Colorbond® Steel with Thermatech® Solar Reflectance Technology Year-Round Climate Control

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Average temperature in the world has increased over the last few years. The frequency of hot days and nights has increased and is likely to continue to be so. It is creating stressful, unhealthy, and unproductive working conditions. These conditions are more common in cities, where urban heat islands (UHIs) are caused by the intensity of non-reflective, high mass materials that absorb a comparatively large proportion of solar radiation. There is a need for alternatives to mechanical air-cooling solutions to reduce energy demand & related greenhouse gas emissions.

To address the issue, BlueScope R& D team has introduced Colorbond® steel with Thermatech™ Solar Reflectance Technology shows the brand's enduring qualities - innovative, superior, cutting-edge and trend leading. With Thermatech™ technology, we are helping to create a future that is comfortable not just for people, but for the environment too. Combined with Colorbond® steel's renowned durability, colour retention and flexibility, you now have the power to shape the landscape to suit your business objectives, vision and conscience.

Thermatech™ technology is a solar reflectance technology incorporated into Colorbond® steel without changing its appearance. It lowers surface temperature by absorbing lesser heat from the sun. In other words, Colorbond® steel with Thermatech™ technology is able to reflect more solar heat, thereby keeping both roofs and buildings cooler (fig 1). Reduced heat stress also means greater durability for entire roofing systems and superior ROI. Thus, Thermatech™ solar reflectance technology ensures cool comfort, while reducing energy cost.

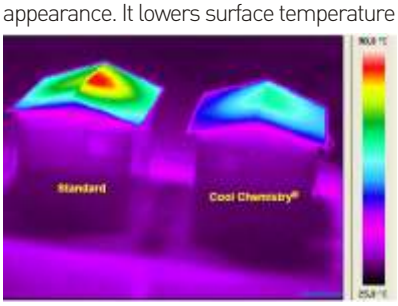


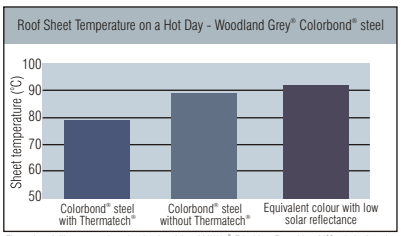
Fig.1

The Fact: Thermal Performance for School Buildings

Most people can relate to an experience of oppressive summertime heat in a classroom where the air-conditioner has struggled or there was no air-conditioner present. It is hardly conducive to good learning outcomes. Good design can avoid these scenarios and also lead to reduced energy costs and positive environmental outcomes.

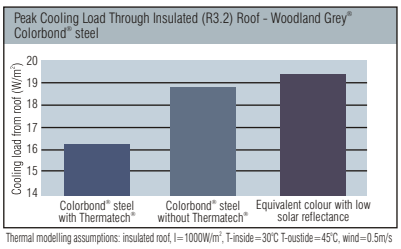
One of the main factors that makes a school building different from a home is that it is predominantly occupied during the day. Therefore it is important when designing a school building that it performs well on hot days, and in a climate-constrained world minimises energy use on mechanical cooling. For this reason choosing materials with high solar reflectance to minimise the impact of heat absorbed from the sun is important. BlueScope Steel has recognised this and developed Thermatech® solar reflectance technology. The inclusion of this technology has increased the solar reflectance of all colours in the standard Colorbond® steel palette, with an average increase of about 5%. When compared to similar colours of lower solar reflectance the difference is much greater. Thermatech™ allows you to choose from a range of attractive colours, with the knowledge that the colour has been optimised to provide the best outcome, with regards to energy efficiency and durability with all of the attributes expected from Colorbond® steel.

The below graphs provide an indication of the benefits for school buildings from Thermatech™ when choosing the roof colour Woodland Grey.



Thermal modelling assumptions: insulated roof, I = 1000W/m², T-inside = T-ouside = 30°C, wind = 0.5m/s

Fig.2



Thermal modelling assumptions: insulated roof, I = 1000W/m², T-inside = 30°C T-ouside = 45°C, wind = 0.5m/s

Fig.3

The inclusion of Thermatech® increases the solar reflectance of Woodland Grey by about 15%

This will keep the roof up to 10°C cooler (even cooler when compared to similar colours of low solar reflectance) which will assist in keeping the building cooler and reducing the need for air-conditioning. Studies have shown that in moderate to hot climates the energy savings from increased roof solar reflectance through changing from a dark solar absorptive roof to a light solar reflective roof vary from about 10% to 50%1. The savings depend upon factors such as the climate, the building shape and form, the

level of insulation and the usage of the building. As school buildings are predominantly occupied during the day, combined with their often high roof to wall ratio, they typically derive high-energy savings. This would translate to possible cooling energy savings approaching 12% through the inclusion of Thermatech™ for Woodland Grey (15% when compared to roofing materials of similar colour of low solar reflectance).

Increasing roof solar reflectance reduces peak cooling loads on air-conditioning equipment. The inclusion of Thermatech™ will reduce the peak cooling load from an insulated (R3.2) Woodland Grey roof by about 2.6 W/m^2. This will place less strain on the air-conditioning equipment or for a 1000 m^2 conditioned school building, allow equipment downsizing as a result of a 2.6 kW reduction in load.

A study of two similar schools, identically coloured, with the only difference being the solar reflectance of the roof demonstrates the large savings possible from using materials with high solar reflectance. The study was conducted in Georgia, USA in a subtropical climate, with hot summers, not unlike Australian coastal regions north of Brisbane and very cold winters, not unlike Hobart. The study showed that the higher solar reflectance roof, resulted in cooling savings of 13% (when heating was included the annual energy saving was about 9%2).

Lawrence Berkeley National Laboratories have been studying the value of high solar reflectance roofing on climate change3. They have recently quantified that the reduced warming provides an equivalent offset of about 1 tonne of CO_2 for every 10 m^2 of roofing that has its solar reflectance increased by 40%. This equates to 2.5 kg.CO_2-e/m^2 per % change in solar reflectance. On this basis the inclusion of Thermatech™ for Woodland Grey has an offset value of about 37 kg.CO_2-e/m^2 or 37 tonne for a 1000 m^2 school building. Of course when the direct energy savings are included, the net CO_2 emission reductions due to Thermatech™ are even greater.

High solar reflectance roofing also offers other benefits as a result of reduced warming of the local environment (urban heat islands). This translates to reduced cooling loads on other buildings. Choosing high solar reflectance materials for school buildings throughout all but the coldest parts of Australia is entirely appropriate. Choosing Colorbond® steel with Thermatech™ provides peace of mind that your chosen colour has been optimised to provide the best sustainability and any energy efficiency outcomes.

Reference

1. Akbari H, Konopacki S and Parker D, Updates on revision to ASHRAE Standard 90.2: Including roof reflectivity for residential buildings, Proceedings of the ACEEE summer study on energy efficiency in buildings, 2000.
2. Cool update Selling a green roof, Metal Roofing, April/May 2006 http://www.coolmetalroofing.org/elements/uploads/news/TMI_CaseStudy_11.pdf
3. Akbari H, Global cooling: Increasing worldwide albedos to offset CO2, 5th Annual California Climate Change Conference, Sacremento, CA 9 Sep 2008. ◆

KAIST RESEARCHERS DEVELOP A WALL -CLIMBING DRONE

Researchers developed a new wall-climbing drone that can approach any type of structure by flying and sticking to the target and utilizing a pose change and perching mechanism. It has a great role in civil structural health monitoring since most existing robots require the installation of additional infrastructure or use magnetic-based technology or vacuum adhesion and it is difficult to apply those technologies to structures with diverse surface shapes and materials.

Professor Hyun Myung in the Department of Civil and Environmental Engineering at Korea Advanced Institute of Science and Technology (KAIST) has developed CAROS (Climbing Aerial RObot System), which does not require installation of any additional infrastructure and which features maximized mobility and safety as a wall-climbing robot.

This robot has higher mobility than existing wall-climbing robots because it can fly. It can restore its pose after an accidental fall due to an unexpected disturbance. Since the robot can stick to the surface, it can perform close inspection and maintenance of the structure. This technology also can be used to assess the situation in a fire disaster. Currently, FAROS (Fireproof Aerial RObot System) is being developed based on the CAROS that can both fly and climb the vertical wall to overcome narrow or destroyed spaces caused by fire.

The robot body is covered with aramid fiber to protect its electric components and mechanical parts from the direct effects of the flame. The technology can also be applied to various types of maintenance of urban structures such as inspection of wind turbine blades and cleaning of high-rise buildings and solar panels.