

Case Study

Deep Energy Savings in Existing Buildings



Overview

Site Details

- Owner: Mercy Corps
- Location: Portland, OR
- Building Type: Office
- Project Description: Major Renovation and New Addition
- Size SF: 83,000
- Stories: 4
- Project Completion: 2009
- Year Built: 1892

Recognition:

- LEED-NC Platinum

MERCY CORPS HEADQUARTERS

Mercy Corps is an international organization providing emergency relief service and sustainable economic development in 36 countries around the world. Its new global headquarters is located in the Packer-Scott building, a Portland landmark originally built in 1892. This building is 50% historic renovation and 50% new construction, with a seismic retrofit acting as the “knuckle” between existing and new. The four-story building (with one floor below grade on the existing portion) includes corporate offices on the upper floors and a global learning center on the ground floor. Mercy Corps describes its new headquarters as “a green building, reflecting our commitment to environmental sustainability. Climate change is one of our planet’s most critical challenges and a consideration in many of our programs around the world. Locally, we are seeking to reduce our organization’s carbon footprint which includes energy consumption, water usage and other environmental impacts.”

The information in this profile addresses both the renovated and the new parts of the building.

Motivations

Project goal: Mercy Corps’ decision to build a new headquarters was based on the following goals:

1. Commitment to cost efficiency
2. Create a smaller environmental footprint
3. Provide additional space and consolidation of employees in a single location
4. Improved public involvement in its work

The building's primary heating and cooling are provided by a multi-variable refrigerant flow (VRF) fan coil system.

Having paid more than \$34,324 in monthly rent at its previous location, Mercy Corps determined that owning a building was more cost-effective than renting. Paying a mortgage resulted in a lower monthly payment going toward an appreciable asset that Mercy Corps now owns.

Rationale and economic criteria: It was important to Mercy Corps that the organization be fiscally responsible with donor contributions throughout the construction process. Pursuing energy efficiency supports its mission of sustainability, and lower operating costs allow it to spend more money on projects throughout the world. Mercy Corps was particularly interested in natural ventilation, so operable windows and motorized clerestory windows were included in the design. THA Architecture played a major role in guiding the design process with the owner, advocating for the energy efficiency and sustainable measures ultimately incorporated into the project.

Technologies and Design Strategies

HVAC: The building's primary heating and cooling are provided by a multi-variable refrigerant flow (VRF) fan coil system. The system consists of 10 outdoor variable-speed compressor heat pump condensing units mounted on the roof. Two insulated refrigerant pipes connect the unit to a BC Controller. A central ventilation and exhaust shaft provides fresh air to each major space through a variable air volume (VAV) box controlled by carbon dioxide sensors. Energy savings from this system are realized through reduced pumping energy, a variable speed compressor, fan coils and outside air (OSA) set up in parallel, with heat recovery.

Envelope: Insulation was added at all exterior walls (R-10) and roof cavities (R-15). Existing windows are operable, and the glazing was replaced with double-paned insulated low-E glass. At the central atrium, motorized clerestory windows open to exhaust air.

Lighting: The overall lighting power density for the building is 0.91 W/sf. Actual energy use is reduced through the lighting control system. High-efficiency lighting includes direct/indirect T8 fixtures with automatic dimming ballasts located in the perimeter offices.

Daylighting: Horizontal exterior shades are located at every floor on the south-facing façade. These shades are made with sage glass that darkens as the temperature increases and provides shading for the building. Large windows with views allow natural light to penetrate into the space. Perimeter office lighting operates with daylighting controls.

Controls: Building Management System (BMS), daylighting controls, occupancy sensors, motorized clerestory controls and computer sleep mode are all incorporated into the building.

Efficiency Measures

- Variable speed compressor heat pump condensing units
- Variable air volume (VAV) box with CO² sensors
- Increased insulation
- Motorized clerestory windows to exhaust air
- Low-e glazing
- Direct/Indirect T8 fixtures with dimmable ballasts
- Daylighting controls
- Building Management System – controls
- Commissioning

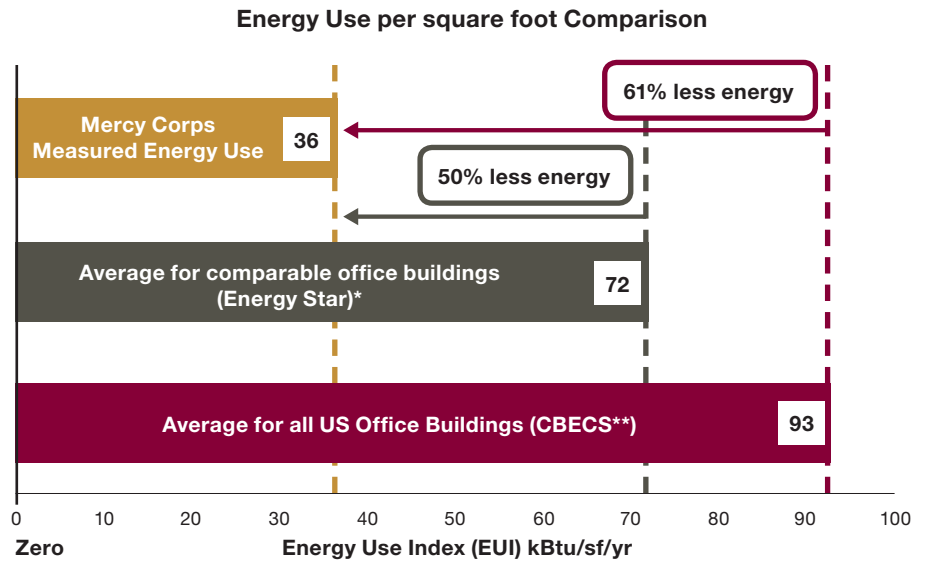
These shades are made with sage glass that darkens as the temperature increases and provides shading for the building.

Commissioning: Both fundamental and additional commissioning took place on the building, as required for LEED certification.

Monitoring system: Monitoring is conducted by means of Whole Building Management System (BMS).

Renewables: The building has the infrastructure for a 79kW photovoltaic array, but due to cost Mercy Corps has not purchased the panels.

Energy Performance



* Comparable office average energy use from the Energy Star Portfolio Manager program based on like type, size, occupancy, hours, and climate - determined from statistical analysis of the CBECS dataset
 **Average energy use for all U.S. Office buildings through the Commercial Building Energy Consumption Survey (CBECS)

Energy Performance

% Better than Baseline	61%
Baseline	National Average*
Measured Energy Use (KBtu/SF/yr)	36
Energy Star Score	93

*CBECS – U.S. DOE Energy Information Agency’s Commercial Building Energy Use Index 2003

Actual energy use for the Mercy Corps Building in 2010 was 36 kBtu/sf/yr (EUI)¹ – 69% less energy per square foot than the average for offices in the U.S.² The U.S. average for all offices is a good basis for quickly comparing buildings of the same type. A more specific comparison can be made through the Energy Star Portfolio Manager program, which determines the energy use of buildings of like type, size, hours of use and climate. In this example the Energy Star program calculated that comparable buildings would use less energy than the average for U.S. office buildings.

This building, however, uses half the energy of the Energy Star estimate. The Mercy Corps building’s estimated energy use after the major renovation was modeled compared to a baseline building per ASHRAE 90.1 -2004, and was

1 An Energy Use Intensity (EUI) is the total energy (gas and electric) used in thousands (k) of British thermal units (Btu) divided by the square feet (sf) of the space – resulting in a commonly used metric of kBtu/sf/yr.
 2 CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003.

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estimated to use 43 kBtu/sf/yr. The actual energy use of just 36 kBtu/sf/yr. (16% below the estimate) attests to the comprehensive and integrated nature of the efficiency measures selected and the continued attention to the building operations since occupancy. The building has an ENERGY STAR score of 93, placing it in the top 6% of office buildings nationally.

Financial

Total project cost: \$37,000,000 \$445/sf (new and renovation)

Funding and Incentives: The majority of capital for the building came from a private fundraising campaign. Mercy Corps received grants to incorporate efficiency measures into the project. The Lemelson Foundation owns 9% of the building. Scheduling and cost control were very important to the owners, who hired a construction manager to ensure the project remained on budget.

Estimated annual cost savings: Per ASHRAE 90.1 – 2004, the building is estimated to save \$37,624 annually, a 35% savings over a baseline building.

Project Results

User Satisfaction and Innovation: According to Hugh Donnelly, Manager of Administration and Facilities for Mercy Corps, user satisfaction for the building “...has been net positive all around. The goal of creating a community was absolutely achieved.”

Employees enjoy working in the building and are adjusting to the open office environment, which is a change from their previous location. Donnelly believes the most innovative aspects of the building are the Building Management System and the method by which the clerestory windows exhaust air naturally.

Acknowledgements and Sources

Project Team:

- Owner Representative: Mercy Corps
- Architect: THA Architecture
- Mechanical Engineer: Glumac Engineering
- General Contractor: Walsh Construction

Sources:

- Mercy Corps: Hugh Donnelly, Manager Administration + Facilities
- Green Building Services: Ralph DiNola
- Glumac: Dana Troy
- Green Building Services: Historic Buildings – A survey of project profiles
- Historic Portland Building Revamped into LEED Platinum Mercy Corps Headquarters: by Yuka Yoneda 3/4/11 – inhabitat

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- Mercy Corps, Center for Change - Portland Development Commission
 - www.mercycorps.org
 - US Green Building Council president visits Mercy Corps for LEED Platinum ceremony – Portland
 - Architecture blog: Brian Libby 12/7/09

Photos: Courtesy of THA Architecture

Research and Development:

- New Buildings Institute (NBI): Liz Whitmore, Cathy Higgins, Mark Lyles

Funding:

- Northwest Energy Efficiency Alliance (NEEA): Mark Rehley, John Jennings
- NBI's work is also supported by the Doris Duke Charitable Foundation and the Kresge Foundation

Existing Building Renewal Initiative

This work is part of NEEA's regional Existing Building Renewal initiative to accelerate the market's adoption of deep, integrated energy-efficient renovations. The initiative currently focuses on office buildings but will add other market sectors with large potential energy savings. This is one of the ways the region can rapidly revamp existing stock to achieve 30–60% energy savings — on the way to netzero-energy use by commercial buildings.

For more information on the Existing Building Renewal Initiative

contact: Peter Wilcox pwilcox@neea.org or www.betterbricks.com

For additional case studies highlighting high performance commercial buildings, visit NBI's Getting to 50 Database:

buildings.newbuildings.org/

For more information about NBI's efforts to improve the energy performance of existing buildings, visit:

newbuildings.org/advanced-design/existing-buildings

New Buildings Institute

New Buildings Institute (NBI) is a nonprofit organization working collaboratively with commercial building professionals and the energy industry to improve the energy performance of commercial buildings.