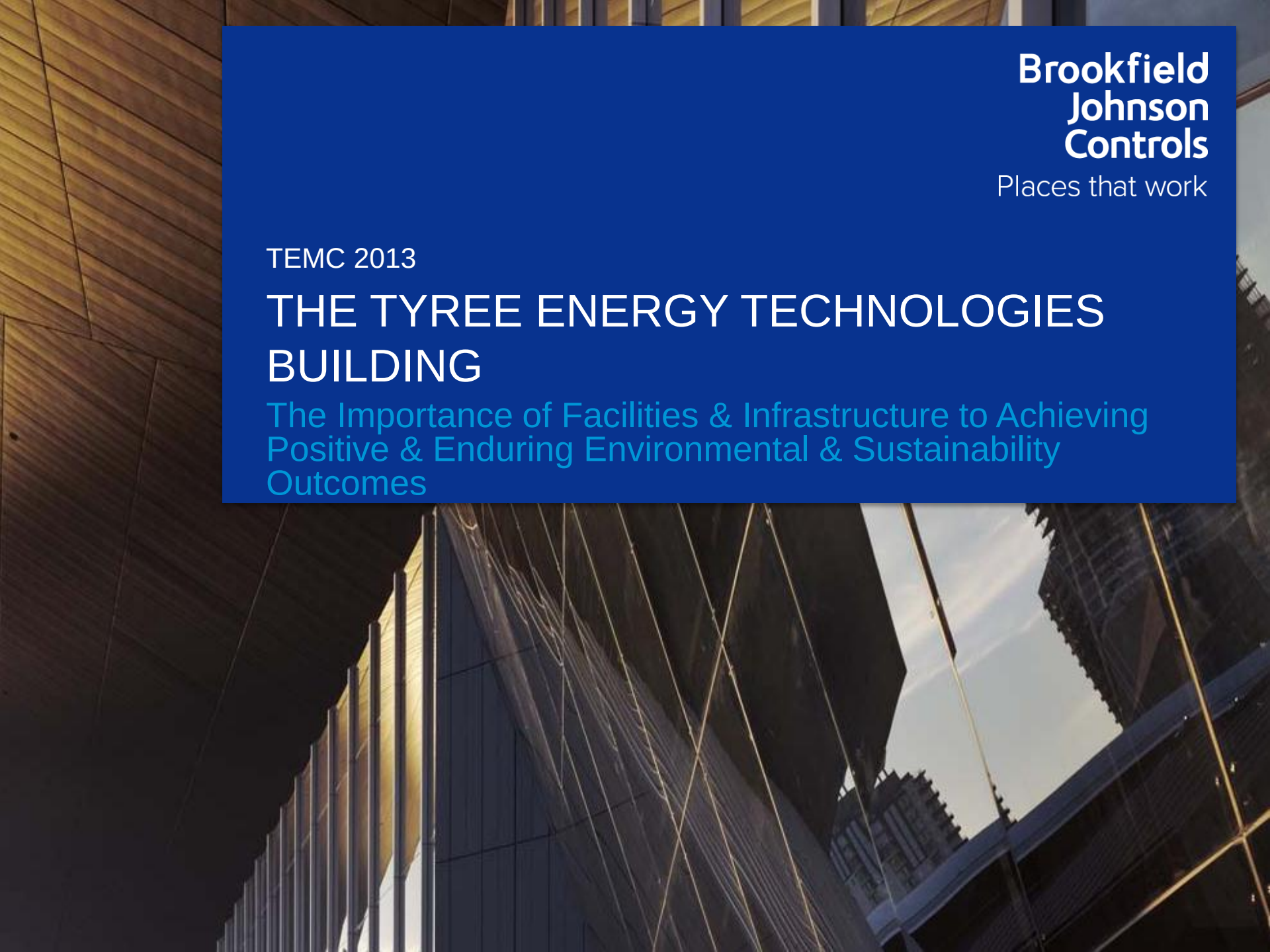

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Places that work

TEMC 2013

THE TYREE ENERGY TECHNOLOGIES BUILDING

The Importance of Facilities & Infrastructure to Achieving Positive & Enduring Environmental & Sustainability Outcomes

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Introduction

- Building Overview
- Environmental & Sustainability Features
- Role and value of collaborative working practices
- Importance of facilities and infrastructure to the delivery of positive and enduring environmental and sustainability outcomes
- Lessons learned

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About

- $123.5 million.
- Completed 11 January 2012.
- Relocation of 250 UNSW personnel with the transfer of 17 teaching and research laboratories.
- 6 Green Star design certification - fourth 6 Star education facility in Australia and a first for UNSW.
- Supported by $75m in funding under the federal government's Education Investment Fund.
- Building Usage: Common (26%), Teaching (11%), Labs (19%) (50/50 – Wet /Dry), Offices (17%).

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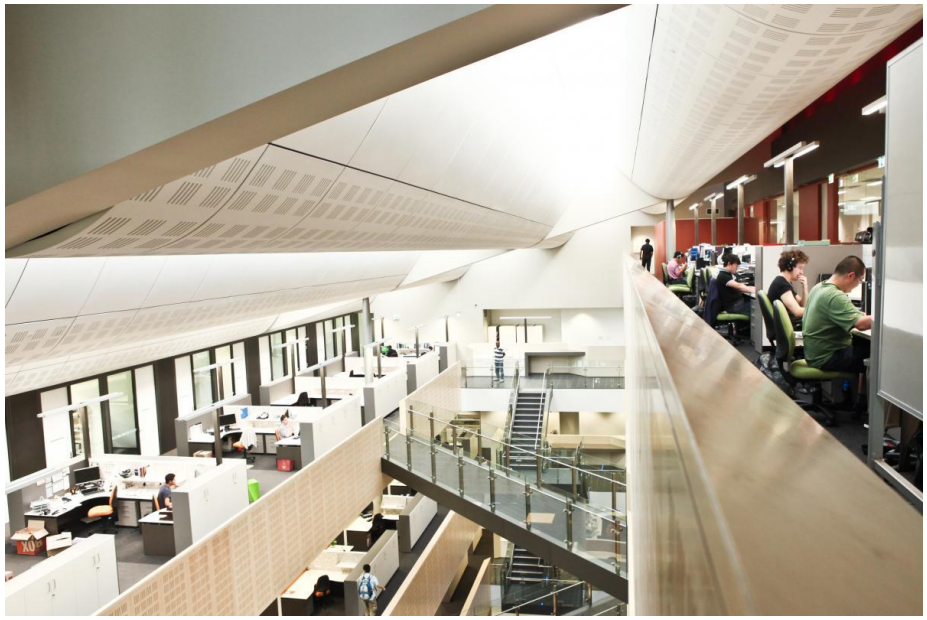
Key Design Features

- Five levels totalling approximately 15,000 m2.
- Incorporates administrative spaces, teaching and learning spaces, engineering workshops, engineering display spaces, café, and research areas including laboratories.



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Key Design Features

- The roof of the building incorporates photovoltaic cells for the testing of research and development work as well as contributing to the energy input requirements of the facility.
- Central atrium space uses access stairs and pedestrian bridges to connect the floor levels. This increases the visual and physical interconnection and enhances the collaborative nature of the design.

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Objective of the Building

- Create a new home for the Australian Energy Research Institute incorporating teaching.
- Laboratories to support the ongoing research of UNSW researchers in world record-breaking solar photovoltaic technologies, sustainable clean fuels, smart grids, energy storage, energy economics and policy analysis.
- Educational hub for undergraduate and postgraduate students, providing an optimal learning environment for the expert engineers and analysts who will shape our energy future.
- Accommodate and showcase cutting edge research in clean energy including photo-voltaics, carbon capture and storage.

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Environmental & Sustainability Features

- Tri-generation System
- Photovoltaic System
- Thermal Labyrinths
- Bore water cooling/heating
- Lighting controls
- Night Purge
- Double Glazing
- Treated bore water
- Metering

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Tri-generation system

- Generates electricity and useful heat from the combustion of natural gas.
- Waste heat used to produce hot water for heating, or chilled water for cooling via absorption chiller.
- Electricity is then exported to the university's HV network.
- Chilled water is exported to the campus Central Energy Plant which provides 5 buildings with chilled water.

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Photovoltaic System

- 1,100 m2 roof-mounted photovoltaic array with arrays at different tilt angles.
- Total capacity of 150 kWp.
- Electricity produced exported to the university's high voltage network.

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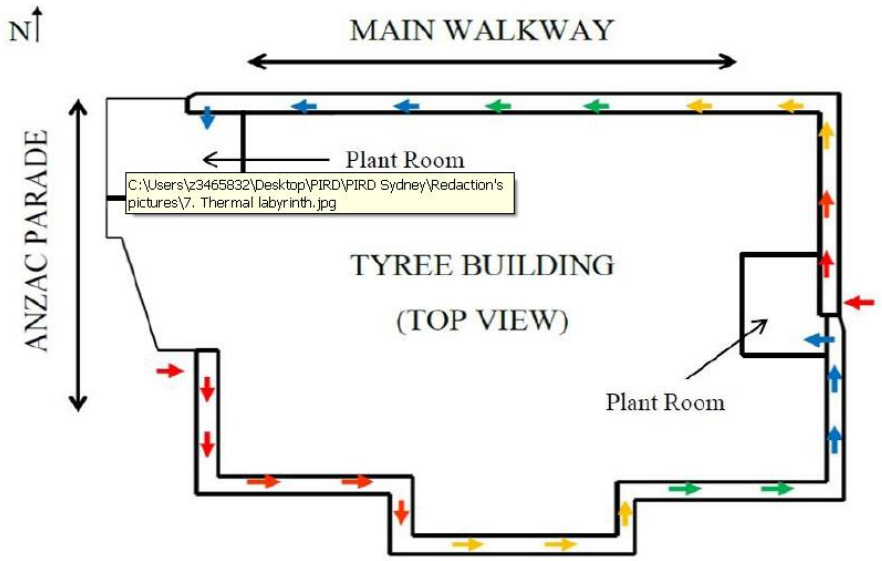
Thermal Labyrinths

- One northern and one southern labyrinth.
- Underground passive heating and cooling systems are in fact long concrete tunnels.
- Dimensions are approximately 90 m long, 1.2 m wide and 3 m height.



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Bore water cooling/heating

- Large underground storage tanks used to supply water to pressure pumps with variable speed drives.
- Non-potable water used in toilets, irrigation, cooling towers.
- Rain water collected from roof and stored on site in a rainwater tank; treated before being used.
- Fed back into the aquifer using a percolation chamber when the system collects too much compared to the building's needs.

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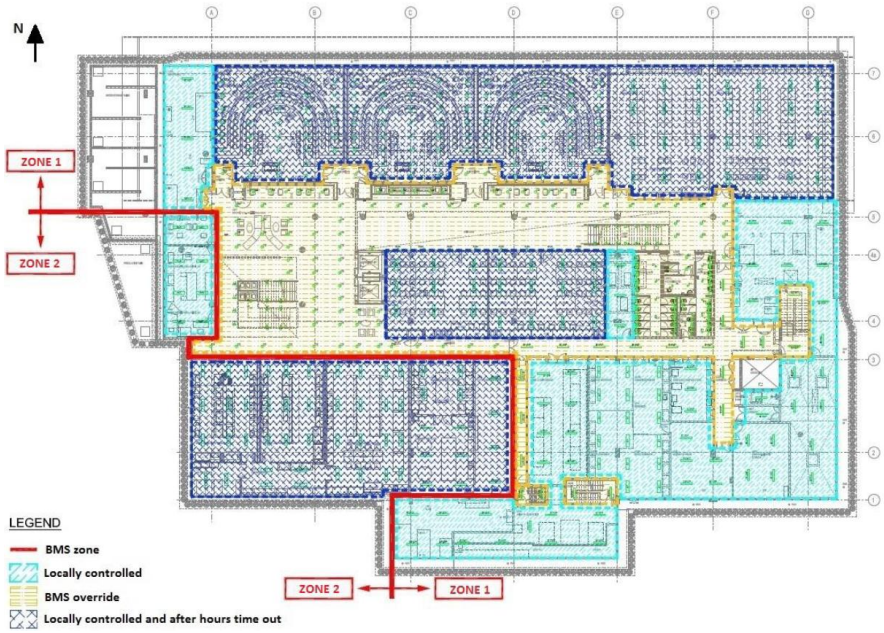
Lighting Controls

- The lighting control system of is composed of:
  - *One photo electric sensor for on off lighting control (only for external lighting)*
  - *Photo electric sensors for dimming control*
  - *Motion sensors (After Hrs)*
  - *Light switches*
  - *BMS time schedule*
- Sensors measures light levels dims accordingly if adequate natural light is available.



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Night Purge

- The configuration of the sloping spoon roof has vertical windows along the length of the building.
- These windows can be opened through the BMS to allow the building core to be purged overnight when the outside air conditions and internal building temperatures are suitable.
- This is similar to the operation of the economy cycle on an air handling unit.

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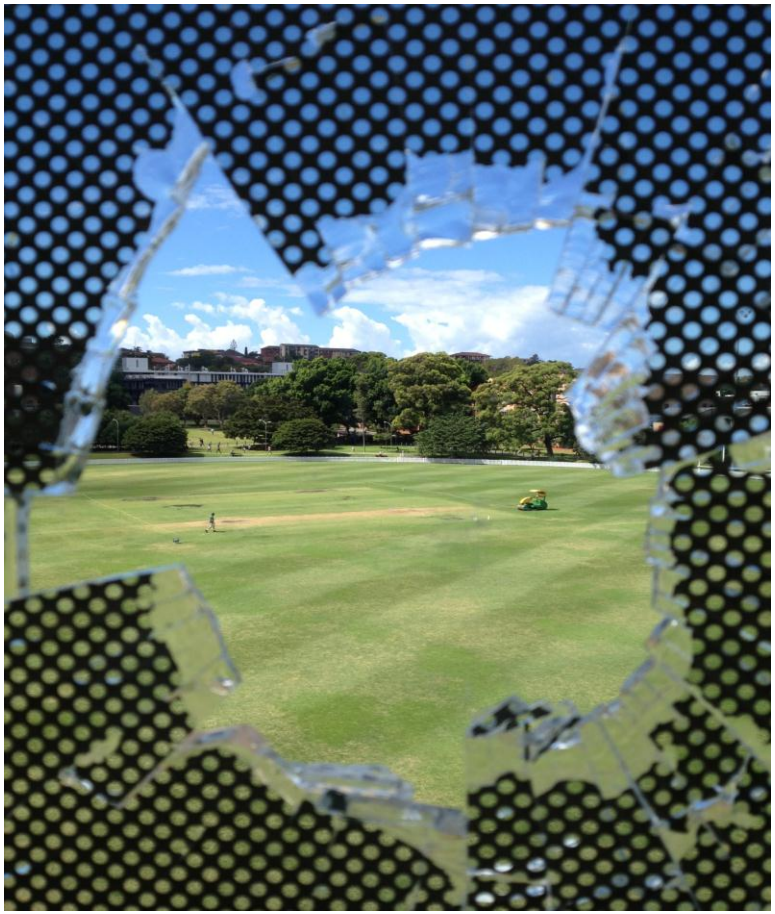
Double Glazing

- Windows are double glazed and there is also the “white wall” windows on the eastern side of TETB to reduce thermal heat transfer through the windows into the building.



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Treated Bore Water

- Treated bore water used to supply the building including water to all toilet cisterns, plant rooms and the labs.
- Treated water is also supplied to the Trigen cooler.
- The cooler drains the water out each evening and goes into the storm water and back to the underground tanks and is used in the bore water system.
- If the temperatures do not require water on the pads, the sump in the cooler remains unfilled and dry.
- There is potable water supplied to the hand basin through a TMV and cold water to the safety shower /eye wash.
- Treated bore water tanks are backed up from the potable water should the water level in the tanks drop to that level.

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Metering

- Over 150 meters.
- **Gas consumptions** for Domestic Hot Water (DHW), tri-generation system, café and whole building.
- **Potable water consumptions** for the whole building, secondary supply to non-potable water tank, for DHW and café.
- **Non-potable water consumptions** for the whole building, cooling tower, reverse osmosis (purified water in laboratories) and toilets.
- **Electricity consumptions** measured for the two Main Switch Board (MSB) for the whole building, major equipment and each area.
- **Lighting consumptions** measured for each area.
- **Thermal energy** for absorption chiller (cooling produced), tri-generation (heating recovered), Central Energy Plant (cooling produced) and boilers (heating produced).

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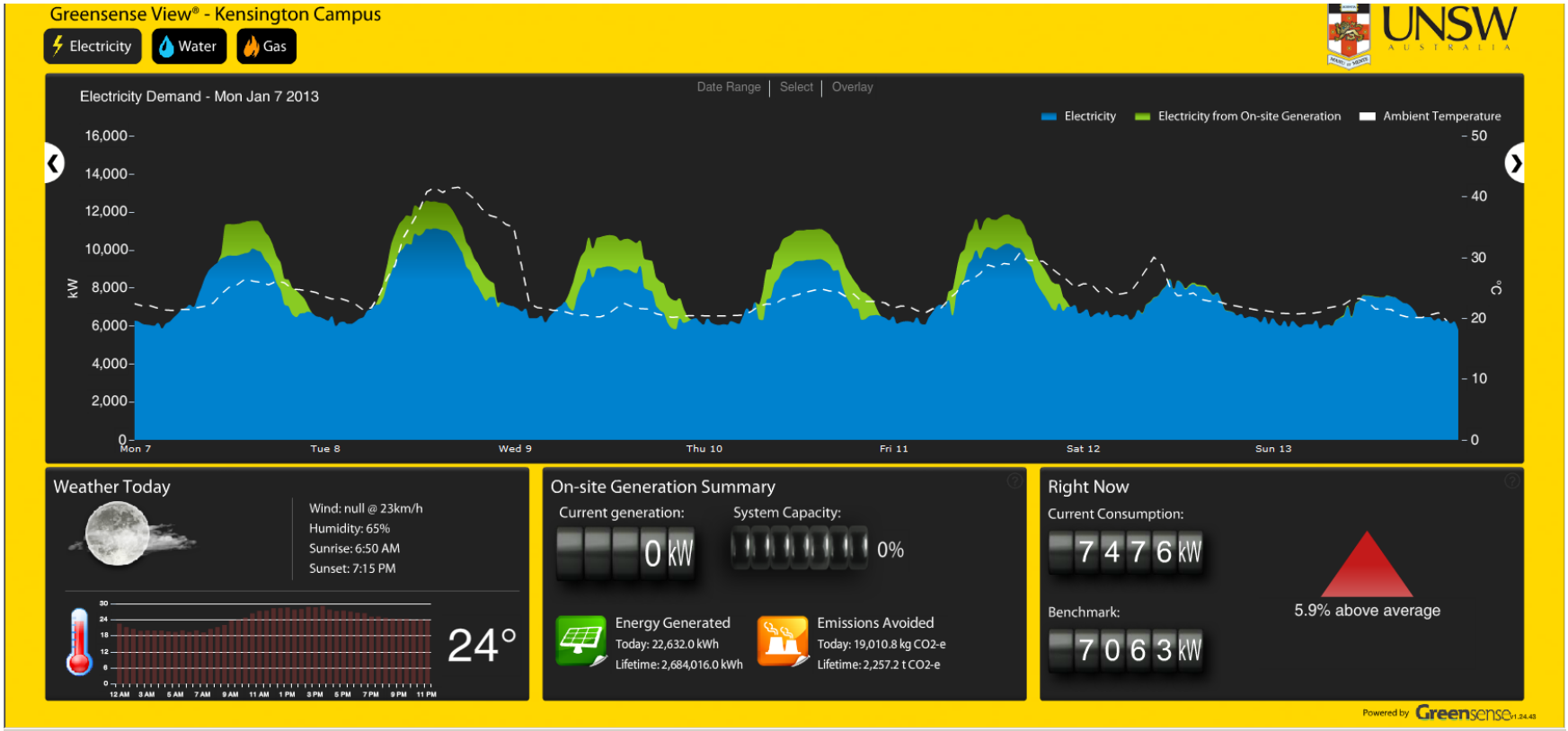
Real-Time reporting – Kensington Campus



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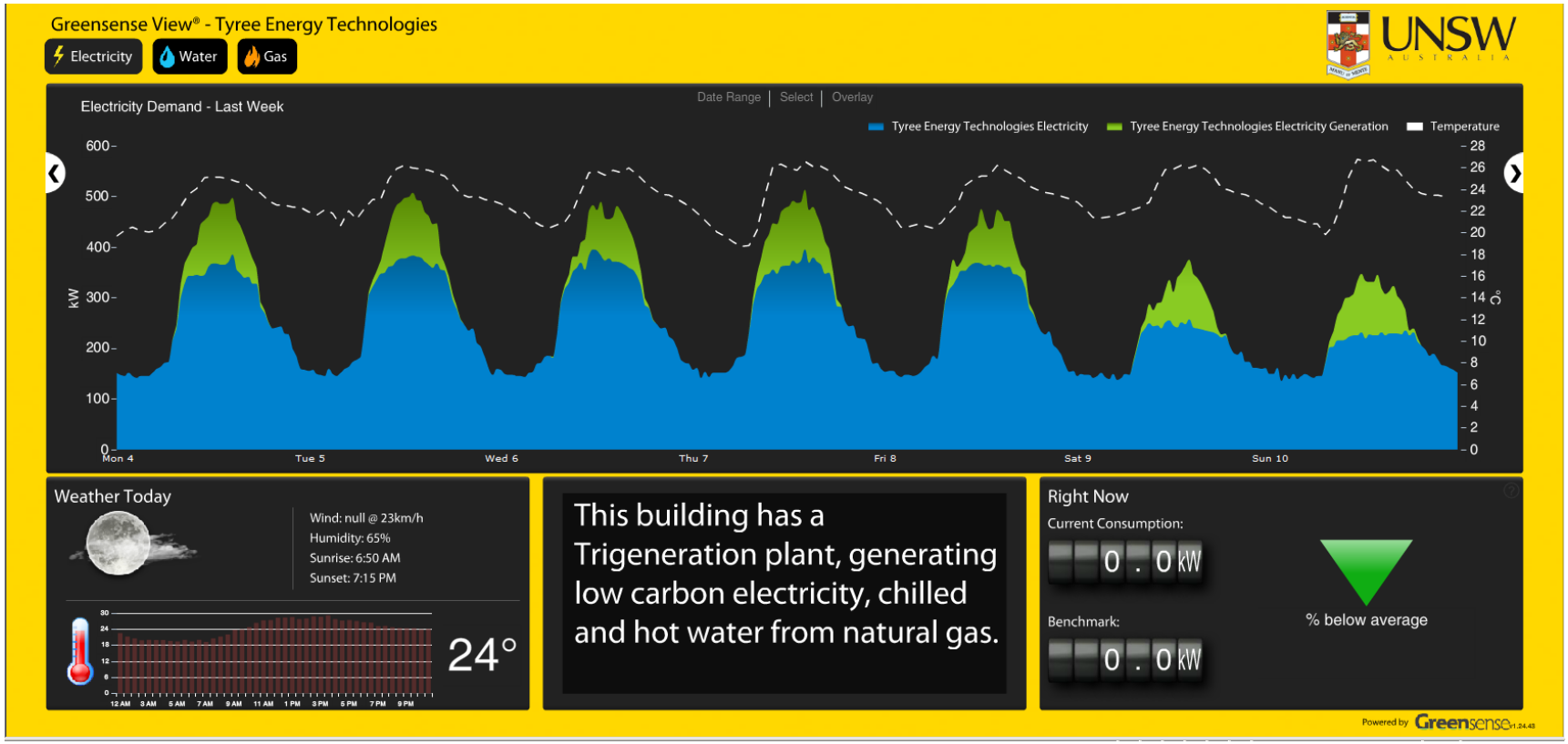
Real-Time reporting – Tyree Building



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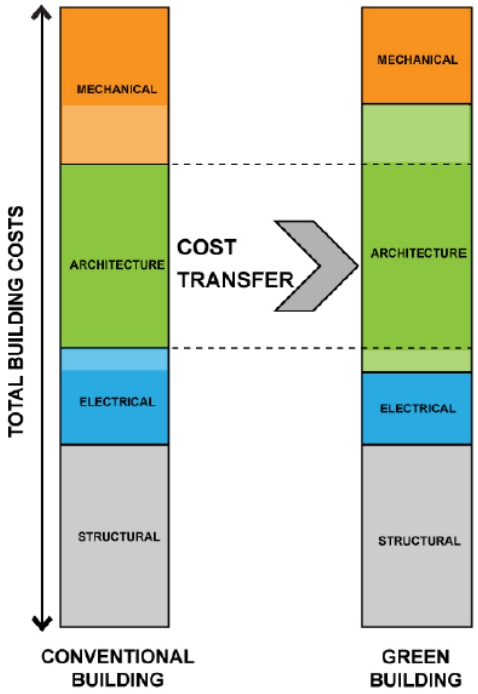
Cost Transfer

Integrated Design

Cost Transfer

Transfer costs from mechanical and electrical systems to building architecture



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The Importance of Effective Collaboration

- Importance of promoting effective collaboration between all stakeholders for the successful design, construction and management.
- Collaboration vital for the TETB's success throughout its operational lifespan.
- Demand for new technologies, specialist systems, flexible infrastructures and environmental management requires onsite management team (and wider industry) to continue to work hand-in-hand with the end users to ensure expertise to install and maintain new plant and equipment to keep the TETB at the cutting edge of energy research and to maintain leading energy efficiency and sustainability outcomes.

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Proven Best Practice & Innovation to Deliver

- The energy infrastructure in the building is important for its success
- The provision of comprehensive, up-to-date information through electrical meters and the ground floor foyer display system ‘Showcase’ the 6 star Green Star rating.
- Specialist services incorporated to meet current requirements, while providing flexibility to meet future changes in technology as well as different teaching and research requirements.

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Conclusion and Lessons Learned

- Late design changes impact building efficiency
- Addition of Retail space
- New technologies limit suppliers
- Importance of engaging FM early in design process