

An Introductory Overview of Green/Sustainable Retrofitting of Existing Buildings in the U.S.

May 2010

THE CHEAPEST ENERGY IS “SAVED ENERGY”¹

Executive Summary

The word “Retrofit” today, has many connotations when used in the current Green Marketplace for Building Energy improvements. While there are a multitude of retrofit methods and concepts employed in existing buildings to achieve energy savings, most do not provide significant savings in either the short-term or long-term. However, there is one retrofit method that provides substantial and continual energy savings with long-term service life and the opportunity to employ renewable energy technologies. The method is “*Retrofit Re-roofing with Metal*”.

The Department of Energy estimates that 25% of our buildings have poorly insulated and maintained roofs making them immediate candidates for high performance retrofit re-roof applications. Furthermore, the DOE’s Building Technologies Program (BTP) identified residential and commercial buildings as the largest energy consuming sectors, accounting for about 40% of the total U.S. annual energy use². In addition, the BTP found that between 24-30% of these sectors’ energy loads are from thru-roof heat gain/heat loss and air infiltration. You may say that a significant portion of our energy costs is “*Going through the Roof*”.

Key Facts

Retrofit Metal Re-roofing provides design professionals and building owners with solutions for the following:

- Reduces energy demand and substantially improves our energy efficiency and dependence on oil.
- Creates Jobs in the construction, design and metal components manufacturing areas as well as the renewable solar energy market.
- Roof maintenance for flat roofs as compared to metal roofing is greatly reduced by as much as 40-50%.
- Land fill infiltration of flat roof tear offs is eliminated and cost of land fill management is improved.
- Metals (Steel and Aluminum) are fully recyclable and achieve LEED points for existing building certification.
- Metal roof systems offer the building owner reduced insurance premiums for their catastrophic wind and hail resistant qualities.
- Retrofit metal roof systems are professionally engineered to meet all governing national and local building codes.

¹ Peter Turnbull, Pacific Gas & Electric

² Energy Information Administration 2006 Report

Other Retrofit Methods for Existing Buildings

- There are several methods for making our heating, ventilation and air-conditioning (HVAC) systems more efficient.
- Adding insulation to existing building walls and roofs has always been an economical method to achieve greater energy efficiency.
- An intelligent combination of building automation in light and “plug-in” management can be a key to making buildings more energy efficient.
- Water efficiency is another component in the Greening of a building. This can come in the forms of more efficient water heating and re-use of rainwater for non-potable uses.

The Solution is “Right over our Heads”

Too often, designers and building owners overlook an obvious solution when needing to improve an existing building’s energy efficiency. Retrofit Metal Re-roofing is a well established technology that is available throughout the United States. This proven solution is economical and long-lasting and provides building owners with immediate and continual returns on their investment. While used for several decades by all types of governmental bodies and commercial building owners, Retrofit Metal Roofing’s true potential and value has yet to be fully utilized on a widespread basis. When retrofitting a building for energy efficiency, metal roofing should be considered to be *the platform* upon which to achieve greater energy savings and sustainability.

Retrofit re-roofing systems address existing buildings with both flat and sloped roofs. Retrofit wall systems can be installed virtually over any type of construction material as shown below.



New Sloped Metal Roof over Existing Flat Roof



New Metal Roof over Existing Sloped Metal Roof



Wall Retrofit - Before



Wall Retrofit - After

Energy Savings and Environmental Benefits

Retrofit Metal Re-roofing provides many options that can include the addition of insulation to upgrade the building to current energy code standards, convective ventilation³ for cooling the roof assembly and Energy Star “Cool” rated new metal roofing that reflects and emits the Sun’s solar radiance. In addition, integrated renewable solar water heating, solar space heating and solar electricity can easily be employed in the re-roof assembly. Each of these systems is well known in the retrofit construction marketplace with years of history that prove their sustainable value with the ability to pay for themselves. With the new metal roof being *the platform* of this technology, the building owner enjoys a long-lasting high performance roof that is currently assessed with a 41.6 year⁴ service life.

According to the National Association of Homebuilders Research Center, 20 billion pounds of asphalt shingles are dumped into U.S. landfills annually. The recycled content of metal roofing and siding is much higher than the recycled content in petroleum based roofing products and provides a more than double service life, reducing the frequency of roof replacement and materials being taken to the landfill. Metal is fully recyclable at the end of its useful life which again reduces the solid waste stream helping to sustain our much desired Green environment.

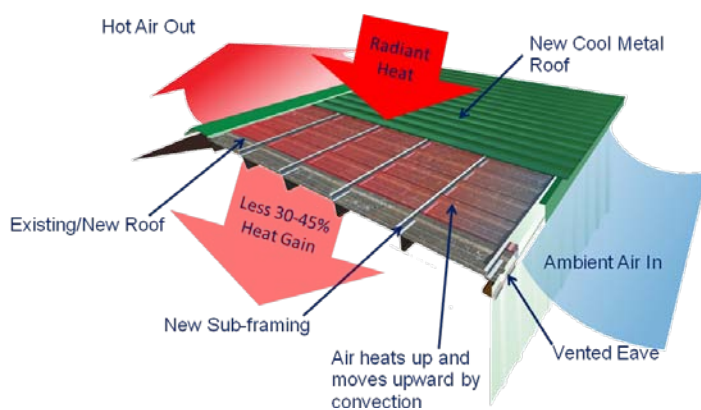
Since all of retrofit metal re-roofing systems originate from 28% to 45% recycled steel or aluminum, they are available for Leadership in Energy and Environment Design (LEED) points. Once the system is installed they are virtually 100% recyclable.

High Performance Integrated Retrofit Re-Roofing Systems

Below are illustrations that explain the basic fundamentals of integrated energy efficient and renewal energy systems

Above Sheathing Ventilation

These systems are referred to as ASV have proved to reduce the heat transmission through the new metal and existing roof assemblies by as much as 45%. The ventilated technology essentially uses the space between the existing and new roofs as a barrier to reduce heat flow and to cool the entire assembly.

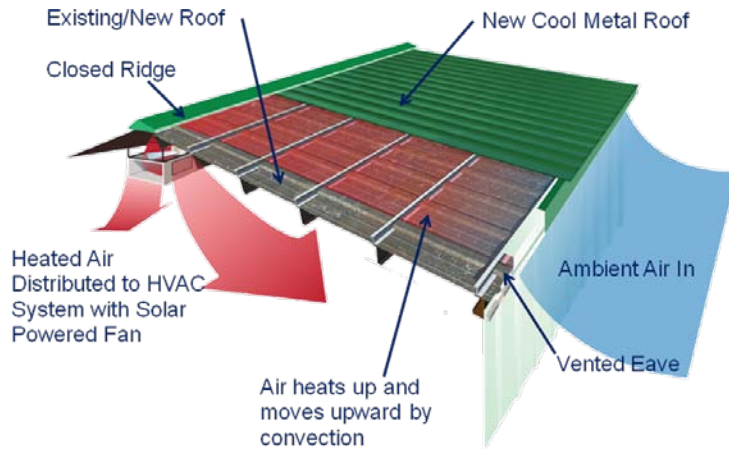


³ Convective ventilation is known as Above Sheathing Ventilation (ASV)

⁴ 2007 Ducker Worldwide Case Study and Report, the best flat roof system (Single-ply) has a service life of 20.5 years compared to 41.6 years for metal roofing

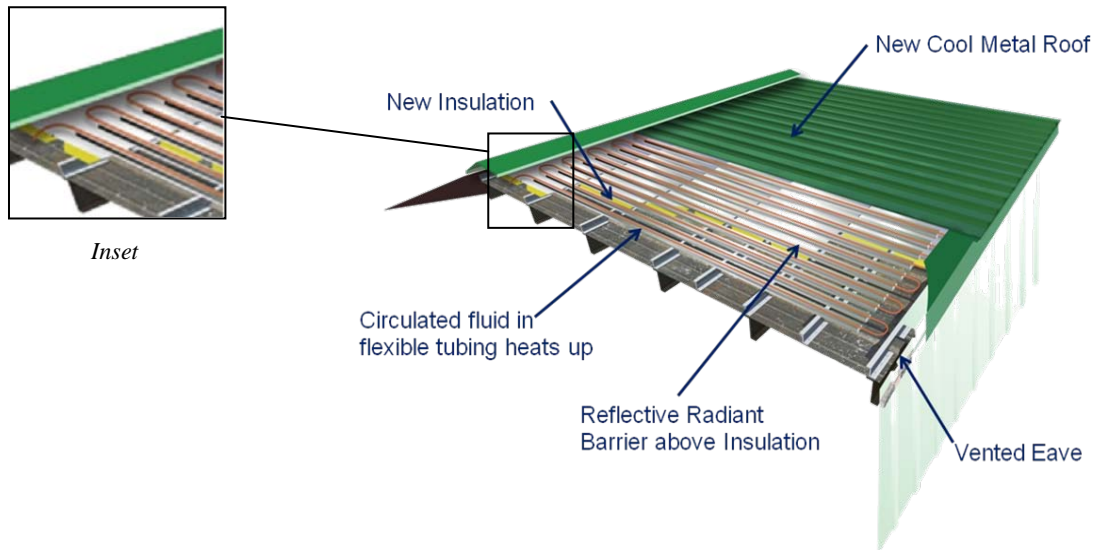
Solar Heat Recovery

Solar thermal heating technologies can be applied for space heating to lower energy consumption in the winter months. Similar to ASV, in lieu of the heated air being ventilated out of the roof assembly, it is captured and re-directed to the building's existing ductwork and/or other convective construction materials that retain heat. In summer months, the air is then ventilated out through damperable roof ventilators located at the high point of the roof, same as an ASV system.



Solar Water and Space Heating

Solar water heating technologies can be utilized for domestic water heating, radiant space heating, and process heating and cooling, lowering energy demand. These systems are highly efficient and can provide returns on investment in as little as 5-years plus they can be integrated with ASV and Solar Thermal Heat Recovery in the same roof assembly.



Photovoltaic Solar Electricity

With metal roofing as the platform for Retrofit Re-roofing, the addition of renewable photovoltaic solar electricity installed atop the new metal roof is very feasible. The two most-used systems include thin-film Adhered Photovoltaic (APV) and Mono or Poly Crystalline, which are mounted to the new metal roof's standing ribs/seams. When installed with an ASV system, the efficiency of these systems are improved because of the cooling of the roof assembly.



Thin-Film Adhered Photovoltaic



Mono or Poly Crystalline Photovoltaic

Rainwater Harvesting

Rainwater harvesting systems reduce the dependence on water demand and help crowded cities with storm water drainage problems and related costs. They meet the requirements of almost any structure for delivering non-potable water and have a 95% collection efficiency. They meet building requirements for storm water drainage and surface water runoff. There are numerous non-potable uses such as, landscape irrigation, equipment/vehicle washing, exterior building maintenance, fire protection and toilet flushing. Water efficiency is another area in the LEED program where a metal roof can qualify for points if it is integrated with rainwater harvesting systems. Metal roofing is the only roofing material that is considered toxic contaminated proof as compared to asphaltic and petroleum based roofing products.

Economic Impact

According to the DOE, the average commercial building size is approximately 15,000 square feet and the average residence is 2300 square feet. Applying those figures, and the relative market share of the metal roofing in each of the two building segments, we can project that 37,000 commercial buildings and 730,000 homes could potentially see their cooling/heating energy loads reduced by at least 45% saving 10-12 Gigawatts of energy (kWh PV-T) annually, or enough to heat and cool every home in Arkansas for two months or for 12 months in the District of Columbia.

A recent McGraw-Hill Smart Market Report on *Green Retrofit and Renovation Market Opportunities* projected the retrofitting of existing buildings to grow between 20-30% by the end of 2014 and in the process create as many as 50,000 jobs. We estimate that 7,500 of these new jobs will be in the metal construction industry that experienced a net loss of 30,000 jobs during the recent economic slowdown, dropping from 90,000 to 60,000 direct metal construction jobs.

Summary

Thousands of buildings have already been retrofitted for school districts, federal/military installations and state and municipal facilities as well as commercial buildings. Each of them is currently enjoying the benefits and cost savings of this re-roofing concept. If the other previously mentioned energy saving retrofit techniques would be employed with a Retrofit Metal Re-roof application, the result would be a building that has gone a long way towards achieving net-zero status.

“The Cheapest Energy is Saved Energy”

About the Authors:

Robert Scichili is Chairman and President of Robert Scichili Associates, Inc. He has 42 years experience in the coatings and metals industries. Bob is a prominent industry educator, speaker, consultant and board member. He is the pioneer of cool and high performing coatings for metal building envelope components.

S. Mark James is considered one of the foremost industry experts on retrofit metal roof systems, having been directly involved in over 20 million square feet of projects for private and public entities including Federal, State, Local Government and Military installations. He is currently employed as VP Sales & Marketing for Roof Hugger, Inc., a nationwide retrofit framing systems manufacturer.