Energy Analysis Report

for

PCC Newberg Education Center
2010093

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:

Introduction

This report presents the results of energy analysis conducted for the 13,500 sf PCC Newberg Education facility. The facility will be 13,500 sf of new construction, consisting of classroom, computer lab, administrative offices, student commons, and multipurpose spaces.

The project is enrolled in the Path to Net Zero Pilot program. Energy analysis was conducted using the free DOE2 modeling software eQuest, version 3.64. Based on the results of analysis, the project is expected to achieve the minimum 50% energy savings target prior to renewable as required under the Path to Net Zero Pilot. The project is under the 2007 Oregon Structural Specialty Code; therefore the baseline and proposed energy models are established using the SEED Appendix L guideline.

The energy conservation measures (ECM) which were identified and implemented during the design and analysis process are as follows:

ECM #	Description	Incremental Cost $	kWh Savings	Energy Cost Savings $	Simple Payback (yrs)
1	Structural Insulated Wall/Roof Panels	$18,240	10322	$713	25.6
2	Reduced Lighting Power Density	$5,150	13299	$889	5.8
3	High Performance Glazing	$8,300			
4	Daylighting	$12,213			
3 & 4	Combined ECM	$20,513	10455	$770	26.6
5	Reduced Exterior LPD	$8,000	6040	$328	24.4
6	Heat Recovery Ventilation	($7,325)			
8	ASHP serving Radiant floor Htg/backup Clg system	$100,000			
6 & 8	Combined ECM	$92,675	51627	$6,726	13.8
7	Natural Ventilation	$92,000	5450	$107	859.8
9	Laptop Comp. vs Desktops	$2,000	6784	$465	4.3
10	Heat Pump DHW	$200	139	$27	7.4
	NZE Model (Proposed) (includes all ECM)	$238,778	122090	$11,807	20.2
	Interactive (Proposed) select ECM	$146,778	119997	$11,693	12.6

Overall, the project anticipates saving 51% of the energy compared to baseline. A total of 122,090 kWh/year electrical energy savings is projected. No gas use is anticipated during normal operation of the facility. The simple payback of the proposed facility is estimated at 20.2 years. In addition to the proposed ECM, a solar photovoltaic (PV) system has been designed to achieve net zero energy. The projected energy generation from the PV system is anticipated to be at least 109,345 kWh/year (conservative) and up to 112,761 kWh/yr (balanced estimate for bi-facial PV contribution). The proposed energy model projects an annual electrical usage of 115,339 kWh. It is anticipated if the solar PV performs above the conservative estimate & ECM 11 is accounted for that the facility will achieve net zero energy.

ECM 1, 2, 6&8 combined, 9, and 10 are expected to be cost effective within the expected life of the equipment. ECM 3&4, 5, and 7 are not cost effective under conventional simple payback analysis. However, as this project is pushing to achieve net zero energy, these measures were selected for implementation due to their impact on net energy savings, helping to achieve the greater than 50% energy savings target. In addition, these measures allows to project to provide an improved building environment, reduced the need for additional expensive solar photovoltaic (PV) onsite generation, and provides the facility owner with marquee sustainable energy features to exhibit. When

weighted against the additional cost of increased solar PV all of the measures identified above were included in the final package. Two simulation Proposed models have been created for the ETO submission package. The Interactive model reflects ECM included in the Proposed design which are to be considered for incentives. The Proposed Model includes all ECM listed above for achievement of NZE.

Additional ECMs were discussed and analyzed during the design process, but not selected for inclusion in the final package. Information on these additional ECM is provided in the Summary of ECM section of this report.

Building and Systems Description

The proposed facility is a new single story 13,500 sf classroom building located at 135 Werth Boulevard Newberg, Oregon. The facility includes two (2) typical classrooms, a computer lab classroom, administrative offices, a large commons/study area, and a larger dividable multipurpose classroom. The facility will be served by all electric energy systems to facilitate integration of solar photovoltaics into the net zero energy design.

The designed photovoltaic system will consist of two parts: one with bi-facial photovoltaic (PV) panels, and the other with typical single sided PV panels. The bi-facial PV system is designed to be 25.35 kW rated capacity, and the standard PV is 75.25 kW. The anticipated energy generation from each system is as follows:

- 25.35 kW system – anticipated 29,430 kWh/year with conservative 12% contribution from backside of PV, or as much as 32,846 kWh with 25% contribution achievable according to manufacturer data
    - System located on south facing building canopy over courtyard area
- 75.25 kW system – anticipated 79,915 kWh/year
    - located on south facing building roof area

Under the project's goals to achieve net zero energy, the economic analysis of proposed energy conservation measures included an analysis for simple payback, but ECM were not eliminated solely by this metric. The additional consideration of achieving net zero energy, reducing the onsite building energy use by greater than 50%, and minimizing the additional solar photovoltaic generation capacity and cost were all considered in final selection of ECM. In light of these additional requirements, the project is including ECM which would not pass traditional simple payback analysis to meet these additional project requirements.

The facility is expected to be occupied according to the following schedule:
PCC Yearly schedule:
Fall Term - Late September (September 20) to mid-December (Dec. 12)

- Three week break

Winter Term - Beginning of January (Jan. 3) to late March (March 20th)

- One week break

Spring Term - End of March (March 28) to mid-June (June 12)

- One week break

Summer Term - Late June (June 21st this year) to beginning of September (Sept. 5th, this year)

- Two week break

It is expected that the Administration area will be open the entire year other than official holidays. During the times between terms the actual hours of operation may vary.

PCC Newberg Academic Center Schedule of Use:
<u>Spring, Fall and Winter Terms</u>
Monday – Friday
Classrooms:
8:30 to 8:30pm - occupied
8:30pm to 8:30am – building closed
Administration Suite:
8am to 5pm – fully occupied
5pm to 8:30pm – semi occupied
Commons:
8:00am to 9:00 pm – occupied

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Saturday
Classrooms:
8:30am to 12:30pm – occupied
Administration Suite:
Infrequently occupied, typically closed
Commons:
8:00am to 1pm – occupied
Sunday – Building Closed

June – August
Monday – Thursday
Classrooms:
8:30 to 8:30pm - occupied
8:30pm to 8:30am – building closed
Administration Suite:
8am to 5pm – fully occupied
5pm to 8:30pm – semi occupied
Commons:
8:00am to 9:00 pm – occupied
Friday, Saturday and Sunday – Building Closed

The building HVAC system is as follows:

- Primary heating served by radiant slab
- Heat source is an air-to water heat pump
- Ventilation air provided by HRV units or natural ventilation
- Cooling provided by natural ventilation (mechanically controlled intake louver system)
- IT room has two systems: split system AC unit & WSHP unit on radiant loop to facilitate heat recovery during heating operation
- HRV units have additional water heating coil served by radiant loop system to temper supply air when needed

Summary of Energy Conservation Measures

ECM 1 Improved insulation – SIP construction

The building envelope loads will be targeted for reduction by utilizing structurally insulated panels (SIP) to achieve a higher overall assembly u-value on the walls and roof. Walls are to be 8" thick SIP, with the roof to be 12" thick SIP.

Item	**Code assembly u-value (btu/h-ft2-F)**	**Proposed SIP assembly u-value (btu/h-ft2-F)**
Wall	0.130	0.031
Roof	0.05	0.021

ECM 2 Reduced lighting power density

The installed lighting power density (LPD) is to be reduced significantly from the Oregon Code baseline allowances. Reduced LPD will result in significantly less electrical use for lighting. The lower lighting power density will also result in reduced heat gains to the space, allowing for a wider range of outside temperatures when natural ventilation cooling can be used. An adverse effect will result on the heating energy due to lower LPD.

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Room Name	Baseline LPD (W/sf)	Proposed LPD (W/sf)
Classroom	1.4	0.47 (typ.)
Admin Offices	1.1	0.57 (typ.)
Restrooms	0.9	1.0 (typ.)
Commons	0.6	0.58 (typ.)
Multipurpose	1.3	0.53 (typ.)
Conference	1.3	0.5 (typ.)
Storage	0.8	0.6 (typ.)

ECM 3 Improved glazing performance & ECM 4 Daylighting control

ECM 3 & 4 have been combined in the revised submission due to the interactive effects of selecting glazing per requirements of optimized daylighting.

The glazing used for the project will have improved thermal performance compared to the Oregon code requirement. Glazing is to be double pane, argon filled ½ inch gap, Solarban 60/Clear and include a thermally broken aluminum frames.

Item	Code	Proposed
Windows u-value (NFRC)	0.54	0.42
SC (SHGC)	0.57 (0.50)	0.44 (0.36)

Daylighting is required under the code for the classroom spaces. However, energy savings are expected as a result of implementing daylighting control for the administrative office spaces, multipurpose rooms and the commons area. The layout of skylights and windows examined with daylighting in mind to effectively maximize the use of natural daylight while also reducing required electrical lighting.

ECM 5 Reduced exterior lighting power density

For the building attached exterior lighting under the extended roof canopy and the entry doorways, exterior lighting power density was reduced below the allowances under code.

Item	Baseline LPD	Proposed LPD
Canopy Lighting	1.25 W/sf (~3,240 sf)	(4) ‘SB’ @ 33W (4) ‘SC’ @ 75W (10) ‘SD’ @ 75W (5) ‘SE’ @ 75W (2) ‘SF’ @ 75W
Main Entry Doors	30 W/lf (3 lf)	
Other Entry Doors	20 W/lf (6 lf)	
Total kW	4.26	1.71

ECM 6 Heat recovery ventilation & ECM 8 Radiant heating system with air source heat pump

ECM 6 & 8 have been combined in the revised submission due to the interactive effects of system capacity of HRV on selected HP.

Ventilation air is to be supplied via dedicated outside air units for the entire facility during non-natural ventilation periods. These units will all have heat recovery wheels with high sensible effectiveness. The heating and cooling energy associated with treating outside air will be reduced.

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HRV	Sensible Effectiveness
HRV-1	79.9%
HRV-2	79.9%
HRV-3	79.9%
HRV-4	63.7%
HRV-5	76.0%
HRV-6	83.9%
HRV-7	83.9%

The space heating will be provided by a radiant in-slab system, with the heating water source an air-to-water heat pump. The hot water loop will also supplement the ventilation system heating via heating coils downstream of the HRV units. An electric boiler has been provided for a backup heat source, but is not expected to run.

The air-to-water heat pump is simulated as a heat pump chiller on a two pipe loop, just as would be available in the actual design. However, the loop design sequence is such that it should never operate to cool the space, thus heating only energy is consumed. The eQuest model has a few hours of cooling demand on this loop. The radiant loops are simulated using baseboard heaters connected to the loop, as the airside HRV systems are modeled as the primary system in eQuest.

ECM 7 Natural ventilation cooling

(This measure has been eliminated from incentive application due to the high incremental cost. It is included in the calculations for NZE per discussions with project review team.)

The project anticipates that nearly 100% of the cooling load can be accomplished without compressor cooling. (The exception is the IT space will be cooled via a split system during cooling season, and a WSHP tied into the radiant loop during heating season.) The majority of the building will be cooled by natural ventilation only. CFD analysis has been conducted to support the natural ventilation design. CDF concluded that for the typical classroom space approximately 1,500 cfm would be available through natural ventilation based on the natural ventilation intake/exhaust design parameters. Energy analysis modeling was conducted assuming this ACH rate is the maximum available in classrooms, and included a 20% reduced value for safety factor in other areas.

ECM 9 Laptop computers

As a method to reduce the miscellaneous plug loads in the facility, it is proposed that all of the computers in the Lab classroom space be Energy Star laptop computers. Office workstations will also have laptop computers. It is anticipated that the typical workstation desktop with monitor will draw 100W. The proposed laptop solution will have a power draw of 30W. In addition, Energy Star vending machines will be used in the commons area. A rough count of 40 computers is estimated for the entire facility and was used as a basis for energy input reductions in eQuest.

ECM 10 Heat pump domestic hot water heater

Domestic hot water will be supplied by a heat pump water heater. A heat pump will provide a significant efficiency improvement over a standard electric hot water heater. Per the manufacturer cut sheet the energy factor is 2 for this unit.

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ECM 11 (Alternate) Solar preheating of ventilation air

An alternate ECM proposed as an addendum is preheating ventilation air using an air intake located at the underside of the solar PV array. This measure would reduce the heating energy associated with ventilation air. At this time energy savings calculations have not been included in this report. Spreadsheet calculations are being conducted to estimate the impact of this measure.

Additional Considered ECM not included in final design

The following ECM were considered and analyzed during the design process but eliminated due to budget, design, or other considerations:

- Ground source heat pump system using a vertical bore field – improved heating and cooling performance
- Switched outlets - reduce misc. electrical plug loads
- Triple pane glazing system – reduce glazing envelope heat/cool loads
- Optimized exterior shading – assist in passive heating/cooling strategies
- Optimized south facing glazing – no glazing located high under roof canopy with no potential for solar gains and no significant visible gains from occupant prospective
- Displacement ventilation with higher air temperatures

Economic Summary

Electric utility is provided to the site via Portland General Electric. The utility rate used for simulations is PGE schedule 83. The virtual utility rate in the proposed energy simulation is calculated to be 0.0751 $/kWh. The standard Energy Trust of Oregon New Buildings program summary tables: Estimated Electric & Gas Savings, Cost and Incentive Summary (Table 4.1) and Cost Effectiveness Calculator (Table 4.2) are provided below. As indicated previously, not all implemented ECM prove to be cost effective, but are still included to meet the projects Net Zero energy savings targets. Please note that as these tables are supplied by the Energy Trust under the New Buildings program, the cost effectiveness tests and the incentive projections may not accurately reflect the results for this project under the Energy Trust of Oregon, Path to Net Zero Pilot Program.

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Table 4.1 Estimated Electric & Gas Savings, Cost and Incentive Summary

ECM #	Custom Track Measure Description	Acceptable ECM	Electric Energy (kWh/yr)	Electric Cost ($/yr)	Gas Energy (therms/yr)	Gas Cost ($/yr)	Measure Incremental Cost	Total Potential Incentive If Measure is Cost-effective*	CEC Pass/ Fail	Payback before incentive	Payback after incentive	Eligible Commissioning Incentive
1	SIP	YES	12,563	$943			$18,240	$1,256	PASS	19.3	18.0	
2	Reduced Interior LPD	YES	16,186	$1,216			$5,150	$1,619	PASS	4.2	2.9	
3	ECM 3 Improved vertical glazing & ECM 4 Daylighting	NO	12,725	$956			$20,513		FAIL	21.5	21.5	
4	NA	NO							#DIV/0!	0.0	0.0	#DIV/0!
5	Reduced exterior LPD	NO	7,351	$552			$8,000		FAIL	14.5	14.5	
6	ECM 6 Heat recovery ventilation & ECM 8 Air-to-water heat pump with radiant system	NO	62,836	$4,719			$92,675		FAIL	19.6	19.6	
7	Not Included	NO							#DIV/0!	0.0	0.0	#DIV/0!
8												
9	Laptop computers vs desktops	YES	8,257	$620			$2,000	$826	PASS	3.2	1.9	
10	Heat pump domestic hot water heater	NO	169	$13			$200		FAIL	15.7	15.7	
	Custom Track Sub-Total		120,087	$9,019			$146,778	$3,701		**16.3**	**15.9**	
	Acceptable Custom Track Measures		**37,006**	**$2,779**			**$25,390**	**$3,701**		**9.1**	**7.8**	**#DIV/0!**

Table 4.2 Cost Effectiveness Calculator

Energy Trust of Oregon, Inc. Cost-Effectiveness Calculator Tool Commercial Sector																
Version: 03/25/10	**Starting Year: 2008**		**Today's Date**	10/14/2011												
Project Description	PCC Newberg Education Center - Path to Net Zero Pilot															
Organization Name	PCC Newberg															
Project Name:	PCC Newberg Education Center															
Site Address:	135 Werth Boulevard Newberg, Oregon															
Program:	***Select Electric Sponsor***	Portland General Electri		***Select Gas Sponsor***	No Program											
Energy Conservation Measures: Input light-green Cells																
Measure #	**Energy Efficiency Measure Name**	**Select Business Type**	**Select Electric Measure Description:**	**Select Natural Gas Load Profile**	**Select Project Type**	**Measure Lifetime (Maximum 70 yrs)**	**Annual Electricity Savings (kWh)**	**Annual Natural Gas Savings (therms)**	**Total Incremental Cost of Measure**	**Annual Non-Energy Benefits $ (if any)**	**Total Potential Incentive If Measure is Cost-effective***	**NPV of Non Energy Benefits**	**Utility System PV of Benefits**	**Societal PV of Benefits**	**Combined Utility System BCR**	**Combined Societal BCR**
1	SIP	School	Insulation	None	New Construction	45	12,563		$18,240		$1,256		$22,859	$22,859	18.2	1.3
2	Reduced Interior LPD	School	Lighting	None	New Construction	10	16,186		$5,150		$1,619		$11,113	$11,113	6.9	2.2
3	ECM 3 Improved vertical glazing & ECM 4 Daylighting	School	Glazing	None	New Construction	15	12,725		$20,513		None		$11,774	$11,774		**0.6**
4	NA	School	Daylighting	None	New Construction						None					
5	Reduced exterior LPD	School	Lighting	None	New Construction	10	7,351		$8,000		None		$5,047	$5,047		**0.6**
6	ECM 6 Heat recovery ventilation & ECM 8 Air-to-water heat pump with radiant system	School	HVAC	None	New Construction	20	62,836		$92,675		None		$74,667	$74,667		**0.8**
7	Not Included	School	HVAC	None	New Construction						None					
8		School	HVAC	None	New Construction						None					
9	Laptop computers vs desktops	School	Processes	None	New Construction	5	8,257		$2,000		$826		$2,705	$2,705	3.3	1.4
10	Heat pump domestic hot water heater	School	Processes	None	New Construction	20	169		$200		None		$196	$196		**1.0**
Total							**120,087**		**$146,778**		**$3,701**		**$128,361**	**$128,361**	**34.7**	**0.9**

***Subject to all other program requirements cost-effective measures may be eligible for the following incentives:**

1. New Construction Projects: $0.10/kWh and $0.80/Therm
2. Major Renovation Lighting Measures: $0.17/kWh up to 35% of eligible project cost, not to exceed 100% of incremental cost
3. Major Renovation Non-lighting Measures: $0.25/kWh and $1/Therm up to 50% of eligible project cost, not to exceed 100% of incremental cost

Total incentive for custom track projects will not exceed $500,000.

Incentive rates and caps are subject to change. Contact your New Buildings program representative to verify the latest incentive offer.

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Summary of ECM Costs

Table 5.1 Estimated ECM Incremental Costs

ECM #	Description	Baseline Cost	Proposed Cost	Incremental Cost $	kWh Savings	Energy Cost Savings $	Simple Payback (yrs)
1	Structural Insulated Wall/Roof Panels	Wall: 2"x6" Mtl stud wall 16' high: $28.50/lf (650lf) = $18,525 +R13 Batt: $0.90/sf (9,800 sf) = $8,865 Roof Framing: Steel Joist $2.5/sf (13,500sf) = $33,750 Roof Insl.:R19 $3.12/sf (13,500sf) = $42,120 Total cost $103,260	Wall: 7.25" thick SIP $8/sf = $78,400 Roof: 11.25" thick SIP $9/sf = $91,125 Total = $121,500	$18,240	10322	$713	25.6
2	Reduced Lighting Power Density	NA	T5 fixtrures, non-standard "A", & "K": 106 x $25 increase/fix. = $2,650 LED Downlights: 50 x $50 increase/fix. = $2,500 All other fixtures are standard	$5,150	13299	$889	5.8
3	High Performance Glazing	Additional Cooling/Heating equipment capacity(2 Tons @ $2,500/ton): $5,000	Cost add: $2.50/sf for low-e solar coatings, $1.0/sf for Argon fill ~3,800 sf glazing	$8,300			
4	Daylighting	Basic lighting control panel: $15,000	9 - photocell sensor @ $500/sensor: $4,500 Lighting control panel: $22,713	$12,213			
3 & 4	Combined ECM			$20,513	10455	$770	26.6
5	Reduced Exterior LPD	NA	Cost add: 4 - "SC" @ $450 each + 9 "SD" @ $300 each + 5 "SE" @ $500 each + 2 "SF" @ $500 each = $8,500	$8,000	6040	$328	24.4
6	Heat Recovery Ventilation	HRV-1: $2,250 HRV-2: $2,250 HRV-3: $2,250 HRV-4: $1,500 HRV-5: $7,500 HRV-6: $3,000 HRV-7 $3,000 Total Cost: $21,750 Additional Cooling/Heating equipment capacity(6 Tons @ $2,500/ton): $15,000	HRV-1: $3,400 HRV-2: $3,400 HRV-3: $3,400 HRV-4: $2,100 HRV-5: $8,575 HRV-6: $4,275 HRV-7 $4,275 Total Cost: $29,425	($7,325)			
8	ASHP serving Radiant floor Htg/backup Clg system	7 - 5 Ton HPs $5500 ea. 13 - 1 T HPs $2,500 ea. Total $71,000	Radiant HW Loop & Pumps: $97,000 ASHP: $74,000 Total: $171,000	$100,000			
6 & 8	Combined ECM			$92,675	51627	$6,726	13.8
7	Natural Ventilation	NA	Louvers: $70/sf x ~600 sf = $42,000 Ventilation chimeny: $50,000	$92,000	5450	$107	859.8
9	Laptop Comp. vs Desktops	40 - Workstations (Desktop PC's w/Monitor)$500/workstation: $20,000	40 - Workstations (Laptop PC) $550/workstation: $22,000	$2,000	6784	$465	4.3
10	Heat Pump DHW	Electric Storage	Heat Pump DHW	$200	139	$27	7.4
	NZE Model (Proposed) (includes all ECM)	NA	NA	$238,778	122090	$11,807	20.2
	Interactive (Proposed) select ECM	NA	NA	$146,778	119997	$11,693	12.6

Source of Cost Estimate:

RSMeans was used to estimate the following costs:

Baseline:
- ECM 1, 6, 8 & 10

Proposed
- ECM 3, 6, 7 (louvers) & 10

A contractor's preliminary cost estimate was used to establish a cost for the following:

Baseline
- NA

Proposed
- ECM 1, 2, 4, 5, 7 (chimney) & 8

Costs for ECM 9 were based on typical system costs from Dell computers website.

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Appendix A

Summary Table of Modeling Inputs

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PCC Education Center	Classroom Facility	
Newberg, Oregon (4C)	13,500 sf	
Item:	Proposed PCC Newberg Edu. Center	Oregon Code (Chapter13) Climate Zone 1
Architectural		
Roof Construction	SIP Panel assembly u-value: 0.021 btu/h-ft2-F	Layers per SEED Appendix L. Assembly u-value: 0.05 btu/h-ft2-F
Roofing products	emittance: 0.70	emittance: 0.70
Wall Construction	Brick faced SIP, assembly u-value: 0.031 btu/h-ft2-F	Layers per SEED Appendix L. Assembly u-value: 0.130 btu/h-ft2-F
Heated slab on grade	F=0.860 (R15 for 24in.)	F=0.860 (R15 for 24in.)
Vertical Glazing	Double pane, solarban 60, 1/2 inch argon filled gap, thermally broken aluminum/curtainwall frames: assembly u-value = 0.42, SC = 0.44 (SHGC = 0.36)	Assembly u-value = 0.54 COG SC = 0.57
% Window to Wall	26% glazing	26% glazing
Doors	swinging; u-factor: 0.70	swinging; u-factor: 0.70
Horizontal Glazing	glass w/curb; assembly u-value: 1.17 btu/h-ft2-F SHGC, glass (0.7%): 0.49	Assembly u-value = 1.23 COG SC = 0.47
Shading	Roof overhang canopy	None
Electrical		
Interior Light Power Density (typical values)	Classroom: 0.47 Office: 0.57 Commons: 0.5 RR:1.0 Mech/Elec: 0.65 Multipurpose: 0.53 Storage: 0.6 Conference: 0.5	Classroom: 1.4 Office: 1.1 Commons: 0.6 RR: 0.9 Mech/Elec: 1.5 Multipurpose: 1.3 Storage: 0.8 Conference: 1.3
Lighting Controls	Occupancy & Timeclock controls (same as baseline) Daylighting controls	Occupancy & Timeclock controls Daylighting controls - classrooms
Exterior Light Power Density	1.72 kW	4.26 kW
Electrical Misc Plug Loads	Laptop computers in Classroom (30W/comp), E-star in office spaces, E-star vending machines	Desktop computers in Comp. Classroom (100W/comp)

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Item:	Proposed PCC Newberg Edu. Center	Oregon Code (Chapter13)
Mechanical		
HVAC System	Air-to-water heat pump serving radiant slab for heating, HRV units deliver ventilation air to radiant zones; unless natural ventilation available. Cooling provided by natural ventilation only.	PSZ-HP w/economizer (70F high limit)
Ventilation air	From HRV units: (unit/sensible effectiveness) HRV-1 / 0.799 HRV-2 / 0.799 HRV-3 / 0.799 HRV-4 / 0.637 HRV-5 / 0.760 HRV-6 / 0.839 HRV-7 / 0.839	No heat recovery, ventilation provided thru PSZ-HP units
Fans	HRV fans & ceiling fans: 5,935 cfm OSA. Supply fans: 0.18W/cfm (typ.) ; return fans: 0.13W/cfm (typ.) total (0.31W/cfm typ.)	fan power = 0.8226 W/cfm ~12,200 cfm
Cooling Efficiency	Air-to-water heat pump - 9.6 EER. Normal operation not intended to use for cooling	units<65,000 btu/h 13 SEER units>65,000 btu/h 11 EER
Heatinging Efficiency	Air-to-water heat pump: 2.0 COP	units<65,000 btu/h 7.7 HSPF units>65,000 btu/h 3.3 COP@47F
T-stat settings	Relaxed occupied space control setpoints (82F clg, 68F htg)	Relaxed occupied space control setpoints (82F clg, 68F htg)
Plumbing		
Domestic Hot Water	Heat Pump (EF=2)	Electric Storage

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Appendix B

Oregon Code Baseline - BEPS, BEPU & ES-D reports

PCC Newberg Education Center Ch 13 Code DOE-2.2-47h2 2/15/2011 15:57:08 BDL RUN 2

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	139.3	0.0	179.9	175.1	30.1	0.0	7.2	178.7	0.0	35.9	18.0	46.0	810.3
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	139.3	0.0	179.9	175.1	30.1	0.0	7.2	178.7	0.0	35.9	18.0	46.0	810.3

TOTAL SITE ENERGY 810.34 MBTU 58.4 KBTU/SQFT-YR GROSS-AREA 58.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2431.02 MBTU 175.1 KBTU/SQFT-YR GROSS-AREA 175.1 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 2.06
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 122

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center Ch 13 Code DOE-2.2-47h2 2/15/2011 15:57:08 BDL RUN 2

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	40826.	0.	52705.	51313.	8820.	0.	2123.	52360.	0.	10529.	5285.	13468.	237429.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 237429. KWH 17.104 KWH /SQFT-YR GROSS-AREA 17.104 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 2.06
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 122

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	237429. KWH	20304.	0.0855	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				20400.		

ENERGY COST/GROSS BLDG AREA: 1.47
ENERGY COST/NET BLDG AREA: 1.47

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Appendix C

ECM 1 – BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM1 DOE-2.2-47h2 6/27/2011 11:17:04 BDL RUN 4

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	122.0	7.5	0.0	18.0	44.5	0.0	0.0	17.6	18.5	435.7
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	122.0	7.5	0.0	18.0	44.5	0.0	0.0	17.6	18.5	435.7

TOTAL SITE ENERGY 435.71 MBTU 31.4 KBTU/SQFT-YR GROSS-AREA 31.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1307.15 MBTU 94.2 KBTU/SQFT-YR GROSS-AREA 94.2 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 10.74
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 211
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 364

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM1 DOE-2.2-47h2 6/27/2011 11:17:04 BDL RUN 4

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15399.	0.	45397.	35746.	2209.	0.	5271.	13045.	0.	0.	5171.	5425.	127664.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 127664. KWH 9.197 KWH /SQFT-YR GROSS-AREA 9.197 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 10.74
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 211
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 364

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	127664. KWH	9420.	0.0738	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				9516.		

ENERGY COST/GROSS BLDG AREA: 0.69
ENERGY COST/NET BLDG AREA: 0.69

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Appendix D

ECM 2 – BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM2 DOE-2.2-47h2 6/27/2011 11:18:26 BDL RUN 5

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	104.1	0.0	154.9	81.3	8.8	0.0	16.0	44.6	0.0	0.0	17.6	18.5	445.9
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	104.1	0.0	154.9	81.3	8.8	0.0	16.0	44.6	0.0	0.0	17.6	18.5	445.9

TOTAL SITE ENERGY 445.87 MBTU 32.1 KBTU/SQFT-YR GROSS-AREA 32.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1337.62 MBTU 96.4 KBTU/SQFT-YR GROSS-AREA 96.4 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 8.43
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 364
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 108

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM2 DOE-2.2-47h2 6/27/2011 11:18:26 BDL RUN 5

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	30492.	0.	45397.	23818.	2582.	0.	4685.	13078.	0.	0.	5163.	5425.	130641.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 130641. KWH 9.411 KWH /SQFT-YR GROSS-AREA 9.411 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 8.43
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 364
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 108

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	130641. KWH	9596.	0.0735	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				9692.		

ENERGY COST/GROSS BLDG AREA: 0.70
ENERGY COST/NET BLDG AREA: 0.70

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Appendix E

ECM 3 & 4 - BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM3 DOE-2.2-47h2 6/27/2011 11:19:17 BDL RUN 6

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	86.6	0.0	154.9	88.8	8.8	0.0	16.3	44.5	0.0	0.0	17.6	18.5	436.2
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	86.6	0.0	154.9	88.8	8.8	0.0	16.3	44.5	0.0	0.0	17.6	18.5	436.2

TOTAL SITE ENERGY 436.17 MBTU 31.4 KBTU/SQFT-YR GROSS-AREA 31.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1308.51 MBTU 94.3 KBTU/SQFT-YR GROSS-AREA 94.3 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 9.08
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 337
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 163

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM3 DOE-2.2-47h2 6/27/2011 11:19:17 BDL RUN 6

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	25381.	0.	45397.	26023.	2592.	0.	4786.	13032.	0.	0.	5161.	5425.	127797.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 127797. KWH 9.206 KWH /SQFT-YR GROSS-AREA 9.206 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 9.08
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 337
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 163

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	127797. KWH	9477.	0.0742	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				9573.		

ENERGY COST/GROSS BLDG AREA: 0.69
ENERGY COST/NET BLDG AREA: 0.69

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Appendix F

ECM 5 – BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM5 DOE-2.2-47h2 6/27/2011 11:19:57 BDL RUN 7

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	92.7	4.9	0.0	16.7	35.7	0.0	0.0	17.7	46.0	421.1
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	92.7	4.9	0.0	16.7	35.7	0.0	0.0	17.7	46.0	421.1

TOTAL SITE ENERGY 421.10 MBTU 30.3 KBTU/SQFT-YR GROSS-AREA 30.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1263.29 MBTU 91.0 KBTU/SQFT-YR GROSS-AREA 91.0 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 45
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 129

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM5 DOE-2.2-47h2 6/27/2011 11:19:57 BDL RUN 7

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	27154.	1439.	0.	4892.	10447.	0.	0.	5177.	13468.	123382.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 123382. KWH 8.888 KWH /SQFT-YR GROSS-AREA 8.888 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 45
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 129

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	123382. KWH	9035.	0.0732	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				9131.		

ENERGY COST/GROSS BLDG AREA: 0.66
ENERGY COST/NET BLDG AREA: 0.66

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Appendix G

ECM 6 & 8- BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM8 DOE-2.2-47h2 6/27/2011 11:22:42 BDL RUN 8

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	149.9	14.5	0.0	7.4	129.1	0.0	32.1	17.6	18.5	576.7
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	149.9	14.5	0.0	7.4	129.1	0.0	32.1	17.6	18.5	576.7

TOTAL SITE ENERGY 576.69 MBTU 41.5 KBTU/SQFT-YR GROSS-AREA 41.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1730.06 MBTU 124.6 KBTU/SQFT-YR GROSS-AREA 124.6 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 2.69
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 149

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM8 DOE-2.2-47h2 6/27/2011 11:22:42 BDL RUN 8

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	43925.	4256.	0.	2175.	37831.	0.	9393.	5160.	5425.	168969.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 168969. KWH 12.172 KWH /SQFT-YR GROSS-AREA 12.172 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 2.69
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 149

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	168969. KWH	15433.	0.0913	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				15529.		

ENERGY COST/GROSS BLDG AREA: 1.12
ENERGY COST/NET BLDG AREA: 1.12

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Appendix H

ECM 7 – BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM7 DOE-2.2-47h2 6/27/2011 10:33:23 BDL RUN 7

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	17.6	18.5	400.5
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	17.6	18.5	400.5

TOTAL SITE ENERGY 400.49 MBTU 28.9 KBTU/SQFT-YR GROSS-AREA 28.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1201.46 MBTU 86.6 KBTU/SQFT-YR GROSS-AREA 86.6 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM7 DOE-2.2-47h2 6/27/2011 10:33:23 BDL RUN 7

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	25899.	2194.	0.	4781.	13075.	0.	0.	5165.	5425.	117342.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 117342. KWH 8.453 KWH /SQFT-YR GROSS-AREA 8.453 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	117342. KWH	8707.	0.0742	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				8803.		

ENERGY COST/GROSS BLDG AREA: 0.63
ENERGY COST/NET BLDG AREA: 0.63

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Appendix I

ECM 9 – BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM9 DOE-2.2-47h2 6/27/2011 11:23:16 BDL RUN 9

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	179.9	85.4	8.8	0.0	16.3	44.6	0.0	0.0	17.6	18.5	423.6
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	179.9	85.4	8.8	0.0	16.3	44.6	0.0	0.0	17.6	18.5	423.6

TOTAL SITE ENERGY 423.64 MBTU 30.5 KBTU/SQFT-YR GROSS-AREA 30.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1270.92 MBTU 91.6 KBTU/SQFT-YR GROSS-AREA 91.6 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 7.42
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 301
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 114

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM9 DOE-2.2-47h2 6/27/2011 11:23:16 BDL RUN 9

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	52705.	25013.	2569.	0.	4771.	13071.	0.	0.	5165.	5425.	124126.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 124126. KWH 8.942 KWH /SQFT-YR GROSS-AREA 8.942 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 7.42
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 301
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 114

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	124126. KWH	9172.	0.0739	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				9268.		

ENERGY COST/GROSS BLDG AREA: 0.67
ENERGY COST/NET BLDG AREA: 0.67

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Appendix J

ECM 10 - BEPS, BEPU & ES-D reports

PCC Newberg Education Center ECM10 DOE-2.2-47h2 6/27/2011 11:23:47 BDL RUN 10

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	18.1	18.5	401.0
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	18.1	18.5	401.0

TOTAL SITE ENERGY 400.96 MBTU 28.9 KBTU/SQFT-YR GROSS-AREA 28.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1202.88 MBTU 86.7 KBTU/SQFT-YR GROSS-AREA 86.7 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM10 DOE-2.2-47h2 6/27/2011 11:23:47 BDL RUN 10

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	25899.	2194.	0.	4781.	13075.	0.	0.	5304.	5425.	117481.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 117481. KWH 8.463 KWH /SQFT-YR GROSS-AREA 8.463 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center ECM10 DOE-2.2-47h2 6/27/2011 11:23:47 BDL RUN 10

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	117481. KWH	8734.	0.0743	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				8830.		

ENERGY COST/GROSS BLDG AREA: 0.64
ENERGY COST/NET BLDG AREA: 0.64

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Appendix K

Interactive Proposed Model – BEPS, BEPU & ES-D reports

PCC Newberg Education Center Interactive DOE-2.2-47h2 6/27/2011 11:24:20 BDL RUN 11

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	17.6	18.5	400.5
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	88.4	7.5	0.0	16.3	44.6	0.0	0.0	17.6	18.5	400.5

TOTAL SITE ENERGY 400.49 MBTU 28.9 KBTU/SQFT-YR GROSS-AREA 28.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1201.46 MBTU 86.6 KBTU/SQFT-YR GROSS-AREA 86.6 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center Interactive DOE-2.2-47h2 6/27/2011 11:24:20 BDL RUN 11

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	25899.	2194.	0.	4781.	13075.	0.	0.	5165.	5425.	117342.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 117342. KWH 8.453 KWH /SQFT-YR GROSS-AREA 8.453 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 5.84
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 198
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 120

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center Interactive DOE-2.2-47h2 6/27/2011 11:24:20 BDL RUN 11

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	117342. KWH	8707.	0.0742	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				8803.		

ENERGY COST/GROSS BLDG AREA: 0.63
ENERGY COST/NET BLDG AREA: 0.63

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Appendix L

Proposed Model - BEPS, BEPU & ES-D reports

PCC Newberg Education Center Proposed DOE-2.2-47h2 2/15/2011 15:47:45 BDL RUN 1

REPORT- BEPS Building Energy Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	52.6	0.0	154.9	92.7	4.9	0.0	16.7	35.7	0.0	0.0	17.7	18.5	393.6
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	52.6	0.0	154.9	92.7	4.9	0.0	16.7	35.7	0.0	0.0	17.7	18.5	393.6

TOTAL SITE ENERGY 393.65 MBTU 28.4 KBTU/SQFT-YR GROSS-AREA 28.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1180.94 MBTU 85.1 KBTU/SQFT-YR GROSS-AREA 85.1 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 45
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 129

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center Proposed DOE-2.2-47h2 2/15/2011 15:47:45 BDL RUN 1

REPORT- BEPU Building Utility Performance WEATHER FILE- Portland OR TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	15407.	0.	45397.	27154.	1439.	0.	4892.	10447.	0.	0.	5177.	5425.	115339.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 115339. KWH 8.309 KWH /SQFT-YR GROSS-AREA 8.309 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 45
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 129

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PCC Newberg Education Center Proposed DOE-2.2-47h2 2/15/2011 15:47:45 BDL RUN 1

REPORT- ES-D Energy Cost Summary WEATHER FILE- Portland OR TMY2

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE ($)	VIRTUAL RATE ($/UNIT)	RATE USED ALL YEAR?
PGE 83-S 3P N-TOU Lrg N-Res Elec	ELECTRICITY	EM1	115339. KWH	8593.	0.0745	YES
NW Natural-OR 3-Commercial	NATURAL-GAS	FM1	0. THERM	96.	0.0000	YES
				8689.		

ENERGY COST/GROSS BLDG AREA: 0.63
ENERGY COST/NET BLDG AREA: 0.63