



# Sustainable Design with High-Performance Protective Coatings

USING WATER-BASED PVDF COATINGS

- Cool Roofs & Cool Coatings
- Going Green: Examining Industry Trends
- Green Building Initiatives

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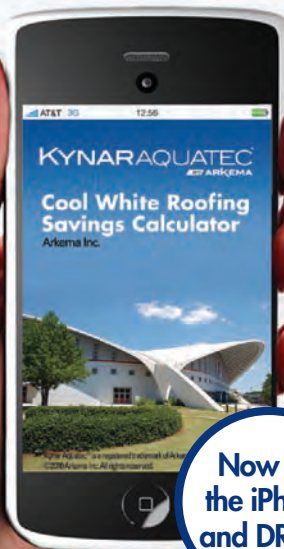
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## Enter your state and roof dimensions to determine the benefits of using Kynar Aquatec®

The Kynar Aquatec® Cool White Roof Savings Calculator will display the yearly energy savings, cost savings and reduction in CO<sub>2</sub> emissions for a Kynar Aquatec® coating over an elastomeric acrylic coating. Also, graphs will be displayed depicting the 20 year energy savings, life cycle cost and total CO<sub>2</sub> reduction.

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BY ARKEMA



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## ABOUT THE COVER:

Chosen as the topcoat for the roof of the spectacular MGM Grand Hotel and Casino that defines the Las Vegas skyline, United Coatings' Kymax® offers excellent resistance to dirt pick up and outstanding durability. Formulated with advanced Kynar

Aquatec® PVDF emulsion technology, the high-performance coating provides the maximum reflectance value for the life of the roofing system.

Photo courtesy of the MGM Grand Hotel  
Cover design by Breanna Fong

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# Sustainable Design with Coatings

Welcome to this special supplement on Sustainable Design with High-Performance Protective Coatings, a partnership between Arkema Inc. and BNP Media.

Our main interest in developing this publication was to provide useful information to our readers on the latest developments and technological advancements in green building systems. On the following pages you'll read the opinions and advice of a wealth of professionals in the field of sustainability—architects, contractors, industry consultants, coatings manufacturers, technology experts and contributing editors—on sustainable design using water-based PVDF coatings, cool roofing applications, new developments in coating technology, market trends, and much more.

Environmentally friendly or “green” building design is becoming increasingly popular in North America. To meet the growing demand for educational material in this area, this special insert will be featured in five BNP Media magazines throughout the year: *Architectural Roofing & Waterproofing*, *Environmental Design + Construction*, *Roofing Contractor*, *Restoration & Remediation*, and *Sustainable Facility*.

As you peruse the pages of this supplement, we're confident you'll find the articles useful in helping you meet your sustainable design and high-performance building goals.



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# Coating the Environment

Sustainable design heats up, but water-based PVDF coatings keep buildings cool

BY MICHELLE HUCAL, LEED AP

As the sustainable design market continues to heat up, water-based PVDF coatings help keep things cool and contribute to greener buildings. As architects, specifiers, contractors and facility managers look to save money, lower energy consumption and help the environment, or just exceed current building codes, it's critical to understand how coatings can contribute to environmental design and construction.

"The roofing industry has been radically changed by the green building movement," said Rick Damato, Editorial Director for *Roofing Contractor* magazine. "New roofing materials and systems have historically been touted for their ease of application, longevity, superior warranty and, in the case of steep-slope roofing, lower installed cost, color and design appeal. All of these things are still important, but 'green' and 'sustainable' have, in a relatively short period of time, moved from relative obscurity to the top of the list."

Water-based PVDF coatings have garnered greater attention for their contribution to new and existing sustainable roofs and building envelopes, as well as the overall health, safety and welfare of building occupants and the environment.



A major restoration of the roof on the Broadway Truck Repair Center in Spokane Valley, WA, with United Coatings' bright white, highly reflective Kymax® coatings (formulated with Kynar Aquatec® PVDF emulsion) offered significant advantages in lowering the roof temperature by reflecting heat from the sun.

PHOTOS COURTESY OF UNITED COATINGS CORPORATION

## The PVDF Advantage

A cool roof, for example, can reduce roof surface temperature by as much as 100 degrees, reducing the heat transferred into a building (and the demand on the HVAC system) and prolonging a roof's lifecycle.

Kynar Aquatec® PVDF emulsion-based coatings from Arkema Inc., for instance, provide high reflectivity and emissivity. Kynar Aquatec® emulsions are used by paint formulators to make premium weatherable water-based coatings. Coatings formulated with these emulsions can provide the durability of traditional Kynar 500® based coatings, now in a VOC-compliant, field-applied, ambient air-dry system. These coatings can easily be applied to a variety of substrates, including metals, plastics, wood, concrete, and textiles.

"The Kynar Aquatec® PVDF emulsion is an innovative extension of the highly successful Kynar 500® PVDF resin used for coatings in the exterior metal construction industry. Kynar Aquatec® can provide a high solar reflectance and thermal emittance value of any coated surface over a long service life with very little change in the radiative properties," said Scott Kriner, President, Green Metal Consulting, Inc.

## Building Codes, Standards and Initiatives

Kynar Aquatec® PVDF emulsion-based coatings available from several manufacturers meet or exceed most green building codes and standards, including California's Title 24 and ENERGY STAR®.

"Compliance with Title 24 and other green building initiatives frequently requires a roof with a highly-reflective, highly-emissive top surface," Damato said. "Many roofing systems can only achieve this with a final application of an approved roof coating. Roof coatings may also add to the sustainability of membrane roofing systems by keeping the surface temperatures lower and slowing membrane degradation caused by UV rays."

## Green Building Rating Systems

The Leadership in Energy and Environmental Design (LEED) Green Building Rating

System is a third-party certification program and a widely recognized benchmark for the design, construction and operation of high performance green buildings.

Coatings may contribute to LEED requirements within multiple categories, including Sustainable Site credit 7.2 "Heat Island Effect: Roof."

A cool Kynar 500® PVDF resin-based pre-painted metal roof can qualify for one point in Credit 7.2 of the Sustainable Sites category if it covers at least 75 percent of the roof surface area (excluding parapets, skylights and equipment) and meets criteria for solar reflectance index (SRI) values.

## Lifecycle and Maintenance

It's important to select and specify a product that can extend or maximize a building's lifecycle. Reducing maintenance time and costs can result in greater efficiency and reduce construction waste associated with renovations.

Kynar Aquatec® PVDF emulsion-based coatings pick up very little dirt, allowing white coatings to stay whiter, achieving total solar reflectance values greater than 0.80, according to Arkema Inc. Kynar Aquatec® emulsion-based coatings also have been reported by the Cool Roof Rating Council (CRRC)

to have initial total solar reflectance and emissivity values greater than 0.85 each.

"The excellent durability of coatings formulated with this emulsion allows for building owners to avoid having to re-coat or spend precious maintenance dollars on their building envelope," Kriner said.

## Energy-Saving Restoration

Coatings based on Kynar Aquatec® PVDF emulsions can be applied in the field to protect metal surfaces with a weatherable fluoropolymer based finish, which enables metal surfaces to be touched-up, repaired or restored, resulting in improved reflectivity. A non-cool metal roof can easily be converted to a white cool roof and, if it is ever removed, it can easily be recycled.

Thus, two key sustainable properties are extending the life of an existing structure with weatherable colored coatings and providing the highest and longest energy savings for a cool white roof coating.

## Air Quality Improvement

In addition to energy reduction, water-based PVDF coatings may help attain the goal of reducing volatile organic compound (VOC) emissions and reduce many harmful chemicals released by many traditional coatings.

Water-based PVDF coatings have garnered greater attention for their contribution to sustainable roofs.



# Coating Technology AND Innovation

Kynar Aquatec® PVDF emulsion-based coatings offer green solutions for a variety of building re-coat and repair challenges

BY JERRY PETERSHEIM AND  
KURT WOOD

The increasing demand for low VOC (volatile organic compounds) and less energy intensive processing has put waterborne coating technologies in the forefront of U.S. building design.

Recent advances have led to the development of waterborne systems based on poly(vinylidene fluoride) (PVDF) polymers or copolymers: a step towards extremely weatherable green coatings. The new technology platform is based upon hybrid latex particles incorporating both fluoropolymer and acrylic resin.

## How Water-Based PVDF Coatings Work

The most commonly used fluorocarbon paints for architectural application are factory-applied, baked coatings based on PVDF resin.

The topcoat systems have proven long-term color and gloss retention with expected lifetimes, in many cases, of 30 years or more. They have been specified by architects — since the mid-1960s — to coat billions of square feet of metal for applications, including roofing, wall panels, window and door frames, and accessories.

However, due to several factors, there is an increased need for water-based coatings with equal or better weatherable performance to restore or recoat these factory-applied finishes. Factors include: the need to refresh or restore the color of aged installations; the desire to change or match building décor; the increased demand for energy savings by converting colored metal roofs to cool white reflective roofs; and the reduced cost of recoating versus reinstallation of coated metal parts.

## Options for Field Repair on Coatings

Field-applied paints over existing painted metal components, whether

Coatings formulated with Kynar Aquatec® PVDF emulsions can now be applied in the field to touch-up, repair, or restore metal surfaces with a highly durable finish.

PHOTO COURTESY OF EER SYSTEMS

for touch up and repair or for restoration purposes, need to have an excellent dry and wet adhesion to the pre-painted substrate. For weathered conventional resins, such as polyesters and acrylics, surface oxidation generally assures that field-applied paints will easily wet the substrate and find plenty of chemical and physical “hooks” on the substrate, which will promote good long-term adhesion.

Lower surface energy coatings, such as fluorocarbons and silicone-modified topcoats, can often be much more difficult to wet, and incompatibility between the resin used in the repair coating and the substrate topcoat resin can often lead to adhesion problems. For these reasons, both silicones and fluorocarbons have been considered as being difficult to recoat.

Another complicating factor, particularly for older buildings, is that the resin chemistry of the old finish that the new coating system must adhere to may not be known. Occasionally, a building manager may be certain what is on the building, but may still be mistaken.

Matching the resin chemistry of the old and new coatings is generally a safe strategy in terms of getting good adhesion, but it is also important in terms of matching the weathering properties of the old and new coatings.

In the case of PVDF-based coatings, one PVDF resin grade for air-dry coatings has been commercially available for approximately 20 years, and the main suppliers of PVDF-based paint have offered color-matched touch up and repair paints based on this product. These solvent-borne air-dry PVDF paints have excellent adhesion to factory-applied baked PVDF finishes and comparable outdoor weatherability when the same pigments are used.

### Water-Based Fluorocarbon Latex Approach

PVDF-based Kynar Aquatec® emulsions look identical to many of the standard acrylic latex products used to make waterborne industrial and architectural coatings, and they are formulated into paints in the same way.

However, their chemical structure is profoundly different. Compositionally, Kynar Aquatec® emulsion products are hybrids. That is, each latex particle contains more than one kind of resin. In this case, the predominate resin is a PVDF copolymer grade, very similar to that used for solvent air-dry coatings.

The goal of the Kynar Aquatec® emulsion approach is to have a water-based product platform with performance features comparable to baked PVDF finishes – not only for long-term color and gloss retention, but also for other properties like resistance to dirt pick-up, chemical attack and staining, resistance to algae and fungal growth, and resistance to erosion and abrasion.

Paints based on the new Kynar Aquatec® emulsion technology show very good adhesion directly to PVDF-based factory-applied coatings, and also to many common types of primers, including epoxies and acrylics.

### Cool Roof Uses

Cool roofs – roofs that efficiently reflect visible and infrared light from the sun and also radiate heat at night – are highly sought-after. One way to achieve high solar reflectivity and emissivity is to apply a white elastomeric acrylic paint to the roof. However, these elastomeric acrylic coatings are



South Florida exposure studies suggest that Kynar Aquatec®-based coatings are expected to retain TSR values over 0.80 for more than seven years.

also known to lose a good fraction of their reflectivity over a period of several years, and they become unsightly due to factors such as dirt pickup, mildew and algae growth, and the migration of underlayer materials through the coating.

Waterborne PVDF-based Kynar Aquatec® technology offers an alternative binder for white roof restoration coatings with vastly improved “stay clean” properties compared to traditional roofing surfaces such as membranes and conventional elastomeric acrylic coatings.

Given their low VOC waterborne character, their excellent outdoor durability and color retention leading to reduced life cycle costs, and their ability to be formulated to cool roof pigments for lasting building efficiency, the new water-based fluorocarbon technology offers green solutions for a variety of building re-coat and repair challenges.



**Left:** Jerry Petersheim is the Kynar Aquatec® business development engineer at Arkema, Inc. **Right:** Dr. Kurt Wood is the Kynar® Coating principal scientist at Arkema, Inc.

# Bright New Surface Highlights Roof Restoration of Stegeman Coliseum

New water-based topcoat provides long service life, resistance to dirt build-up, and cool roof properties

**S**tegeman Coliseum is the home of the University of Georgia basketball and gymnastics teams. Built in 1964, it is also a landmark on the school's Athens, GA, campus because of its unique dome-shaped concrete roof supported by four massive concrete legs.

Recently, however, the normally bright white, 130,000-square-foot roof was dulling as a result of dirt, mildew and other airborne pollutants that were embedding in the roof, to the point that the outline of the roof's concrete deck pattern was telegraphing through.

To help solve the problem, university officials brought in Patrick L. Downey, a veteran of over 25 years in the roofing industry and president of Merik, Inc., a roofing consulting service based in Marietta, GA.

According to Downey, the principal problem was a breakdown of the existing acrylic coating, along with dirt and mildew build up and some minor chalking. There was also damage to flashing systems and the lightning protection system that needed repair.

## Desired Longer Service Life

When it came to the selection of a coating system for the roof restoration, Downey said the primary concern was a desire for a longer service life. The acrylic coatings that had been applied during previous restorations were expected to last five to seven years, but began deteriorating after only two to three years.

"Good compatibility between the new coating and the existing coating was also important," he said. "Thus, as part of our due diligence, we conducted adhesion tests on the roof using a number of coatings that incorporated new water-based technology. We also wanted a coating that was user friendly for the installer and an application process that wouldn't interfere with the operation of the facility."

Selected for use as the topcoat on the coliseum roof was ReflectiClean™ from ER Systems Inc., a single component, waterborne elastomeric coating that provides excellent color retention and fade resistance as well as a 15-year warranty.





## Would Use New Coating Again

Available in eleven standard colors plus custom color matching, the new coating is based on Kynar Aquatec®, a new emulsion-based, low-VOC PVDF fluoropolymer technology developed by Arkema Inc. to deliver the same durability and performance as Kynar 500® PVDF resin-based coatings.

However, rather than requiring high temperature factory baking, coatings based on Kynar Aquatec® cure at ambient temperatures, meaning they can be field applied to a variety of substrates, including metal, PVC, SPF, concrete and wood, and as a finish coat over acrylic basecoats.

"This was our first experience with this coating, and we definitely found it to be an acceptable option for future work," Downey said. "We would have no hesitation using it again, especially in projects that require a high end coating system."

## New Roof Installed in Stages

M. Jordan Roofing, a commercial, industrial and institutional roofing contractor located in Manchester, GA, performed restoration of the roof. According to Mike Hughes, Jordan Roofing's project manager on the coliseum job, the roof restoration involved a number of stages.

"We pressure washed the entire roof first," Hughes said. "Once that was done, we could see which flashings required repair. We also removed areas of old roof coating that had delaminated and filled them by embedding a fabric and covering them with an acrylic coating."

Next, the entire roof was covered with a nine-mil dry thickness of an acrylic coating. The acrylic coating was then covered with two coats of the ReflectiClean™ finish coat. Applied at the rate of one half gallon per 100 square feet, the finish coats totaled seven mils in thickness.

## New Coating Easy to Apply

Hughes reported that this was his first major use of the new topcoat. "We had applied the coating before, but only in small areas and primarily over painted metal roofs," he said. "This is the first time we applied it onto such a large area."

While he noted that this was his first experience with the coating, it probably will not be his last. "From an applicator's point of view, I would use this coating again and recommend it because it was so easy to work with," Hughes said. "It mixed well and sprayed well. Plus, there were no problems with viscosity or color matching. It was very consistent."

He also noted that while the job was not overly difficult, there was an unexpected challenge. "As our crew was applying the new topcoat, the roof surface was so bright,



they had to wear sunglasses just to see where they had applied the coating," he said. "And, not just normal sunglasses, but those with polarized lenses. That's how bright the surface was."

## Exhibits Cool Roof Properties

While the roof's surface brightness presented a minor challenge to the roofing contractor, it was a major benefit to the roofing consultant. Downey notes that because the coliseum was constructed during the sixties, it has minimal insulation. As a result, heat reflectivity of the roof's surface was another important aspect of the project.

"The fact that the new coating is a harder film and more resistant to dirt build-up and mildew will help with the roof's long-term heat reflection, which is important to the ongoing operation of the building," Downey said. "So while the roof of the building does look great aesthetically, it also exhibits a great deal of functionality in terms of its heat reflectivity and cool roof properties."

And, this was not a matter overlooked by the school, because as Downey pointed out, "The University of Georgia is actively involved in cool roof and other sustainability issues, not only with the coliseum, but with other structures throughout its campus."

# COATING TRENDS

Coatings companies looking to achieve outstanding cool white roofing performance are formulating products with Kynar Aquatec® emulsions

BY TOM WATTS

Coatings companies looking to meet ever-increasing market demands for high-performance cool white roofs are recommending Kynar Aquatec® PVDF emulsion-based coatings based on their significant economic and environmental benefits.

Shawn Carney, special accounts manager for United Coatings, said the Kynar Aquatec® formulation is four times more weather resistant than its closest acrylic roof-coating rival.

"The economic model kicks in when you look at its longevity," Carney said. "It may be more expensive to put on at the beginning, but it lasts so much longer, and the return on investment is much greater."

Other benefits he pointed out were not having to reapply the coating, which eliminates transportation back to the job site and fuel costs, along with not having to get back up on a roof for another application.

"With Kynar Aquatec® PVDF emulsions, we are meeting the market trend for high reflective coatings with a premium product," said Jerry Petersheim, Kynar Aquatec® business development engineer at Arkema Inc.

The key property of Kynar Aquatec® PVDF emulsions is color stability in pigmented or white systems. "What that property yields in white systems is a total solar reflectance value," Petersheim said. "Not only does it provide high initial value, but also a high value longer."

As far as replacing a roof, Petersheim noted that it is less expensive to apply a coating. Elastomeric acrylics are cheaper, he added, but they need to be recoated. "Because Kynar Aquatec®-based coatings do not have to be recoated as often, they are significantly more economical when

looking at the life cycle of a roof," he said. "Their carbon footprints are also significantly lower because recoating or replacement is not necessary over the life of the product."

Petersheim added that Kynar Aquatec®-based coatings offer potential benefits within the LEED® rating system since they can be used, for example, in a system where rainwater is collected and reused for agriculture and landscape purposes.

## Self-Cleaning, Smart Coating

Scott Kriner, president of Green Metal Consulting, Inc., and technical director of the Metal Construction Association, said one of the trends for exterior coatings is in self-cleaning technology though special pigmentation. "From an energy point of view, every surface has some level of reflectance," according to Kriner. "There are multiple advantages to keeping roofs and walls clean."

Kriner commented that another trend is the cool roof concept transferring to wall systems.

"Just within the last year, more coating companies have cool wall

coatings technology," he said. "Combine that with self-cleaning and you have a cool surface that will remain cool."

Another trend is in the category of smart or self-healing coatings for surfaces that become scratched or damaged.

Kriner said self-cleaning coatings are going to be more specific for industrial, urban and industrial regions.

## Cool Roofing

Patrick Downey, president of Merik, Inc., was the roofing consultant on the Stegeman Coliseum project at the University of Georgia. He said in terms of cool roofing, the Coliseum is a perfect example because of construction of



"Dirt pick-up resistance, color stability and water

repellency are leaps and bounds better with the Kynar Aquatec® emulsion."

—Shawn Carney, *United Coatings*

the building. "The heat-reflective properties of the coating systems are significant in the operation of the building," he said. "A black surface roof in summer could reach 180 degrees Fahrenheit, but white reflective will never exceed 110 degrees Fahrenheit."

Downey said there was minimal insulation value in this dome assembly. Georgia is warm and white reflective coating was a significant part of using this coating.

"It's a water-based system, so it's easier to work with in the application stage, and cleanup issues are significantly easier since there are minimal VOCs or solvents involved," Downey continued.

### Alkyd Based

Steve Heinje, vice-president of research for United Coatings, said there is a trend towards high technology materials and less material.

"In paint we have moved from vegetable-based resins (alkyd) cut in petroleum solvent to acrylic latex," he said. "The acrylics last longer and no solvent is wasted in application. Kynar Aquatec® emulsion is as advanced compared to acrylic latex as acrylic latex was to alkyd-based paint.

"Roof coatings have moved from asphalt in solvent, to acrylic latex, and now to higher value systems like Kynar Aquatec®."

Heinje said with Kynar Aquatec® PVDF emulsion-based coatings, "white stays white."

"Acrylic elastomers in roofing get dirty, and this limits their long term effectiveness," he said. "Solar reflectivity (energy) and lower overall life cycle cost are the major driving trends in roofing today."

Heinje said Kynar Aquatec® PVDF emulsions give the highest performance available in a water-based format. "This is performance equal to the best solvent based products of the past," he said. "Because the initial cost is high, and the per gallon cost is very high indeed, you have to look at life cycle costs. Once it's looked at that way, the cost issue isn't that different from other high performing products like silicone and urethane or the cheaper low-tech products like asphalt emulsion and aluminized coatings.

"Energy savings from reflectivity is a major issue, and coatings will be able to maximize that benefit due to their

resistance to environmental and biological degradation," he continued.

Heinje said as far as the environment is concerned, Kynar Aquatec® PVDF emulsion-based coating products provide solvent-borne performance in a water-based product. "So the reduction of air pollutants at like performance is the first thing," he said. "Maximizing the energy savings from 'white' is the next best case for the technology."



**"As the industry continues to educate contractors and customers, the market for exceptional products, such as Kynar Aquatec®-based coatings, will improve."**

**—Scott Howard, Commercial Roofers, Inc.**

### Need for Continuing Education

Scott Howard of Commercial Roofers, Inc., worked on the Las Vegas MGM using United Coatings' Kymax® coating, which is formulated with Kynar Aquatec® PVDF emulsions.

"For clients who understand and appreciate the benefits of the Kynar Aquatec®-based coatings, it is often a self-selling product," Howard said. "However, many potential customers do not understand coatings, let alone Kynar Aquatec®."

As the industry continues to improve and educate both the contractors and the customers, the market for premium and exceptional products, such as Kynar Aquatec®-based coatings, will improve, Howard said.

## WHAT ARCHITECTS SAY

A survey conducted by International Communications Research (ICR) found more than 95 percent of architects consider weatherability and corrosion resistance as "critical" or "very important" to specifying, recommending, or approving coatings for metal roof and wall panels. And nearly nine out of 10 of these same architects rated Kynar 500® PVDF resin-based metal coatings as "good" or "excellent" in terms of weatherability and color retention, and said they prefer coatings formulated with Kynar 500® PVDF resins.

In the ICR survey, 57 percent of the architects responded that Kynar 500® PVDF resin-based coatings are important in the performance of today's state-of-the-art cool roofing technology. Cool metal roofs coated with a PVDF-based resin can reduce energy consumption by up to 40 percent as part of a total system design, as reported by the Oak Ridge National Laboratory.

For more information on the survey results, visit [www.kynar500.com](http://www.kynar500.com).



# Green Building Initiatives

## The Role of Coatings in Optimizing Energy Efficiency

BY SCOTT KRINER

In the United States, there are over 100 million homes and 5 million commercial buildings. The building sector of our economy collectively uses 39 percent of the nation's total energy. To a building owner, energy represents the single largest controllable operating expense. Cooling and heating are responsible for approximately one-third of a building's energy usage.

According to Oak Ridge National Laboratory, 17 percent of the energy for cooling and heating is associated with the heat gain and/or heat loss from the roof. And yet, a building's roof is often the least energy efficient component of the building envelope.

as possible and the operation of the building needs to practice energy conservation measures. Once the energy usage has been minimized, the balance of the energy required is generated from renewable energy technologies at or on the building.

It is no wonder that energy efficiency is a cornerstone in many sustainable building initiatives and programs. The green building design covers the construction, operation and re-use or removal of the built environment in an energy-efficient and sustainable manner. According to McGraw Hill Construction, more than 75 percent of the architecture/engineer community is now involved in some way with green building.

One way to improve the energy efficiency of a roof is to install a cool roof. A cool roof can significantly reduce the cooling and heating energy use in a building. In addition to saving energy on an annual basis, a cool roof can help to reduce the peak electricity demand often seen during the afternoon hours of a summer day. By keeping the peak demand below the maximum power available on the grid, interruptions in power can be avoided. For that reason, utility companies have become interested in cool metal roofing and offer rebates for the installation of a cool roof.



PHOTO COURTESY OF ER SYSTEMS

Coatings formulated with Kynar 500® resins or Kynar Aquatec® PVDF emulsions easily pass the most stringent cool roofing standards.

### Green Initiatives

There are many green building initiatives or certification programs in the marketplace. But many of today's building designers are looking beyond simply certifying a green building. Instead, they are finding ways to design a building to be off the grid through net zero energy or near zero energy operation. To accomplish this, the building assemblies need to be as energy efficient

### Urban Heat Island

From an environmental point of view, cool roofing can also help to mitigate the effects of urban heat island. This is a phenomenon where warmer air temperatures are seen in urban areas because of the abundance of non-reflective roadways, parking lots, and roofs, combined with less vegetation. The dark surfaces absorb more solar energy and remain warm, causing the air that moves over the surface to become warmer as well.

Metropolitan areas can be 6 degrees Fahrenheit to 12 degrees Fahrenheit warmer than the surrounding suburbs because of the urban heat island effect. The warm air also poses a potential risk to the health of the inhabitants due to smog formation.

Heat is a catalyst in the formation of smog from NOX gases. Research at the Lawrence Berkeley National Laboratory has shown that replacing the dark low slope roof surfaces in metropolitan areas with cool roofs can lower the ambient air temperatures, help to alleviate the urban heat island, and improve air quality.

## Cool Roofing Defined

Cool roofing is defined differently in specific codes, standards and incentive programs. A cool roof is characterized by its solar reflectance and thermal emittance properties. Generally speaking, a cool roof is one that has relatively high solar reflectance and high thermal emittance.

During the daylight hours, a roof is subjected to solar energy striking its surface. The term “solar reflectance” is a measure of the amount of the solar electromagnetic energy that is immediately reflected from the surface. Solar reflectance is reported as a decimal (0 – 1.00) or as a percentage (0 percent to 100 percent).

A general rule of thumb, according to Lawrence Berkeley National Laboratory, is that for every one-point increase in solar reflectance, the surface temperature decreases by 1 degree Fahrenheit. The solar energy that is not reflected from the surface of a roof is absorbed into the outer surface and is converted into heat. The heat can be removed by convection as air flows over the surface. It can also be conducted through the roof material into the sheathing below. The remaining energy can also be re-emitted to the night sky in the form of infrared energy. The measure of that re-emitted energy is referred to as thermal emittance, which is also expressed as a decimal (0 – 1.00) or as a percentage (0-100 percent).

## Energy Efficiency

The radiative properties of cool roofing reduce the amount of heat transferred into the living space or attic below the roof, which in turn lowers air conditioning costs and electricity production at the utility. A reduction in energy consumption has a direct effect on the amount of greenhouse gases being emitted at a fossil fuel fired power plant.

Studies have shown that a cool roof can save a building owner as much as 20 percent in their cooling energy costs.

Many roofing systems are Energy Star® labeled and meet other cool roof requirements in state and national codes and standards.

Oak Ridge National Laboratory ([www.ornl.gov](http://www.ornl.gov)) has developed online calculators that estimate the energy savings of cool roofs compared to dark conventional roof products. The data from these calculators can give an indication of the savings that are possible with cool roofs. However, the real proof of how a cool roof can save energy is based on actual installations.

## Field Demonstrations

There are real-world case studies that demonstrate cool metal roofing's ability to save money on cooling and heating bills. A Georgia school district constructed two identical 90,000-square-foot schools and maintained the schools' thermostat settings at the district office.

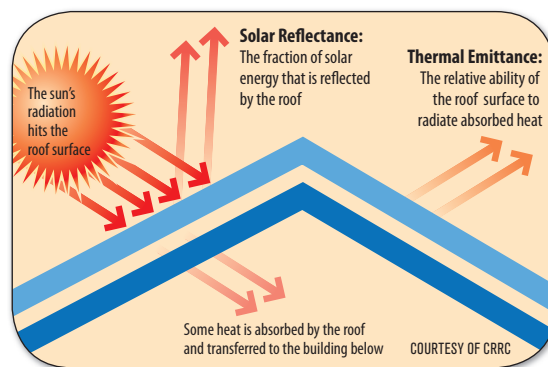
The construction of the schools was identical except for the type of roof. On one school, a metal roof from Architectural Metal Systems was installed with a Hunter Green 70 percent Kynar 500® resin-based paint system with a solar reflectance of 0.12.

On the second school, a metal roof was installed with the same color but the 70 percent Kynar 500® resin-based paint system featured special pigments in the paint system that increased solar reflectance to 0.29. After the first year of operation, the school district showed an \$8,000 savings in cooling/heating utilities at the school with the cool pre-painted metal roof.

## Reflective Coatings

The use of reflective coatings formulated with Kynar 500® PVDF resin or water-based Kynar Aquatec® PVDF emulsions are very effective in retaining the initial solar reflectance of a painted metal roof. Their resistance to fade and degradation from the weather provides a building owner with a sustainable and long-lasting cool roof.

This makes cool roofing an energy efficient product and one that is an integral part of any building's sustainable design. For more information, visit my blog at [www.kynar500.com](http://www.kynar500.com).



*Scott Kriner is President of Green Metal Consulting, Inc. He is the technical director of the Metal Construction Association, and also is a consultant for manufacturers and suppliers of metal roofing and wall systems.*

# Cool Roof Tops Off Environmentally Friendly Cold Storage Facility

7.5 Million-cubic-foot facility expected to be nation's first LEED-NC Gold certified cold storage building

Compared to commercial buildings, attaining LEED® certification for an industrial building is not easy, as evidenced by the fact that only 2 percent of all Leadership in Energy and Environmental Design for New Construction (LEED-NC) registered buildings are designated as industrial.

However, that did not deter Innovative Cold Storage Enterprises (ICE) of San Diego, CA. The firm recently completed a huge, new facility that is expected to be the nation's first LEED-NC Gold certified cold storage building.

Included among the environmentally responsible features of the new facility is an energy-conserving cool roof that reduces refrigeration loads by preventing heat from penetrating the interior of the building.



### New Topcoat Used on New Facility

Designed and built by Hamann Construction of San Diego, the facility, known as ICE-2, houses 7.5 million cubic feet of freezer space. It is the second cold storage facility built by Hamann for Innovative Cold Storage. The first — ICE-1 — was constructed in 1998.

The roof on ICE-2 consists of 2 inches of sprayed polyurethane foam over 6 inches of rigid polystyrene insulation over a 1½-inch high fluted steel deck, which

produces a thermal insulation value of R-42. A polyurea vapor barrier was then applied followed by an acrylic coating and finally a white fluoropolymer topcoat.

The ICE-2 roof construction is essentially the same as ICE-1 except for the topcoat. "On ICE-1, the finish coat is an acrylic coating onto which roof granules were broadcast," Hamann project architect, Paul Giese, said.

### Wanted Longer Life Expectancy

Giese said on ICE-2, "We wanted a finish coat that had a longer life expectancy and much higher solar reflectivity, not only to comply with California Title 24 cool roof requirements, but also to provide long-term energy savings."

Chosen as the topcoat on ICE-2 was Kymax®, a thin-build elastomeric coating from United Coatings Corporation that provides high initial and aged solar reflectance, color stability, and weather resistance over new or existing roof surfaces.

Available with a 20-year warranty from United Coatings, the coating is based on Kynar Aquatec®, a new emulsion-based, low-VOC PVDF fluoropolymer technology developed by Arkema Inc. to deliver the same durability and performance as Kynar 500® PVDF resin-based coatings.

### Solar Reflectance a Key Concern

With solar reflectance and thermal emissivity values greater than 0.85 each, Hamann LEED project administrator, Phoebe Hamann, noted that the bright white Kymax® topcoat not only complied easily with Title 24, but also generated an extremely high SRI of 110 for use in LEED credit calculations.

Hamann also noted winds from the Pacific Ocean deposit a considerable amount of dirt onto the roof surface. However, the topcoat's ability to shed dirt allows it to remain white, a key factor in the coating's ability to retain its solar reflectance over time.

# Renowned Chicago Synagogue Looks Up To New Weather-Resistant Roof

New water-based topcoat a key element in re-roofing of landmark house of worship

**M**ost religious sanctuaries in the United States have been built in a classical style, often characterized by columns and buttresses. One extraordinary exception to this classical norm is the North Shore Congregation Israel, a Jewish synagogue near Chicago, IL.

Formed from concrete columns that soar to more than 50 feet in the air, this synagogue is like no other in its distinctive appearance. The structure's unique design makes its roof a fragmented array of varying angles and slopes made all the more complex by an abundance of skylights.



### New Type of Topcoat Applied

Most of the roof consists of spray polyurethane foam (SPF) insulation and numerous layers of protective coatings that were applied years ago. Recently, the roof began to experience leaks, and synagogue officials opted to replace the failing system with a similar combination of SPF foam and protective coatings.

One difference, however, was the use of a different type of finish or topcoat to cover the roof. Instead of an acrylic topcoat like that applied in the past, Kymax®, a new elastomeric coating by United Coatings Corporation, was selected.

Kymax® is a thin-build coating that provides color stability, resistance to dirt build-up, and weather resistance. It is based on Kynar Aquatec®, a new emulsion-based PVDF fluoropolymer technology developed by Arkema Inc. that provides the same durability and performance as Kynar 500® PVDF resin-based coatings.

However, unlike factory-applied Kynar 500® resin-based coatings, coatings based on Kynar Aquatec® cure at ambient temperatures, meaning they can be field applied to a variety of substrates, including metal, PVC, SPF, concrete and wood, and as a finish coat over acrylic basecoats.

Available with a 20-year warranty from United Coatings, Kymax® features a low-VOC formulation that made it ideal for North Shore Congregation Israel, where exodus during the application was not possible.

Another benefit of the coating is the potential energy savings created by its ability to resist dirt pick-up, biological growth and other external factors that reduce the reflectivity of traditional roofing materials.

### Pleased with New Topcoat

Insulated Roofing Contractors (IRC) of Louisville, KY, handled the re-roofing project. "This was the first time we used the Kymax® coating and were pleased with its application and the end result," said Jim Kaiser, IRC's senior project manager.

"And, we believe it will rise in popularity as more and more environmentally friendly building codes are implemented across the country," he adds.

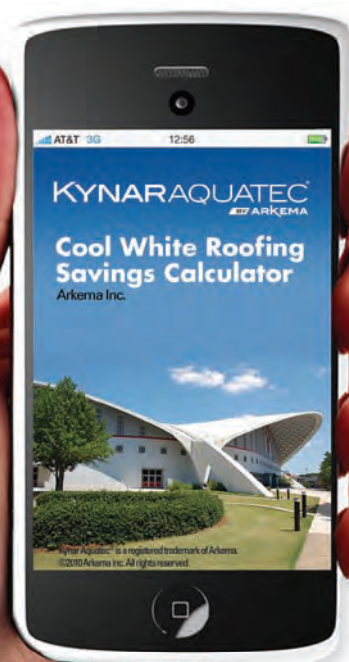
When the time came to begin work, IRC separated the roof into four sections, completing one area before moving to the next. The process included removal of the old SPF and coatings, installation of new SPF insulation over the exposed concrete roof deck, application of two layers of acrylic base coatings and then two layers of Kymax® finish coats.

# CHOOSING THE RIGHT COOL WHITE ROOF COATING CAN **REDUCE YOUR ENERGY COSTS UP TO 63%.**

Stegeman Coliseum completed in May 2008

Over time, cool roofs made with Kynar Aquatec® PVDF resins are up to 63% more energy efficient than those made with acrylic-based coatings.<sup>1</sup> And that translates directly to a 63% reduction in CO<sub>2</sub> greenhouse gas emissions. Added together, they help lessen the urban heat island effect and slow the rate of global warming.

Kynar Aquatec® PVDF resins help cool roofs stay whiter longer, significantly reducing weathering and dirt pickup. They start out roughly the same, but in a three-year Cool Roof Rating Council study, Kynar Aquatec®-based coatings retain a minimum total solar reflectance value of 0.77 while acrylic-based coatings can drop to 0.55<sup>2</sup>! The result is sustainable reductions in energy consumption and CO<sub>2</sub> emissions.



## KYNARAQUATEC® BY ARKEMA

### Cool White Roofing Savings Calculator App for iPhone & DROID

The Kynar Aquatec® Cool Roof Energy Savings Calculator enables building owners, architects and industrial designers to calculate the potential Cool Energy Savings for a Kynar Aquatec® cool white roof vs. elastomeric acrylic.

[www.KynarAquatecSolution.com](http://www.KynarAquatecSolution.com) [www.arkema.com](http://www.arkema.com)



<sup>1</sup> Derived from a study published by Lawrence Berkeley National Laboratory on energy savings and greenhouse gas reduction.<sup>2</sup> The T.S.R. values of 0.77 are three-year test data certified by the Cool Roof Rating Council.

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