InfraCOOL™ Technology

Dulux Acra-Tex

PROJECT CASE HISTORY – Visy Campbellfield Technology Centre

COOLROOF COATINGS – Core Function

Due to their large surface area and exposure, Roof Surfaces capture enormous amounts of the suns energy and thus COOL ROOFS offer potential cooling energy savings of 20-40%*, resulting in direct cost and green house gas emission savings

- Dulux® InfraCOOL™ technology works by maximising TOTAL SOLAR REFLECTION

including the (invisible) infra-red portion of the suns energy which accounts for over 50% of the suns total solar energy

Project Aspect:
Roof Structure – MAXIMUM SOLAR ABSORPTION

PROJECT INFORMATION

Project Name:	Visy Campbellfield Vic Technology Centre
ROOF AREA:	70
Location:	13 Reo Crescent Campbellfield Vic 3061
Application Date:	November 07, 01, 2010 (completion)
Contacts:	Colin Corlass-Brown Projects Engineer Visy Pulp & Paper (Campbellfield) colin.corlass-brown@visy.com.au

PROJECT OBJECTIVES & SCOPE

Improve
Worker & Customer Comfort, test effectiveness of technology and reduce power consumption to 2 Air conditions or improve there effectiveness.
Determine if the planned installation of an additional air conditioning unit would be required

EXTERNAL ROOF:	Uncoated Weathered Corrugated zinculume With ceiling Insulation no roof cavity
CEILING:	Panel

COATING SPECIFICATION

Surfaces – Zinculume generally in good condition with no corrosion.
"Corrugated" deck sections provided adequate run-off to prevent water ponding.

Surface Preparation	High Pressure Wash
PRIMER	Dulux MetalShield Etch Primer
HEAT REFLECTIVE MEMBRANE	Dulux COOLROOF Cool Roof White *with InfraCOOL™ Technology*

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Visy Campbellfield Technology Centre – PREDICTED BENEFITS

PROJECT EVALUATION

Minimisation of heat gain requires a preliminary understanding of the dynamics of heat flow and transfer as defined by :

Conduction: Heat transfer through a solid object
(eg heat we can feel by touch on a surface and for which insulating measures are typically suitable)

Radiation: Direct transfer of heat from one object to another without heating the airspace between
(eg. Solar energy transmitted by the Sun for which REFLECTIVE measures are most effective)

- Minimising heat gains requires a barrier designed appropriately to negate the specific heat source.
- In Australia and most other climates, the prominent source of heat gain is Radiant (ie Suns Solar rays)
  With up to 93% of a buildings heat gain in summer attributable to Radiant heat

Key coating performance criteria for minimising the absorption of Radiant Heat

- REFLECT Heat in the FIRST INSTANCE before heat absorption & therefore before insulation is effective
- >90% Total Solar Reflection (TSR) is optimal for maximum cooling effect
- Must have low dirt pick-up, to maintain reflectance for maximum cooling
  - Accumulation of dirt / mould can reduce effectiveness by up to 70%

An increase in TOTAL SOLAR REFLECTION Due to their large surface area and exposure, Roof Surfaces capture enormous amounts of the suns energy and thus COOL ROOFS offer potential energy savings of 20-40%*, resulting in direct cost and green house gas emission

ASTM E1980-01: SOLAR REFLECTANCE INDEX

The following comparative test data (based on constant solar conditions) demonstrates the predicted surface temperature cooling benefit using Dulux® InfraCOOL™ technology in the specified Project System in the pre-existing Project environment.

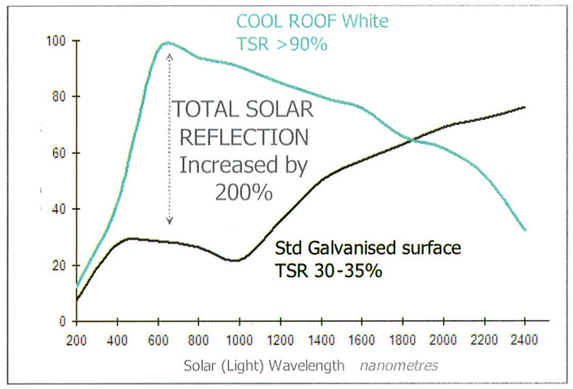
		Dulux® AcraTex® COOL ROOF WHITE			Weathered GALVANIZED SURFACE		
Total Solar Reflectance	*% TSR ASTME903 or C1549*	90.0%			30 – 35 %		
Reflectance of the suns energy across the broad solar spectrum							
• *visible region*	*(colour relevant)*						
• *non visible region*	*(Infra-red)*						
Thermal Emittance	*0-1 scale, ASTM C1371*	0.90			0.26		
The ability of a material to release captured heat energy							
	Wind condition...	*low*	*medium*	*high*	*low*	*medium*	*high*
Solar Reflectance Index	*relevant to wind conditions*	113.4	113.46	113.52	-35.52	-2.7	17.39
Surface Temperature	*constant air temperature : 37C* *constant Solar flux : 1000 W/m2*	41	40	38	124	84	58
InfraCOOL™ effect	*potentiel surface temp. COOLING*	**20 - 44°C COOLER** ***High to medium** wind conditions*					

ASTM E903: SOLAR ABSORBANCE

TSR and Spectral Reflectance is tested in accordance with ASTM E-903
% Reflectance of both versions is reported at individual wavelengths from 200-2500 nanometers

Results:

- TSR (Total Solar Reflectance) increased from 30% to 90% (200% increase) with InfraCOOL™
- Reflectance increase across the both the visible spectrum (300-700nm) and most significant portion of the Infra-red spectrum (700-1800nm).



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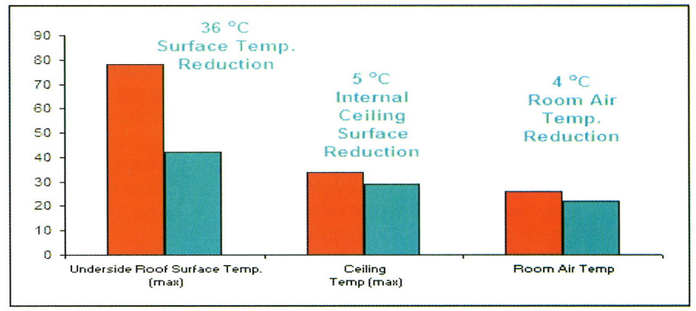
Visy Campbellfield Technology Centre – ACTUAL DELIVERED BENEFITS

- **Immediate drop in Roof Surface, Ceiling and Room temperatures as evidenced from actual project Temperature Data monitoring**
- **$11,540.00 capital expenditure cost saving (quote Lakes Heating & Cooling 3.3.2010) 2x 9.7 K Watt Air Conditions not needing to be installed due to improvements in the operation of current system. Which is now maintaining, a set point of 22ºC.**
- **Improved Occupancy comfort levels:**
  - **Immediate feedback from centre staff acknowledges the internal cooling.**



PROJECT TEMPERATURE MONITORING

Temperature Data loggers were installed to monitor PRE and POST application conditions including

- ROOF SURFACE (underside)
- Ceiling Surface
- Mid Ceiling Room Air Space
- Lower Ceiling Air Space

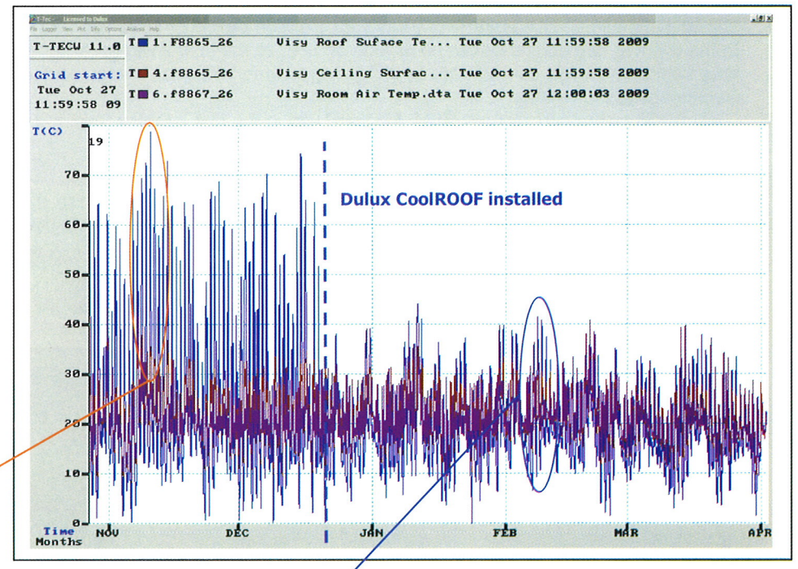
Data loggers recorded temperatures at 30 minute intervals form the period

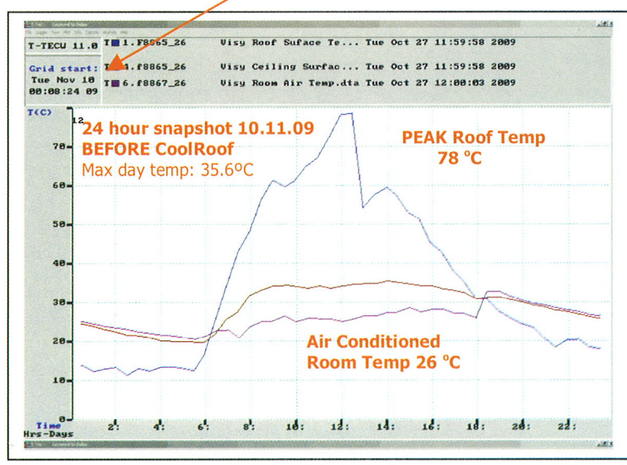
- Start : 27.10.2009
- End : 31.03.2010

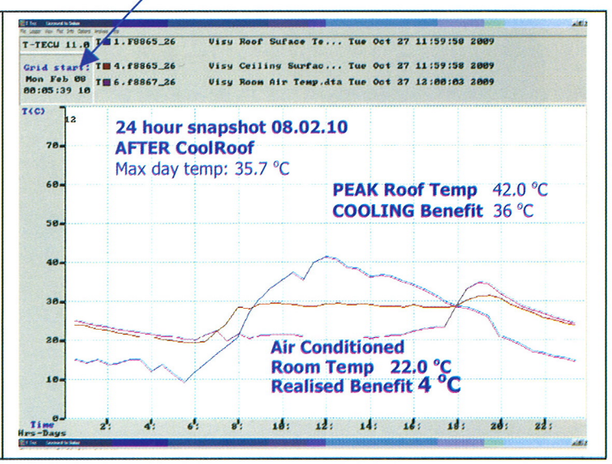
Bureau of Meteorology records for air temperature, wind speed & sunshine hours were accessed to correlate data for the purpose of like day comparisons

- 10.11.2009 (Before CoolRoof)
  vs.
- 08.02.2010 (After CoolRoof)

were selected for specific 24 hour "like for like" comparisons







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THE NEED FOR COOL ROOFS

What is a COOL ROOF

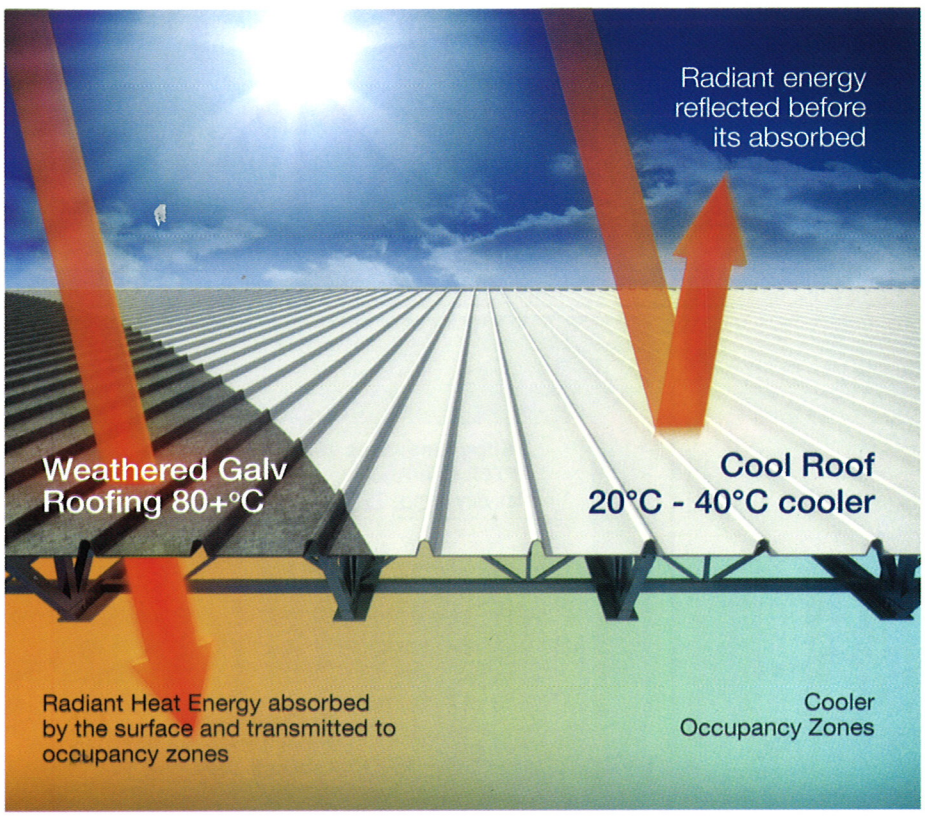
- COOL ROOFS reflect the sun's light back into space BEFORE it can be absorbed and transferred as heat to the building below.
- Reflection in the first instance should be the primary control of Radiant heat gain (Sun light) rather than relying on "after the event" insulation to hold back the heat load otherwise absorbed.
- Highlighting the importance of COOL ROOFS, in climates like Australia, where the prominent source of a buildings heat gain is Radiant Sunlight and up to 93% of a buildings heat gain in summer is attributable to Radiant heat, REFLECTIVE COOL ROOFS should be a key focus in combating heat gain, reducing energy costs and its associated greenhouse (power) emissions.
- Over 50% of the suns energy (sunlight) is invisible InfraRed energy and thus COOL ROOF technology is effective on both the light we see (colour) and invisible InfraRed light, delivering maximum TOTAL SOLAR REFLECTION for the selected colour – meaning even dark colours can be made cooler.
- Dulux COOL ROOF White delivers maximum cooling benefits reflecting over 90% of the Suns total light energy

URBAN HEAT ISLAND EFFECT

- The term "heat island" describes built up areas (eg cities) that are hotter than nearby rural areas.
- The annual mean air temperature of a city with 1 million people or more can be 1–3°C warmer than its surroundings.
- In the evening, the difference can be as high as 12°C as the built environs' absorbed heat is released back as it cools.
- Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions.
- COOL ROOF technology reduces HEAT ABSORPTION in the first instance, minimising the built environs stored heat energy and thus its ability to artificially increase surrounding air temperatures.

Put in context by US Energy Secretary Stephen Chu - COOL ROOFS :
"Indeed, it is almost certainly the single cheapest of the 12 to 14 wedges needed to stabilize near 2°C total warming - the equivalent to taking the world's approximately 600 million cars off the road for 18 years, while quickly paying for itself in direct energy savings!"

The benefits of Dulux® Cool Roof



Maximum Solar Reflection
Weathered Galv and Dark Coloured roofs absorb massive amounts of solar radiation which in-turn transmit heat into occupancy zones. Cool Roofs reflect heat energy in the first instance - before heat is absorbed, meaning insulation & cooling efficiencies are maximised

Reduced Cooling Costs
Less Heat penetration means lower cooling costs. Comparative studies identify cooling energy savings of 20-40% are possible using Cool Roof technology.

Improved Occupancy Comfort
In non-air conditioned facilities such as workshops and warehousing, cool roofs translate immediately to cooler working and warehousing facilities, improving productivity and stability of stored goods.

Lowers Carbon Footprint
Less use of air conditioning reduces power consumption and associated greenhouse gasses which is good for the environment and for you.

Further reading: Reducing Urban Heat Islands: Compendium of Strategies – US EPA, Geo-engineering, adaption and CO2 mitigation – Climate Progress US

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**Energy saving potential based on Field Study of 2 identical buildings with constant state air-conditioning. High reflectance white coating vs original dark roofing surface.*