Commercial Energy Compliance Narrative

Mixed Use Development

101 York St., Portland, ME 04101

16 February 2016

Building Energy Use Summary

The following is a narrative to clarify the inputs and results for the energy model of the proposed Mixed Use Development at York and High St. The city of Portland, ME has adopted the Maine Uniform Building and Energy Code (MUBEC) and therefore is required to meet the energy provisions outlined in the *2009 International Energy Conservation Code*. Per section 501 of the *2009 IECC* (Commercial Energy Efficiency), commercial buildings shall comply with section 501.1 or 501.2. This project is pursuing compliance per section 501.2 exception, total building performance. This requires that the energy model conforms to sections 506, and also satisfies sections 502.4, 503.2, 504, and 505.

Performance based compliance (section 506.3) requires that "a proposed building (proposed design) be shown to have and annual energy cost that is less than or equal to the annual energy cost of the standard reference design". Energy prices shall be taken from an approved source, therefore recent commercial energy rate profiles were used, sourced from the Department of Energy - U.S. Energy Information Administration.

Per section 506.4, documentation shall be provided. Please see below for information satisfying section 506.4.1:

1.) Address: 101 York St, Portland, ME 04101
2.) Compliance report: Please see pg. 5
3.) Individual completing compliance report: Clare Dow-Ramirez
4.) Name and version of software: Hourly Analysis Program (HAP) 4.91

The standard referenced design was analyzed using identical methods as the proposed design, except as specified in section 506.5. Additional documentation may be required by the code official per section 506.4.2, and shall be provided upon request.

Per section 502.1.1: "Commercial buildings or portions of commercial buildings enclosing Group-R occupancies shall use the specified value from the Group-R column of table 502.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group-R shall use the specified values from the all other column of Table 502.1.2". Differing occupancy types were considered and reflected in the model. When the conditions for the standard reference or "baseline" building were established, a "proposed" building was created to compare the performance of both conditions. The proposed building modified the following components:

COMPONENT	BASELINE STANDARD	PROPOSED BUILDING
Floors, Slab-On-Grade	Unheated – Table 506.5.1(1) F-0.54 – Table 502.1.2 Interior perimeter insulation, vertical boards, R-10, 24" deep. – ASHRAE 90.1, Appendix 'A', section A6.3, Table A6.3, assembly F-factors for slab on grade floors.	Unheated F-0.58 Interior perimeter insulation, vertical boards, R-5, 24" deep. – ASHRAE 90.1, Appendix 'A', section A6.3, Table A6.3, assembly F-factors for slab on grade floors.
Roof Insulation	Insulation entirely above deck Solar abs. = 0.75 – Table 506.5.1(1) U-0.048 – Table 502.1.2 Exterior air film (R-0.17), 4" continuous rigid foam board insulation (R-20), steel deck, and interior air film (R-0.61) – ASHRAE 90.1, Appendix 'A', section A2.2, Table A2.2, rated R-value of insulation alone.	Insulation entirely above deck Solar abs. = 0.90 Dark U-0.038 – Entire assembly U-value Exterior air film (R-0.17), 60 mil. EPDM (R-0.15), 4" closed cell polyisocyanurate (R-23.6), steel deck, air space (R-.91), 5/8" gypsum board (R-0.56), and interior air film (R-0.61) – ASHRAE 90.1, Appendix 'A', section A2.2 and ULC listed long term thermal resistance value.
Walls, Above-Grade Insulation (Group-R)	Steel framed wall Solar abs. = 0.75 – Table 506.5.1(1) U-0.057 – Table 502.1.2, Group-R 6" framing @ 24" O.C., batt insulation in the stud cavity (R-19), continuous board insulation (R-7), exterior air film (R-0.17), stucco finish (R-0.08), 2 layers of 5/8" gypsum board (R-0.56 each), and interior air film (R-0.68) – ASHRAE 90.1, Appendix 'A' , section A3.3.3.2, Table A3.3, cavity insulation R-value	Steel framed wall Solar abs. = 0.675 Medium U-0.081 – Entire assembly U-value 6" framing @ 24" O.C., batt insulation in the stud cavity (R-21), exterior air film (R-0.17), face brick (R-.43), air space (R-.91), 5/8" DENSGLASS (R-0.56), 5/8" gypsum board (R-0.56), and interior air film (R-0.68). – ASHRAE 90.1, Appendix 'A' , section A3.3.3.2, Table A3.3, cavity insulation R-value

Walls, Above-Grade Insulation (All Other)	Steel framed wall Solar abs. = 0.75 – Table 506.5.1(1) U-0.064 – Table 502.1.2, All Other 2x6 framing @ 24" O.C., batt insulation in the stud cavity (R-19), continuous board insulation (R-5), exterior air film (R-0.17), stucco finish (R-0.08), 2 layers of 5/8" gypsum board (R-0.56 each), and interior air film (R-0.68) – ASHRAE 90.1, Appendix 'A' , section A3.3.3.2, Table A3.3, cavity insulation R-value	Steel framed wall Solar abs. = 0.675 Medium U-0.081 – Entire assembly U-value 2x6 framing @ 24" O.C., batt insulation in the stud cavity (R-21), exterior air film (R-0.17), face brick (R-.43), air space (R-.91), 5/8" DENSGLASS (R-0.56), 5/8" gypsum board (R-0.56), and interior air film (R-0.68). – ASHRAE 90.1, Appendix 'A' , section A3.3.3.2, Table A3.3, cavity insulation R-value
Walls, Below-Grade Insulation (All Other)	Mass wall C-0.119 – Table 502.1.2 115 lb/ft3 CMU 8", solid grout (R-0.87), continuous rigid foam board insulation (R-7.5) Assembly U-value: 0.102 – ASHRAE 90.1, Appendix 'A' , section A4.2.3-b2, Table A3.1C and A3.1D, assembly U-factors and effective R-values	Mass wall C-0.092 12"normal weight solid concrete wall (R-0.75), continuous rigid foam board insulation (R-10) Assembly U-value: 0.082 – ASHRAE 90.1, Appendix 'A' , section A4.2.3-a1, Table A3.1B, assembly U-factors
Fenestration	Operable: U-0.35, SHGC-0.40 Storefront: U-0.45, SHGC-0.40 Entrance Doors: U-0.80, SHGC-0.40 - Table 502.3	Operable: U-0.24, SHGC-0.16 Storefront: U-0.41, SHGC-0.38 Entrance Doors: U-0.77, SHGC-0.40
Lighting	Building Area Type Multifamily: 0.7 W/sf Unknown: 1.0 W/sf -Table 505.5.2, LPD for "Unknown" occupancy per Table 506.5.1	LED lighting, 0.50 W/sf

HVAC	System: PTHP Fan Control: Constant volume Cooling Type: DX Heating Type: Heat Pump - Table 506.5.1 (3)	Low ambient ducted heat pump split system with floor mounted air handler serving residential units. Single zone packaged rooftop units DX cooling with gas furnace serving the public spaces. Ductless split system serving the exercise room. Unitary heating equipment serving the vestibule and storage areas. Cooling equipment was modeled per Table 506.5.1(1), footnote 'c' in these areas

Each building was modeled assuming an air leakage rate of 0.35ACH at residential living areas to account for outside air being delivered to the space by natural means. All other spaces assumed an air leakage rate of 0.12 CFM/ft2. HVAC equipment heating and cooling loads were determined using procedures outlined in the ASHRAE standard, accounting for envelope, lighting, ventilation, and occupancy loads. The baseline's HVAC systems are sized so the equipment's capacities are proportionally no larger than the proposed case, and the number of unmet load hours is no smaller. Baseline HVAC equipment efficiencies have been determined per table 503.2.3(3) and meet ASHRAE 90.1 minimum equipment efficiencies. An identical schedule was created to model thermostat controls in both cases, providing a 5°F deadband, off-hour setbacks, and modulation of auxiliary electric resistance heat. Service water heating has not been specified in the proposed design; therefore no hot water heating was modeled. Exterior lighting, elevators, and fan power were defined as a miscellaneous energy loads, and were modeled identically in both cases.

After the software completed building calculations, a "Building Simulation Report" was generated to show "Performance Rating Method" compliance. The "Performance Rating Table" on page 6 of this document compares each end use of both buildings. The proposed building shows a 4.2% reduction in total energy use and a 18% reduction in energy cost savings. This satisfies the requirements outlined in the *2009 International Energy Conservation Code,* and therefore will meet the requirements of the Maine Uniform Building and Energy Code (MUBEC).

General Information

Simulation Program Name and Version ..... **Hourly Analysis Program v4.91**
Simulation Weather File Name ..... **Portland, Maine (TM2)**

Building Designations

Proposed Building ..... **PORTLAND YORK ST**
Baseline - 0 degrees ..... **[B000] PORTLAND YORK ST**
Baseline - 90 degrees ..... **n/a**
Baseline - 180 degrees ..... **n/a**
Baseline - 270 degrees ..... **n/a**

Floor Areas

	Proposed Design	Baseline
Total Conditioned Floor Area (ft²)	98,103	98,103
Total Floor Area (ft²)	98,103	98,103

Envelope and Glazing Data

Above-Grade Wall & Vertical Glazing Areas:

Orientation	Baseline Design (0° rotation)			Proposed Design		
	Gross Above-Grade Wall Area	Vertical Glazing Area		Gross Above-Grade Wall Area	Vertical Glazing Area	
	(ft²)	(ft²)	(% WWR)	(ft²)	(ft²)	(% WWR)
North	2,999	504	16.8	2,999	504	16.8
North-Northeast	0	0	0.0	0	0	0.0
Northeast	168	0	0.0	168	0	0.0
East-Northeast	11,111	3,823	34.4	11,111	3,823	34.4
East	4,714	1,798	38.1	4,714	1,798	38.1
East-Southeast	0	0	0.0	0	0	0.0
Southeast	0	0	0.0	0	0	0.0
South-Southeast	325	0	0.0	325	0	0.0
South	4,701	1,320	28.1	4,701	1,320	28.1
South-Southwest	0	0	0.0	0	0	0.0
Southwest	0	0	0.0	0	0	0.0
West-Southwest	7,825	1,711	21.9	7,825	1,711	21.9
West	5,139	1,351	26.3	5,139	1,351	26.3
West-Northwest	110	0	0.0	110	0	0.0
Northwest	0	0	0.0	0	0	0.0
North-Northwest	862	339	39.3	862	339	39.3
Total	**37,952**	**10,845**	**28.6**	**37,952**	**10,845**	**28.6**

Roof & Skylight Areas:

Baseline Design (0° rotation)			Proposed Design		
Gross Roof Area	Skylight Area		Gross Roof Area	Skylight Area	
(ft²)	(ft²)	(%)	(ft²)	(ft²)	(%)
20,011	0	0.0	20,011	0	0.0

Note: In these tables, roof and skylight surfaces with slope of 60° or more (from horizontal) are treated as walls and vertical glazing, as according to ASHRAE 90.1 Section 3.

Advisory Messages

Message	Proposed Building	Baseline Building (0 deg. rotation)	Difference
Number of hours heating loads not met	0	0	0
Number of hours cooling loads not met	114	117	-3

Energy Type Summary

Energy Type	Utility Rate Description	Units of Energy	Units of Demand
Electric	Maine - EIA 2013	kWh	kW
Natural Gas	Maine - EIA 2012	MCF	MBH

Energy Units:
1 kBTU = 1,000 BTU
1 kWh = 3.412 kBTU
1 MCF = 1,000.000 kBTU

Demand Units:
1 MBH = 1,000 BTU/h
1 kW = 3.412 MBH

Baseline Performance - Performance Rating Method Compliance

End Use	Process	Baseline Design Energy Type	Units of Annual Energy & Peak Demand	Baseline (0 deg rotation)	Baseline (90 deg rotation)	Baseline (180 deg rotation)	Baseline (270 deg rotation)	Baseline Design
Interior Lighting	No	Electric	Energy kWh	223,994	0	0	0	223,994
			Demand kW	54.2	0.0	0.0	0.0	54.2
Space Heating	No	Electric	Energy kWh	107,636	0	0	0	107,636
			Demand kW	194.2	0.0	0.0	0.0	194.2
Space Heating	No	Natural Gas	Energy MCF	0	0	0	0	0
			Demand MBH	0.0	0.0	0.0	0.0	0.0
Space Cooling	No	Electric	Energy kWh	98,739	0	0	0	98,739
			Demand kW	88.6	0.0	0.0	0.0	88.6
Pumps	No	Electric	Energy kWh	0	0	0	0	0
			Demand kW	0.0	0.0	0.0	0.0	0.0
Heat Rejection	No	Electric	Energy kWh	0	0	0	0	0
			Demand kW	0.0	0.0	0.0	0.0	0.0
Fans - Interior	No	Electric	Energy kWh	114,159	0	0	0	114,159
			Demand kW	14.3	0.0	0.0	0.0	14.3
Receptacle Equipment	Yes	Electric	Energy kWh	100,306	0	0	0	100,306
			Demand kW	20.7	0.0	0.0	0.0	20.7
Exterior Lights	No	Electric	Energy kWh	3,504	0	0	0	3,504
			Demand kW	0.8	0.0	0.0	0.0	0.8
Elevator	Yes	Electric	Energy kWh	7,008	0	0	0	7,008
			Demand kW	0.8	0.0	0.0	0.0	0.8
Exhaust Fans	No	Electric	Energy kWh	1,224	0	0	0	1,224
			Demand kW	0.4	0.0	0.0	0.0	0.4
Baseline Energy Totals	Total Annual Energy Use kBTU			2,240,215	0	0	0	2,240,215
	Annual Process Energy kBTU							366,154
	Process Energy Modeling Compliance							N

(1) This form determines compliance using cost calculations from Section 1.9. Process Energy Costs should be modeled to accurately reflect the proposed building. Process Energy must be the same in the baseline and proposed cases, unless an exceptional calculation is used. Process energy costs must be at least 25% of the total baseline energy costs. Any exceptions must be supported by a narrative and/or other supporting doucmentation.
(2) In this project Process Energy is 16% of total baseline energy cost.

Baseline Energy Costs

Energy Type	Baseline Cost (0 deg rotation) ($)	Baseline Cost (90 deg rotation) ($)	Baseline Cost (180 deg rotation) ($)	Baseline Cost (270 deg rotation) ($)	Baseline Building Performance ($)
Electric	76,950	0	0	0	76,950
Natural Gas	0	0	0	0	0
Total Baseline Costs	**76,950**	**0**	**0**	**0**	**76,950**

Performance Rating Table - Performance Rating Method Compliance

End Use	Process ?	Baseline Building Units	Baseline Building Results	Proposed Design Energy Type	Proposed Design Units	Proposed Building Results	Percent Savings
Interior Lighting	No	Energy kWh	223,994	Electric	Energy kWh	148,919	34 %
		Demand kW	54.2		Demand kW	38.0	30 %
Space Heating	No	Energy kWh	107,636	Electric	Energy kWh	25,252	77 %
		Demand kW	194.2		Demand kW	43.9	77 %
Space Heating	No	Energy MCF	0	Natural Gas	Energy MCF	509	n/a
		Demand MBH	0.0		Demand MBH	873.7	n/a
Space Cooling	No	Energy kWh	98,739	Electric	Energy kWh	62,015	37 %
		Demand kW	88.6		Demand kW	59.8	33 %
Pumps	No	Energy kWh	0	Electric	Energy kWh	0	n/a
		Demand kW	0.0		Demand kW	0.0	n/a
Heat Rejection	No	Energy kWh	0	Electric	Energy kWh	0	n/a
		Demand kW	0.0		Demand kW	0.0	n/a
Fans - Interior	No	Energy kWh	114,159	Electric	Energy kWh	131,485	-15 %
		Demand kW	14.3		Demand kW	21.5	-51 %
Receptacle Equipment	Yes	Energy kWh	100,306	Electric	Energy kWh	100,306	0 %
		Demand kW	20.7		Demand kW	20.7	0 %
Exterior Lights	No	Energy kWh	3,504	Electric	Energy kWh	3,504	0 %
		Demand kW	0.8		Demand kW	0.8	0 %
Elevator	Yes	Energy kWh	7,008	Electric	Energy kWh	7,008	0 %
		Demand kW	0.8		Demand kW	0.8	0 %
Exhaust Fans	No	Energy kWh	1,224	Electric	Energy kWh	1,224	0 %
		Demand kW	0.4		Demand kW	0.4	0 %
Energy Totals	Baseline Total Energy Use (kBTU)		2,240,215	Proposed Total Energy Use (kBTU)		2,146,015	4 %
	Baseline Annual Process Energy (kBTU)		366,154	Proposed Annual Process Energy (kBTU)		366,154	0 %

Energy Cost and Consumption by Energy Type - Performance Rating Method Compliance

	Proposed Design		Baseline Design	
Energy Type	**Energy Use**	**Cost ($)**	**Energy Use**	**Cost ($)**
Electric	479,712 kWh	56,222	656,569 kWh	76,950
Natural Gas	509 MCF	6,223	0 MCF	0
Subtotal (Model Outputs)	**2,146,015 kBTU**	**62,445**	**2,240,215 kBTU**	**76,950**
	Energy Generated	**Renewable Energy Cost Savings ($)**		
Total On Site Renewable Energy				
	Energy Savings	**Cost Savings ($)**		
Exceptional Calculation Totals				
	Energy Use	**Cost ($)**		
Net Proposed Design Total	**2,146,015 kBTU**	**62,445**		
	Percent Savings		**Energy Use Intensity**	
	Energy	**Cost**	**Proposed Design (kBTU/ft²)**	**Baseline Design (kBTU/ft²)**
Summary Data	**4.2 %**	**18.8 %**	**21.88**	**22.84**

LEED 2009 EA Credit 1 Points Reference Table

New Construction % Cost Savings	Existing Building Renovations % Cost Savings	LEED 2009 Points Awarded
12%	8%	1 pt
14%	10%	2 pt
16%	12%	3 pts
18%	14%	**4 pts**
20%	16%	5 pts
22%	**18%**	**6 pts**
24%	20%	7 pts
26%	22%	8 pts
28%	24%	9 pts
30%	26%	10 pts
32%	28%	11 pts
34%	30%	12 pts
36%	32%	13 pts
38%	34%	14 pts
40%	36%	15 pts
42%	38%	16 pts
44%	40%	17 pts
46%	42%	18 pts
48%	44%	19 pts