

*Newbury Municipal Buildings
Energy Cost Analysis*

for

DBM



**ENERGY
AUDIT**

Residential and Light Commercial
Energy Analysis

Prepared By:

DDMI

Tuesday, December 08, 2015



Project Summary

General Project Information

Project Title: Newbury Municipal Buildings Company Name: DDMI
 Project Date: Tuesday, December 08, 2015
 Client Name: DBM

Design Data

Building Area: 0 sq.ft.
 People: 0
 Occupancy: 0 Loads Adj. Factor: 0.77
 AC On Temp.: 0 °F

Actual City: Newbury, NH
 Weather Ref. City: Concord, New Hampshire

Summer Outdoor: 87 °F Winter Outdoor: -3 °F
 Summer Indoor: 75 °F Winter Indoor: 72 °F
 Cooling Hours: 775 Degree Days: 7,471

Annual Operating Cost Estimate

System Description	Fuel Rates Set	Total Heating Cost	Total Cooling Cost	Annual Service Charges	Total Oper. Cost	Average Monthly Cost
Propane Boiler - DX Cooling	1	\$12,893	\$2,260	\$0	\$15,152	\$1,263
Pellet Boiler - DX Cooling	1	\$16,191	\$2,260	\$0	\$18,451	\$1,538
Geothermal	1	\$7,627	\$2,026	\$0	\$9,652	\$804



Input Data - System 1 - Propane Boiler - DX Cooling

Estimated Cost

Cooling

System Type:	Standard Air Conditioner	
Model:		
Efficiency:	13.00 SEER	
Capacity:	300,000 Btuh	
Cooling Load:	300,000 Btuh	
Annual Cost (Bin Data Method):		\$2,259.50

Heating

System Type:	Propane Boiler	
Model:		
Efficiency:	95 AFUE	
Capacity:	360,000 Btuh	
Heating Load:	360,000 Btuh	
Annual Cost (Bin Data Method):		\$12,892.90

Total Cost

Total Annual Operating Cost:		\$15,152.40
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Input Data - System 2 - Pellet Boiler - DX Cooling

Estimated Cost

Cooling

System Type:	Standard Air Conditioner	
Model:		
Efficiency:	13.00 SEER	
Capacity:	300,000 Btuh	
Cooling Load:	300,000 Btuh	
Annual Cost (Bin Data Method):		\$2,259.50

Heating

System Type:	Pellet Boiler	
Model:		
Efficiency:	85 AFUE	
Capacity:	360,000 Btuh	
Heating Load:	360,000 Btuh	
Annual Cost (Bin Data Method):		\$16,191.20

Total Cost

Total Annual Operating Cost:		\$18,450.71
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Input Data - System 3 - Geothermal

Estimated Cost

Cooling

System Type:	Ground Source Heat Pump	
Model:		
Efficiency:	14.50 EER	
Capacity:	300,000 Btuh	
Cooling Load:	300,000 Btuh	
Annual Cost (Bin Data Method):		\$2,025.76

Heating

System Type:	Ground Source Heat Pump	
Model:		
Efficiency:	4.9 COP	
Capacity:	360,000 Btuh	
Heating Load:	360,000 Btuh	
47° Capacity:	0 Btuh	
17° Capacity:	0 Btuh	
47° COP:	0.0	
17° COP:	0.0	
Capacity Balance Point:	-3 °F	
Cutoff Temperature:	-99 °F	
Annual Cost (Bin Data Method):		\$7,626.62

Backup

System Type:	None
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Total Cost

Total Annual Operating Cost:		\$9,652.38
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Monthly Costs - System 1 - Propane Boiler - DX Cooling

Monthly System Cost

Month	Cooling		Heating		Total Cost
	Cost	%	Cost	%	
January	\$0.00	0.0%	\$2,115.67	100.0%	\$2,115.67
February	\$0.00	0.0%	\$1,792.75	100.0%	\$1,792.75
March	\$0.00	0.0%	\$1,673.23	100.0%	\$1,673.23
April	\$23.44	2.1%	\$1,072.75	97.9%	\$1,096.20
May	\$244.64	28.0%	\$629.39	72.0%	\$874.02
June	\$466.08	60.3%	\$306.88	39.7%	\$772.96
July	\$751.91	82.9%	\$155.41	17.1%	\$907.32
August	\$529.17	65.3%	\$280.72	34.7%	\$809.89
September	\$205.87	27.6%	\$539.22	72.4%	\$745.09
October	\$38.39	3.9%	\$946.29	96.1%	\$984.68
November	\$0.00	0.0%	\$1,356.68	100.0%	\$1,356.68
December	\$0.00	0.0%	\$2,023.92	100.0%	\$2,023.92
Total	\$2,259.50	14.9%	\$12,892.90	85.1%	\$15,152.40

Monthly Fuel Usage and Cost

Month	Electricity		Natural Gas		Propane		Pellet	oil to pellet equiv
	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	
January	\$0.00	0.0	\$0.00	0.0	\$2,115.67	1,615.0	\$0.00	0.0
February	\$0.00	0.0	\$0.00	0.0	\$1,792.75	1,368.5	\$0.00	0.0
March	\$0.00	0.0	\$0.00	0.0	\$1,673.23	1,277.3	\$0.00	0.0
April	\$23.44	156.3	\$0.00	0.0	\$1,072.75	818.9	\$0.00	0.0
May	\$244.64	1,630.9	\$0.00	0.0	\$629.39	480.4	\$0.00	0.0
June	\$466.08	3,107.2	\$0.00	0.0	\$306.88	234.3	\$0.00	0.0
July	\$751.91	5,012.7	\$0.00	0.0	\$155.41	118.6	\$0.00	0.0
August	\$529.17	3,527.8	\$0.00	0.0	\$280.72	214.3	\$0.00	0.0
September	\$205.87	1,372.4	\$0.00	0.0	\$539.22	411.6	\$0.00	0.0
October	\$38.39	255.9	\$0.00	0.0	\$946.29	722.4	\$0.00	0.0
November	\$0.00	0.0	\$0.00	0.0	\$1,356.68	1,035.6	\$0.00	0.0
December	\$0.00	0.0	\$0.00	0.0	\$2,023.91	1,545.0	\$0.00	0.0
Total	\$2,259.50	15,063.4	\$0.00	0.0	\$12,892.90	9,841.9	\$0.00	0.0

Average Electric Cost Per kWh: \$0.150/kWh
 Average Propane Cost Per Gallon: \$1.310/Gallon
 Total annual cooling load energy: 195,823,648 BTU
 Total annual heating load energy: 1,104,288,000 BTU



Monthly Costs - System 2 - Pellet Boiler - DX Cooling

Monthly System Cost

Month	Cooling		Heating		Total Cost
	Cost	%	Cost	%	
January	\$0.00	0.0%	\$2,656.91	100.0%	\$2,656.91
February	\$0.00	0.0%	\$2,251.37	100.0%	\$2,251.37
March	\$0.00	0.0%	\$2,101.28	100.0%	\$2,101.28
April	\$23.44	1.7%	\$1,347.19	98.3%	\$1,370.63
May	\$244.64	23.6%	\$790.40	76.4%	\$1,035.03
June	\$466.08	54.7%	\$385.38	45.3%	\$851.46
July	\$751.91	79.4%	\$195.17	20.6%	\$947.08
August	\$529.17	60.0%	\$352.53	40.0%	\$881.71
September	\$205.87	23.3%	\$677.17	76.7%	\$883.04
October	\$38.39	3.1%	\$1,188.38	96.9%	\$1,226.77
November	\$0.00	0.0%	\$1,703.75	100.0%	\$1,703.75
December	\$0.00	0.0%	\$2,541.68	100.0%	\$2,541.68
Total	\$2,259.50	12.2%	\$16,191.20	87.8%	\$18,450.71

Monthly Fuel Usage and Cost

Month	Electricity		Natural Gas		Propane		Pellet oil to pellet	
	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	equiv
January	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0	\$2,656.91	1,196.8
February	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0	\$2,251.37	1,014.1
March	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0	\$2,101.28	946.5
April	\$23.44	156.3	\$0.00	0.0	\$0.00	0.0	\$1,347.19	606.8
May	\$244.64	1,630.9	\$0.00	0.0	\$0.00	0.0	\$790.40	356.0
June	\$466.08	3,107.2	\$0.00	0.0	\$0.00	0.0	\$385.38	173.6
July	\$751.91	5,012.7	\$0.00	0.0	\$0.00	0.0	\$195.17	87.9
August	\$529.17	3,527.8	\$0.00	0.0	\$0.00	0.0	\$352.53	158.8
September	\$205.87	1,372.4	\$0.00	0.0	\$0.00	0.0	\$677.17	305.0
October	\$38.39	255.9	\$0.00	0.0	\$0.00	0.0	\$1,188.37	535.3
November	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0	\$1,703.75	767.5
December	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0	\$2,541.68	1,144.9
Total	\$2,259.50	15,063.4	\$0.00	0.0	\$0.00	0.0	\$16,191.20	7,293.3

Average Electric Cost Per kWh: \$0.150/kWh
 Average Pellet Cost Per Ton: \$263/Ton
 Total annual cooling load energy: 195,823,648 BTU
 Total annual heating load energy: 1,104,288,000 BTU



Monthly Costs - System 3 - Geothermal

Monthly System Cost

Month	Cooling		Heating		Total Cost
	Cost	%	Cost	%	
January	\$0.00	0.0%	\$1,259.06	100.0%	\$1,259.06
February	\$0.00	0.0%	\$1,066.62	100.0%	\$1,066.62
March	\$0.00	0.0%	\$995.18	100.0%	\$995.18
April	\$21.02	3.2%	\$634.83	96.8%	\$655.85
May	\$219.33	37.4%	\$367.81	62.6%	\$587.13
June	\$417.87	70.3%	\$176.20	29.7%	\$594.06
July	\$674.13	88.5%	\$87.68	11.5%	\$761.81
August	\$474.43	74.7%	\$160.61	25.3%	\$635.05
September	\$184.57	37.2%	\$312.11	62.8%	\$496.68
October	\$34.42	5.8%	\$556.76	94.2%	\$591.18
November	\$0.00	0.0%	\$805.56	100.0%	\$805.56
December	\$0.00	0.0%	\$1,204.19	100.0%	\$1,204.19
Total	\$2,025.76	21.0%	\$7,626.62	79.0%	\$9,652.38

Monthly Fuel Usage and Cost

Month	Electricity		Natural Gas		Propane		Pellet	oil to
	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	pellet equiv
January	\$1,259.06	8,393.7	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
February	\$1,066.62	7,110.8	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
March	\$995.18	6,634.5	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
April	\$655.85	4,372.3	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
May	\$587.13	3,914.2	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
June	\$594.06	3,960.4	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
July	\$761.81	5,078.7	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
August	\$635.05	4,233.6	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
September	\$496.68	3,311.2	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
October	\$591.18	3,941.2	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
November	\$805.56	5,370.4	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
December	\$1,204.19	8,028.0	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0
Total	\$9,652.38	64,349.2	\$0.00	0.0	\$0.00	0.0	\$0.00	0.0

Average Electric Cost Per kWh: \$0.150/kWh
 Total annual cooling load energy: 195,823,648 BTU
 Total annual heating load energy: 1,104,288,000 BTU



Fuel Rates Set 1 - Newbury

Electricity

Season	\$/kWh	Escalation	Service Charge
Winter	\$0.15	0.0%	\$0.00
Summer	\$0.15	0.0%	\$0.00

Summer Months: April to October

Natural Gas

Season	\$/Therm	Escalation	Service Charge
Winter	\$0.0	0.0%	\$0.00
Summer	\$0.0	0.0%	\$0.00

Summer Months: April to October

Propane

Season	\$/Gallon	Escalation
Winter	\$1.31	0.0%
Summer	\$1.31	0.0%

Summer Months: April to October

Pellet

Season	\$/Ton	Escalation
Winter	\$263	0.0%
Summer	\$263	0.0%

Summer Months: April to October



Economic Analysis - Comparison Case 1 - Sys. 1 vs. Sys. 3

Item	1 - Propane Boiler - DX Cooling	3 - Geothermal
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First Year Costs

Cooling	\$2,260	\$2,026
Heating	\$12,893	\$7,627
Hot Water	\$0	\$0

System Costs

System Cost	\$0.00	\$100,000.00
Rebates & Incentives		\$30,000.00
Net System Cost		\$70,000.00

Investment Analysis

Net Investment Amount		\$70,000.00
Savings Over System Lifetime of 20 Years		\$110,000.50
Monthly Average Savings		\$458.34
Break-Even Years (At Zero Interest)		12.7 Years
Internal Rate of Return		4.75%
Return on Investment		57.14%