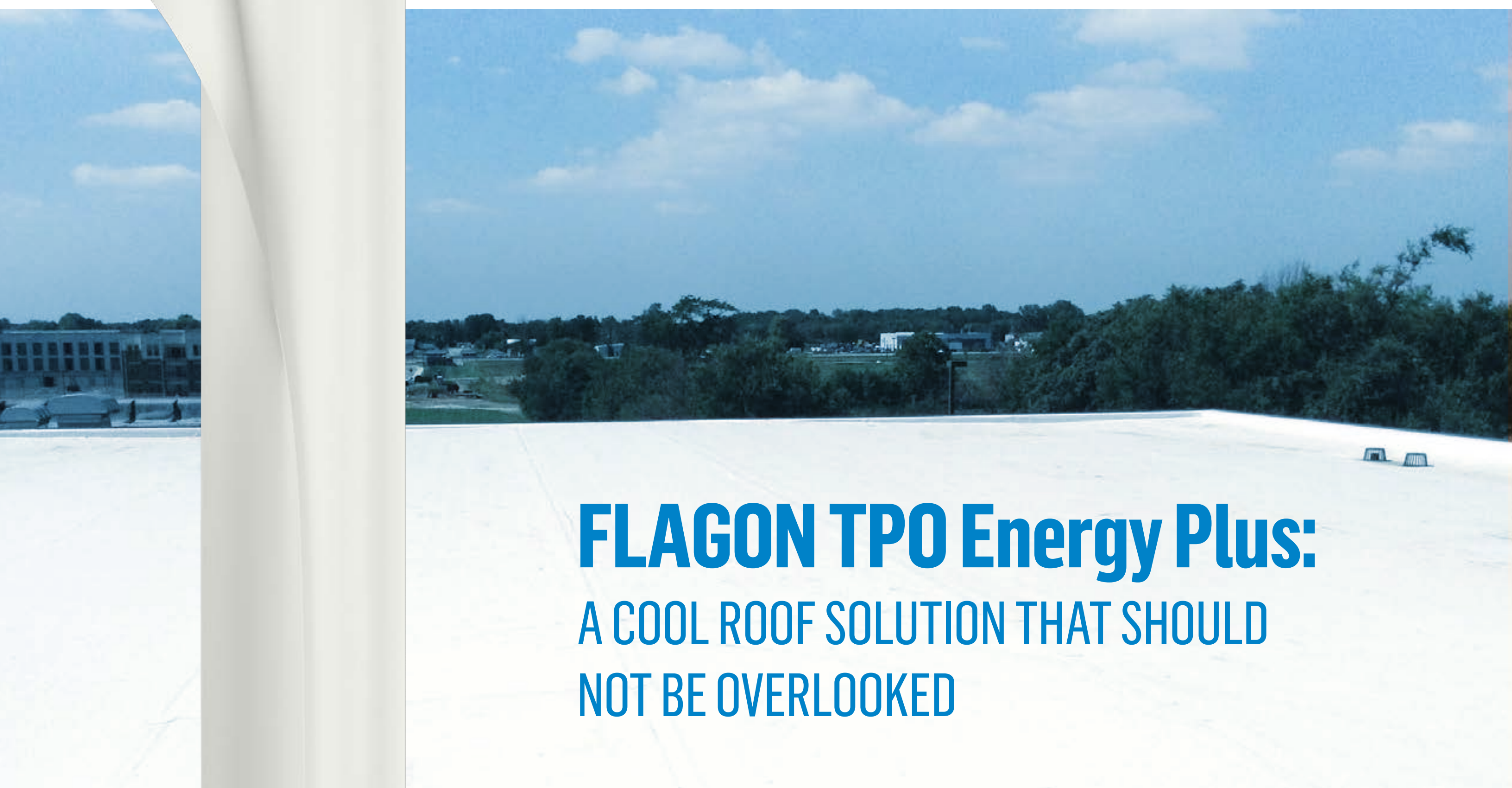
SOPREMA



FLAGON TPO Energy Plus:

A COOL ROOF SOLUTION THAT SHOULD NOT BE OVERLOOKED

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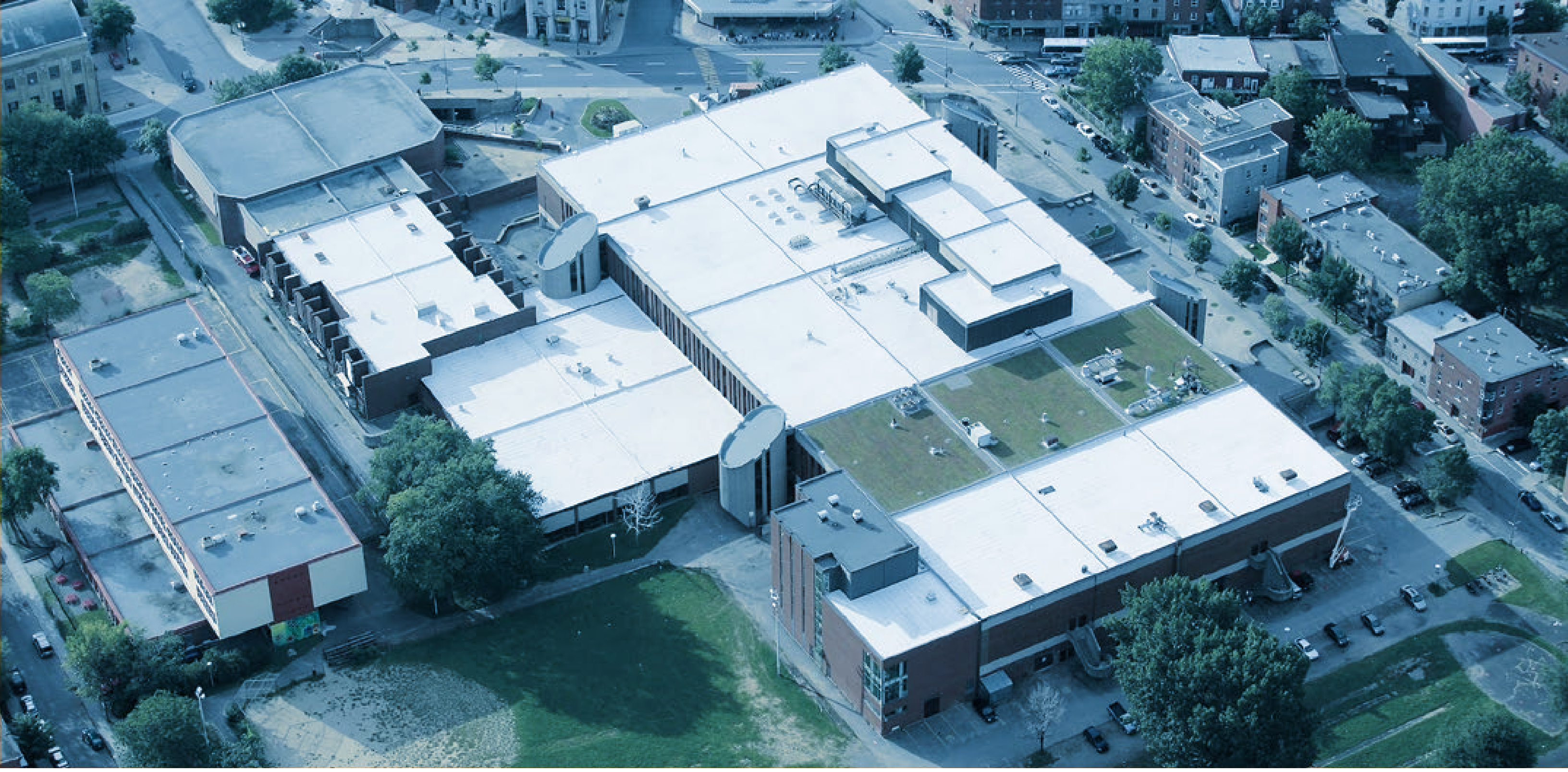


INTRODUCTION

Climate change carries recognised risks and dangers . Its effects are observed particularly in cities, mainly due to Tab 1le of Contentsurban heat islands coupled with pollutants and greenhouse gas (GHG) emissions. The increase in air temperature in our buildings and our cities can affect the comfort of individuals, whether indoors or outdoors, as well as our health and energy expenditures. The colour white plays a significant role when it comes to the longevity of the roof, because it prevents the waterproofing membrane from overheating when exposed to the sun, therefore reducing the urban heat island effect. The aging of most materials used for roof waterproofing i s a ccelerated when the temperature is increased, and slowed down when the material is cooled. Exposure to UV rays also has a negative impact on the endurance of waterproofing materials. For example, if vegetation is installed over any roofing membrane, the membrane's durability will be directly improved, both due to the cooling and because it is hidden from UV rays.

Indeed, cool roofs are a solution capable of reflecting solar heat and reducing its absorption. This is due to the reflectivity and emissivity properties of the materials used, which reflect solar radiation back to the atmosphere.

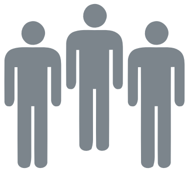
Moreover, SOPREMA's FLAGON TPO membranes are an excellent single-ply solution to help counter urban heat islands by reducing the surface temperature of roofs.

This ebook explores the impact of the heat island effect on the environment and the role buildings can play against it. It describes how cool roofs work and illustrates their benefits for buildings and communities. Plus, it explains why TPO is the best single-ply solution to consider when it comes to cool roofing.

BUILDINGS HAVE A SIGNIFICANT IMPACT ON THE ENVIRONMENT

Right now, there are 7.8 billion human beings on our planet; we were 4 billion in 1970 and 2 billion in 1930. Population forecasts estimate that the world population will reach 10 billion by 2050. During the 20th century, world energy consumption increased 10 times and the extraction of industrial minerals increased 27 times[2]. These trends have accelerated, over the past two decades as a result of the increase in demand from emerging economies and the maintenance, at a sustained level, from developed countries.

The building sector has environmental impacts: it generates approximately 40% of all energy-related CO_2 emissions worldwide and 36% of final consumption-related CO_2 emissions[3]. It is also one of the largest consumers of mineral matters. In a single century, the extraction of building materials has multiplied by a factor of 34[4]. The function of houses and buildings is to meet the basic needs of individuals, in particular by ensuring their health and safety, given their growing use:



Australians spend

90%

of their time inside buildings[5]

The world population reached about

7.7 billion

people in 2019. This figure could rise to

8.5 billion

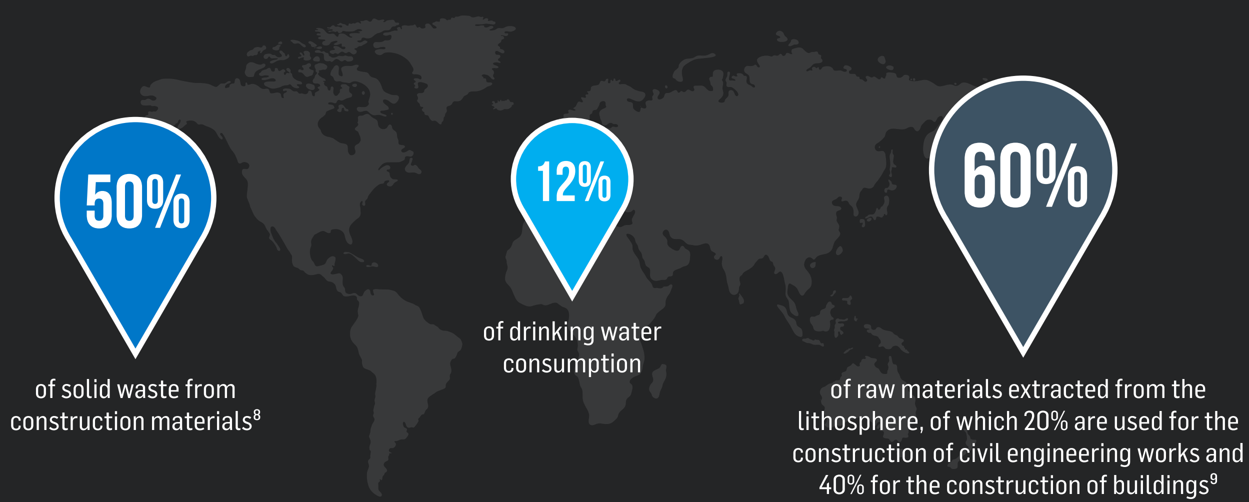
by 2030[6]

55%

of the world's population lives in cities, and in Australia that figure is[7]

86%

By meeting energy demand during their useful life, buildings will directly and indirectly generate greenhouse gas emissions that will vary according to their use and context. In addition to the waste of resources and energy, various forms of generated pollution exist. Here are global statistics on the construction industry:



Greenhouse gases warm the Earth. The Intergovernmental Panel on Climate Change declared that our planet's average temperature is on the way to increase by 2 to 7 degrees Celsius (4 to 13 degrees Fahrenheit) in the next hundred years, which would result in a climate that humans have never experienced before. This fast temperature change is distressing to our ecosystems and increases heat wave frequency and duration, which creates significant health risks to people everywhere in the world[10].

THE POWER OF BUILDERS

It's undeniable, the various stakeholders in the construction sector are essential players in sustainable development, and their role is decisive in ensuring a better world. It is important to rethink how we make, design, build, and transform our built environment.

Whether we are architects, installers, or government institutions, we all share the same planet. We must therefore all take action to minimize the impact of our activities on the environment and our health.

On the one hand, builders play a major role in the industry by improving the design of buildings and construction methods. On the other hand, manufacturing companies like SOPREMA must make it a priority to contribute to the protection of the environment and human health as well as to the fight against climate change by multiplying and diversifying solutions aimed at supporting the evolution of building sustainably.

Poorly designed and constructed buildings contribute to greater energy consumption as well as resource depletion. Reducing energy consumption in buildings is one way to reduce the overall human impact on the environment and climate change.

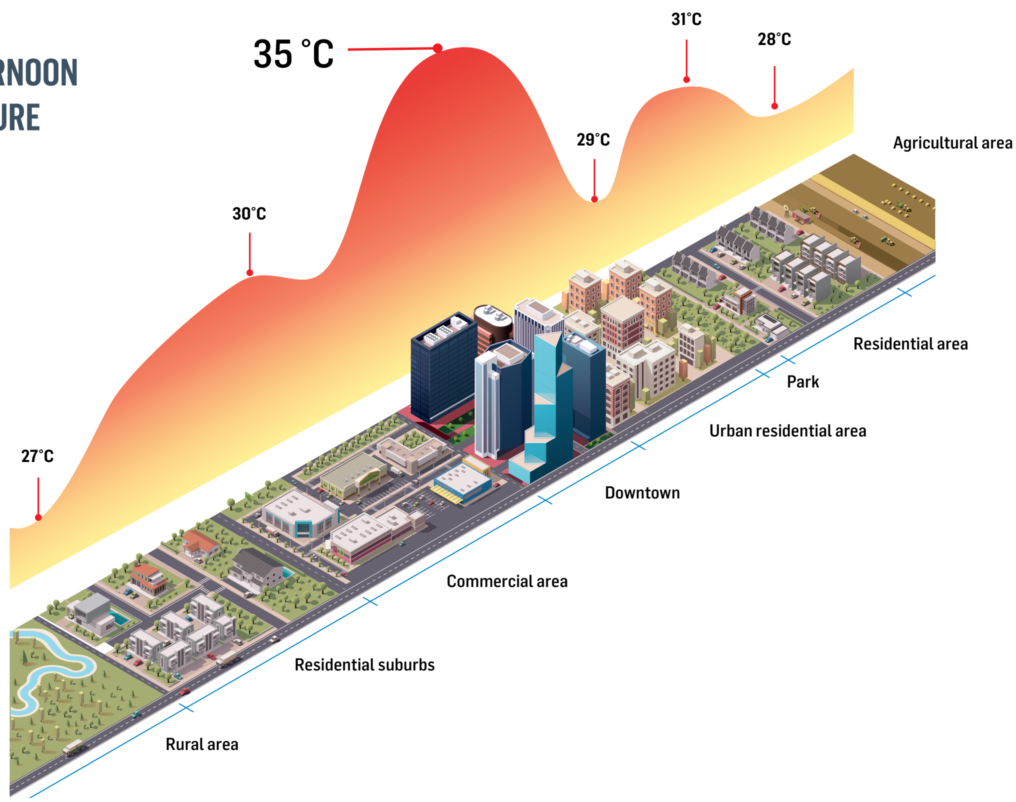
HEAT ISLANDS: WHAT ARE THEY?

Urban heat islands are localized increases in temperatures (daytime and nighttime) recorded in urban areas and compared to neighbouring rural or forest areas or to average regional temperatures. This phenomenon can be explained, among other things, by the increased presence of asphalt surfaces and concrete buildings, which are made of materials that absorb heat.

Temperatures in urban areas can be up to 12 °C higher than in peripheral regions [11]. Replacing nature (forests, marshes, fields, etc.) with infrastructure (buildings, urban networks, roads, etc.) contributes to heat absorption. Urban areas therefore reach higher temperatures.

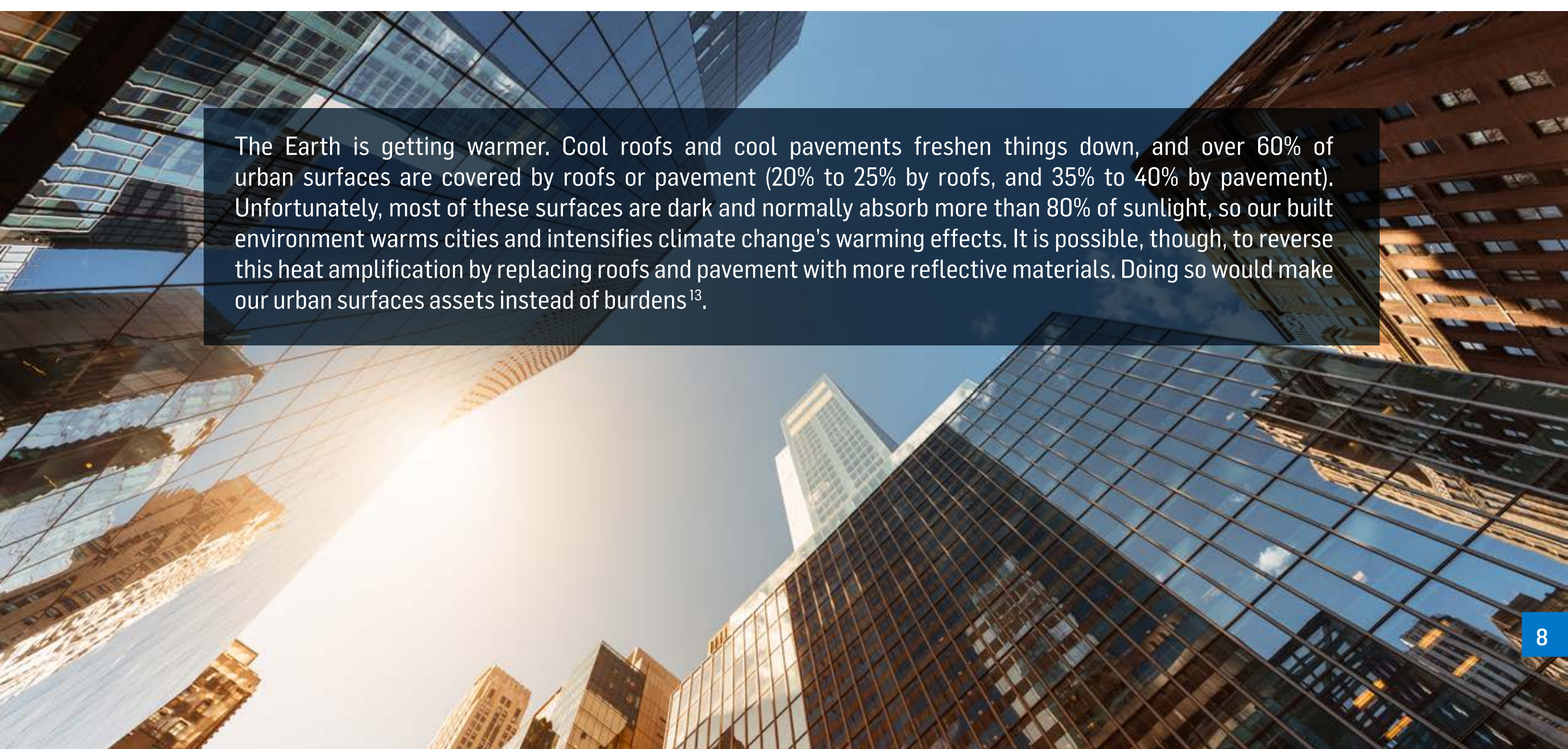
As they are accentuated by climate change, heat waves are increasing in duration, frequency, and intensity. Moreover, the building characteristics, the densification of human activities, and the mineralization of surfaces make urban environments even more favourable to heat islands [12].

LATE AFTERNOON TEMPERATURE



THESE URBAN HEAT ISLANDS CAN LEAD TO SEVERAL PHENOMENA:

Mitigating urban heat islands implies better organization of urban areas and transportation as well as the modification of land use. More particularly in the organization of urban areas, the reduction of urban heat islands requires an appropriate choice of materials, while favouring a share of vegetation and a share of permeable surface.

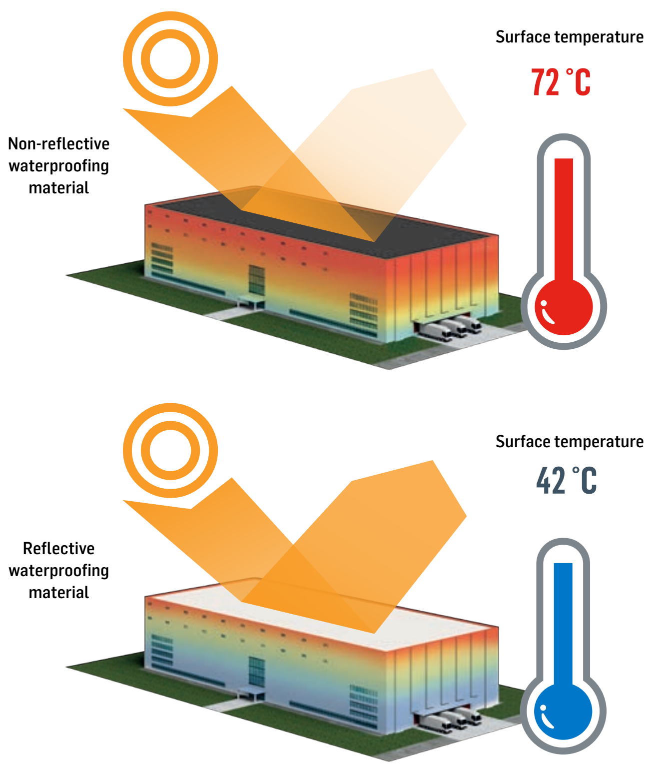


The Earth is getting warmer. Cool roofs and cool pavements freshen things down, and over 60% of urban surfaces are covered by roofs or pavement (20% to 25% by roofs, and 35% to 40% by pavement). Unfortunately, most of these surfaces are dark and normally absorb more than 80% of sunlight, so our built environment warms cities and intensifies climate change's warming effects. It is possible, though, to reverse this heat amplification by replacing roofs and pavement with more reflective materials. Doing so would make our urban surfaces assets instead of burdens[13].

COOLER BUILDINGS. COOLER CITIES. COOLER PLANET.

Roads, infrastructure, facades, and cladding with dark surfaces retain and store heat indoors and outdoors. The temperature therefore rises. An obvious solution thus presents itself to us: reflecting the solar energy, just as it has always been done in certain regions of the world.

To mitigate the phenomenon of urban heat islands, building envelope materials should not excessively absorb the heat generated by solar radiation. As buildings have an important place in cities, a judicious choice of facade and roof surfaces must be made. Choosing a covering material with a reflectivity capacity, such as white reflective membranes, is one solution to urban heat islands. The solar reflectance index (SRI) of cool roofs is much higher than that of traditional asphalt and gravel membranes, which effectively reduces the temperature of the roofing system, thus decreasing that of cities[14] .

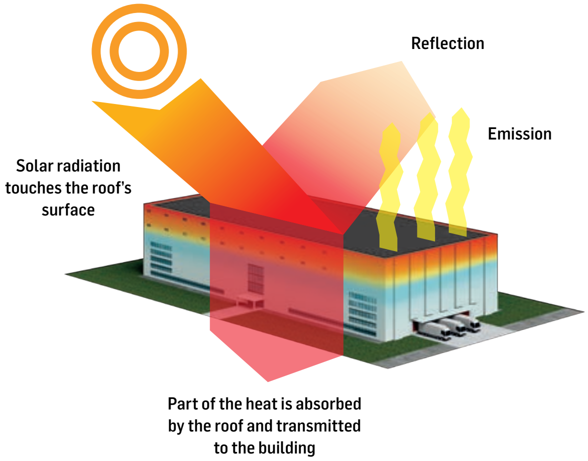


> "Cool roofs are one of the quickest and lowest-cost ways we can reduce our global carbon emissions and begin the hard work of slowing climate change.[15]"
>
> — Dr. Steven Chu, US Energy Secretary

The concept is easy to understand: dark-coloured surfaces reflect less sunlight than light ones do, so they produce more heat. Increasing our buildings and paved surfaces reflectivity using white or reflective coloured surfaces can help reduce cities' temperature by reducing their buildings' temperature.

A cool roof has surface properties that allow it to reflect a major part of solar radiation. The radiative properties of this cladding are specific:

- High reflectivity (60 to 80%) on the solar spectrum[16];
- High emissivity of infrared radiation.

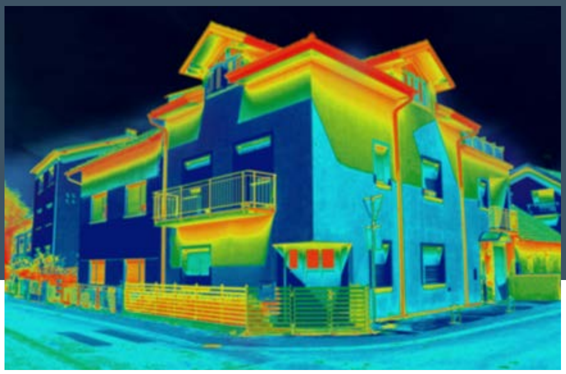


Thus, the surface temperature is then lower than that of other materials and the quantity of heat transmitted within the building and to the immediate external environment is reduced.

Reflectivity is the ratio of reflected solar energy to incident solar energy expressed as a percentage. The higher the percentage, the more solar energy is reflected. Examples of reflectivity and emissivity for different materials:

WHAT IS INFRARED?

Materials absorb visible light, store the corresponding energy and release that energy by emitting infrared radiation, often at night. Infrared is a version of light that is invisible to the naked eye.

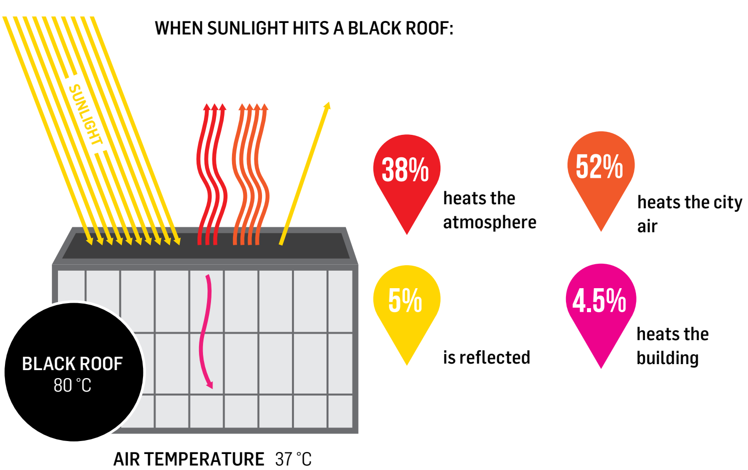


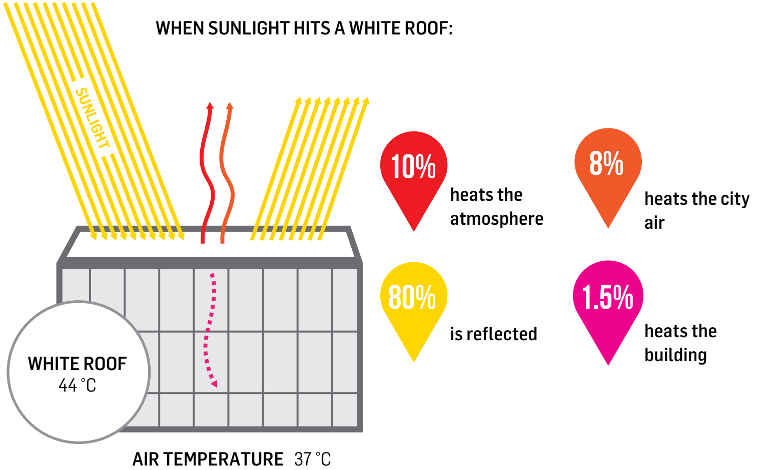
	Cool roof	Corrugated sheet metal	Tiles	Coloured paint	White paint	Bricks and stones	Concrete	Asphalt	Trees	Grass
REFLECTIVITY	60% to 80%	10% to 15%	4% to 35%	10% to 50%	50% to 90%	3% to 18%	10% to 35%	5% to 20%	15% to 18%	25% to 30%
EMISSIVITY	80% to 100%	10% to 15%	80% to 100%	80% to 100%	80% to 100%	10% to 20%	10% to 20%	80% to 100%	80% to 100%	80% to 100%

In radiative transfer, emissivity corresponds to the radiative flux of the thermal radiation emitted by a surface element at a given temperature relative to the reference value, which is the flux emitted by a black material at this same temperature. This last value being the maximum possible value, emissivity is a number less than or equal to it.

EFFECTS OF A COOL ROOF VERSUS A DARK ROOF

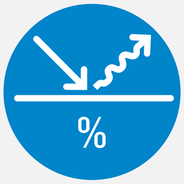
A white roof (right) in temperate or tropical regions absorbs about 80% less sunlight than a black roof (left).



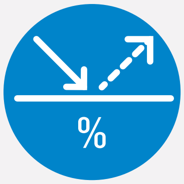


Source: Global Cool Cities Alliance (2012), with data from Lawrence Berkeley National Laboratory[17].

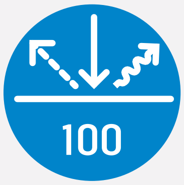
REFLECTIVE WATERPROOFING CLADDING IS THUS CHARACTERIZED BY THE FOLLOWING:



EMISSIVITY
Part of the heat reflected outside without being transmitted to interior spaces (according to ASTM C1371).



REFLECTIVITY
Percentage of reflected solar radiation (according to ASTM C1549, ASTM E1918, ASTM E903, and CRRC-1).

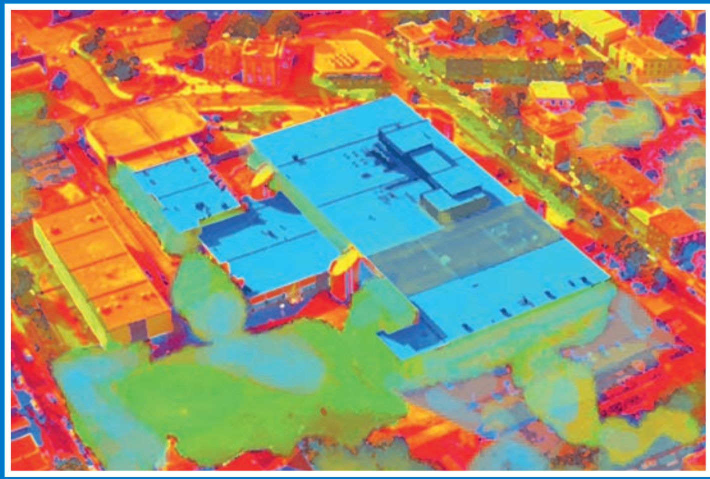


REFLECTANCE INDEX
The solar reflectance index, or SRI, is calculated based on emissivity and reflectivity, in accordance with the ASTM E1980 standard.

Cool roofs help combat the effects of urban heat islands by reducing the surface temperature of roofs. We can see below the infrared thermography of a roof that shows the temperature difference between the cooled surface of the roof and the surrounding surfaces.

While a roof with non-reflective waterproofing cladding can reach a surface temperature of over 80°C, reflective cladding can limit this temperature increase to around 40 °C.

THE COLOUR SCALE REPRESENTS THE TEMPERATURES FROM HOTTEST (RED) TO COLDEST (BLUE).



IN SUMMARY, HERE IS WHY COOL ROOFS ARE A REFRESHING INNOVATION:

They extend the lifetime of the roof and **minimize** maintenance requirements.

They increase the service life of air conditioning equipment .

They reduce greenhouse gas emissions.

They reduce the urban heat island effect and thus **improve** the living conditions of city dwellers.

THE SINGLE-PLY SOLUTION IN TERMS OF COOL ROOFS

Roofing professionals in Australia now have so many options for their designs. They have access to numerous technologies that offer a wide range of solutions for all tastes and budgets, and single-ply systems is one of them.

Single-ply systems have been available for several decades overseas, and their popularity is ever-growing.

WHY TPO FOR THE AUSTRALIAN MARKET?

- Track record of proven durability
- Quality consistency
- Easy to weld in various conditions
- Inherently fire resistant without high filler content

FLAGON TPO ENERGY PLUS: GOODBYE SUNSHINE

As mentioned previously, choosing covering material having a reflectivity capacity is one solution among others to counter urban heat islands. SOPREMA's TPO membranes is a solution, as its high reflectivity help reduce the absorption of heat on the roof.

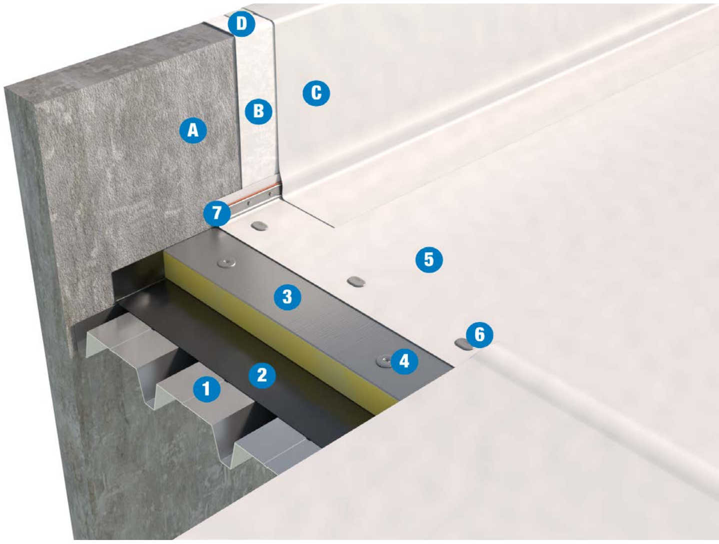
FLAGON TPO membranes represent an industry leading range of synthetic waterproofing membranes. Durable and easy to install, SOPREMA's FLAGON product line offers superior weldability under a wide range of environmental conditions. Thanks to their unparalleled flexibility and conformability, our membranes can be installed on the most complex shapes whether they are low or steep slopes.

HORIZONTAL

1. Metal deck
2. SOPRAVAP'R
3. SOPRA-ISO
4. Insulation fastener
5. FLAGON EP/PR DR ENERGY PLUS
6. Membrane fastener
7. FLAG BAR

VERTICAL

A. Substrate
B. Geotextile
C. FLAGON EP ENERGY PLUS
D. Finishing element

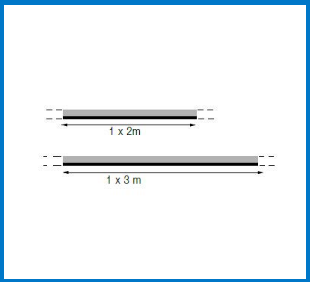


FLAGON EP/PR DE ENERGY PLUS (TPO)

Material	Reinforcement	Colour upper side	SRI	Dimensions
Thermoplastic Polyolefin (TPO)	Polyester	Traffic white (RAL 9016)	107	1.5 mm x 20 m x 1.05 m

FULL PRODUCT LINE WITH ADHESIVES AND ACCESSORIES

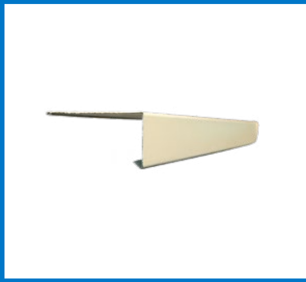
FLEXOCOL TPO



SHEET METAL WITH VISIBLE SIDE IN TPO
TPO FLAG LAMIERA ACCOPPIATA ENERGY PLUS

WALL PROFILE
PROFILO A PARETE TPO ENERGY PLUS

TPO DECOR PROFILE
PROFILO PIRAMIDALE ENERGY PLUS



PERIMETER PROFILE
PROFILO PERIMETRALE TPO

EXTERNAL CORNER IN TPO
ANGOLO ESTERNO - TPO 90° - 95 mm

INTERNAL CORNER IN TPO
ANGOLO INTERNO - TPO 90°

THE SOPREMA DISTINCTION

Proven durability through decades of exposure to various conditions around the world

Complete FLAGON TPO assemblies backed by SOPREMA's warranty

SUCCESS STORIES

TECNOPOLO, Bologna - 2020, FLAGON EP/PR Energy Plus - 25.000 m2

CENTRO COMMERCIALE ADIGEO, Verona - 2017, Flagon EP/PR Energy Plus - 47.000 m2

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ROOFS WALLS FOUNDATIONS PARKING DECKS BRIDGES ADDITIONAL EXPERTISE

WATERPROOFING INSULATION VEGETATIVE SOLUTIONS SOUNDPROOFING ACCESSORY PRODUCTS

SOPREMA is an international manufacturer specializing in the production of waterproofing and insulation products, as well as vegetative and soundproofing solutions, for the building and civil engineering sectors.

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