pathways to net zero precincts

RACE for 2030 RELIABLE AFFORDABLE CLEAN ENERGY

CASE STUDY FACTSHEET
Curtin University Bentley Campus

Lead Partners
Curtin University

ABOUT

Location: Bentley WA, Whadjuk Country

Size: 11.4ha

Typology: Mixed-use

Status: In operation

Located 6km southeast of the Perth CBD, Curtin University's Bentley campus spans 116ha and comprises over 100 buildings supporting academic, administrative, commercial, residential and recreational uses.

Research activities for this case study align with a scheduled campus masterplan review being undertaken by Curtin Properties, Facilities and Development, as well as the preparation of the University's decarbonisation strategy. This provides an opportunity to embed research into this major mixed-use precinct.

Initial research is focusing on the piloting of a Digital Twin platform as a decision support tool to understand the impact of increased space utilisation, improved energy efficiency outcomes and the integration of Consumer Energy Resources (CER). Future research activities will test a novel integrity framework to support Curtin's decarbonisation efforts and the role of green infrastructure in supporting net zero outcomes will also be explored.

HIGHLIGHTS

01

Real-time sensor data is being used to track energy consumption and CO_2 emissions across selected Curtin campus buildings which, through the use of the Digital Twin tool, will ultimately inform low carbon and energy efficiency interventions in the Curtin precinct.

02

Plans are underway to use the Digital Twin scenario planning tool to simulate renewable energy integration and smart grid scenarios to inform future sustainability initiatives and net zero planning for Curtin's Bentley campus.

KEY RESEARCH QUESTIONS

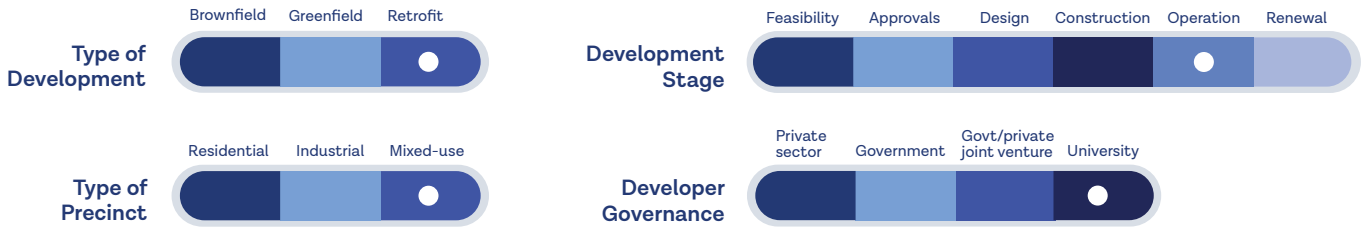
How can Digital Twins be used to optimise sustainability performance and energy efficiency in complex precincts?

What capabilities do Digital Twin platforms offer for modelling and simulating renewable energy integration in a campus setting?

How can real-time data from building systems and occupant behaviours be used to inform operational decisions and reduce Scope 2 emissions?

Image by VAM Media

CASE STUDY FEATURES OF INTEREST



1. CURTIN'S COMMITMENT TO SUSTAINABILITY THROUGH DIGITAL INNOVATIONS

Curtin University has made sustainability a core focus of its operations and research agenda. Partnering on the precinct-scale Digital Twin initiative reflects this commitment by applying advanced technologies to monitor and undertake real-time simulation and modelling to improve environmental performance across campus. The project aligns with Curtin's broader goal of achieving net zero emissions through innovation, smart infrastructure, and evidence-based decision making while contributing to key UN Sustainable Development Goals, including Clean Energy, Sustainable Cities, and Climate Action.

2. INFORMING SUSTAINABILITY THROUGH DATA-DRIVEN DECISION MAKING

Curtin's use of a dense sensor network across selected buildings on the Bentley campus precinct is allowing for detailed tracking of energy consumption and CO_2 emissions. The buildings are equipped with various types of sensors, such as sub-metered energy sensors, indoor environmental quality sensors, occupancy and motion sensors. For instance, people counting data is being collected through cameras at building entrances, while space occupancy is monitored via Cisco Wi-Fi access points integrated with the Cisco Spaces platform. The integrated data environment is enabling both granular analysis and cross-domain insights on how building operation, energy operation, and people's behaviour interact. Where available, renewable energy generation and consumption data is being collected for supporting more informed operational decisions on optimising renewable energy utilisation.

3. FORECASTING SUSTAINABILITY OUTCOMES USING A DIGITAL TWIN

The Digital Twin serves as a powerful predictive tool to model the outcomes of various sustainability initiatives before they are implemented. By simulating the effects of renewable energy integration, occupancy changes, and efficiency upgrades, the platform enables informed decision-making that balances environmental, operational, and financial considerations.

Early work on the Digital Twin research has involved evaluating multiple cloud computing platforms (AWS, Azure, Unity) to develop a robust understanding of the trade-offs between visualisation, real-time analytics, and integration capabilities. The research team compared the performance of these platforms from various aspects and found the AWS platform to be the best suitable for their work (Figure 1).

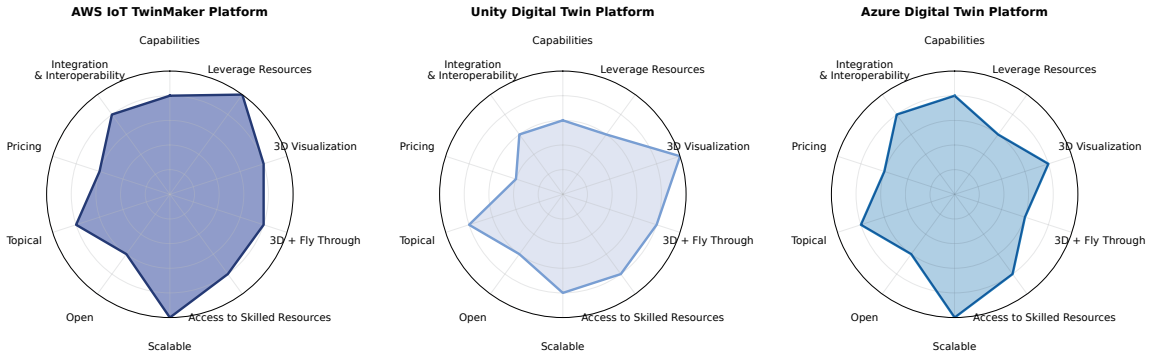


Figure 1: Performance comparison between cloud computing platforms which identified AWS as most suitable for this work.

4. EXPLORE ENERGY TRANSITION SCENARIOS TO SUPPORT INFORMED DECISION-MAKING FOR DECARBONISATION

The project team will be simulating the integration of CER including rooftop solar photovoltaic systems, battery storage, and smart grid technologies. These simulations will assess the potential for reducing both operational carbon emissions and long-term energy costs through different mixes of these technologies, supporting smarter campus energy management and contributing to the decision making processes for Curtin's broader decarbonisation, net-zero and sustainability goals.

INITIAL LEARNINGS

DEVELOPMENT STAGE	PRELIMINARY INSIGHTS FROM THE CASE STUDY
Overall	• An integrated data environment, with real-time sensor data and digital twin technologies, enables both granular analysis and cross-domain insights, supporting more informed low carbon operational decisions and long-term planning.
Feasibility/ Business Case	• The Digital Twin research activities serves as a pilot case study for the Curtin Precinct. It is expected to demonstrate substantial improvements in operational efficiency, data-driven decision-making, and overall building performance. The Digital Twin tool can support developers, property managers, and researchers by demonstrating how net zero design features, such as shared solar and green infrastructure, can significantly enhance the performance and planning of energy efficient and net zero buildings.
Construction	• While the current Digital Twin Pilot is targeted to support carbon emission reduction for operational emissions, learnings can be applied for future construction and renewal projects across the Curtin precinct.
Operation	• The data being gathered though the Digital Twin Pilot is effective in identifying operational energy inefficiencies and guide interventions and informed decision-making to support carbon emission reduction.
Renewal	• While the current Digital Twin Pilot is targeted to support carbon emission reduction for operational emissions, learnings can be applied for future construction and renewal projects across the Curtin precinct.

FURTHER INFORMATION

Pathways to Net Zero Precincts Website – Curtin Case Study

Exchange Curtin Website

Curtin's support includes the CISCO Curtin Centre for Future Networks

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