



ABOUT

Location: Sunshine Vic, Wurundjeri Country

Size: 3000 ha

Typology: Mixed-use

Status: Planning

The Sunshine Precinct is a key urban area situated at a vital junction between Melbourne's city centre and the western growth areas, offering strong connections to regional hubs, major transport routes, and economic infrastructure. Planned infrastructure upgrades through major government projects will further boost accessibility and development opportunities in the precinct. As the precinct is expected to experience a significant increase in both population and employment density, it faces the risk of growing environmental pressures. Without a sustainable design framework, issues such as urban heat, water scarcity, high carbon output, and inefficient land use could compromise the precinct's liveability and long-term performance. To ensure that growth is managed responsibly and the area remains resilient to future challenges, it is essential to embed environmental sustainability into the core of precinct planning.

This project was undertaken to identify and evaluate opportunities for enhancing urban resilience in the Sunshine Priority Precinct. The key Net Zero attribute aligned focus areas included urban heat mitigation, water efficiency improvements, embodied carbon management, and the transition to renewable energy. The purpose was to support the development of a future-ready urban precinct aligned with the Sunshine Priority Precinct Vision 2050.

HIGHLIGHTS

01

The case study uses a precinct model (and upgrades) developed by the Department of Transport and Planning (DTP) to represent proposed 2050 developments across the Albion Quarter, Sunshine Station, and Town Centre.

02

This project explores the integration of energy transition, water balance, low-carbon strategies, and urban heat mitigation within a digital twin framework to support informed planning decisions.

03

Multiple alternative scenarios were simulated to assess the impacts of different environmental and infrastructural settings on precinct performance.

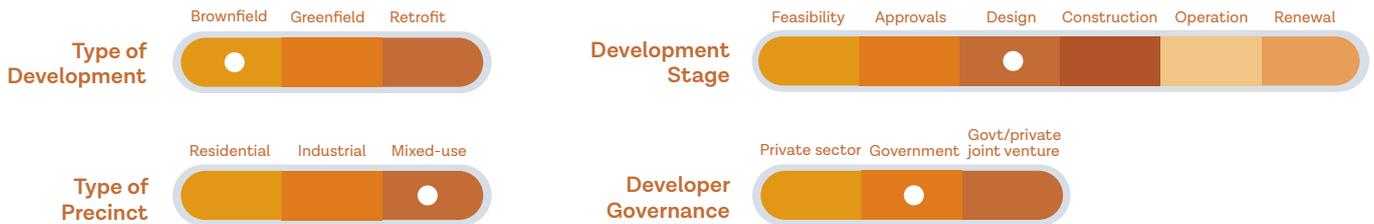
KEY RESEARCH QUESTIONS

How can urban heat, water supply and embodied carbon risks in the Sunshine Precinct be mitigated through integrated planning and resilient infrastructure design?

What are the key risks and opportunities associated with the energy transition in the Sunshine Precinct, and how can these inform sustainable investment and policy decisions?

How can complex environmental, infrastructural, and energy datasets be harmonised within a digital workflow to support evidence-based urban planning and decision-making?

CASE STUDY FEATURES OF INTEREST



1. A CULTURE OF SUSTAINABILITY

The Victorian State Government and Brimbank Council have established a long-term strategic framework and a clear vision for transforming the Sunshine area to address growing population, employment, housing, transport, public space, sustainability, and urban form. This framework outlines what the precinct could look like by 2050 and demonstrates a full commitment to sustainable development and zero emissions. This project supports the framework by exploring strategies to reduce environmental impacts and achieve net-zero goals through integrated sustainability approaches. The study highlights that business-as-usual development threatens Australia's Net Zero commitments unless offsetting or alternative strategies are implemented. Integrated assessment methods and cross-disciplinary approaches further reflect a culture of sustainability embedded throughout the precinct planning process.



2. AVOIDING UNNECESSARY CARBON EMISSIONS AND INTRODUCING LOW-CARBON SOLUTIONS

The study found that building materials are the dominant contributors to carbon emissions in construction, with concrete and steel representing the largest share, making careful material selection critical for reducing the overall footprint. Significant reductions can be achieved through the use of low-carbon materials, which alone can lower emissions by 14% from business-as-usual levels. Combining lightweight and mass timber construction further reduces the footprint by 46% from business as usual levels. Maximum potential reduction – 59% reduction from business as usual emissions – can be realised by eliminating basements and car parking in conjunction with low-carbon construction methods, provided that viable public transport alternatives are available.



3. IMPROVING PERFORMANCE WITH LOWER-CARBON TECHNOLOGIES

The precinct's energy transition is supported through rooftop and façade PV systems, battery storage, and smart EV integration, complemented by greening strategies to reduce cooling demand. Urban heat mitigation is achieved through strategic building and street orientation, carefully planned vegetation, and climate-responsive materials, ensuring passive cooling and reduced heat accumulation across the precinct. Water balance is enhanced by targeted canopy planting, irrigation, and maximising green space where feasible, supporting resilience against rainfall deficits and drought risk. These integrated strategies collectively improve the performance of the precinct while contributing to its net-zero and sustainability goals.

INITIAL LEARNINGS

DEVELOPMENT STAGE	PRELIMINARY INSIGHTS FROM THE CASE STUDY
Overall	<p>The study highlights that integrated design strategies across heat, water, carbon, and energy systems are essential for achieving net-zero outcomes in the Sunshine Precinct. Urban heat modelling revealed that poor ventilation, reflective surfaces, and limited shade elevated temperatures to 45°C, while irrigated vegetation, water bodies, and optimised airflow significantly reduced heat stress; cutting temperatures by up to 10.9°C in redesigned scenarios. Water analysis showed limited greening capacity in the Sunshine Station and Town Centre areas, whereas Albion Quarter provides greater potential through increased deep-soil planting, 3m verges, and continuous irrigation to sustain canopy health and cooling performance. Embodied carbon assessment identified concrete and steel as the largest emitters, with low-carbon materials, mass timber substitution, and removal of basements and carparks reducing emissions by 59% from baseline levels. Energy modelling demonstrated that rooftop and façade solar systems, battery storage, and smart EV charging can enhance renewable energy use and grid stability, while greening measures reduce cooling energy demand by up to 20%. Together, these strategies illustrate how integrated planning in materials, landscape, and energy design can deliver substantial carbon reductions and thermal resilience across the precinct by 2050.</p>
Feasibility/ Business Case	<p>The feasibility assessment confirms that the Sunshine Precinct’s sustainable transformation is achievable through integrated planning across heat, water, carbon, and energy domains. Urban heat mitigation measures such as optimised street orientation, strategic tree placement, irrigated vegetation, and climate-responsive materials were found to reduce air temperatures by up to 10.9 °C, significantly improving thermal comfort and lowering cooling energy demand by up to 20%. Water resilience can be strengthened by investing in 3-metre-wide verges, structural soils, and continuous irrigation, particularly in areas like Albion Quarter where canopy expansion is feasible. Replacing conventional concrete and steel with low-carbon materials and mass timber construction, and removing basements and carparks, can lower embodied emissions by 59% from baseline levels. In the energy domain, combining rooftop and façade solar PV, battery storage, and smart EV charging improves system efficiency and stability by up to 15%. Together, these integrated strategies demonstrate a feasible pathway toward a resilient, low-carbon, and net-zero Sunshine Precinct by 2050.</p>
Approvals/ Planning	<p>The study’s findings will strengthen the planning and approval process by providing a clear technical basis for future design and policy decisions. Evidence on heat mitigation, water management, carbon reduction, and renewable integration can help refine planning controls, development standards, and infrastructure priorities to better reflect climate-responsive design principles. These insights will also support decision-makers in assessing development applications against measurable sustainability outcomes rather than general policy goals. In practice, the findings can inform updates to local planning schemes, guide infrastructure investment, and promote cross-agency coordination to ensure that approvals encourage innovation while maintaining compliance with safety and performance standards. Ultimately, this evidence-led approach will enable more consistent, transparent, and forward-looking planning decisions across the Sunshine Precinct.</p>
Design	<p>The findings of this project provided following recommendations for precinct design.</p> <ol style="list-style-type: none"> 1. Optimise building and street orientation: Align buildings and streets along the north-south axis to enhance ventilation, increase setbacks to reduce heat retention, and adapt street designs to support airflow and shading. 2. Integrate vegetation strategically: Select tree types and placement based on climate, street orientation, and wind patterns; use irrigation to maximise cooling and maintain plant health. 3. Enhance open spaces: Provide shade, maintain unobstructed airflow, and use irrigated greenery or water features to significantly reduce local temperatures. 4. Use climate-responsive techniques for materials selection: Apply high-thermal-mass, low-reflective materials in sun-exposed areas; avoid unirrigated grass and overly reflective facades. 5. Leverage wind and microclimate: Preserve ventilation corridors, manage wind speeds with tree placement, and adapt designs to seasonal wind patterns for passive cooling. 6. Invest in structural soil, active and passive irrigation and soil volume, particularly in priority areas for shading. 7. Invest in active and passive irrigation on all new streets to support tree growth. 8. Provide alternative water supply to support open space irrigation for cooling and active irrigation of street trees. 9. Consider options to provide more tree canopy on private land.

INITIAL LEARNINGS

DEVELOPMENT STAGE	PRELIMINARY INSIGHTS FROM THE CASE STUDY
Design cont.	<ol style="list-style-type: none"> 10. Use low-carbon materials: Prioritise timber and other low-emission alternatives instead of concrete and steel. 11. Combine design strategies: Reduce basements, carparking, and adopt lightweight construction to maximise carbon savings. 12. Support public transport: Ensure reduced parking is offset by accessible transport options. 13. In high rise and high-density districts, east west BIPV better matches the demand profile and improves consumption efficiency. 14. Electric vehicle deployment should scale prudently, since very large fleets create a new charging peak even with smart charging during valley time. 15. At higher PV penetration levels, medium to large battery capacity is required; larger batteries enhance peak substitution, reduce ramping, and improve system stability.
Construction	<p>The construction of the Sunshine Precinct should prioritise low-carbon materials, efficient building techniques, and integrated renewable energy systems. Concrete and steel which dominate emissions, should be substituted with low-carbon alternatives such as timber, and lightweight construction methods should be employed to reduce high-carbon material use, particularly in walls, floors, and structural elements. Basements and carparking should be minimised or eliminated where feasible, with public transport accessibility compensating for reduced parking. During construction, careful planning of photovoltaic integration on rooftops and façades, along with provision for battery storage and smart EV charging infrastructure, should be incorporated to maximise renewable energy use and grid efficiency from the outset. Overall, construction should follow an integrated, low-carbon, and energy-conscious approach, ensuring that both embodied and operational carbon are minimised while supporting the precinct's long-term net-zero goals.</p>
Operation	<p>Passive cooling, ventilation, and water strategies will continue to deliver energy and comfort benefits throughout the precinct's life. North-south building orientation, ventilation corridors, and strategically placed vegetation will maintain natural airflow, reduce heat accumulation, and lower indoor and outdoor temperatures, reducing the need for mechanical cooling. Irrigated trees, green spaces, and water features will sustain microclimate cooling even during dry periods, supported by structural soils and alternative water sources. These measures will translate to ongoing energy savings, with up to 20% reduction in cooling demand, while enhancing occupant comfort, mitigating urban heat stress, and supporting the precinct's long-term sustainability and net-zero operational goals.</p>



Support for other Case Studies that are part of RACEfor2030's Pathways to Net Zero Precincts project includes Curtin University; DevelopmentWA; Hesperia; Sustainable Built Environment National Research Centre; Hawaiian; Western Power; Adelaide University, Government of South Australia; City of Adelaide; Power Tech Energy Pty Ltd; and Sustainable Energy Commitment Pty Ltd.

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