Reflective roofs and energy efficiency

Reflective roof coatings can reduce the temperature inside farm facilities by up to 15 percent, reducing the energy demand of heating, ventilation and cooling (HVAC) systems. Savings are most significant where there was previously limited or no ceiling insulation in place. When commissioning new facilities or undertaking maintenance of existing ones, the additional cost of adding reflective coating to roofs is likely to be warranted.

Benefits of reflective roofs
Reflective roof coatings complement other forms of building insulation in reducing the required size and operating times of heating, cooling and ventilation (HVAC) systems.

The inclusion of reflective roof coatings in the construction specifications of new facilities may mean that smaller, less expensive HVAC solutions can be employed.

Reflective is better than plain white paint
Dark colours absorb heat while light ones reflect it. Light-coloured roofs have been reported to enable 15 percent savings in energy use for cooling over their dark-roof counterparts (US Department of Energy).

New reflective paint products available in Australia may offer larger savings still, and do not have to be light in colour to be effective. This can be an important factor when planning approval places constraints on the visual impacts of roofs.

Light-coloured roofs will not bring the same solar heating gains during colder periods, but this benefit is far outweighed by those that come from having a light roof. Insulating your roof and/or ceiling will offset any negative impacts from heat loss.

Technical factors
In hot, sunny conditions, dark roofs can reach temperatures of nearly 90 degrees Celsius as they absorb latent heat from direct sunlight. This extreme heat can degrade building materials and shorten the life of roofs. Additionally, as heat is collected, it radiates through the roof material and into the building below.

Light-coloured roofs reflect much of this heat energy back into the air and keep material surface temperatures much lower (generally below 55 °C). Covering or painting a dark roof with a light colour can reduce cooling costs within the building significantly, as cooling systems need to work less hard to reach and maintain desired temperatures.

Solar emissivity
The absorption rate of an object is measured by a rating called solar emissivity. When selecting reflective roof paint, the lower the emissivity, the better. An emissivity rating of one means an object will absorb and radiate the maximum amount of solar radiation; a number closer to zero denotes a more reflective surface that absorbs less radiation. Different companies label emissivity paints in different ways, so make sure you’re clear about what measurements you’re looking at before you buy. Visible colour reflects only a portion of a roof’s emissivity, so two identically coloured roofs can have significantly different rates of solar radiation.

Roof life/maintenance
Extreme temperature changes cause materials to expand and contract. Ultraviolet (UV) light from the sun can accelerate the breakdown and degradation of building materials. Keeping your roof below 55 degrees reduces both thermal stress on the roof and the amount of UV energy absorbed, extending the useful life of your roof.

Quick tips
- The best time to use a reflective paint is when you’re painting anyway. Usually, reflective roof coatings are only five to 10 percent more pricey than traditional paint alternatives. Lifetime savings on a cooled building will likely net you significant savings in energy and maintenance costs over the lifetime of the roof.
- It’s about more than just colour. Check the solar emissivity ratings to ensure that the paint you choose for your roofs is rated to reflect rather than absorb solar radiation.

Figure 1: The diagram above shows how energy from the sun interacts with two different buildings. The building on the left has been covered with a light-coloured, reflective coating, and most of the UV rays from the sun are reflecting off this building.
Reflective roof coverings

In order to function to their full reflective capacity, white and light coloured roofs should be kept free of dust and debris. Build-up of this type of material can reduce the radiant capacity of the roof by over 20 percent.

Key parameters to consider

According to industry representatives, reflective roof coatings are five to 10 percent more expensive, on average, than traditional paint options (Coolshield International, 2014). Materials and labour can be cost-prohibitive capital expenses, especially when you’re looking at reflective roof coating – so the best time to consider this action is when roofs need to be painted or replaced.

Further information

Solar reflective paints – Cool Shield International, Solacoat
Solacoat is a manufacturer of reflective paints for various types of roof coverage.
www.solacoat.com.au

A video demonstrating this product’s performance, using a thermal imaging camera, is available here:
youtu.be/rOER2ShzOvw?t=2m7s

U.S. Department of Energy: Cool Roof Guide
A guide to the energy savings that can be made by investing in cool roofing, and to applications for cool roofs.
www1.eere.energy.gov/femp/pdfs/coolroofguide.pdf

Global cool cities alliance: Cool roofs IEA workshop

References

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Available at: www.aces.edu/poultryventilation/documents/InsulationPVP.pdf [Accessed 2013].

Coolshield international, 2014. Coolshield international reducing heat from our environment. [Online]


Available at: www1.eere.energy.gov/buildings/pdfs/cool_roof_fact_sheet.pdf

Available at: www.epa.gov/hiri/mitigation/coolroofs.htm