Reiss Building and Renovation

Hinesburg, Vermont

South Hero Congregational Church

Electrical Data

Electrical Use (KWH/yr)		**46,920**
80% for heat (KWH/yr)		**37,536**
$/ yr		**$ 7,808.00**
$/yr/heat		**$ 6,246.00**

The Road Map

Reiss Building and Renovation
756 Buck Hill Road
Hinesburg, Vermont 05461

Congregational Church of South Hero 5/14/10
24 South Street
South Hero, Vermont 05486

Estimated Costs for Energy Work

	Item	Estimated Cost
1	**Energy Audit**	**$ 1,000.00**
2	**Seal penetrations in annex attic space and insulate** **24" of cellulose installed after fiberglass is removed**	**$ 7,320.00**
3	**Sheetrock ceiling in room 4 and 6 of annex**	**$ 2,892.00**
4	**Seal and insulate attic in sanctuary** **24" of cellulose over fiberglass** **Weather strip and insulate hatch**	**$ 7,857.00**
5	**Seal around range hood in kitchen**	**$ 78.00**
6	**Install pv on south roof** **63 panels w/ 210 watts each** **State incentive $ 30,089.00** **Fed Credit $ 16,769.00**	**$ 85,995.00**
7	**Mitsubishi air to air heat pumps** **Eight MSZFE-12A units**	**$ 32,000.00**
9	**Froling wood pellet boiler** **20/25 unit up to 80,000 btus** **Baseboard hot water** **Hopper on exterior of building**	**$ 54,656.00**
10	**Solar hot water; two Heliodyne Golbi 408 panels** **Mounted on annex roof** **State incentive $ 1,050.00**	**$ 9,500.00**

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Skeetrock ceiling in room 4 and 6 of annex					**$ 2,892.00**
Seal and insulate attic in sanctuary					**$ 7,857.00**
	24" of cellulose over fiberglass				
	Weatherstrip and insulate hatch				

South Hero Congregational Church 1/17/2013

Btu Load Improved Building Envelope

Annex	Ft2	R-Value	U-factor	Ft2 x U	Delta T	Btu/ hr
Ceiling	1628	60	0.02	32.6	78	2539.7
Slab	1628	10	0.1	162.8	20	3256.0
Walls; upper	1177.5	19	0.05	58.9	78	4592.3
Walls; lower	2387.75	19	0.05	119.4	78	9312.2
Windows; upper	132.5		0.35	46.4	78	3617.3
Windows; lower	189.58		0.35	66.4	78	5175.5
Doors	40	4	0.25	10.0	78	780.0
						29,272.9
Total Volume (Ft3)	31,420					
Air exchange	ACH N=	cfm50 x 60		ACH N =	0.33	
		V x N				
(15% reduction)	Blower Door	2,422 cfm				
Btu/ hr air	Vol x HC Air x Delta T					
	10,385	x .018 x 78				14,580.0
Total Annex Btu Improved						**43,852.9**

Btu Load Improved Building Envelope

Sanctuary	Ft2	R-Value	U-factor	Ft2 x U	Delta T	Btu/ hr
Ceiling	2288	60	0.02	45.8	78	3569.3
Slab	2288	10	0.1	228.8	20	4576.0
Walls	2750	19	0.05	137.5	78	10725.0
Windows	272		0.35	95.2	78	7425.6
Doors	84	4	0.25	21.0	78	1638.0
						27933.9
Total Volume	42,511					
Air exchange	ACH N=	cfm50 x 60		ACH N =	0.16	
		V x N				
	Blower Door	1594				
Btu/ hr air	Vol x HC Air x Delta T					
	6,801	x .018 x 78				9,549
Total Sanctuary Btu Improved						**37,483**

Mitsubishi air to air heat pumps			**$ 42,375.00**
	Two 18,000 btu/ hr units in sanctuary		
	One 18,000 btu/hr unit on lower level of annex (larger room)		
	One 9,000 btu/hr unit on the lower level of the annex (smaller room)		
	Two 9,000 btu/hr units on second floor of annex		
	One 12,000 btu/ hr unit on the second floor of the annex		

Mitsubishi air to air heat pumps				**Estimated**
	36,000 btu/ hr units in sanctuary			**37,483**
	48,000 btu/hr units in annex			**43,853**


EXIT

Solar PV?

Electrical Data

Electrical Use (KWH/yr)	**46,920**
80% for heat (KWH/yr)	**37,536**

PV system

Heat pump has an average COP of 2.5

46,920/ 2.5 = 18,760 KWH/yr

One 265 watt panel X 1.2 = 318 KWH/yr

18,760/318= 58.99 panels

Questions?

Richmond House

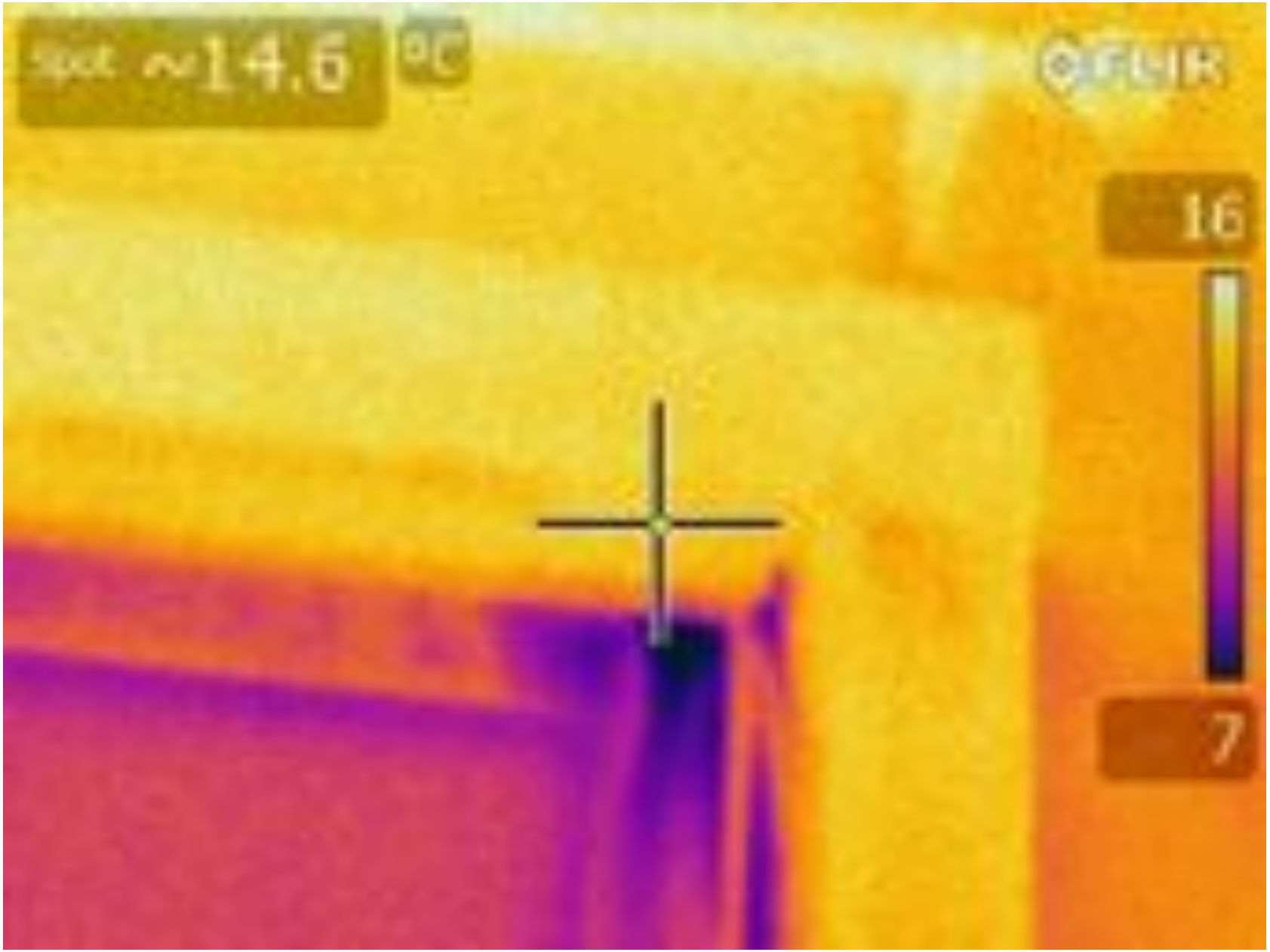
House built in 1907

Three Bedrooms

1,248 sq. ft. of conditioned space

Stone foundation

Full attic


Spot 14.6 °C
FLIR
16
7

3/16/12 Energy Audit Results

cfm50 3,396

ACH Natural 1.03

gals oil/ yr 650 ($2,385.00/ yr)

BTU/ Sq. ft. 53,524

Electric Use ‘11- ‘12 1952 kwh/yr

CAZ worst case -1.5

The Road Map

Reiss Building and Renovation

756 Buck Hill Road

Hinesburg, Vermont 05461

Betsy Hardy 05/01/12

341 Jericho Rd.

Richmond, Vt 05477

Recommendations and Estimated Costs for Energy Work

	Item	Estimated Cost
1	Energy Audit	$ 400.00
2	Foam band joists in basement and 4' down basement wall	$ 3,094.00
	4" of closed cell foam in all exposed joist bays and 3" on wall	
	Foam 4' down fon east, south and north walls	
	Foam entire west wall (under deck)	
	Ignition paint on all exposed surfaces	
	Limited masorny work on wall	
3	Insulate attic storage main house after foaming penetrations w/ foam	$ 2,386.00
	Remove fiberglass insulation, foam all penitrations,	
	Add 24" of cellulose (R-75)	
	Fiberglass will be baged and left on site	
4	Construct new hatch to attic	$ 760.00
	Weighted door on hinges with foam core	

5	Add storage area in attic	$ 1,040.00
	Plywood stoarage area 8' x 16'	
	Framing using 2 layers of 2x10 joists	
6	Replace sliding door in kitchen	$ 2,211.00
	Marvin Integrity sliding door	
	New door foamed in place	
	New exterior and interior trim	
7	Add storm panel to front window	$ 324.00
	Marvin custom storm window	
8	Replace exterior door in basement	$ 926.00
	ThermaTru Smooth star flush door	
	Door foamed in place	
	New exterior trim	
9	Remove heat lines in basement	$ 654.00
10	Foam domestic hot water lines and heat lines in the basement	$ 192.00
11	Bath fan	$ 732.00
	Panasonic 110 cfm fan	
	ducted to gable end with solid pvc pipe	

12	Air- air domestic hot water			$ 3,514.00
		Stieble Eletron Accelera 300 heat pump water heater		
		80 gal storage tank		
13	Solar pv			
		24 Solar World panels roof applied		$ 19,642.00
		SMA 6000 Inverter (located in basement)		
		Each panel 265 watts, toal peak wattage 6,360		
		Approximately 7,632 kwh/yr		
		New 100 amp 30 circuit panel in the basement		
		Fed credit estimate	$ 5,120.00	
		State incentive estimate	$ 2,312.00	
			$ 7,432.00	
		Adjusted solar pv estimate	$ 12,210.00	
	Total			$ 23,156.00
	Total adjusted after incentives and credits			$ 15,724.00

14		Add two 18,000 btu mini split air to air heat pumps				$ 9,000.00
			Mitsubishi MSZ (MUZ)-FE 12 NA			
			Cost per unit $4,500.00			
			For info see: www.mitsubishicomfort.com			

Phase I Summer 2012


ARRIS
KITTEN CAT

Cost of Energy Work Phase I

Insulate and seal Basement	$4,620.00
Insulate and Seal Attic	$3,832.00
Replace 6’ sliding door	$3,795.00
	$12,247.00
State Incentive	$2,259.00
Total Adjusted Cost	$9,988.00

Test Out Results

cfm50	3,396	1,943
ACH Natural	1.03	.59
gals oil/ yr	650	391
Kwh/yr	1952	1,108
CAZ worst case	-1.5	-1.9

Phase II

12	Air- air domestic hot water			$ 3,514.00
		Stieble Eletron Accelera 300 heat pump water heater		
		80 gal storage tank		
13	Solar pv			
		24 Solar World panels roof applied		$ 19,642.00
		SMA 6000 Inverter (located in basement)		
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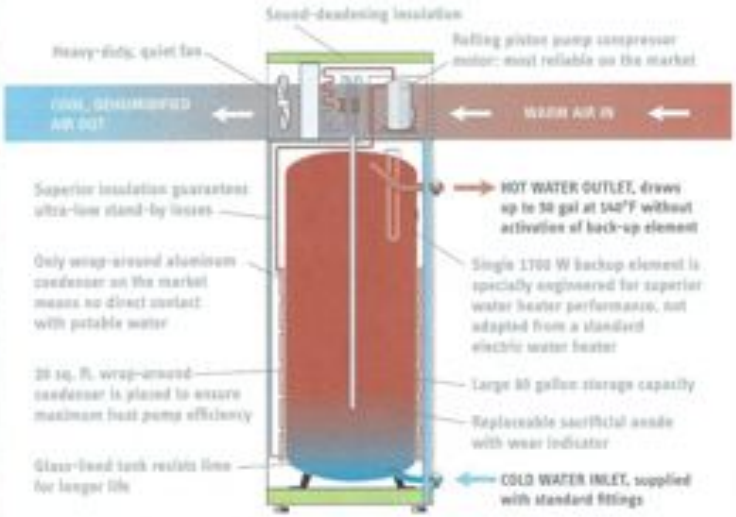
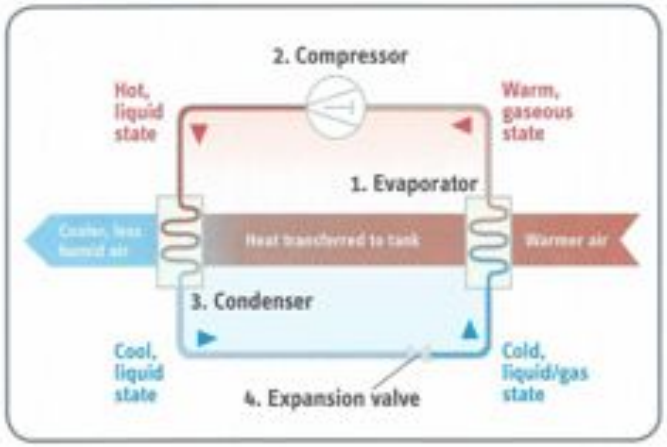
Capture the Energy

STIEBEL ELTRON





Simple innovation from Germany.

Heat pumps have been around for decades, but a heat pump water heater is a new concept. The Accelera® 300 works like an air conditioner but instead of dumping the heat outdoors, it puts it into the water.

The heat pump system contains a fan that forces air through an evaporator (1). The evaporator contains a liquid refrigerant. When this refrigerant evaporates, it extracts heat from the ambient air.

The now warm gaseous refrigerant passes through the compressor (2) which increases its pressure. As the pressure increases, the temperature of the refrigerant rises. The refrigerant turns back into a liquid which is now hot.

The hot refrigerant then passes through the condenser (3), which is wrapped around the water tank, transferring its heat to the water.

The refrigerant which is now cool then passes through an expansion valve (4), where it goes back into a gaseous state and the process begins anew.

State and Local Rebates / Incentives | Regional incentives for the Accelera® 300 may be available. The US Department of Energy's Database of State Incentives for Renewables & Efficiency website, DSIRE, has up-to-date details at: http://www.dsireusa.org/

ISO 9001 CERTIFIED

intertek

SAVE WATER MONEY

ENERGY STAR HAUTE EFFICACITÉ HIGH EFFICIENCY

Richmond House Heat Take Off

Btu Load at -10 Degree C

	Ft2	R	U	Ft2 x U	Delta T	Btu/ hr
Ceiling	624	80	0.01	8.1	78	632.7
Slab	575	5	0.2	115.0	28	3220.0
Walls; 1st & 2nd	1,349	11	0.09	121.4	78	9470.0
Walls; basemt	200	16	0.06	12.0	78	936.0
Walls; basemt	200	16	0.06	12.0	50	600.0
Walls; basemt	287	2	0.5	143.5	28	4018.0
Windows; new	35		0.3	10.5	78	819.0
Windows; old	136		0.4	54.4	78	4243.2
Doors; new	42		0.3	12.6	78	982.8
Doors; old	38		0.25	9.5	78	741.0
						25,662.7

Total Volume (V) 14,352 Blower Door cfm50 1,943

Air exchange ACH N= $\frac{\text{cfm50} \times 60}{\text{V} \times \text{N}}$ $\frac{1{,}943 \times .97 \times 60}{14{,}352 \times 13.8}$

ACH N = .57

Btu/ hr air Vol x HC Air x Delta T

(14,352 x .57) x .018 x 78 11,485.0

Total Btu/hr **37,147.7**

Phase III Air-Air Heat Pumps for Space Heating

14		Add two 18,000 btu mini split air to air heat pumps				$ 9,000.00
			Mitsubishi MSZ (MUZ)-FE 12 NA			
			Cost per unit $4,500.00			
			For info see: www.mitsubishicomfort.com			

Projected KWH Annual Usage

• Two Heat Pumps (2,200 each)	4,400
• DHW Heat Pump	1,000
• Plug Load	1,200
	6,600
Project annual solar production	7,632
Available for Electric Car	1,032

Projected KWH Annual Usage

• Two Heat Pumps (2,200 each)	4,400
• DHW Heat Pump	1,000
• Plug Load	1,200
	6,600
Project annual solar production	7,632
Available for Electric Car	1,032

KWH/Yr Based on Present Oil Use

391 gals/ yr = 54.036 Mbtu/ yr

54.036 Mbtu/yr x .80 = 43.228 Mbtu/yr

43.228 Mbtu/yr / 2.6 (COP) = 16.63 Mbtu/yr

16,626,523/ 3412 (KWH / btu) = 4,873 KWH/yr

Heat Load	4,873
Plug Load	1,200
Total	6,073

The Numbers

Not taking into account the cost of "externalities" and the increasing cost of fossil fuel

Phase I	$ 9,988.00
Phase II	$15,724.00
Phase III	$ 9,000.00
	$34,712.00

Annual Utility Expenses 2011- 2012 $2,834.00

$2,834 x . 9 = $2,550.00 ($284.00 not realized)

$34,712.00/ $2,550.00 = 13.6 yrs

Vermont's Energy Future?

Conservation

250 gals oil/ house yr x 80,000 homes

20 M gals oil/ yr

30.2 M gals propane/yr

27.1 M ccf nat gas/ yr

Vermont's Energy Future?

Conservation + Renewables

650 gals oil/ house yr x 80,000 homes

52 M gals oil/ yr

78.4 M gals propane/yr

70.5 M ccf nat gas/ yr

Vermont's Energy Future

80, 000 homes is ¼ of the total housing stock

All buildings 90 % renewable by 2050

New homes net zero by 2030