

Thermal Performance for School Buildings



COLORBOND® steel with Thermatech® solar reflectance technology



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 20 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 graphs overleaf provide an indication of the benefits for school buildings from Thermatech® when choosing the roof colour Woodland Grey®.

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.

Colorbond®

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 2.6W/m². This will place less strain on the air-conditioning equipment or for

a 1000m² conditioned school building, allow equipment downsizing as a result of a 2.6kW reduction in load.

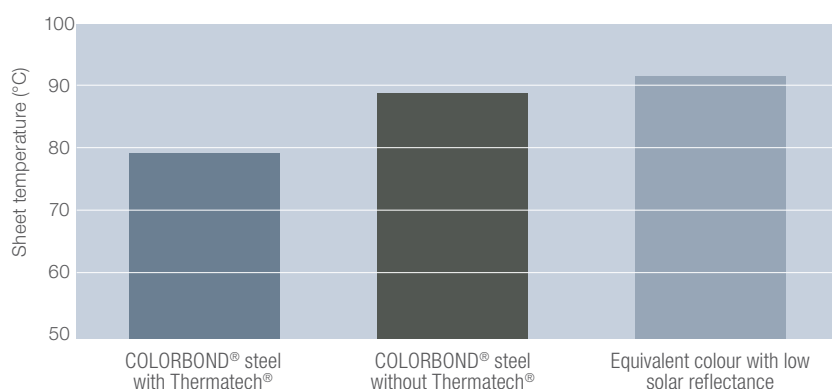
A study of two similar schools, identically coloured, with the only difference being the solar reflectance of the roof demonstrates the large savings possible from using materials with high solar reflectance. The study was conducted in Georgia, USA in a subtropical climate, with hot summers, not unlike 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 CO₂ for every 10m² of roofing that has its solar reflectance increased by 40%. This equates to 2.5kg.CO_{2-e}/m² per % change in solar reflectance. On this basis the inclusion of Thermatech® for Woodland Grey® has an offset value of about 37kg.CO_{2-e}/m² or 37 tonne for a 1000m² school building. Of course when the direct energy savings are included, the net CO₂ 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.

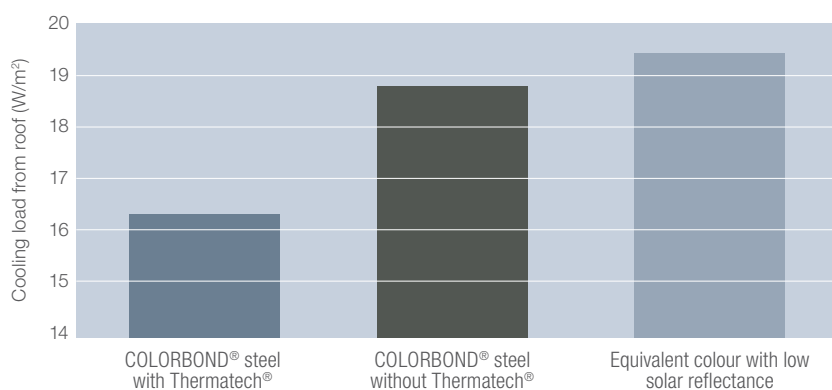
Choosing high solar reflectance materials for school buildings throughout all but the coldest parts of Australia is entirely appropriate. Choosing COLORBOND® steel with Thermatech® provides peace of mind that your chosen colour has been optimised to provide the best sustainability and any energy efficiency outcomes.

Roof Sheet Temperature on a Hot Day – Woodland Grey® COLORBOND® steel



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

Peak Cooling Load Through Insulated (R3.2) Roof – Woodland Grey® COLORBOND® steel



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

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, Sacramento, CA 9 Sep 2008.

For further information visit www.colorbond.com/thermatech or call 1800 022 999.

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