WHITE PAPER

An Illustrated Method to Stimulate the Economy, Achieve Energy Savings and Sustain the Environment While Modernizing Public School Facilities in the United States

Written for the 2009 Stimulus Act

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EXECUTIVE SUMMARY

The installation of sustainable retrofit metal roof assemblies over existing school building roofs can save energy for heating and cooling, dramatically extend the roofs' service lives, and enhance the appearance of the buildings.

- This document addresses the modernization of public schools to make them more energy efficient.
- A nationwide program to retrofit public school facilities enhances U.S. based job opportunities in the construction market, the design community and metal product manufacturing sectors.
- The retrofit metal roof systems discussed in this document are made of sustainable, environmentally friendly materials that can help school building projects earn credits toward certification in the U.S. Green Building Council's LEED™ (Leadership in Energy and Environmental Design) program.
- Sustainable retrofit metal roof assemblies provide ongoing energy efficiency.
- A retrofit metal roof's life cycle requires less maintenance and offers a service life of more than other roofing methods.
- A program to retrofit public schools delivers ongoing long-term cost savings to public schools, allowing school funding to be spent on education rather than on energy and roof maintenance and replacement.

KEY FACTS

- The Energy and Information Administration (EIA)[1] 2003 database shows that public schools consumed 649 trillion BTUs for comfort cooling and heating.
- The installation of sustainable retrofit metal roof assemblies over existing school building roofs can save heating and cooling energy, dramatically extended roof service life, and enhance the appearance of the buildings.

[1] Energy Information Administration; Department of Energy. 2003 Building Characteristics Overview of Major Fuel Consumption.

- Savings are estimated in the billions of dollars through extended roof service life, reduced maintenance costs, and savings on energy used for heating and cooling.
- When available, Federal funding for such a program can foster economic growth employing U.S. workers to retrofit existing building roofs with new metal systems on a portion of the 6.6 billion square feet[2] of current roofs sheltering public school facilities.

KEY CONSIDERATIONS

- The EIA[3] estimated that about 25% of public K-12 schools had inadequate roofs protecting their occupied space. Many pre-1980 schools were constructed with flat or low-slope built-up roofs (BUR). More than 87,004 public schools had these types of roofs.
- Some 1.65 billion square feet of new retrofit metal systems could be installed on 25% of the pre-1980 public schools that need repair.
- The Metal Construction Association (MCA) represents small and medium sized metal roof and wall system manufacturers throughout the nation that have the expertise necessary to provide a complete retrofit package through qualified roofing contractors operating at the local level.
- Metal roofing offers superior weatherability and long-term performance compared to petroleum-based low-slope roof systems. The use of metal also helps reduce the United States' dependence on oil. The estimated service life of a metal roof is 60+ years, which is more than double that of the best flat roof system[4] and therefore provides a substantial return on investment to a school district.
- Metal roofing systems are ideal for the incorporation of solar technology. This can be done through traditional photovoltaic (PV) panels, thin film PV laminates, and/or the collection and use of warm air from a specially designed cavity beneath a metal roof system. The photovoltaic systems, when installed over a new retrofit metal roof system, have a unique benefit to building owners. The current service life of PV is approximately 20 to 30 years. If the PV is installed over a new roof of lesser service life, or an existing conventional roof system, then the building owner is faced with removing the PV to replace the roof at the end of its service life, only to re-install the PV.

RETROFIT METAL ROOFING DEFINED

Retrofit metal roofing is a fully engineered system designed for existing buildings with roofs of any slope. These systems utilize light-gauge steel framing to create the slope and receive new high-performance metal roofing. This essentially creates a new ventilated attic space between the existing roof and the new sloped roof. Insulation is then added at the topside of the existing roof to increase the thermal resistance to meet Model Energy Code, ASHRAE 90.1 minimum values (R).

[2] Economic Policy Institute Briefing Paper #216-dated April 29, 2008 and the National Center for Education Statistics (NCES), 2007 Digest

[3] Energy Information Administration; Department of Energy 2007 Building Energy Data Book, DOE/EE-0324, Table 7.5.6 "Percentage of Public K-12 Schools with Inadequate Building Features."

[4] Per the Metal Construction Association Third-party Service Life Research program completed in 2015.

METAL CONSTRUCTION ASSOCIATION
8735 W. Higgins Road, Suite 300, Chicago, IL 60631
847.375.4718 | mca@metalconstruction.org | www.metalconstruction.org

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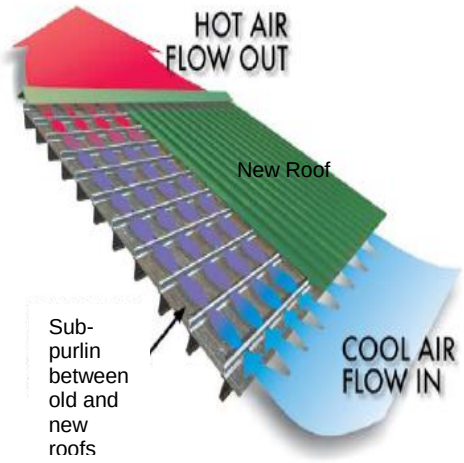
Some metal roof systems enable new metal roofing to be installed directly over existing shingles and other product types. Based upon either the individual product design or the installation of continuous sub-purlin members on the existing roof plane, an airspace is created to achieve ventilation or provide an airgap between the roof deck and the high performance metal roof.



In the past few years, retrofit metal roofs have increased in popularity, which is largely due to recognition of their value based on tests conducted at the DOE's Oak Ridge National Laboratories. These retrofit systems, which create what is referred to as above sheathing ventilation (ASV), have proven to reduce the heat transmission through the new metal and existing roofs and into the building by as much as 30%.[5] The ventilated assembly essentially uses the space between the existing and new roofs as a barrier to heat flow.

ENVIRONMENTAL BENEFITS

Many environmental benefits accompany the retrofit metal roofing concept. They include:

- Retrofit metal roofing systems are sustainable and continue to provide a return on the investment even after the initial cost has been retired.
- The systems are principally manufactured from steel or aluminum that originates from recycled metal. According to the Steel Recycling Institute, depending on the components used in individual systems, anywhere from 25% to 95% of the materials are derived from recycled metal. At the end of the building's useful life, the metal roof is 100% recyclable, meeting some requirements of the LEED building rating standards.
- In the majority of cases, the existing roof surface and substrate (membrane and insulation) remain on the roof and the new retrofit metal roof system is constructed over them. This keeps existing roofing materials out of local landfills, which is typically not the case in a conventional roof replacement.
- Since metal roofing is the component used as the roof's finished weathering membrane, it also helps reduce the heat island effect so common in metropolitan areas. Even more so, the metal roof can be a cool or reflective roof that mitigates the heat island effect and contributes to LEED certification.
- Most of today's colored metal roofs are coated with a long-lasting polyvinylidene fluoride paint system utilizing reflective pigment technology, which provides exceptional energy efficient qualities. This type of coating has been tested[5] and implemented with results providing as much as 80% reduction in heat transmission (absorbed energy through the roof). This means up to 80% of the sun's heat energy is reflected and emitted from the surface of the metal roof and not transmitted through the roof to the unconditioned attic space.
- Retrofit metal roof systems are eco-friendly, do not out-gas the way that petroleum-based roofing materials do, and reduce the impact on the environment thus qualifying them for several national green initiatives, including the U.S. EPA and DOE's ENERGY STAR rating program, the USGBC's LEED building rating system, and GBI's Green Globes program,

[5] Testing and research conducted by Oak Ridge National Laboratories from 2000 to 2012

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IMPACT ON THE U.S. ECONOMY

Several studies on retrofit metal roof systems are currently being conducted by industry associations, independent metal system manufacturers and Oak Ridge National Laboratories.

As an example, using 25% of the K-12 public school's square footage or 1.65 billion square feet, the following illustrates potential annual savings from installing metal retrofit roof systems over existing school roofs.

Maintenance Savings	$ 247,500,000
Budget Relief from roof replacements[6]	$1,347,743,605
Energy Consumption Savings	$ 710,420,000
Total Annual Savings	$2,305,663,605

SUMMARY

Retrofit metal roof systems have been utilized for decades to resolve issues related to the use of petroleum-based low slope roof membranes such as high levels of maintenance and continual roof replacements over the service life of a building.

Thousands of buildings have already been retrofitted including schools, federal/military installations, state and municipal facilities, and commercial structures. Each of these buildings has been reaping the benefits and cost savings of this efficient reroofing concept. The use of energy efficient and sustainable retrofit metal roof assemblies can help ensure that dollars intended for education are spent on educating children rather than operating or maintenance costs.

Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction. MCA promotes the benefits of metal in construction through:

- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry
- Recognition of industry-achievement awards
- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org

[6] Budget relief from roof replacements is explained as not having to budget for future built-up roof replacements because of the 60+ year service life expectancy of the new metal roof

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