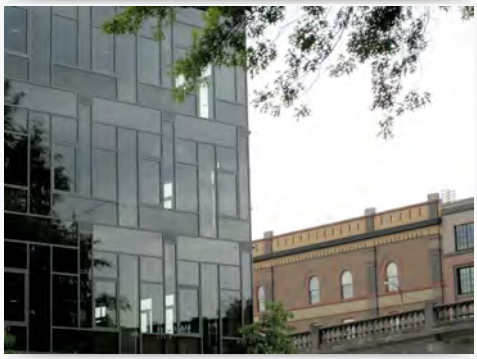

Credit: Christian Columbres.

Credit: Craig Alness



Mercy Corps Global Headquarters

Mercy Corps, a Portland-based non-profit humanitarian agency, transformed the historic Skidmore Fountain Building and an adjacent parking lot into a high performing work space used as its global headquarters. The new building also features the Mercy Corps Action Center, a new interactive public space that educates and empowers visitors to fight global poverty, and Mercy Corps Northwest's small business support center. Through integrated design, the development team identified measures that significantly reduced the building's energy, water and material use. The building's efficiency gains and reduced operating costs increased Mercy Corps' ability to extend its worldwide environmental, economic and social goals.

Project Highlights

- **Historic building renovation**
- **DOE eQuest 3D energy performance modeling**
- **LEED Platinum certification**
- **Solar PV system**

Portfolio Contents

- **Final Report**
- **Ecoroof Technical Datasheet**
- **LEED Construction Document**
- **LEED Energy Analysis**
- **Sustainability Features Poster**

Inhabitat Article (External Link)

Green Investment Fund

EnergyTrust of Oregon
Portland Water Bureau — From Forest to Faucet
Environmental Services
Bureau of Planning and Sustainability
Innovation. Collaboration. Practical Solutions.
City of Portland, Oregon
Sam Adams, Mayor · Susan Anderson, Director

City of Portland Green Investment Fund

Grantee Final Report

PROJECT INFORMATION

Name of Primary Contact:	Graham Craft				
Company or Organization:	Mercy Corps				
Address:	45 SW Ankeny St.				
City, State & Zip:	Portland, OR 97204				
Phone:	503.896.5000	Fax:	503.896.5011	E-mail:	gcraft@mercycorps.org

PROJECT DETAILS

Project Name:	Mercy Corps Global Headquarters
Project Owner:	Mercy Corps
Project Address:	45 SW Ankeny St.
City, State, ZIP:	Portland, OR 97204
Date Project Started:	March 2008
Date of Completion:	September 2009
Building Certifications:	LEED Platinum Certification

Design and Construction Team

Architect or Designer:	THA Architecture
General Contractor:	Walsh Construction Co.
Landscape Architect:	Walker Macy
Structural Engineer:	ABHT
Civil Engineer:	David Evans and Associates, Inc.
Mechanical Engineer:	Glumac
Electrical Engineer:	Glumac
Interior Designer:	THA Architecture
Green Building Consultant:	Green Building Services, Inc.
Energy Modeler:	Glumac

LEED Consultant:	Green Building Services, Inc.
Additional:	Shiels Obletz Johnsen, Inc. Project Manager

Building Details

If building has mixed use, please include the sq. ft of each type of use

Gross Floor Area:

Building Type

☐ Single-family Residential
☐ Multi-family Residential
☒ **Commercial**
☐ Industrial
☐ Institutional
☐ Mixed-Use
☐ Other (describe)

Site Conditions (check all that apply)

☐ Previously Undeveloped Land
☒ Previously Developed Land
☐ Brownfield Site
☐ Preexisting Structure(s)

Project Type

☒ Renovation
☒ New Construction
☐ Addition

Project Costs

Land Acquisition:	$3,575,000
Site Clearing/Deconstruction:	$1,064,614
Site Development:	$163,581
Public Improvements:	Included in site improvements above
Design Fees:	$2,948,855
Permits:	$287,129
System Development Charges:	$0
Construction:	$20,076,979
Green Technologies:	Included in construction number above. See measures listed below.
Other Costs:	$9,075,573
Total:	$37,191,733

Project Measure Matrix

In the following Matrix, as requested, please provide detailed information about all green products and materials identified in the Grant Agreement, Green Building Practices and Features.

Green Building Project Measure Matrix

Product/ brand or Measure by Category	Model #	Vendor	Cost				Efficiency/ Equipment Ratings or Capacity	Certifications	Incentives, Credits, rebates, grants, etc…
			Design	Material	Equipment	Labor			
Energy									
Photovoltaic System	Not installed								Not yet installed
Light colored roofing material	Siplast P-20/30 CR FR 1A	Siplast		$5,150		$6,300			n/a
Controls, monitoring & public interface				$40,000		$80,000	n/a		n/a
Modular exterior skin	See next line item			Costs in next line item		Costs in next line item	n/a		n/a
Terra Cotta Rainscreen / Sunshades -	Longoton	Shildan		$215,626		$225,432	n/a		n/a
PV Integrated Glass	Sage Glass	Sage Electrochromics		$93,000		$32,000			n/a
High efficiency thermally insulated glass	Sun Guard SN68	Guardian		$150,000		$270,000			n/a
Water Efficiency									
All low flow toilets and urinals -	Water Closet Z5610 Urinal Z5789	Zurn		$9,850		$4,260			
	Shower Faucet	Symmons							

	1-117-FS-X								
Stormwater Management									
Stormwater planters w/ artistic conveyance strategy	n/a	n/a		$26,200		$32,070	n/a	n/a	n/a
Permeable pavers	SF Rima	Willamette Graystone		$15,000		$16,750	n/a	n/a	n/a
Materials and Resources									
Recycled content carpet, gyp board, structural steel, metal framing, reinforcing steel	n/a	n/a	No premium	$967,442	No premium	No premium	n/a	n/a	n/a
Construction and Demolition Waste Recycling									
95% diversion rate	n/a	n/a	n/a	n/a	$34,940	$8,735	n/a	n/a	n/a

PROJECT HIGHLIGHTS

Financial Savings & Benefits

Can any soft or hard cost savings be identified from installation of green measures? Please provide actual cost savings.	Construction Waste Diversion – No cost savings from construction waste diversion Energy Savings – No hard or cost savings identified related to energy. Water Savings – To be determined.
Can any operational cost savings from green measures be identified? Please provide actual or projected operational cost savings.	Energy Savings – The energy cost savings are projected to be $42,651 per year once the solar photovoltaic system is installed. Without the solar PV system, the annual energy cost savings are projected to be $37,115. These values are based on the Energy and Atmosphere credit 1 LEED Submittal Template prepared by Glumac. Water Savings – To be determined. Reduced SDC charges – No SDC charges applied to project Reduced Stormwater Charges – No storm water charges applied to project

Environmental Benefits

Please be as specific as possible. Compare against code or a similar conventional building as relevant.

Modeled Energy Savings: *(Annual kWh or therms per sq foot)*	Based on the energy modeling performed by Glumac there was significant energy savings. The energy model was based on ASHRAE 90.1 2004 and showed a 9.6% electrical energy savings and 90% gas savings. These correspond to savings of 89,955 kWh and 25,745 therms. These savings on a square foot basis, based on a total square footage of 82,474 SF, translate to savings of 1.09 kWh/SF and 0.31 therms/SF.
Estimated Annual Water Savings: *(Annual savings in gallons per person)*	Using a combination of dual-flush toilets (1.6/1.1 gpf), 0.125 gpf urinals, 0.5 gpm lavatories, 1.8 gpm showerheads, and 1.5 gpm kitchen sinks, the project is predicted to save 253,937 gallons per year. These savings are based on 277 FTE, 102 visitors/customers. This equates to an annual water savings of 670 gallons per person compared to the fixtures mandated by the Energy Policy Act of 1992.
Construction and Demolition Waste Recycling: *(% recycled by weight or volume of total waste)*	1,481.27 tons (96%) of on-site generated construction waste was diverted from landfill and recycled.
Estimated Annual Reduced Stormwater Runoff: *(% total permeable surface area of total site area)*	The stormwater runoff rate and volume were reduced by 36% and 31% respectively compared to pre-development conditions. 21.3% of the site area is vegetated and permeable.
Enhanced Habitat: *(% area of restored or new habitat of total site area)*	Prior to development, there were no vegetated areas. Post-development there are 2,564 sq. ft. of vegetated site area and 3,810 sq. ft. of vegetated roof area. All plantings are native or adaptive species.
Other:	

Community Benefits

Can any specific community benefits be identified? Examples include educational opportunities, public access or community benefit programs.	Mercy Corps hosted a tour as part of an Energy Trust conference that focused on the use of the VRF system.

LESSONS LEARNED

Describe key outcomes from this project. How has the project changed from its original scope and why? Would you recommend the green technology or practice to other projects? Were there any policy, zoning or building code related issues that affected the project?	Describe key outcomes from this project. -The project has been certified as LEED Platinum. It is an efficient building that is projected to save approximately 35.7% on energy costs. -Mercy Corps staff have expressed positive feedback on the building. It has been described as an inspiring and productive work environment. -By bringing the energy of 200 Mercy Corps staff to the Old Town area, the project has had a positive impact on the surrounding neighborhood. -The Action Center provides a vibrant, educational experience for visitors. -A significant historic building that was in disrepair has been renovated and seismically upgraded providing a safe working environment. How has the project changed from its original scope and why? The project kept to its original scope and budget. Would you recommend the green technology or practice to other projects? -Multiple Ecodesign charettes early on in the process with the entire design team helped strategize on effective and appropriate sustainable systems for the project. -The Variable Refrigerant Flow mechanical system is projected to save about 20% of the total building energy use. -The Sage glass used in the sunscreen over the entry is a promising technology that could be used in various applications to save energy. Were there any policy, zoning or building code related issues that affected the project? Modifications were made to the original design in response to the historic design review that the city requires for projects in this area. The overhang at the top of the East Facade was added, the joint between the old and new buildings was expanded and the original brick on interior at the connection between buildings was expressed.

IMAGES AND GRAPHICS

Please attach drawings and photos that describe the project and the green technology or practice.

Questions? Please contact Kyle Diesner, 503-823-4166 at OSD. Thank you for taking the time to share what you've learned!

Ecoroof Technical Detail Sheet

Project: Mercy Corps
Address: 45 SW Ankeny
Contact: Graham Craft Phone: 503.896.5839
Date: 3/25/10
Date Completed: 9/15/09
Ecoroof square footage: 4,000
Roof square footage: 20,000

Submittals: Final planting drawing; irrigation drawing if irrigation system is used; cross section of assembly through each soil depth; maintenance plan, copy of building permit:

Fill out separate form for each ecoroof or portion of ecoroof that has different structural capabilities, soil depths, or materials.

Ecoroof components	Supplier	Quantity	Unit type	Weight per s.f.	Unit cost	Labor cost	Total cost
Membrane	Siplast Teranap	95	Rolls	1.89 lbs.	$115.56	$11,000	$21,978
Root barrier if needed	N/A						
Drain mat if needed	Tremco TremDrain GR	25	Rolls	.48 lbs.	$0.95	N/A	$3,800
Drainage Channel if needed	N/A						

Ecoroof Technical Detail Sheet

Ecoroof components	Supplier	Quantity	Unit type	Weight per s.f.	Unit cost	Labor cost	Total cost
Protection board if needed	N/A						
Growing media	Pro-Grow Extensive Roof-Top Media	40	CY	N/A	$116.03	$1,120	$5,761
Tray/mat if needed	N/A						
Gravel or paver paths if needed	River Rock	15	CY	N/A	$173.27	$1,050	$3,649
Edging	Aluminum Angle	200	LF	N/A	$20	$480	$4,480
Mulch	3/8 River Rock	10	CY	N/A	$347.80	$1,807	$5,285
Irrigation system if needed	Temporary						
Total							**$44,953**

Ecoroof Technical Detail Sheet

Ecoroof Plants List all species by latin name	*Spacing or Square Footage*	*Quantity*	*Unit type, i.e. seeds, plugs, mats, pots*	*Unit Cost*	*Labor cost*	*Total cost*
Sedum Divergens	10” O.C	480	4” Pot	**$3.62**	**$335.40**	**$2,073**
Sedum Album	10” O.C	480	4” Pot	**$3.62**	**$335.40**	**$2,073**
Sedum Acre	10” O.C	480	4” Pot	**$3.69**	**$335.40**	**$2,106**
Delosperma Nubigenum	10” O.C	480	4” Pot	**$3.99**	**$335.40**	**$2,250**
TOTAL						**$8,502**

LEED-NC

How to Interpret this Report

Purpose

The Leadership in Energy and Environmental Design (LEED) Rating System was designed by the US Green Building Council to encourage and facilitate the development of more sustainable buildings.

Environmental Categories

The report is organized into five environmental categories as defined by LEED including:

LEED Prerequisites

Prerequisites must be achieved. Non-compliant prerequisites must be resolved before a certification can be awarded.

LEED Credits

The environmental categories are subdivided into the established LEED credits, which are based on desired performance goals within each category. An assessment of whether the credit is earned or denied is made and a narrative describes the basis for the assessment.

Achieved

☐

The applicant has provided the mandatory documentation which supports the achievements of the credit requirements, achieving the associated points. Currently the project has scored the adjacent points in this category.

Denied

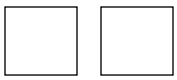
☐

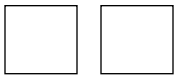
The applicant has applied for a point in a particular credit, but has misinterpreted the credit intent or cannot substantiate meeting the requirements. Currently the project has the adjacent points in this category.

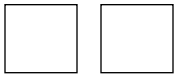
Rating

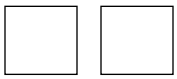
Official Scores

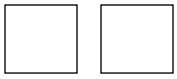
Earned	Denied	Possible Points

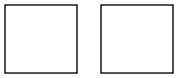


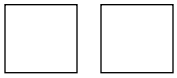


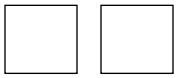


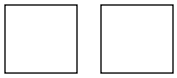


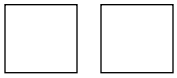


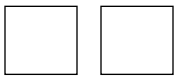


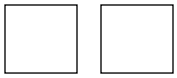


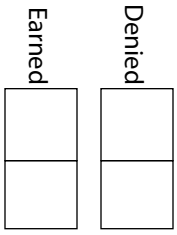








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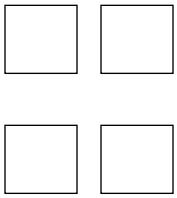
Denied
Possible Points



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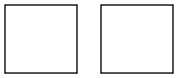

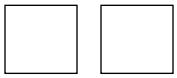

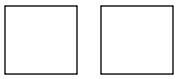

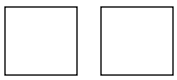

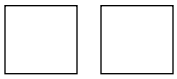

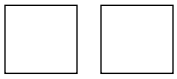

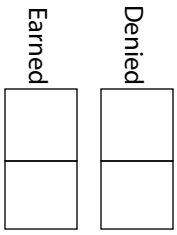

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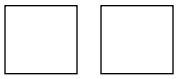

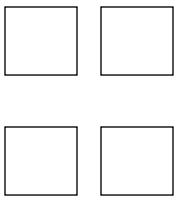


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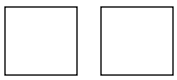
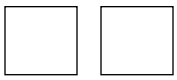
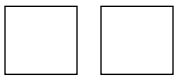
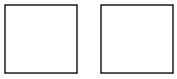
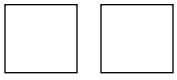
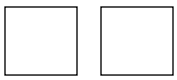


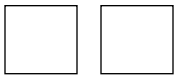


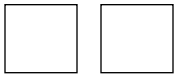


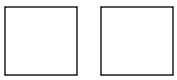


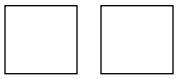


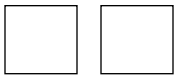


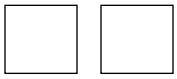


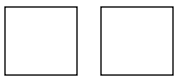


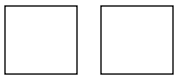


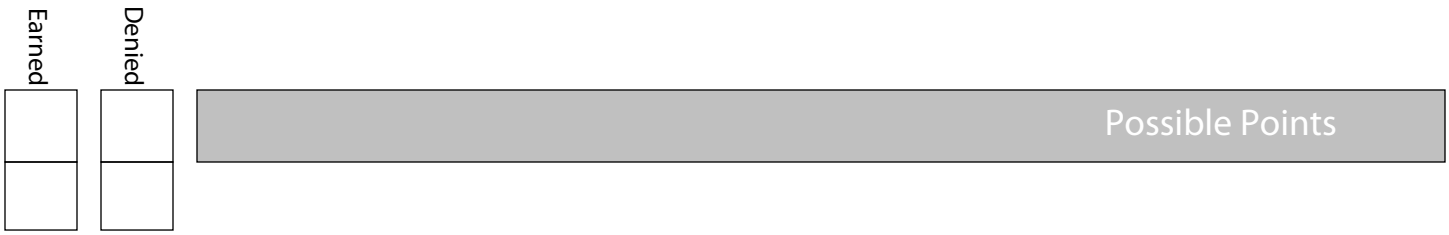


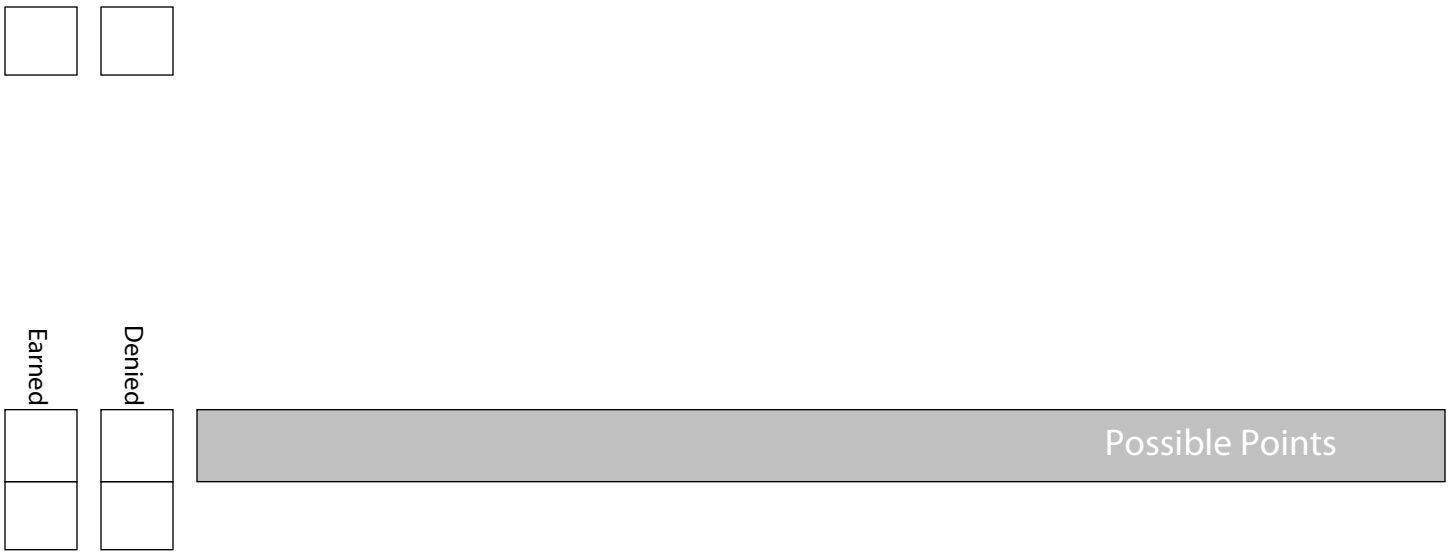









Earned
Denied
Possible Points


Earned
Denied
Possible Points

FINAL REPORT

Mercy Corps Headquarters
Revision 1
LEED® NC 2.2 Energy Analysis

prepared for

Thomas Hacker Architects
733 SW Oak St.
Portland, OR 97205

January 16, 2009

prepared by

GLUMAC
320 SW Washington St., Suite 200
Portland, OR 97204-2640
p. 503-227-5280
f. 503-274-7674

Job No. 208G3901A

Disclaimer

The results of the energy analysis presented in this report cannot be construed to have absolute, predictive accuracy, representing the actual energy use of the building or its individual systems. All reasonable efforts have been taken to ensure the accuracy of the energy model inputs, including verifying that actual details correspond to the building as it is currently designed. The primary benefit of energy modeling is for comparison of alternative design options to determine their relative energy savings potential.

There a number of factors that will cause the actual energy use of the building to diverge from the projected energy use of the model. Among these are: differences in building design relative to the building modeled; abnormal weather conditions; variations in schedules for equipment, systems, and occupancy; inconsistencies in the application of controls and operations strategies compared to those used in the model; the level of direct loads; and changes in connected loads and electricity and gas rates. In addition, the model results do not necessarily take into account all the energy uses of a facility or building site that would show up as loads on the utility meters.

Nevertheless, refinements of the energy model to reconcile all these differences, when these adjustments are made by a capable energy engineer, can yield model results that are more consistent with actual energy use.

Glumac contributors

Dana Troy, Energy Analyst

Seattle • Portland • Sacramento • San Francisco • Los Angeles • Irvine
320 SW Washington St., Suite 200
Portland, OR 97204-2640
T. 503.227.5280 F. 503.274.7674

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Executive Summary

The new Mercy Corps Headquarters is a renovation/addition to the historic Packer Scott Building located in Downtown Portland, Oregon. The building is a half existing renovation and half new construction addition, totaling approximately 80,000 square-feet, consisting primarily of office space. The DOE2 based software eQUEST was used to simulate the energy performance of the building. A 3-D model representation can be seen in Figure 1 below.

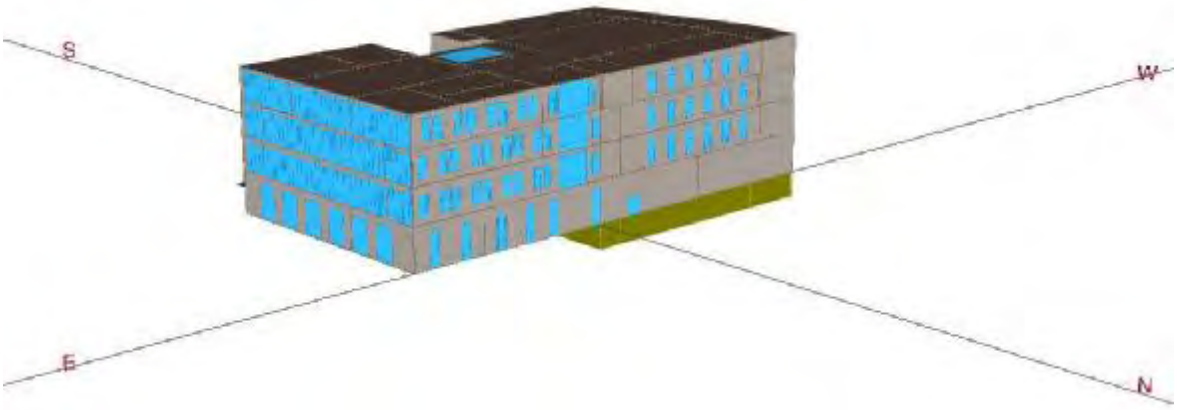

Figure 1 – 3-D computer model of the new Mercy Corps headquarters

The project team is striving for a LEED® Platinum rating, so energy performance is a high priority since there are 10 available points under Energy & Atmosphere, Credit 1 – Optimize Energy Performance. The standard used for energy performance analysis is the Performance Rating Method (PRM) as defined in Appendix G of ASHRAE 90.1-2004.

The design incorporated many energy efficiency measures (EEMs) that were analyzed throughout the design process. These EEMs include, but are not limited to:

- Variable Refrigerant Flow HVAC system
- 100% OSA make up air system
- Daylighting
- Improved envelope insulation
- Improved windows
- 79 kW photovoltaic array

Since the Mercy Corps Headquarters is a partial existing building renovation and partial new construction, the New Construction and Existing Building point thresholds for EAc1 are averaged to give the new point thresholds for this specific project. Each point threshold is adjusted to 3.6 percentage points less than the New Construction thresholds (e.g. the first point starts at 6.9% instead of 10.5%).

The Energy Use Intensity (EUI) for the baseline and design building is 82.2 and 43.2, respectively. Figure 2 illustrates the annual energy use, in MBtus per year, of the different end uses, such as interior lighting, space heating and cooling, and miscellaneous equipment, for the baseline and design buildings.

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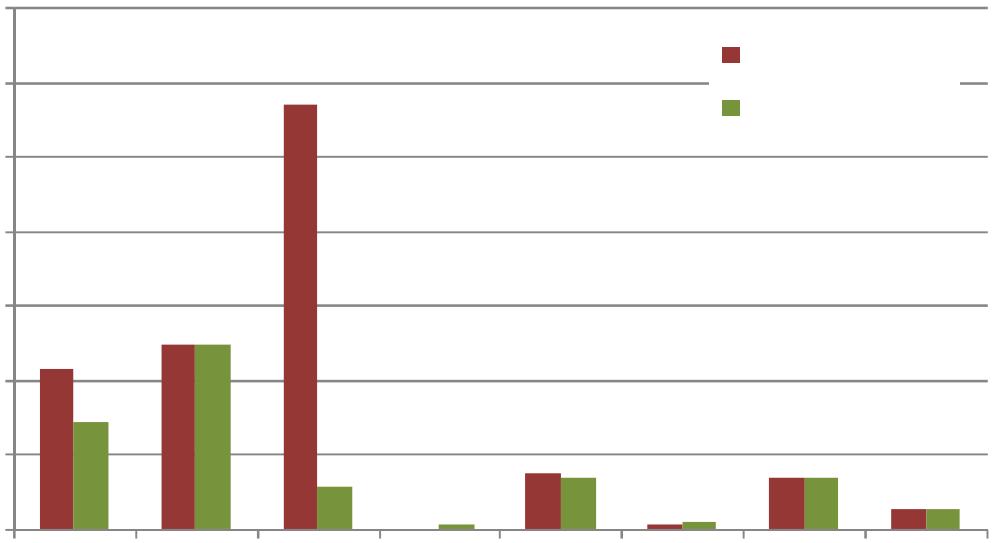

Figure 2 – Baseline vs. design energy end uses

The annual energy costs for the baseline and design buildings are $1.29 and $0.83 per square-foot per year, respectively. Figure 3 below illustrates the differences in utility costs of gas and electricity for the baseline and design buildings.

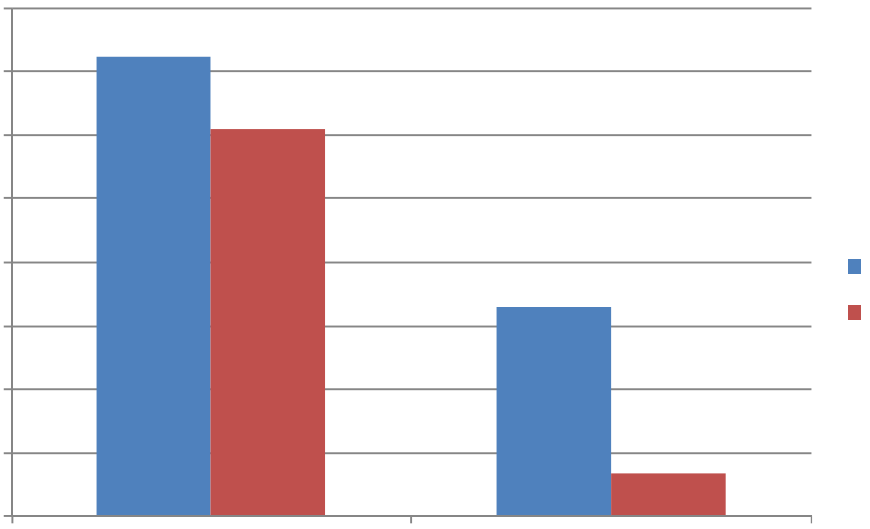

Figure 3 – Annual gas and electricity costs

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Using LEED and ASHRAE 90.1 rules, the energy cost savings relative to the budget baseline, without renewables, is calculated to be $37,624 per year or 35.56%. With the addition of a 68.6 kW PV array, the building saves an additional $5,044, increasing the total energy cost savings to $42,160 or 39.85%. Table 1, below, shows how the savings are calculated, separating the Energy Cost Budget (ECB) and Design Energy Cost (DEC) results according to their gas and electricity use.

Table 1 – Energy optimization by fuel type

Energy and Cost Summary by Fuel Type

Type	Proposed Energy Use (kBtu)	Design Cost ($/yr)	Baseline Energy Use (kBtu)	Baseline Cost ($/yr)	Design / Baseline Energy %	Design / Baseline Cost %
Electricity	2,846,946	$ 61,848	3,191,150	$ 72,548	89%	85%
Natural Gas	284,500	$ 6,844	2,859,025	$ 33,260	10%	21%
Total Nonrenewable	3,131,446	$ 68,692	6,050,175	$ 105,808	52%	65%
Renewable	235,225	$ 5,044	-	$ -	-	-
Total Including Renewables	**2,896,221**	**$ 63,648**	**6,050,175**	**$ 105,808**	**48%**	**60%**
				Percent savings without renewable energy =		**35.08%**
				Percent savings with renewable energy =		**39.85%**

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Summary and Results

The new Mercy Corps Headquarters is a renovation/addition to the historic Packer Scott Building located in Downtown Portland, Oregon. The existing portion, approximately 42,000 square-feet, makes up the western half of the building, with four above grade floors and one below grade floor. The addition, approximately 40,000 square-feet, makes up the eastern portion of the building, with only four above grade floors and no below grade. The 3-D eQUEST model graphics show four different views of the complex in Figures 4A, 4B, 4C, and 4D.

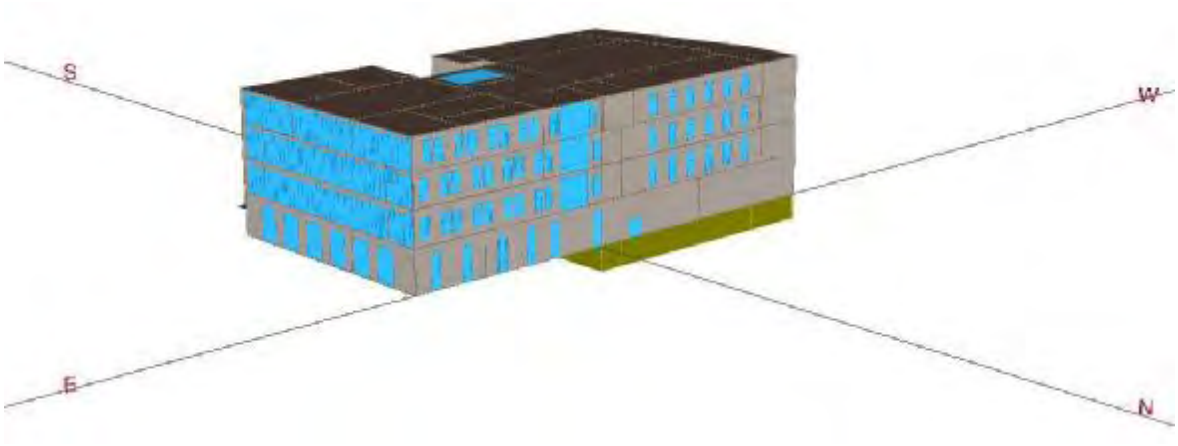

Figure 4A - View from the NE

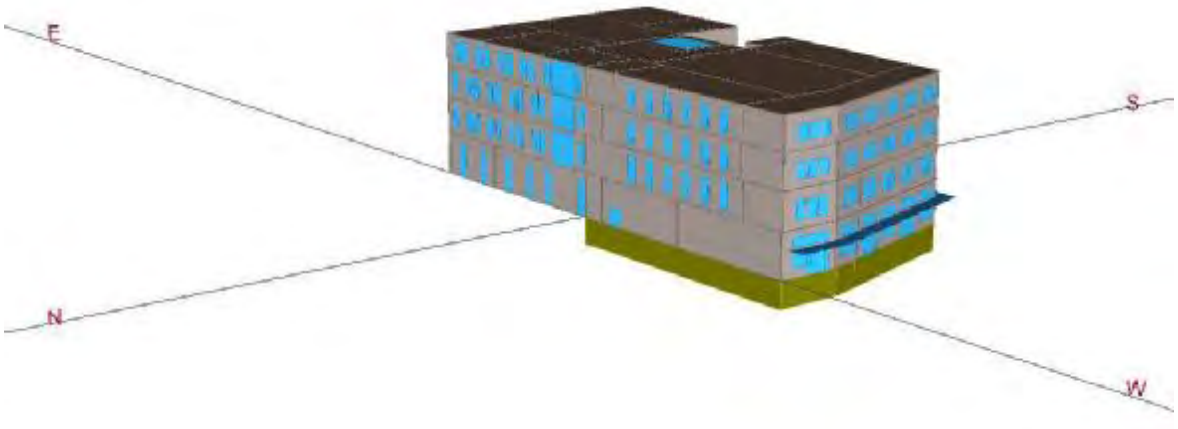

Figure 4B - View from the NW

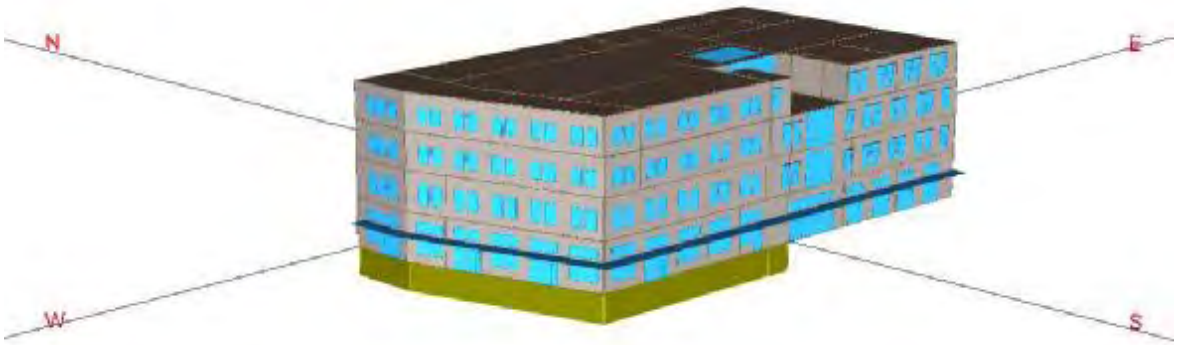

Figure 4C - View from the SW

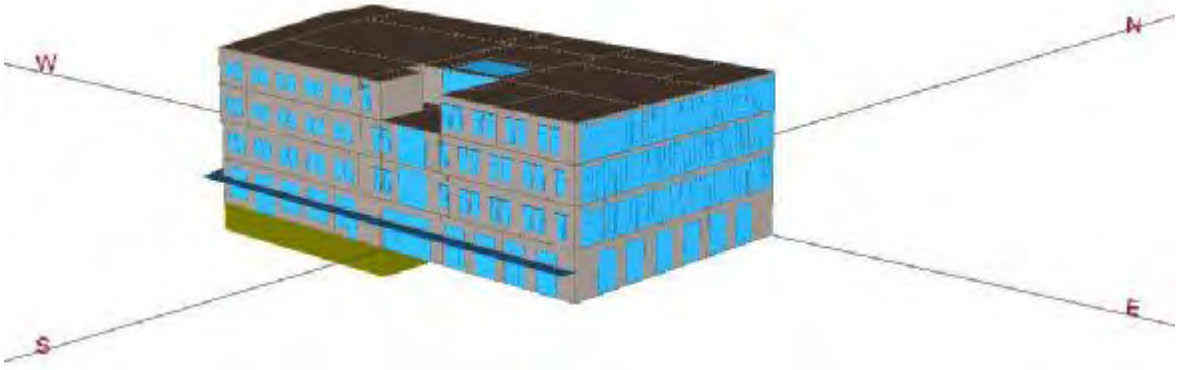

Figure 4D - View from the SE

Results

This report presents the energy savings resulting from an analysis of the differences between the proposed design and the budget baseline developed using ASHRAE 90.1-2004 following the Performance Rating Method (PRM) as defined in Appendix G.

Since the Mercy Corps Headquarters is a partial existing building renovation and partial new construction, the New Construction and Existing Building point thresholds for EAc1 are averaged to give the new point thresholds for this specific project. The new point thresholds can be seen in Table 2 below.

Table 2 – Adjusted EAc1 Point Thresholds

New Construction	Points	Existing Buildings	Points	Mercy Corps	Points
10.5%	1	3.5%	1	6.9%	1
14.0%	2	7.0%	2	10.4%	2
17.5%	3	10.5%	3	13.9%	3
21.0%	4	14.0%	4	17.4%	4
24.5%	5	17.5%	5	20.9%	5
28.0%	6	21.0%	6	24.4%	6
31.5%	7	24.5%	7	27.9%	7
35.0%	8	28.0%	8	31.4%	8
38.5%	9	31.5%	9	34.9%	9
42.0%	10	35.0%	10	38.4%	10

Existing Area:	**42,493**
Addition Area:	**39,981**
Total Area:	**82,474**

Using LEED and ASHRAE 90.1 rules, the energy cost savings relative to the budget baseline, without renewables, is calculated to be $37,624 per year or 35.56%. With the addition of a 68.6 kW PV array, the building saves an additional $5,044, increasing the total energy cost savings to $42,160 or 39.85%. Table 3, on the following page, shows how the savings are calculated, separating the Energy Cost Budget (ECB) and Design Energy Cost (DEC) results according to their gas and electricity use.

Based on these new point thresholds, the project is eligible for up to ten (10) LEED points for the Optimize Energy Performance Credit under the LEED NC 2.2 table.

Table 3 – Energy Optimization by fuel type

Energy Summary by End Use

End Use	Energy Type	Proposed Building		Budget Building		Optimized Energy Performance
		Energy [10^3 Btu]	Peak [10^3 Btu/h]	Energy [10^3 Btu]	Peak [10^3 Btu/h]	[%]
Lighting - Interior	Electricity	711,200	229	1,077,300	251	66%
Miscellaneous Equipment	Electricity	1,235,400	273	1,235,400	273	100%
Space Heating	Natural Gas	284,500	400	2,859,025	3,300	10%
Space Heating	Electricity	35,400	251	0	0	N/A
Space Cooling	Electricity	368,600	408	375,175	681	98%
Pumps & Auxiliary	Electricity	46	15	28,125	10	0%
Fans - Interior Ventilation	Electricity	360,100	122	339,150	189	106%
Heat Pump Supplemental	Electricity	300	81	0	0	N/A
Service Water Heating	Electricity	135,900	16	136,000	55	100%
Exceptional Calculation	Electricity	0	0	0	0	N/A
TOTAL BUILDING CONSUMPTION		**3,131,446**		**6,050,175**		**52%**

eQUEST runs with DEC and ECB results

Full tabulation of all key modeling results may be found in Appendix A.

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Energy Savings Strategies

The new Mercy Corps Headquarters is located in the mild climate of Portland, Oregon. The majority of the space is used for offices for 150-190 staff member, while a portion of the building on the first floor is dedicated to a learning center providing public education related to the challenges Mercy Corps is addressing throughout the works, a gallery, and a small rentable retail space. The side is bordered to the North by the Burnside Bridge, to the West by First Avenue and the MAX line, to the South by Ankeny Plaza, and to the Easy by Naito Parkway. The overall topography of the site is flat.

Numerous energy savings strategies have been incorporated in the project, including, but not limited to, variable-refrigerant flow fan coil units, increased wall and roof insulation, high efficiency windows, a photovoltaic array, a green roof, a high efficient lighting design. Details on the energy savings strategies can be seen below.

Occupancies

Occupancy is expected to be typical office space hours of operation, with employees arriving around 7:00AM and leaving around 5:00PM, Monday through Friday. The retail portion of the building is open seven days a week.

Other schedules, such as lighting and HVAC, are built around these parameters. Schedules are the same in the proposed design and budget baseline models.

Utilities

Electricity

Portland General Electric – Rate 83. Large nonresidential customers whose demand does not exceed 1,000 kW. Monthly charges include a basic charge, demand charge, energy charge, and system usage charge. Average rate for the proposed design is $0.070 per kWh.

Natural Gas

NW Natural Gas – Schedule 31. Nonresidential service. Monthly charges include a basic charge and energy charge. Average rate for the proposed design is $2.10 per therm.

NOTE

The average utility rates may appear high compared to the incremental costs per kWh for electricity or per therm for gas. However, the *average rate* is the equivalent of the total energy cost divided by the total energy used, in kWh or in therms.

For example, the average gas rate of $2.10 cents per therm takes into account much more than incremental cost of a therm. There may be time-of-use, peak, seasonal, and demand charges, as well as tiered rates and account base charges.

Building envelope

Table 4 summarizes all the key inputs for the baseline and as-designed models. Details are described in the sections that follow.

Table 4 – Summary of model inputs

Model Input Parameter	Proposed Design Input	Baseline Design Input 0o
Exterior Wall Construction	R-10 rigid polystyrene. Average U = 0.080	Addition: R-13 batt insulation within frame. Average U = 0.124 Existing: Uninsulated brick wall. Average U = 0.99
Roof Construction	Average 6-inches of rigid polystyrene. Average U = 0.031	Continuous rigid insulation above deck. Average U = 0.063
Below-Grade Wall Construction	Uninsulated concrete. Overall capacitance of 1.140	Same as proposed design
Floor/Slab Construction	Uninsulated concrete	Same as proposed design.
Window-to-wall ratio	35.4% overall	Same as proposed design.
Fenestration Type	Double pane, low-e glass. Cardinal, Solarban 60, Solarban 70, Fritted.	Double pane, low-e glass.
Fenestration U-factor (overall)	Fixed glazing: Assembly U-0.41 Operable glazing: Assembly U-0.47 (ASHARE 31.8 of 2005 Fundamentals)	Assembly U-0.57
Fenestration SHGC (SC)	Cardinal: 0.41 (0.47) Solarban 70 Starphire: 0.27 (0.31) Solarban 60 Clear: 0.38 (0.44) Translucent: 0.23 (0.26)	0.25 (Appendix G specifies non-north values for ALL glazings)
Fenestration Visual Light Transmittance	Cardinal: 0.80 Solarban 70 Starphire: 0.63 Solarban 60 Clear: 0.70 Translucent: 0.42	Same as proposed design. There is no daylighting in the baseline, so VLT is irrelevant.
Shading Devices	Large shades on first floor, south and east facades. Small shades on addition south façade.	No shades.
Interior Lighting Power Density	0.91 W/sf	1.0 W/sf (Office Building Area Method)
Daylighting Controls and other lighting control credits	Interior office daylighting dimming sensors.	Same as proposed design.
Exterior Lighting Power (kW)	4,884 Watts	1,580 Watts
Receptacle Equipment Power Density	1.25 W/sf in conditioned spaces.	1.25 W/sf (to meet minimum 25% of total energy costs).
Primary HVAC System Type	City Multi Variable Refrigerant Flow with 100% OSA make up air units providing ventilation air.	System 4 – Packaged VAV with DX cooling and hydronic reheat. One system per floor.
Fan Supply Volume	Make up air unit: ~26,500 cfm Fan coils: ~56,500 cfm	81,839 total cfm (20°F ΔT heating and cooling based on space temperature and supply air temperature)
Fan Power	MAU: 0.0006284 kW/cfm Fan coils: 0.0004532 kW/cfm	Supply: 0.0008734 kW/cfm Return: 0.0002620 kW/cfm
Economizer Control	100% make up air unit bypasses VRF fan coils when building load can be met with only ventilation air. There is no full economizer.	Fully modulating for all units up to 75°F OAT.

Model Input Parameter	Proposed Design Input	Baseline Design Input 0o
Domestic Hot Water	39,814 kWh per year for general office usage. ~3% of total building energy costs.	Same as proposed design.
Boiler efficiencies	Not modeled.	80% efficient cast iron boiler.
Condenser unit efficiencies	VRF heating mode: 0.296 EIR VRF cooling mode: 0.315 EIR	Heating: N/A Cooling: 9.3 EER
Pumps	0 kW	19 kW/gpm
Heat recovery	Plate heat exchanger on the make-up air unit. 60% effective	N/A

Above-Grade Walls

Design. All above grade walls are constructed with two-inches of exterior rigid polystyrene insulation with an R-value of R-5 per inch. Exterior finishes vary from existing sandstone and brick with a majority of the addition being terracotta tile with small areas of spandrel panel. General layer sandwich is as follows, exterior to interior: <Exterior Finish>, Polystyrene 2in (IN35), Air Lay <3/4in Vert (AL11), GypBd 1/2in (GP01), 4in Metal Stud No Insulation, GypBd 1/2in (GP01). Calculated assembly U-factor of U-0.080.

Budget*:* The addtion exterior wall type is metal frame with R-13 between-stud insulation. The construction results in a code equivalent overall U-factor equal to 0.123.

The existing portion of the building is modeled as it was before the construction, as per Table G3.1 of Appendix G. Construction is face brick with assembly U-factor of U-0.99.

Below-Grade Walls

Design. The underground wall is uninsulated concrete, modeled with a capacitance of C-1.140.

Budget*:* Same as design.

Roof

Design. The design roof has an average of 6-inches of rigid polystyrene (R-5 per inch) entirely above deck. Roof layer sandwich is as follow, exterior to interior: Blt-Up Roof 3/8in (BR01), Polystyrene 6in R-5/in, Poured Concrete Slab, Interior Finish. Calculated assembly U-factor of U-0.031.

Budget. The addition roof is defined as R-15 continuous insulation entirely above deck to achieve a code equivalent overall U-factor of 0.063.

Slab on grade floor

Design. Modeled as a slab-on-grade floor, 6-in.thick, uninsulated concrete.

Budget. Same as design.

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Windows

Design. The window-wall ratios for the north, east, south, and west façades were calculated to be 21.2%, 66.7%, 35.5%, and 29.1%, respectively. The total window-wall ratio for the building is 35.4%. With the percent glazing being lower than the 40% ratio allowed by ASHRAE 90.1-2004 Appendix G, the wall insulation has more of an impact on reducing the loads on the building, further increasing the value of the EEMs.

A wide variety of windows are to be installed throughout the building. All windows to be installed in the building are to have double-pane, ½" air space, ¼" glass, low-e, thermally broken glazing, with center-of-glass U-factors of 0.29. Assembly glazing U-factors are calculated using Table 4 on page 31.8 of the ASHRAE Fundamentals Handbook.

Window dimensions included the frames, but the frame width was left out of the model and instead the glass was modeled as the entire opening so the conductance would represent the overall assembly U-factor.

All existing windows consist of Cardinal glass with Wood frames, resulting in an assembly U-factor of 0.39 and 0.35 for the operable and fixed windows, respectively. To account for the film coefficient, the eQUEST Glass Conductance is 0.438 and 0.39 for the operable and fixed windows, respectively. The solar heat gain coefficient for all existing glazing is 0.41, or a 0.47 shading coefficient.

All clear glazing on the South and East facades of the addition is PPG Solarban 70 Starphire with aluminum thermally broken frames, resulting in an assembly U-factor of 0.47 and 0.41 for the operable and fixed windows, respectively. To account for the film coefficient, the eQUEST Glass Conductance is 0.548 and 0.464 for the operable and fixed windows, respectively. The solar heat gain coefficient for the Solarban 70 Starphire glazing is 0.27, or a 0.31 shading coefficient.

All clear glazing on the North facade of the addition is PPG Solarban 60 Clear with aluminum thermally broken frames, resulting in the same assembly U-factors and Glass Conductance as the PPG Solarban 70 Starphire. The solar heat gain coefficient for the Solarban 60 Clear glazing is 0.38, or a 0.44 shading coefficient.

All fritted, or frosted glazing on the addition has PPG Solarban 70 Starphire for the outer window pane, a ½" air space, an then two ¼" panes of glass sandwiched together with a frosted material in between. All have aluminum thermally broken frames, resulting in the same assembly U-factors and Glass Conductance as the PPG Solarban 70 Starphire. The translucent layer reduces the solar heat gain coefficient to 0.23, or a 0.264 shading coefficient.

Budget. The window-to-wall ratio for the conditioned office space falls between 30.1% and 40% range, requiring an overall assembly U-factor of 0.67 and 0.57 for operable and fixed windows, respectively, and solar heat gain coefficients of 0.39, or a 0.45 shading coefficient. Appendix G requires all baseline glazing solar heat gain coefficients to be "$SHGC_{all}$". The eQUEST Glass Conductance for the baseline windows is 0.842 and 0.688 for operable and fixed windows, respectively.

Infiltration

Design. Infiltration is modeled to allow for between 0.2 and 0.4 air changes per hour (ACH) and fluctuates based on outdoor wind speeds.

Budget. Same as design.

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Lighting - Interior

Design. Total connected lighting wattage of the building was calculated to be 75,000 Watts. At 82,474 square-feet, the overall lighting power density (LPD) is 0.91 W/sf. The LPD calculation was performed by the electrical engineers for the Oregon Energy Code compliance forms.

Daylighting sensors connected to automatic dimming ballasts are included in the perimeter office spaces.

Budget. The baseline building is modeled using the Building Area Method on Table 9.5.1 of ASHRAE 90.1-2004. The specified LPD for an office is 1.0 W/sf, or 82,474 Watts, resulting in a 9% reduction in lighting power over code.

Lighting—exterior

Design. There are a total of 1,100 connected watts for canopy lighting, as calculated by the electrical engineer for Oregon Energy Code compliance.

The parking lot has an area of approximately 5,120 square feet with four 120 Watt lamps illuminating the area, totaling 480 Watts for the entire parking lot.

There are 17 doors on the main level at an average width of three feet, totaling 51 feet of total linear door width. All doors are either illuminated by the canopy lighting or not illuminated.

Budget. According to the CIR dated April 25th, 2007, baseline exterior lighting power density is calculated according to Section 9.4.5 of ASHRAE 90.1-2004 and that credit can only be claimed for the "Tradable Surfaces" on Table 9.4.5. Canopy, parking lot, and exterior door lighting all fall under the tradable surfaces category.

Maximum canopy and parking lot lighting power is 1.25 and 0.15 W/sf, respectively. Main entries are allowed 30 W/linear foot of door width. See Table 5 below for baseline and design lighting power densities.

Table 5 – Summary of model inputs

		Budget	Design
Canopy Lighting	2,069 sf	2,586	1,100
Parking Lot	5,120 sf	768	480
Doors	51 ft	1,530	0
Totals		**4,884**	**1,580**

There is no façade illumination.

Plug loads

Design. Same as the budget.

Budget. Plug loads were assumed to be an average of 1.25 W/ft^2 throughout the conditioned spaces of the building. This input was necessary to meet the requirement of 25% process energy costs of the baseline.

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Elevators

Design. An elevator load is approximated at 3% of the total proposed kWh, based on ACEEE studies, totaling approximately 29,000 kWh per year, or about $2,000. The elevator energy use was included into the plug loads.

Budget. Same as design.

Mechanical and plumbing systems

Forced AC systems

Design. Primary building heating and cooling are provided by the Mitsubishi City Multi variable refrigerant flow (VRF) fan coil system. The system consists of an outdoor variable speed compressor heat pump condensing units mounted on the building roof. Two insulated refrigerant pipes connect this outdoor unit to a control terminal called a BC Controller. Refrigerant pipe and control wiring then connect multiple fan coil units to the BC Controller. The system is capable of providing heating or cooling to the space through the fan coils.

Each City Multi condensing unit can handle a maximum of approximately 20 tons, and cannot transfer heat between one another. Because of the size of the building, there are ten condensing units, two per floor, one for the basement, and an additional one for the retail portion of the first floor. Most of the condensing units serve both interior, exterior, north and south facing zones, providing the maximum heat transfer.

Horizontal fan coils are located over core area ceiling, within soffited areas, or in utility spaces. Unducted return air will mix with ventilation air ducted to each fan coil location. Ventilation for perimeter offices is provided through the mechanical system. Operable openings offer supplemental ventilation that also interlock with the space conditioning fan coils.

A central fresh air ventilation shaft and an exhaust shaft will be provided in the building core. The exhaust shaft will provide building exhaust for pressure relief, toilet exhaust, and other miscellaneous general exhaust. The fresh air ventilation air provided to each major space will be provided from a terminal VAV box controlled by CO_2 sensors in the space. The ventilation system will operate in parallel to the space conditioning system.

Both outside air and exhaust are provided by a factory built dedicated variable volume 100% outside ventilation air handler equipped with, air-to-air heat recovery, direct expansion cooling with condenser cooled by exhaust airstream and hot water heating coil.

Energy savings from this system comes from three major areas:

1. **No pumping energy**. Very little energy is required to move the refrigerant through the piping. When a group of zones being served by a condensing unit are close to achieving a heating and cooling balance, the only energy required is a small compressor load to circulate the refrigerant through the pipes.
2. **Variable speed compressor**. At the times between full heating or cooling and perfect heat balance, smaller amounts of heat need to be added or rejected. The variable speed compressor adds to the part load efficiency, adding to the energy performance of the system.
3. **Fan coils and OSA set up in parallel**. By running the VRF fan coils and OSA in parallel, the fan coils can be turned off when the OSA can meet the loads of the building. Since Portland has a very mild climate with an annual average temperature of 55°F, this can be met quite often.

4. **Heat exchange**. Since the main condensing units serve at least one core space and multiple perimeter spaces, as well as north and south facing zones, heat can be transferred from zone to zone through the BC controller before additional heat is needed to be added or extracted by the outside condensing unit.

Fan power was calculated to be 0.0006284 kW/cfm for the make up air units and 0.000144 kW/cfm for the fan coils.

Modeling HVAC assumptions

Since eQUEST cannot explicitly model a variable refrigerant flow HVAC system, a system supported by eQUEST was modified to simulate the performance of the City Multi system. There are various methods in the energy modelling community for simulating a VRF system, and we have modified one of those methods to create a conservative approach of documenting the energy use.

The only other HVAC system that transfers heat from one zone to another in a similar manner is a water loop heat pump; however, there are three components in the water loop heat pump that are not apparent in a VRF system: condenser water loop, boilers, and cooling towers.

We instead chose to model the system as single zone split system heat pumps. A VRF system is essentially a group of air to air heat pumps that are allowed to exchange energy between one another before the condenser is required to extract or add energy back into the system.

Listed below is how each was modified to resemble the VRF:

1. **Single zone heat pumps**. One conditioned zone was assigned per system. The system used was a PVVT (packaged variable air volume) system. Heating DX efficiency was given an EIR to resemble the COP of the condensing unit, approximately 0.296. The cooling DX efficiency was given an EIR of 0.315.
2. **Variable speed compressors**. The PVVT system allows the use of a variable speed compressor as well as the same functionality as a packaged single zone unit.
3. **Energy recovery**. A separate hand calculation was performed using hourly data to determine the amount of heat recovered from the VRF system. See the exceptional calculations section for more detail.

Although the compressors are variable speed, the VRF fan coils are constant volume. The minimum flow and fan ratio were set to 1.0 in eQUEST.

Budget. The building, being five floors, 80,000 square feet of conditioned space, and a mix of gas and electric heating, falls under System 5 as the baseline HVAC system, according to Table G3.1.1A.

According to the CIR dated June 19, 2007, the calculation from ASHARE 90.1-2007 Appendix G can be used to calculate the HVAC system fan power. Using the baseline design supply fan volume and the pressure drop adjustments for the make up air unit, the supply fan power was calculated to be 0.0008733 kW/cfm (75% of total fan power) and the return/exhaust fans were calculated to be 0.0002620 kW/cfm (25% of total fan power multiplied by 0.90 according to G3.1.2.8). See Table 6 for details.

Table 6 – Baseline fan power calculations

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Total supply fan capacity (cfm):		75,674	
PD adjustments (from Table 6.5.3.1.1B to the right)			
#	*Type (if applicable)*	*Adjustment*	*cfm thru device*
1	Particulate Filtration Credit: MERV 13 th	0.90	26,450
2	Heat recovery device	1.11	26,450
3	Sound attenuation section	0.15	26,450
4			
5			
6			
7			
8			
9			
10			
Total PD adjustment (A):		13.83	
		CV: Systems 3-4	*VAV: Systems 5-8*
Baseline fan brake horsepower:		84.9636254	112.2062654
Fan motor efficiency (Table 10.8):		N/A	95.0%
Total system fan power (Watts):		N/A	88,111
Supply fan power		N/A	0.000873267
Exhaust fan power		N/A	0.00026198

Domestic hot water

Design. A domestic hot water heater is modeled with an 80% efficient burner. Using a default schedule developed by eQUEST, the process load was increased until the energy use was equivalent to approximately 3% of the total building's energy costs. This energy use correlates to the ACEEE and CEBECS database for domestic hot water in an office building.

Budget. Same as design.

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Exceptional Calculations

The section describes all necessary descriptions and calculations for energy savings strategies that either required by the LEED rating system or cannot be directly modeled.

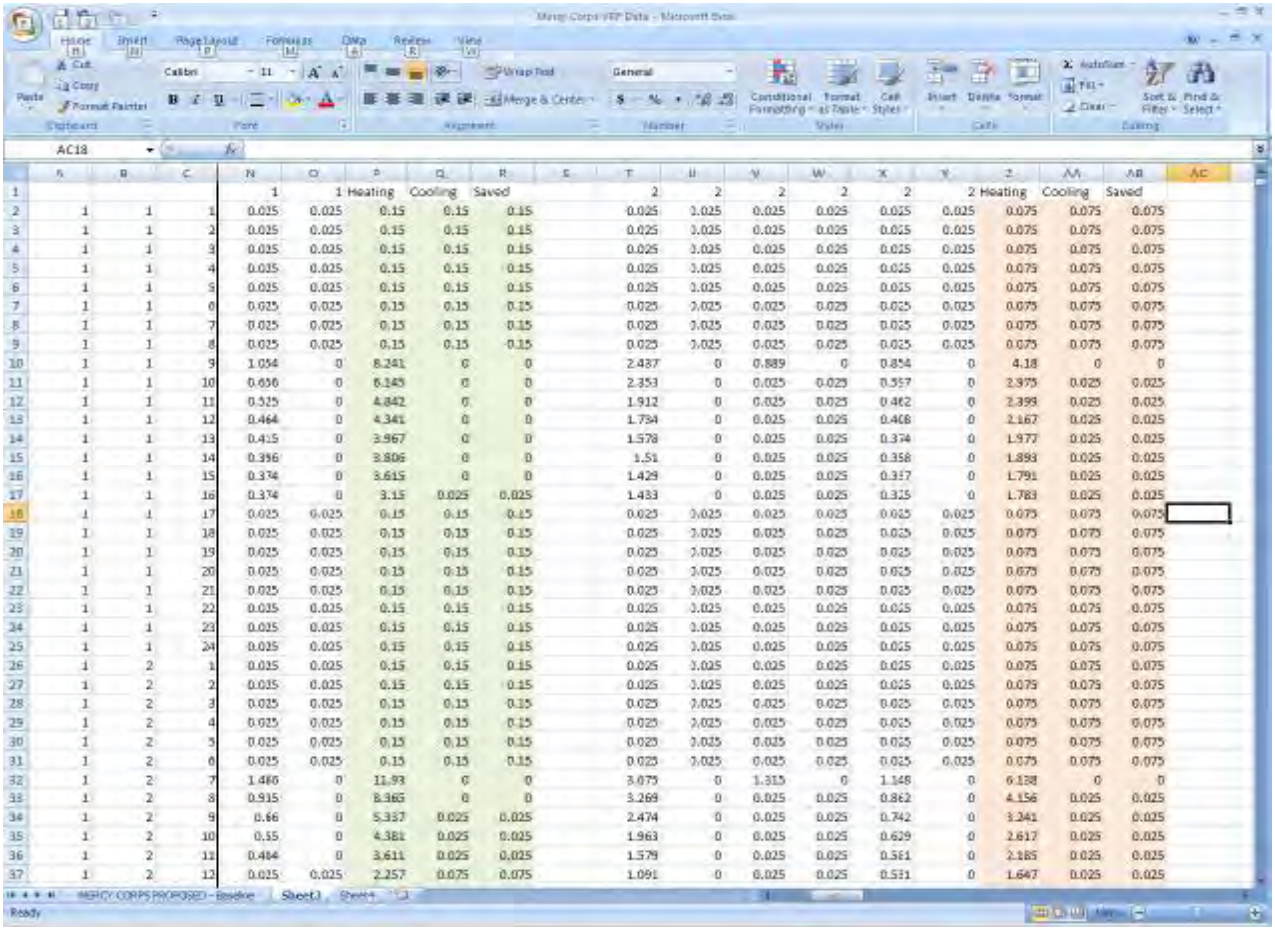
Exceptional calculation 1: Variable refrigerant flow energy recovery

The maximum capacity for a City Multi condensing unit is 20 tons and the Mercy Corps building contains 10 condensing units. For this reason, every space within the building cannot exchange energy with one another.

Hourly reports were created within eQUEST to output each zone's electrical consumption for heating or cooling for a particular hour. In the hourly output Excel file, zones under the same condensing unit were grouped together. The heating energy and the cooling energy required for each hour under one condensing unit were added together. If heating *and* cooling energy were required in different zone, under the same VRF condenser, and in the same hour, the smaller of the two values was added as savings.

The spreadsheet included over one million pieces of data output from the hourly reports of eQUEST. A screenshot of a portion of the spreadsheet can be seen in Figure 5 on the following page.

The total kWh of possible recovered energy totaled 6,964 kWh, or approximately $539 per year.



	N	O	P	Q	R	T	U	V	W	X	Y	Z	AA	AB
1	1	1	Heating	Cooling	Saved	2	2	2	2	2	2	Heating	Cooling	Saved
2	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
3	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
4	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
5	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
6	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
7	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
8	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
9	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
10	1.054	0	8.241	0	0	2.437	0	0.889	0	0.854	0	4.18	0	0
11	0.656	0	6.145	0	0	2.353	0	0.025	0.025	0.557	0	2.975	0.025	0.025
12	0.525	0	4.842	0	0	1.912	0	0.025	0.025	0.462	0	2.399	0.025	0.025
13	0.464	0	4.341	0	0	1.784	0	0.025	0.025	0.408	0	2.167	0.025	0.025
14	0.415	0	3.967	0	0	1.578	0	0.025	0.025	0.374	0	1.977	0.025	0.025
15	0.396	0	3.806	0	0	1.51	0	0.025	0.025	0.358	0	1.893	0.025	0.025
16	0.374	0	3.615	0	0	1.429	0	0.025	0.025	0.337	0	1.791	0.025	0.025
17	0.374	0	3.15	0.025	0.025	1.433	0	0.025	0.025	0.315	0	1.783	0.025	0.025
18	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
19	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
20	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
21	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
22	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
23	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
24	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
25	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
26	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
27	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
28	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
29	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
30	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
31	0.025	0.025	0.15	0.15	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.075	0.075	0.075
32	1.486	0	11.93	0	0	3.075	0	1.315	0	1.148	0	6.138	0	0
33	0.915	0	8.365	0	0	3.269	0	0.025	0.025	0.862	0	4.156	0.025	0.025
34	0.66	0	5.337	0.025	0.025	2.474	0	0.025	0.025	0.742	0	3.341	0.025	0.025
35	0.55	0	4.381	0.025	0.025	1.963	0	0.025	0.025	0.629	0	2.617	0.025	0.025
36	0.484	0	3.611	0.025	0.025	1.579	0	0.025	0.025	0.561	0	2.185	0.025	0.025
37	0.025	0.025	2.257	0.075	0.075	1.091	0	0.025	0.025	0.531	0	1.647	0.025	0.025

Figure 5 – VRF energy recovery spreadsheet screenshot

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Appendix A—Energy Optimization

Table A-1 – Energy use and energy costs with no exceptional calculations

Energy Summary by End Use

End Use	Energy Type	Proposed Building		Budget Building		Optimized Energy Performance
		Energy [10^3 Btu]	Peak [10^3 Btu/h]	Energy [10^3 Btu]	Peak [10^3 Btu/h]	[%]
Lighting - Interior	Electricity	711,200	19,636	1,077,300	21,600	66%
Miscellaneous Equipment	Electricity	1,235,400	23,417	1,235,400	23,417	100%
Space Heating	Natural Gas	89,500	161	2,234,625	2,900	4%
Space Heating	Electricity	203,300	47,214	0	0	N/A
Space Cooling	Electricity	649,500	57,970	393,900	58,520	165%
Heat Rejection	Electricity	17,200	5,041	0	0	N/A
Pumps & Auxiliary	Electricity	33,500	967	37,575	813	89%
Fans - Interior Ventilation	Electricity	299,100	6,506	277,625	16,427	108%
Service Water Heating	Electricity	135,900	16	135,100	4,660	101%
TOTAL BUILDING CONSUMPTION		**3,374,600**		**5,391,525**		**63%**

Energy and Cost Summary by Fuel Type

Type	Proposed Energy Use (kBtu)	Design Cost ($/yr)	Baseline Energy Use (kBtu)	Baseline Cost ($/yr)	Design / Baseline Energy %	Design / Baseline Cost %
Electricity	3,285,100	$ 66,892	3,156,900	$ 71,914	104%	93%
Natural Gas	89,500	$ 1,884	2,234,625	$ 27,142	4%	7%
Total Nonrenewable	3,374,600	$ 68,775	5,391,525	$ 99,056	63%	69%
Renewable	235,225	$ 4,823	-	$ -	-	-
Total Including Renewables	**3,139,375**	**$ 63,952**	**5,391,525**	**$ 99,056**	**58%**	**65%**
				Percent savings without renewable energy =		**30.57%**
				Percent savings with renewable energy =		**35.44%**

Table A-1 – Energy use and energy costs with exceptional calculation 1

Energy Summary by End Use

End Use	Energy Type	Proposed Building		Budget Building		Optimized Energy Performance
		Energy [10^3 Btu]	Peak [10^3 Btu/h]	Energy [10^3 Btu]	Peak [10^3 Btu/h]	[%]
Lighting - Interior	Electricity	711,200	229	1,077,300	251	66%
Miscellaneous Equipment	Electricity	1,235,400	273	1,235,400	273	100%
Space Heating	Natural Gas	284,500	400	2,859,025	3,300	10%
Space Heating	Electricity	35,400	251	0	0	N/A
Space Cooling	Electricity	368,600	408	375,175	681	98%
Pumps & Auxiliary	Electricity	46	15	28,125	10	0%
Fans - Interior Ventilation	Electricity	360,100	122	339,150	189	106%
Heat Pump Supplemental	Electricity	300	81	0	0	N/A
Service Water Heating	Electricity	135,900	16	136,000	55	100%
Exceptional Calculation	Electricity	-23,775	0	0	0	N/A
TOTAL BUILDING CONSUMPTION		**3,131,446**		**6,050,175**		**52%**

Energy and Cost Summary by Fuel Type

Type	Proposed Energy Use (kBtu)	Design Cost ($/yr)	Baseline Energy Use (kBtu)	Baseline Cost ($/yr)	Design / Baseline Energy %	Design / Baseline Cost %
Electricity	2,823,170	$ 61,340	3,191,150	$ 72,548	88%	85%
Natural Gas	284,500	$ 6,844	2,859,025	$ 33,260	10%	21%
Total Nonrenewable	3,107,670	$ 68,184	6,050,175	$ 105,808	51%	64%
Renewable	235,225	$ 5,044	-	$ -	-	-
Total Including Renewables	**2,872,446**	**$ 63,140**	**6,050,175**	**$ 105,808**	**47%**	**60%**
				Percent savings without renewable energy =		**35.56%**
				Percent savings with renewable energy =		**40.33%**

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Table A-2 – Summary of baseline end uses and peak loads, in utility units, by orientation

End Use	0°	90°	180°	270°	Average	No EC	EC 1
Lighting - Interior, kWh	315,652	315,652	315,652	315,652	315,652	208,374	208,374
Peak, kW	73.7	73.7	73.7	73.7	73.7	67.0	67.0
Misc Equipment, kWh	361,964	361,964	361,964	361,964	361,964	361,964	361,964
Peak, kW	79.9	79.9	79.9	79.9	79.9	79.9	79.9
Space Heating, therms	28,462	29,348	28,906	27,645	28,590	2,845	2,845
Peak, MBH	3,300.0	3,300.0	3,300.0	3,300.0	3,300.0	400.0	400.0
Space Heating, kWh	0	0	0	0	0	10,363	10,363
Peak, kW	0.0	0.0	0.0	0.0	0.0	73.7	73.7
Space Cooling, kWh	110,967	111,314	108,175	109,268	109,931	107,991	107,991
Peak, kW	201.0	200.5	201.8	194.5	199.5	119.5	119.5
Pumps & Aux, kWh	10,953	11,159	10,541	9,776	10,607	13,323	13,323
Peak, kW	2.8	2.9	2.8	2.7	2.8	4.5	4.5
Fans, kWh	99,468	99,617	99,420	98,990	99,374	105,523	105,523
Peak, kW	56.0	54.0	54.7	56.4	55.3	35.8	35.8
Ht Pump Supplem, kWh	0	0	0	0	0	74	74
Peak, kW	0.0	0.0	0.0	0.0	0.0	23.6	23.6
DHW, kWh	39,854	39,854	39,854	39,854	39,854	39,814	39,814
Peak, kW	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Excep Calculation, kWh	0	0	0	0	0	0	(6,964)
Peak, kW	0.0	0.0	0.0	0.0	0.0	0.0	n/a
kWh	938,859	939,562	935,607	935,505	**937,383**	847,425	840,461
therms	28,462	29,348	28,906	27,645	**28,590**	2,845	2,845
Electrical Energy Cost	$72,710	$72,684	$72,549	$72,247	**$72,548**	$61,848	**$61,340**
Natural Gas Energy Cost	$33,132	$34,034	$33,582	$32,293	**$33,260**	$6,844	**$6,844**
Total Energy Cost	$105,842	$106,718	$106,131	$104,540	**$105,808**	$68,692	**$68,184**

Table A-3 – Summary of baseline end uses and peak loads, in kBtu/yr and MBH, by orientation

End Use	0°	90°	180°	270°	Average	No EC	EC 1
Lighting - Interior, kBtu	1,077,300	1,077,300	1,077,300	1,077,300	1,077,300	711,200	711,200
Peak, MBH	251.5	251.5	251.5	251.5	251.5	228.6	228.6
Misc Equipment, kBtu	1,235,400	1,235,400	1,235,400	1,235,400	1,235,400	1,235,400	1,235,400
Peak, MBH	272.6	272.6	272.6	272.6	272.6	272.6	272.6
Space Heating (gas), kBtu	2,846,200	2,934,800	2,890,600	2,764,500	2,859,025	284,500	284,500
Peak, MBH	3,300.0	3,300.0	3,300.0	3,300.0	3,300.0	400.0	400.0
Space Heating (elec), kBtu	0	0	0	0	0	35,400	35,400
Peak, MBH	0.0	0.0	0.0	0.0	0.0	251.5	251.5
Space Cooling, kBtu	378,700	379,900	369,200	372,900	375,175	368,600	368,600
Peak, MBH	685.8	684.1	688.6	663.7	680.5	407.7	407.7
Pumps & Aux, kBtu	37,400	38,100	3,600	33,400	28,125	46	46
Peak, MBH	9.6	9.9	9.6	9.2	9.6	15.4	15.4
Fans, kBtu	339,500	340,000	339,300	337,800	339,150	360,100	360,100
Peak, MBH	191.1	184.3	186.6	192.4	188.6	122.2	122.2
Ht Pump Supplem, kBtu	0	0	0	0	0	300	300
Peak, MBH	0.0	0.0	0.0	0.0	0.0	80.5	80.5
DHW, kBtu	136,000	136,000	136,000	136,000	136,000	135,900	135,900
Peak, MBH	54.6	54.6	54.6	54.6	54.6	16.0	16.0
Excep Calc, kBtu	0	0	0	0	0	0	(23,775)
Peak, MBH	0.0	0.0	0.0	0.0	0.0	0.0	0.0
kBtu	6,050,500	6,141,500	6,051,400	5,957,300	**6,050,175**	3,131,446	**3,107,670**

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T. 503.227.5280 F. 503.274.7674

Appendix B-1.1—BEPS report, run for the Mercy Corps design model

Mercy Corps Proposed Design DOE-2.2-44e4 1/16/2009 10:34:19 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	711.2	0.0	1235.4	35.4	368.6	0.0	45.5	360.1	0.0	0.3	135.9	0.0	2892.2
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	284.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	284.5
MBTU	711.2	0.0	1235.4	319.9	368.6	0.0	45.5	360.1	0.0	0.3	135.9	0.0	3176.8

TOTAL SITE ENERGY 3176.75 MBTU 43.2 KBTU/SQFT-YR GROSS-AREA 43.2 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 8961.23 MBTU 121.7 KBTU/SQFT-YR GROSS-AREA 121.7 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Appendix B-1.2—BEPU report, run for the Mercy Corps design model

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Mercy Corps Proposed Design                                                    DOE-2.2-44e4   1/16/2009     10:34:19  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                  WEATHER FILE- Portland     OR TMY2
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	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	208374.	0.	361964.	10363.	107991.	0.	13323.	105523.	0.	74.	39814.	0.	847425.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	2845.	0.	0.	0.	0.	0.	0.	0.	0.	2845.

```
          TOTAL ELECTRICITY    847425. KWH        11.511 KWH     /SQFT-YR GROSS-AREA   11.511 KWH     /SQFT-YR NET-AREA
          TOTAL NATURAL-GAS      2845. THERM       0.039 THERM   /SQFT-YR GROSS-AREA    0.039 THERM   /SQFT-YR NET-AREA


          PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.0
          PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0

          NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
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Appendix B-1.3—ES-D report, run for the MERCY CORPS design model

Mercy Corps Proposed Design DOE-2.2-44e4 1/16/2009 10:34:19 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	847425. KWH	61848.	0.0730	YES
NW Natural-OR 31-Comm-Vol	NATURAL-GAS	FM1	2845. THERM	6844.	2.4053	YES
				==========		
				68691.		

ENERGY COST/GROSS BLDG AREA: 0.93
ENERGY COST/NET BLDG AREA: 0.93

Appendix B-2.1—BEPS report, runs for the Mercy Corps baseline model

Mercy Corps Baseline 0-Degree Rotation DOE-2.2-44e4 1/15/2009 15:45:41 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	1077.3	0.0	1235.4	0.0	378.7	0.0	37.4	339.5	0.0	0.0	136.0	0.0	3204.3
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	2846.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2846.2
MBTU	1077.3	0.0	1235.4	2846.2	378.7	0.0	37.4	339.5	0.0	0.0	136.0	0.0	6050.5

TOTAL SITE ENERGY 6050.46 MBTU 82.2 KBTU/SQFT-YR GROSS-AREA 82.2 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 12459.06 MBTU 169.2 KBTU/SQFT-YR GROSS-AREA 169.2 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Mercy Corps Baseline 90-Degree Rotation DOE-2.2-44e4 1/15/2009 16:23:03 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	1077.3	0.0	1235.4	0.0	379.9	0.0	38.1	340.0	0.0	0.0	136.0	0.0	3206.7
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	2934.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2934.8
MBTU	1077.3	0.0	1235.4	2934.8	379.9	0.0	38.1	340.0	0.0	0.0	136.0	0.0	6141.4

TOTAL SITE ENERGY 6141.45 MBTU 83.4 KBTU/SQFT-YR GROSS-AREA 83.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 12554.85 MBTU 170.5 KBTU/SQFT-YR GROSS-AREA 170.5 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Mercy Corps Baseline 180-Degree Rotation DOE-2.2-44e4 51/15/2009 16:24:08 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	1077.3	0.0	1235.4	0.0	369.2	0.0	36.0	339.3	0.0	0.0	136.0	0.0	3193.2
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	2890.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2890.6
MBTU	1077.3	0.0	1235.4	2890.6	369.2	0.0	36.0	339.3	0.0	0.0	136.0	0.0	6083.8

TOTAL SITE ENERGY 6083.81 MBTU 82.6 KBTU/SQFT-YR GROSS-AREA 82.6 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 12470.21 MBTU 169.4 KBTU/SQFT-YR GROSS-AREA 169.4 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Mercy Corps Baseline 270-Degree Rotation DOE-2.2-44e4 1/15/2009 16:25:03 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	1077.3	0.0	1235.4	0.0	372.9	0.0	33.4	337.8	0.0	0.0	136.0	0.0	3192.8
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	2764.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2764.5
MBTU	1077.3	0.0	1235.4	2764.5	372.9	0.0	33.4	337.8	0.0	0.0	136.0	0.0	5957.4

TOTAL SITE ENERGY 5957.39 MBTU 80.9 KBTU/SQFT-YR GROSS-AREA 80.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 12343.10 MBTU 167.7 KBTU/SQFT-YR GROSS-AREA 167.7 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Appendix B-2.2—BEPU reports, runs for the MERCY CORPS baseline model

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Mercy Corps Baseline 0-Degree Rotation                                    DOE-2.2-44e4   1/15/2009    15:45:41  BDL RUN  1

REPORT- BEPU Building Utility Performance                                          WEATHER FILE- Portland     OR TMY2
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	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	315652.	0.	361964.	0.	110967.	0.	10953.	99468.	0.	0.	39854.	0.	938859.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	28462.	0.	0.	0.	0.	0.	0.	0.	0.	28462.

```
          TOTAL ELECTRICITY    938859. KWH        12.753 KWH     /SQFT-YR GROSS-AREA   12.753 KWH     /SQFT-YR NET-AREA
          TOTAL NATURAL-GAS     28462. THERM       0.387 THERM   /SQFT-YR GROSS-AREA    0.387 THERM   /SQFT-YR NET-AREA


          PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.4
          PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0

          NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
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Mercy Corps Baseline 90-Degree Rotation DOE-2.2-44e4 1/15/2009 15:45:41 16:23:03 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	315652.	0.	361964.	0.	111314.	0.	11159.	99617.	0.	0.	39854.	0.	939562.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	29348.	0.	0.	0.	0.	0.	0.	0.	0.	29348.

TOTAL ELECTRICITY	939562. KWH	12.763 KWH	/SQFT-YR GROSS-AREA	12.763 KWH	/SQFT-YR NET-AREA
TOTAL NATURAL-GAS	29348. THERM	0.399 THERM	/SQFT-YR GROSS-AREA	0.399 THERM	/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Mercy Corps Baseline 180-Degree Rotation DOE-2.2-44e4 1/15/2009 16:24:08 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	315652.	0.	361964.	0.	108175.	0.	10541.	99420.	0.	0.	39854.	0.	935607.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	28906.	0.	0.	0.	0.	0.	0.	0.	0.	28906.

TOTAL ELECTRICITY 935607. KWH 12.709 KWH /SQFT-YR GROSS-AREA 12.709 KWH /SQFT-YR NET-AREA
TOTAL NATURAL-GAS 28906. THERM 0.393 THERM /SQFT-YR GROSS-AREA 0.393 THERM /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Mercy Corps Baseline 270-Degree Rotation DOE-2.2-44e4 1/15/2009 16:25:03 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	315652.	0.	361964.	0.	109268.	0.	9776.	98990.	0.	0.	39854.	0.	935505.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	27645.	0.	0.	0.	0.	0.	0.	0.	0.	27645.

TOTAL ELECTRICITY 935505. KWH 12.707 KWH /SQFT-YR GROSS-AREA 12.707 KWH /SQFT-YR NET-AREA
TOTAL NATURAL-GAS 27645. THERM 0.376 THERM /SQFT-YR GROSS-AREA 0.376 THERM /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

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

Appendix B-2.3—ES-D reports, runs for the MERCY CORPS baseline model

Mercy Corps Baseline 0-Degree Rotation DOE-2.2-44e4 1/15/2009 15:45:41 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	938859. KWH	72710.	0.0774	YES
NW Natural-OR 31-Comm-Vol	NATURAL-GAS	FM1	28462. THERM	33132.	1.1641	YES
				==========		
				105842.		

ENERGY COST/GROSS BLDG AREA: 1.44
ENERGY COST/NET BLDG AREA: 1.44

Mercy Corps Baseline 90-Degree Rotation DOE-2.2-44e4 51/15/2009 16:23:03 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	939562. KWH	72684.	0.0774	YES
NW Natural-OR 31-Comm-Vol	NATURAL-GAS	FM1	29348. THERM	34034.	1.1597	YES
				==========		
				106718.		

ENERGY COST/GROSS BLDG AREA: 1.45
ENERGY COST/NET BLDG AREA: 1.45

Mercy Corps Baseline 180-Degree Rotation DOE-2.2-44e4 1/15/2009 16:24:08 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	935607.	KWH	72549.	0.0775	YES
NW Natural-OR 31-Comm-Vol	NATURAL-GAS	FM1	28906.	THERM	33582.	1.1618	YES
					106131.		

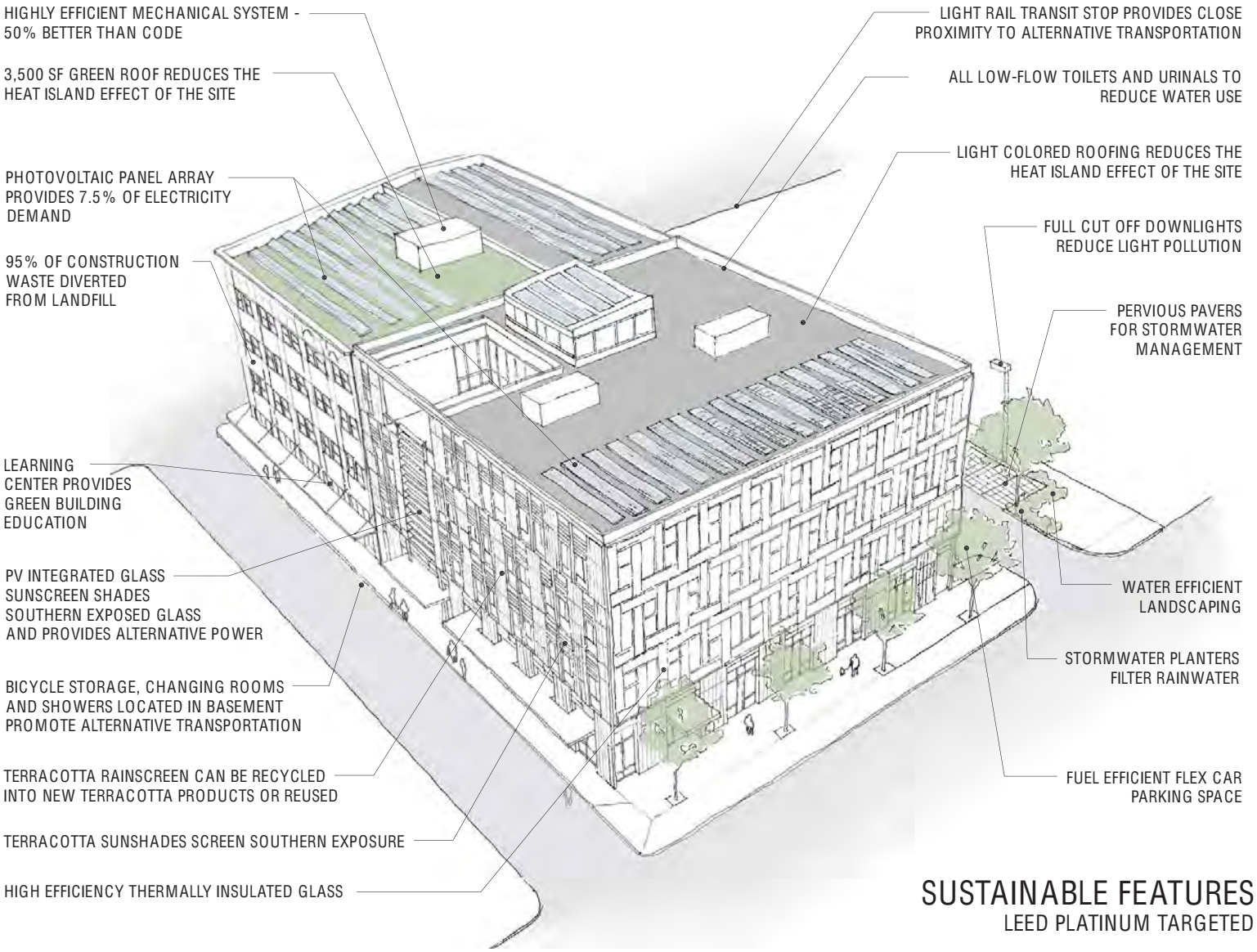
ENERGY COST/GROSS BLDG AREA: 1.44
ENERGY COST/NET BLDG AREA: 1.44

Mercy Corps Baseline 270-Degree Rotation DOE-2.2-44e4 1/15/2009 16:25:03 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	935505.	KWH	72247.	0.0772	YES
NW Natural-OR 31-Comm-Vol	NATURAL-GAS	FM1	27645.	THERM	32293.	1.1681	YES
					104540.		

ENERGY COST/GROSS BLDG AREA: 1.42
ENERGY COST/NET BLDG AREA: 1.42



SUSTAINABLE FEATURES

LEED PLATINUM TARGETED