

Case study

Michigan Alternative and Renewable Energy Center

Muskegon, Michigan



FlexSys™ system helps in achieving Gold LEED® certification

The Michigan Alternative and Renewable Energy Center in Muskegon, Michigan is one of the first facilities in the State to achieve the Gold Leadership in Energy & Environmental Design (LEED®) 2.1 rating for green buildings - a goal obtained in part by employing the Johnson Controls FlexSys™ underfloor-air distribution system.

The Center is the first commercial project in the world to integrate fuel-cell technology, a heat-recovery system for heating and air-conditioning, solar photovoltaics and a nickel-hydride battery storage system. The innovative 26,600-square-foot research center is the result of a partnership among the City of Muskegon, the Michigan Public Service Commission and Grand Valley State University.

Gold certification requires 39-51 points, which can be earned by addressing six environmental categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality and Innovation & Design Process. HVAC-system design is relevant in several categories: It can help earn points by impacting energy performance, ozone depletion, indoor environmental quality, ventilation effectiveness, system controls and commissioning.

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LEV KAGANOVICH
PRINCIPAL
MECHANICAL DESIGN STUDIO, INN.

Here’s how Lev Kaganovich, principal at Mechanical Design Studio Inc., Walnut Creek, California and Ken Skinner, project manager for Grand Rapids, Michigan-based design/build firm Workstage, combined the capabilities of the Johnson Controls FlexSys system and general HVAC systems to earn LEED points.

Optimizing Energy Performance

Calculations showed the mechanical system alone earned points by being 35.2 percent more efficient than required by ASHRAE/IESNA Standard 90.1-1999, and the total building performance was 30.4 percent more efficient. The FlexSys system contributed by allowing more “free cooling” through the use of outside air. The system allows outside air at 62 degrees Fahrenheit or cooler dry bulb temperature, rather than the 55 degrees Fahrenheit for a standard ducted system. Also, the system’s low-pressure air distribution requires lower fan energy. For this increased energy performance, four Energy & Atmosphere points were earned.

Ozone Depletion

With Gold LEED certification as a goal, designers planned from the outset on using environmentally responsible HFC-407C refrigerants in the mechanical equipment. By reducing ozone depletion, the system earned one Energy & Atmosphere point.

Carbon Dioxide (CO₂) Monitoring

The FlexSys system accommodated CO₂ sensors to monitor the second-floor office area, which complements CO₂ monitoring in the first-floor laboratory, earning one Indoor Environmental

Quality credit. Thanks to the sensors, outside air can be introduced in occupied areas to ensure CO₂ levels never exceed outdoor levels by more than 530 parts per million.

Increase Ventilation Effectiveness

One Indoor Environmental Quality point was earned by the consulting engineer submitting a narrative on the impact of the FlexSys system on increasing air-change effectiveness in the building. The definition of air-change effectiveness is a comparison of the age of air in the occupied areas to the age of air that would exist if ventilation air were perfectly mixed. According to ASHRAE Standards Interpretation IC 62-1989-24, underfloor-air distribution systems have a better ventilation effectiveness than overhead-distribution systems. The conditioned air is delivered directly into the occupants’ breathing zone. Contaminated air in the room warms, and natural convection carries it to the ceiling, where it is removed.

Controllability of Systems

Unlike overhead-duct distribution, each FlexSys floor terminal is regulated by the temperature-control system. This control feature earned the system one Indoor Environmental Quality credit.

Additional LEED points earned

Other Energy & Atmosphere points were earned as the result of additional commissioning steps performed by Workstage and measurement and verification specified by Mechanical Design Studio. The management of indoor environmental quality during construction by Grand Valley State

University, and indoor chemical-and-pollutant source control resulted in Indoor Environmental Quality points. Lastly, water saving plumbing fixtures and landscaping resulted in Water Efficiency points.

More than just LEED credits

Just as important as the LEED credits contributed by the FlexSys system was its flexibility and redundancy. "With a FlexSys underfloor system, it's substantially easier to accommodate last-minute changes by the architect," says Kaganovich. "Adjustments are easy to make to the plans and in the field."

Workstage's Ken Skinner likes the completeness of the FlexSys concept. "Our cooling solution is open to the entire plenum. We can use the same devices in the interior as we do for the perimeter. Heat coils can also be included in these versatile terminal devices, which are extremely quiet and can be easily changed to accommodate individual comfort needs of the building occupants."

The facility opened its doors in November 2003, and received its gold LEED rating in June 2005. Today, the center remains a leading resource for alternative-energy technology and applications, with an innovative design that is complemented by the efficiency, comfort and flexibility of the Johnson Controls FlexSys system.

LEED Credit Category	Steps Taken	Points Earned
Energy & Atmosphere (EA) Credit 1: Optimize Energy Performance	Building exceeds the requirements of ASHRAE/IESNA Standard 90.1-1999	4 points
Energy & Atmosphere (EA) Credit 4: Ozone Depletion	Mechanical equipment uses environmentally responsible HFC-407C refrigerant	1 point
Indoor Environmental Quality (EQ) Credit 1: Carbon Dioxide (CO ₂) Monitoring	System incorporates CO ₂ sensors throughout to monitor and control CO ₂ levels	1 point
Indoor Environmental Quality (EQ) Credit 2: Increase Ventilation Effectiveness	Uses a FlexSys UFAD system to increase air-change effectiveness	1 point
Indoor Environmental Quality (EQ) Credit 6.2: Controllability of Systems	Each FlexSys floor terminal is regulated by the temperature-control system	1 point

The FlexSys system design helped earn LEED points by impacting energy performance, indoor environmental quality, ventilation effectiveness and system controls.

