

# Environmentally Sustainable Design

## Clinical Services Building

Environmentally Sustainable Design (ESD) principles have been embedded within all aspects of The Queen Elizabeth Hospital (TQEH) Stage 3 Redevelopment, which includes a new multi-deck car park completed in 2019, and a new 27,000m<sup>2</sup> Clinical Services Building (CSB) due to be completed mid-2024.

The project has achieved a 6 Star ESD rating for the design of the building using SA Health's In-house Green Rating Assessment Tool (IGRAT). This outstanding achievement is based on the ESD elements outlined within this fact sheet and highlights the project's commitment towards climate change, carbon neutral targets and environmental responsibility.

## Energy efficiency

- The Clinical Services Building will be first major healthcare building in Australia to be all-electric, with no natural gas used in the building.
- Heat pump technology will provide heating and hot water generation to replace traditional gas-fired boilers. Waste heat from the mechanical services will be used as the primary source of heating, with an electric back up resulting in no natural gas used.
- The thermal efficiency of the building has been significantly increased over code requirements, including enhanced thermal glazing performance, and increased insulation in the façade (external walls and glazing), roofs and courtyard floors. Increasing the thermal efficiency will reduce heat lost from the building in winter and minimise heating of the building during summer, reducing the load and energy consumption of the air-conditioning.
- The façade of the new Clinical Services Building has been designed to minimise air leakage from the building by 50% over code requirements. A well-sealed, more air-tight building improves energy efficiency by reducing the amount of heated/cooled air that can escape the building. Pressure testing is being carried out to validate the facade performance meets the design target, with preliminary results demonstrating 80% over code requirements. Testing air tightness of multi-storey buildings is very uncommon in Australia, so this initiative is seen as a major ESD innovation and a first for hospital buildings in South Australia.
- A lift destination control system will reduce power consumption of the lifts by eliminating unnecessary lift car travel and provide an improved experience for the users.
- Fine tuning of the building engineering systems will be completed for 2 years after completion of the new CSB to optimise the performance of the building services, improving energy efficiency, reducing water consumption and improving the comfort conditions for the occupants in the building. Fine tuning of multi-storey buildings is typically only conducted for 1 year following completion, but this project has doubled the timeframe as an innovation to maximise the benefits and allow the air conditioning systems to be fine-tuned over each season twice (two winter, shoulder and summer seasons).
- 8 Electric Vehicle (EV) charging stations are installed within the new car park, with capacity to increase the quantity of EV charging bays in the future as the percentage of EV and hybrid vehicles increases consistent with the South

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Australian government targets. The ambulance bays in the new Clinical Services Building emergency department have also been designed to accommodate EV charging of ambulances in the future.

### Solar Power

- 370 kilowatts of solar photovoltaic (PV) panels were installed on the new car park in 2021. The solar PV panels are generating over 567,000 kilowatt-hours of electricity per year and has reduced the whole TQEH site's grid electricity consumption by 3.4%.
- The new Clinical Services Building includes provision for a future installation of 450 kilowatts of solar PV panels, which would generate over 675,000 kilowatt-hours of electricity and the total solar PV capacity would reduce the TQEH grid electrical consumption by 7.4%.

### Greenhouse Gas Emissions

- Eliminating gas consumption with an all-electric hospital will reduce carbon dioxide emissions by 597,000 kilograms every year, representing a 41.8% reduction in total carbon dioxide emissions for the new Clinical Services Building.
- With South Australia's target for 100% renewable energy by 2030, the carbon dioxide emissions of the Clinical Services Building would reduce by 1,366 tonnes per year, which is a 90.8% reduction equivalent and the equivalent of taking 650 cars off the road each year.
- Providing a fully electric building provides a credible pathway for TQEH to be carbon neutral.
- The refrigerants in the engineering equipment have been selected with low Global Warming Potential (GWP) and Ozone Depletion Potential (ODP) and is forecast to reduce the amount of greenhouse gas emissions equivalent to 1,228 kilograms of carbon dioxide per year.

### Water Efficiency

- All rainwater captured from the roof of the existing ward inpatient buildings is captured, treated and reused for toilet flushing within the building, resulting in a 7.2% reduction in potable water usage.
- Washbox technology is being used on the Clinical Services Building as an environmentally friendly solution for tool washing of the construction trades such as painters and concreters. This technology recycles all water used for tool washing and consumes 98% less potable water than the traditional approach. Liquid waste is eliminated, and the product has been certified to greatly reduce the impact on ecosystems and human health associated with wastewater discharge.
- The water used in the concrete structure of the new Clinical Services Building included 50% recycled or reclaimed water.
- All commercial taps and fittings have been selected with 6-star WELS water efficiency ratings, and where thermostatic mixing valves are used the flowrates have been limited to reduce overall water consumption of the building.
- All stormwater captured will be treated to reduce pollution and contaminants to best practice targets before discharge to the council system.

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### Construction ESD Initiatives

- The Clinical Services Building structure includes over 40% replacement content in the concrete, which significantly reduces the amount of carbon dioxide emissions and energy usage required for production of the concrete. Re-use of materials such as fly ash for the replacement content also reduces the amount of waste sent to landfill, whilst also increasing the strength of the concrete.
- Environmentally responsible building materials have been incorporated into the Clinical Services Building, including the use of certified or reused timber for internal structural supports in lieu of steel, all steel sourced from certified Responsible Steel Makers, over 90% of flooring has environmental certification and flooring, pipes and blinds are PVC free or meet best practice guidelines for reduction.
- An Environmental Management Plan and Waste Management Plan has been developed for the construction of the new CSB to ensure compliance with the ESD targets.

### Wellbeing

- The air-conditioning systems have been designed to provide improved Indoor Air Quality (IAQ) with the fresh air supply at least 50% higher than code requirements, controlled air recirculation and temperature ranges reducing energy consumption needed for heating/cooling.
- Carbon dioxide monitoring has been implemented in non-clinical areas which will control the air-conditioning and optimise indoor air quality, in turn reducing energy consumption and greenhouse gas emissions associated with the air-conditioning systems.
- Access to natural light for patients and staff has been maximised to improve wellbeing by facilitating good circadian rhythms and enhancing mental health, whilst also improving staff efficiency and overall wellbeing. External shading and blinds will control daylight glare and maximise energy efficiency.
- Access to external views for patients provides significant wellbeing benefits and studies have shown that patient length of stay / recovery is improved where there are windows and natural light in patient bedrooms.
- Low Volatile Organic Compound (VOC) materials specified for building components such as paints, adhesives and carpets to improve the indoor air quality for occupants.
- Bicycle parking facilities expanded as part of the new car park construction, promoting more opportunities for staff and visitors to be active.
- The building has been designed for acoustic performance and comfort, where maximum noise levels and reverberation is controlled to improve the wellbeing of building occupants, reduce sleep disturbance of patients, and improve privacy and confidentiality of conversations.

### Climate Adaption for the new Clinical Services Building

- A Climate Change Risk Assessment was completed for the new Clinical Services Building to identify the major current and future climate risks for the specific project and location. A Climate Change Adaptation Plan has been developed to demonstrate how the facility design is able to reduce the operational risks associated with all high or medium climate risks.
- The air-conditioning systems have been designed to accommodate temporary carbon filters to filter out smoke during bushfire events (or other transient external airborne contaminants). This will significantly limit smoke ingress into the hospital

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to ensure the indoor air quality remains satisfactory for all occupants, but particularly respiratory patients who could be severely impacted.

- Increased temperature and humidity projections because of climate change have been incorporated into the design of the mechanical plant and air-conditioning systems (RCP8.5 predictions used as the basis of the design).
- With increasing severity and frequency of storm events predicted, the building has been constructed above the predicted floor level for a 1:200-year flood event. The building stormwater systems have also been designed to accommodate the peak stormwater discharge.

### Sustainable and Healthy Environments (SHE) Survey

- The SHE survey is used to map workers' satisfaction, health (physical and emotional) and productivity. SHE collects data about human, organisational and environmental-related variables that combined may affect people and their productivity at work such as air quality, light, water and workspaces.
- SHE delivers insights into the design and performance of workspaces from the occupants' perspective and is endorsed for use by the Green Building Council of Australia (GBCA) and WELL, and it will account for IGRAT innovation points.
- The SHE survey will be conducted with staff pre and post move to provide a benchmark and comparison for staff satisfaction with their work environments.
- The SHE pre-move survey was sent to staff in February 2023 and 155 responses were received. The responders provided for a good spread across a range of age groups with two thirds being female and majority working over 30+ hours per week. Key responses based on staff existing environment included:
  - 60% of respondents were not satisfied with their current access to natural light and 25% of those were strongly dissatisfied;
  - 74% do not have access to a pleasant external view from their workspace;
  - air quality had mixed responses from satisfied to not satisfied and air circulation/movement was highlighted as an area of concern;
  - all respondents agreed that physical configuration of the workspace was important to them.
- These aspects will be greatly improved in the new CSB, and the post-move SHE survey is likely to see a major improvement in staff responses and satisfaction.

### For more information

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