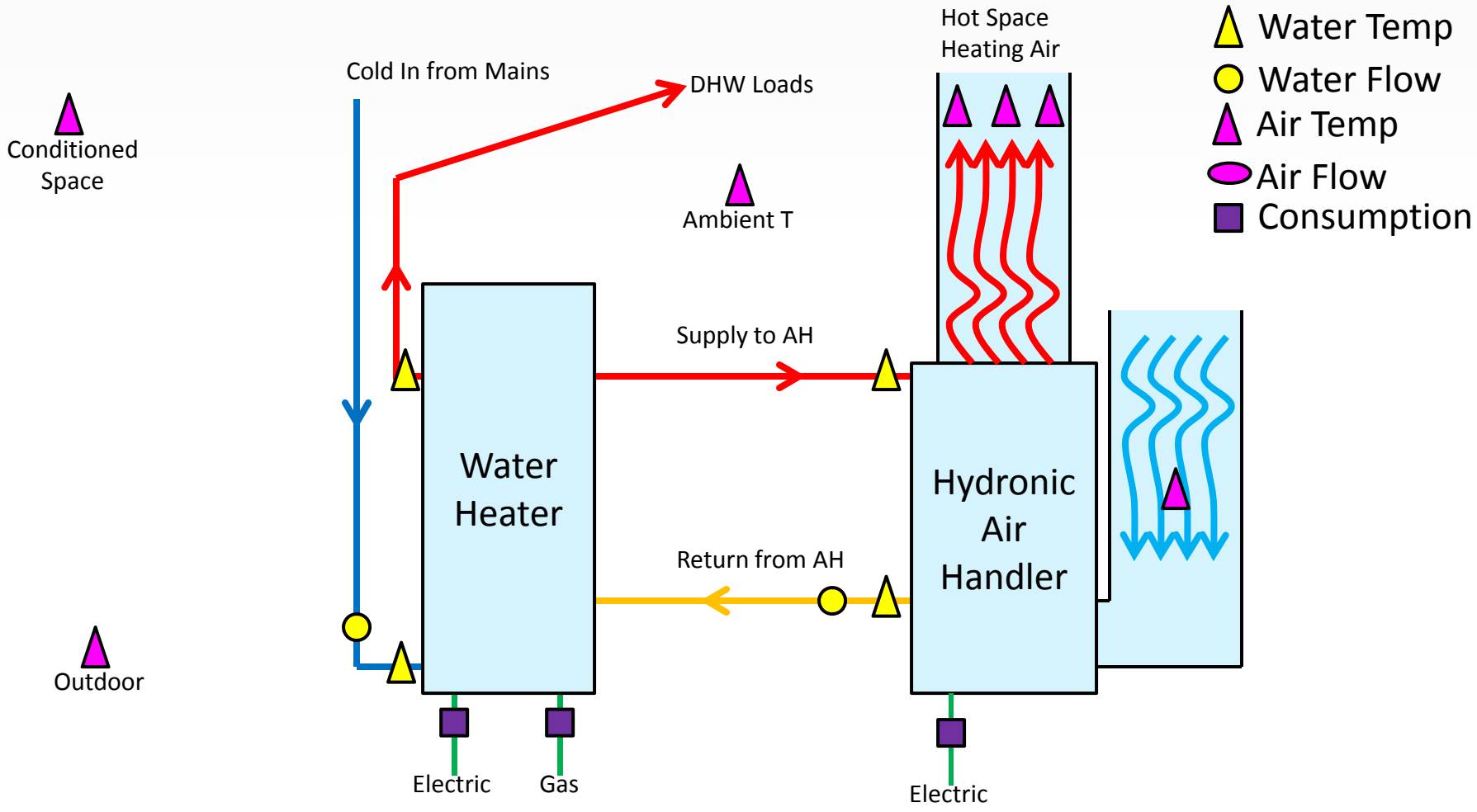
What is next

+ 300 installs in Minnesota by end of 2012
  + Cost and Utility bill analysis on all 300 sites
  + Detailed pre/post monitoring on 20 sites

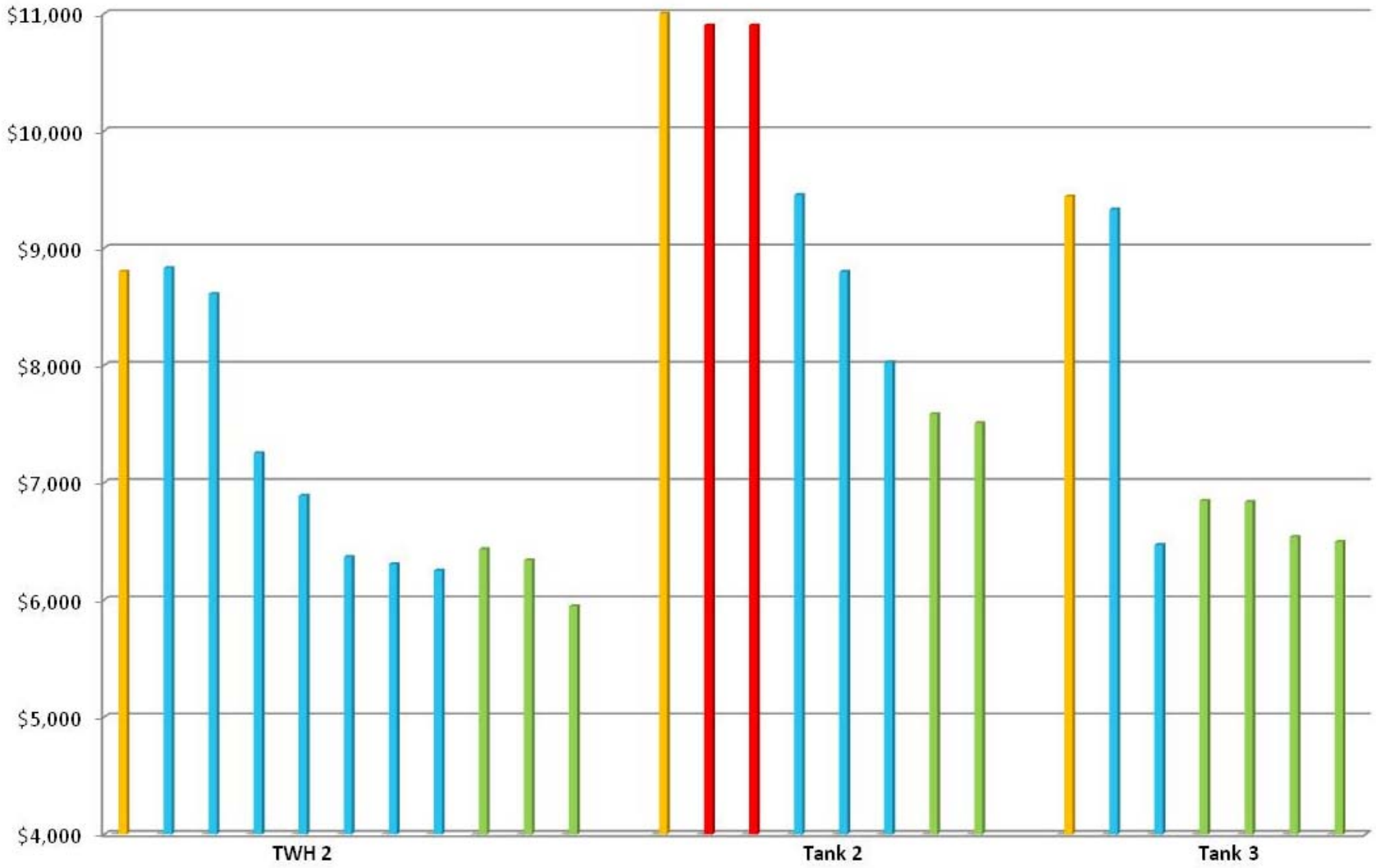
Existing Equipment



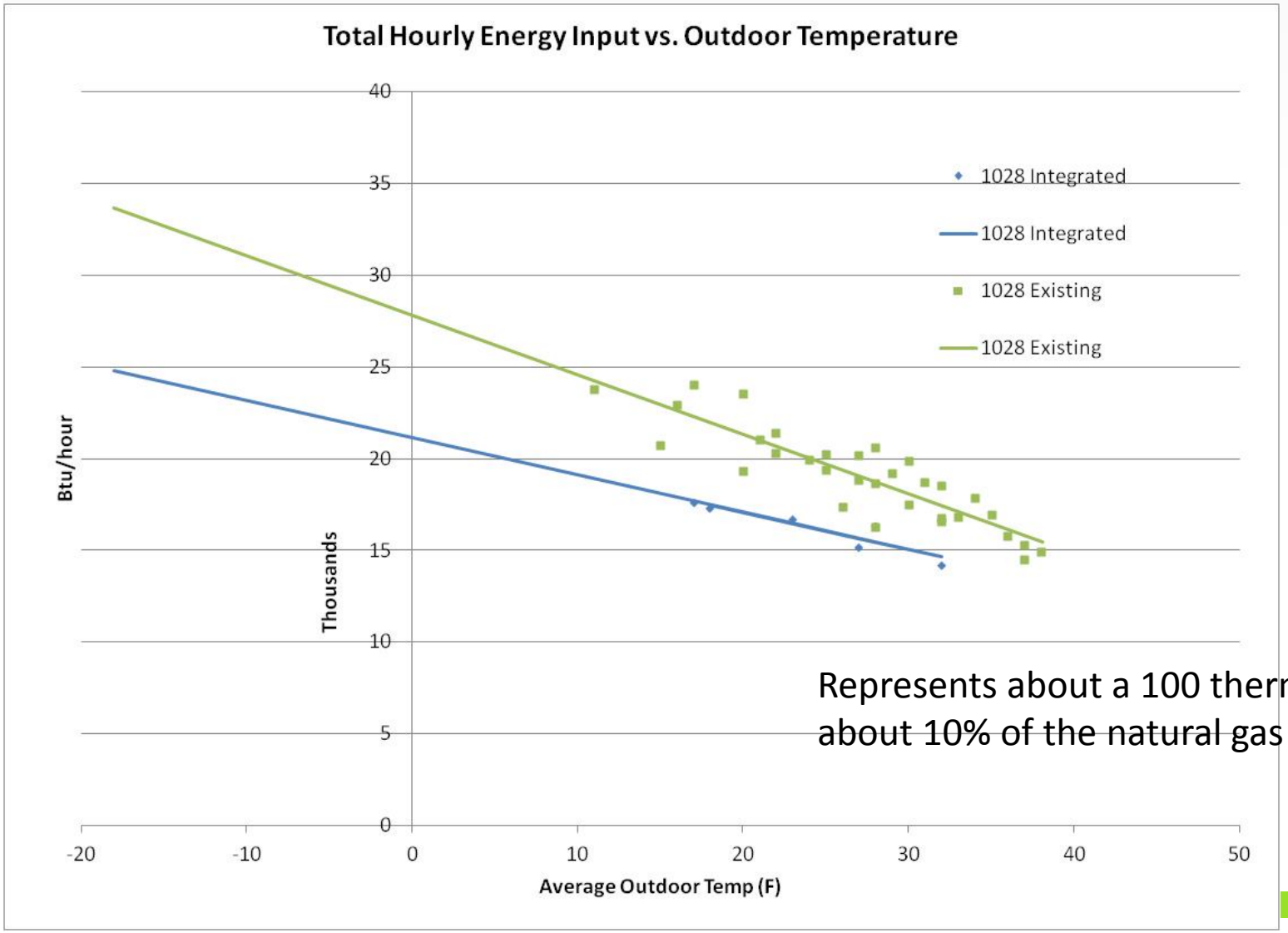
DIA Installation



Field Monitoring Installation

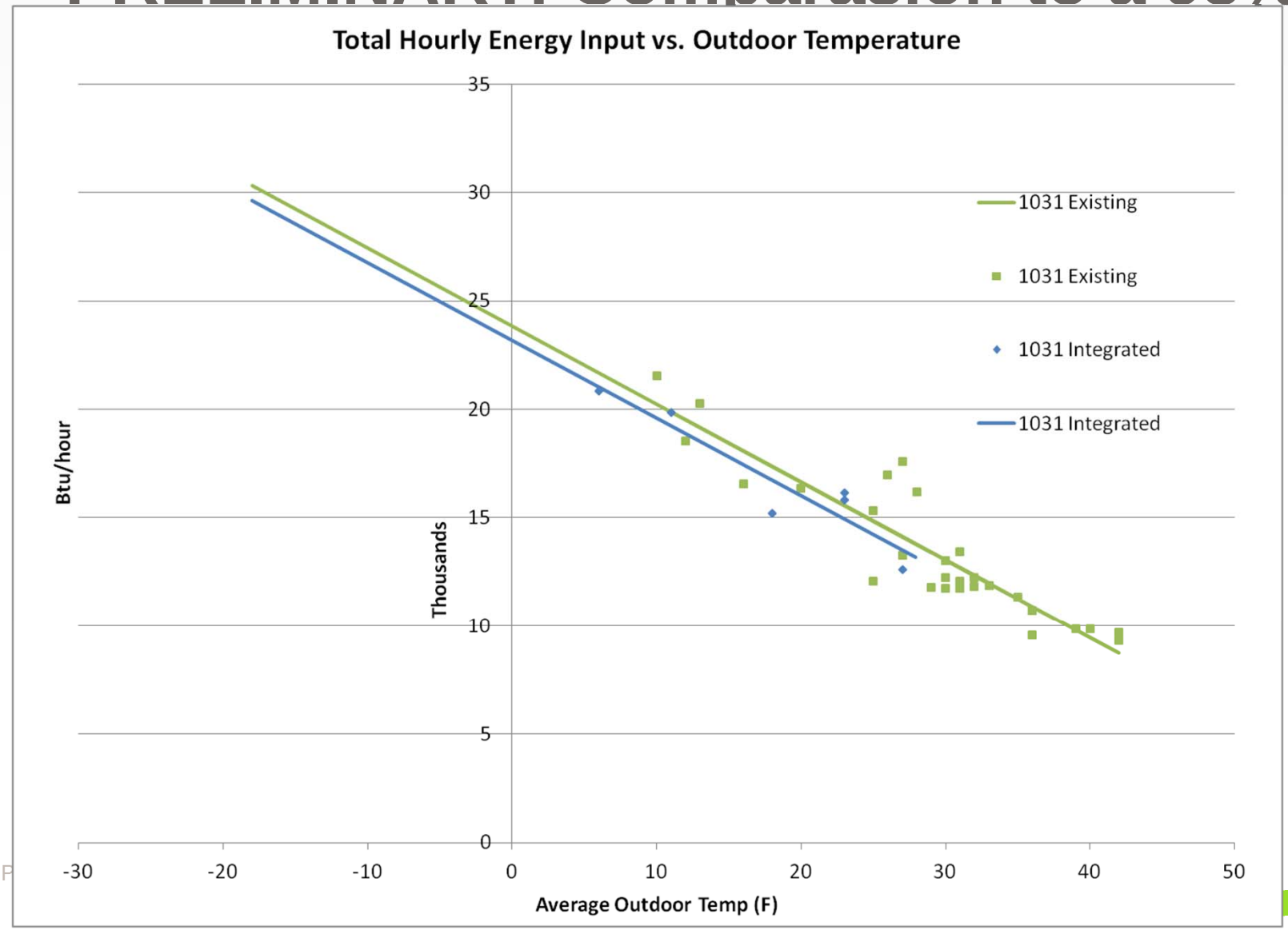

Cost Analysis—First 26 Installations
$11,000
$10,000
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
TWH 2
Tank 2
Tank 3

PRELIMINARY: Energy Consumption



Represents about a 100 therm/yr savings or about 10% of the natural gas space heating bill

PRELIMINARY: Comparasion to a 93%



Questions?

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