Taking cool to the next level

Heat-deflecting technologies aren't relegated to the roof, as coatings makers, users look to capitalize on new applications

Passing the test

Allen Zielnik
Atlas Material Testing Technology LLC

(Above): A cool-wall stucco and coating system, iSTUCCO™ from Superior Products International, was used on these condominiums in Austin, TX. Photo courtesy of Superior Products International.

The selection of *JAC*'s "Top Green Coatings Picks," a highlight of the May 2008 edition of this journal, presented a stern challenge to the publishers and editors, thanks to the quantity and quality of the great projects entered. One aspect of this report that stood out as signaling more than just a fleeting flavor of the month in building and design, however, was the use of coatings to contribute to energy efficiency.

While many notable reflective and other "cool-roof" technologies were showcased in the "Top Green Picks" report, the use of coatings to extend this energy-efficiency boost to the entire building envelope emerged as a significant theme. While *JAC*, and this column, have extensively covered cool-roof coatings issues, it makes sense to examine how energy-efficient wall coatings can also provide value.

While the "energy management philosophy" of the past century has emphasized thermal insulation and R-value, current practice is increasingly looking to methods to manage, or block, heat transfer into the building.

It's relatively easy to envision how a low-slope reflective roof, bombarded much of the day with intense sunlight, would provide cooling-energy savings in hot climates, but the picture is not so clear with walls. After all, the walls of buildings generally are oriented to the various compass directions. In the Northern Hemisphere, south-facing exposures receive more direct radiation from the sun, while northern walls do not. East-facing facades see the morning sun, while western walls receive powerful afternoon sunlight during the hottest part of the day. So, are "cool wall coatings" capable of delivering significant reductions in cooling-energy demand? And are these coatings, which are more expensive than traditional coatings, needed on all four sides? Or three? Or perhaps just one side?

Roughly 51% of the energy in solar radiation exists in the infrared portion of sunlight, with about 43% contained in the visible portion and the remainder present in the ultraviolet spectrum. The solar reflectance of conventional black paint is only about 5%, while white paint boasts reflectance of around 80% (a mirror's reflectance is about 95%). As a result, lighter building colors reflect more solar radiation, and therefore reduce heat energy more than darker colors do. That's one reason why white reflective roofs can save cooling costs in hot climates (but can increase cold-climate winter heating costs when that extra heat would be welcome).

Thus, based strictly on solar reflectivity, a reflective wall coating facing north would be of little benefit since it doesn't receive significant direct solar radiation. And a reflective eastern façade would exert only minimal effect in the relative cool of the morning. Southern and western exposures, on the other hand, could have a significant impact due to greater exposure to solar heating.

Then there's the issue of appearance and aesthetics. Certainly, reflective white roofs have become commonplace on many commercial, industrial, and institutional buildings. But color is a much more important consideration with exterior facades. The good news is that,

as is the case with roof coatings, a variety of special infrared-reflective pigments in a range of colors can be used to formulate heat-mitigating wall coatings.

New directions for the technology

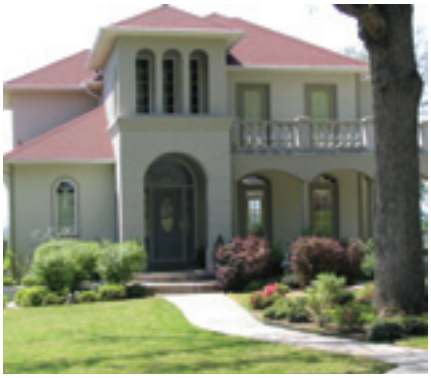
While colored "cool coatings" have been offered for field-applied applications for some time, a more recent development is the formulation of factory-applied finishes for façade panels or metal extrusions used in curtain wall systems, and for awnings, shutters, and other exterior building elements.

An example is Valspar's new Flurospar® SR enhanced solar-reflective fluoropolymer coating for aluminum extrusions and wall panels. This product, which contains IR-reflective ceramic pigments and is available in a variety of colors, has been shown to reduce building-envelope temperature, even in dark colors. Because it is based on fluoropolymer technology, the product is expected to retain gloss and color for an extended lifetime, which promotes sustainability by minimizing field maintenance and emissions of VOCs (volatile organic compounds) that result from frequent repainting. Even more traditional field-applied exterior cool-wall coatings are reported to increase paint-job lifecycles by 50% to 100%, further contributing to sustainability and maintenance savings as well as energy efficiency.

As is the case with cool-roof technologies, solar reflectance is important, but is not the only property required for wall coatings that are designed to reduce cooling-energy demand. Also significant is the property known as thermal emissivity, or the ability to re-radiate heat to the environment (heat flows from higher to lower concentration). A coating with a high level of emissivity dissipates heat to the atmosphere rather than passing it along to the building interior. Thus, in hot climates, exterior coatings with both a high level of solar reflectance and high thermal emittance are needed (both expressed on a 0 to 1.0 scale, or sometimes as a percentage—0-100%—with higher values being better).

While such exterior coatings can provide

substantial cooling cost benefits in hot climates, particularly when paired with cool roofs as part of a building-envelope solution, the use of the coatings for interior applications should not be overlooked. When applied to the inside surfaces of exterior walls, energy-efficient coatings reflect and re-emit heat back into the room rather than passing it to the outside, an important advantage in cold climates with high heating costs. Using coatings such as these on both the exterior and interior of walls can provide summer cooling and winter heating efficiencies in cold climates. Products such as Sherwin-Williams E-Barrier™ Reflective Coating are designed to be applied to the inside of roof decks, and can complement cool-wall coatings as part of a building-envelope system.



Superior Products International's SuperTherm® cool-wall coating was applied to the exterior of this home in Little Rock, AR. Photo courtesy of Superior Products International.

An additional factor that allows coatings to contribute to energy efficiency is their role as moisture and air barrier. In winter, it is estimated that as much as 40-50% of a building's energy loss is the result of air moving out of the building, much of it through leaks. Conversely, moisture ingress is a major factor in lowering wall and roof insulation R-values. The use of breathable, moisture-resistant coatings can significantly improve energy efficiency, even when using products without special energy-saving formulations that provide reflectivity and emissivity.

Browsing the growing cool-wall marketplace

A good example of the kind of multiple functionality that these types of coatings can deliver is seen in one of the top five selections in the "Top Green Coatings Picks" report in the May *JAC*—the Bel Air Condominium project in Austin, TX. Here, the developer, specializing in contemporary, green, environmentally conscious, and energy-efficient new construction, selected Superior Products International's SuperTherm® high-reflectivity, high-emissivity, one-component acrylic/urethane elastomeric coating for testing on the exterior sidewalls of several condominium buildings. The coating is formulated to limit moisture penetration and air infiltration as well as reduce heat load. By incorporating four different ceramic-type materials, the coating is said to block 95% of the solar radiant heat.

The coating was applied in the summer of 2007. The interior temperature of the condominium building was then consistently more than 11F lower than before coating. Subsequently, the developer selected Superior's iSTUCCO™ System for the project's Phase II construction. Superior's iSTUCCO™ System consists of a ceramic-containing stucco and SuperTherm topcoat . The company's product portfolio includes HSC, a coating product that contains a blend of seven ceramic materials. The HSC coating can be applied to the inside of roof decks to reduce attic temperatures by blocking heat transmission through the roof into the attic.

Superior Products International provides extensive performance data on field-applied products. For example, tests for Vodafone in Turkey on outdoor telephone shelters documented a 52% reduction in air-conditioner energy use. A coating application to a cement-block apartment building near Munich, Germany, resulted in a 76% decrease in the heat energy loss passing through the outer wall, thus saving considerable heating costs and avoiding expensive thermotechnical reconstruction to meet new European EnEv energy regulations.

A number of heat-reflective and emissive

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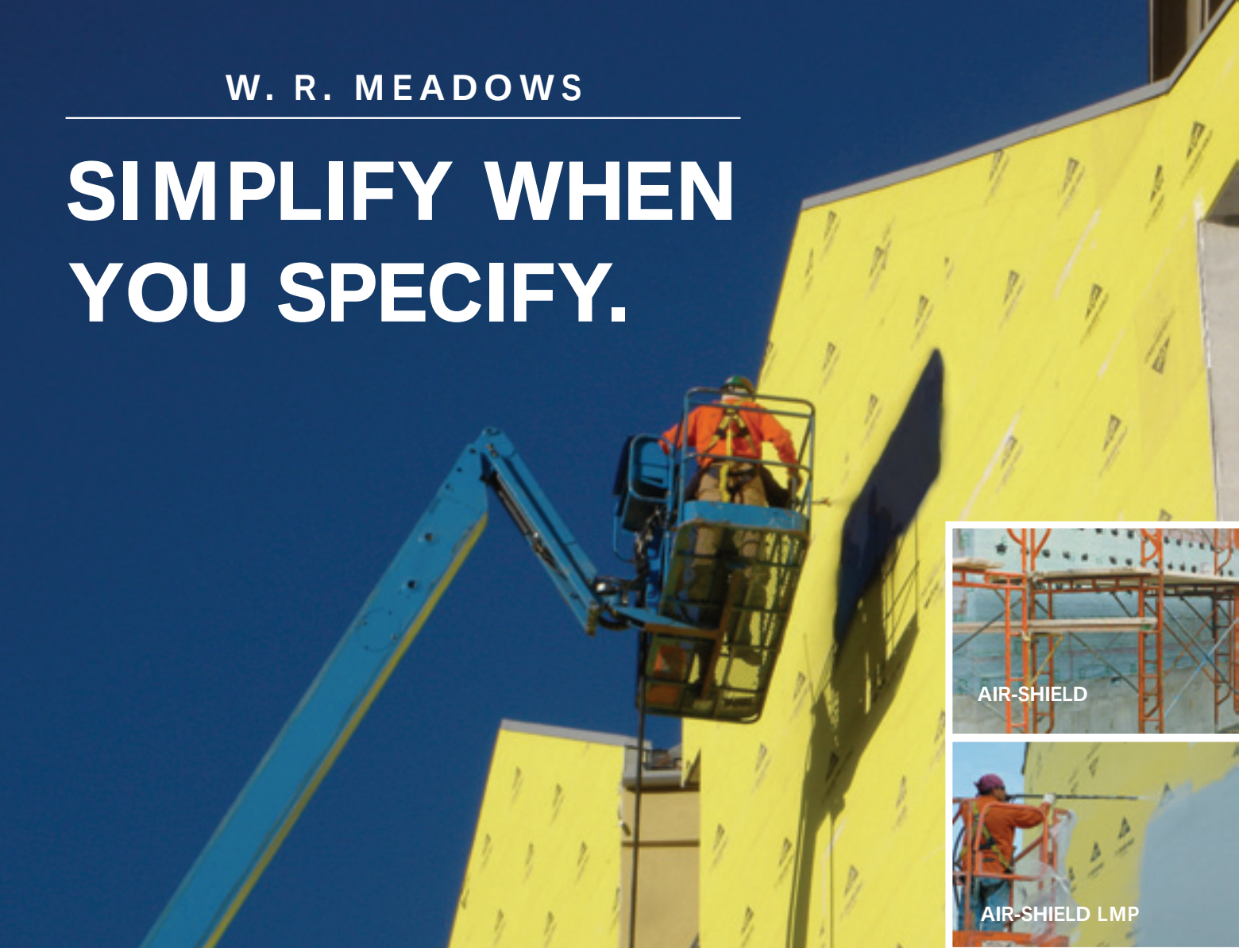

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pigments and materials are being used by various coatings manufacturers, and the performance of specific technologies identified as "ceramic" or "mixed metal oxide" should not be extrapolated to apply to all products. As actual energy savings are highly dependent on the individual building structure, local climate, and total building envelope, as well as the product formulation, and with few standard tests or practices to reference, it is strongly recommended that the specifier, contractor, or building owner solicit and evaluate any field performance data available from the prospective supplier.

Also in the category of "cool-wall" technologies in the *JAC* Top Green Coatings Picks report was the 1080 Chestnut Street Association Condominiums in San Francsico, where Ultimate Coatings Company's Thermo-Seal™ 1500 product was applied to the exterior walls. This solar IR-reflective non-elastomeric acrylic coating, which incorporates mixed metal oxide pigments, was applied over an epoxy primer to provide a moisture-proof but breathable, dirt- and mildew-resistant surface with a 12-year durability warranty.

Yet another Top Green Coatings Pick entry was the project involving a Kohl's Department Store in Panama City, FL. Here, Textured Coatings of America's TEX-COTE® COOLWALL® IR-reflective coating was applied to the exterior over a textured primer also supplied by Textured Coatings. The IR-reflective coating also can stake a claim to fairly extensive third-party test data to support the company's assertions of energy-efficiency contributions. Oak Ridge National Laboratory, a federal institution whose work was cited in this column in the June-July issue regarding dirt retention and efficiency loss of cool-roof coatings, also tested TEX-COTE COOLWALL and substantiated that the product could reduce cooling-energy costs by 4.2% to 21.9%, depending on climate and other factors.

Also an example of this type of cool wall technology is EnviroCoatings' (Canada) Ceramic InsulCoat thermal-barrier coating. The first coat of this two-coat, 100% acrylic waterborne system dries to the touch in 15 to 30 minutes, allowing the second coat to be applied two hours later. Tinting to any color is possible for exterior walls, with lighter shades for roof applications. The product contains Cerylium, a proprietary formula of 23 ingredients that provides a thermal barrier to restrict heat movement through walls. The product can be applied as a clear coat to brick masonry and stucco, which allows upgrading of energy-inefficient brick structures without changing their appearance. The company

Restoration vs. Replacement: A Matter of Planning

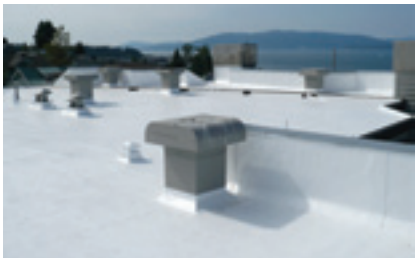
The time for building owners to decide between roof replacement and restoration is long before the leaks and other damage have started. "A good maintenance program means that building owners seldom have to think about their roofs," explains J.K. Milliken, vice president and general manager of Medina, Ohio-based Republic Powdered Metals, Inc.

Restoration-Based Planning

Roof restoration is more economical than replacement, easier to install and less disruptive to business. "We handle restoration coating projects for substrates including metal, BUR, modified bitumen, weathered single ply, foam and concrete," Milliken says.

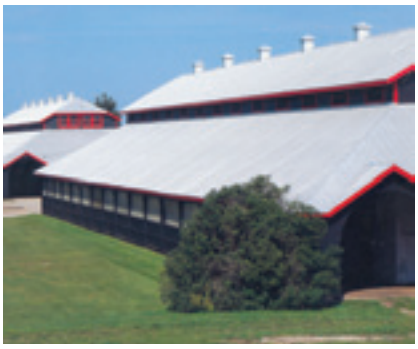
Restoring roofs has many advantages over replacing them:

- **Substantial time and labor savings for installation.** Installations can be scheduled quickly, usually use smaller work crews, and are completed in a matter of days, Milliken says.
- **Safe, easy application on most roofs.** Republic coatings can be applied by roller, brush or spray equipment with little or no disruption to business.
- **Sustainable initiatives supported with environmentally-friendly solutions.** Because the roof is not removed, there is no waste for landfill and no landfill fees incurred. And Republic's GEOGARD®, SOLARGARD® and ALUMANATION®, 301 coatings offer substantial energy savings by reflecting the solar heat – even in moderate climates.
- **Superior product performance.** Restoration coating updates and can completely change the look of a facility. In addition, Milliken said, "most of our coatings offer warranties ranging in length from 5 to 12 years, so it's possible to restore the roof and then simply maintain it."
- **Significant cost savings.** Savings can be realized in the direct comparison between removal and replacement of the roof versus repair and coating; in the long-term costs for roof life cycle; and in the development of regular maintenance budgets.

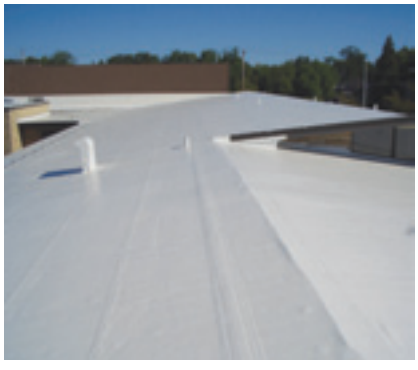


Windermere Condo Assoc., Bellingham, WA (GEOGARD®)

Naples Philharmonic, Naples, FL (SOLARGARD® 6083 and SOLARGARD® Acrythane)



Hamburg Place, Lexington, KY (ALUMANATION® 301)



Stevens Point Schools, Stevens Point, WI (GEOGARD®)

About Republic Powdered Metals, Inc.

Established in 1947 and based in Medina, Ohio, Republic Powdered Metals is a pioneer of reflective roof coatings, and was the founding company of RPM International Today Republic Powdered Metals is a leader in the roof coatings and restoration industry, with innovative products that offer long-term performance and energy savings.

Republic Powdered Metals offers a wide range of roof coatings for restoration purposes:

- GEOGARD®
- ALUMANATION® 301
- SOLARGARD® Ultra
- SOLARGARD® 6083
- SOLARGARD® Hy-Build
- PERMAROOF®
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says customers report energy savings of 30–50% after application.

Getting a payback on the investment

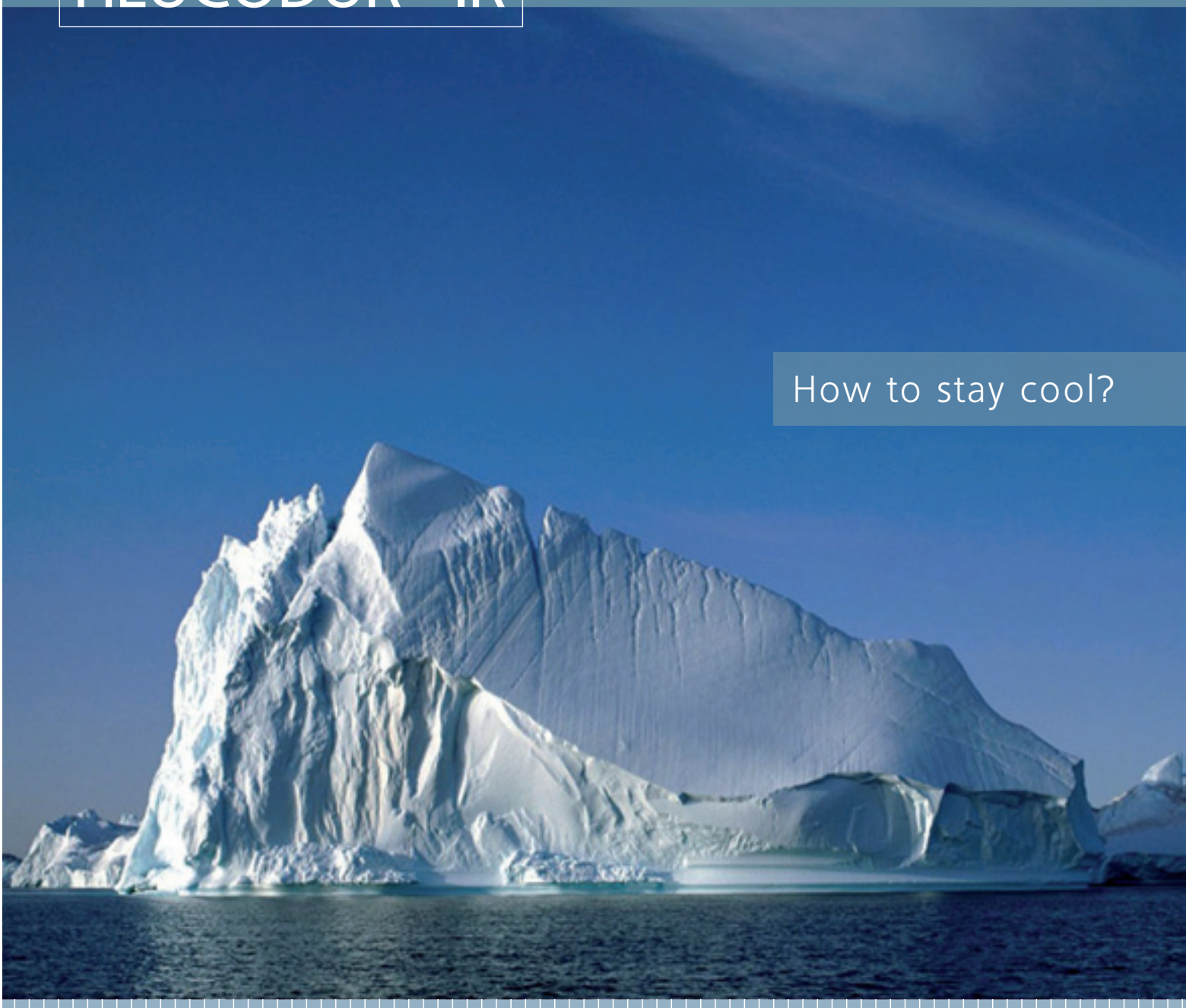
Clearly, a variety of energy-saving wall-coating products and systems have entered the marketplace for commercial and residential structures, both new and existing. Many of these products are compliant with local, regional, or national environmental or other regulations, and are also tested or certified to meet various standards such as the LEED rating system, the Cool Roof Rating Council rating system, GreenSeal, and others. A number of different chemistries are employed to meet both energy-management functionality and important coatings characteristics and properties, and the performance of these products in this regard should be evaluated for the specific application.

Some guidelines are as follows.

- The coating must be appropriate and provide sufficient durability for the intended use and substrate. This dictates the selection of coating chemistry type, such as acrylic, acrylic/urethane, or other, and whether the coating should be elastomeric (high elongation and flexibility) or non-elastomeric. If the coating delaminates or degrades quickly, it doesn't matter how energy efficient it might be.
- Where appropriate, the coating must meet aesthetic requirements. Some products come with a limited color palette—earthtones only, for example—or a narrow range of gloss.
- Energy efficiency and savings will vary with climate, making performance data based on extensive testing highly valuable. Short of this type of test data, customer testimonials on the product for the given location or climate should be sought.
- The whole building envelope should be considered in determining the role played by energy-conserving coatings. This process should begin with the biggest energy liability, the roof, followed by the walls. Great coating reflectivity and emissivity numbers won't do much for a leaky or drafty building, meaning that the use of waterproofing, air/vapor barriers, or other measures to make the building water- and air-tight should constitute integral steps in this holistic approach.
- It is wise to gain an awareness of local codes, restrictions, incentives, and rebates that involved the energy efficiency of buildings.
- Don't forget to savor your results when the utility bill arrives, and consider reinvesting the savings in other energy-reduction steps.

JAC

HEUCODUR® IR



How to stay cool?

Heubach's new HEUCODUR® IR pigments exhibit the unique property of being able to reflect IR radiation therefore exhibiting significantly reduced heat build-up as compared to conventional pigments. Using HEUCODUR® IR pigments in coatings and plastics offers economical and ecological advantages, such as:

› Cooler interiors thus allowing for energy savings

› Less degradation of the polymer matrices leading to improved product durability

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We look forward to being able to provide you with more detailed information.

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