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ABOLIN CO

Cool Barrier Technology and Photovoltaic Roof Systems Applications Guide

Cool Barrier Technology Applications

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Introduction

Cool roofs can help many building owners save money while protecting the environment. If you are planning a new building or replacing or restoring an existing roof, cool roofs should be considered as an energy efficiency option. Cool roof products exist for virtually every kind of roof.

Just as wearing light-colored clothing can help keep a person cool on a sunny day, cool roofs use solar-reflective surfaces to maintain lower roof temperatures. Traditional dark roofs can reach temperatures of 150ºF (66ºC) or more in the summer sun. A cool roof under the same conditions could stay more than 50°F (28ºC) cooler.

Why Use Cool Roofs

A cool roof can be desirable to a building owner for several reasons. Cool roofs can reduce energy bills by decreasing air conditioning needs, improve indoor thermal comfort for spaces that are not air conditioned, and decrease roof operating temperature, which may extend roof service life.

In many cases, cool roofs cost about the same as non-cool alternatives. The energy cost savings you can realize from a cool roof depends on many factors, including local climate; the amount of insulation in your roof; how your building is used; energy prices; and the type and efficiency of your heating and cooling systems.

Cool roofs can also benefit the environment, and policymakers may issue cool roof regulations to provide these benefits to society. Cool roofs can reduce local air temperatures, which improves air quality and slows smog formation; reduce peak electric power demand, which can help prevent power outages; reduce power plant emissions, including carbon dioxide, sulfur dioxide, nitrous oxides, and mercury, by reducing cooling energy use in buildings; and reduce heat trapped in the atmosphere by reflecting more sunlight back into space, which can slow climate change.

What Is a Cool Roof

Cool roofs are roofs that are designed to maintain a lower roof temperature than traditional roofs while the sun is shining. Sunlight is the primary factor that causes roofs to become very hot.

How Cool Barrier Technology Works

Cool Barrier Technology creates surfaces that reflect sunlight and emit heat more efficiently than hot or dark roofs, keeping them cooler in the sun. In contrast, conventional roofing products absorb much more solar energy than cool roofs, making them hotter.

Since most dark roofs absorb 90% or more of the incoming solar energy, the roof can reach temperatures higher than 150°F (66ºC) when it's warm and sunny. Higher roof temperatures increase the heat flow into the building, causing the air conditioning system to work harder and use more energy in summertime. In contrast, Cool Barrier Technology can create surfaces that absorb even less than 10% of the solar energy, reducing the roof temperature and decreasing air conditioning energy use.

Solar reflectance and thermal emittance are the two key material surface properties that determine a roof's temperature, and they each range on a scale from 0 to 1. The larger these two values are, the cooler the roof will remain in the sun.

Solar Reflectance is the fraction of sunlight that a surface reflects. Sunlight that is not reflected is absorbed as heat. Solar reflectance is measured on a scale of 0 to 1. For example, a surface that reflects 55% of sunlight has a solar reflectance of 0.55. Most dark roof materials reflect 5 to 20% of incoming sunlight, while light-colored roof materials typically reflect 55 to 90%. Solar reflectance has the biggest effect on keeping your roof cool in the sun.

Thermal Emittance describes how efficiently a surface cools itself by emitting thermal radiation. Thermal emittance is measured on a scale of 0 to 1, where a value of 1 indicates a perfectly efficient emitter. Nearly all nonmetallic surfaces, have high thermal emittance, usually between 0.80 and 0.95, that helps them cool down. Bare, shiny metal surfaces, like aluminum foil, have low thermal emittance, which helps them stay warm. A bare metal surface that reflects as much sunlight as a white surface will stay warmer in the sun because it emits less thermal radiation.

Cool Barrier Technology creates surfaces which are characterized by very high solar reflectance and infrared emiitance values.

Photovoltaic Roof Systems

Photovoltaic roof systems are a passive renewable energy source for converting sunlight into electricity. The generation of electricity from photovoltaic effect based technology is possible through the interaction of sunlight with certain “doped” semi-conductor materials. Electrons are released from these materials resulting in a current. That direct current is then converted to alternating current with an inverter, and provides electricity to power the building. The basic building block of PV technology is called the “solar cell”

Photovoltaic Roof Systems, Solar Reflectance and Energy Generation

A white reflective roof can significantly reduce the cooling load placed on a commercial building by reducing the solar heat gain. When a photovoltaic system is installed on such a roof, 75% or more of the roof surface may be covered with a product that can have a lower solar reflectance than the roof surface. The lower reflectance value results in a higher solar heat gain, and creates a “penalty” in the cooling load of an otherwise cooler roof. However, the photovoltaic system is itself converting solar energy into electricity.

The actual net power balance generated by an installed PV system is affected by the overall integrity of the roof, the size and efficiency of the PV system, the local climate conditions (driving total solar irradiance), and the wind conditions. When a PV system is installed over a very light colored roof (higher SR), there will be an added cooling load due the darker color of the PV surface and lower solar reflectance compared to the high-reflectance roof. However, when installed over a dark colored roof, the PV system will actually improve the thermal performance of the roof by providing a higher solar reflectance over the PV system’s covered area. When installing PV product over a painted metal roof surface, the thermal emittance (TE) of both surfaces may be similar.

New PV systems technologies such as Solyndra’s cylindrical PV panels and Sanyo’s Double Hit Double Bifacial, which can generate electricity not only from their front side but also from its rear side because of their unique structure are ideal for applications where energy generation and energy efficiency are both of great concern for the building owners. Real applications have shown that in such a case the annual energy yield could increase up to 26% compared to standard PV modules applications and the simultaneous use of a cool roof.

Photovoltaic Roof Systems and Cool Roofs

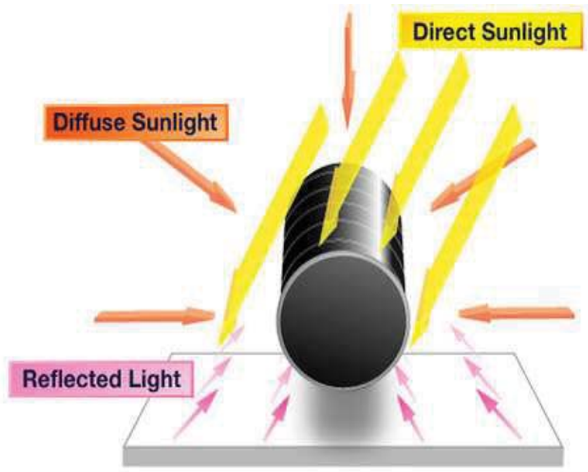
Most homes and buildings in warm climates have been built with what today is considered to be inadequate insulation, low efficiency HVAC systems, and poorly placed ducts. While these "deficiencies" could be addressed individually, on many buildings the roof has been designed to be replaced on an almost regular basis. As such, a Cool Roof may be one of the most cost-effective conservation measures which can, to a large extent, ameliorate many of the effects of "poor building practice". The need for re-roofing of existing buildings is also a great opportunity for PV application, which is also primarily installed on existing structures.

Cool Roofs Economics

Roof cost should be evaluated using a lifecycle approach. This means taking into account the upfront costs as well as the ongoing savings and expenses incurred throughout the roof's service lifetime. Other non-cost considerations are shown in Table 1. Roof lifetime, expected maintenance (regular roof inspections, repairs, and recoatings), disposal, and replacement costs should be evaluated for each viable roof option.

Table 1: Non-cost Considerations

FACTOR	NOTES
Voluntary Programs	In some regions, cool roofs are required by legislation, but there are also voluntary programs which encourage the use of cool roofs
Comfort	The use of cool roofs maintain cooler indoor temperatures
Durability	Cool roofs may degrade slower and last longer than similar non-cool roofs
Maintenance	A cool roof needs not more cost for maintenance than a non-cool roof.



How Much More Cool Barrier Coating Systems Will It Cost?

Cool Barrier Coating Systems do not cost more than a non-cool roof coating system. Major roof costs include upfront installation (materials & labor) and ongoing maintenance (repair, recoating, and cleaning).

Materials & Labor

The installed costs of a roof can vary depending on several factors, including its type, size, complexity, method of attachment, and building location. Nevertheless, in cases where new roof surfaces need to be installed, cool roof options are usually similar in cost or slightly more expensive than similar non-cool alternatives. Slightly higher upfront costs occur mostly in colored roofs that require specialty pigments. The labor required to install or coat cool roofs is about the same as for non-cool roofs.

On the other hand, converting a roof that is in good condition into a cool roof can cost more. For instance, if you want to coat your new dark roof just to make it a cool roof, the additional cost can be significant. More often, roofs are coated to extend their lifetimes. If you are already planning to coat your roof, then using a cool coating instead of a dark one will probably cost about the same. Notice that the cost of coating a roof cool depends on the existing roof's surface. Rough surfaced roofs, like those covered in granules, have more surface area, and require more coating material to achieve the desired thickness. If the existing roof is not already cool, it may require one extra coating to ensure full coverage.

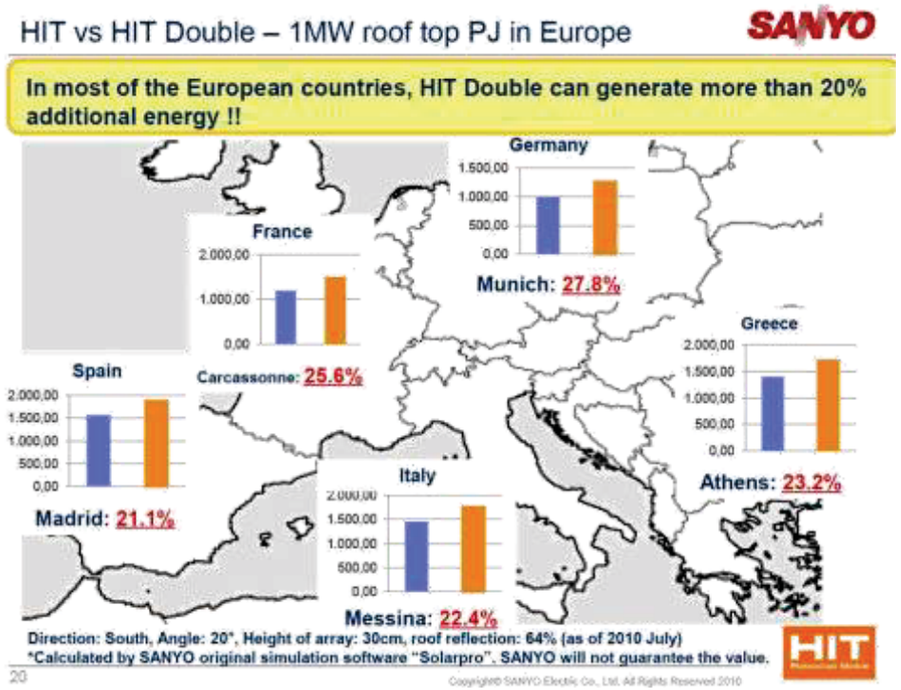
Maintenance

Maintenance cost of Cool Barrier Coating Systems is less than non-cool roofs products. Cool Barrier Technology by Abolin Co, allows the formation of surfaces with high solar reflectance initial and aged values in comparison to standard cool roofs or non-cool roofs products. Also in warm, moist locations, Cool Barrier Coating surfaces are less susceptible to algae or mold growth than hot roofs or other cool roof technologies. This is due the advanced binders technology used. Following our instructions for proper application use an optimum performance is expected to be obtained.

How Much Will You Earn?

Many already performed applications with Cool Barrier Technology and Solyndra's Cylindrical Solar Panels clearly demonstrate an increase in energy production even more than 20%. This is similar to hundreds of Sanyo's Hit double PV systems applications with Cool Roofs in most of the European Countries.

ARTE REAL ESTATE, PV SOLYNDRA, COOL BARRIER TECHNOLOGY, ITALY. Application on APP membrane.



The increased energy generation in context to the durability and the long reflectivity maintenance of the recommended Cool Barrier Roof Coating System technology can offer a cost benefit solution with direct and long lasting economic benefits for the owner of the building.

Recommended Cool Barrier Coating Systems for use in Bifacial PV Modules Applications

Solar Spectrum Reflectivity by Product							
i	**COATING CODE**	**Total Solar Reflectance**	SRUV	**SRVIS**	SRNIR	**Recommended Surface**	**Suitable basecoats or primers**
1	**COOL BARRIER 2K WHITE***	**0.91**	0.11	**0.95**	0.92	Metal Roofs – Flat, Low or Big Slope	ABOLIN EPOXY UNIPRIMER 2 COMP SOLVENT, ABOLIN WASH PRIMER 2 COMP
System Composition and Notes	**Top Coat:** Solvent based system based on polyurethane polyester 2 component binders suitable for heavy duty industrial applications. **Primer Systems:** a) Solvent based system based on anticorrosive pigments and epoxy polyamide 2 component binders, b) for Galvanised steel and/or aluminium there is also the need for surface's pre-treatment with the use of a solvent based etch primer (Wash Primer). **Notes:** The system must be applied from a professional team. Suitable for industrial applications only. The system performs excellent anticorrosive properties, excellent reflectivity maintenance and very high durability.						
2	**COOL BARRIER ROOF OPTIMUM WHITE**	**0.89**	0.07	**0.95**	0.89	Concrete, Ceramic, Bituminous APP or SBS membranes top granulated, thermoplastic polyolefin (TPO) – Flat, Low or Big Slope Roofs	COOL BARRIER GRIP NANO,COOL BARRIER PROTECTA CLEAR, COOL BARRIER ROOF (SPECIAL EDITION)
System Composition and Notes	**Top Coat:** Water based system based on the most well known globally binder technology today in terms of durability and reflectivity maintenance: Waterbased polyvinylidene fluoride. **Primer Systems:** CONCRETE & CERAMIC SURFACES – a) Water based nano-structured acrylic (Cool Barrier Grip Nano), b) Water based nano- structured acrylic colloid silica modified (Cool Barrier Protecta Clear). BITUMINOUS APP or SBS MEMBRANES – b) water based acrylic based on elastomeric binders according to ASTM 6083 (COOL BARRIER ROOF). **Notes:** No need for professional team. Suitable for DIY applications also. The system performs excellent weathering and fungi resistance properties, excellent reflectivity maintenance and very high durability.						
***Cool Barrier 2K White Can be formulated on aliphatic, polyurethane-acrylic binders either based on aliphatic, polyester polyurethane binders Acc. to MIL-C-85285C**							

Cool Barrier Coating Systems: Specifications

1. COOL BARRIER 2K Top Coat

A two-component aliphatic, polyester polyurethane coating.

SPECIFICATIONS: **According to MIL-C-85285C**

DESCRIPTION: **COOL BARRIER 2K Top Coat** is a two component chemically cured product that forms a film that is resistant to chemicals, solvents and abrasion. This product has excellent adhesion to most substrates and is recommended for heavy duty industrial applications where a tough, chemical resistant coating is required. This coating is available for brush, roll and spray applications. It is specially formulated for excellent ultraviolet ray resistance and superior exterior durability.

PROPERTIES:

SOLIDS (Weight)	67 – 70%
SOLIDS (Volume)	55 - 57%
VISCOSITY	70 - 90 KU
GLOSS:@60 DEG	
Gloss Colors	Minimum 90%
Semi-gloss Colors.	15 - 45%
COLORS	Cool Barrier Colour Palette
POT LIFE (77 degrees F)	6 - 8 Hours
TACK FREE	2 Hours
RECOAT	Overnight
LIGHT SERVICE	24 Hours
FULL SERVICE	7 Days
VOC (Maximum) TYPE I	420 g/L

ADVANTAGES:

- Excellent Exterior Durability
- Abrasion Resistant
- Chemical Resistant
- Meets ASTM Standard Tests
- Resistant to Corrosive Fumes
- Meets Military Specification

Cool Barrier Coating Systems: Specifications

2. COOL BARRIER ROOF OPTIMUM

A PVDF water based coating.

DESCRIPTION: **COOL BARRIER ROOF OPTIMUM** is an innovative coating technology based on acrylic-modified PVDF resin. It is a low-build elastomeric coating that provides the ultimate in reflectivity, color stability and weather resistance over new or existing roof surfaces. Although it is highly flexible, it exhibits tough, enamel like finish that resists abrasion, biological growth, dirt, oil and all types of weather extremes.

PROPERTIES:

Volume Solids	**ASTM D 2697**	43% (±2%)
Weiqht Solids	**ASTM D 1644**	64, 87%
Tensile Strenqth -1,000 psi	**ASTM D 2370**	606, 7 psi
Initial Elonqation o°F	**ASTM D 2370**	1O2, 8%
Tear Resistance	**ASTM D1004**	>2oo PLI (14.4 kN/m)
COLORS		Cool Barrier Colour Palette
Abrasion Resistance	**ASTM D968**	30 I/mil Falling Sand Test
Funqi Resistance	**ASTM G21**	Zero Rating
Accelerated Weathering	**ASTM D4798/G155**	
	or G154 UVB 313	4,000 Hours = Pass
Permeance	**ASTM D1653**	>3 @3 milsDFT
VOC (Maximum)		120 g/L

ADVANTAGES:

- Excellent Long Term Colour Retention
- Excellent Long Term Gloss Retention
- Excellent Resistance to UV Degradation
- Excellent Resistance to Chalking
- Outstanding Dirt Pick-Up and Stain Resistance
- Excellent Resistance to Algae and Fungal Growth
- Excellent Resistance to Abrasion
- Excellent Flexibility

Cool Barrier Roof Coatings for PV applications related to Cool Roofs: Comparison to other Cool Roof products solutions

Product	Waterproofing	New Roof	Roof Retrofit	Need for Professional Stuff	Durability	Roof Restoration
Cool Barrier Roof Optimum System	No	Suitable Shape independent Roof Slope independent	Suitable Shape independent Roof Slope independent	Not Necessary	Excellent	Yes
Cool Barrier 2k Top Coat System	No	Suitable Shape independent Roof Slope independent	Suitable Shape independent Roof Slope independent	Necessary	Excellent	Yes
Single Ply Membranes System	Yes	Suitable Shape dependent Roof Slope dependent	Shape dependent Roof Slope dependent Suitable/ Need for Existing Roof Removal	Necessary	Excellent	Difficult
Elastomeric coatings Pure Acrylic System	No	Suitable Shape independent Roof Slope independent	Suitable Shape independent Roof Slope independent	Not Necessary	Good	Yes