

Building with Metal: Energy-Efficient, Custom-Built Schools

Metal buildings offer custom-designed, energy efficient facilities options for school districts.

By Dan Walker, P.E.



On school campuses across the country, students, school officials, and teachers are calling for the adoption of low-energy building codes and smarter construction practices. Many schools have turned to metal building systems to create custom-designed structures that exemplify a low-energy, high-value model.

Metal building systems provide what school district leaders want and need: versatility, energy efficiency, low maintenance costs, and a long life.

An Evolution

The metal construction industry has undergone an evolution during the past decade, leading to more sophisticated metal building systems. At the forefront of that advancement is the Metal Building Manufacturers Association (MBMA) and its members, which have invested in engineering technology, fabrication concepts, structural improvements, and building quality.

With the help of research and industry innovations, manufacturers can create truly customized steel

structures. Most manufacturing processes use computerized fabrication technology, so each design becomes a precise and unique structure that meets a school's specific requirements.

"From the inside to the outside, a metal building is completely customizable, which surprises many people involved in school construction," Jay Johnson, director of architectural services for MBMA, says. "The finished product is whatever the end users want it to be, and finishes like glass, brick, stone, and wood can be incorporated into the design." Johnson adds, "The building is energy efficient, environmentally sustainable, and beautiful—metal buildings check all the right boxes."

The design begins with the core of a metal building system, which is a high-performance, custom-designed structural steel frame. That frame bears the load of the building, so the exterior finish can be modern or traditional, depending on school officials' desire to blend with or stand out from other campus buildings.

The Sustainable Side

The Steel Recycling Institute notes that steel is North America's number one recycled material. The steel used in metal building systems contains a high percentage of recycled content and is recyclable at the end of its life span.

The steel framing of a metal building system contributes points to the U.S. Green Building Council's Leadership in Energy and Environmental Design program and the Green Building Institute's Green Globe rating program. Energy Star-rated products are also available from many manufacturers as part of their product lines for metal building systems.

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The components used will determine the building's level of sustainability. Factory-insulated wall panels have R-16 to R-32 thermal performance, for instance. Fiberglass blanket insulation, rigid board insulation, or a combination of both is also available, providing options for different wall and roof finishes. So metal building systems can achieve virtually any desired R-value with other cladding materials.

Metal roofing is another energy-efficient feature to explore. Because of coating technology, metal roofs can reduce the urban heat island effect, increase emissivity, and raise reflectivity.

W. Lee Shoemaker, director of research and engineering for MBMA, says, "Industry research has resulted in the development of cool roofing technology that enables

the roof to reflect the sun's rays back into the atmosphere. The roof stays cool, the building absorbs less heat, and as a result the cooling costs are lower."

Consider Solar Systems

Metal roofs are fire and hail resistant and offer excellent wind-uplift performance. They also last longer than traditional roofing materials, adding to the value proposition that metal brings to the table.

Topping a metal roof with solar panels is an excellent option because the standing-seam roofs of metal buildings are ready-made to support solar arrays without the need for additional racking. Solar systems simply clamp to the seams of standing-seam metal roofing panels without penetrating the roofing material.

The low environmental impacts of a metal building can be proved by performing a life-cycle assessment.

It is important to examine the long-term performance and maintenance costs of any structure before making a final decision. Long-term maintenance costs—such as clearing snow from flat roofs, patching roof leaks, and replacing roofs—can add up for school districts. Metal roofing lasts longer and has lower maintenance costs than any other roofing type without the degradation and environmental concerns posed by other materials, such as asphalt, thermoplastic polyolefin, and rubber roofs.

The low environmental impacts of a metal building can be proved by performing a life-cycle assessment using the Athena Impact Estimator tool to show how metal buildings stack up against ordinary building construction from a life-cycle approach.

"For metal buildings systems, life-cycle costs are low because the steel structures are long lasting and relatively maintenance free. The longevity of a metal building increases when the structure is paired with durable cladding materials, such as metal roofs and walls. The life of a metal roof is typically 40 years or more compared with 15 or 20 years for other materials," Johnson explains.

The entire metal building system, including all the steel framing members and metal roof and wall coverings, are custom engineered for each building application and then shipped to the construction site. The process provides customization, cost savings from no wasted materials, a fast-track construction period, and the capability to erect a building year-round.

Reasons Why

A look at some schools around the country highlights the advantages of metal buildings. The Louis and Josephine Buondonno Forum at St. Augustine Preparatory School in Richland, New Jersey, was completed in 14



A metal building structural system provided the perfect column-free clear spans in the dining hall and gymnasium at the Louis and Josephine Buondonno Forum at St. Augustine Preparatory School in Richland, New Jersey.

months. School officials wanted to add science labs, academic classrooms, athletic facilities, a dining hall, a chapel, and administrative

offices. The Vineland, New Jersey, architectural firm that was asked to design the 96,000-square-foot addition to complement two existing

buildings selected a metal building system.

For the pool, dining hall, and gymnasium, a metal building structural system provided the perfect column-free clear spans. Because any exterior material can be selected to accompany a metal building, a brick exterior was chosen to match the existing buildings. A metal roof brought sustainability and low-maintenance performance to the project. Sustainability and performance were taken even further with the installation of solar panels, which now supply approximately 60% of the building's electricity.

An impressive group of seven metal building systems makes up the 150,515-square-foot Columbus Middle School in Columbus, Mississippi. The buildings radiate from a rotunda hub, which creates a gym-cafeteria; sixth-grade, seventh-grade, and eighth-grade wings; administrative offices; an auditorium-band hall; and a library. Every hallway is visible from the rotunda, making the school easy to monitor.

Added Value

Building smarter does not have to be more complicated. Schools can be value-added projects when materials are researched for cost, versatility, energy efficiency, and more. Students and those who work in these institutions deserve to spend their days in structures that perform efficiently and give them the best learning and working environment possible.

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