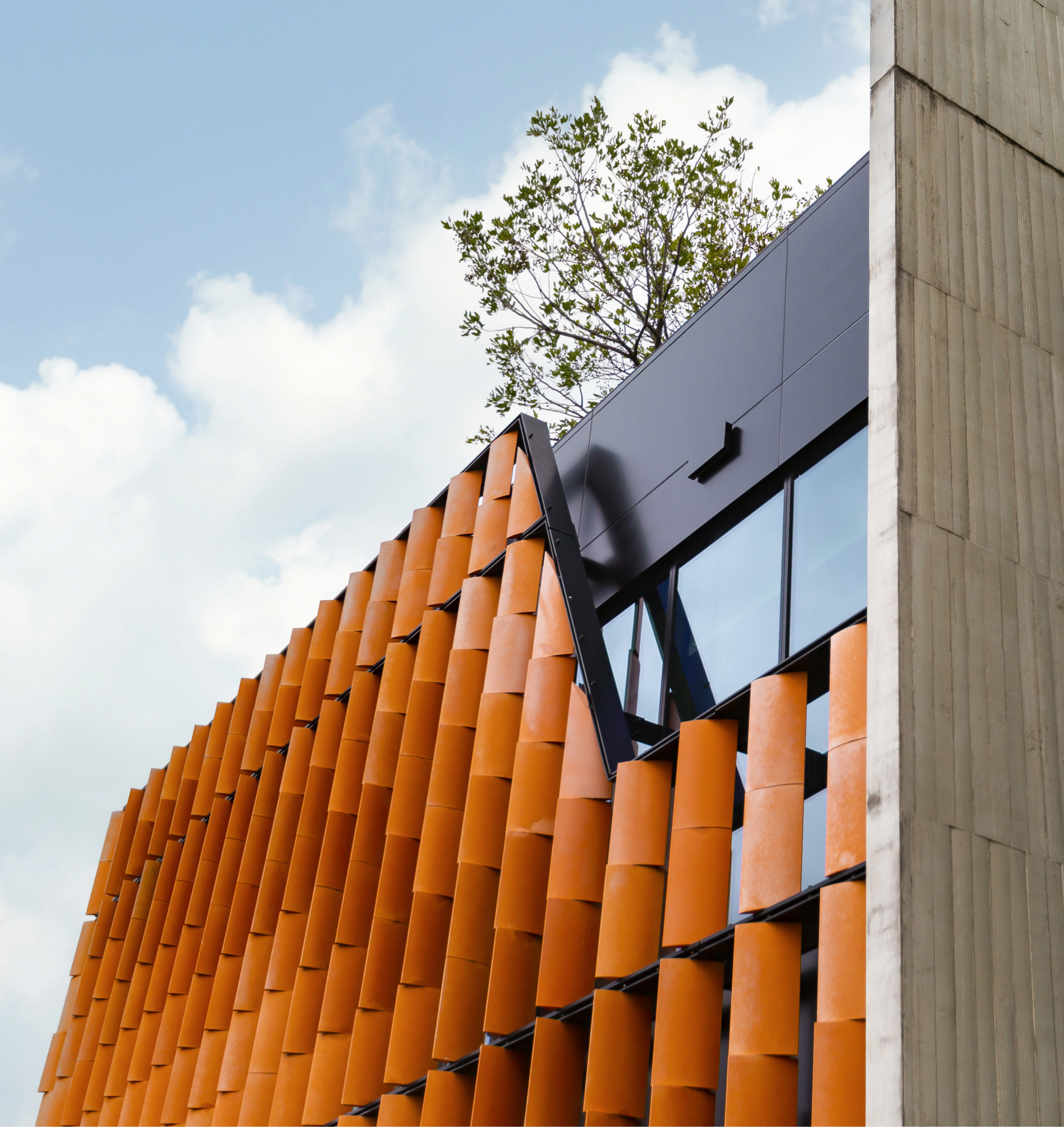


FACADES FOR THE FUTURE

Sustainable Design Considerations and Material Selection

Network Architectural

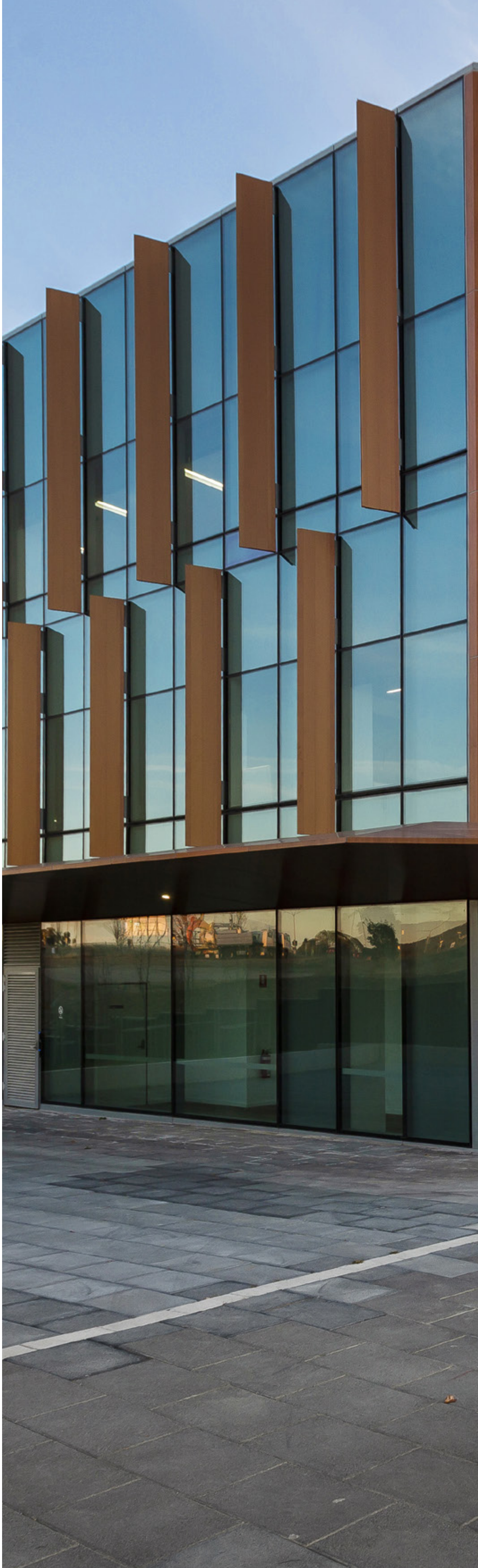
Introduction

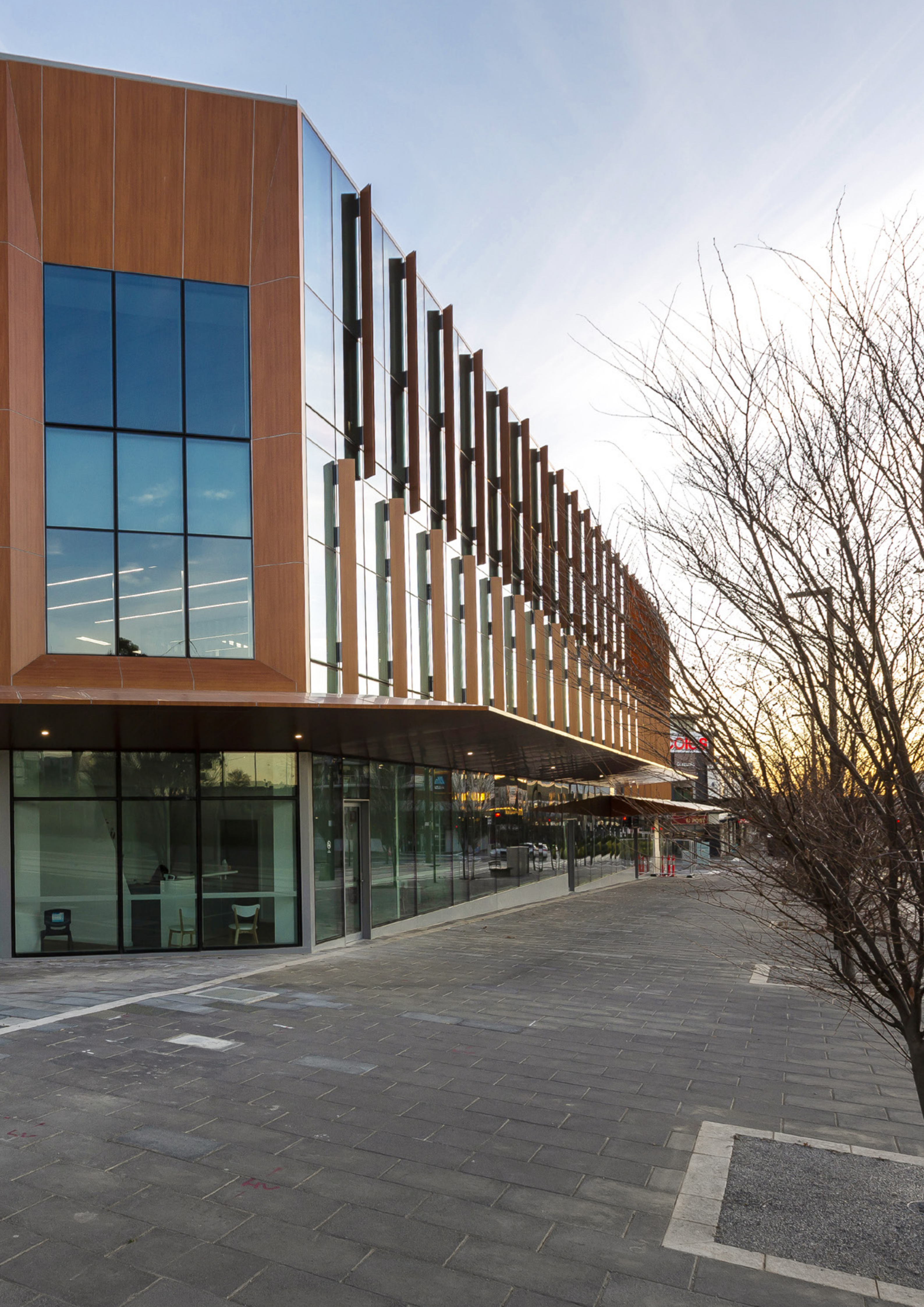
A building's facade sets the bar for its long-term performance, making it one of the most important and difficult design elements. The design of the modern facade is constantly evolving as technology and materials develop. In the face of climate change, future facades will need to not only deliver iconic aesthetics and weather protection but also reduce the carbon footprint of the structure throughout its entire life cycle.

Reports estimate that the built environment is responsible for 39% of all energy-related carbon emissions in the world: 28% of these emissions are operational emissions from the energy required to heat, cool, and power buildings; the remaining 11% of emissions are from building materials and construction.[1]

It is the responsibility of architects, designers, and specifiers to create sustainable, energy-efficient structures. Specifying sustainable facade materials is a crucial first step in accomplishing this as the facade can account for up to 30% of the building's embodied carbon footprint based on a 2021 study by the World Business Council for Sustainable Development.[2]

In this whitepaper, we examine the carbon impact of facades and their role in sustainable development. We also take a close look at the relevant design considerations when designing sustainable facades and selecting appropriate facade materials.





Operational vs. embodied carbon

Operational carbon is the total amount of energy used to heat, cool, ventilate, light, and power our buildings. Any building's energy efficiency plan must consider the building's envelope, so facade designers have made tightening the envelope a top priority.

To maximise thermal performance, reduce air leakage, and improve natural daylighting, cladding materials and other facade elements (e.g. shading devices and glazing) must be of high quality, well-designed, and properly installed. This can increase energy efficiency and lower capital and operating costs by reducing the need for mechanical and electrical building services, such as heating and cooling. Other factors, including stricter energy regulations and a shift toward both on- and off-site renewable energy production, are helping to decrease operating energy carbon emissions in current and new building stock.

While operational carbon can continue to be reduced throughout the building's lifespan, embodied carbon cannot be altered once construction is complete. Embodied carbon is the carbon emissions linked to building materials and construction processes over the course of a structure's entire lifecycle. Embodied carbon emissions result from the extraction of raw materials, their manufacturing and refinement, transportation, installation, maintenance and the eventual disposal of used materials.

Carbon emissions released before built assets are used currently make up 11% of the global sector's greenhouse gas emissions, but by 2050, they will account for half of all new construction's carbon footprint.[3] This is due to the projected growth in construction initiatives to support an ever-increasing global population. For this reason, reducing embodied carbon through thoughtful design and material selection should be a priority for facade designers.

Increasing sustainability through facade design

Architects and designers must consider several factors when designing facades in order to reduce their embodied carbon and increase their sustainability. Firstly, the type of facade system utilised for the project will contribute to the structure's overall sustainability. Advancements in building technology have provided facade designers with a wider array of options in relation to improving a structure's long-term energy efficiency and performance.

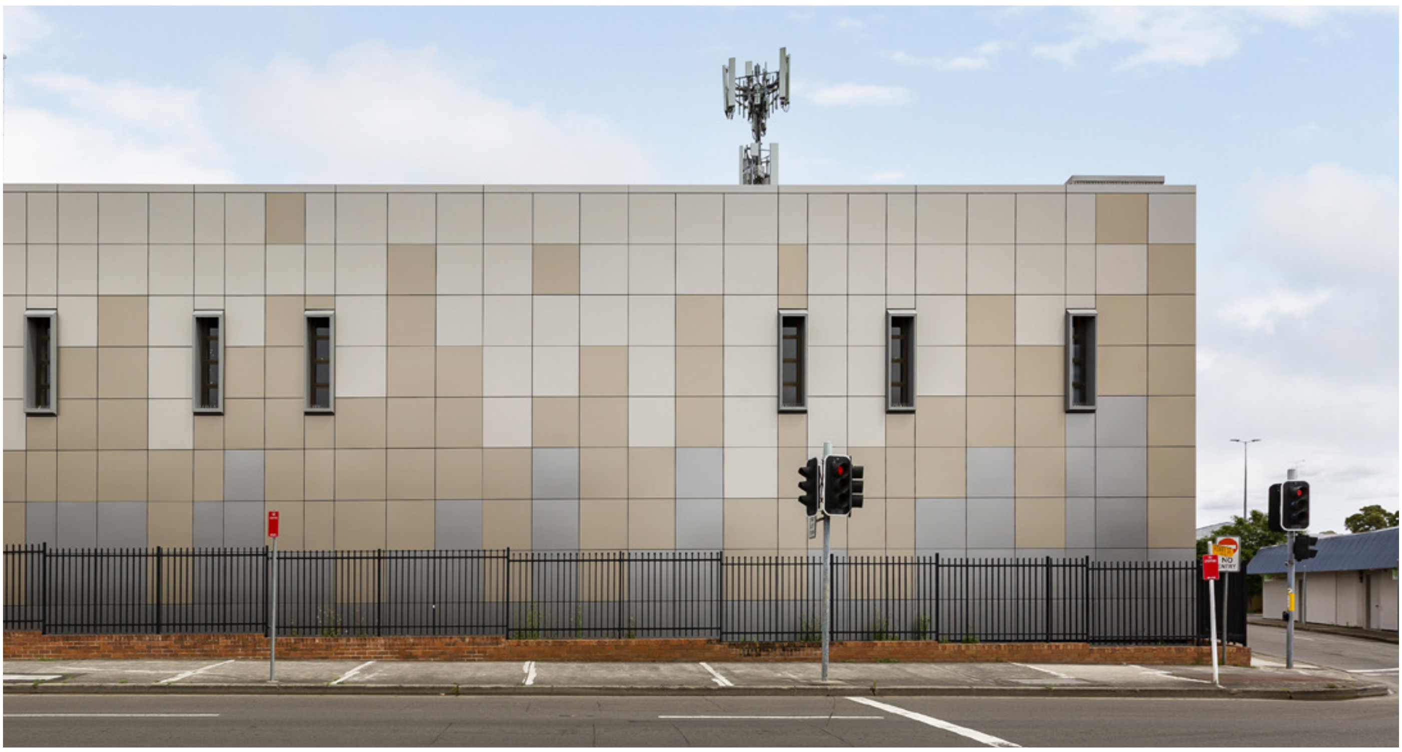
For example, rainscreen cladding refers to a double-skin facade system in which an air cavity is created between the load bearing wall and the cladding material, allowing continuous ventilation. This type of facade has grown in popularity as it enhances the thermal insulation of the inner wall and protects it from damage. It also provides shading to the main structure and helps dissipate heat.

Second, sustainable building materials should be preferred. In this regard, some general principles should be observed, including ensuring materials are non-polluting, non-toxic and durable with low embodied carbon. They should also be sourced and manufactured in a responsible manner, with efforts taken to ensure only renewable raw materials are used where possible. Additionally, the end-of-life of facade materials should be considered so that when a material has reached the end of its useful life, it can be recycled to produce materials for new construction.

As discussed further below, tools such as life cycle assessments and Environmental Product Declarations assist architects and designers in evaluating and selecting environmentally preferable products.

Finally, a well-designed facade incorporates sustainable materials efficiently. Relevant considerations in this respect are explained in the Royal Institute of British Architects Journal:[4]

- Minimising the number of facade system types and materiality variations helps leverage the advantages of repetition and optimisation of components during production and installation. This can improve material efficiency, thus helping reduce embodied carbon in production, transportation and installation.
- Cladding panels of various shapes and sizes need multiple processes to be installed properly, which results in material waste. The effects of detailing choices can be better understood by architects working with material suppliers and consultants, with the goal of eliminating waste as early as possible.
- It is important to find the appropriate balance between aesthetics and the selection and material quantities of finish systems. Embodied carbon can increase or decrease depending on the type of material used, the production location, batch size restrictions, processing, and fuel source.
- Early consideration must be given to the possibility of recycling or reusing facade system components and materials after their design lives are over.



Identifying sustainable facade materials

Building materials are frequently chosen for facade designs after being assessed for performance, aesthetic appeal, and cost. With “sustainable” facades, these criteria are widened to include both health and environmental impacts.

Depending on the type of material, the qualities of building products vary greatly. Following are some tools and methods for evaluating the performance and environmental impact of facade materials.

Life cycle impacts

Due to the wide variation in carbon impacts that different facade systems have, architects and designers need to take informed approaches to minimising upfront carbon. A useful tool in doing so are life cycle assessments (LCAs), which systemically examine building products’ range of potential environmental impacts over the course of their lifespan. LCAs can also identify opportunities to lessen these effects and use natural resources as efficiently as possible.

Many stakeholders in material supply chains are concentrating on decarbonising their manufacturing operations. As a result, there has been a significant decline in embodied emissions for specific types of materials. One example of this is aluminum. Leading aluminum cladding products include recycled aluminum content and are produced using renewable energy sources, making them a greener option when compared to competing alternatives.[5]

Environmental Product Declarations

A transparent Environmental Product Declaration (EPD) provides information about the environmental performance of products and services from a life cycle perspective that is unbiased, comparable, and independently verified. This information helps professionals compare similar products based on their environmental performance. EPDs also give product manufacturers the knowledge they need to lessen their environmental impact throughout the supply chain and to show the market that they are dedicated to a higher sustainability mission.

EPDs and other types of certifications (e.g. the Good Environmental Choice Australia ecolabelling program) are useful tools for indicating whether a cladding product is environmentally low impact. Manufacturers should be prepared to answer questions about the components of their products, the manufacturing process, and their commitment to sustainability. As we look for ways to fully decarbonise the built environment, It is important to partner with manufacturers and suppliers who prioritise reducing embodied emissions throughout the product life cycle.

Durability, lifespan and maintenance

About 100 billion tonnes of raw materials are extracted annually for use in the building and construction industry.[6] At the same time, building and construction are responsible for an estimated third of the world’s waste. One way to reduce the amount of waste that ends up in landfall is creating durable buildings that last a long time.

As they provide weather protection and acoustic, thermal and fire resistance, facades are an essential ingredient for a building’s longevity. Throughout their lifespan, facades are exposed to many harmful elements that can cause damage, such as ultraviolet (UV) light, high temperatures, wind-driven rain, freeze-thaw, chemical substances, and even potentially fire. Using materials that are not ‘fit for purpose’ for building facades can lead to defects and premature building failure, physical instability, and higher maintenance costs.

Durability, in this context, refers to the lifespan of the facade material and its ability to withstand degradation and damage from various elements. When evaluating facade materials, the following properties should be considered:

- resistance to moisture damage;
- ability to withstand temperature variations, including extremes of either heat or cold;
- resistance to corrosion and decay;
- resistance to the natural degradation caused by exposure to UV light;
- non-combustibility and resistance to fire; and
- ability to withstand various loads and impacts (e.g. flying debris).

Note that materials with low maintenance requirements will help towards achieving sustainable building outcomes. If a building owner requires someone to clean, repair and maintain the facade on a regular basis, this has to be built into the embodied carbon of the product and will add substantial ongoing costs, which should be considered when selecting sustainable facade materials.

End-of-life considerations

End-of-life (EOL) describes the last stages of the use of a product or material. As efforts are made to ensure construction materials are handled in a way that minimises waste and emissions, the treatment and disposal of materials once they have reached the end of their useful lives is becoming an issue of greater importance.

When EOL is considered, certain materials stand out due to their life cycle benefits. Aluminum, for example, has a unique selling proposition in that few materials can match its durability, yet it is 100% recyclable and can be recycled without losing its inherent strength and value. According to the Aluminum Association, nearly 75% of all aluminum ever produced is still in use today.[7] In addition, it is reported that in most industrial sectors recycling rates for aluminum exceed 90%.[8]

Why Mitsubishi ALPOLIC™ NC/A1 is the sustainable cladding choice

Available from Network Architectural, Mitsubishi ALPOLIC™ NC/A1 (DtS Non-Combustible) is a fire-safe, durable, compliant, aluminium composite cladding. It is composed of a non-combustible mineral core making it far superior to other aluminium cladding alternatives on the market.

Like all ALPOLIC™ products, Mitsubishi ALPOLIC™ NC/A1 is easy to process and shape, weather resistant, impact resistant and has superior flatness. The front side is colour-coated with the high-quality fluoropolymer resin Lumiflon FEVE, making it highly resistant to weathering, UV radiation, corrosion and colour fading.

Mitsubishi ALPOLIC™ NC/A1 receives the tick of approval on sustainability, which is evident in Mitsubishi's successful registration of its EPD, which has been produced by Good Environmental Choice Australia (GECA). This EPD should be a major ongoing factor when specifying sustainable facades on reclads or new builds that are serious about the environment and reducing their carbon impact. It also means specifying ALPOLIC™ NC/A1 will help towards Green Star points for the building.

ALPOLIC™ NC/A1 is a maintenance-free panel that comes standard with a 20-year full replacement warranty. In the case of other cladding products, the warranty is often directly connected to maintenance. It is this requirement for regular maintenance that can impact the embodied carbon of the building. With ALPOLIC™ NC/A1, embodied carbon from a life cycle and maintenance point of view is kept to an absolute minimum.

In addition, ALPOLIC™ NC/A1 has a staggering life expectancy of 50 years. With its Lumiflon FEVE coating technology and rigorous testing, ALPOLIC™ NC/A1 is the most durable, high-quality cladding material on the market.

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All information provided correct as of September 2023.

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