DATE: April 18, 2007

TO: Carl Valente, Bill Hadley, Wayne Brooks, and Jon Himmel, Town of Lexington

FROM: Brad Jones, Sebesta Blomberg

RE: Energy modeling study for modified DPW facility design
Sebesta Blomberg Project No. 700435

CC: Janet Slemenda and Michael Lawrence, HKT
John Tan and Joe Remondi, RW Sullivan
Dave Fennell, Sebesta Blomberg

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MEMORANDUM

Sebesta Blomberg & Associates, Inc. (Sebesta Blomberg) has been retained by the Town of Lexington to provide continuous energy modeling efforts for the modified design documents dated in March, 2007. Please note that none of the information in this memo has changed from the information provided April 3, 2007, but there a few minor edits to the text. The purpose of this memo is to use building energy modeling software, DOE2.1, to:

1. Setup a "Base Case" building based on the update architectural and MEP design documents in March 2007.
2. Compare the "Base Case" with several design alternatives for optimal design solutions

The table below summarizes the total energy usage and costs for the Base Case and different alternatives. The annual energy cost for the Base Case is about $117,600. Several design alternatives have been studied. For Alternative 1, if the operations area wall insulation is increased from R-15.7 to R21.7 (all wall insulation is R-21.7), the annual energy savings are $1,400. For Alternative 2, if all wall insulation is R-21.7, and all roof insulation is R-31, the annual energy savings are $1,800. For Alternative 3, if all wall and roof insulation only meets MA code minimum requirements, the annual energy cost will be increased by $8,500. For Alternative 4, if the floor insulation is increased from R-17 to R-34, the annual savings are about $2,100. Alternative 5 is to install waste oil heater to provide supplement heating to vehicle staging/prep area. The mechanical engineer has estimated the annual heating savings of 2,800 Therms, and therefore $4,200 annual cost savings.

Category	Annual Energy Cost	Incremental $
Base Case	$117,579	
Alt 1: Increase Wall Insulation	$116,147	-$1,432
Alt 2: Increase Wall and Roof Insulation	$115,768	-$1,811
Alt 3: Code Minimum Insulation	$126,088	$8,509
Alt 4: Increase Floor Insulation	$115,453	-$2,126
Alt 5: Waste Oil Heater*	$113,379	-$4,200

Input

A summary of the building input information is listed in the table below. For comparison purposes, previous design parameters (Jan, 07) are also quoted in parenthesis if different from the current design values.

Table: Building input information.

Building Envelop				
Type	**U-value**	**R-value**	**SGHC**	Notes
Roof (Admin)	0.032 (0.053)	31 (19)		
Roof (Central Storage&Shops)	0.037 (0.053)	27 (19)		Assume additional R-2 due to installation of green roofs
Roof (Other spaces)	0.04 (0.053)	25 (19)		
Exterior Wall (Admin)	0.046 (0.1)	21.7 (10)		
Exterior Wall (Operations)	0.064 (0.14)	15.7 (7)		
Floor	0.059	17		
Window (Admin)	0.5 (0.6)		0.32 (0.6)	Exterior sunshades (No sunshades)
Window (Operations)	0.24 (0.5)		0.32 (0.6)	
Space Internal Loads and Ventilation				
Space Type	**Lighting**	**Plug Power**	**Ventilation**	
	W/Sq Ft.	**W/Sq Ft.**	**No. Persons**	**Outside Air Rate**
Administration Building	1.5	1.5	100	20 CFM/person
Central Storage	1.5	1	2	20 CFM/person
Wash Bay	1	1	1	2 CFM/Sq. Ft. Office operating schedule
Utility space & Operation	1.5	1	2	20 CFM/person
Vehicle Maintenance	1	0.5	5	1.5 CFM/Sq. Ft. Office operating schedule
Vehicle Staging / Prep	1	0.5	1	1.5 CFM/Sq. Ft. Assume 2 hour/day Exhaust Fan Operation
Space Operation Temperature (F)				
Space Type	**Summer**		**Winter**	
	6am-7pm wkday	**7pm-6am wkday, weekend**	**6am-7pm wkday**	**7pm-6am wkday, weekend**
Administration Building	75	90	72	55
Central Storage			60	50
Wash Bay			50	50
Utility space & Operation	75	90	72	55
Vehicle Maintenance			60	50
Vehicle Staging / Prep			45	45

HVAC	
Space Type	**System Type**
Administration Building	Gas heating, DX cooling, VAV RTU with Energy Recovery from Locker Rm (Gas heating, DX cooling, VAV RTU)
Central Storage	Gas-fired Unit Heater. Ventilation air from admin space
Wash Bay	Gas-fired Heating and Vent
Utility space & Operation	Gas heating DX cooling RTU
Vehicle Maintenance	Gas-fired heating and vent with heat recovery
Vehicle Staging / Prep	Gas-fired radiant heaters, CO control exhaust fans

For comparison purpose, the average flat rates adopted in the previous energy study are used:

Electricity – $0.17/kWh
Natural Gas – $1.5/Therm

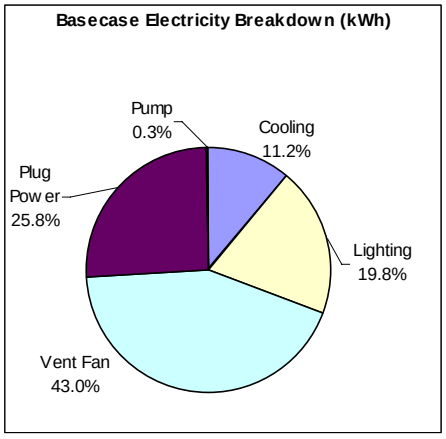
For detailed building area description and energy modeling software, please refer to the previous energy modeling report dated on December 20, 2006, and energy modeling memo on Jan 22, 2007. The energy modeling for this modified design has the following major differences from previous design in January 07:

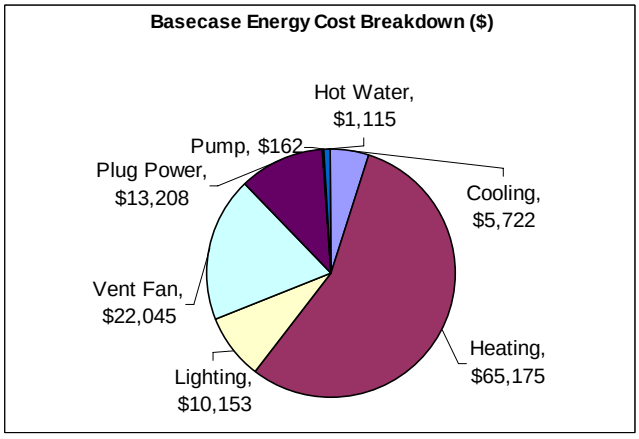
1. Additional vest/toilets areas to the Admin building
2. Energy recovery function is added to the Gas fired heating and DX cooling roof top unit for the Admin building
3. Improved building envelope performance on walls, roofs, and windows. Exterior and interior shading devices are added to the Admin Building.

Results:

Base Case

The figures below show the end use of electricity, and total cost for end uses. It shows that the heating cost constitutes more than half of the total energy cost.





Alternatives

The table below summarizes the total energy usage and costs for the Base Case, and alternatives to add more insulation. It shows that for the Base Case, the annual electricity consumption is 301,700 kWh, and natural gas consumption for heating is about 44,200 Therms. Also, the annual energy cost is about $118,000, which is about $11,000 less than the previous design (Jan, 2007).

Table: Calculated energy consumption and costs for Base Case and Alternatives

Category	Strategy Level	Electricity kWh	Natural Gas Therm	Energy Cost $	Incremental $
Base Case		301,700	44,193	$117,579	
Alternatives					
Alt 1: Increase Wall Insulation	Operations: R-21.7	301,828	43,224	$116,147	-$1,432
Alt 2: Increase Wall and Roof Insulation	Operations Walls R-21.7, Roofs R-31	301,828	42,971	$115,768	-$1,811
Alt 3: Code Minimum Insulation	All Walls R-7, Roofs R-19	304,126	49,591	$126,088	$8,509
Alt 4: Increase Floor Insulation	All Floors R-34	301,203	42,832	$115,453	-$2,126
Alt 5: Waste Oil Heater*	Supplemental heat in vehicle staging / prep	301,700	41,393	$113,379	-$4,200