

# Cool Roofs

Imagine an energy efficiency strategy the equivalent of taking every car in the world off the road for about 11 years, writes **Warren McLaren**. Steven Chu reckons that's the environmental benefit possible by making all dark coloured roofs (and roads) a lighter, more reflective shade. Steven who? US President Barack Obama's Secretary of Energy, who's also a Nobel Prize winning physicist.

"Cool roofs are one of the quickest and lowest cost ways we can reduce our global carbon emissions and begin the hard work of slowing climate change," said Secretary Chu. And when you consider roofing accounts for about one quarter of the world's urban area you can see he might be onto something.

Indeed, California's Building Energy Efficiency Standards already dictate cool roof requirements for many heated or cooled non-residential buildings, be they new construction or re-roofing projects.

Here are a few cool roof options for Australian buildings.

## Green Roofs

Green Roofs, also termed Living Roofs, are those planned out with vegetation. Green Roofs Australasia contend that "... the presence of transpiring vegetation, provided shade and a substrate holding water, allow green roofs to lower the ambient temperature experienced within a building during the day." It is also the experience in Germany that green roofs extend the lifetime

of a roof up to three times, by limiting its exposure to weather degradation. Australia's largest green roof project is the Victorian Desalination Project with its 26,000 sqm surface to be covered in 98,000 indigenous plants. Such roofing not only looks good, it works. U.S. Postal Service's Morgan Processing and Distribution Center is New York's biggest green roof at 2.5 acres (1 hectare) was projected to save \$30,000 USD annually in heating and cooling costs, but the savings in the first year of operation were more than \$1 million USD. Toronto, Canada was the first North American city to introduce a bylaw requiring green roofs on new commercial, institutional and residential developments with a minimum gross floor area of 2,000 sqm.

The use of deciduous plants like trees and vines that lose their foliage in the winter has long been considered a proven passive solar design strategy, for cooling structures in summer and allowing sun access in the cooler months. Shade sails are the non-biological techno equivalent. The author has seen houses in the tropics with their entire north-facing roofs shaded by sail cloth structures. To assist in securing such double roofing, RoofExtends provided the Shade Sail Anchor. This Australian designed and made steel bracket allows shade sails to be fixed directly to existing rooflines. It bolts through tile or metal roofing onto rafters, wall top plates and wall studs providing greater structural integrity than mounting to fascia boards.

## Shade

ShadeScope Steel reckon it's possible to "reduce the annual cooling energy costs of your building by up to 7.5 per cent," with their Colorbond Coolmax roofing. Their calculations indicate that the reduced heat flows from Colorbond Coolmax could save around \$0.57/sqm and \$1,170/sqm on the cost of HVAC cooling equipment compared to standard Colorbond and Zincalume roofing respectively. This is because the external surface temperature of the Colorbond Coolmax roof sheet tested up to 6,50C and 180C cooler than those roof materials. Furthermore Bluescope Steel point to a US study that suggests pre-painted metal retained almost 95 per cent of its initial solar reflectance over three years, where over the same period white coatings displayed a 25 per cent drop in solar reflectance. Coolmax is currently available only in one colour, but thankfully, the core technology, Thermatech, is now standard across the traditional 20 Colorbond shades, albeit not as reflective as Coolmax. Through Retacom make Solars, a long span roofing sheet, which includes a Thermatech outer sandwiched with a integral polystyrene foam offering up to R 3.7 insulation.



Image courtesy Fratelle Group

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## Reflective Coatings

Acratex InfraCool is a heat reflective coating that its makers, Dulux, believe offers three times the Total Solar Reflectance (TSR) of a standard weathered galvanized roof surface. By bouncing back radiant heat, external surfaces treated with the likes of InfraCool "can be 20-40°C cooler, translating into cooler occupancy zones, lowering cooling energy demand and thus delivery cost and energy emission savings." For non-air-conditioned facilities with large expanses of roof, such as workshops and warehousing, Dulux suggest that "cool roofs translate immediately to ... improving productivity and stability of stored goods." Dulux point out that visible light spectrum that InfraCool technology targets, with even dark colours made to reflect more. For example, standard charcoal roofing has TSR (Total Solar Reflectance) of just 6.8 per cent, whereas InfraCool bumps that up to 26.9 per cent, which is nearly a 300 per cent improvement.

## Evaporative Cooling

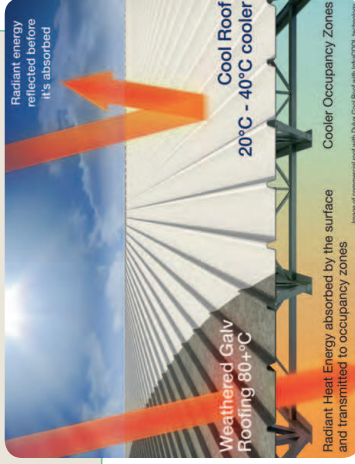
A novel approach that garners similar results to light-coloured roofing is the installation of an evaporative roof cooling system, whereby a water pipe mounted on the ridge line of building produces a thin film of water over the roof surface, that cools as it evaporates. Such systems are said to reduce the summer surface temperature of roof from 77°C down to 35°C, which subsequently equates to an increase of room temperature of about only 4°C, without use of air conditioning. The suggestion is that evaporative roof cooling systems can reduce air conditioning cost by up to 50 per cent. Admittedly roof sprays do rely on a little external power to get the water to the roof but the energy consumed for pumping is minimal compared to energy saved by the reduction in air conditioning load. The water can be captured and reused with the system or otherwise used elsewhere on the site.

## Solar Vents

Should the cost of a full cool roof installation or retrofit not be fiscally viable, it's still possible to reduce the air temperature in roof spaces. Everyone is familiar with the ubiquitous wind-powered whirlygig seen atop many commercial, industrial and some residential roofs. But without a moving air current, even the Edmonds SupaVent can be challenged. Enter the solar powered roof vent. The Solar Whiz from Global Eco & Environmental Solutions (GES) is said to move 10-30 times more air than a whirlygig. GES suggest even their smallest model can perform about five air changes per hour in the average roof space, sufficient to keep the roof space temperature only a few degrees above the outside ambient temperature. Which is an improvement over the usual 60-70°C temps found in Australian roof spaces during summer. The Solar Whiz's photovoltaic panels can be coupled with a thermostat so the fan does not operate in winter. Other styles of solar fans include Solatube's Solar Star, the Solarvent, Skydome's Solar Powervent, and SolarVenti, to name but a few.



Image courtesy Edmonds SupaVent



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