

1354 THE LOMBARDO WELCOME CENTER: MILLERSVILLE UNIVERSITY'S FIRST NET-ZERO ENERGY BUILDING

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1. INTRODUCTION

Millersville University of Pennsylvania plans to construct a \$7.5 million, 15,000 square-foot campus building that is both net-zero energy and net-zero water runoff. The structure will generate as much power as it consumes over the course of a year, facilitating the campus goal of reaching carbon neutrality by 2040. The completed building will house the Admissions, Marketing, and Residence staff; the University's Welcome Center; and an atrium educational center. The building was in part made possible by a \$1 million gift from Samuel N. and Dena Lombardo; Sam serves as CEO of the Benecon Group in Lititz, PA. This document highlights the eco-friendly design features that will work in tandem to achieve the building's environmental objectives.

2. BUILDING ENVELOPE

The exterior envelope is designed to be 20 percent more efficient than the standard code requirements. Exterior walls will be constructed of 0.1524m glass fiber blanket batt insulation (R-13) between the studs and continuous 0.0762m rigid polyisocyanurate insulation boards (R-12) over the exterior terra cotta rain screen. The roof insulation is continuous 0.1651m minimum polyisocyanurate.

The curtain wall surrounding the lobby area will be constructed of 0.0254m insulated glass units consisting of 2 pieces of glass with an intervening air space of argon gas to increase the insulation value. The curtain wall is composed both of glass with a low e-coating to reduce ultraviolet light during high sun angle exposures, and similar glass with 20% or 80% frit patterns (white dots on glass) added to further reduce solar radiation.

The system is thermally broken to prevent the transport of heat into or out of the building.

3. BUILDING TEMPERATURE

Indoor air temperature will be regulated by a combination of geothermal energy systems and passive design features. Heating and cooling will be achieved with an HVAC system using a closed loop geothermal heat pump with an energy recovery wheel. It will be connected to a geothermal well field with 20 wells drilled down 400 feet per well. Stone markers will identify the well locations for students and staff.

A radiant heating floor will circulate warm water during the cool season through the floor system in the lobby. The lobby concrete floor also provides a degree of thermal mass, allowing passive solar gain during the day.

Individual zone temperature control will be enabled, as will system setbacks when the office is unoccupied (occupancy sensors). CO2 monitoring in the presentation room allows the system to ramp down when few people are in the space.

4. ELECTRICITY AND PLUG LOADS

The Lombardo Center will be powered by a rooftop solar array, filling the entire top of the building with about 500 solar photovoltaic panels. In addition, there will be a 20-panel dual axis tracker system on the south side of the building. This tracker will move to follow the sun, and be visible to students and staff.

Energy Star equipment and appliances will keep the building's energy demand to a minimum. Furthermore, the printer stations and kitchenette appliances will be centrally located to reduce need for individual appliances in offices. Low-flow plumbing fixtures minimize water heating requirements. Overall, the building is designed to use less than 50% of the energy of a conventional building.

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5. LIGHTING

LED lighting will be employed throughout the building, and possess sensor controls for dimming when there is sufficient natural lighting. Sun path diagrams were analyzed in selecting optimal window locations. The building will be oriented along an east/west axis to provide more southern exposure and solar gain, and also allow for natural daylighting on the south and north facings. Fixed exterior sun shades above the south windows limit direct sunlight during the summer months.

6. NET ZERO RAIN RUNOFF

In addition to the structure's energy efficiency features, the building also provides for storm water management, ultimately protecting the water quality of the Susquehanna River and Chesapeake Bay. As such, the structure will feature a number of rain gardens and water retention areas. Collectively, they allow infiltration of most of the runoff into the ground and aquifers below. A "water fall" feature highlights water flowing from the roof to the rain garden to make it visible to students and staff.

7. EDUCATION

Key to the university's sustainability education mission, the atrium education center will be equipped to serve an environmental education function for net-zero energy as well as net-zero water runoff design and construction. The center will be designed for interactive learning through a media touch screen wall and interactive demonstrations. Over 10,000 annual visitors will be able to monitor, both in real-time and over time, storm water and energy production and consumption. The electricity metering system will be able to divide the energy demand into its heating, cooling, lighting, plug-in equipment, and hot water components. The location for the Lombardo Welcome Center was chosen due to its centralized position on campus, making it easily accessible for the campus community.



Figure 1. South-facing view of the Lombardo Welcome Center, with dual-axis solar tracking system in front.



Figure 2. The Atrium Education Center will allow visitors to track building energy and storm water metrics.