
Windows in High-Performance Homes: Example Projects

NEHERS Conference Call
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Robb Aldrich
Steven Winter Associates, Inc.
raldrich@swinter.com



RDI Home – Colrain, MA



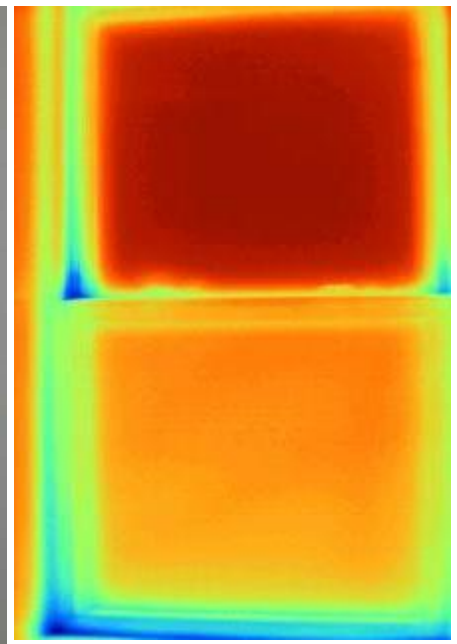
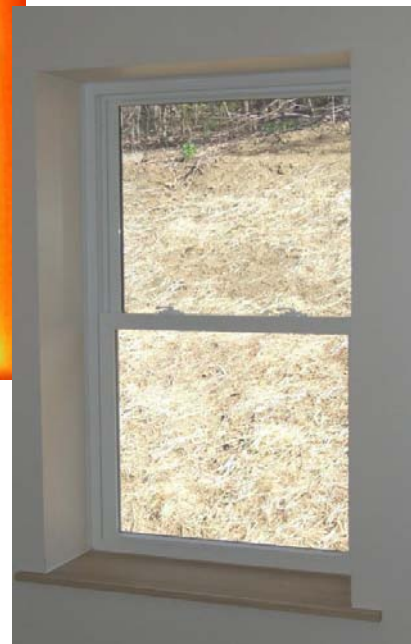
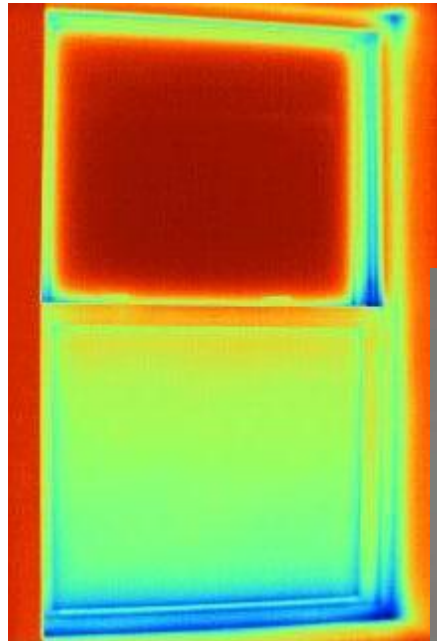
Colrain Home Spec's

- Double walls (R-40+)
- Heat Mirror windows
- R-50 attic insulation
- R-20 slab insulation
- Air tight



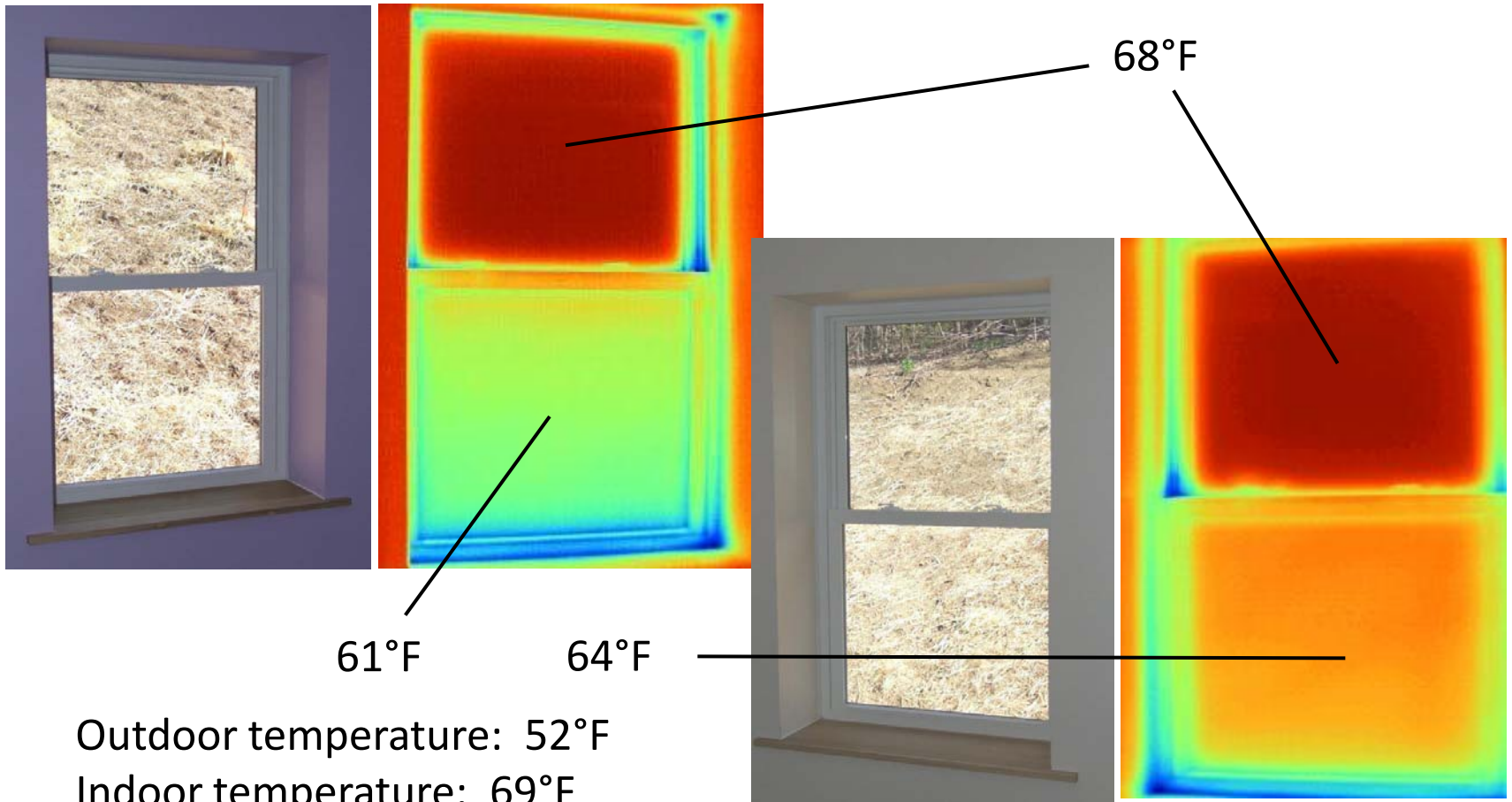
Heat Mirror Windows

U-value: 0.20 Btu/ft²hr F, SHGC: 0.34



Heat Mirror Windows

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Outdoor temperature: 52°F
Indoor temperature: 69°F



Project 2: Wisdom Way Solar Village



20 Homes in Greenfield, MA



WWSV Envelopes

- Double walls (R-40+)
- R-50 attic
- 200-350 CFM₅₀ (~0.1 CFM₅₀/ft² shell)
- Windows...?



Window Wish List

- Paradigm heat mirror product was no longer available.
- Tried find affordable, high solar gain, low U-value windows:
 - $U \leq 0.20 \text{ Btu/ft}^2\text{h F}$
 - $\text{SHGC} \geq 0.5$ (at least for south)
 - $\text{VT} \geq 0.5$
- Contacted dozens of window suppliers and manufacturers.



What we Found

Orientation	Manufacturer	Description	U-value [Btu/ft ² hr°F]	SHGC	VT
South	Paradigm	Double-pane, low-e on surface 3	0.26	0.37	0.53
North, East, West	Paradigm	Triple-pane, low-e on surfaces 2 and 5	0.18	0.23	0.37



Envelope Implications

RDI: We're investing thousands in these envelopes. We **MUST** save \$\$ on HVAC!



Room Heaters

Home Design Loads 9,500 - 13,000 Btu/h
(design temp 2 F)

Unit Heater Specifications:

Lo: 10,200 Btu/hr

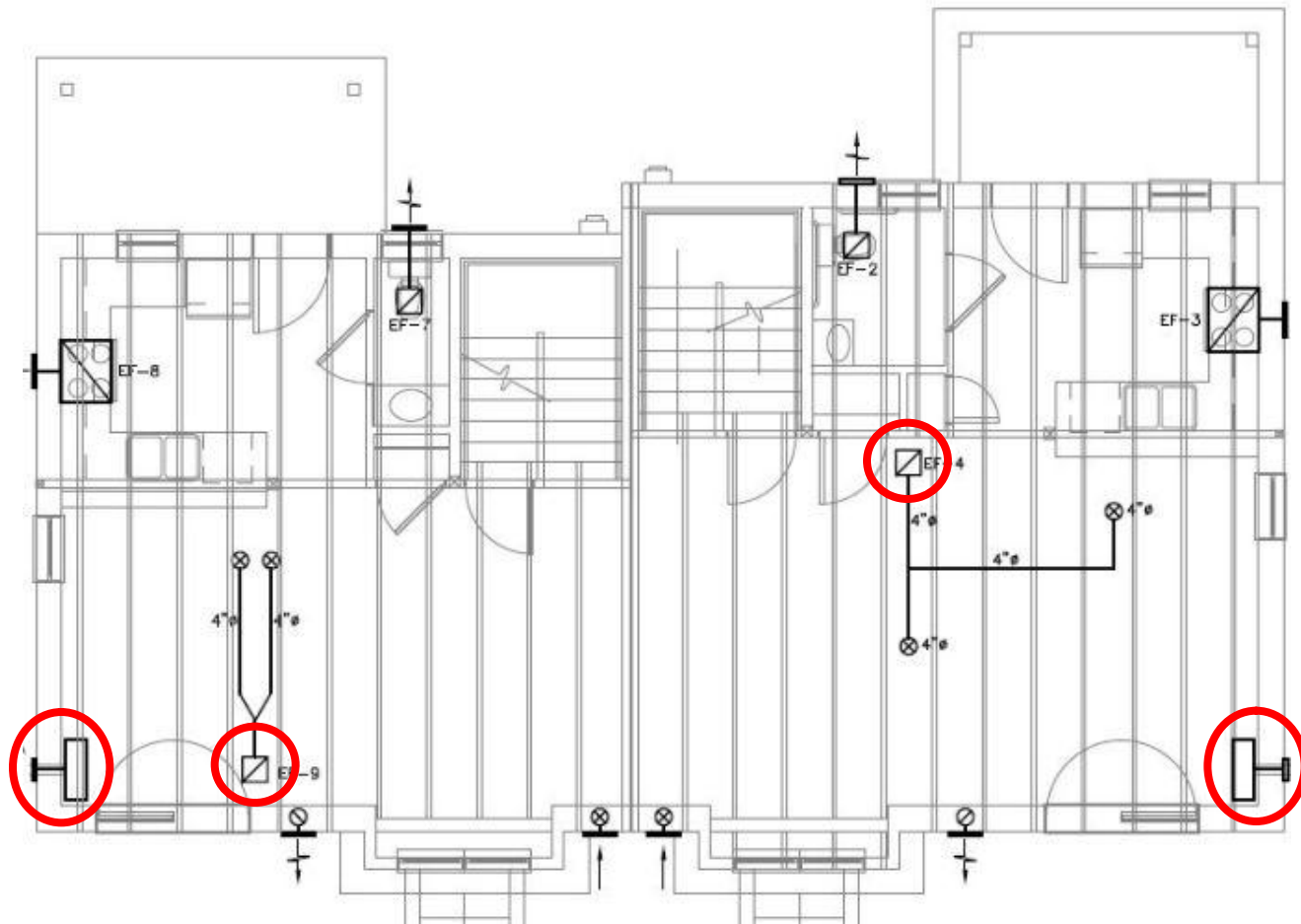
Hi: 16,000 Btu/hr

83% AFUE

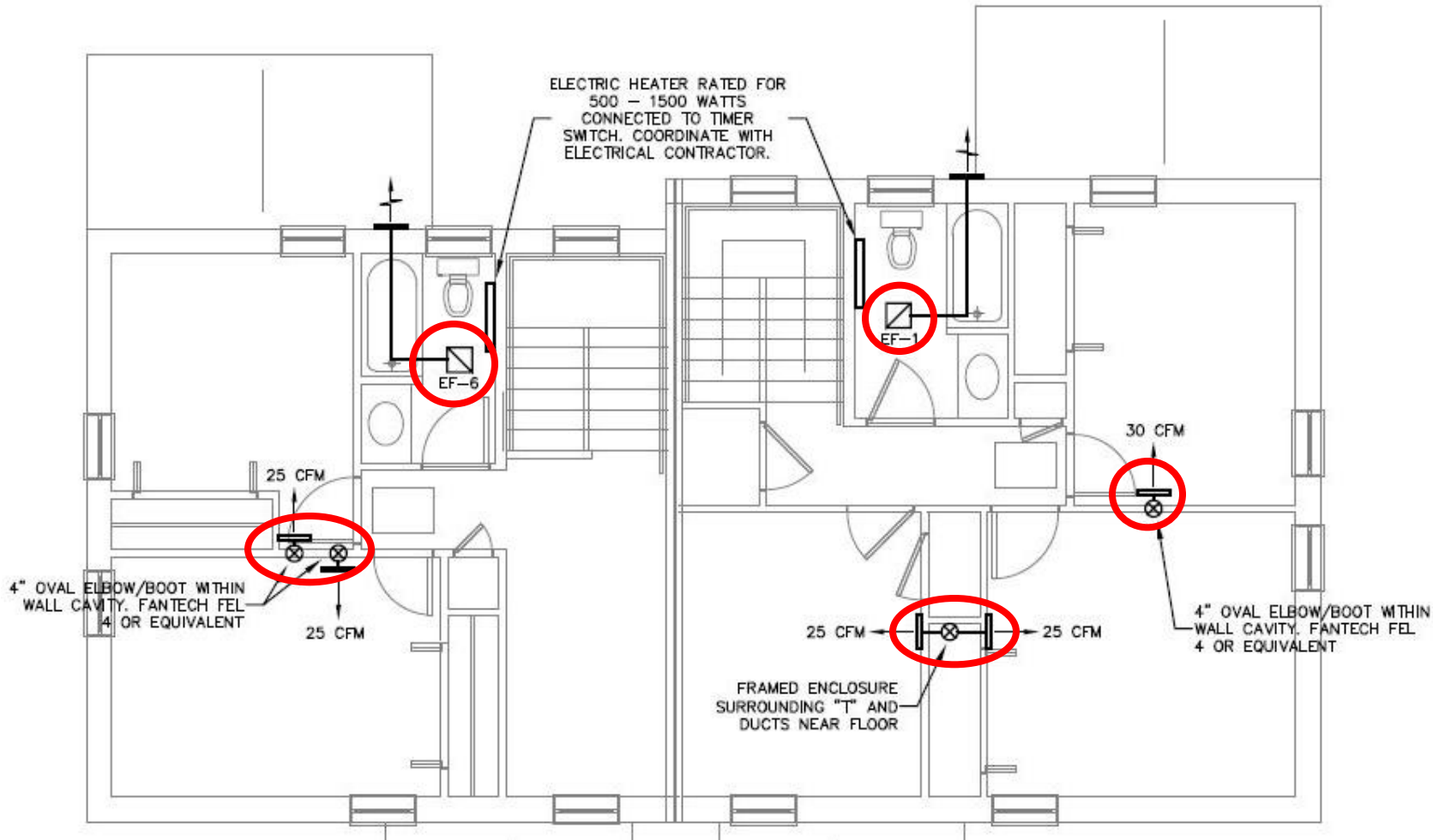
Sealed Combustion



Heating System – First Floor

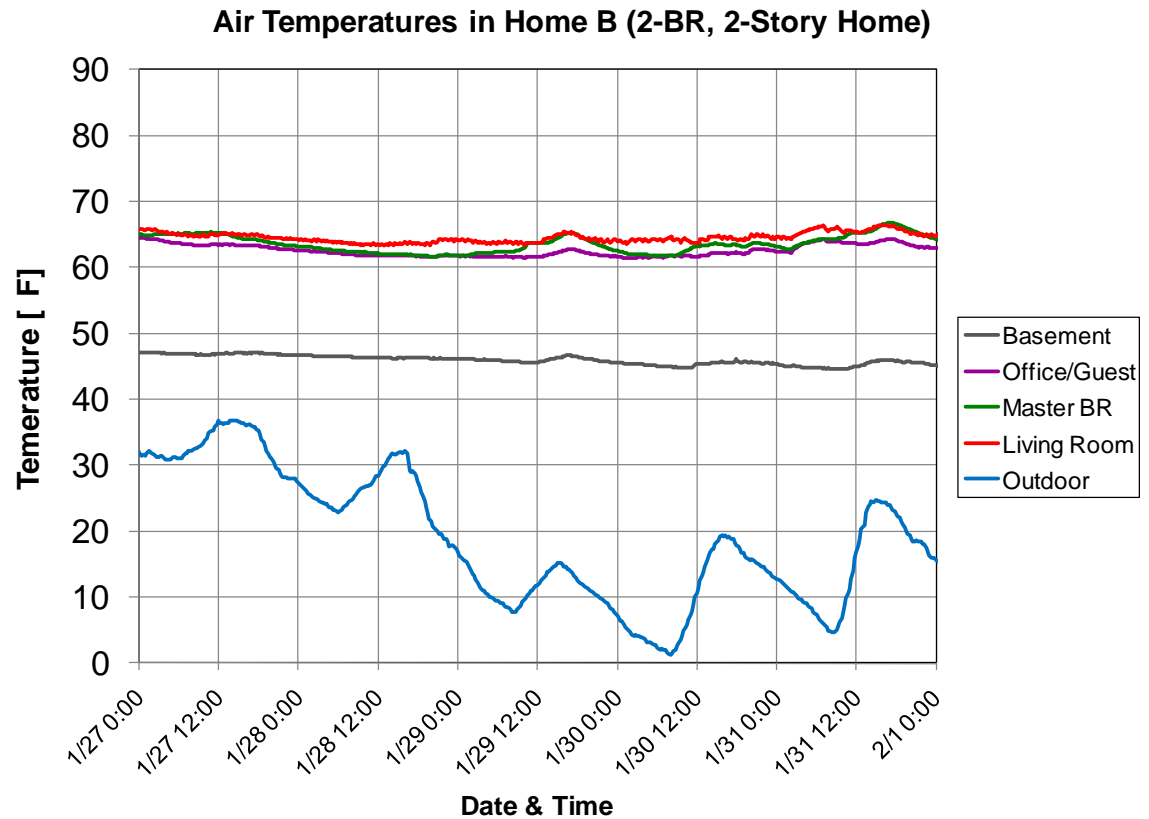


Heating System – Second Floor



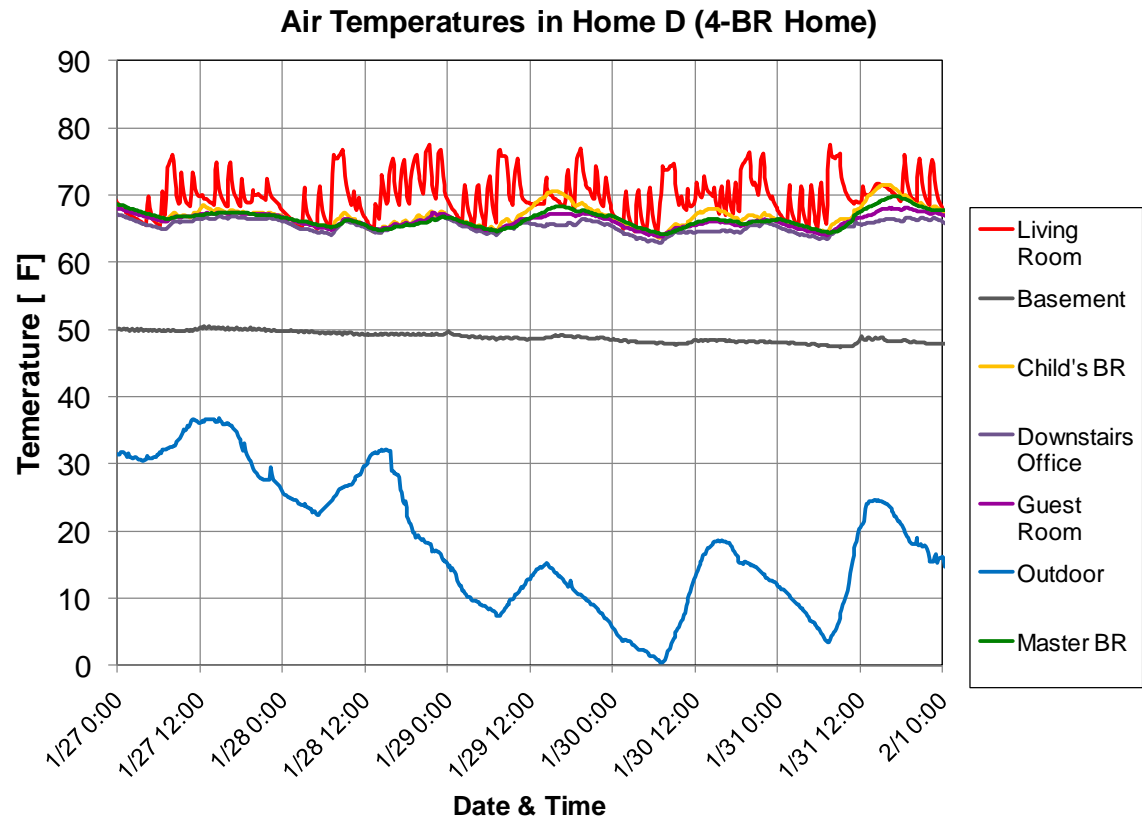
Winter Monitoring (B)

- 2009-2010
- NO set-back used
- Bedrooms slightly cooler, but that's desirable



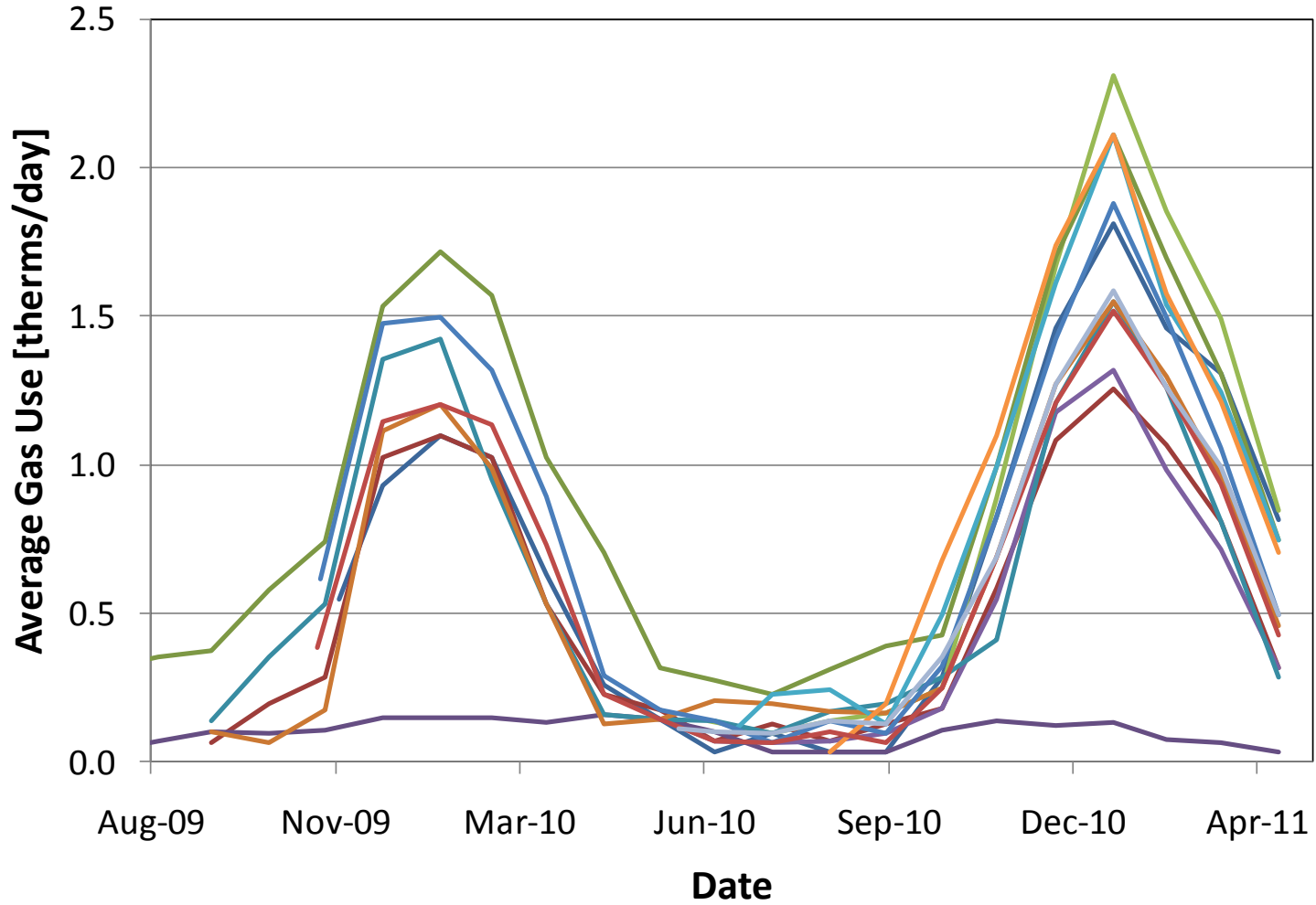
Winter Monitoring (D)

- Largest home, most complex plan
- Aggressive setback & set-up
- Bedrooms definitely cooler
- Not a big deal



WWSV Gas Use

WWSV Gas Use



Annual Energy Costs (8 Homes)

	Min	Max	Average
Natural Gas	\$183	\$485	\$377
Electricity	-\$216	\$68	-\$40
Total	\$171	\$458	\$337

*Including utility fees of approx. \$20/month



Up-Front Costs (energy-related)

Measure	Incremental Cost
Double Walls	\$3,776
R-50 Attic Insulation	\$300
R-40 Floor Insulation	\$540
Triple-pane Windows	\$1,436
Total Envelope	\$6,052
Heating System Savings	(\$4,500)
Net Incremental Cost	\$1,552



Costs of Windows

Windows	Cost
Double-Pane	\$23 /ft ²
Triple-Pane	\$35 /ft ²



Thank You!

Robb Aldrich
Steven Winter Associates, Inc.
61 Washington St.
Norwalk, CT 06854
203-803-5097
raldrich@swinter.com

U.S. Department of Energy
Building America Program:
www.buildingamerica.gov



Report on WWSV testing and monitoring of HVAC:
http://www.carb-swa.com/articles/advanced%20systems%20research/room_heaters_a dv_system.pdf

