
“From the Ground Up” High Efficiency Houses

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“From the Ground Up” Houses

- Design Competition Among Architecture Firms
 - run by Syracuse University School of Architecture in 2009
 - highly energy efficient designs, all approx 1200 sq ft + basement
- Syracuse Center of Excellence received DOE funding for Detailed Monitoring



TED House



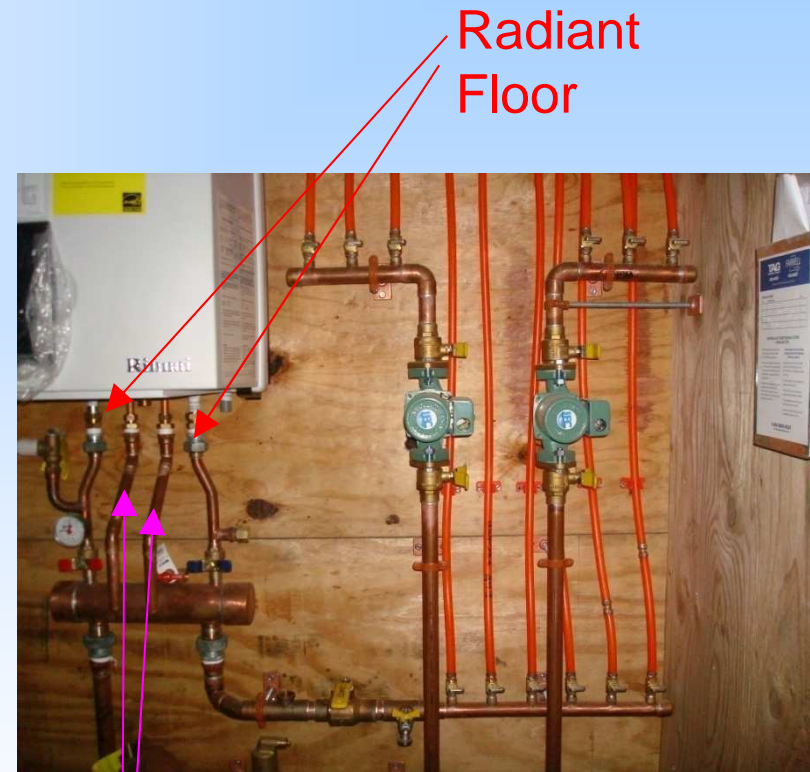
R-House



LiveWork House

TED House

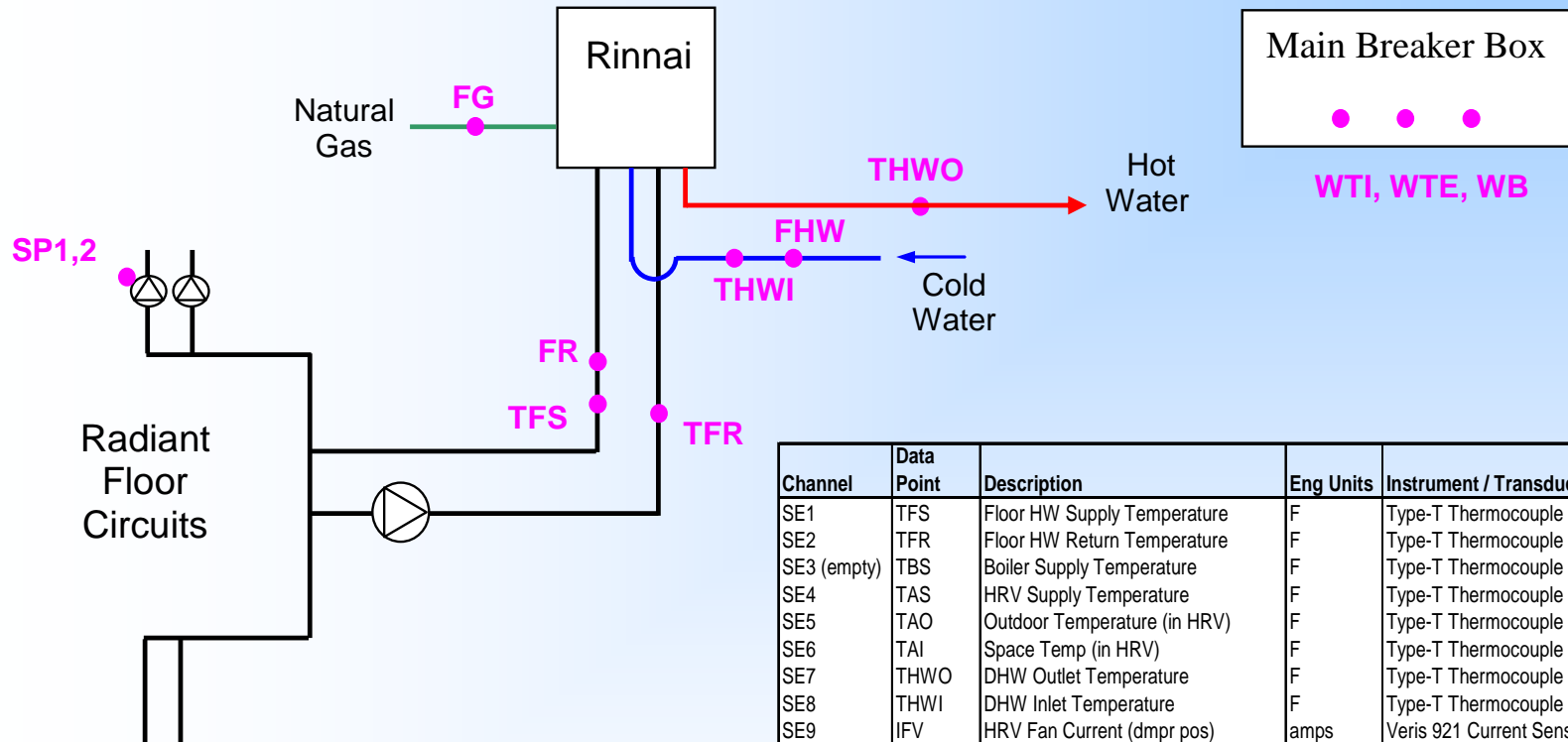
- Rinnai E75C “Combi”
(75 MBtu/h, 96%)
 - space heating via radiant floor (2 zones)
 - Separate DHW circuit
- High Efficiency Envelope
 - 0.475 ACH50
 - Serious windows ($U=0.14$)
 - 4 in foam & 15 in cellulose
 - ICF foundation
- Two adult occupants



Radiant
Floor

DHW

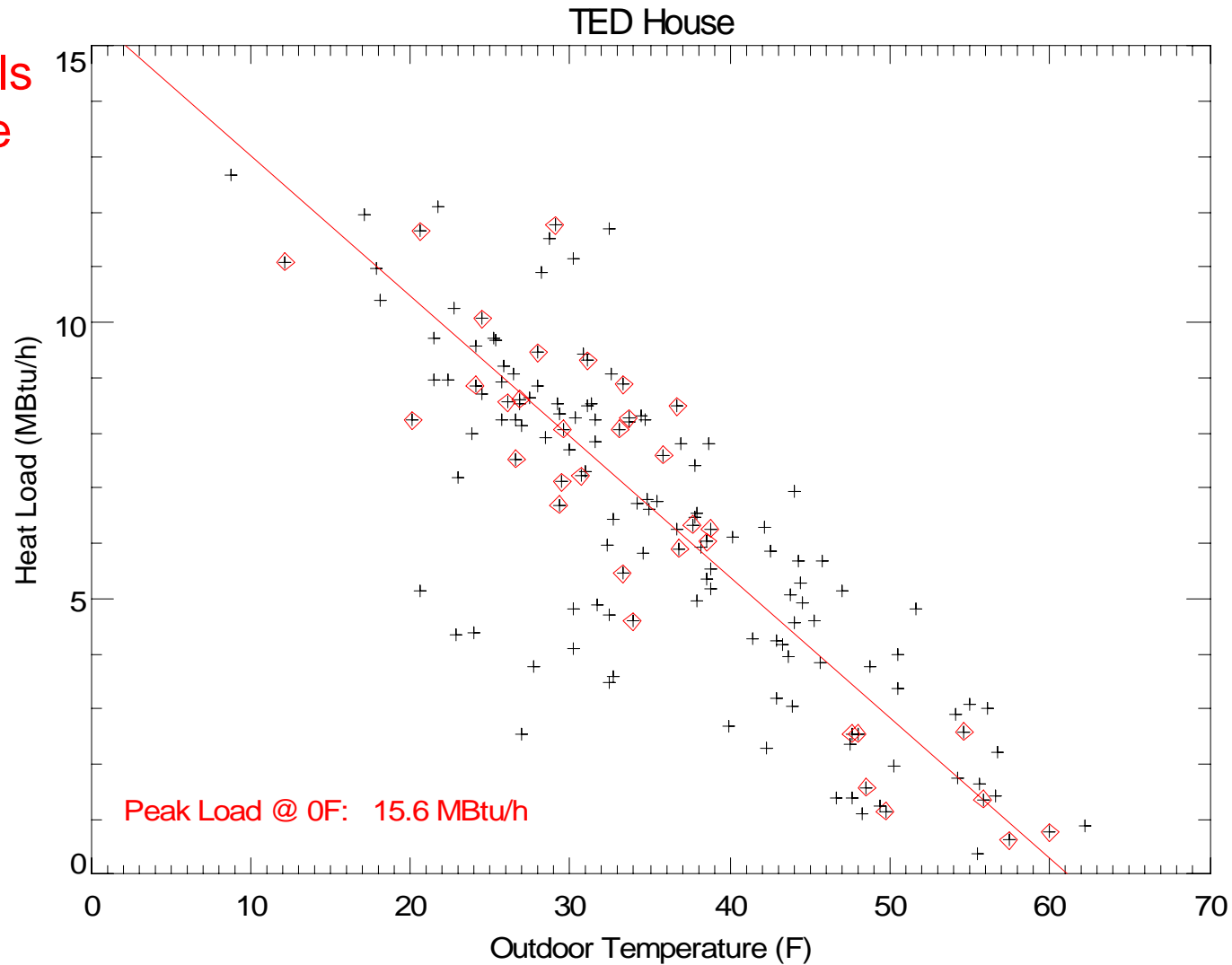
Instrumentation – TED House



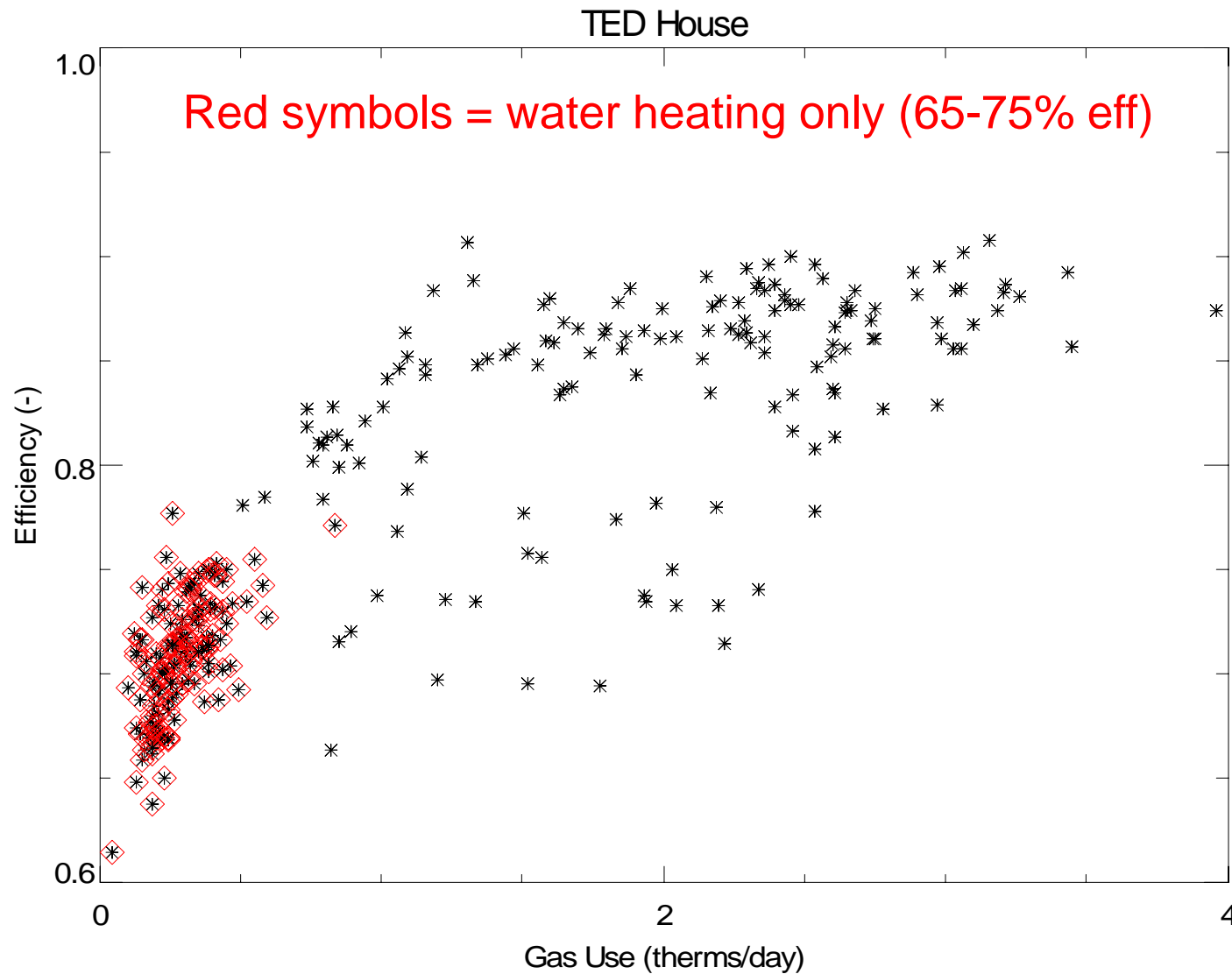
Channel	Data Point	Description	Eng Units	Instrument / Transducer	Range
SE1	TFS	Floor HW Supply Temperature	F	Type-T Thermocouple	n/a
SE2	TFR	Floor HW Return Temperature	F	Type-T Thermocouple	n/a
SE3 (empty)	TBS	Boiler Supply Temperature	F	Type-T Thermocouple	n/a
SE4	TAS	HRV Supply Temperature	F	Type-T Thermocouple	n/a
SE5	TAO	Outdoor Temperature (in HRV)	F	Type-T Thermocouple	n/a
SE6	TAI	Space Temp (in HRV)	F	Type-T Thermocouple	n/a
SE7	THWO	DHW Outlet Temperature	F	Type-T Thermocouple	n/a
SE8	THWI	DHW Inlet Temperature	F	Type-T Thermocouple	n/a
SE9	IFV	HRV Fan Current (dmpr pos)	amps	Veris 921 Current Sensor	0 - 30 A
SE10	RHI	Space RH (in HRV)	%	Vaisala RH Transducer	0 - 100% RH
SE13	SP1	Floor Pump 1	min	Veris 300 Current Switch	n/a
SE14	SP2	Floor Pump 2	min	Veris 300 Current Switch	n/a
P1	FR	Flow Rate to Radiant Floor	gpm	Onicon F1300, 3/4 in	n/a
P2	FHW	Hot Water Flow Rate	gal	Omega FTB 4607	n/a
C1	FG	Boiler System Gas Consumption	CF	AM250 Gas Meter with Pulse	n/a
C2	WTI	Total House Power (import)	kWh	Wattnote WNB-208 (P1)	n/a
C3	WTE	Total House Power (export)	kWh	Wattnote WNB-208 (P2)	n/a
C4	WB	Boiler Power (and pumps)	kWh	Wattnote WNB-208 Option 3 (P1)	n/a
C5 (empty)	WA1	Additional Power Monitor 1	kWh	Wattnote WNB-208 Option 3 (P2)	n/a

Space Heating Load – TED House

Red symbols
when space
above 67F



Boiler Efficiency - TED House



R-House

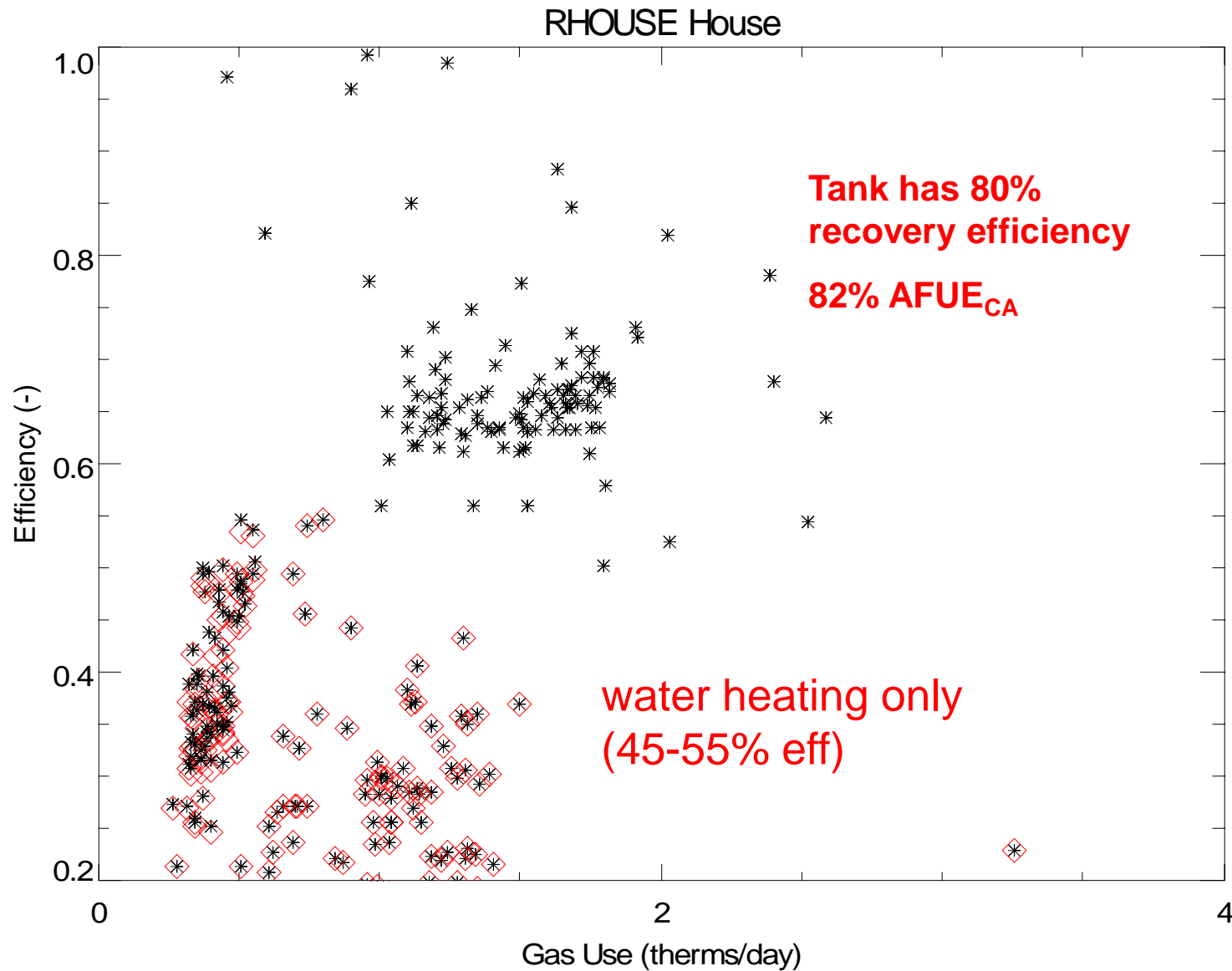
space heating circuit on side of WH Tank

- Passivehaus design
 - ACH50 <1
 - R70 Cellulose Walls
- 45 gallon HW tank
 - Bradford White CDW2TW50
 - Side circuit for Space Heating
- Zehnder HRV with fresh air distribution
- Additional electric heat was intended (but never installed)



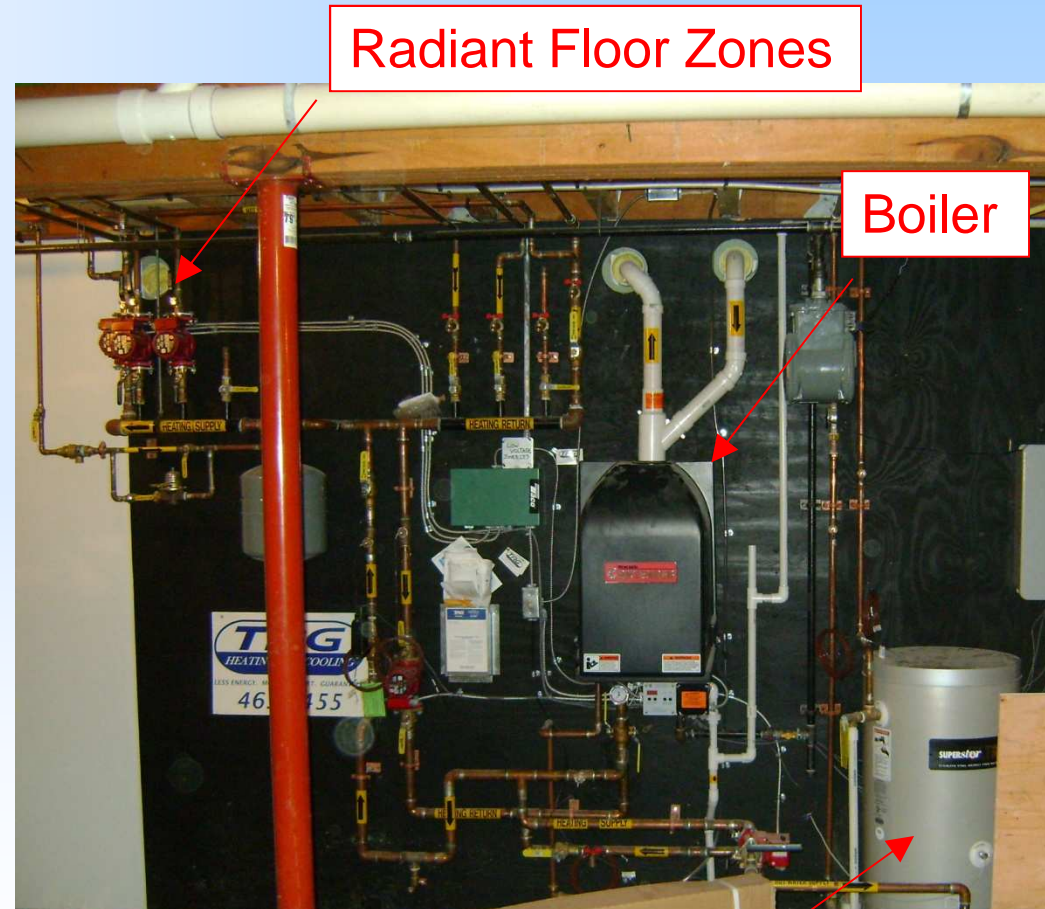
HW Coil for space heating (fresh air inlet)

Tank Efficiency – R-House



LiveWork House

- Energy Efficient House Design
 - Stress skin panels
 - ICF basement
 - HRV
- Wall-Hung Boiler
 - Muchkin Contender (MC-80, 92%)
 - 3 radiant floor zones
 - Indirect water heating

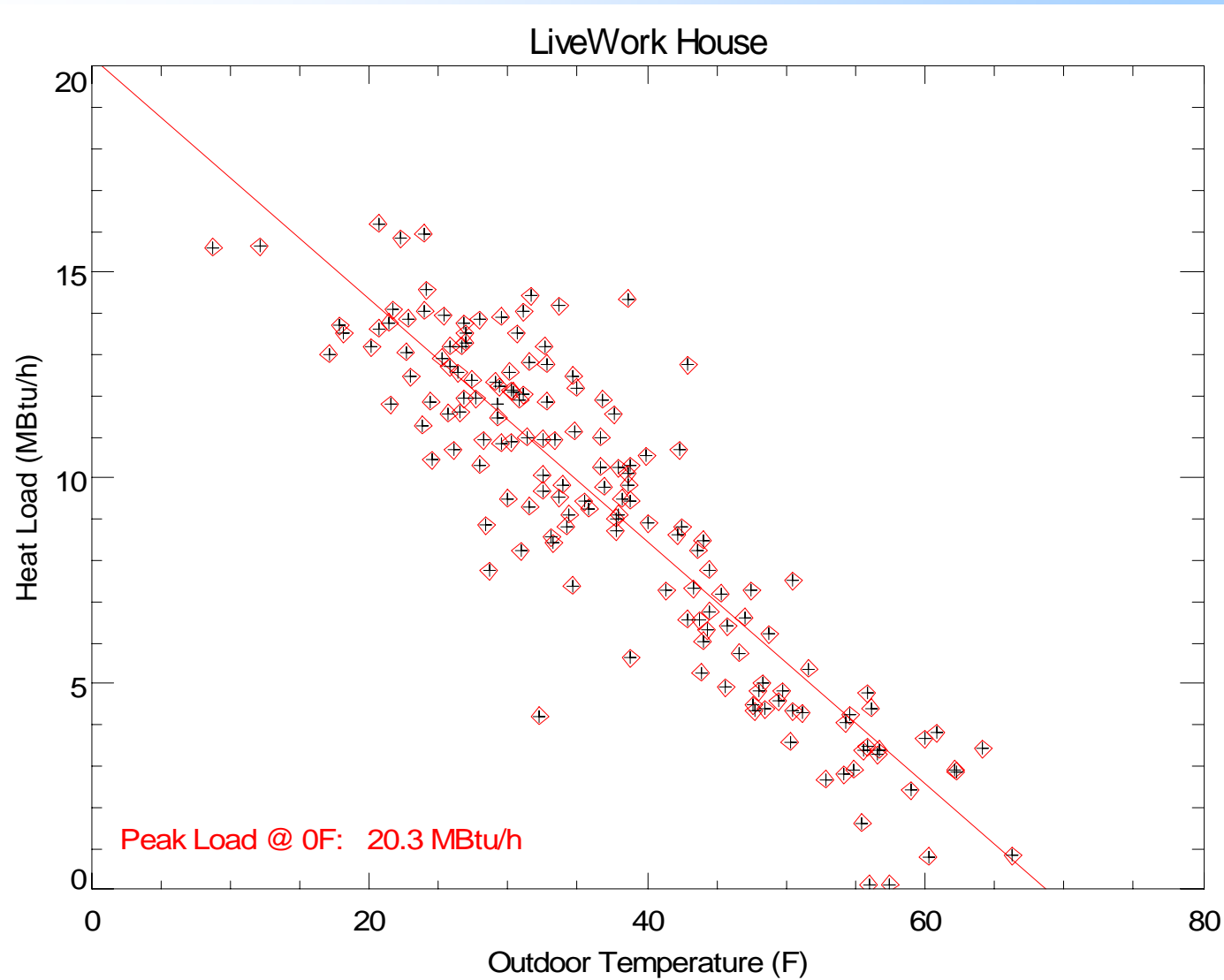


Radiant Floor Zones

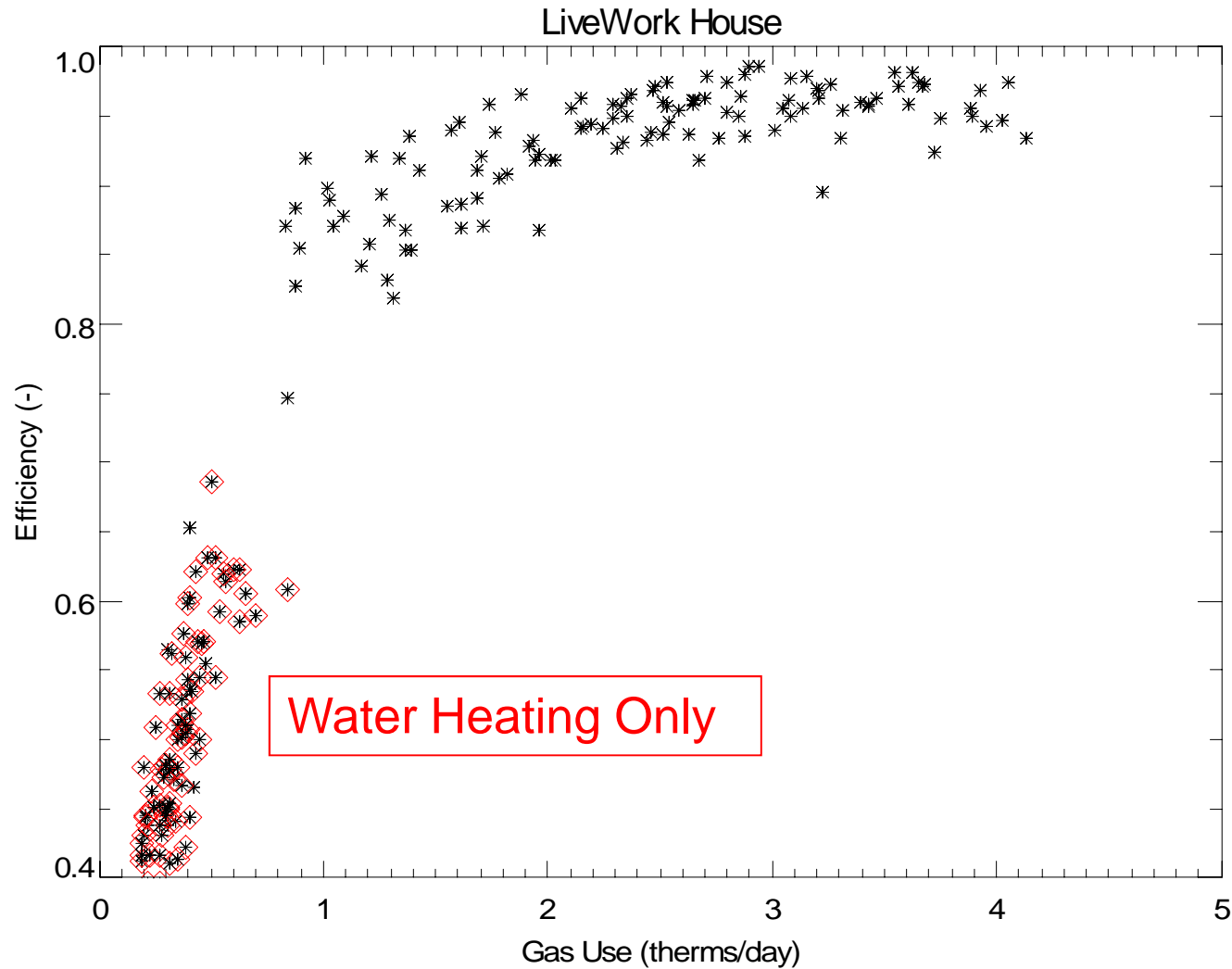
Boiler

Indirect Tank

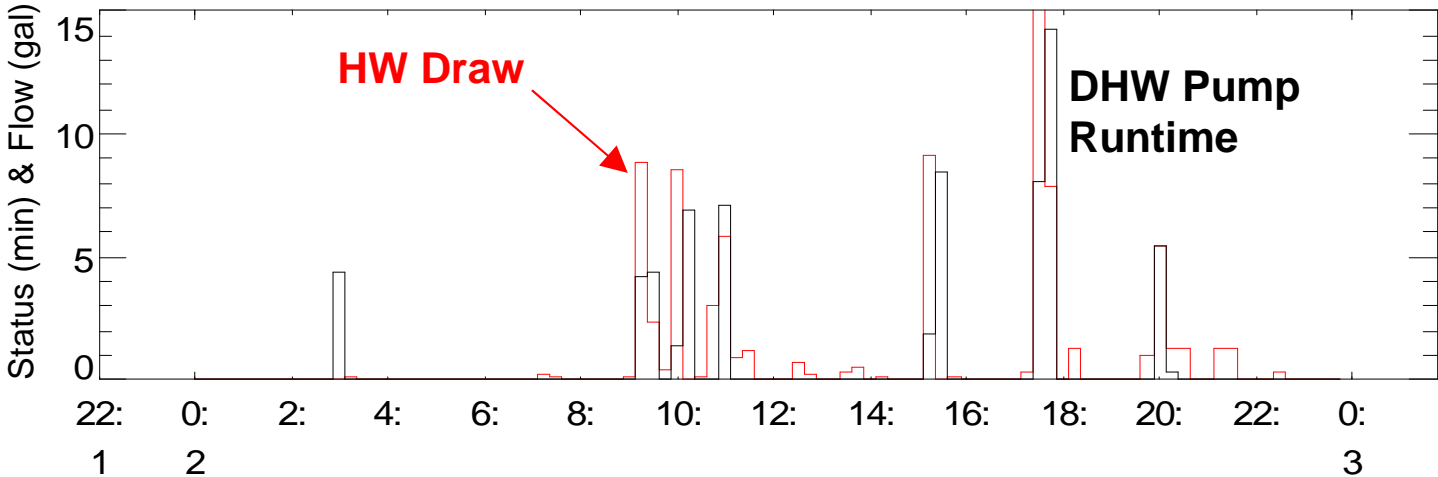
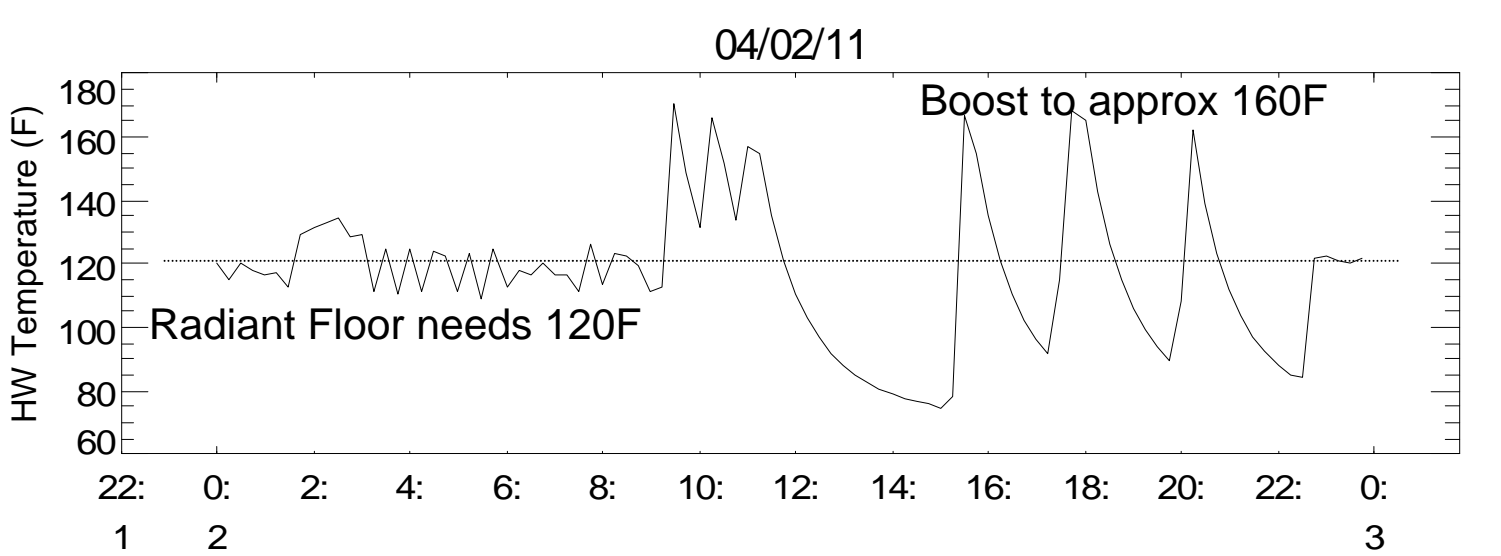
Space Heating Loads - LiveWork



Boiler Efficiency - LiveWork



Temperature Boost Logic - LiveWork



Comparing FTGU Houses

	Ted House	R-House	LiveWork House	Woodland
Peak Ht Load @ 0F (MBtu/h)	16	8-10	20	14
Space Heat (therms/yr)	268	218	570	223
Space heat (therms/ft ² -yr)	0.22	0.18	0.48	0.12
DHW (therms/yr)	96	156	110	408
Electric Use (kWh/yr)	5,323	4,581	7,381	7,480

Summary

- Initial heating season data
 - Modest Heating Loads: 10 to 20 MBtu/h @ 0F
- Boiler efficiencies vary with operating mode
 - Lower efficiency for DHW
- If you have a spare \$10-15k to invest: heating loads can be drastically reduced with better insulation
 - More environmental benefit than Solar Panels?