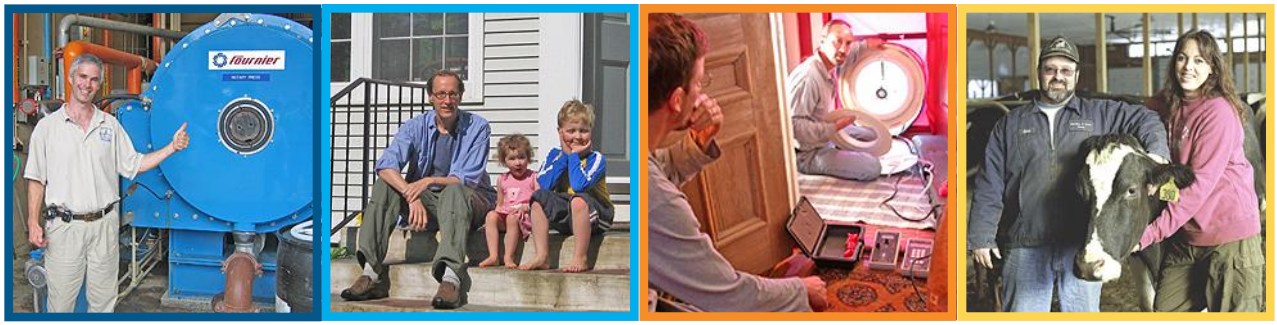
Efficiency Vermont



EVT's High Performance Home Program

Matt Sargent
Senior Energy Consultant
Efficiency Vermont

Better Buildings by Design
February 5, 2014

Efficiency Vermont

High Performance Homes Program

- Pathway to Net Zero
- Lessons learned from Passive House
- Pilot program 2012 and 2013
- Monitoring
- Prescriptive Specifications

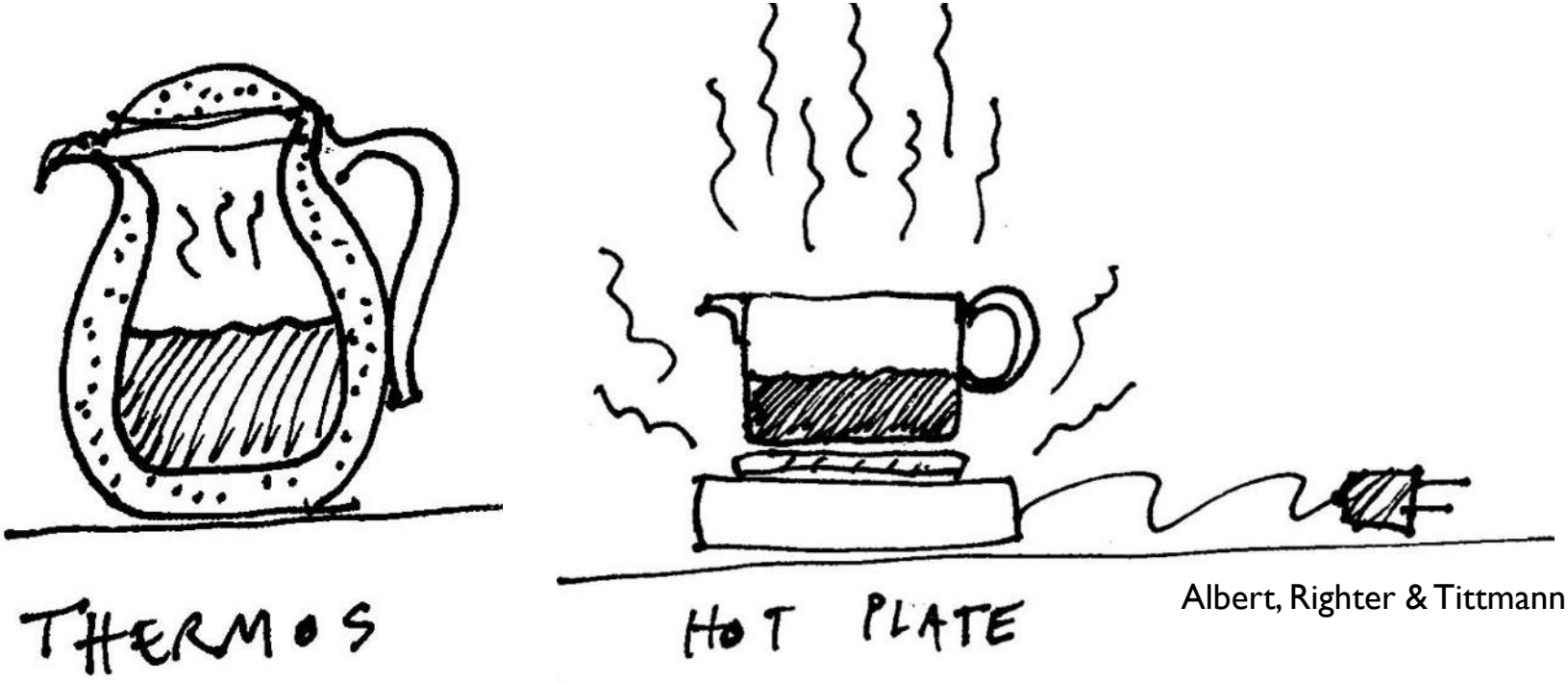
Vermont's Comprehensive Energy Plan

…60% of all new homes in Vermont to ENERGY STAR standards or Efficiency Vermont's Energy Code Plus and broader market penetration of net-zero energy buildings, with a goal of having 30% built to net-zero design standards by 2020 as an interim target on the way to 100% net-zero buildings by 2030.

In Vermont this translates to approximately 275 single family homes built to HPH standards per year.

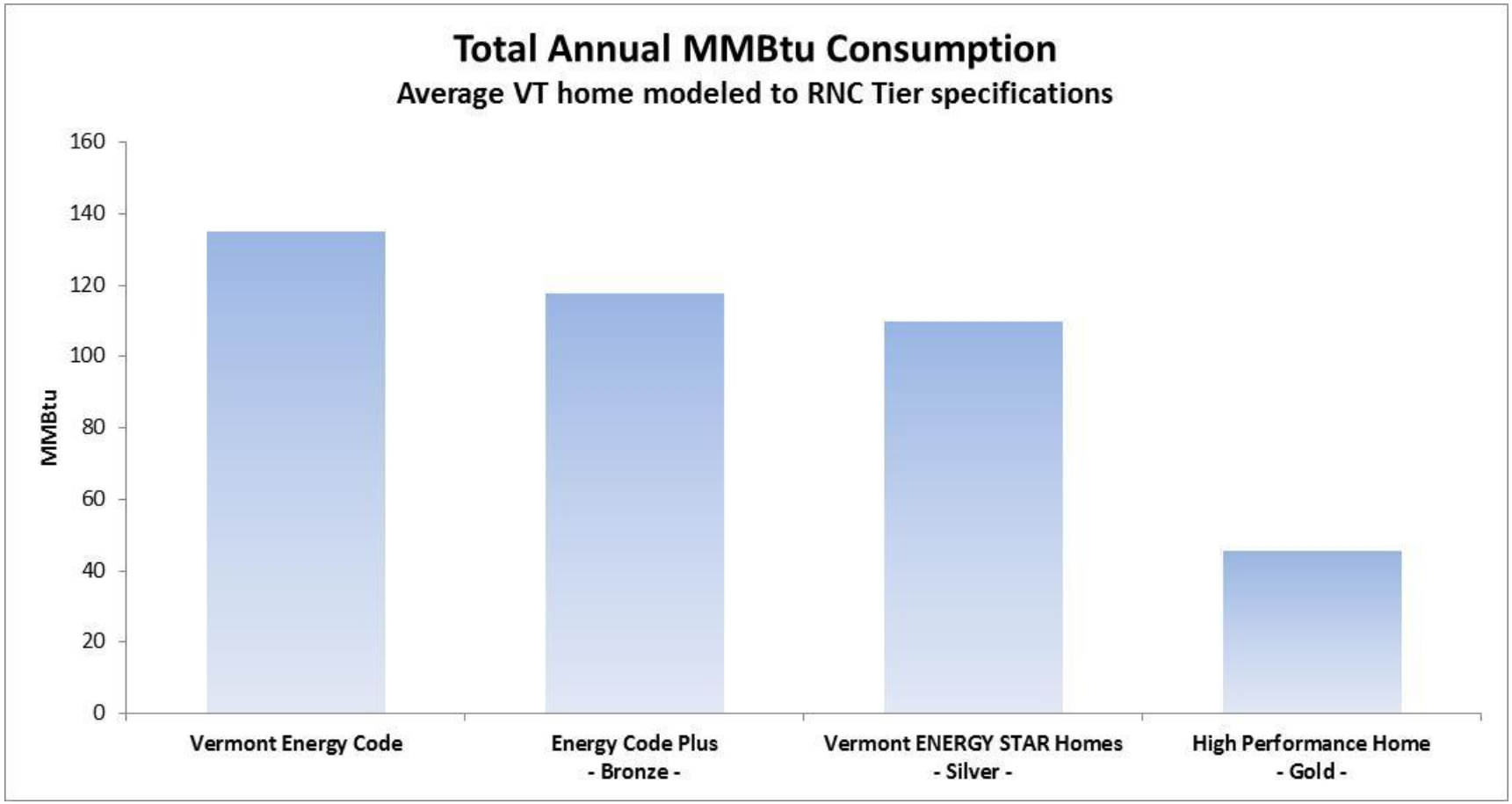
High Performance Home Concept

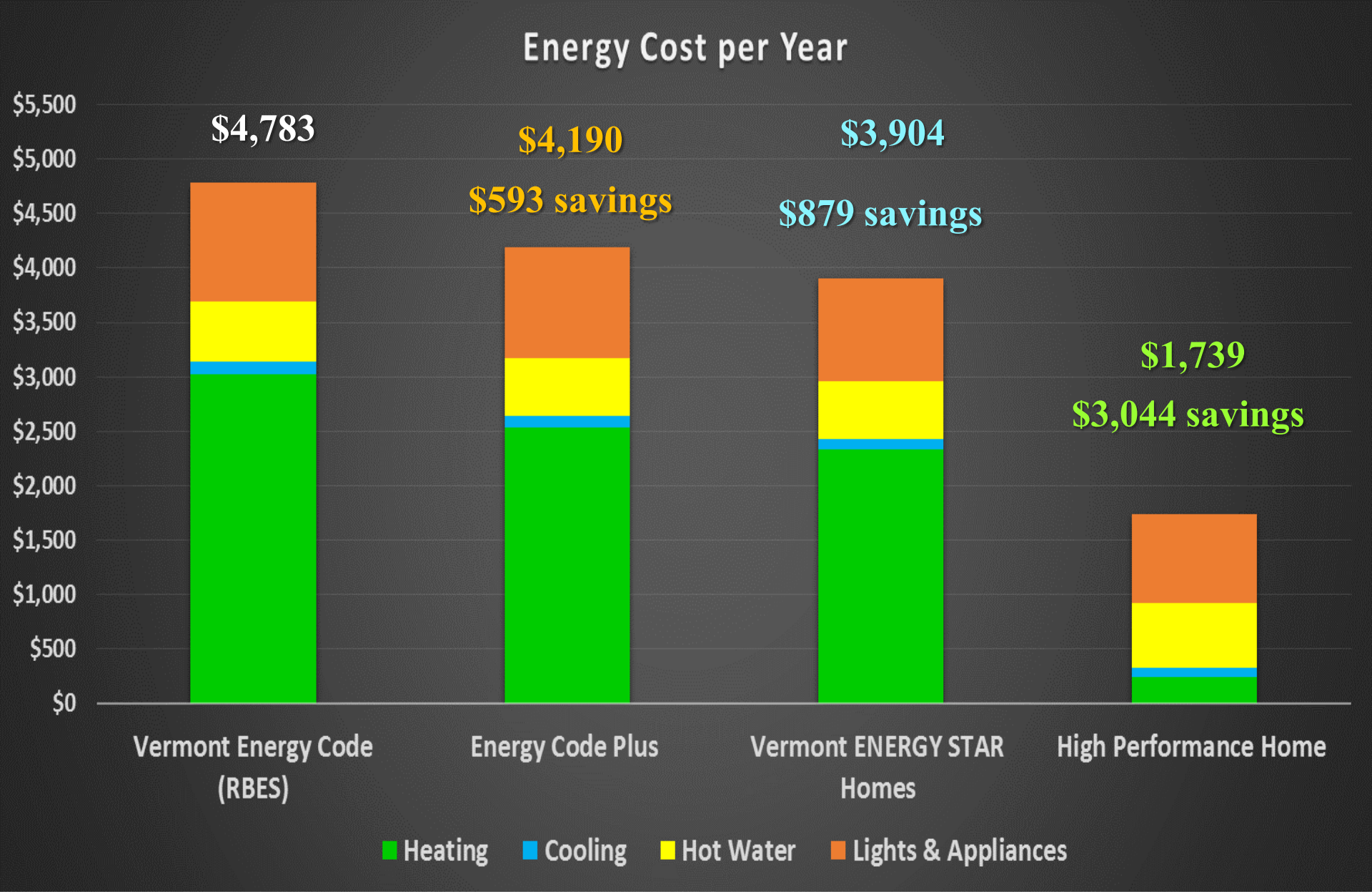
Maintain the temperature using insulation, rather than by using energy.



Albert, Righter & Tittmann

Efficiency Vermont Residential New Construction Tiers

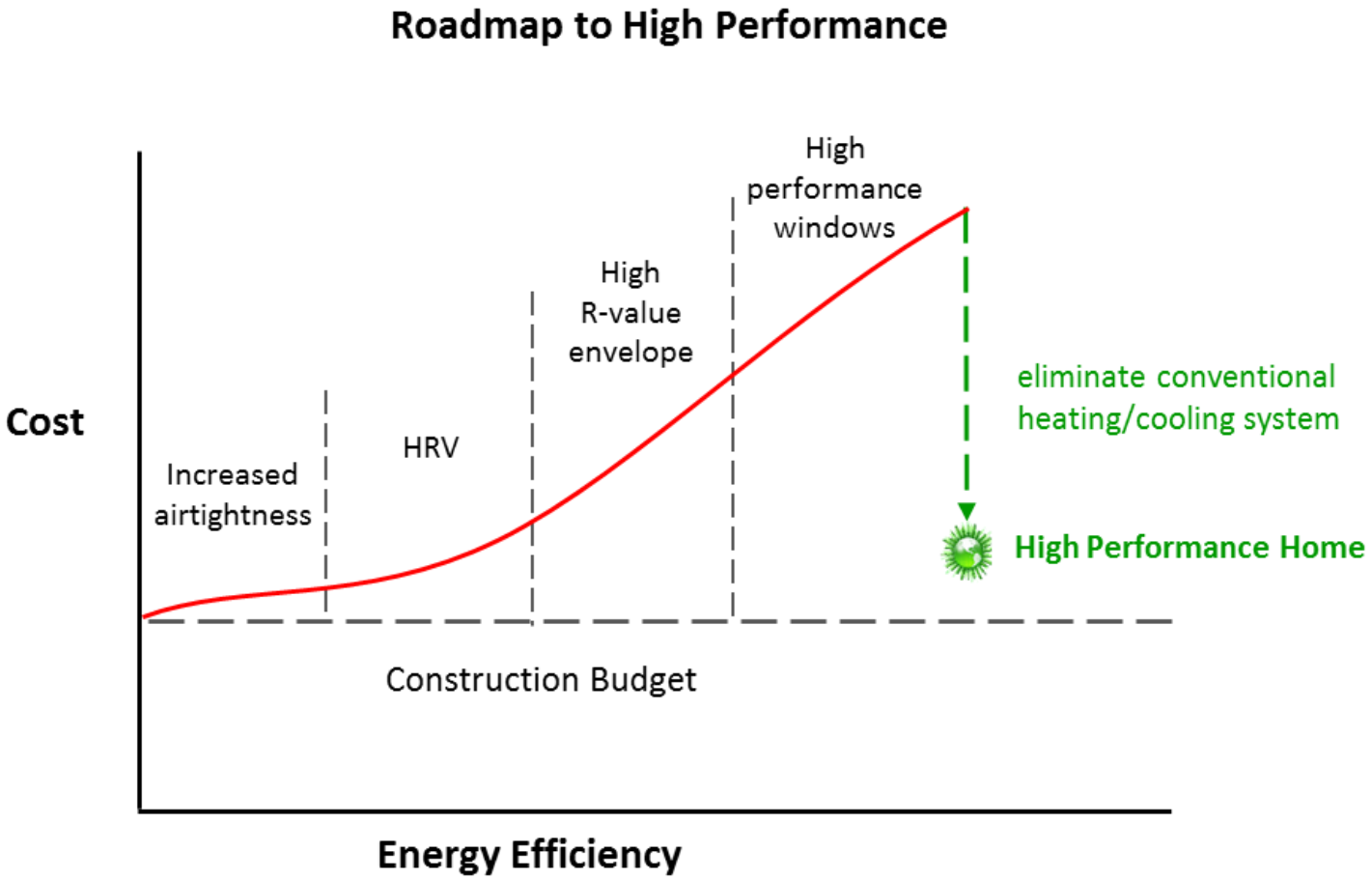



Energy Cost per Year
$5,500
$5,000
$4,500
$4,000
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
$4,783
$4,190
$593 savings
$3,904
$879 savings
$1,739
$3,044 savings
Vermont Energy Code (RBES)
Energy Code Plus
Vermont ENERGY STAR Homes
High Performance Home
Heating
Cooling
Hot Water
Lights & Appliances

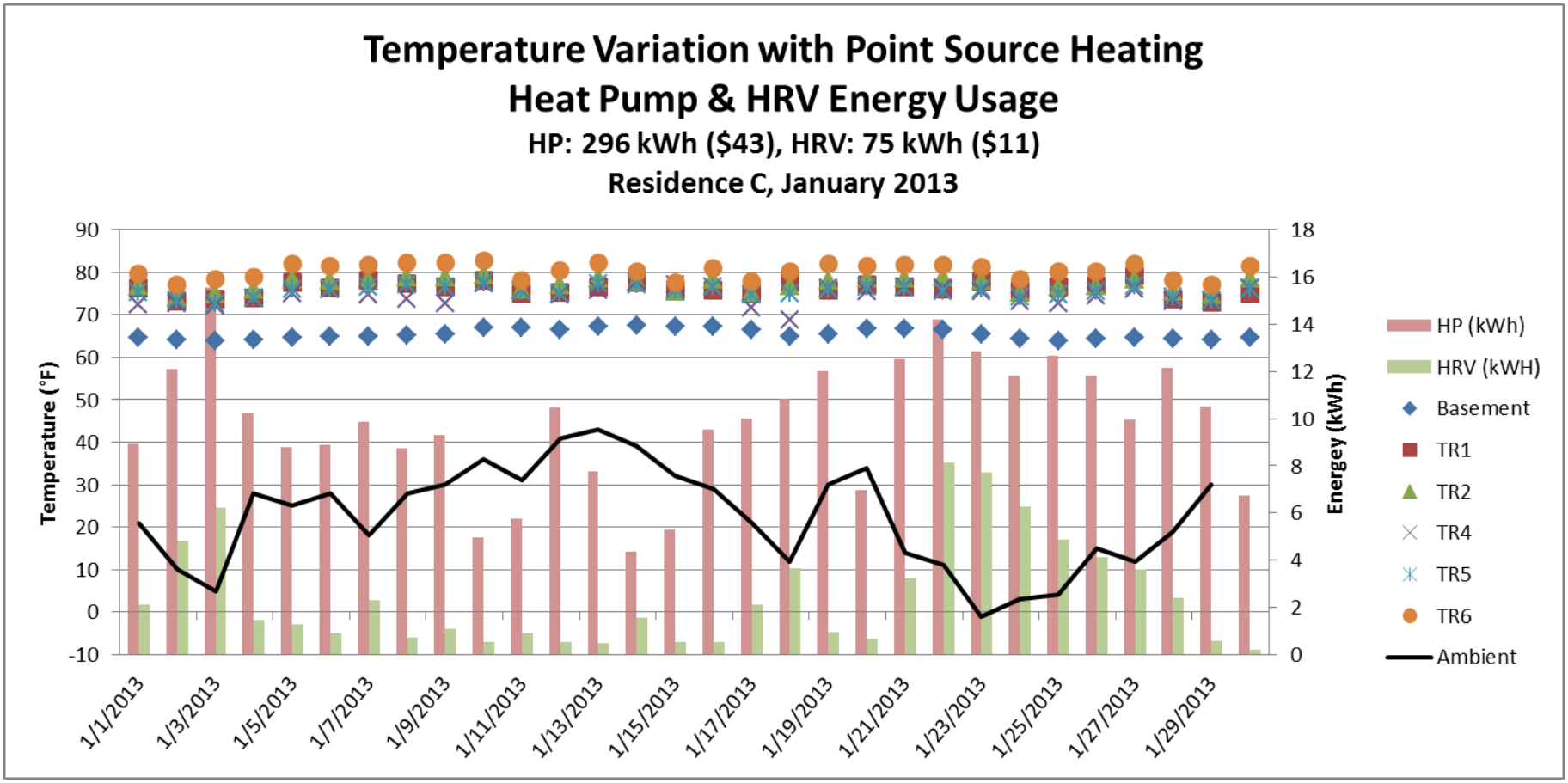
Home Ownership Costs	VT Energy Code Home	High Performance Home Pilot	Cost Increase (+) or Decrease (-) for High Performance Home Pilot
Home Costs			
Home Price	$288,000	$316,800	$28,800
25% Downpayment	$72,000	$79,200	$7,200
Mortgage	$216,000	$237,600	$21,600
Monthly Mortgage Payment	$1,094	$1,279	$185
Energy Cost			
Annual	$4,783	$1,739	-$3,044
Average per Month	$399	$145	-$254
Mortgage & Energy Costs Combined			
Annual	$17,911	$17,087	-$824
Monthly	$1,493	$1,424	-$69

The Code home is an LP gas-heated home (LP gas at $2.913 per gal. - DPS Fuel Price Report 12/13). The High Performance Home uses an ASHP for heating & cooling & an electric resistance water heater. Mortgage: 25% downpayment, 30 year fixed term, 4.5% (4.66% APR) & 0 points - People's United Bank Mortgage Calculator 1/7/14.

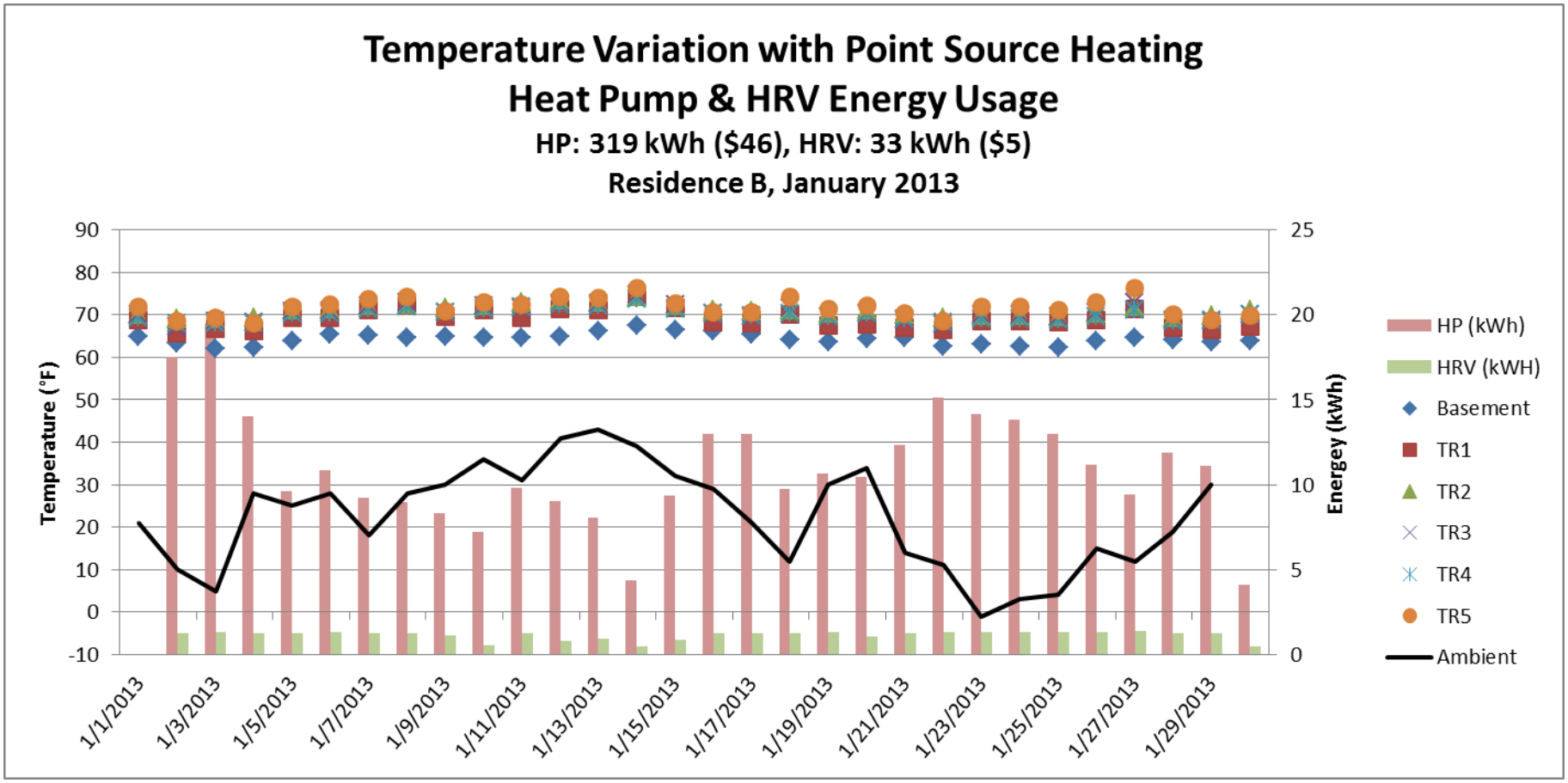
Cost Analysis for High Performance Home



Point Source Heating Adequate for Vermont



Point Source Heating Adequate for Vermont

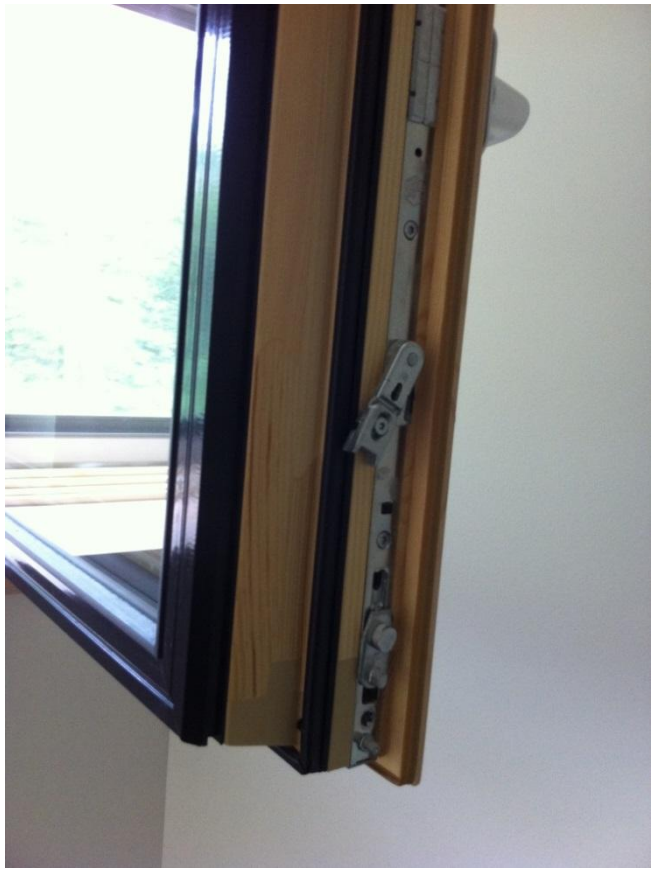


Monitoring Equipment can Help Optimize HVAC Performance

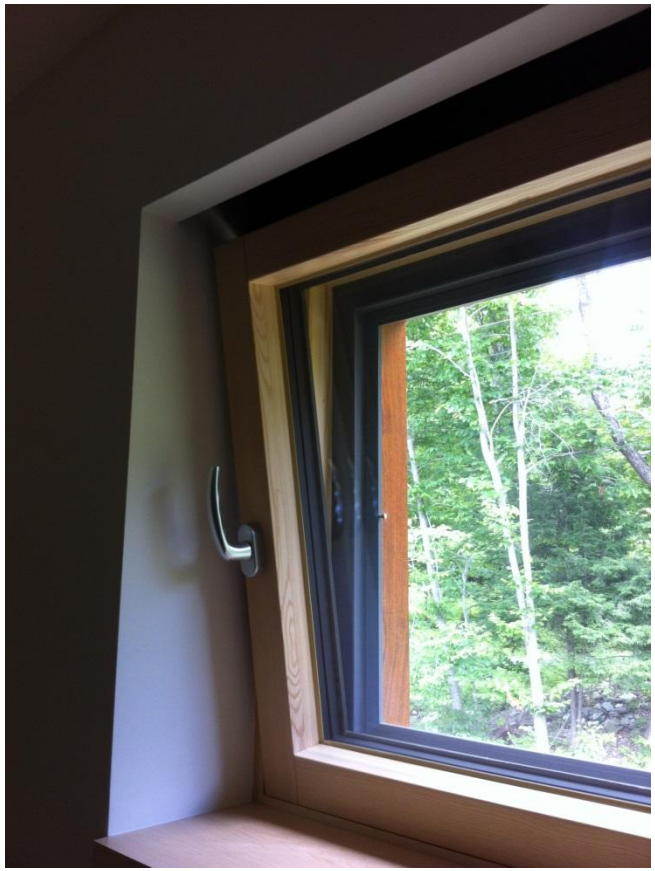
Efficiency Vermont Residential New Construction Tiers

	Vermont Energy Code	Energy Code Plus	ENERGY STAR	High Performance Home
Insulation Installation	Manufacturer's Specification	Grade II	Grade I	Grade I
Windows	U-0.32	U-0.32	U-0.32	U-0.19
Ceiling	R-49	R-49	R-49	R-60
Walls	R-20	R-20	R-20	R-40
Foundation	R-15	R-15	R-15	R-30
Efficient Lighting	50%	50%	80%	95%
Infiltration	5 ACH50	4 ACH50	3 ACH50	1 ACH50
Ventilation	RBES 2011	RBES 2011	ASHRAE 62.2	ASHRAE 62.2 Balanced with recovery efficiency 80% or better

Windows: U-Value 0.19



Tilt and Turn



Installation Details

Doors: U-Value 0.25

Sloped Ceiling: R-60

16”+ Dense-Pack Cellulose

Flat Ceiling: R-80

22”+ Loose Fill Cellulose

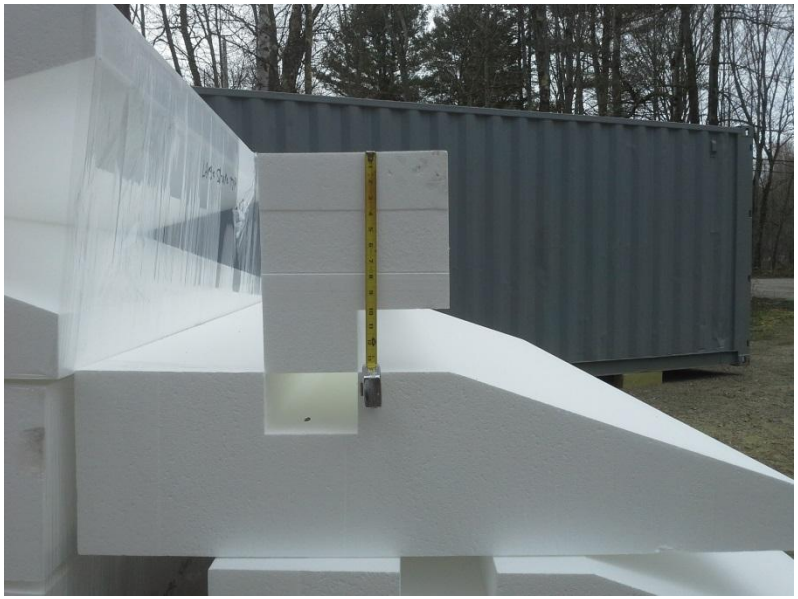
Foundation Insulation: R-30

R-8 footing insulation required

ICF and Interior Foundation Insulation

Slab on Grade: R-30

Slab on Grade

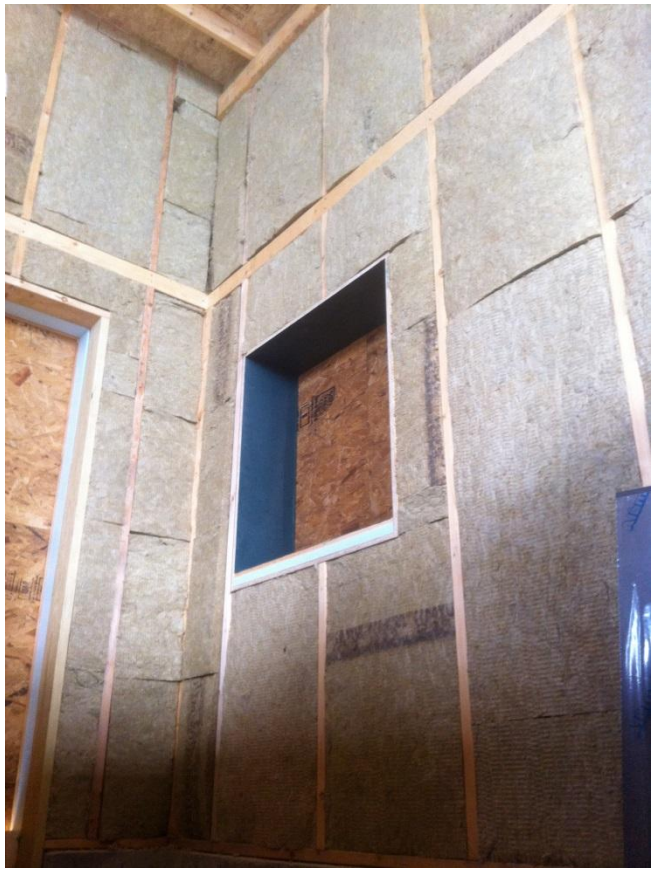


Wall Insulation: R-40

Above Grade and Band Joist

Above Grade Walls

Double Stud Walls



Heating and Cooling Equipment

Energy Star or equivalent, 94% AFUE boilers

Supplemental and Alternative Systems

Water Heating Equipment

Energy Star or equivalent, Drain Water Recovery Recommended

Ventilation:

Recovery Efficiency > 80%

ASHRAE 62.2 or Passive House Whole Ventilation

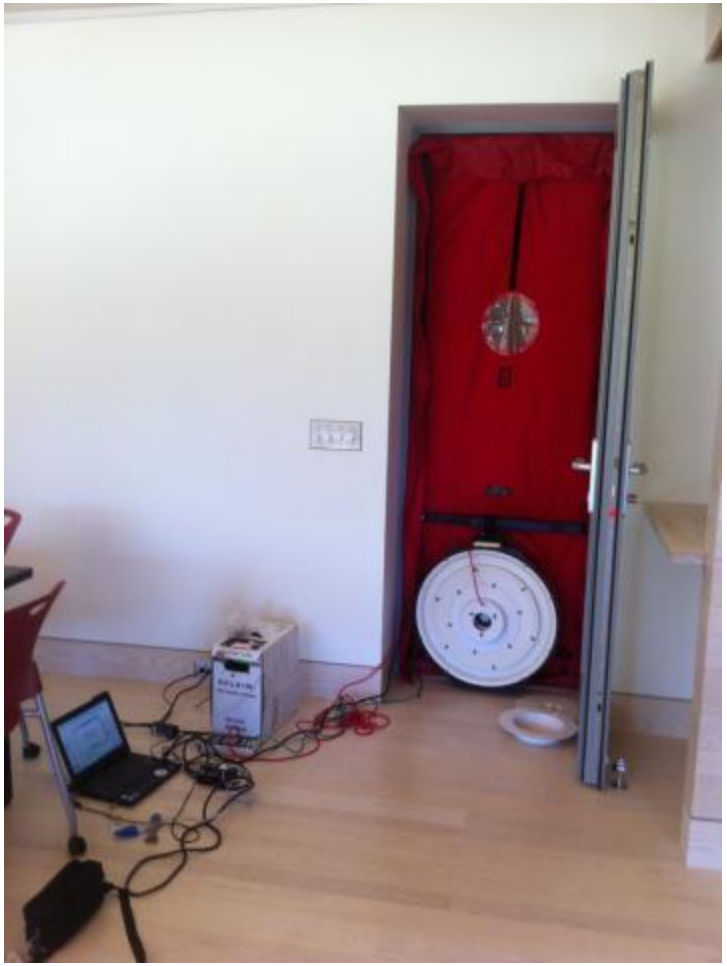
Kitchen and Bath Spot Ventilation

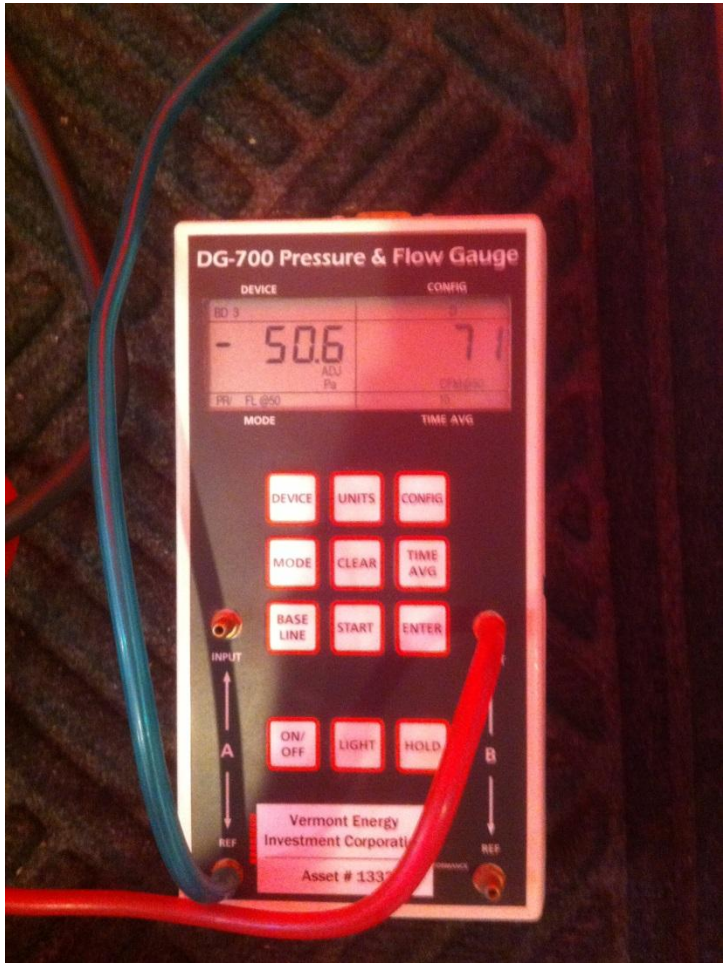
High Performance Mechanicals

Air Leakage < 1.0 ACH50

Habitat for Humanity Passive House

Results




DG-700 Pressure & Flow Gauge
DEVICE
CONFIG
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UNITS
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CLEAR
TIME AVG
BASE LINE
START
ENTER
INPUT
A
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Vermont Energy Investment Corporati
Asset # 133

Seeing is believing