Mission critical

Sustainable, resilient roofing solutions for data centres

BUILDING TRUST

INTRODUCTION

The massive migration of corporate data and IT services to the cloud has increased the demand for more environmentally-friendly data centers. As of 2022, the cloud houses more than 60% of all corporate data.[1] This percentage reached 30% in 2015 and has since kept rising as businesses increasingly move their resources to cloud environments in an effort to increase security and dependability as well as business agility.[2]

Data centers have long been recognised as being excessive energy consumers, accounting for up to 4% of Australia's overall energy use and roughly 10% of the energy used worldwide.[3] The industry is now aware of how crucial building design is to reducing the environmental impact of these essential facilities given the energy needs for cooling and operation. New approaches that lessen energy use and carbon emissions must be considered by owners and operators from the time of planning and construction until use.

When it comes to running a data center, roofing is probably not the first design element that comes to mind when determining efficient methods of cooling an indoor environment. The right data center roofing, however, can positively impact temperature and climate control, resulting in increased energy efficiency while safeguarding the assets stored below. In addition, when carefully considered, roofing materials can go a long way in reducing the total environmental impact of the data centre, especially as operations become more sustainable.

In this whitepaper, we discuss the importance of roof design for modern data centres, and the elements of sustainable roofing in this sector.

WHY ROOFING MATTERS

Simply put, a data centre is a structure built to house computer servers rather than people. These servers must run continuously, without interruption, and they have specific environmental requirements. Services may be required to control summer and winter temperatures in order to maintain a constant, optimal environment that prevents servers from shutting down or malfunctioning. Humidity and pressure stability also need to be carefully maintained to keep equipment in working order for as long as possible.

The roof is a critical component in regulating indoor environmental conditions. Due to the large number of servers running, large data centers quickly become hot; this heat poses a problem for the continued operation of those servers. The sun's heat, which can enter through the roof, is one of the main heat sources that can quickly raise internal temperatures. The roof's design must minimise the amount of solar heat that the data centre building absorbs while still being robust enough to withstand high temperatures and UV rays.

Keeping your building cool from the outside has numerous benefits. The harder your cooling systems need to work, the more wear and tear they will experience, which can result in higher repair and replacement costs. A well-designed roof can reduce the cooling load within the building, which means your cooling systems do not need to work as hard to maintain a safe, operating temperature. Data centre operators can benefit from reduced energy and maintenance costs over the life of the building, and greater peace of mind knowing their servers and equipment are being kept in a stable environment.

Moisture and condensation also pose a significant risk to data centres as they can cause service disruption with considerable commercial impact or even damage expensive equipment. For this reason, the roof system must be designed and constructed to prevent moisture from penetrating through the waterproofing layer of the roof build up. This enables data centre operators to better control moisture and humidity levels within the indoor environment to ensure optimal performance and reliability.

WHAT IS A COOL ROOF?

A ‘cool’ roof is a type of roof created specially to keep its surface temperature lower and absorb less solar energy than a conventional roof. The building’s temperature is reduced as a result, keeping the interior cooler and at a more constant temperature. A number of studies all support the energy and carbon benefits of cool roofing products and systems for low-sloped roofs and steep-sloped roofs.[4]

A roof’s ability to reflect sunlight and dissipate absorbed heat is considered when determining how ‘cool’ it is. A typical ‘cool’ roof includes single-ply and multi-ply membranes and low slope roof build ups. Other types of cool roofs include tiles or shingles coated with a reflective coating, and specialty roofs that are designed to be green by using live plants. Paints and membranes with high solar reflectivity are commonly used.

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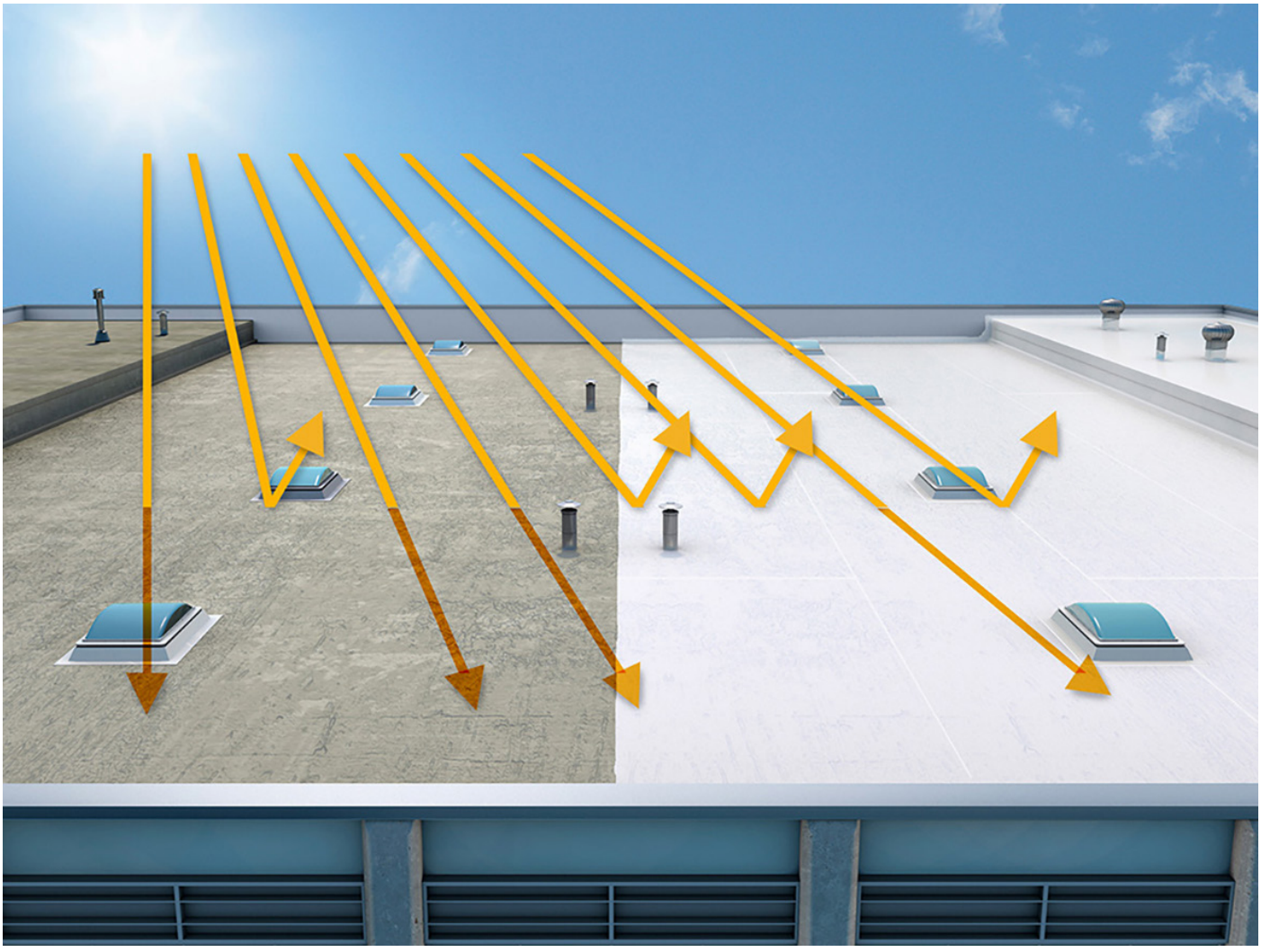

WHAT MAKES ROOFING SUSTAINABLE?

Energy efficiency

When your building is kept several degrees cooler from the start, you use less energy to run your cooling systems, which results in significant energy savings. One case study involved a 100,000 square foot building in Austin, Texas that had a cool roof and was able to reduce peak hour cooling costs by 14%, resulting in annual savings of more than $10,000.[5]

The extent to which the roof affects the temperature inside your building depends on a number of variables. Solar reflexion is one factor, referring to the amount of solar energy reflected by a surface. Black membranes have a low reflexion but high absorption while white membranes have a high solar reflexion and low absorption. In general, a finished roof surface that is lighter will reflect more heat and light than one that is darker.

The thermal properties of the roofing material are also relevant, with materials that are both reflective and weak conductors for heat providing the best protection. Furthermore, the roof's slope has an impact on how easily it absorbs sunlight, while roof ventilation can help to expel absorbed heat.

Greenhouse gas reduction

Around 25% of Australia's total electricity consumption and 10% of its total carbon emissions are attributable to the commercial building industry.[6] Hot roof surfaces are being targeted because they are unneeded sources of heat that raise air temperatures and increase demand for air conditioning. Energy efficiency, through cooler roofs, lowers greenhouse gas emissions, both directly from burning or using fossil fuels and indirect emission reductions from electricity generation.

In addition, cool roof surfaces can help lessen the urban heat island effect. 'Urban heat islands' develop when cities replace natural land cover with dense clusters of paved, constructed, and other surfaces that absorb and retain heat.[7] This has the effect of raising energy costs (e.g. for air conditioning), air pollution levels, and heat-related illnesses and deaths.[8]

The urban heat island effect is made worse by warm, dark roofs that radiate heat into the atmosphere and warm the air that passes over them.[9] Replacing hot roofs with cool roofs has numerous benefits, including reducing cooling energy demand, and improving air quality by slowing the formation of ground level ozone.[10]

Eco-friendly materials

Specifiers can determine the environmental impacts of building materials and products using a range of tools and resources. Life cycle assessment (LCA), for example, is a cradle-to-grave or cradle-to-cradle analysis methodology to assess environmental impacts associated with all the stages of a product's life. An Environmental Product Declaration (EPD), which is supported by an LCA, gives specifiers the assurance that a building product's sustainability claims are validated against transparent, unbiased standards, and simplifies the process of making direct comparisons between similar products.

Third-party certification, such as LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method) should also be considered.

Waste minimisation

Minimising waste during installation is an important aspect of sustainable roof design. There is a misperception that systems are harder to install, not flexible and more expensive than liquid-applied membranes. In fact, sheet membranes help reduce waste as they are engineered to the correct thickness whereas a liquid membrane can require up to five coats to achieve the same thickness. Leading sheet systems offer long-term durability, and by not having to recoat, less material is consumed, and less material is sent to landfill.

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SIKA SARNAFIL

A sustainable commercial roofing system

Data centres present particular challenges. Sika Sarnafil understands these challenges and offers roofing systems that satisfy the performance requirements of every part of a data centre for both new build and refurbishment projects.

With more than 60 years of roofing and waterproofing experience in locations all over the world, Sika Sarnafil provides a single source for integrated and compatible roofing solutions, along with the following benefits:

- Technical and practical support, including specification documents, BIM objects, and more.
- Engineered membranes that guarantee the required membrane thickness every time.
- Unique fixing equipment for solar panels.
- Third-party verification that complies with the relevant Australian standards.
- Watertight and harmonious design.

Roofing solutions

Sarnafil Roof Membranes

Sarnafil thermoplastic (PVC), single-ply, roofing waterproofing membranes are the best time-tested solution to stay watertight (when applied by trained and registered contractors). These membranes are UV and fire resistant, provide excellent wind uplift resistance and are FM approved. Their sustainability credentials are also unmatched, with a long life cycle, low environmental impact and high recyclability. Sarnafil membranes are also LEED, Green Globes, BBA, BREEAM, DGNB and NSF compliant.

Sarnafil Mechanically Attached & Adhered Systems

The Sarnafil range includes products from both installation options: mechanically fastened or adhered. The mechanically fastened version allows for fast application by installing fasteners and plates through the membrane seam to approved substrate and is the economical choice.

The adhered version is secured to the approved substrate using adhesive, providing the best solution for an aesthetically pleasing yet robust assembly that contours well to uniquely-shaped roofs. It does not require any fastener penetration through the membrane.

Sarnafil Self-Adhered System

The Sarnafil Self-Adhered System only requires a one-step pressure sensitive ‘peel and stick’ application process without the labor and VOC fumes associated with liquid primers and adhesives. This system allows for a fast and robust as well as cost competitive application that can accelerate the construction schedule by eliminating the need of additional adhesives or solvents, not requiring any cure time and reducing the amount of waste.

Sika SolarMount-1 (SSM1) Roof System

Sika SolarMount-1 offers a non-penetrating system that is engineered to perform under extreme conditions. This solution reduces the amount of required labor by being surface mounted via hot air welding to the Sarnafil membrane without any penetrations.

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All information provided correct as of September 2022

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