

# STEEL Fact File

An information source for design professionals

## FF9 – SOLAR REFLECTANCE INDEX / ENERGY EFFICIENCY

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**BlueScope** is committed to continual improvement of environment performance and the efficient use of natural resources. Our objective is to produce a range of versatile steel building products and steel solutions that are innovative, durable, safe and aesthetically pleasing.

### 🔍 Energy Efficiency

There are numerous ways to improve energy efficiency, such as:

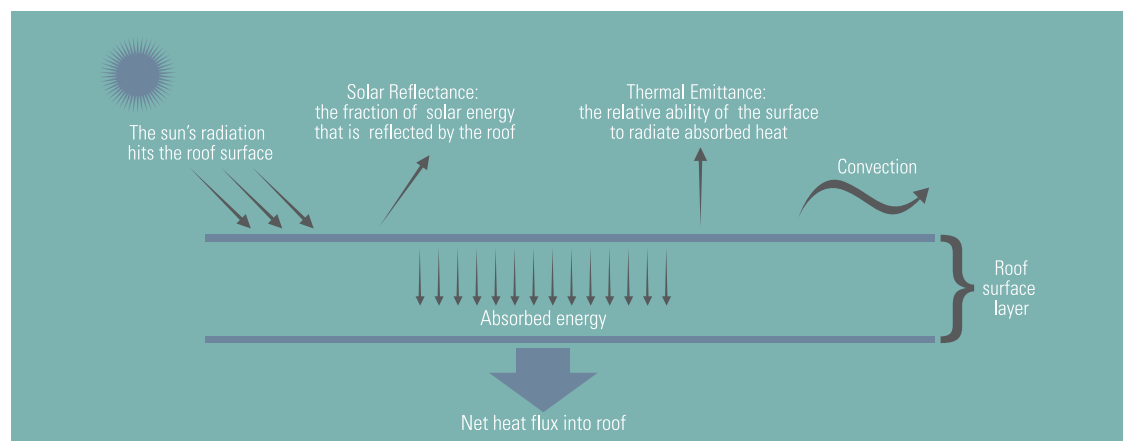
- Light coloured roofing materials to reduce solar heat gain
- The use of low thermal mass materials that respond to temperature changes comparatively quickly whereas high thermal mass materials take longer to heat or cool
- Insulating walls, ceilings, roofs and suspended floors
- Favourably orientating the building and providing exterior shading to control solar heating and wind flow
- Thermatech™ solar reflectance technology



In hot tropical climates, low thermal mass materials such as steel with light coloured roofs and walls can be used to reduce energy demand for internal cooling. For example, a light coloured Clean COLORBOND™ steel roof not only reduces the amount of solar radiation absorbed, but is also very effective at re-radiating heat. Such thermal comfort is maintained by the dirt resistance property in Clean COLORBOND™ steel.

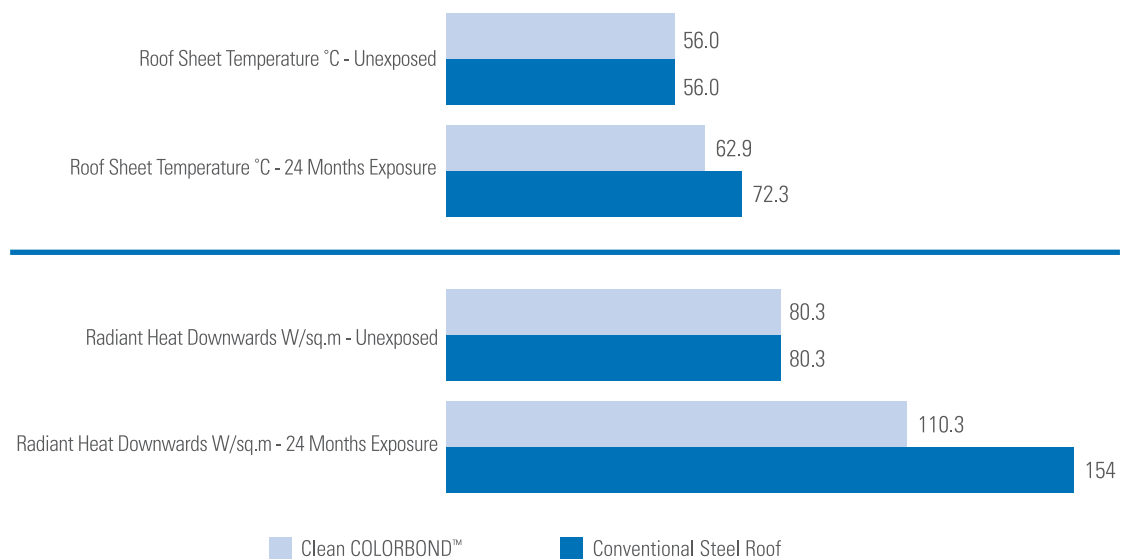
With the addition of Thermatech™ solar reflectance technology, darker coloured Clean COLORBOND™ steel products absorb less energy, creating the advantages of a cooler roof and a cooler building, similar to lighter shaded colours.

The Solar Reflectance Index (SRI) is widely used by green building rating tools to mitigate the Urban Heat Island (UHI) effect. SRI is a value that incorporates both solar reflectance and thermal emittance in a single value to represent a material's temperature in the sun. SRI quantifies how hot a surface would get relative to standard black and standard white surfaces. Table 1.0 shows the SRI values of different types of roofing materials.



## 🔍 Dirt resistance also assists in cooling

Roofing Material		Uninsulated Clean COLORBOND™ Steel Roof	Uninsulated Conventional Steel Roof
Roof Sheet Temperature °C	Unexposed	56.0	56.0
	24 months exposure	62.9	72.3
Radiant Heat Downwards W/sq.m	Unexposed	80.3	80.3
	24 months exposure	110.3	154.0



**Assume: 1000W/sq.m**

**Exterior temperature : 36°C**

**Thermal emittance : 0.85**

## 🔍 Recycled Content Materials

Steel is 100% recyclable and is globally one of the most recycled materials by volume. The amazing metallurgical properties of steel allow it to be recycled continually with no degradation in performance, and from one product to another. Steel is produced using two different processes: Basic Oxygen Furnace (BOF) and Electric Arc Furnace (EAF). Both processes consume recycled scrap steel to produce new steel. When steel completes its useful life, it can easily be recycled and not landfilled. According to the Steel Recycling Institute ([www.recycle-steel.org](http://www.recycle-steel.org)) the post-consumer recycled content and pre-consumer recycled content from BOF production during 2009 was 24.3% and 9.4%, respectively. Whereas the post-consumer recycled content was 74.3% and the pre-consumer recycled content was 17.8% from EAF production over a similar period of time. BlueScope products are produced using the BOF method. As you can see, the EAF process uses almost all scrap steel. One should not make erroneous environmental comparisons between steel made using the BOF and EAF processes since both are part of a complementary steel-making system.

# 🔍 Frequently Asked Questions (FAQ)

## 1. What is SRI?

The Solar Reflectance Index (SRI) is a numerical expression of a constructed surface's ability to reflect solar heat. SRI values are derived from a calculation in ASTM E1980 which uses a roof's solar reflectance, thermal emittance and medium wind coefficient to generate a unit-less value from 0 to 100. A standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. The higher SRI values indicate a roof whose surface temperature is lower, thereby reducing heat gain in the living space beneath the roof. Green building rating tools such as Leadership in Energy and Environment Design (LEED) and Malaysia's Green Building Index (GBI) encourage using building materials with high SRI values to reduce the intensity and impact of the Urban Heat Island (UHI) effect.

### SRI Values required by LEED & GBI

Roof	Slope	SRI
Low-Slope	≤ 2/12	78 or greater
Steep-Slope	> 2/12	29 or greater

## 2. What is solar reflectance?

Solar reflectance is the proportion of the total solar radiation that is reflected back from a surface to the atmosphere. Any solar radiation that is not reflected is absorbed into the building envelope, requiring further energy to cool the building; or partially convected into the atmosphere and thus increasing the ambient air temperature in the surrounding environment (Urban Heat Island effect).

## 3. What is thermal emittance?

Thermal emittance is the proportion of absorbed solar radiation that is radiated back to the atmosphere. Most unpainted metallic coated steels have low thermal emittance (less than 0.30), while pre-painted steels (regardless of colour) have high thermal emittance values of around 0.85. A roofing material with a higher thermal emittance will re-emit absorbed thermal energy more quickly than a material with a low emittance and keep roof temperature lower.

## 4. What is Convection vs. Conduction ?

Sunlight that is not reflected is converted into heat that dissipated through convection, conduction or radiation. Convection is heat circulation due to air flow. An example is when hot air rises or cool air falls. Conduction is heat that transfers through solid object. An example of this

is heat being transferred from outside building into the house (inside of the home). Radiation is heat travels from a heat source to warm a surface. An example is the sun shining through a window directly heating the floor or furniture.

## 5. What is Thermatech™ technology?

A solar reflectance technology is incorporated into Clean COLORBOND™ steel to lower surface temperature by absorbing less heat from the sun. Thermatech™ optimizes the thermal performance of every colour in the standard Clean COLORBOND™ steel palette, without changing their appearance. Thermatech™ provides greater thermal comfort all-year round, whilst using less energy for air-conditioning and helps to mitigate the urban heat island effect.

## 6. What is recycled content material?

Recycled content denotes the proportion of a product that is generated from post-consumer or pre-consumer material, and has become an important benchmark in green buildings rating tools. According to the LEED-NC guide, there is a default post-consumer recycle content value for steel of 25% which can be used regardless of documentation as steel is usually made from at least 25% post-consumer recycled steel. In cases where the steel recycled content is greater than 25%, documentation should be provided.

## 7. What is post-consumer material?

Post-consumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the products, which can no longer be used for its intended purpose (e.g. demolished buildings scrap, old car bodies). Post-consumer material also includes the return of material from distribution chains.

## 8. What is pre-consumer material?

Pre-consumer (sometimes also referred to as post-industrial) material is recovered from the product manufacturing process before it is sold to end users (e.g. offcuts from car manufacturers sold back to the steel industry). Reutilization of materials such as rework, regrind or scrapping within the processes that generated them is not considered pre-consumer material recycling in terms of recycled content. However, recovery of these materials is still recycling, because materials that would have otherwise become waste are reprocessed and incorporated into new products.

Table 1.0: Solar Properties of Roofing Materials<sup>1</sup>

Roofing Material	Solar Reflectance (ASTM E903)	Thermal Emittance (ASTM C1371)	Solar Reflectance Index (SRI) - ASTM E1980**
Red Clay Tiles	0.33	0.90	36
Red Concrete Tiles	0.18	0.91	17
Aluminium	0.61	0.25	50
Galvanized Steel	0.61	0.04	37
ZINCALUME® Steel	0.67	0.30	63
<b>Clean COLORBOND™ Steel</b>			
Thredbo White/Eco White*	0.73	0.84	89
Off White/Enduring White*	0.70	0.86	85
African White/Amazing White*	0.70	0.86	85
Neutral Beige/Urban Beige*	0.69	0.85	83
Mosaic Blue/Nexus Blue*	0.68	0.85	82
Aloe Green/Wasabi Green*	0.68	0.86	82
Ivory Grey/Cosmic Grey*	0.67	0.85	81
Fantasy Yellow/Solaris Yellow*	0.67	0.85	80
Cape White/Cedarberg White*	0.66	0.86	79
African Cream/Durable Cream*	0.60	0.85	70
Shale Grey/Ultimate Grey*	0.59	0.86	69
Almond Beige/Breathless Beige*	0.59	0.86	69
Khaki Beige/Dynamic Beige*	0.55	0.85	64
Dune/Sahara Sands*	0.53	0.85	61
Armour Grey/Livid Grey*	0.43	0.86	47
Pale Eucalypt/Intimate Green*	0.42	0.85	46
Heritage Red/Enchanting Red*	0.32	0.86	33
Cape Red/Oriental Red*	0.31	0.86	32
Volcanic Grey/Ore Grey*	0.29	0.86	29
Safari Brown/Southern Brown*	0.29	0.85	28
African Blue/Two Ocean Blue*	0.28	0.85	27
Colonial Green/Garden Route Green*	0.27	0.86	27
Cape Charcoal/African Charcoal*	0.23	0.84	19

\* Colour name in Clean COLORBOND™ Ultra

\*\* SRI is calculated using ASTM E1980-01 with Medium Convection Coefficient (12) value reported. This data is approximate values only - may vary based on paint formulation and / or metallic coating thickness

Following is comparison roofing sheet temperature:  
 Roof Sheet Surface Temperature (°C) : Thermatech® vs Non-Thermatech®

Clean COLORBOND™ Steel - Colours	Roof Sheet Surface Temperature (°C)*	
	Thermatech™	Non-Thermatech™
Off White	50.3	52.5
African Cream	55.8	57.3
Shale Grey	56.3	60.5
Heritage Red	70.0	71.1
Volcanic Grey	71.5	75.3
Cape Charcoal	75.0	78.2

\* Calculated according to ASTM E1980. Assume 1000W/sq.m

**For more information on BlueScope or its products please visit [www.bluescopesteel.co.za](http://www.bluescopesteel.co.za).**



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