CUT COSTS AND GREENHOUSE GAS EMISSIONS

Cool Roofs Get Boost From Philadelphia's New Energy Policy

By Michael Magallanes

Endorsement of cool roofs as an effective way to cut energy costs and reduce greenhouse gas emissions took a big leap in May when the city of Philadelphia, PA, adopted a cool roof policy. The new policy mandates energy-efficient reflective roofs or "green" roofs on all new commercial and residential buildings with no or low slopes.

Philadelphia joins such jurisdictions as Chicago and New York in passing a cool roof law, and the city believes the legislation will greatly improve its overall green rating as well as save money for residents. City officials also believe the new policy will make Philadelphia a better place to live by reducing the dreaded heat island effect that many cities experience in the summer. Philadelphia's comprehensive sustainability plan (of which the cool roof regulations are a part) includes goals to reduce citywide energy consumption by 10% and to retrofit 15% of the city's housing stock by 2015.

While there are many different products and procedures available in the ever-expanding green marketplace, there are some steps that can be taken that are basic, yet effective. At the top of the list is the "cool roof," which can be implemented rather easily and at a very reasonable cost. Black and dark-colored roofing materials can dramatically increase a building's cooling load, while cool roofs reflect the sun's radiant energy before it penetrates the interior of the building, reducing the load.

Energy-efficient cool roofing systems can significantly reduce roof temperature during the summer, thereby reducing the

Cool roofing systems help cut energy costs by keeping attics cooler, improving occupant comfort, cutting maintenance costs, increasing the life cycle of the roof, and reducing urban heat islands and their associated smog.

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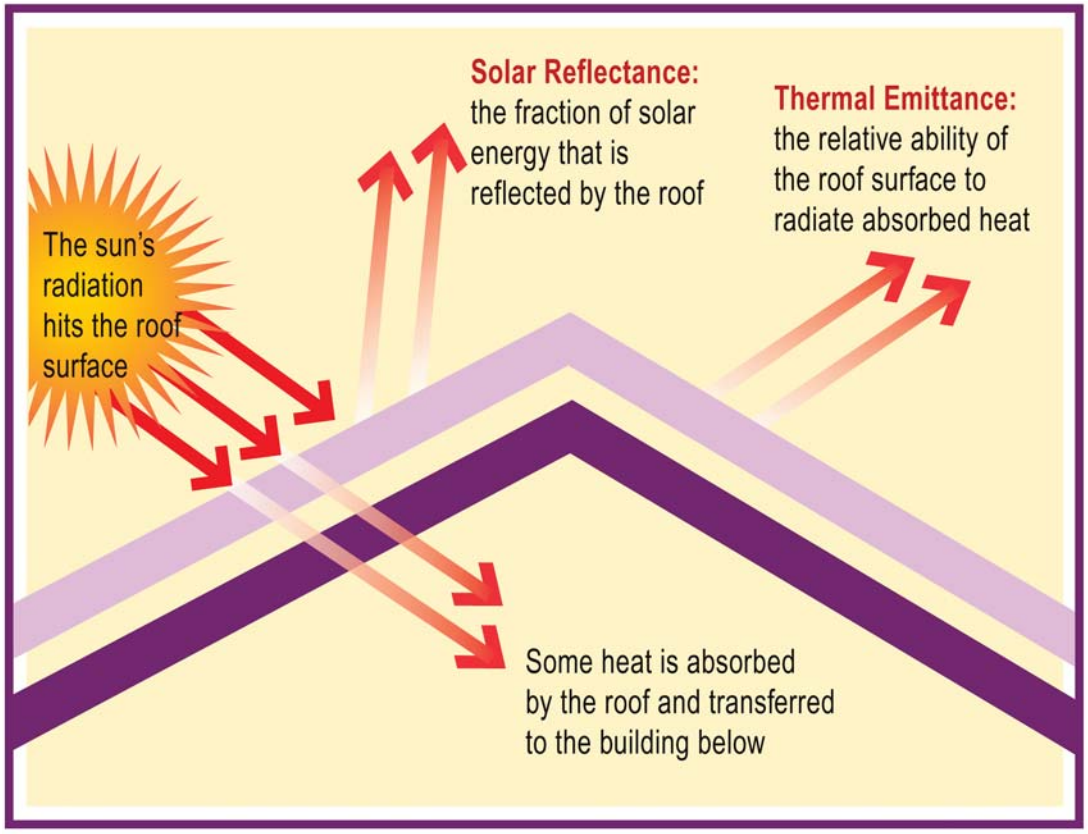
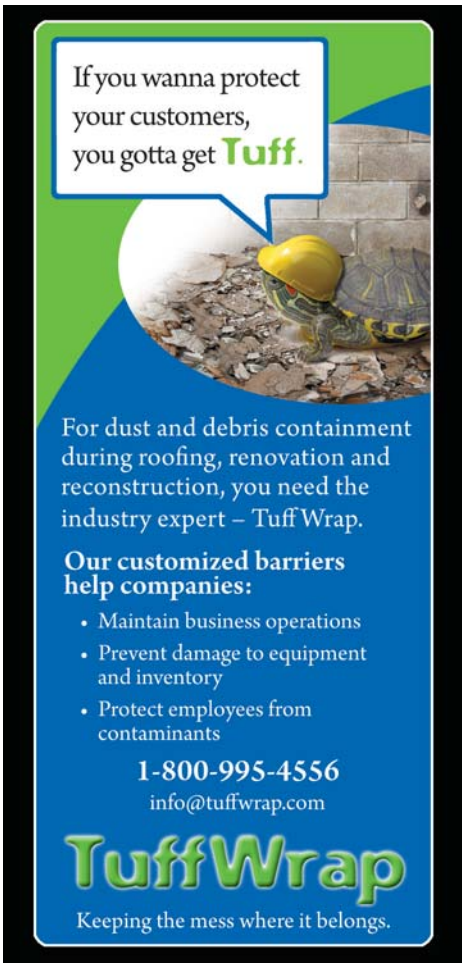


Heat island profile – Solar reflectance and thermal emittance are the two measures used to determine the "coolness" of a roof. As long as the coating is white or light-colored, the roof will have high reflectance and emittance levels.



A cool roof benefits not only the building on which it is installed, but also the surrounding neighborhood. In the summer, major urban areas become heat islands, where temperatures can soar 4° to 8°F above that of the surrounding area.

building's energy requirements for air conditioning. This helps to cut energy costs by keeping attics cooler, improving occupant comfort, cutting maintenance costs, increasing the life cycle of the roof, and reducing urban heat islands and associated smog. In fact, reflective materials can help keep a building's surrounding neighborhood cooler.

WHAT IS A COOL ROOF?

Cool roofs consist of materials that very effectively reflect the sun's energy from the roof surface. Cool materials for low-slope roofs are mainly bright white in color, although nonwhite colors are starting to become available for roof applications. Cool roofs must also have high "emissivity," allowing them to emit infrared energy. Bare metals and metallic coatings tend to have low reflectivity and are not considered cool materials.

Solar reflectance and thermal emittance are the two measures used to determine the "coolness" of a roof. The solar reflectance index (SRI) of a roofing product is a method for determining the radiative properties of roofing materials. SRI is defined by ASTM Standard E1980-01; the Environmental Protection Agency (EPA) summarizes SRI as "the relative steady-state surface temperature with respect to the standard white (SRI = 100) and standard black (SRI = 0) under the standard solar and ambient conditions."

White reflective coatings contain transparent polymeric materials such as acrylic—and a white pigment, such as titanium dioxide (rutile)—to make them opaque and reflective. These coatings typically reflect 70% to 80% of the sun's energy. Despite the white appearance, these pigments absorb the 5% or so of the sun's energy that falls in the ultraviolet spectrum. Thus, the pigments help protect the polymer material and the substrate underneath from UV damage. As long as the coating is white or light-colored, the roof will have high reflectance and emittance levels.

Consultants who recommend that a building owner or manager go in the cool roof direction should consider these factors:

- When selecting a roof material, look for high solar reflectance, endurance of high reflectance over time, and high emittance. High emittance lowers the roof temperature by increasing the release of heat by thermal radiation. For a highly reflective roof, avoid untreated metal roofs and aluminum coatings. If installing a metal roof, make sure it is painted a light color (not a clear coating) and is rated by the Cool Roof Rating Council.
- Avoid nonsolar-reflective asphalt

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shingles or coatings, if the budget allows.

- Evaluate the climate of the building. Do heating or cooling loads dominate energy usage? If cooling dominates, this may be a good candidate for a new energy-efficient roof.
- Determine what makes more sense economically: transforming the existing roof into a cool roof by coating it with a cool roof product or replacing the roof entirely with a manufactured cool roof. While it may make more sense to replace an older roof near the end of its life cycle, a newer roof still in good shape can be economically transformed into a cool roof that will rival the effectiveness of a new, manufactured cool roof.

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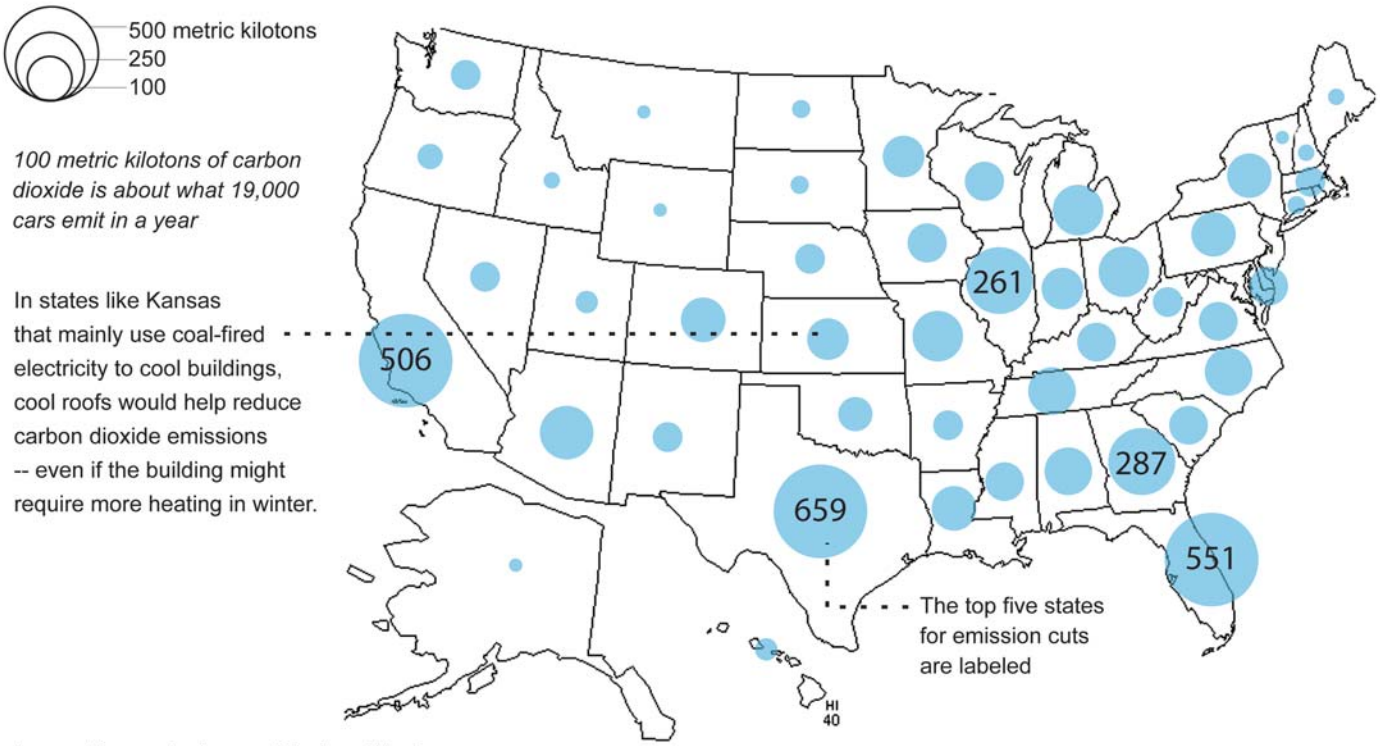
Imagining a Cool-Roof Nation

Dark-colored roofs absorb high levels of light and heat in the summertime. Researchers estimate that if 80 percent of commercial buildings were retrofitted with "cool" roofs that reflected heat, the nation could save enough on air-conditioning to reduce carbon dioxide emissions by 6.23 million metric tons annually - the equivalent of taking 1.2 million cars off the road.

Annual reduction in carbon dioxide emissions if 80% of commercial roofs were converted to "cool" roofs



Source: Roonene Levinson and Hasbern Akbari, Heat Island Group, Lawrence Berkeley National Laboratory

FOUR CATEGORIES OF COOL ROOFS

There are four broad categories of materials that can be used to upgrade a roof's reflectivity to EnergyStar® levels: metal, tile, roofing membranes, and reflective coating. Of the four, a reflective coating may be the most economically achievable for existing buildings because it doesn't require any significant retrofitting of the structure, which can be costly and time-consuming.

Exact energy and money savings for each type of cool roof will depend on a number of factors, such as the type and efficiency of insulation in the ceilings and exterior walls,[1] the windows, the efficiency of the cooling system, and, most important, the climate of the building's location. Based on experience with our Coat'N'Cool product, a reflective coating can lower the interior temperature of a commercial or industrial building by 8° to 12°F during the hottest four hours of a summer day, noon to 4 PM. Not only does the lower interior temperature help reduce energy costs, it also improves worker productivity, especially in a nonair-conditioned space, by creating a working environment that is more comfortable.

Some specific benefits of cool roofs are

- Saving on annual electricity bills by reducing summer air-conditioning costs,
- Saving peak electricity demand costs if time-of-use metering is in effect,
- Reducing maintenance and replacement expenses by extending roof life,
- Increasing indoor comfort in summer by reduction of infrared conversion from visible light,
- Reducing the "heat island effect" in cities and suburbs,
- Reducing air pollution and smog formation, and
- Reducing roofing waste added to landfills.

A BENEFIT TO SURROUNDING NEIGHBORHOODS

A cool roof benefits not only the building or buildings on which it is installed but also the surrounding neighborhood. In the summer, major urban areas become heat islands where temperatures can soar 4° to 8°F above the temperature in the surrounding area. This rise in temperature corresponds to a rise in harmful ozone and, therefore, smog levels in the urban air. For every degree above 70°F, the concentration of smog increases 3%. For every 1,000 sq ft of cool roof, ten tons of CO_2 emissions are offset each year.[2]

However, a city populated with buildings having reflective roofs will not experience this effect as strongly. A recent study by the Lawrence Berkeley National Laboratory's (LBNL) Heat Island Group found that if the buildings in Los Angeles were upgraded with reflective roofs, the city could save $35 million per year in energy costs.

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TAX INCENTIVES

Through its Tax Incentive Assistance Project, the federal government offers a tax deduction of up to $1.80 per sq ft to owners or tenants (or designers, in the case of government-owned buildings) of new or existing commercial buildings that are constructed or reconstructed to save at least 50% of the heating, cooling, ventilation, water heating, and interior lighting energy cost of a building that meets ASHRAE Standard 90.1-2001.

Only buildings covered by the scope of ASHRAE Standard 90.1-2001 are eligible. Partial deductions of $.60 per sq ft can be taken for improvements to one of three building systems that reduce total heating, cooling, ventilation, water heating, and interior lighting energy use by a certain percentage—the building envelope (10%), lighting (20%), or heating and cooling system (20%). These deductions are available for buildings or systems placed in service from January 1, 2006, through December 31, 2013.

COOL ROOFS AND SUSTAINABLE PROGRAMS AND CODES

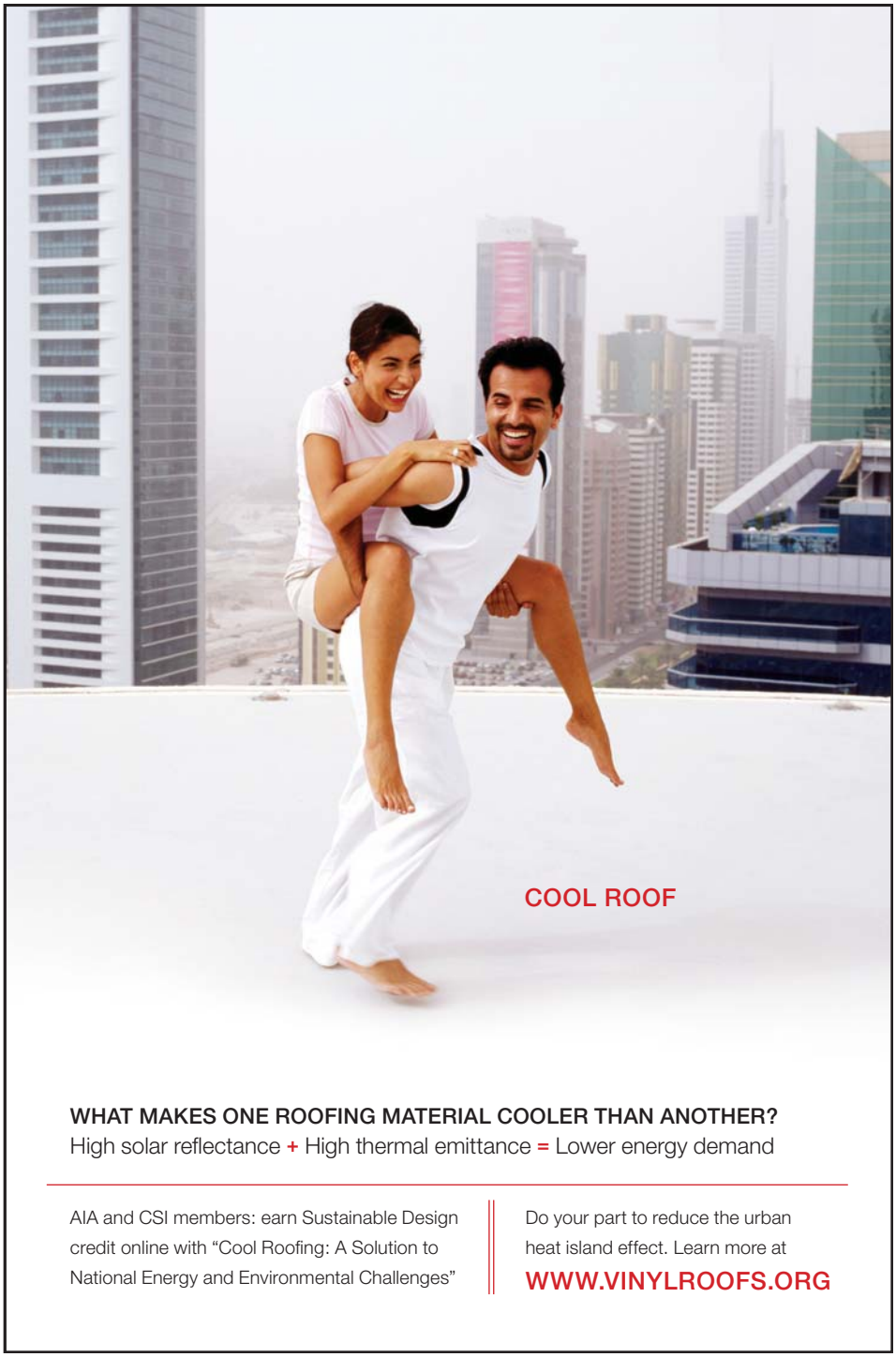
A key set of codes for cool roofs has been established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers in ASHRAE Standard 90.1-2001. Other codes and rating systems are offered by the organizations listed below.

Cool Roof Rating Council – The CRRC administers a rating program in which companies can label roof surface products with radiative property values. The CRRC does not set a minimum definition for "cool." The CRRC simply lists the measured radiative property values on its directory. However, a cool roof product that provides 70% reflectivity and 75% emissivity is effective. Any roofing product can be tested as long as it is in compliance with the Product Rating Program Manual (CRRC-1). All radiative property testing is conducted by accredited laboratories. Solar reflectance can be measured in accordance with ASTM test methods C1549, E1918, E903, and CRRC-1 Method #1, Test Method for Certain Variegated Products. Thermal emittance is measured in accordance with ASTM C1371. A product's placement on the directory does not mean that the product is "cool" as defined by any particular code body or program.

LEED® – Leadership in Energy and Environmental Design® is the U.S. Green Building Council's Green Building Rating System, a voluntary certification program for sustainable buildings. LEED® has several different systems, including one for new construction and existing buildings. LEED® for new construction and major renovations (LEED-NC), Version 2.2, gives credit for a cool roof under "Sustainable Site Credit 7.2: Heat Island Effect: Roof." LEED-NC credits roofs with an SRI value greater than or equal to 78 for low-slope roofs, and 29 for steep-slope roofs. LEED® for Existing Buildings (LEED-EB), Version 2, gives credit for a cool roof under "Sustainable Site Credit 6.2: Heat Island Reduction: Roof." LEED-EB gives credit for a roof with Energy Star®-compliant material that has a minimum thermal emittance of 0.90.

LEED-NC references the CRRC as a source of product ratings, though it does not require the product to be CRRC-rated. It permits other sources as well, such as the US-EPA Energy Star® reflective roof program.

Energy Star® – Energy Star®-qualified roof products reflect more of the sun's rays.



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This can lower roof surface temperature, decreasing the amount of heat transferred into a building. Roof products qualify for the Energy Star® label based on their solar reflectance, without compromising product quality and performance. Energy Star®-labeled roofs are more common on commercial buildings but can also be used on residential homes. The greatest benefit is obtained in hot, sunny climates where air conditioning is used a great deal. If a building is already shaded and the roof is not exposed to much sun, a reflective roof may not provide a significant benefit. The benefits will also be lessened if the attic space is well insulated.

REFERENCES

1. For the typical commercial structure with a built-up or modified bitumen roof, the use of a cool roof coating can increase the efficiency of the insulation dramatically. Based on the DOE calculator, using Philadelphia as the model city, with mid-range figures for energy consumption, an 84 reflectivity, and 87 emittance, the following are the effective upgrades in R-value with the use of a cool roof coating (www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm).
   R-19 upgraded to R-32
   R-11 upgraded to R-15
   R-7 upgraded to R-11
   R-5 upgraded to R-9
2. Lawrence Berkeley National Laboratory.

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Cowboys' Employees Reach Settlement In Practice Field Structure Collapse

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Out-of-court settlements have been reached between two Dallas Cowboys employees and Summit Structures, LLC of Allentown, PA, and its Canadian parent, Cover-All Building Systems, Inc., concerning the May 2, 2009, accident in Irving, TX, that caused a fabric-covered tubular steel frame structure, designed and used to enclose a practice field, to collapse during a severe thunderstorm. Cowboys scout Rich Behm was paralyzed below the waist, and Joe DeCamillas, a special teams coach, suffered a broken vertebrae in the collapse. The two men had charged that the companies should have known the building didn't meet code and that they were grossly negligent in the facility's design and construction. Separate suits against owners of the building (companies owned by Cowboys owner Jerry Jones) are still pending. For that reason, settlement figures have not been revealed.

Cover-All is now in receivership. It and Summit are facing at least four unrelated lawsuits over other failed buildings. Citing "significant costs," including lawsuits and repair of damaged structures, Cover-All filed for bankruptcy in March and laid off most of its 500 employees. Afterward, the company issued a safety warning, saying it had reason to believe some of its buildings may not meet building codes for wind and snow.

A draft report from the National Institute of Standards and Technology (NIST) issued last October and finalized in January [see December 2009 *Interface*, page 38], said the Cowboys' facility fell in winds of 55 to 65 mph — well below the national design standard to withstand wind speeds of 90 mph.

The final report may be downloaded online at **http://www.nist.gov/manuscript-publication-search.cfm?pub_id=904696&division=861**.

"10,000,000 Solar Roofs" Initiative Advances in Senate

A solar policy proposal put forward by Vermont Senator Bernie Sanders has recently been approved by the Senate Committee on Energy & Natural Resources. The measure would subsidize solar installations through competitive grants. In 2012, $250 million in grants would be authorized, and $500 million a year would be provided between 2013 and 2021. The Ten Million Solar Roofs bill, as its name suggests, has the ultimate goal of subsidizing the installation of 10 million solar arrays in the country. Senate Majority Leader Harry Reid has been asked to include the measure in a broader energy package that's expected to come before the Senate later in the summer.

– CoolerPlanet.com

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