



ENERGY STAR
INFRARED HEAT REFLECTIVE

Cool Solutions to Dark Colour....!



COOLING
OUR URBAN
ENVIRONMENT

INFRARED HEAT REFLECTIVE



Environmental Leadership is Everyone's Responsibility.





Table of Contents

Introduction.....	1
Infrared Heat Signature	2
How do Energy Star products work ?	3
What are “urban heat islands” ?	4
The relationship between Heat and Smog (Ozone)	6
What are Energy Star Qualified Products ?	7
The Problem and Solution.....	8
The Problem and Solution - Plain Metal Roofing	9
 PRODUCTS	
Energy Star Gloss and Low Sheen	10
Energy Star Metal-Flex	11
Energy Star Dirtguard I.R. Elastic	12
Energy Star EC-100 Dirtguard SM	13
Energy Star Tilesshield	14
Energy Star Armatex Textures.....	15
Energy Star B-16 I.R. Grey Z.P. Primer	16
Energy Star Dirtguard I.R. Gloss	17
Energy Star Ceram-4000	18
Energy Star Tilesshield SM	19
 Energy Star Certification	
Temperature Difference Chart to ASTM E-1980-01 Standard vs Energy Star	21
Building Code of Australia (BCA) Colour Classification	22
NSW Building and Sustainability Index (BASIX) Colour Classification	23
What do (%T.S.R.) Total Solar Reflectance, figures represent.	24
(%T.S.R.) Tests reports to ASTM C-1549.....	25
What do (S.R.I.) Solar Reflectance Index, figures represent	27
What is Dirtguard Technology and Why is it Important ?	28
Why are Energy Star coatings MORE DURABLE	30
 APPENDIX	
(S.R.I.) .Tests reports to ASTM E-1980-01.....	32
 APPENDIX II	
Available colours	39



You Can Now Design In A World Where Dark Colour No Longer Needs To Be Hot Colour

A coating doesn't have to be white to be cool... As an Architect, Builder or Homeowner, rich dark colour is an important part of your building design and decoration. Unfortunately, dark colours soak up the sun and get hotter and hotter as the day progresses. As a result, building temperature and power consumption are increased and greater demand is placed on our environment and global resources.

In a world that now demands we be more energy efficient and resource conscious, the use of dark colour, although attractive, created a new design challenge for our industry to overcome. It would be the "holy grail" in coating technology, to achieve a black or deep tone that would reflect solar heat and stay cool.

The exponential growth of urban areas has produced what science now calls "urban heat islands" with the major contributing factor being heat-absorbing roofing, walls and pavements.



As a result of ongoing research and development into heat reflective coatings Astec developed a new technology of colour infused nano ceramics that reflect heat by selective reflection of infrared light. This technology has enabled us to offer dark colour exterior coatings that reflect fully 50% of Solar energy and provide positive results for our environment and consumers.



CERTIFIED PRODUCTS



The successful development of Energy Star® enables you to make choices to provide positive contributions to our global environment with reductions in Urban Heat, Smog and through it's energy efficiency, help reduce Co2 emissions.

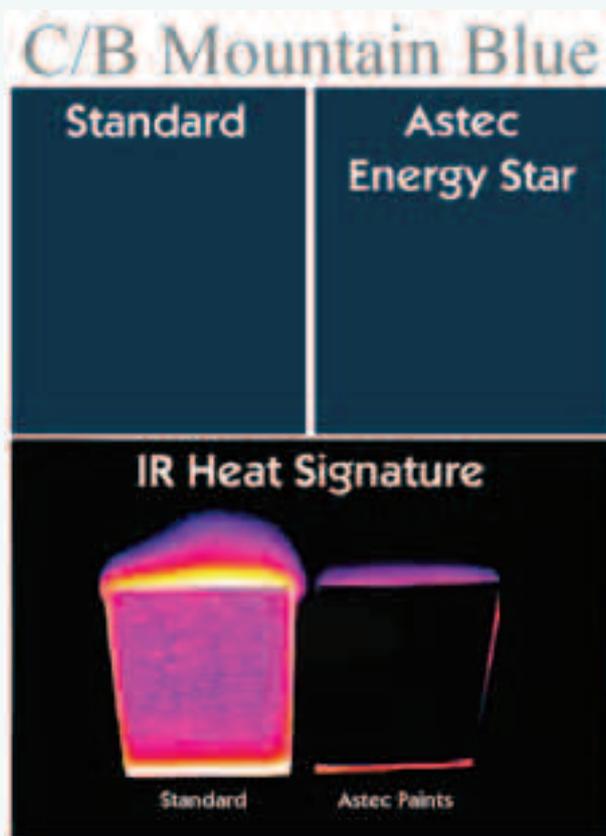


Our environment is constantly changing and we are all making choices that have an impact now and into the future. Choose Energy Star® with confidence and Paint with Pride.

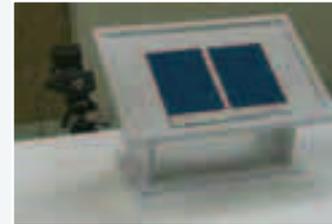
Infrared Heat Signature.....

A Coating Can Now be Dark and Cool.....!

No longer does a coating have to be white to be cool... Two coatings can be identical in visible colour, yet their infrared reflectance characteristics can be completely different. The coating that reflects infrared light will remain cooler than the coating that absorbs it. Because IR-light comprises fully half of sunlight, the IR-reflectivity of a coating is even more important than its colour when it comes to heat build-up.



The IR heat signature was captured by an infrared camera from the rear of two panels during a Solar Radiation Exposure Test. One panel was Astec Energy Star® Low Sheen and the other, a competitor's premium exterior acrylic. Both panels were identical in colour.



How Do Energy Star Products Work?

Energy Star Coatings reflect fully 50% of Solar energy with a new technology of colour infused nano ceramics that reflect heat by selective reflection of infrared light.

The electromagnetic radiation from the Sun that strikes the Earth consists of radiation in the wavelengths of about 300 nanometres (nm) to 2500 nanometres. The wavelength region below 400 nanometres is called Ultraviolet (UV).

The UV is responsible for sun burn to our bodies and causes degradation to paints and construction surfaces. The Visible region, 400 to 700 nanometres, is the area where the human eye is attuned to see light in all its various colours.

The final area from 700 to 2500 nanometers is the Infrared (IR) region. These longer wavelengths are invisible to the eye, yet contain about half of the solar energy which strikes the earth (see Figure 1).

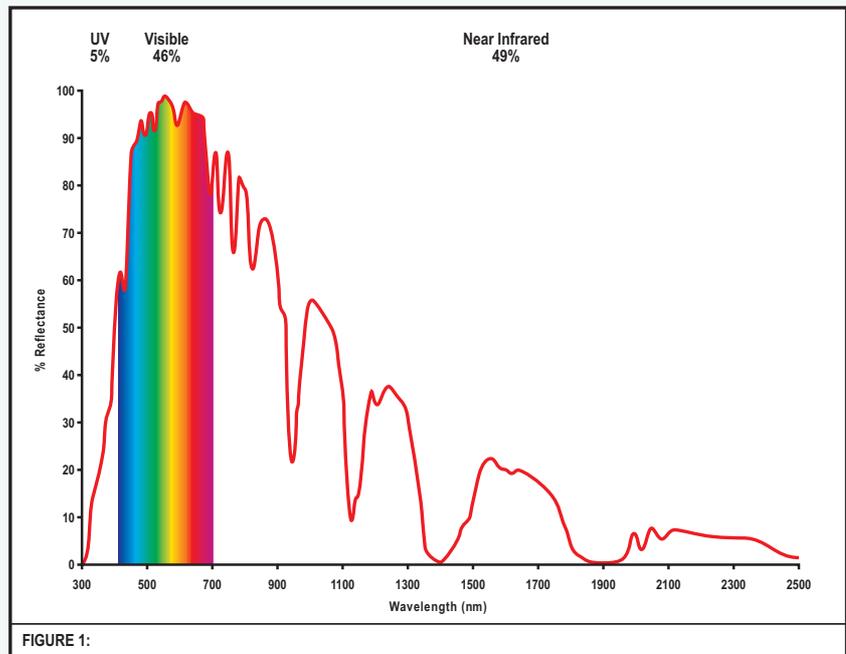


FIGURE 1:

The Human eye can see different colours by selective reflection in the visible region, in other words, we see a red colour because the radiation in the red portion of the visible spectrum is reflected; the remaining radiation in the visible range is more or less absorbed. We can not see in the infrared region of the spectrum, so the human eye can not determine what is going on there by sight. But, we can feel the effects of its energy in the form of heat.

Touch your bitumen driveway, climb on a black tiled roof, or place your hand on your black vehicle when it's been out in the sun for a while. It's quite HOT! In fact, some dark coloured roofing and side wall can attain a temperature of 88 degrees Celsius or more. Why?, well it's because these materials absorb a large portion of the infrared radiation from the Sun.

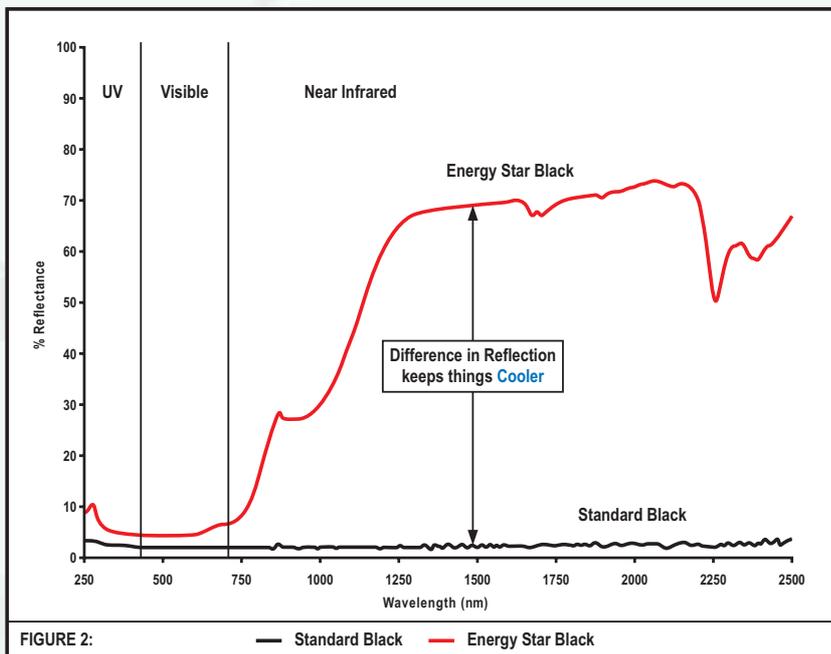


FIGURE 2:

— Standard Black — Energy Star Black

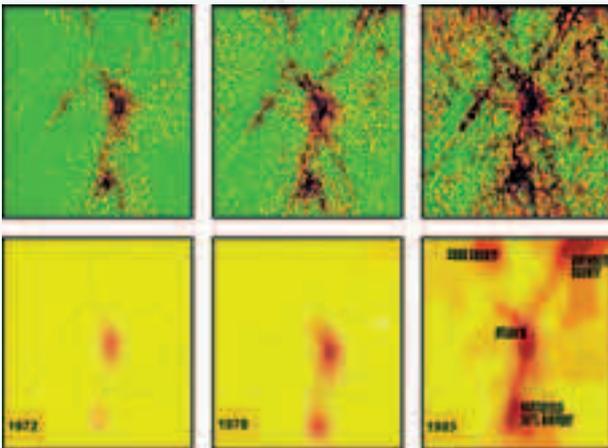
Look at the second chart (Figure 2). We show a standard black acrylic paint versus Energy Star acrylic paint. Notice the difference in the curves. The normal black paint absorbs the radiation across the whole solar spectrum, where Energy Star black reflects in the invisible Infrared portion. The colour appears black in the visible portion of the spectrum, but reflects in the invisible Infrared portion. This results in significantly less solar energy being absorbed, which means less heat build-up.

What are “urban heat islands” ?

As vegetation has been replaced by non-reflective construction materials for roofing walls and pavements, our cities have become steadily warmer. With the increase in city temperatures peak energy demand and smog have grown along with an escalation in respiratory health related issues. Our Cities are now known as “urban heat islands”.



The effects of “urban heat island” in Atlanta Georgia 1978 to 1993. Captured by Satellite thermal imaging.

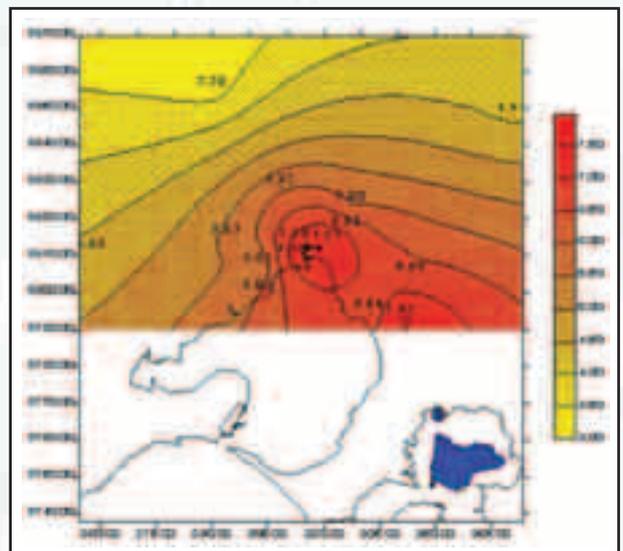


- The exponential growth of urban areas has produced what science now calls “urban heat islands” with the major contributing factor being heat-absorbing roofing, walls and pavements.
- The temperature in the air above the urban heat islands can be as much as twelve degrees hotter than the surrounding areas.
- As a result of these higher temperatures, air conditioning costs and power consumption are increased.
- An alarming result of this excess heat and it’s demand for additional energy production for cooling, is the high levels of ozone and smog experienced in our cities.

In 1998 the “Urban Heat Island Project” was formed. The project was developed in co-operation with the ENVIRONMENTAL PROTECTION AGENCY AND LOCAL GOVERNMENTS. The focus of this group is to develop ways to make our cities cooler and thereby reduce pollution, and save energy. Data from these groups have shown there is a steady increase in the “urban heat island” effect over several decades.

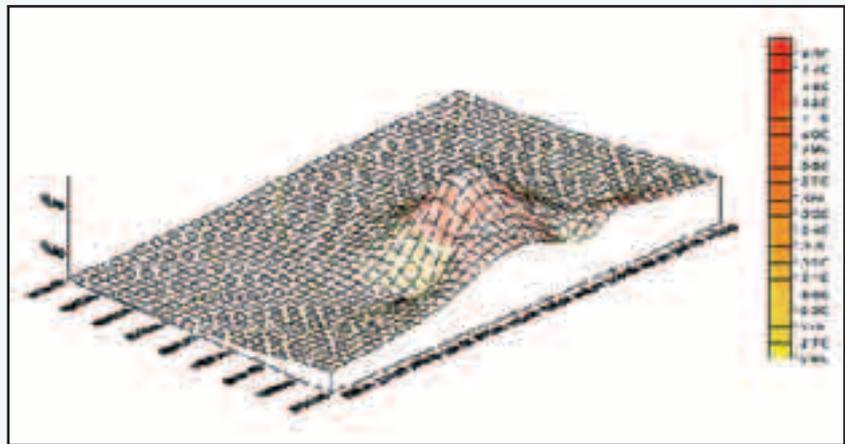
Japan is averaging an increase in temperature of 0.60 F per decade, Los Angeles 0.80 F and average minimum temperatures from many weather stations over most of Australia have shown an increase of between 0.1 deg C and 0.3 deg C per decade since 1951.

► **The plot shows the 1985-94 Winter (JJA) Mean Minimum Observed Temperature recorded at 15 sites around Melbourne.**



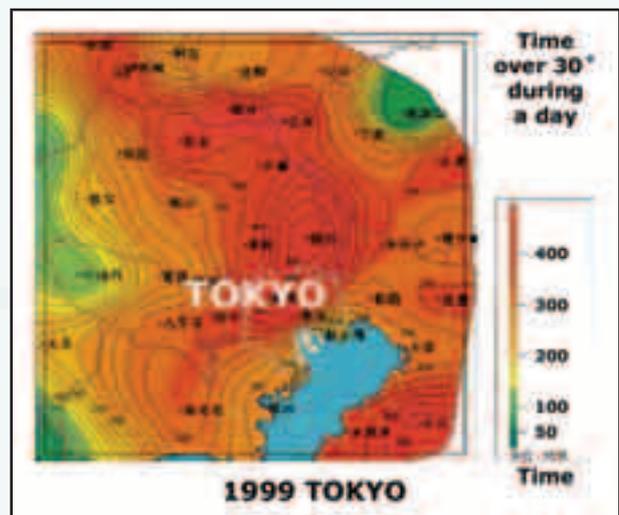
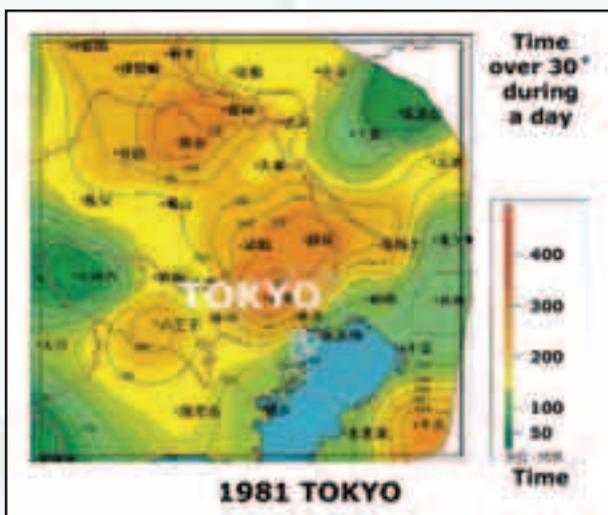
What are “urban heat islands” ?

The plot right shows the 1985-94 Summer Mean Minimum Potential Temperature contours for Melbourne. This plot shows a UHI of 1.81 deg C, which is determined by subtracting the



average value of Melbourne and Laverton airports from the average value of the three inner city sites of Melbourne, Paisley and Alphington. The peak in the contours is located over Melbourne's CBD. The key shows a UHI of 2.0 deg C, with a contour interval of 0.1 deg C.

The effects of “urban heat island” in Tokyo Japan 1981 to 1999. Captured by Satellite thermal imaging.



Japan is averaging an increase in temperature of 0.60 F per decade, Los Angeles 0.80 F and average minimum temperatures from many weather stations over most of Australia have shown an increase of between 0.1 deg C and 0.3 deg C per decade since 1951.

The relationship between Heat and Smog (Ozone).

Urban Heat Islands Increase Smog (Ozone)!

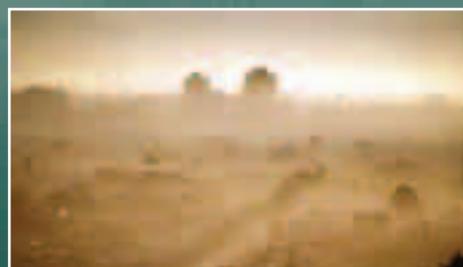


Nitrogen oxides are produced from fossil fuel combustion by motor vehicles and by power plants. They are highly reactive gases that form when fuel is burned at high temperatures.

The major mechanism for the formation of Nitrogen Oxide in the atmosphere is the oxidization of nitric oxide. A suffocating, brownish gas, nitrogen oxide is a strong oxidizing agent that reacts in the air to form corrosive nitric acid, as well as toxic organic nitrates and plays a major role in the atmospheric reactions that produce ground-level ozone or smog.

Ozone, or smog is very sensitive to temperature and with rising temperatures in our cities, smog becomes worse.

Smog has become a persistent environmental health problem that aggravates allergies and respiratory illnesses, especially in children and the elderly. It is suggested by government authorities that with the increase in city temperatures, smog and health risks will become worse.



What are ENERGY STAR® Qualified Products?

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ENERGY STAR is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency.

The program was created in 1992 by the Environmental Protection Agency, E.P.A. and is managed globally by government departments.

AUSTRALIA

Australian Green house office

www.energystar.gov.au

UNITED STATES

Environmental Protection Agency (EPA)

www.energystar.gov

CANADA

Natural Resources Canada (NRCan)

www.oeenr.gc.ca/energystar/

EUROPEAN UNION

The European Commission (EC)

www.eu-energystar.org/

JAPAN

The Energy Conservation Centre, Japan (ECCJ)

www.eccj.or.jp/ene-star/english/prog/index.html

TAIWAN

The Environment and Development Foundation (EDF)

www.energystar.org.tw/indexE.htm

To date the ENERGY STAR program has helped to conserve energy in countless ways. The EPA states that the results are already adding up. In 2004 alone, with the help of ENERGY STAR, partnered products saved enough energy to power 24 million homes and avoid greenhouse gas emissions equivalent to those from 20 million cars all while saving \$10 billion in the US alone.

Energy savings are acknowledged as a critical element in the effort to preserve the environment. The less energy we consume the less fossil fuel we must consume to create the energy. The less fossil fuel we burn, the less smog we produce and the less acid rain falls, and the less global warming we induce. Businesses, governments and homeowners throughout the world have discovered that not only is the reduction in energy good for our environment but significant costs are saved as well.

To earn the ENERGY STAR label, coatings must meet strict energy efficient criteria set by the

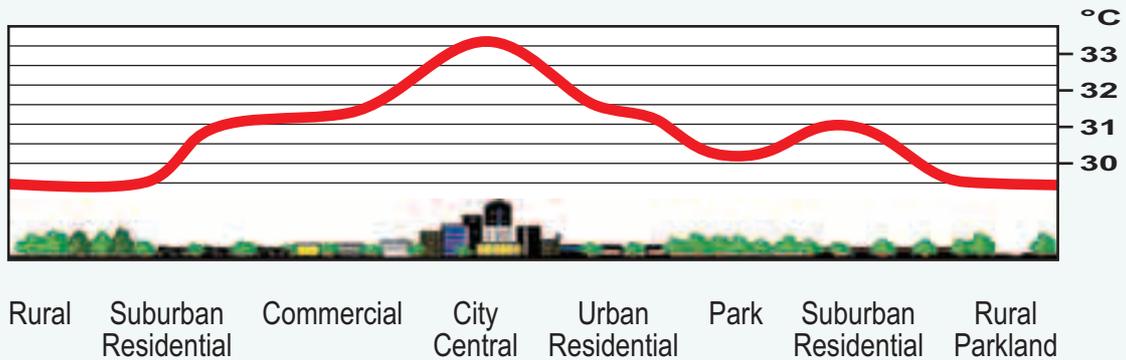
Environmental Protection Agency (EPA). ENERGY STAR exterior coatings must be very effective at reflecting the sun's rays to contribute to lower building temperatures. As an example, on roofing surfaces lower temperatures will decrease the amount of heat transferred into the building resulting in a reduction of peak cooling demand by as much as 10 to 15 percent.

Since ENERGY STAR labelled products can reduce the amount of air conditioning required to cool buildings, the EPA asserts energy bills can be reduced by up to 50%. And with the reduction in peak cooling demand it is possible for building owners to use smaller, less expensive HVAC systems, says the EPA.

Exactly how much money can be saved with the use of ENERGY STAR labelled products depends on the geographic location, climate, type of existing insulation and type of roof or cladding.

The Problem and Solution...!

Urban Heat Profile



Problem



Standard Urban Colours

Charcoal 5.6%	Brown 6.6%
Slate Grey 16.6%	Terracotta 15.8%
Gull Grey 47.8%	Red 14.2%

Standard Average	%TSR	17.76
Standard Average	Temp°C	99.00

Solution



Astec Energy Star Colours

Charcoal 32.8%	Brown 37.1%
Slate Grey 40.3%	Terracotta 42.4%
Gull Grey 68.3%	Red 37.5%

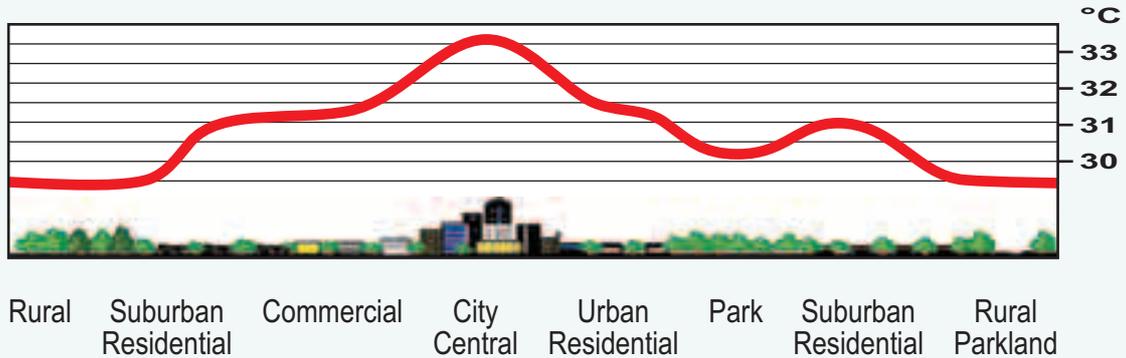
Astec ES Average	%TSR	43.06
Astec ES Average	Temp°C	77.00

Astec Energy Star Colours would be more reflective by: 25.3%
Astec Energy Star Colours would be Cooler by: 22.0°C

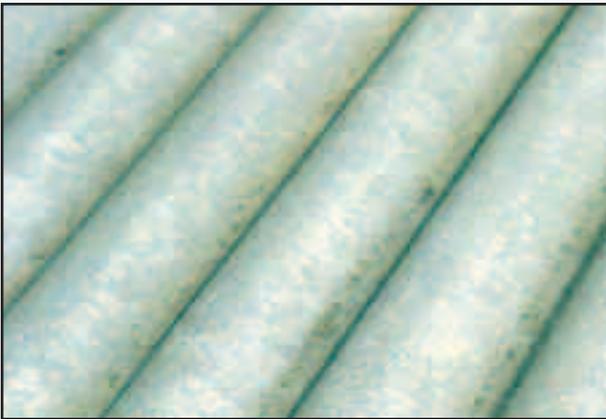
The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.

The Problem and Solution - Plain Metal Roofing...!

Urban Heat Profile



Problem

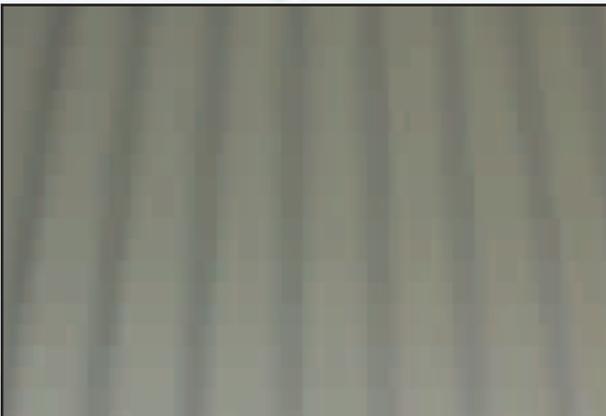


Galvanized Roofing

Emittance	ASTM C-1371	0.261
%T.S.R.	ASTM C-1549	0.450
S.R.I.	ASTM E-1980-01	-7.71
Solar Absorbance	ASTM E-1980-01	0.55

Galvanized Roofing	S.R.I.	-7.71
Galvanized Roofing	Temp @ 37°C	109.00

Solution



Astec Energy Star Gull Grey

Emittance	ASTM C-1371	0.900
%T.S.R.	ASTM C-1549	0.683
S.R.I.	ASTM E-1980-01	83.00
Solar Absorbance	ASTM E-1980-01	0.317

Astec ES Gull Grey	S.R.I.	83.00
Astec ES Gull Grey	Temp @ 37°C	58.00

Astec Energy Star Gull Grey increases the S.R.I. of plain metal by: 90.71%

Astec Energy Star Gull Grey would be Cooler than plain metal by: 51.00°C

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.

Energy Star® Gloss and Low Sheen.

BUY PRODUCTS THAT
MAKE A DIFFERENCE

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ENVIRONMENT

Astec Energy Star Low Sheen and Gloss remain COOL even in dark colours. The products are manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. They are low V.O.C., 100% acrylic paints and both are Silicone Modified for added water resistance and durability. They are designed for use on all exterior timber, fibro, masonry and metal.

The applied film is tough, yet flexible and because they remain cool, testing has shown that they will last eight times longer than all conventional exterior acrylic paints. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

**Timber, masonry, fibro,
and galvanized metal.**



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T.S.R. Data

S.R.I. Data



CERTIFIED PRODUCTS

Energy Star® Metal-Flex.

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ENVIRONMENT

Energy Star Metal-Flex remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. The product is available in both Gloss and Low Sheen and are both Silicone Modified for added water resistance and durability. They are low V.O.C., 100% acrylic paints, designed for use on all correctly prepared and primed, sloped metal roofing.

The applied film is resistant to mould and dirt pick-up, is tough, yet flexible and because they remain cool, testing has shown that they will last eight times longer than all conventional exterior acrylic roof paints.

Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Galvanized and pre-painted metal roofing.



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CERTIFIED PRODUCTS

Energy Star® Dirtguard I.R. Elastic.

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Energy Star Dirtguard IR Elastic remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. The product is a semi gloss, Crack Bridging elastomeric waterproofing coating for masonry and texture coated walls, that will bridge continually moving cracks without cracking or wrinkling.

The product is Silicone Modified for added water resistance and durability. It is a high solid, low V.O.C., second generation 100% acrylic with low temperature flexibility to -20°C. The product incorporates Astec Dirtguard Technology providing excellent resistance to environmental dirt pick-up and mould.

The cured film is tough and highly elastic, and because it remains cool, testing has shown that it will last eight times longer than all conventional exterior acrylic wall coatings.

Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Masonry and texture finished walls.



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CERTIFIED PRODUCTS

Energy Star® EC-100 Dirtguard S.M.

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Energy Star EC-100 Dirtguard S.M. remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. The product is a Crack Bridging elastomeric waterproofing membrane with excellent resistance to ponded water, it is semi-gloss, has excellent elongation and recovery and provides a positive waterproof seal for concrete and ply decks, metal, asbestos and cement tiled roofing.

The product is silicone modified for added water resistance and durability. It is a high solid, low V.O.C., second generation 100% acrylic with low temperature flexibility to -20°C. The product incorporates Astec Dirtguard Technology providing excellent resistance to environmental dirt pick-up and mould.

The cured film is tough and highly elastic, and because it remains cool, testing has shown that it will retain it's elasticity eight times longer than all conventional acrylic waterproof membranes. Astec Energy Star coatings were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Waterproofing of flat concrete and ply decks.

Asbestos, metal and cement tiled roofing.



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CERTIFIED PRODUCTS

Energy Star® Tilesshield.

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Energy Star Tilesshield remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. The product is a high gloss coating designed specifically for concrete roof tile restoration.

Tilesshield is a highly modified 100% acrylic that incorporates Astec Dirtguard and proprietary cross linking technology. Tilesshield will remain free of environmental contaminants through face to face block resistance that is achieved within 35 minutes of it's application.

The product was originally designed to tolerate the demanding environmental contaminants in Asian cities and is an excellent replacement for solvent-borne acrylics and polyurethane, providing many of the same performance properties without harmful solvent release to the atmosphere. It is Silicone Modified for added water resistance and durability.

Tilesshield is now Australia's leading finish for concrete roof tiles. The cured film is tough, flexible and block resistant, and because it remains cool, testing has shown that it will last eight times longer than all conventional acrylic roof coatings. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Cement tiled roofing.



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CERTIFIED PRODUCTS

Energy Star® Armatex Textures.

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Energy Star Armatex Textures remain COOL even in dark colours. The textures are a re-formulation of our well known Armatex texture range that now incorporates the use of colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light.

The products are formulated to provide a ready for use material that can be applied straight from the drum by either Trowel, Roller or Spray to suitably prepared vertical walls. The final result is a unique, textured finish that is hard wearing, flexible and transforms concrete, brick, fibro and many other construction materials into a decorative rendered wall appearance.

Carefully graded washed and dried sands are blended with Astec second generation 100% acrylics to form a flexible product that is extremely well bound, fast and trouble free to apply.

Energy Star Armatex provides a strongly adhered film with outstanding exterior durability, and because they will last eight times longer than all conventional acrylic texture coatings. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Texture finish for exterior walls.



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CERTIFIED PRODUCTS

Energy Star® B-16 I.R. Grey Z.P. Primer.

A Cathodic Barrier with Outstanding Adhesion to New Metal Surfaces.

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B-16 I.R. Grey Primer remains COOL as it is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light.

The product is an industrial grade, oil fortified, anti-corrosive primer that contains high level Zinc Phosphate pigments. The zinc phosphate provides cathodic protection for the metal substrate, as it chemically prevents iron from reacting with oxygen to form rust.

The product is resin rich, therefore adheres extremely well to bare steel and galvanized sheet. B-16 I.R. Grey Primer promotes tremendous adhesion for top-coats to new galvanized metal, requiring only a mist prime to achieve this result.

B-16 I.R. Grey Primer is surface tolerant to the power and hand tool cleaned substrates that are commonly experienced on aged metal roofing. Used in combination with Astec Rus-traint, the system provides good resistance to electrolysis that is experienced at sheet overlaps.

Most importantly, the Solar reflective properties of the product ensure that the primer will not attract heat and boil beneath semi-opaque protective top-coats. Additionally, it provides a cool surface for subsequent roofing top-coats that are applied in direct sunlight.

The cured film is anti-corrosive and highly adhesive. It provides a strong and reliable intercoat adhesion with all Astec Energy Star Infrared Heat Reflective top-coats.

PRINCIPLE USE:

Galvanized and pre-painted metal roofing.



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CERTIFIED PRODUCTS

Energy Star® Dirtguard I.R. Gloss.

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Energy Star Dirtguard I.R. Gloss remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light.

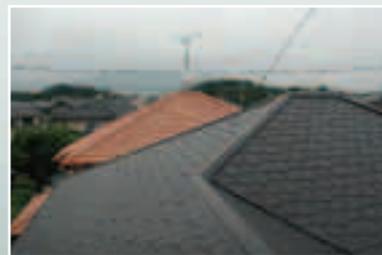
The product is a highly modified 100% acrylic gloss. It is low V.O.C, and incorporates Astec Dirtguard and proprietary cross linking technology. The product was originally designed to tolerate the demanding environments in Asian cities, providing excellent long-term resistance to dirt pick-up and mould.

The product is water resistant, flexible and has exceptional flow and leveling properties. During brush or spray application the product levels to a very smooth and uniform gloss finish. The product is principally used for metal roofing applications where a low film build, but highly infrared reflective, (S.R.I. 112.33), coating is required.

The cured film is tough, flexible and block resistant, and because it remains cool, testing has shown that it will last eight times longer than all conventional acrylic roof coatings. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Galvanized and pre-painted metal roofing and asbestos roofing.



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S.R.I. Data



CERTIFIED PRODUCTS

Energy Star® Ceram-4000

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Energy Star Ceram-4000 remains COOL even in dark colours. The product is manufactured using traditional and colour infused nano ceramics that provide low thermal transfer and reflect fully 50% of Solar heat by selective reflection of infrared light.

Ceram-4000 is a very low V.O.C., 100% acrylic, high build ceramic coating that has very low thermal conductivity, resulting in low heat transfer through the product to the internals of a roof, thermal conductivity, (0.1 W/ m / Deg C).

The product is flexible, impact resistant and flows extremely well to a smooth linen appearance. The product can be used as a stand alone top-coat over primed sloped roofing or can be over-coated with Metal-Flex, Tilesshield or IR Gloss for additional performance benefits. The combination of say, Ceram-4000 top-coated with Energy Star I.R. Gloss, will result in high solar reflectivity, high emissivity and low thermal conductivity while providing good dirt pick-up resistance and lower rain noise transfer to the internals of a building (8 db average noise reduction).

Ceram-4000 is designed for use on all correctly prepared and primed sloped roofing. The product is tough, yet flexible and because they remain cool, testing has shown that they will last eight times longer than all conventional exterior acrylic roof paints. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Galvanized and pre-painted metal roofing, concrete tiles and asbestos roofing.



CONTACT ASTEC FOR:

Technical Data Sheet

T.S.R. Data

S.R.I. Data



CERTIFIED PRODUCTS

Energy Star® Tilesshield S.M.

BUY PRODUCTS THAT
MAKE A DIFFERENCE

COOLING
OUR URBAN
ENVIRONMENT

Energy Star Tilesshield S.M. remains COOL even in dark colours. The product is manufactured using colour infused nano ceramics that reflect fully 50% of Solar heat by selective reflection of infrared light. The product is an ultra high gloss coating designed specifically for concrete roof tile restoration.

Tilesshield S.M. is a highly modified 100% acrylic that incorporates Astec Dirtguard and proprietary cross linking technology. It provides excellent long-term block resistance for the roof surface to remain free of environmental contaminants for cleaner rain water collection. The product was originally designed to tolerate the demanding environmental contaminants in Asian cities. It is Silicone Modified for added water resistance and durability.

Tilesshield S.M. is now Australia's leading finish for concrete roof tiles. The cured film is tough, flexible and block resistant, and because it remains cool, testing has shown that it will last eight times longer than all conventional acrylic roof coatings. Astec Energy Star paints were the first in Australia to earn the ENERGY STAR label for energy efficient paints. As an Architect, Builder or Homeowner, cooler buildings are a positive contribution to our global environment with reductions in Urban Heat, Smog and through energy efficiency, help reduce CO2 emissions.

PRINCIPLE USE:

Cement tiled roofing.



CONTACT ASTEC FOR:

Technical Data Sheet

T.S.R. Data

S.R.I. Data



CERTIFIED PRODUCTS

Colour Name	Standard	ENERGY STAR	Deg C Cooler	% Cooler
Plain Galvalume Sheet Metal	80	na	na	na
White	49	41	8	16%
8068 C/B Heritage Red	99	81	18	18%
8069 Red Iron Oxide	99	80	19	19%
8070 Terracotta	98	77	21	21%
8071 Clay Tone	90	74	16	18%
8072 Warm Clay	76	65	11	14%
8073 Tuscany	70	60	10	14%
8074 C/B Ironbark	103	78	25	24%
8075 Pioneer	105	87	18	17%
8076 Regal Brown	102	80	22	22%
8077 Yallara Brown	103	81	22	21%
8078 C/B Weathered Copper	103	80	23	22%
8079 Charcoal	105	84	21	20%
8080 C/B Slate Grey	98	79	19	19%
8082 Nimbus	102	82	20	20%
8083 C/B Beige	88	69	19	22%
8084 Merino	71	58	13	18%
8085 Off White	67	53	14	21%
8086 Sandalwood	61	52	9	15%
8087 C/B Smooth Cream	60	50	10	17%
8088 Mocca	85	66	19	22%
8089 Stone	71	58	13	18%
8098 Carraige Green	105	90	15	14%
8099 Bruns Green	104	89	15	14%
8100 Mist Green	92	76	16	17%
8101 C/B Rivergum	99	76	23	23%
8102 Olive Green	103	79	24	23%
8103 Blue Grass	100	82	18	18%
8104 Botanic	103	88	15	15%
8105 French Green	83	69	14	17%
8108 C/B Mountain Blue	104	89	15	14%
8081 C/B Birch Grey	81	63	18	22%
8094 Quarry	81	65	16	20%
8095 Mid Biscuit	71	57	14	20%
8097 Light Latte	69	56	13	19%
8106 C/B Saltbush	89	68	21	24%
8107 Cobalt	99	83	16	16%
8110 Pewter	83	64	19	23%
8111 Autumn	76	64	12	16%
8112 Chino	82	64	18	22%
8091 Broken White	57	48	9	16%
8092 Neutral White	60	50	10	17%
8093 Pale Buscuit	62	53	9	15%
8096 Light Cream	58	50	8	14%
8109 Gull Grey	75	58	17	23%

Temperature Difference Chart to ASTM E-1980-01 Standard vs Energy Star

The use of Energy Star heat reflective coatings on the external roof and walls of a property is guaranteed to increase the buildings reflectivity to sola induced heat and reduce the absorbed heat in the building envelope. In some circumstances and climatic conditions, substrate temperatures can be reduced by as much as 50%.

To accurately state the temperature reduction that can be achieved using Energy Star is however, difficult to state as every building is different and there are many factors that will effect the actual reduction of internal temperature such as; existing insulation levels, Australian climate zone, glazing, shading, the buildings orientation and external fabric.

However, for the assistance of our users we are able to accurately state substrate temperature reductions from tests conducted to ASTM E 1980-01 which is an international standard for the testing of thermally regulated paints and coatings.

The chart above compares standard colours to identical colours in Astec Energy Star and provides an example of plain galvanized metal under the same test conditions.

Colour	Solar Absorptance	Complying BCA Colours
Energy Star C/B Heritage Red	0.625	Dark
Energy Star Red Iron Oxide	0.61	Dark
Energy Star Terracotta	0.576	Dark
Energy Star Clay Tone	0.553	Dark
Energy Star Warm Clay	0.405	Light
Energy Star Tuscany	0.340	Light
Energy Star C/B Ironbark	0.591	Dark
Energy Star Pioneer	0.712	Dark
Energy Star Regal Brown	0.614	Dark
Energy Star Yallara Brown	0.630	Dark
Energy Star C/B Weathered Copper	0.609	Dark
Energy Star Charcoal	0.672	Dark
Energy Star C/B Slate Grey	0.597	Dark
Energy Star Nimbus	0.645	Dark
Energy Star C/B Beige	0.457	Light
Energy Star Merino	0.317	Light
Energy Star Off White	0.253	Light
Energy Star Sandalwood	0.233	Light
Energy C/B Smooth Cream	0.215	Light
Energy Star Mocca	0.424	Light
Energy Star Stone	0.311	Light
Energy Star Carraige Green	0.754	Dark
Energy Star Bruns Green	0.741	Dark
Energy Star Mist Green	0.56	Dark
Energy Star C/B Rivergum	0.555	Dark
Energy Star Olive Green	0.606	Dark
Energy Star Blue Grass	0.640	Dark
Energy Star Botanic	0.721	Dark
Energy Star French Green	0.461	Light
Energy C/B Mountain Blue	0.745	Dark
Energy C/B Birch Grey	0.378	Light
Energy Star Quarry	0.402	Light
Energy Star Mid Biscuit	0.305	Light
Energy Star Light Latte	0.291	Light
Energy Star C/B Saltbush	0.442	Light
Energy Star Cobalt	0.662	Dark
Energy Star Pewter	0.393	Light
Energy Star Autumn	0.391	Light
Energy Star Chino	0.394	Light
Energy Star Broken White	0.187	Light
Energy Star Neutral White	0.215	Light
Energy Star Pale Biscuit	0.246	Light
Energy Star Light Cream	0.213	Light
Energy Star Gull Grey	0.317	Light
Energy Star EC-100 SM White	0.137	Light
Energy Star Ceram-4000 White	0.121	Light
Energy Star Dirtguard I.R. Gloss White	0.108	Light
Energy Star EC-100 Dirtguard White	0.097	Light
Energy Star Tileshield White	0.083	Light
Energy Star Dirtguard I.R. Elastic White	0.097	Light
Energy Star GIS/LS White	0.133	Light
Energy Star Armatex White	0.098	Light
Energy Star Tileshield S.M. White	0.108	Light
Energy Star Metal-Flex GLS/LS White	0.108	Light

CLASSIFICATION OF ASTEC ENERGY STAR COLOURS IN ACCORDANCE WITH THE (BCA), BUILDING CODE OF AUSTRALIA.

The Building Code of Australia (BCA), has classified roof colour into light and dark, the lighter complying colours qualify for a deemed to satisfy insulation concession. The table below contains the Solar Absorptance and compliance of each Energy Star colour.

BCA classifications for light colour is a Solar Absorptance less than **0.55**

BCA classifications for dark colour is a Solar Absorptance greater than **0.55**

Typical Standard Absorptance Values	
Colour	Value
Slate (Dark Grey)	0.90
Red, Green	0.75
Yellow, Buff	0.60
Zinc aluminium-dull	0.55
Galvanized steel-dull	0.55
Light Grey	0.45
Off white	0.35
Light Cream	0.30

Colour	Solar Absorptance	Complying BCA Colours
Energy Star C/B Heritage Red	0.625	Medium
Energy Star Red Iron Oxide	0.61	Medium
Energy Star Terracotta	0.576	Medium
Energy Star Clay Tone	0.553	Medium
Energy Star Warm Clay	0.405	Light
Energy Star Tuscany	0.340	Light
Energy Star C/B Ironbark	0.591	Medium
Energy Star Pioneer	0.712	Dark
Energy Star Regal Brown	0.614	Medium
Energy Star Yallara Brown	0.630	Medium
Energy Star C/B Weathered Copper	0.609	Medium
Energy Star Charcoal	0.672	Medium
Energy Star C/B Slate Grey	0.597	Medium
Energy Star Nimbus	0.645	Medium
Energy Star C/B Beige	0.457	Light
Energy Star Merino	0.317	Light
Energy Star Off White	0.253	Light
Energy Star Sandalwood	0.233	Light
Energy C/B Smooth Cream	0.215	Light
Energy Star Mocca	0.424	Light
Energy Star Stone	0.311	Light
Energy Star Carraige Green	0.754	Dark
Energy Star Bruns Green	0.741	Dark
Energy Star Mist Green	0.56	Medium
Energy Star C/B Rivergum	0.555	Medium
Energy Star Olive Green	0.606	Medium
Energy Star Blue Grass	0.640	Medium
Energy Star Botanic	0.721	Dark
Energy Star French Green	0.461	Light
Energy C/B Mountain Blue	0.745	Dark
Energy C/B Birch Grey	0.378	Light
Energy Star Quarry	0.402	Light
Energy Star Mid Biscuit	0.305	Light
Energy Star Light Latte	0.291	Light
Energy Star C/B Saltbush	0.442	Light
Energy Star Cobalt	0.662	Medium
Energy Star Pewter	0.393	Light
Energy Star Autumn	0.391	Light
Energy Star Chino	0.394	Light
Energy Star Broken White	0.187	Light
Energy Star Neutral White	0.215	Light
Energy Star Pale Biscuit	0.246	Light
Energy Star Light Cream	0.213	Light
Energy Star Gull Grey	0.317	Light
Energy Star EC-100 SM White	0.137	Light
Energy Star Ceram-4000 White	0.121	Light
Energy Star Dirtguard I.R. Gloss White	0.108	Light
Energy Star EC-100 Dirtguard White	0.097	Light
Energy Star Tileshield White	0.083	Light
Energy Star Dirtguard I.R. Elastic White	0.097	Light
Energy Star GIS/LS White	0.133	Light
Energy Star Armatex White	0.098	Light
Energy Star Tileshield S.M. White	0.108	Light
Energy Star Metal-Flex GLS/LS White	0.108	Light

CLASSIFICATION OF ASTEC ENERGY STAR COLOURS IN ACCORDANCE WITH THE (BASIX), THE NEW SOUTH WALES BUILDING AND SUSTAINABILITY INDEX.

The New South Wales Building and Sustainability Index (BASIX), has classified roof colour into light, medium and dark determined by their solar absorptance. The light and medium colours have insulation and or roof space ventilation concessions. The light, medium and dark categories are also to be used in verification software, such as NatHERS, if the verification path is used to meet the BASIX thermal comfort requirement. The table below contains the Solar Absorptance and compliance of each Energy Star colour.

BASIX classifications for light colour is a Solar Absorptance less than **0.475**

BASIX classifications for medium colour is a Solar Absorptance between **0.475-0.70**

BASIX classifications for dark colour is a Solar Absorptance greater than **0.70**

Typical Standard Absorptance Values	
Colour	Value
Slate (Dark Grey)	0.90
Red, Green	0.75
Yellow, Buff	0.60
Zinc aluminium-dull	0.55
Galvanized steel-dull	0.55
Light Grey	0.45
Off white	0.35
Light Cream	0.30

What do (%T.S.R.) Figures Represent.

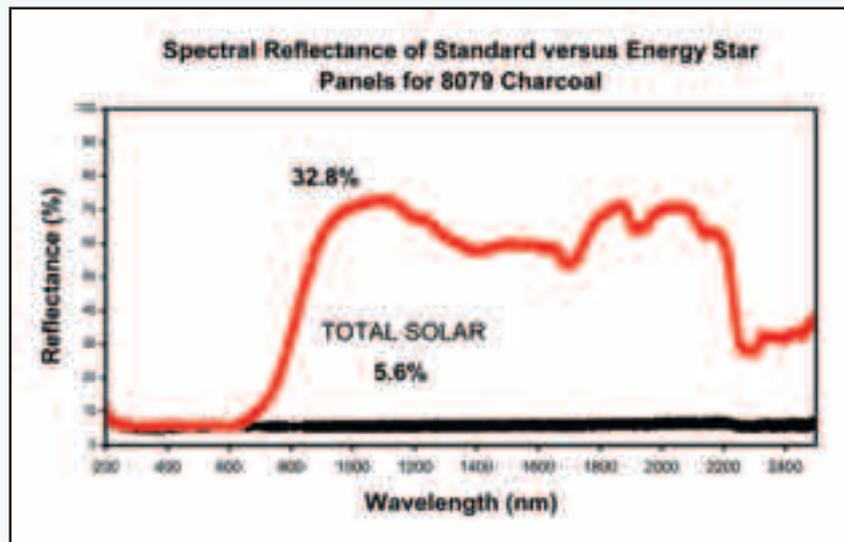
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T.S.R. figures are values that express in numerical terms the Total Solar Reflectance of a given surface and are usually expressed as (%T.S.R.)

The total solar reflectance figures are obtained through laboratory testing of coating films to such standards as ASTM E-903 or ASTM C-1549.

Testing to ASTM E-903 or ASTM C-1549 provides numbers as expressed as T.S.R.% that are the ratio of total solar energy which is reflected outward by the coating system to the amount of total solar energy falling on the coating system.

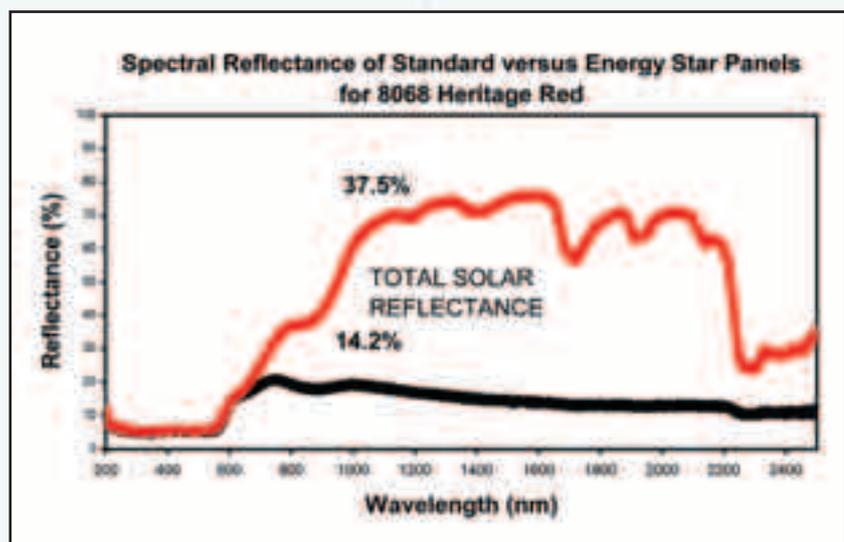


The way T.S.R.% is commercially understood, is that the difference in % of two different T.S.R. figures is broadly applicable to what happens in the real world when the surfaces are exposed to Solar radiation from the Sun. The actual surface temperature of a coating can vary greatly when influenced by such things as cloud cover and wind. However, T.S.R.% values have proven to offer a relatively consistent way of calculating the difference in surface temperature that could be expected between two products with different T.S.R. numbers.

If a coating with a T.S.R.% of 14.2 developed a temperature of 65 degrees Celsius on a 28 degree day. Then we wanted to know the surface temperature should that coating be replaced with a coating that had a higher T.S.R.% figure of 37.5. The difference in surface temperature would be the difference in % between the two T.S.R. figures subtracted as a percent from the initial temperature.

In the case of this example, the T.S.R. difference is 23.3%, therefore, the surface temperature would be the original 65 degrees C less 23.3% which results in a temperature reduction of 15.15 deg C and a final surface temperature of 49.85 degrees Celsius.

It should be noted that T.S.R. figures do not take into account any other insulating properties of a coating film such as varying rates of thermal transmission properties between different coatings. As a result the actual heat that is convected into the building can vary.



Reflectance for Energy Star Whites Base

Material ID	ASTM Test	Result, Solar Reflectance, Air Mass = 1.5					
		Method	% TSR			SD	95% CI
Specimen No.		1	2	3	% Avg	SD	95% CI
EC-100 T SM	C 1549	86.2	86.3	86.5	86.3	0.157	0.1778
ES Ceram-4000	C 1549	87.9	87.8	87.9	87.9	0.035	0.0397
ES DG IR GLOSS	C 1549	89.2	89.3	89.2	89.2	0.040	0.0457
ES EC-100 DIRTGUARD	C 1549	90.3	90.3	90.2	90.3	0.046	0.0523
ES TILESIELD	C 1549	89.4	89.2	89.2	89.2	0.100	0.1133
ES DG IR ELASTIC	C 1549	90.3	90.2	90.3	90.3	0.078	0.0884
ES GLS/LS	C 1549	86.7	86.6	86.7	86.7	0.035	0.0392
ES ARMATEX	C 1549	87.9	87.8	87.9	87.9	0.035	0.0397
ES TILESIELD SM	C 1549	89.4	89.2	89.2	89.2	0.100	0.1133
ES METAL-FLEX GLS/LS	C 1549	89.2	89.3	89.2	89.2	0.040	0.0457

Reflectance for Standard Paint Colours versus Energy Star Colours

Material ID		ASTM Test	Result, Solar Reflectance, Air Mass = 1.5					
			Method	% TSR			SD	95% CI
Specimen No.			1	2	3	% Avg	SD	95% CI
8068 C/B Heritage Red	Std.	C 1549	14.2	14.3	14.2	14.2	0.049	0.0555
8068 C/B Heritage Red	Energy Star	C 1549	37.5	37.6	37.5	37.5	0.047	0.0532
8069 Red Iron Oxide	Std.	C 1549	14.6	14.7	14.6	14.6	0.050	0.0560
8069 Red Iron Oxide	Energy Star	C 1549	39.0	39.1	39.0	39.0	0.047	0.0532
8070Terracotta	Std.	C 1549	15.8	15.9	15.8	15.8	0.048	0.0538
8070Terracotta	Energy Star	C 1549	42.4	42.5	42.4	42.4	0.047	0.0532
8071 Clay Tone	Std.	C 1549	27.9	28.0	27.9	27.9	0.049	0.0555
8071 Clay Tone	Energy Star	C 1549	46.7	46.8	46.7	46.7	0.047	0.0532
8072 Warm Clay	Std.	C 1549	46.9	47.0	46.9	46.9	0.035	0.0400
8072 Warm Clay	Energy Star	C 1549	59.5	59.6	59.5	59.5	0.047	0.0527
8073 Tuscany	Std.	C 1549	54.2	54.3	54.2	54.2	0.049	0.0549
8073 Tuscany	Energy Star	C 1549	66.0	66.1	66.0	66.0	0.050	0.0560
8074 C/B Ironbark	Std.	C 1549	9.6	9.7	9.6	9.6	0.049	0.0555
8074 C/B Ironbark	Energy Star	C 1549	40.9	41.0	40.9	40.9	0.049	0.0549
8075 Pioneer	Std.	C 1549	6.5	6.4	6.4	6.4	0.072	0.0817
8075 Pioneer	Energy Star	C 1549	28.8	28.9	28.8	28.8	0.047	0.0532
8076 Regal Brown	Std.	C 1549	9.7	9.8	9.7	9.7	0.050	0.0560
8076 Regal Brown	Energy Star	C 1549	38.6	38.7	38.6	38.6	0.049	0.0555
8077 Yallara Brown	Std.	C 1549	6.6	6.7	6.6	6.6	0.047	0.0527
8077 Yallara Brown	Energy Star	C 1549	37.1	36.9	36.9	37.0	0.128	0.1450
8078 C/B Weathered Copper	Std.	C 1549	8.6	8.7	8.6	8.6	0.049	0.0549
8078 C/B Weathered Copper	Energy Star	C 1549	39.1	39.2	39.1	39.1	0.048	0.0543
8079 Charcoal	Std.	C 1549	5.6	5.7	5.6	5.6	0.049	0.0549
8079 Charcoal	Energy Star	C 1549	32.8	32.9	32.8	32.8	0.050	0.0566
8080 C/B Slate Grey	Std.	C 1549	16.6	16.7	16.6	16.6	0.047	0.0532
8080 C/B Slate Grey	Energy Star	C 1549	40.3	40.4	40.3	40.3	0.047	0.0532
8082 Nimbus	Std.	C 1549	10.7	10.8	10.7	10.7	0.049	0.0555
8082 Nimbus	Energy Star	C 1549	35.4	35.6	35.5	35.5	0.053	0.0594
8083 C/B Beige	Std.	C 1549	30.3	30.5	30.4	30.4	0.053	0.0594
8083 C/B Beige	Energy Star	C 1549	54.3	54.4	54.3	54.3	0.050	0.0560
8084 Merino	Std.	C 1549	52.6	52.5	52.5	52.5	0.064	0.0719
8084 Merino	Energy Star	C 1549	68.3	68.4	68.3	68.3	0.049	0.0555
8085 Off White	Std.	C 1549	58.7	58.8	58.7	58.7	0.048	0.0543
8085 Off White	Energy Star	C 1549	74.7	74.8	74.7	74.7	0.049	0.0555
8086 Sandalwood	Std.	C 1549	66.1	66.2	66.1	66.1	0.049	0.0555
8086 Sandalwood	Energy Star	C 1549	76.7	76.8	76.7	76.7	0.049	0.0549

Reflectance for Standard Paint Colours versus Energy Star Colours Con't

Material ID		ASTM Test	Result, Solar Reflectance, Air Mass = 1.5					
			Method	% TSR				
Specimen No.			1	2	3	% Avg	SD	95% CI
8087 C/B Smooth Cream	Std.	C 1549	66.8	66.9	66.8	66.8	0.048	0.0543
8087 C/B Smooth Cream	Energy Star	C 1549	78.5	78.6	78.5	78.5	0.049	0.0549
8088 Mocca	Std.	C 1549	34.5	34.6	34.5	34.5	0.049	0.0555
8088 Mocca	Energy Star	C 1549	57.6	57.7	57.6	57.6	0.050	0.0566
8089 Stone	Std.	C 1549	53.0	53.1	53.0	53.0	0.045	0.0510
8089 Stone	Energy Star	C 1549	68.8	69.0	68.9	68.9	0.055	0.0623
8098 Carraige Green	Std.	C 1549	6.3	6.4	6.3	6.3	0.050	0.0560
8098 Carraige Green	Energy Star	C 1549	24.5	24.7	24.6	24.6	0.055	0.0623
8099Bruns Green	Std.	C 1549	6.9	7.0	6.9	6.9	0.049	0.0555
8099Bruns Green	Energy Star	C 1549	25.9	26.0	25.9	25.9	0.048	0.0543
8100 Mist Green	Std.	C 1549	24.4	24.6	24.5	24.5	0.055	0.0623
8100 Mist Green	Energy Star	C 1549	43.9	44.1	44.0	44.0	0.051	0.0571
8101 C/B Rivergum	Std.	C 1549	15.3	15.4	15.3	15.3	0.049	0.0555
8101 C/B Rivergum	Energy Star	C 1549	44.5	44.6	44.5	44.5	0.045	0.0510
8102 Olive Green	Std.	C 1549	8.6	8.7	8.6	8.6	0.048	0.0538
8102 Olive Green	Energy Star	C 1549	39.3	39.5	39.4	39.4	0.051	0.0571
8103 Blue Grass	Std.	C 1549	13.9	13.9	13.9	13.9	0.050	0.0560
8103 Blue Grass	Energy Star	C 1549	36.0	36.0	36.0	36.0	0.050	0.0560
8104 Botanic	Std.	C 1549	8.4	8.5	8.4	8.4	0.055	0.0623
8104 Botanic	Energy Star	C 1549	27.9	27.9	27.9	27.9	0.048	0.0538
8105 French Green	Std.	C 1549	36.7	36.8	36.7	36.7	0.050	0.0566
8105 French Green	Energy Star	C 1549	53.9	53.9	53.9	53.9	0.036	0.0408
8108 C/B Mountain Blue	Std.	C 1549	7.8	7.9	7.8	7.8	0.050	0.0566
8108 C/B Mountain Blue	Energy Star	C 1549	25.5	25.6	25.5	25.5	0.050	0.0566
8081 C/B Birch Grey	Std.	C 1549	39.7	39.8	39.7	39.7	0.050	0.0566
8081 C/B Birch Grey	Energy Star	C 1549	62.2	62.3	62.2	62.2	0.050	0.0566
8094 Quarry	Std.	C 1549	40.2	40.2	40.2	40.2	0.029	0.0327
8094 Quarry	Energy Star	C 1549	59.8	59.9	59.8	59.8	0.050	0.0566
8095 Mid Biscuit	Std.	C 1549	53.5	53.5	53.5	53.5	0.045	0.0510
8095 Mid Biscuit	Energy Star	C 1549	69.5	69.6	69.5	69.5	0.053	0.0594
8097 Light Latte	Std.	C 1549	55.0	55.1	55.0	55.0	0.052	0.0589
8097 Light Latte	Energy Star	C 1549	70.9	71.0	70.9	70.9	0.051	0.0577
8106 C/B Saltbush	Std.	C 1549	28.7	28.8	28.7	28.7	0.052	0.0583
8106 C/B Saltbush	Energy Star	C 1549	55.8	55.9	55.8	55.8	0.054	0.0606
8107 Cobalt	Std.	C 1549	14.2	14.3	14.2	14.2	0.055	0.0617
8107 Cobalt	Energy Star	C 1549	33.8	33.9	33.8	33.8	0.050	0.0566
8110 Pewter	Std.	C 1549	37.3	37.4	37.3	37.3	0.053	0.0600
8110 Pewter	Energy Star	C 1549	60.7	60.8	60.7	60.7	0.052	0.0589
8111 Autumn	Std.	C 1549	45.8	45.9	45.8	45.8	0.053	0.0600
8111 Autumn	Energy Star	C 1549	60.9	61.0	60.9	60.9	0.051	0.0577
8112 Chino	Std.	C 1549	38.5	38.6	38.5	38.5	0.051	0.0577
8112 Chino	Energy Star	C 1549	60.6	60.7	60.6	60.6	0.054	0.0606
8091 Broken White	Std.	C 1549	71.1	71.2	71.1	71.1	0.055	0.0617
8091 Broken White	Energy Star	C 1549	81.3	81.4	81.3	81.3	0.050	0.0566
8092 Neutral White	Std.	C 1549	66.8	66.9	66.8	66.8	0.053	0.0600
8092 Neutral White	Energy Star	C 1549	78.5	78.6	78.5	78.5	0.050	0.0566
8093 Pale Buscuit	Std.	C 1549	64.4	64.5	64.4	64.4	0.055	0.0617
8093 Pale Buscuit	Energy Star	C 1549	75.4	75.4	75.4	75.4	0.045	0.0510
8096 Light Cream	Std.	C 1549	69.6	69.7	69.6	69.6	0.053	0.0600
8096 Light Cream	Energy Star	C 1549	78.7	78.8	78.7	78.7	0.050	0.0566
8109 Gull Grey	Std.	C 1549	47.8	47.9	47.8	47.8	0.053	0.0600
8109 Gull Grey	Energy Star	C 1549	68.3	68.3	68.3	68.3	0.050	0.0560

What do (S.R.I.) Solar Reflectance Index, figures represent ?

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.

Solar reflectance index (SRI), is another measurement beginning to get some attention as a numerical expression of a coating's overall ability to reject solar heat.

Total Solar Reflectance (T.S.R.) figures are expressed as a percentage falling between 0% and 100% dependant on a product's Total Solar Reflectance as tested to ASTM C-1549 or ASTM E-903.

Emissivity or (Infrared emittance), is a measure of the ability of a surface to shed some of it's heat in the form of infrared radiation away from the surface. The results from tests conducted to ASTM C-1371, express the emittance value as a percentage falling between 0% and 100% depending on the product's performance.

Solar reflectance index (SRI), combines both the T.S.R.% reflectivity value and emittance value as a measure of a coating's overall ability to reject solar heat.

The (S.R.I.) index calculation is done in accordance with ASTM E 1980-01. The calculation is based on a mathematical formula that includes values for thermal emittance, total solar reflectance, solar absorptance, three convective coefficients, solar flux, the Stefan Boltzman constant, and various other coefficients.

Example: A standard black with reflectivity 5% and emittance 90% has an index of 0.
A standard white with reflectivity 80% and emittance 90% has an index of 100.

Note: Very hot materials can actually have negative values.
Very cool materials can have values greater than 100.

Extract on topic from Lawrence Berkeley National Laboratory (LBNL) :

"The ASTM's Cool Construction Materials Committee has developed a Solar Reflectance Index with values from 0 to 100, where 100 will be a defined standard white and 0 will be a defined standard black. According to Hashem Akbari, staff scientist and leader of the Heat Island Group at Lawrence Berkeley National Laboratory (LBNL) and chairman of the ASTM committee, the Index measures a material's solar reflectance and thermal emissivity. Thermal emissivity, according to Akbari, is the power to radiate heat from a surface. Given the combination of reflectance and emissivity, Akbari believes it is possible for dark colored materials to be cool and also have high Solar Reflectance."

Using ASTM E 1980-01 the solar reflectance index can be calculated for any given material provided the exact T.S.R.% and emittance values are known.

Coatings with the highest **Solar reflectance index** (SRI), are the coolest choice for exterior applications.

What is Dirtguard® Technology and Why is it Important ?

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.



Maintaining long-term Solar Reflectance is directly related to a products ability to remain clean when exposed to environmental contaminants over extended periods of time. So important is this performance criteria that it forms part of (EPA), The Environmental Protection Agency's product qualification specifications for reflective coatings to qualify for the ENERGY STAR® label.

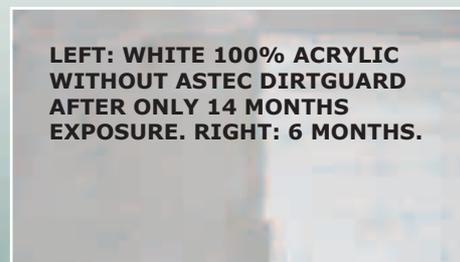
Applied products located in urban, industrial and city locations are field tested after three years of exposure to environmental contaminants to ASTM C-1549 as a measure of their "Maintenance of Solar Reflectance".

As a result of ongoing research and development into dirt pick-up resistance for exterior coatings, Astec developed a new technology now registered to Astec as **Dirtguard®**.

Dirtguard® technology was developed throughout a decade of R&D that was driven by products exported by Astec to Asian regions. In some Asian cities environmental contaminants can deface a coating within months of it's application.

Astec now use Dirtguard® technology in all Energy Star products. The products remain cleaner far longer than conventional coatings, a necessary requirement for maximum retention of their Solar Reflectivity.

Weathering farms in Queensland Australia and Florida America are continuously used by paint companies globally for outdoor exposure testing of paints samples. These farms offer good exposure to high levels of UV and humidity. However, Astec Paints found there was no better location than the harsh environment of Tokyo Central Japan to conduct ongoing tests for dirt pick-up resistance during the development of Astec **Dirtguard®** technology.



What is Dirtguard® Technology and Why is it Important ?

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.



Coatings based on Astec **Dirtguard** technology incorporate the latest in surface curing and nano particle technology. The surface of the film cross links around nano particles to provide an extremely tight surface pack ensuring dirt will not become lodged within the cured film.

Special Silicones also form part of Dirtguard technology and provide added durability and high water resistance to the cured film. The silicones used were selected through years of exterior weathering and dirt pick-up resistance trials that were conducted on exposure racks in numerous Asian cities.

The Silicone modification provides excellent block resistance to environmental contaminants and adds strong water repellency for rapid rain water run off that carries dust and contaminants from the roofing surface. These properties develop even under conditions of high humidity.

Coatings based on Astec Dirtguard Technology remain cleaner longer than conventional exterior coatings. They are easily cleaned, retain their aesthetic appeal and provide optimum maintenance of their solar reflectance in harsh environmental and industrial conditions.



Why are Energy Star Coatings MORE DURABLE ?

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.

Heat and moisture are the two main contributing factors that accelerate the degradation of exterior coatings. In highly humid, tropical environments, conventional acrylics have been known to last as little as three years. In Australia some dark metal roofing can start to change colour and fade from it's original depth within 3 years.

Energy Star coatings have increased durability and life expectancy compared with conventional paints. Independent laboratory testing to ASTM Standards confirmed Solar Reflectance Indexes of 241% greater than normal paints on a dark colour of Charcoal.

Heat generated by Solar Radiation from the sun is a major contributing factor to exterior coating degradation, especially in a standard dark colour.

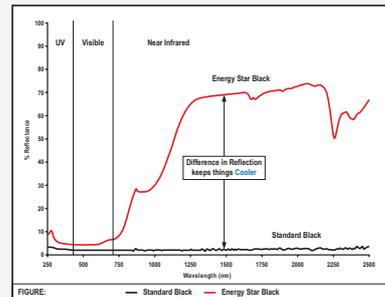
Energy Star Coatings will remain cool even in a *Black*. After exposure to 2800hrs of UVB 313/Moisture testing, in accordance to ASTM G53-96, the gloss, depth of colour, adhesion and film integrity remained un-changed, providing a performance increase of more than 400% when compared to a standard exterior 100% acrylic.

Quite simply, the less heat on the coating the longer they last.

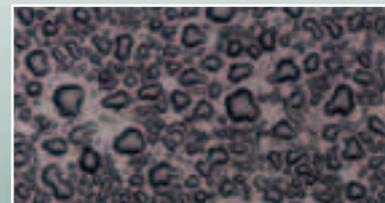
Moisture is the second major contributing factor to exterior coating degradation, especially in water based acrylic coatings. Atmospheric moisture enters the coating film on a daily basis and swells the coating, greatly reducing it's life.

Because the silicones used in Energy Star Coatings stop the ingress of moisture to the coating film, the coating does not swell and will last 400% longer than standard acrylics. Simply put, the less moisture that the coating film has to tolerate the longer it will last.

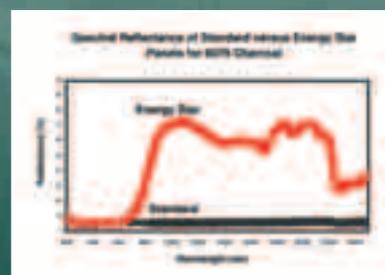
Astec Energy Star Coatings are the most advanced and functional coatings available in Australia. They provide high Solar reflectivity in dark colours, excellent resistance to moisture and remain clean and free from the effects of weathering longer than any other exterior premium paints.



Standard Charcoal	
%TSR	5.6
S.R.I.	-3.92
Solar Absorbance	0.944
Temp @37° C	105° C

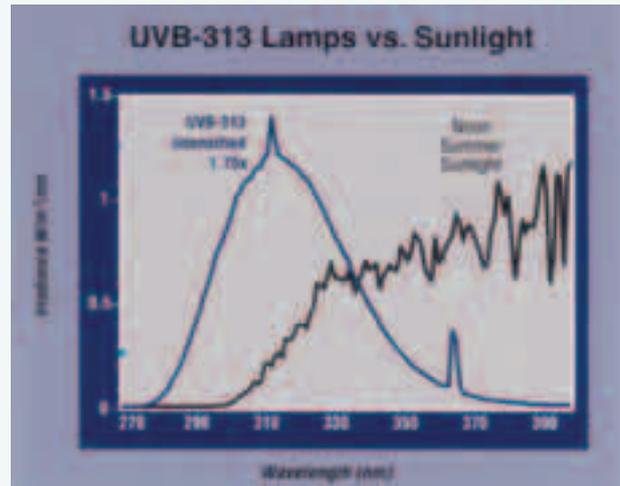


Energy Star Charcoal	
%TSR	32.8
S.R.I.	35.3
Solar Absorbance	0.672
Temp @37° C	84° C



Why are Energy Star Coatings MORE DURABLE ? Cont...

The selection of the energy efficient roofing translates into lower internal building temperatures and less urban heat build-up. Air conditioning power consumption is reduced along with green house emissions.



Solar radiation accelerated weathering exposure of 2800hrs, UVB 313/Moisture testing, in accordance with ASTM G53-96 standards.



All four samples were identical in colour at the beginning of the test cycle. At the end of the test cycle all premium acrylics had chalked and lost their original depth of colour. Whereas the Astec Energy Star acrylic retained it's gloss, mechanical properties and original depth of colour.

The added durability of Astec Energy Star Coatings translates into savings for the consumer from longer maintenance cycles, less substrate damage from solar radiation and most importantly building exteriors retain their aesthetic appeal far longer than with conventional exterior paints.

Appendix



2 November, 2005

Astec Paints Australasia Pty Ltd
262 Marion Road
NETLEY SA 5037

Attention: Mr Mark Waters

REPORT 05MAAD10444 Part 1
Reissue #1 – 1/11/05 – Data Corrections

CLIENT REFERENCE: Request

TITLE: Astec SRI Test

SAMPLE IDENTIFICATION: Astec Energy Star EC-100 Dirtguard

WORK REQUESTED: Determine Solar Reflectance Index according to ASTM E 1980-01

INVESTIGATING OFFICER(S): Natalie Powell

Monty Luke
Laboratory Manager
Materials Services

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1. INTRODUCTION

Mark Waters of Astec Paints Pty Ltd supplied reflectance and emittance data of Astec Energy Star EC-100 Dirtguard samples of various colours to the Amdel Materials Services Laboratory. It was requested that Amdel should carry out calculations to determine the Solar Reflectance Index according to ASTM E1980 – 01. The samples supplied for evaluation were identified as follows.

- ❖ Astec Energy Star EC-100 Dirtguard
- ❖ Astec Energy Star colours

2. PROCEDURE

The sample data supplied were inserted into the American Cool Roof Rating Council ASTM E 1980-01 calculator and the results reported for three convective coefficients corresponding to low, medium and high wind conditions. Standard solar conditions of Solar Flux = 1000W/m² Ambient Air Temp = 310K (37°C), Ambient Sky Temp = 300K (27°C) and no conductive heat transfer were used for all calculations. Each sample used the Emittance value for Astec Energy Star EC-100 Dirtguard white base of 0.90.

3. RESULTS

- ❖ Low Wind Conditions

The results of the calculations of the Astec Energy Star EC-100 Dirtguard sample under low wind conditions were as follows.

<u>Colour</u>	<u>SRI (low)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
White Base	113.83	314	41	106
8068 C/B Heritage Red	41.47	354	81	178
8069 Red Iron Oxide	43.45	353	80	176
8070 Terracotta	47.95	363	90	195
8071 Clay Tone	53.68	347	74	166
8072 Warm Clay	70.94	338	65	149
8073 Tuscany	79.84	333	60	140
8074 C/B Ironbark	45.56	352	79	174
8075 Pioneer	30.08	360	87	189
8076 Regal Brown	42.92	353	80	176
8077 Yallara Brown	40.81	354	81	178
9078 C/B Weathered Copper	43.58	353	80	175

<u>Colour</u>	<u>SRI (low)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
8079 Charcoal	35.30	357	84	184
8080 C/B Slate Grey	45.17	352	79	174
8082 Nimbus	38.84	355	82	180
8083 C/B Beige	63.89	342	69	156
8084 Merino	83.00	331	58	137
8085 Off White	91.87	326	53	128
8086 Sandalwood	94.66	325	52	125
8087 C/B Smooth Cream	97.18	323	50	123
8088 Mocca	68.36	339	66	151
8089 Stone	83.83	331	58	136
8098 Carraige Green	24.63	363	90	194
8099 Bruns Green	26.32	362	89	192
8100 Mist Green	50.08	349	76	169
8101 C/B Rivergum	50.74	349	76	168
8102 Olive Green	43.98	352	79	175
8103 Blue Grass	39.49	355	82	179
8104 Botanic	28.91	361	88	190
8105 French Green	63.35	342	69	156
8108 C/B Mountain Blue	25.80	362	89	193
8081 C/B Birch Grey	74.63	336	63	145
8094 Quarry	71.35	338	65	148
8095 Mid Biscuit	84.66	330	37	135
8097 Light Latte	86.60	329	56	133
8106 C/B Saltbush	65.92	341	68	154
8107 Cobalt	36.61	356	83	182
8110 Pewter	72.58	337	64	147
8111 Autumn	72.85	337	64	147
8112 Chino	72.44	337	64	147
8091 Broken White	101.10	321	48	119

<u>Colour</u>	<u>SRI (low)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
8092 Neutral White	97.18	323	50	123
8093 Pale Buscuit	92.85	326	53	127
8096 Light Cream	97.46	323	50	122
809 Gull Grey	83.00	331	58	137

❖ Medium Wind Conditions

The results of the calculations of the Astec Energy Star EC-100 Dirtguard sample under medium wind conditions were as follows.

<u>Colour</u>	<u>SRI (medium)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
White Base	113.89	313	40	103
8068 C/B Heritage Red	41.91	340	67	152
8069 Red Iron Oxide	43.88	339	66	150
8070 Terracotta	48.36	342	69	155
8071 Clay Tone	54.06	335	62	143
8072 Warm Clay	71.23	328	55	132
8073 Tuscany	80.08	325	52	126
8074 C/B Ironbark	45.99	338	65	149
8075 Pioneer	30.58	344	71	159
8076 Regal Brown	43.36	339	66	151
8077 Yallara Brown	41.26	340	67	152
9078 C/B Weathered Copper	44.01	339	66	150
8079 Charcoal	35.77	342	69	156
8080 C/B Slate Grey	45.59	338	65	149
8082 Nimbus	39.30	341	68	154
8083 C/B Beige	64.22	331	58	137
8084 Merino	83.23	324	51	124
8085 Off White	92.05	321	48	118
8086 Sandalwood	94.82	320	47	116
8087 C/B Smooth Cream	97.32	319	46	114

<u>Colour</u>	<u>SRI</u> <u>(medium)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
8088 Mocca	68.66	329	56	134
8089 Stone	84.05	324	51	123
8098 Carraige Green	25.17	346	73	163
8099 Bruns Green	26.84	345	72	162
8100 Mist Green	50.48	336	63	146
8101 C/B Rivergum	51.14	336	63	145
8102 Olive Green	44.41	339	66	150
8103 Blue Grass	39.95	340	67	153
8104 Botanic	29.42	344	71	160
8105 French Green	63.68	331	58	137
8108 C/B Mountain Blue	26.32	345	72	162
8081 C/B Birch Grey	74.90	327	54	129
8094 Quarry	71.64	328	55	132
8095 Mid Biscuit	84.88	323	50	123
8097 Light Latte	86.80	323	50	121
8106 C/B Saltbush	66.24	330	57	135
8107 Cobalt	37.08	341	68	155
8110 Pewter	72.86	328	55	131
8111 Autumn	73.13	328	55	131
8112 Chino	72.72	328	55	131
8091 Broken White	101.23	317	44	112
8092 Neutral White	97.32	319	46	114
8093 Pale Buscuit	93.02	320	47	117
8096 Light Cream	97.60	319	46	114
809 Gull Grey	83.23	324	51	124

❖ High Wind Conditions

The results of the calculations of the Astec Energy Star EC-100 Dirtguard sample under high wind conditions were as follows.

<u>Colour</u>	<u>SRI (High)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
White Base	113.94	311	38	100
8068 C/B Heritage Red	42.32	326	53	127
8069 Red Iron Oxide	44.28	325	52	126
8070 Terracotta	48.73	325	52	126
8071 Clay Tone	54.40	323	50	122
8072 Warm Clay	71.50	320	47	116
8073 Tuscany	80.30	318	45	113
8074 C/B Ironbark	46.37	325	52	125
8075 Pioneer	31.04	328	55	131
8076 Regal Brown	43.75	325	52	126
8077 Yallara Brown	41.66	326	53	127
9078 C/B Weathered Copper	44.41	325	52	126
8079 Charcoal	36.20	327	54	129
8080 C/B Slate Grey	45.98	325	52	125
8082 Nimbus	39.71	326	53	128
8083 C/B Beige	64.51	321	48	118
8084 Merino	83.43	317	44	111
8085 Off White	92.21	315	42	108
8086 Sandalwood	94.97	315	42	107
8087 C/B Smooth Cream	97.46	314	41	106
8088 Mocca	68.94	320	47	117
8089 Stone	84.25	317	44	111
8098 Carralge Green	25.65	329	56	133
8099 Bruns Green	27.31	329	56	132
8100 Mist Green	50.84	324	51	123
8101 C/B Rivergum	51.50	324	51	123
8102 Olive Green	44.80	325	52	126

<u>Colour</u>	<u>SRI (High)</u>	<u>Surface Temp (K)</u>	<u>Surface Temp (°C)</u>	<u>Surface Temp (°F)</u>
8103 Blue Grass	40.36	326	53	127
8104 Botanic	29.88	328	55	131
8105 French Green	63.98	321	48	118
8108 C/B Mountain Blue	26.80	329	56	132
8081 C/B Birch Grey	75.14	319	46	114
8094 Quarry	71.90	319	46	116
8095 Mid Biscuit	85.07	317	44	111
8097 Light Latte	86.99	316	43	110
8106 C/B Saltbush	66.52	321	48	118
8107 Cobalt	37.50	327	54	128
8110 Pewter	73.12	319	46	115
8111 Autumn	73.39	319	46	115
8112 Chino	72.98	319	46	115
8091 Broken White	101.34	313	40	105
8092 Neutral White	97.46	314	41	106
8093 Pale Buscuit	93.18	315	42	108
8096 Light Cream	97.74	314	41	106
809 Gull Grey	83.43	317	44	111

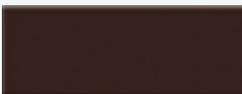
Appendix II - Energy Star® Exterior Colours.

Energy Star Coatings are available in the following exterior colours.

The numbers next to each colour chip represent the Total Solar Reflectance of the colour in Energy Star products. The number in parenthesis represents the Total Solar reflectance of a standard exterior acrylic of the same colour.

The S.R.I. Solar Reflectance Index number next to each chip was tested in accordance with ASTM E 1980-01. The S.R.I. number represented was for medium wind conditions.

Reflectance Tests were performed by independent laboratories in accordance with ASTM C 1549 and to ASTM E-903.

	(66.1) 76.7 94.82 S.R.I.		(27.9) 46.7 54.06 S.R.I.		(14.2) 37.5 41.91 S.R.I.
Sandalwood	Astec 8086	Clay Tone	Astec 8071	C/B Heritage Red	Astec 8068
	(54.2) 66.0 80.08 S.R.I.		(9.7) 38.6 43.36 S.R.I.		(66.8) 78.5 97.32 S.R.I.
Tuscany	Astec 8073	Regal Brown	Astec 8076	Neutral White	Astec 8092
	(46.9) 59.5 71.23 S.R.I.		(6.4) 28.8 30.58 S.R.I.		(64.4) 75.4 93.02 S.R.I.
Warm Clay	Astec 8072	Pioneer	Astec 8075	Pale Biscuit	Astec 8093
	(9.6) 40.9 45.99 S.R.I.		(58.7) 74.7 92.05 S.R.I.		(71.1) 81.3 101.23 S.R.I.
C/S Ironbark	Astec 8074	Off White	Astec 8085	Broken White	Astec 8091
	(6.6) 36.9 41.26 S.R.I.		(34.5) 57.6 68.66 S.R.I.		(38.5) 60.6 72.72 S.R.I.
Yallara Brown	Astec 8077	Mocca	Astec 8088	Chino	Astec 8112
	(30.4) 54.3 64.22 S.R.I.		(15.8) 42.4 48.36 S.R.I.		(40.2) 59.8 71.64 S.R.I.
C/B Beige	Astec 8083	Terracotta	Astec 8070	Quarry	Astec 8094
	(8.6) 39.1 44.01 S.R.I.		(14.6) 39.0 43.88 S.R.I.		(66.8) 78.5 97.32 S.R.I.
C/B Weathered Copper	Astec 8078	Red Oxide	Astec 8069	C/B Smooth Cream	Astec 8087

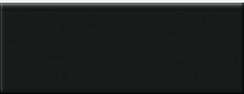
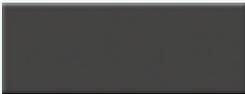
The colours shown are as near as possible to the actual colour card used for Energy Star Coatings. Contact Astec for a colour card. There are 44 standard colours available but other colours can be produced depending on the volume request.

Energy Star Coatings are available in the following exterior colours.

The numbers next to each colour chip represent the Total Solar Reflectance of the colour in Energy Star products. The number in parenthesis represents the Total Solar reflectance of a standard exterior acrylic of the same colour.

The S.R.I. Solar Reflectance Index number next to each chip was tested in accordance with ASTM E 1980-01. The S.R.I. number represented was for medium wind conditions.

Reflectance Tests were performed by independent laboratories in accordance with ASTM C 1549 and to ASTM E-903.

	(55.0) 70.9 86.80 S.R.I.		(36.7) 53.9 63.68 S.R.I.		(8.4) 27.9 29.42 S.R.I.
Light Latte	Astec 8097	French Green	Astec 8105	Botanic	Astec 8104
	(53.0) 68.9 84.05 S.R.I.		(24.5) 44.0 50.48 S.R.I.		(14.2) 33.8 37.08 S.R.I.
Stone	Astec 8089	C/B Mist Green	Astec 8100	Cobalt	Astec 8107
	(52.5) 68.3 83.23 S.R.I.		(15.3) 44.5 51.14 S.R.I.		(47.8) 68.3 83.23 S.R.I.
C/B Merino	Astec 8084	C/B Rivergum	Astec 8101	Gull Grey	Astec 8109
	(28.7) 55.8 66.24 S.R.I.		(8.6) 39.4 44.41 S.R.I.		(39.7) 62.2 74.90 S.R.I.
C/B Saltbush	Astec 8106	Olive Green	Astec 8102	C/B Birch Grey	Astec 8081
	(45.8) 60.9 73.13 S.R.I.		(6.3) 24.6 25.17 S.R.I.		(16.6) 40.3 45.59 S.R.I.
Autumn	Astec 8111	Carriage Green	Astec 8098	C/B Slate Grey	Astec 8080
	(53.5) 69.5 84.88 S.R.I.		(13.9) 36.0 39.95 S.R.I.		(6.9) 25.9 26.84 S.R.I.
Mid Biscuit	Astec 8095	Blue Grass	Astec 8103	Mid Brunswick Green	Astec 8099
	(69.6) 78.7 97.60 S.R.I.		(10.7) 35.5 39.30 S.R.I.		(7.8) 25.5 26.32 S.R.I.
Light Cream	Astec 8096	Nimbus	Astec 8082	C/B Mountain Blue	Astec 8108
	(37.3) 60.7 72.86 S.R.I.		(5.6) 32.8 35.77 S.R.I.		
Pewter	Astec 8110	Charcoal	Astec 8079		

The colours shown are as near as possible to the actual colour card used for Energy Star Coatings. Contact Astec for a colour card. There are 44 standard colours available but other colours can be produced depending on the volume request.



Astec Paints Australasia Pty Ltd

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