Energy Audit

Thermal Envelope

HVAC Loads & Equipment Options

Funded by

EVERSOURCE ENERGY

Philip Read Memorial Library

1088 Rt 12A

Plainfield, NH

April 29 2019

Audit Prepared by

BUILDING STRATEGIES FOR AN AFFORDABLE FUTURE
S.E.E.D.S.
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DESIGN DAY MECHANICALS INC

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Introduction

This Energy Audit has been funded by Eversource. Funds may also be available to help reduce cost for eligible Energy Saving Measures (ESM) including weatherization efforts, lighting and equipment upgrades.

The purpose of an energy audit is to identify ESM in a building. Computer simulated and other energy models were developed for this project using multiple strategies and software. The models estimate predicted future energy consumption based on the local climate conditions, physical dimensions and characteristics of a building, mechanical systems, presumed lighting, equipment, and occupancy patterns, in addition to a number of other variables.

With the building modeled in existing conditions, energy savings can be estimated for improvements to the thermal envelope. The cost of those measures can then be analyzed in terms of predicted energy saved. The primary objective is to evaluate the level of investment warranted by energy and dollars saved from those specific measures. In many cases, as in this one, improving the thermal envelope is expected to yield 'non energy saving benefits, such as improving occupant comfort, and reducing the size of HVAC equipment.

This audit has been prepared with the best of intentions to assist the Town make informed decisions regarding improvements. We do not make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed.

Executive Summary

A Level II Energy Audit, funded by the New Hampshire Local Audit Exchange Program, was conducted by S.E.E.D.S. in December 2011. The report included 17 ESM recommendations and two other suggestions. At the time the basement of the new wing had not been finished and the report also made recommendations around completing the thermal envelope prior to installing drywall.

This Eversource funded audit serves as an update to that prior study and offers three distinct options for heating, cooling, and ventilation (HVAC) improvements.

The recommended weatherization measures (ESM) involves air sealing and adding insulation on the attic floor over the 1920 building. The chart below summarizes the estimated costs for two ESM and predicted annual savings in dollars and energy in million Btus. Since ESMs continue to reduce energy consumption each year for the expected life of the measure, (in this case, for 25 years) the total investment gain and return on investment (ROI) is also presented below. If the energy savings meet the Eversource's threshold based on cost of the measures, the Town may be eligible to a 50% rebate, which would improve the returns substantially.

ESM #	Energy Saving Measures	Cost of Measure	Annual $ Savings	Energy Savings MMBtu	Simple Payback Yrs	Life Of Measure	Annual-ized ROI
1	Weather-strip Doors & Windows	$820	$106	6.38	7.7	25	4.8%
2	Air Sealing and Insulating Old Attic	$1,472	$245	14.75	6.0	25	5.9%
	Totals	**$2,292**	**$351**	**21.14**	**6.5**	25	5.5%
	Eversource Rebate IF approved	-$1,146					
	End Cost to Town	$1,146	$351		**3.3**	25	8.5%

DESIGN DAY Mechanicals Inc

Philip Read Library – Plainfield, NH - HVAC Options

Three electric heat pump options were explored to replace the oil fired heating systems and DX cooling. Cost estimates are still being developed. Estimated annual operating costs for heating and cooling have been predicted for each equipment option below and presented on pages 5 and 6.

Existing Systems

AHU-1, 2, and 3 with ACC-1, 2, and 3 each:

Carrier Model 58CMA12011120 Oil Fired Furnace – 125,000/ 99,000 Btu/h Input/ Output - 80% AFUE

Carrier Compressor Condensing Unit - 48,000 Btu/h Cooling at 95/ 75 Deg F DB/ WB with 12 SEER

OF-1 – Williamson Model 1164-12-8 Oil Furnace – 95,000/ 71,250 Btu/h Input/ Output – 75% AFUE

Option #1

Ground Source Heat Pumps – GSHP-1, 2, and 3 each:

Water Furnace Model NDV049

38,200 Btu/h Heating Output with 4.0 COP

50,800 Btu/h Cooling Output with 19.3 EER

Cost of Geothermal Source Closed Loop Bore Hole Heat Exchangers into building $55,000

Option #2

High Efficiency Air Source Heat Pumps HE-ASHP-1, 2, 3 each:

Daikin Model RXTQ48TAVJU Outdoor Unit with Model FTXQ48TAVJUD Air Handler with 12 kW Electric Coil

52,000 Btu/h Heating at 47 Deg F DB with 3.8 COP

46,100 Btu/h Heating at 17 Deg F DB with 2.8 COP

34,700 Btu/h Heating at -4 Deg F DB with 2.4 COP

45,500 Btu/h Cooling at 95/ 75 Deg F DB/ WB with 16 SEER

Option #3

Code Compliant *Air Source Heat Pumps* ASHP-1, 2, and 3 with Existing Furnaces

Carrier Model 25HNB648A Outdoor Unit with Model CSPH48 Coil and Existing York Model P1DHX16F12001 Oil Fired Furnace

47,640 Btu/h Heating at 47 Deg F DB with 3.6 COP

29,910 Btu/h Heating at 17 Deg F DB with 2.7 COP

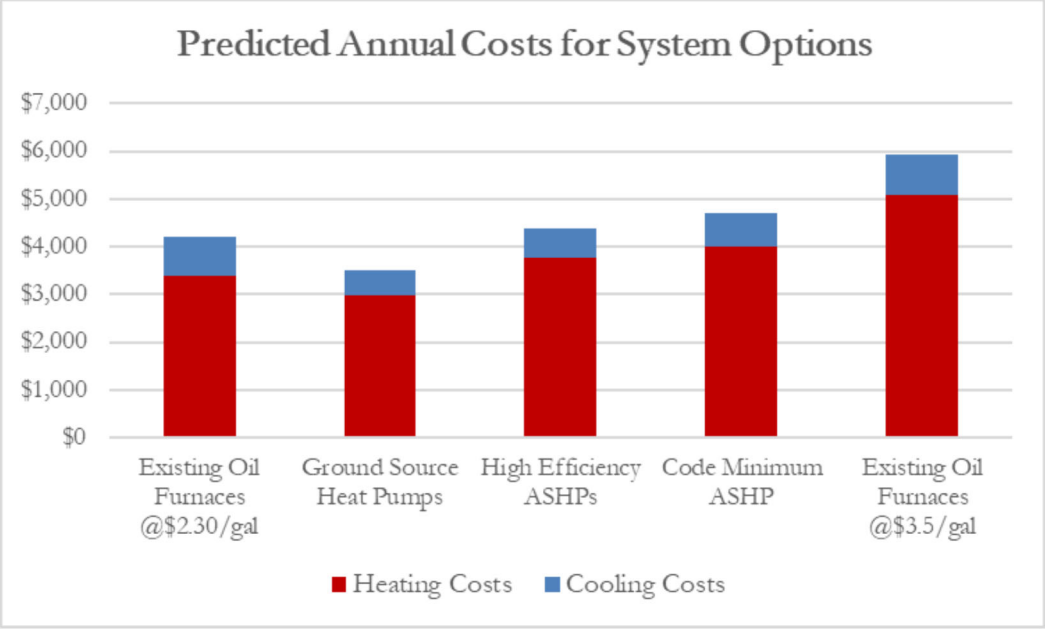
18,110 Btu/h Heating at -3 Deg F DB with 1.8 COP

46,500 Btu/h Cooling at 95/ 75 Deg F DB/ WB with 14 SEER

Based on the historic energy usage and future predictions out of the energy model, converting from the functional oil fired system to more efficient electric heat pumps cannot be justified by cost savings alone. When comparing the fuel costs over the past three years, only ground source heat pumps offer annual operational savings, (just under $400/year) but hardly enough to justify replacing equipment with service life left. At the $2.97 price of a gallon of oil as of April 2019, the annual savings would increase to $1,335—but again, not enough to justify replacing a system in good working order.

The justification to convert to heat pumps would come from the value centered choice to improve efficiency and join the efforts to reducing carbon pollution by eliminating burning of fossil fuels on site. As regional and national policies evolve to an electric grid based on clean, renewable sources of energy, and costs are assigned to carbon emissions, then electric heat pumps will likely become justifiable both ecologically and economically. The heat pump options are therefore presented as a viable option for the future: either when the existing system fails and needs to be replaced, or as the cost of heating oil increases over time.

HVAC System Options	Heating Costs	Cooling Costs	Total $
Existing Oil Furnaces @$2.30/gal	$3,386	$820	$4,206
Ground Source Heat Pumps	$2,989	$510	$3,499
High Efficiency ASHPs	$3,760	$615	$4,375
Code Minimum ASHP	$3,990	$703	$4,693
Existing Oil Furnaces @$2.97/gal	$4,324	$820	$5,144
Existing Oil Furnaces @$3.5/gal	$5,095	$820	$5,915



The chart on the next page compares heating costs in terms of cost per million Btus of heating energy. While the Btu per unit of energy remains constant, annual heating costs depends entirely on the price of each unit and the overall efficiency of the delivery system.

The top two energy line items reflect the cost per million Btus of heating oil in the existing system and a blended rate for electricity per kWh. The average cost for the Library's heating oil system over the past three years has been $20.73 per million Btus. Only ground source heat pumps (GSHP aka geothermal) and wood pellets offer a lower cost per million Btus at the average $2.30 per gallon.

Fuel Type	Fuel Unit	Fuel Price Per Unit (dollars)	Fuel Heat Content Per Unit (Btu)	Fuel Price Per Million Btu (dollars)	Heating Appliance Type	Type of Efficiency Rating	Approx. Efficiency (%)	Fuel Cost Per Million Btu (dollars)
Fuel Oil (#2)	3 yr agv per gallon	$2.30	138,690	$16.58	Furnace or Boiler	AFUE	80%	$20.73
Electricity	kWh	$0.180	3,412	$52.75	Baseboard/ Room Heater	COP 1	100%	$52.75
				Min Code	ASHP	COP 2.8	226%	$23.34
				Winter Avg	ASHP	COP 2.7	240%	$21.98
				Winter Avg	GSHP	COP 4.0	370%	$14.26
Past and Current Fuel Prices								
Fuel Oil (#2)	per Gal 2011	$4.49	138,690	$32.37	Furnace	Seasonal Eff	80%	$40.47
Fuel Oil (#2)	per Gal 2012	$3.65	138,690	$26.32	Furnace	Seasonal Eff	80%	$32.90
Fuel Oil (#2)	per Gal 2018	$2.13	138,690	$15.36	Furnace	Seasonal Eff	80%	$19.20
Fuel Oil (#2)	Gal April 2019	$2.97	138,690	$21.41	Furnace	Seasonal Eff	80%	$26.77
Propane	Gallon	$3.05	91,300	$33.41	HE Condensing Boiler	AFUE	95%	$35.16
Pellets	Ton	$255.00	16,500,000	$15.45	Boiler	EPA	80%	$19.32

As of April 2019, the cost per gallon of oil is $2.97. At that price, all three heat pump options would result in lower annual heating and cooling costs.

While the cost of each option is not yet available, the annual savings to convert to heat pumps is not likely to be a reasonable option until:

1. The price of oil exceeds $5.00 a gallon and or carbon is taxed in some way.
2. The existing furnaces fail and need to be replaced.
3. The associated costs and impacts of climate change are given priority over short term re-investment dollars.

Historic Energy Usage

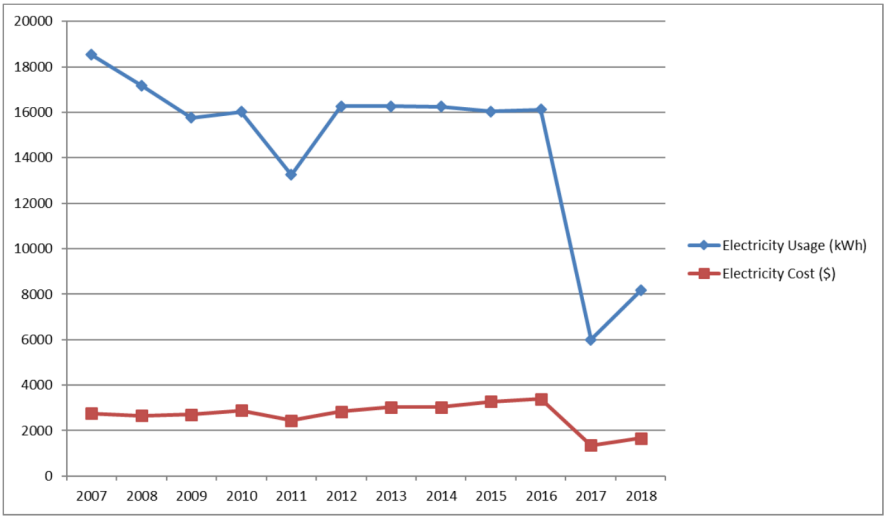
The energy analysis below is based on average annual energy data provided for oil and electricity for the Library.

	Units	Site Btus	Source Btus	$ Cost
Electric - kWh	8173	27.9	92.9	$1,661
Oil - Gallons	1450	200.8	230.9	$3,331
TOTALS		228.7	323.8	$4,992
EUI and Cost per FT2	9112	25.1	35.5	$0.55

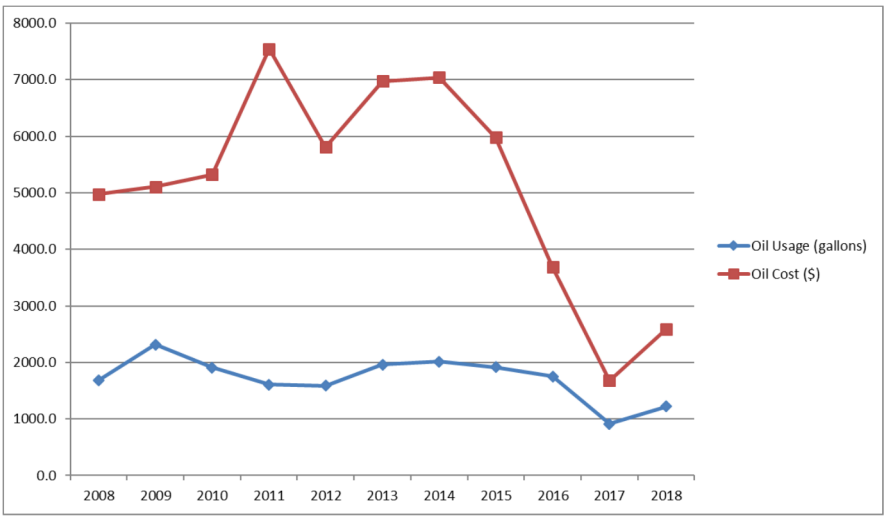
The Energy Utilization Index (EUI) offers a simple snapshot analysis of a building's energy use by looking at total amount of energy input (converted to Btu's) divided by the floor area of conditioned space. "Site Energy" refers to units of energy delivered to a site. Source energy includes transmission and total raw energy the building requires.

Based on the information provided, the Library's Source EUI is 25.1 KBtu/ft2; Source Energy EUI is 35.5 KBtu/ FT2 and energy costs are $.55 per sq ft in 2018 energy prices. This is remarkably low for a NH Library with air conditioning, as libraries are typically intense or large energy consumers, with EUI's routinely over 120KBtu per square foot.

The charts, showing substantial reductions in 2017, are courtesy of Brad.

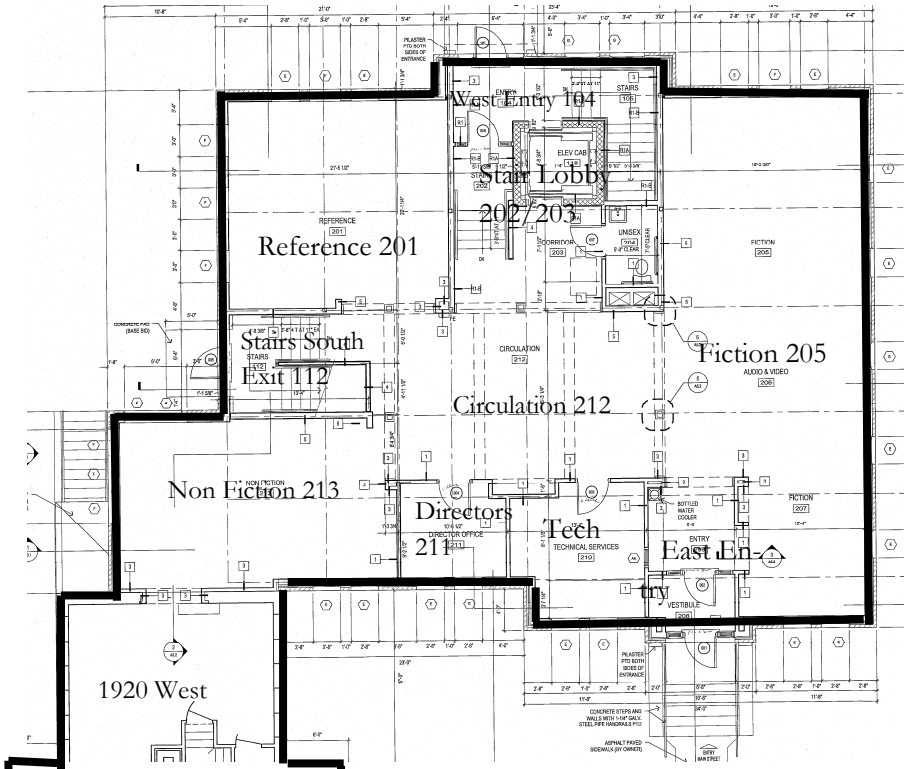


Annual Electric Usage & Costs from 2007 through 2018.

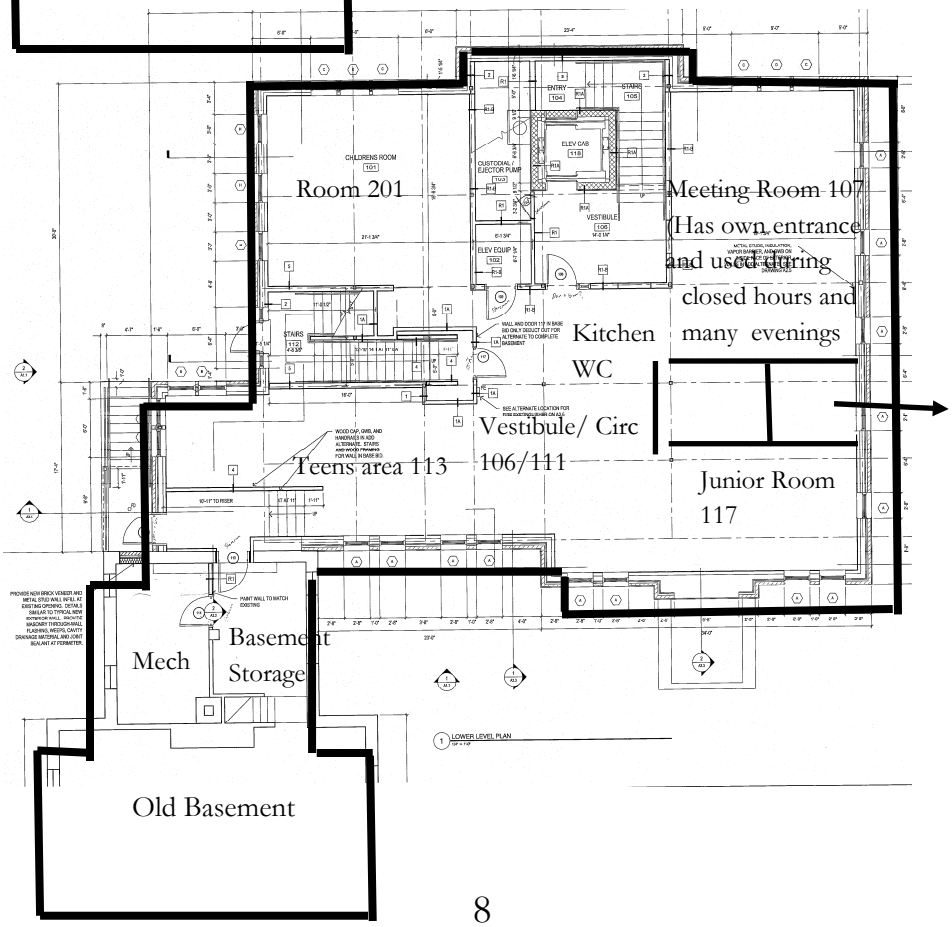


Annual Oil Usage & Costs from 2008 through 2018

Main Level



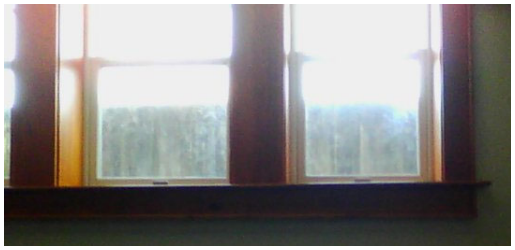
Lower Level

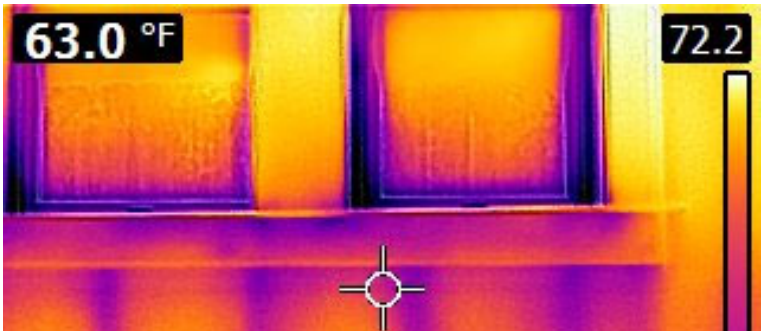


Key to Plan Room #'s, Chvac Software Room #'s, Room labels and peak heat gains and losses in Btus per hour for a winter delta T of 77 degrees (for example an indoor temperature of 72°F and an outdoor temp of –5°F). The Load calc software report is included at the end of this report.

Plan #	Chvac#	Description	Net Gain	Loss
		Main Level		
104	1	West Entry	933	1,331
202/203	2	Stair Lobby	1,833	3,373
201	3	Reference	7,871	6,096
112	4	Stairs- South Exit	2,496	2,543
205	5	Fiction	10,560	12,731
208/209	6	East Entry	1,584	1,882
212	7	Circulation	1,567	4,675
213	8	Non Fiction	8,252	10,091
211	9	Director's Office	2,478	2,976
210	10	Tech	2,887	3,090
	11	1920 West	9,127	12,229
	12	1920 East	8,595	19,070
		Lower Level		
201	13	Old Basement	3,007	8,725
106	14	Basement Storage	843	2,271
107	15	Mechanical	575	1,995
117	16	Room 201	4,548	3,432
107	17	Meeting Room	4,517	5,405
117	18	Junior Room	4,428	3,470
113	19	Teens Area	4,699	3,819
106/111	20	Vestibule/Circ	2,317	1,948

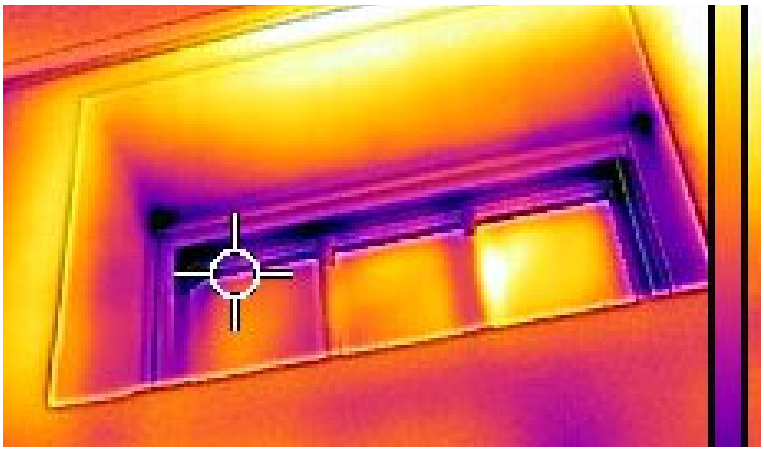
Weather stripping

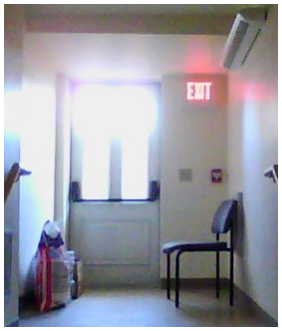




Most windows would benefit from weather-stripping or a caulk sealing applied where the unit fits into the rough opening (below).

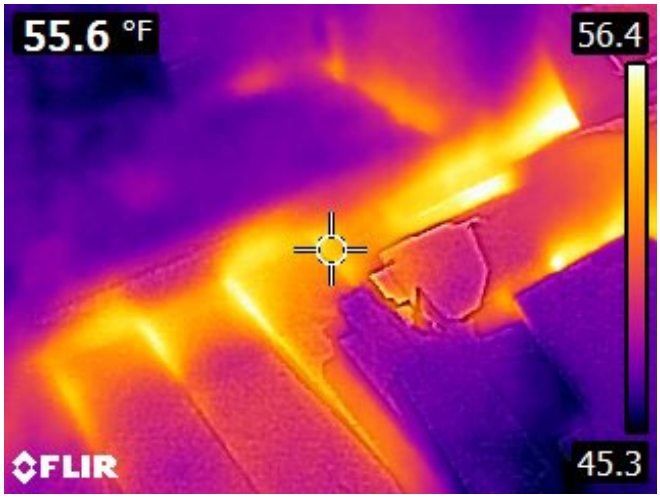
The south exit door is the most egregious air leakage site of all the doors.





The insulated door to the 1920's attic is a major improvement. Still there remain opportunities to air seal the floor boundary and upgrade insulation levels. We discussed on site the idea of removing the board planks, air sealing, and blowing in an additional 10" of cellulose. The recommendation, however, is to only remove boards necessary to access penetrations in the ceiling, perimeter, and interior walls—most especially the transition between the two rooms. Then replace the flooring, and patch open areas, before packing in cellulose below the floor boards and blowing an additional 10 inches cellulose material. This means no longer using the attic for storage, but the floor decking will allow for emergency access to the attic and roof if need.

Digital photos were often too dark to be included here.



Philip Read Memorial Library
Energy Cost Analysis

for

Eversource

Prepared By:

S.E.E.D.S.

Thursday, April 25, 2019

Project Summary

General Project Information

Project Title:	Philip Read Memorial Library	Company Name:	S.E.E.D.S.
Project Date:	Tuesday, April 9, 2019	Company E-Mail Address:	mdillon@myfairpoint.net
Client Name:	Eversource		

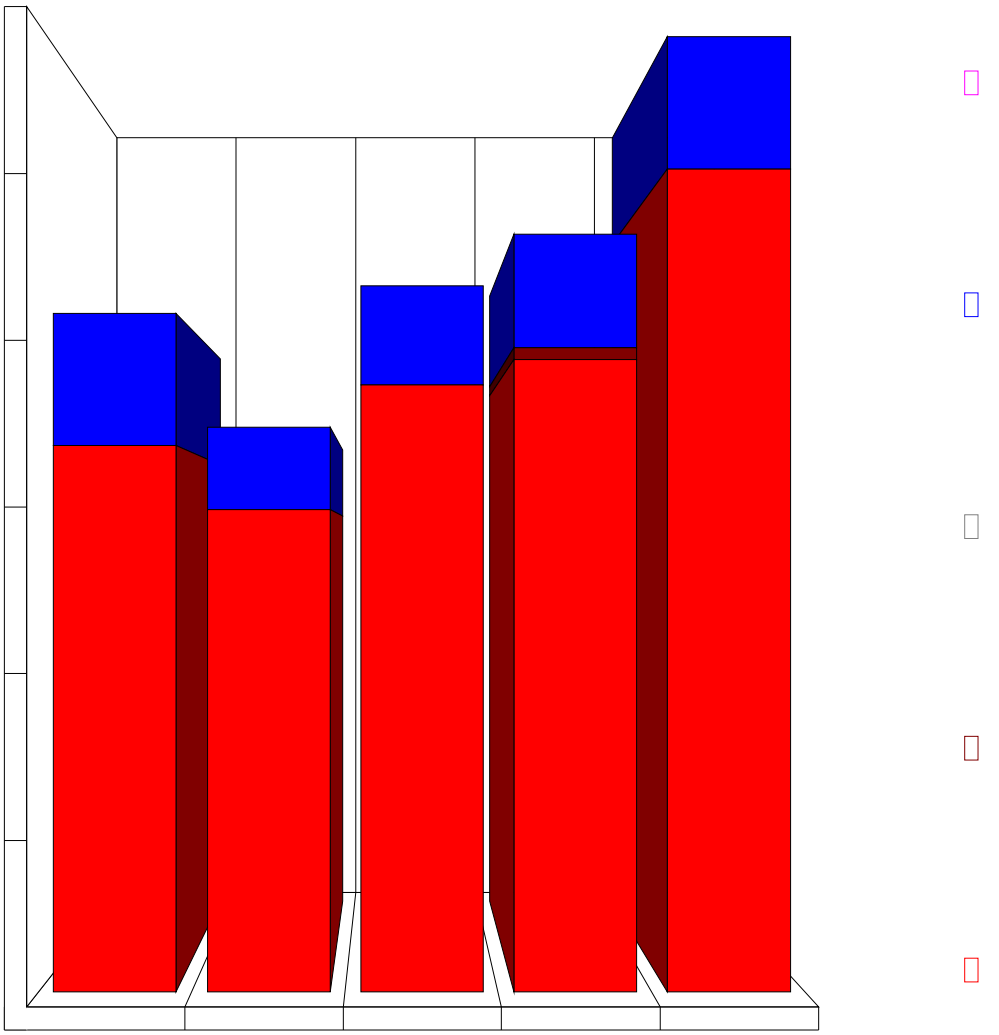
Design Data

Building Area:	8,488 sq.ft.	Cooling Load:	83,755 Btuh
People:	62	Heating Load:	119,366 Btuh
Occupancy:	8	Loads Adj. Factor:	0.60
		AC On Temp.:	74 °F
Actual City:	Lebanon, New Hampshire		
Weather Ref. City:	Concord, New Hampshire		
Summer Outdoor:	87 °F	Winter Outdoor:	-3 °F
Summer Indoor:	75 °F	Winter Indoor:	74 °F
Cooling Hours:	775	Degree Days:	7,200

Annual Operating Cost Estimate

System Description	Fuel Rates Set	Total Heating Cost	Total Cooling Cost	Annual Service Charges	Total Oper. Cost	Average Monthly Cost
Existing Oil Furnaces	1	$3,386	$820	$0	$4,206	$350
Ground Source Heat Pump	1	$2,989	$510	$0	$3,499	$292
High Efficiency ASHP	1	$3,760	$615	$0	$4,375	$365
Code Compliant ASHP	1	$3,990	$703	$0	$4,693	$391
Existing Oil Furnaces at $3.50/gal	2	$5,095	$820	$0	$5,916	$493

Project Summary Bar Chart



Input Data - System 1 - Existing Oil Furnaces

		Estimated Cost
Cooling		
System Type:	Standard Air Conditioner	
Model:		
Efficiency:	12.00 SEER	
Capacity:	48,000 Btuh	
Cooling Load:	83,755 Btuh	
Annual Cost (Bin Data Method):		$820.06
Heating		
System Type:	Fuel Oil Furnace	
Model:		
Efficiency:	80 AFUE	
Capacity:	141,250 Btuh	
Heating Load:	119,366 Btuh	
Annual Cost (Degree Days Method):		$3,385.81
Total Cost		
Total Annual Operating Cost:		$4,205.88

Input Data - System 2 - Ground Source Heat Pump

		Estimated Cost
Cooling		
System Type:	Ground Source Heat Pump	
Model:		
Efficiency:	19.30 EER	
Capacity:	50,800 Btuh	
Cooling Load:	83,755 Btuh	
Annual Cost (Bin Data Method):		$509.88
Heating		
System Type:	Ground Source Heat Pump	
Model:		
Efficiency:	4 COP	
Capacity:	141,250 Btuh	
Heating Load:	119,366 Btuh	
47° Capacity:	114,600 Btuh	
17° Capacity:	114,600 Btuh	
47° COP:	4.0	
17° COP:	4.0	
Capacity Balance Point:	-17 °F	
Cutoff Temperature:	-99 °F	
Annual Cost (Bin Data Method):		$2,989.08
Backup		
System Type:	None	
Total Cost		
Total Annual Operating Cost:		$3,498.96

Input Data - System 3 - High Efficiency ASHP

		Estimated Cost
Cooling		
System Type:	Air Source Heat Pump	
Model:		
Efficiency:	16.00 SEER	
Capacity:	45,500 Btuh	
Cooling Load:	83,755 Btuh	
Annual Cost (Bin Data Method):		$615.05
Heating		
System Type:	Air Source Heat Pump	
Model:		
Efficiency:	2.8 HSPF	
Capacity:	132,800 Btuh	
Heating Load:	119,366 Btuh	
47° Capacity:	114,600 Btuh	
17° Capacity:	114,600 Btuh	
47° COP:	3.8	
17° COP:	2.8	
Capacity Balance Point:	0 °F	
Cutoff Temperature:	-99 °F	
Annual Cost (Bin Data Method):		$3,760.20
Backup		
System Type:	Electric Resistance	
Efficiency:	100.00	
Capacity:	12 kW	
Annual Cost:		$0.00
Total Cost		
Total Annual Operating Cost:		$4,375.24

Input Data - System 4 - Code Compliant ASHP

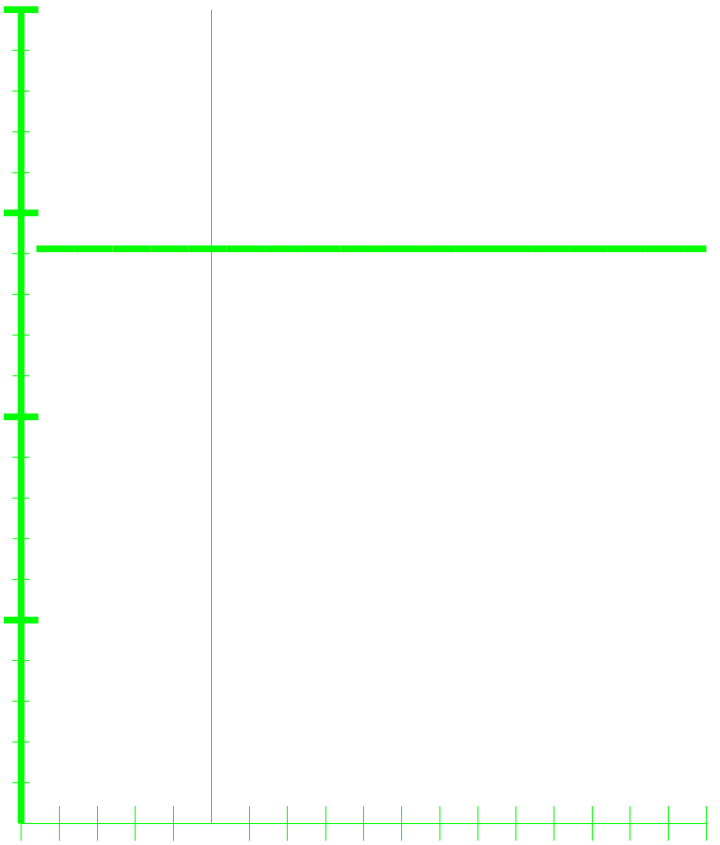
		Estimated Cost
Cooling		
System Type:	Air Source Heat Pump	
Model:		
Efficiency:	14.00 SEER	
Capacity:	46,500 Btuh	
Cooling Load:	83,755 Btuh	
Annual Cost (Bin Data Method):		$702.91
Heating		
System Type:	Air Source Heat Pump	
Model:		
Efficiency:	2.8 HSPF	
Capacity:	140,000 Btuh	
Heating Load:	119,366 Btuh	
47° Capacity:	142,920 Btuh	
17° Capacity:	89,730 Btuh	
47° COP:	3.6	
17° COP:	2.7	
Capacity Balance Point:	17 °F	
Cutoff Temperature:	-99 °F	
Annual Cost (Bin Data Method):		$3,917.24
Backup		
System Type:	Fuel Oil Furnace	
Efficiency:	80.00	
Capacity:	150,000 Btuh	
Annual Cost:		$72.73
Total Cost		
Total Annual Operating Cost:		$4,692.88

Input Data - System 5 - Existing Oil Furnaces at $3.50/gal

		Estimated Cost
Cooling		
System Type:	Standard Air Conditioner	
Model:		
Efficiency:	12.00 SEER	
Capacity:	48,000 Btuh	
Cooling Load:	83,755 Btuh	
Annual Cost (Bin Data Method):		$820.06
Heating		
System Type:	Fuel Oil Furnace	
Model:		
Efficiency:	80 AFUE	
Capacity:	141,250 Btuh	
Heating Load:	119,366 Btuh	
Annual Cost (Degree Days Method):		$5,095.47
Total Cost		
Total Annual Operating Cost:		$5,915.53

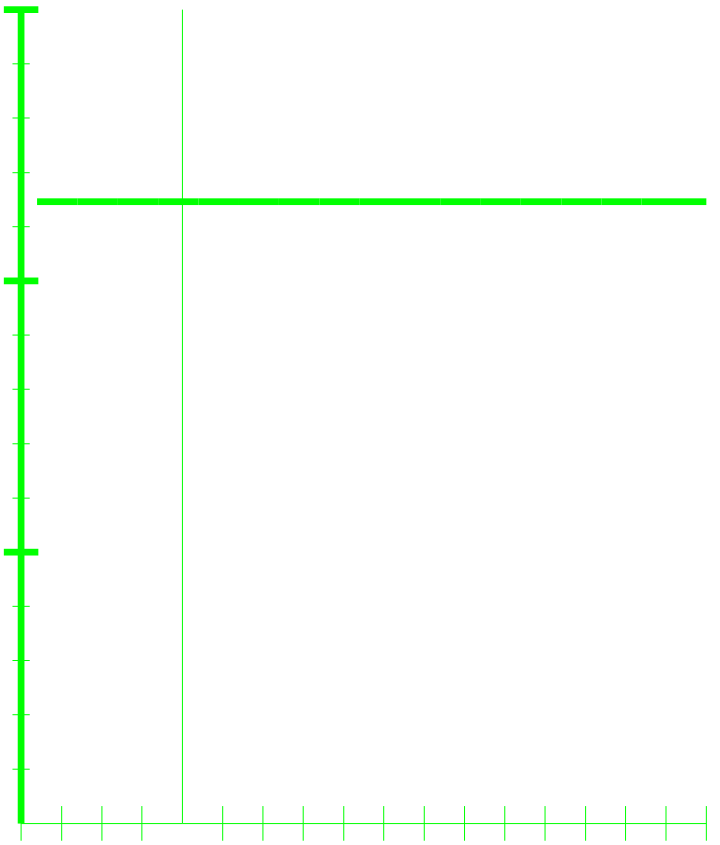
Bin Analysis Report - System 2 - Ground Source Heat Pump

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.60)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	142,619	85,571	85,571	0.606	0	1.13	0.00	1.13
-15 to -10	18	134,868	80,921	80,921	0.573	0	19.20	0.00	19.20
-10 to -5	19	127,117	76,270	76,270	0.540	0	19.11	0.00	19.11
-5 to 0	52	119,366	71,620	71,620	0.507	0	49.10	0.00	49.10
0 to 5	136	111,615	66,969	66,969	0.474	0	120.09	0.00	120.09
5 to 10	154	103,864	62,318	62,318	0.441	0	126.54	0.00	126.54
10 to 15	209	96,113	57,668	57,668	0.408	0	158.91	0.00	158.91
15 to 20	312	88,362	53,017	53,017	0.375	0	218.10	0.00	218.10
20 to 25	385	80,611	48,366	48,366	0.342	0	245.52	0.00	245.52
25 to 30	666	72,860	43,716	43,716	0.309	0	383.87	0.00	383.87
30 to 35	878	65,109	39,065	39,065	0.277	0	452.23	0.00	452.23
35 to 40	650	57,358	34,415	34,415	0.244	0	294.94	0.00	294.94
40 to 45	658	49,607	29,764	29,764	0.211	0	258.22	0.00	258.22
45 to 50	679	41,856	25,113	25,113	0.178	0	224.83	0.00	224.83
50 to 55	619	34,105	20,463	20,463	0.145	0	167.01	0.00	167.01
55 to 60	717	26,354	15,812	15,812	0.112	0	149.48	0.00	149.48
60 to 65	685	18,602	11,162	11,162	0.079	0	100.81	0.00	100.81
Totals:	6,838						$2,989.08	$0.00	$2,989.08



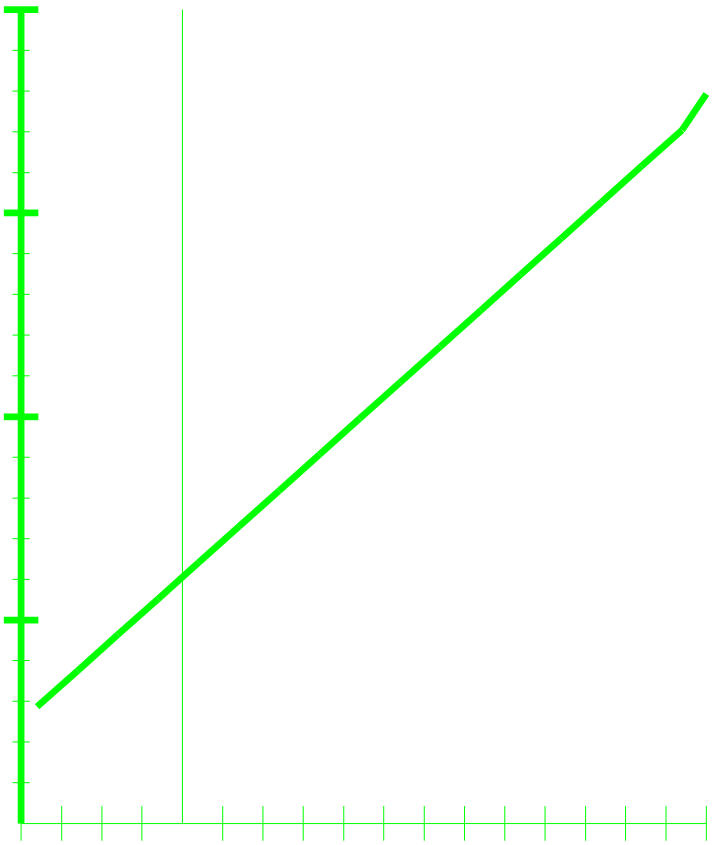
Bin Analysis Report - System 3 - High Efficiency ASHP

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.60)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	142,619	85,571	85,571	0.747	0	2.71	0.00	2.71
-15 to -10	18	134,868	80,921	80,921	0.706	0	41.90	0.00	41.90
-10 to -5	19	127,117	76,270	76,270	0.666	0	38.21	0.00	38.21
-5 to 0	52	119,366	71,620	71,620	0.625	0	90.65	0.00	90.65
0 to 5	136	111,615	66,969	66,969	0.584	0	205.86	0.00	205.86
5 to 10	154	103,864	62,318	62,318	0.544	0	202.46	0.00	202.46
10 to 15	209	96,113	57,668	57,668	0.503	0	238.37	0.00	238.37
15 to 20	312	88,362	53,017	53,017	0.463	0	307.90	0.00	307.90
20 to 25	385	80,611	48,366	48,366	0.422	0	327.36	0.00	327.36
25 to 30	666	72,860	43,716	43,716	0.381	0	484.89	0.00	484.89
30 to 35	878	65,109	39,065	39,065	0.341	0	542.68	0.00	542.68
35 to 40	650	57,358	34,415	34,415	0.300	0	337.07	0.00	337.07
40 to 45	658	49,607	29,764	29,764	0.260	0	281.70	0.00	281.70
45 to 50	679	41,856	25,113	25,113	0.219	0	234.60	0.00	234.60
50 to 55	619	34,105	20,463	20,463	0.179	0	167.01	0.00	167.01
55 to 60	717	26,354	15,812	15,812	0.138	0	143.50	0.00	143.50
60 to 65	685	18,602	11,162	11,162	0.097	0	93.05	0.00	93.05
Totals:	6,838						$3,760.20	$0.00	$3,760.20



Bin Analysis Report - System 4 - Code Compliant ASHP

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.60)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	142,619	85,571	29,550	1.000	56,906	1.33	1.17	2.50
-15 to -10	18	134,868	80,921	38,400	1.000	43,406	26.13	15.98	42.11
-10 to -5	19	127,117	76,270	47,250	1.000	29,905	29.23	11.65	40.88
-5 to 0	52	119,366	71,620	56,100	1.000	16,405	83.39	18.74	102.13
0 to 5	136	111,615	66,969	64,950	1.000	2,904	225.05	22.32	247.37
5 to 10	154	103,864	62,318	62,318	0.844	0	220.54	0.00	220.54
10 to 15	209	96,113	57,668	57,668	0.698	0	252.24	0.00	252.24
15 to 20	312	88,362	53,017	53,017	0.579	0	318.77	0.00	318.77
20 to 25	385	80,611	48,366	48,366	0.482	0	341.00	0.00	341.00
25 to 30	666	72,860	43,716	43,716	0.400	0	506.77	0.00	506.77
30 to 35	878	65,109	39,065	39,065	0.331	0	568.85	0.00	568.85
35 to 40	650	57,358	34,415	34,415	0.271	0	354.28	0.00	354.28
40 to 45	658	49,607	29,764	29,764	0.219	0	296.81	0.00	296.81
45 to 50	679	41,856	25,113	25,113	0.174	0	247.74	0.00	247.74
50 to 55	619	34,105	20,463	20,463	0.133	0	176.73	0.00	176.73
55 to 60	717	26,354	15,812	15,812	0.097	0	152.14	0.00	152.14
60 to 65	685	18,602	11,162	11,162	0.065	0	98.83	0.00	98.83
Totals:	6,838						$3,917.24	$72.73	$3,989.98



Philip Read Memorial Library
HVAC Load Analysis

for

Eversource

Elite Software

CHVAC Commercial HVAC Loads

Prepared By:

S.E.E.D.S.

Monday, April 29, 2019

Building Summary Loads

Building peaks in August at 2pm.

Bldg Load Descriptions	Area Quan	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Roof	5,198	11,653	10.48	0	3,027	3,027	3.64
Wall	4,263	31,332	28.19	0	2,286	2,286	2.75
Glass	839	26,153	23.53	0	37,331	37,331	44.92
Floor Slab	0	0	0.00	0	0	0	0.00
Skin Loads		69,138	62.20	0	42,643	42,643	51.31
Lighting	4,128	0	0.00	0	14,085	14,085	16.95
Equipment	0	0	0.00	0	0	0	0.00
Pool Latent	0	0	0.00	0	0	0	0.00
People	62	0	0.00	9,610	15,190	24,800	29.84
Partition	1,443	2,541	2.29	0	0	0	0.00
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	0	0	0.00	0	0	0	0.00
Cool. Vent.	0	0	0.00	0	0	0	0.00
Heat. Vent.	0	0	0.00	0	0	0	0.00
Cool. Infil.	0	0	0.00	0	0	0	0.00
Heat. Infil.	485	39,473	35.51	0	0	0	0.00
Draw-Thru Fan	0	0	0.00	0	0	0	0.00
Blow-Thru Fan	0	0	0.00	0	0	0	0.00
Reserve Cap.	0	0	0.00	0	1,573	1,573	1.89
Reheat Cap.	0	0	0.00	0	0	0	0.00
Supply Duct	0	0	0.00	0	0	0	0.00
Return Duct	0	0	0.00	0	0	0	0.00
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		111,152	100.00	9,610	73,492	83,102	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	0	0.00	0	0	0	0.00
Infiltration	39,473	35.51	0	0	0	0.00
Pretreated Air	0	0.00	0	0	0	0.00
Room Loads	71,679	64.49	9,610	73,492	83,102	100.00
Plenum Loads	0	0.00	0	0	0	0.00
Fan/Duct/Misc Loads	0	0.00	0	0	0	0.00
Building Totals	111,152	100.00	9,610	73,492	83,102	100.00

Check Figures

Total Building Supply Air (based on a 20° TD):	3,414	CFM
Total Building Vent. Air (0.00% of Supply):	0	CFM
Total Conditioned Air Space:	8,488	Sq.ft
Supply Air Per Unit Area:	0.4022	CFM/Sq.ft
Area Per Cooling Capacity:	1,225.7	Sq.ft/Ton
Cooling Capacity Per Area:	0.0008	Tons/Sq.ft
Heating Capacity Per Area:	13.10	Btuh/Sq.ft
Total Heating Required With Outside Air:	111,152	Btuh
Total Cooling Required With Outside Air:	6.93	Tons

Building Load Profiles

Bldg. Hour	August Adj. Load	(None) Adj. Load	(None) Adj. Load	(None) Adj. Load	(None) Adj. Load	(None) Adj. Load
10am	72,889	0	0	0	0	0
11am	79,272	0	0	0	0	0
12pm	84,497	0	0	0	0	0
1pm	91,273	0	0	0	0	0
2pm	97,989	0	0	0	0	0

Bldg. Hour	August Net Load	(None) Net Load	(None) Net Load	(None) Net Load	(None) Net Load	(None) Net Load
10am	64,277	0	0	0	0	0
11am	69,064	0	0	0	0	0
12pm	72,983	0	0	0	0	0
1pm	78,065	0	0	0	0	0
2pm	83,102	0	0	0	0	0

Bldg. Hour	August Sen. Load	(None) Sen. Load	(None) Sen. Load	(None) Sen. Load	(None) Sen. Load	(None) Sen. Load
10am	54,667	0	0	0	0	0
11am	59,454	0	0	0	0	0
12pm	63,373	0	0	0	0	0
1pm	68,455	0	0	0	0	0
2pm	73,492	0	0	0	0	0

Bldg. Hour	August Lat. Load	(None) Lat. Load	(None) Lat. Load	(None) Lat. Load	(None) Lat. Load	(None) Lat. Load
10am	9,610	0	0	0	0	0
11am	9,610	0	0	0	0	0
12pm	9,610	0	0	0	0	0
1pm	9,610	0	0	0	0	0
2pm	9,610	0	0	0	0	0

Building Pie Charts

Building peaks in August at 2pm.