Massachusetts Green High Performance Computing Center
100 Bigelow Street Holyoke, Massachusetts
Project Profile

LEED-NC v3
Platinum
2013

The Massachusetts Green High Performance Computing Center (MGHPCC) is a data center dedicated to supporting the growing research computing needs of five of the most research-intensive universities in Massachusetts: Boston, Harvard, and Northeastern Universities, the Massachusetts Institute of Technology and the University of Massachusetts. MGHPCC resources will be also available to other research institutions. A further goal of the project was to energize economic activity in downtown Holyoke's former industrial district.

photo credit: Helen Hill

High Performance Computing (HPC) deploys many computers working closely together to solve computationally complex problems that are too large or would take too long for standalone desktop or server computers. Today's HPC systems range from 100s to 100s of thousands of computers working in concert. The computers, and the cooling equipment needed to cool the computers, require a significant amount of energy and space to operate. Thus, the participating universities expanded their research capacity and saved money by collectively investing in *one* data center. In addition, the data center allows the different universities to easily share information on the servers with one another, leading to collaboration on such topics as life sciences and clean energy research.

The new location of the data center offers many advantages over a Boston-area location. In Holyoke, land is more readily available and more affordable than Boston. Furthermore, labor costs, cost of living, and, perhaps most importantly, energy cost is less than Boston. The MGHPCC purchases its power from Holyoke Gas & Electric, which currently offers the lowest industrial electricity rates in Massachusetts and derives most of its energy from renewable energy sources, the city's hydroelectric dam and solar arrays.

LEED® Facts

Massachusetts Green High Performance Computing Center

Location	Holyoke, MA
Rating System	LEED-NC v2009
Certification Achieved	Platinum
Total Points Achieved	80/110
Sustainable Sites	24/26
Water Efficiency	6/10
Energy and Atmosphere	23/35
Materials and Resources	7/14
Indoor Environmental Quality	12/15
Innovation and Design	6/6
Regional Priority	2/4

Project Metrics

43% reduction in energy costs compared to the baseline standard (ASHRAE Standard 90.1-2007), estimated via energy modeling

30% reduction in carbon dioxide-equivalent emissions

44% reduction in lighting power density for building exteriors below the baseline standard (ASHRAE Standard 90.1-2007)

97% construction waste diverted from landfill via recycling and reuse

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ENERGY EFFICIENCY

From the beginning of the project, the Massachusetts Green High Performance Computing Center project team aimed to reduce the energy intensity of the computing center. The following energy conservation measures were vetted during the design process and implemented as part of the MGHPCC.

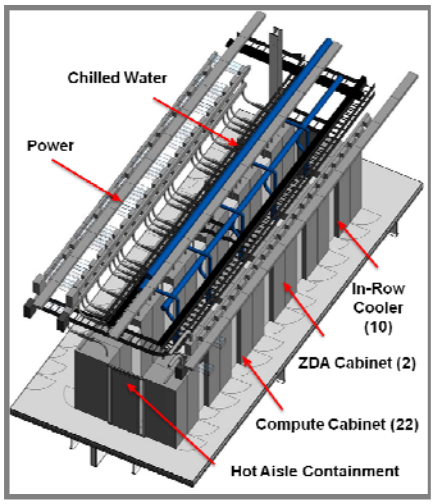
MECHANICAL SYSTEMS

Water Side Economization: The MGHPCC uses a "free cooling" system with water side economization. For more than 70% of the year, the water in the close-coupled cooling system for the MGHPCC computer room will be cooled by heat exchangers that are supplied with cooling tower water. The facility will only need to use its chillers 30% of the time.

Hot aisle containment: Hot aisle containment increases cooling efficiency by reducing the distance between the computers and the cooling units to less than 2 feet. It also prevents hot air generated by the computers from mixing with cold air from the in-row cooling units, which further improves the efficiency of the cooling system.

Controllability of Systems: The in-row cooling units use internal sensors to control their operation.

Controllability of Systems: Occupants in the office areas are able to adjust air flow to meet their needs with individualized controls at their workstations.



MGHPCC, Hot Aisle Containment, M+W Group

photo credit: Helen Hill

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ELECTRICAL SYSTEMS

Occupancy Sensors: Occupancy sensors are installed in all spaces to turn the lights on or off based on actual occupancy. The occupancy sensor time delay is set at 15 minutes to shut-off lights.

Daylight-Harvesting Dimming Controls: Daylight sensors are installed in the administration windowed area. These sensors dim the lighting up or down in response to the amount of supplemental sunlight entering the space.

Reduction in Lighting Power Density: 44% reduction in Lighting Power Density (watts/square foot) when compared to ASHRAE 90.1-2007 baseline. Reduction was achieved through the use of LEDs, high efficiency linear fluorescent lamps and efficient fixtures.

High Voltage Power Distribution: The MGHPCC uses a high voltage power distribution system, which increases efficiency while operating within voltage ranges that are supported by all modern computing equipment. Higher distribution voltages mean lower current for the same amount of power, which reduces energy loss and heat generation in the wiring. Higher distribution voltages also make it possible to eliminate an entire tier of transformers from the facility, which reduces energy losses, saves space, and reduces capital cost.

Landscape and Site

The site is part of downtown Holyoke's former industrial district. The site was first used for manufacturing textiles in the 1880s. The site has also endured other operations, such as tool, cutlery, steam pump, and trolley track manufacturing. These uses have led to a contamination of the site, which was remediated as part of this project.

Additional site improvements included adding native and adapted vegetation as part of the planned landscape—i.e. Inkberry, Sweetgale, and Meadowsweet. This planting, as well as other native plants, were particularly useful in the creation of several biorention areas. Biorention systems are used to remove contaminants and sedimentation from stormwater runoff. In addition, these systems are instrumental preventing erosion and slowing stormwater runoff to allow enough time for water to infiltrate into the soil.

The project also benefits from a number of other strategies associated with decreasing the building users' dependency on personal motor vehicles. For example, the site is located near several public bus stations, which provide an alternative mode of transportation for building users. Bicycle racks and preferred parking spaces were added for occupants who drive a low-emitting or fuel-efficient vehicle to work. These types of vehicles are defined as vehicles that have at least a minimum green score of 40 according to the American Council for an Energy Efficient Economy.

photo credit: MGHPCC

photo credit: Helen Hill

Plumbing Systems and Potable Water Use Reduction

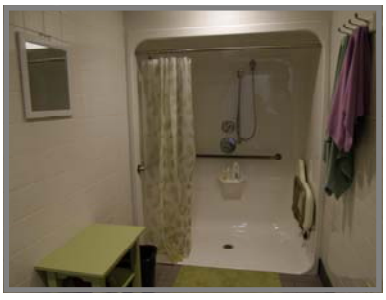


photo credit: Helen Hill

Plantings were selected so that the site does not require a permanent irrigation system. This saves both resources and finances that would normally be needed to maintain the landscape. Additionally, this measure helps save the cost associated with installing and maintaining the irrigation system itself.

The project installed a number of water fixtures that contribute to an estimated water savings of 33% in indoor potable water use as compared to EPAct 1992. That's an estimated annual savings of 29,680 gallons of water. Water efficient water closets with a flush rate of 1.28 gpf were used (saving approximately 6,000 gallons of water per year). Also, waterless urinals were put in place. These fixtures use a sealing liquid that is less dense than urine. Therefore, the urine sinks through the oil, trapping the odor below the oil layer and preventing it from escaping out into the rest of the bathroom. Without the need for water, these fixtures save help save 11,320 gallons of water per year.

PRODUCTS AND MATERIALS

Reinforcing Steel
ArcelorMittal
- 49% post -consumer recycled content
- 51% pre-consumer recycled content

Thin Brick
Belden Brick
- 64% post -consumer recycled content
- 16% pre-consumer recycled content

Metal Framing
ClarkDetrich
- 26% post -consumer recycled content
- 6% pre-consumer recycled content
- 100% regional manufactured and extracted

Hollow Metal Doors
Steelcraft
- 57% post -consumer recycled content
- 31% pre-consumer recycled content

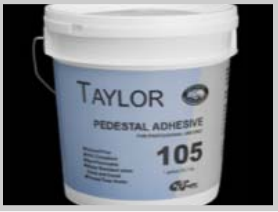
Drywall
LaFarge North America
- 96% pre-consumer recycled content
- 3% post-consumer recycled content

Wood Doors
Eggers Industries, Inc.
- 14% pre-consumer recycled content
- No added urea formaldehyde

FlexGreen
Kerfkore
- 100% pre-consumer recycled content
- No added urea formaldehyde

Promar 200 Zero VOC
Sherman Williams
- No VOCs

Ultrabond Eco 575
Mapei
- VOC Content = 40 g/L vs 60 g/L VOC limit



WF Taylor 105
Envirotec
- VOC Content = 6 g/L vs 60 g/L VOC limit

Series 99 Exit Devices
Von Duprin
- 40% pre-consumer recycled content
- 34% pre-consumer recycled content

Hot Aisle Containment
Wright Line Eaton
- 25% pre-consumer recycled content
- 7% pre-consumer recycled content

KEY MATERIALS HIGHLIGHTS

23% recycled materials (post-consumer content plus one-half of pre-consumer content) value as a percentage of total materials value

25% regional materials (manufactured within 500 miles) value as a percentage of total materials value

100% Forest Stewardship Council (FSC) certified wood—value as a percentage of new wood materials cost

100% only low-VOC, or no-VOC adhesives, sealants, paints and coatings were used

Please note that while many products are described in this project profile, these are provided for informational purposes only, to show a representative sample of what was included in this project. MGHPCC and its affiliates do not specifically endorse nor recommend any of the products listed in this project profile and this profile may not be used in commercial or political materials, advertisements, emails, products, promotions that in any way suggests approval or endorsement of Harvard University.

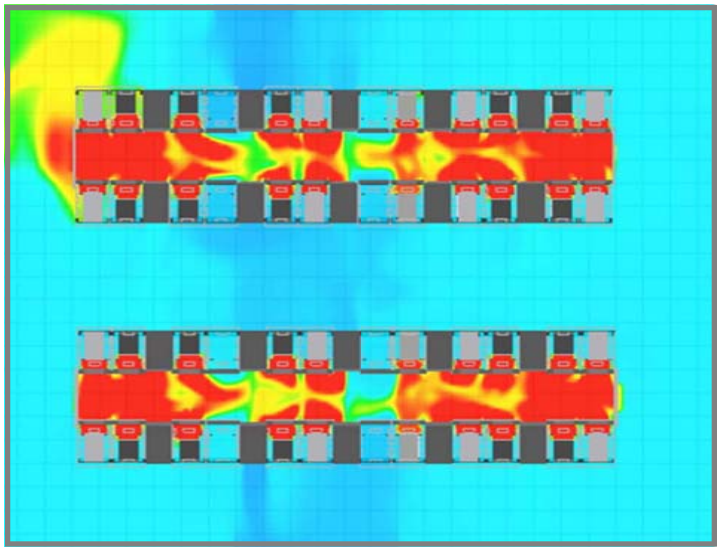
photo credit: Helen Hill

Community Outreach

The MGHPCC serves the community by providing meeting, workshop and classroom space with state-of-the-art audio-visual and internet capabilities. Partnerships with the Holyoke Public Schools, Holyoke Community College, and other local organizations are fostering science, technology, engineering and math (STEM) education at the facility and throughout the community. Programs will include teaching, training, certifications and professional development, resulting in more knowledgeable students and skilled workers. The MGHPCC is a key member of the Holyoke Innovation Task Force, and city-led group whose charge is to stimulate development in Holyoke by promoting innovation and the creative economy.

Innovative CFD Modeling

Computational fluid dynamics (CFD) modeling was used to ensure that MGHPCC's servers and other equipment were using the cooling energy as effectively as possible. First, a sample layout of the equipment was created to be assessed by the model. As a result of the simulation, it was discovered that leaving space between certain equipment while not layering other equipment on top of each other minimized the amount of recirculation of hot air and minimized the by-pass air of cold air within the data center. In addition, partitions are utilized in the cold aisles as a way to create a physical separation between the "cold" aisles and the "hot" aisles. These measures helped provide a significant energy savings in the computing areas alone.



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Project Team

Owner	Massachusetts Green High Performance Computing Center
Architect **MEP Engineer**	M+W Group
Landscape Architect **Civil Engineer**	Vanasse Hangen Brustlin, Inc.
Construction Manager	Turner Construction Company
Commissioning Authority	WSP Flack + Kurtz
Sustainability Consultant	Harvard Green Building Services
Environmental Remediation	Tighe & Bond, Inc. Haley & Aldrich

BOSTON UNIVERSITY

MIT

UMASS

VE RI TAS HARVARD UNIVERSITY

Northeastern

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