University of Sydney
CODCD ESD Report

Introduction

This report outlines the key ESD initiatives to be incorporated into the design of the Sydney University Centre for Obesity, Diabetes and Cardiovascular Diseases (CODCD).

Overview

The project proposal recognises the University's commitment to sustainable design, construction and operation and has prepared the strategy with this at the forefront. The proposal reflects this commitment by incorporating key sustainability initiatives that demonstrate lifelong value for the University.

Key ESD Initiatives

The Centre for Obesity, Diabetes and Cardiovascular Diseases is setting out to be an exemplar leading ESD educational facility. A design approach has been adopted whereby each of the characteristics of the building has been explored to maximise its ESD potential.

This encompasses power, water, hot water and gas consumption generally utilising simple passive design principles that offer long term solutions.

The building envelope massing and orientation has been configured to control unwanted summer solar gain whilst maximising daylighting access. The northerly aspects are predominantly solid mass structure which shields the building from the majority of solar gains. The minimal glazing on this orientation is recessed into the building's envelope which provides

natural shading from high summer sun angles whilst still allowing for the warming benefits of lower winter sun angles.

The internal planning approach sees the spaces with low daylighting requirements (laboratories, cold storage rooms and low occupancy space) located along the north elevation, thereby minimising artificial lighting energy requirements.

Whilst managing solar gain where it is most problematic, the building is open and transparent to the south. This elevation sees extensive use of high performance glazing. The height and extent of glazing to the south maximises glare-free natural lighting. This abundance of natural light benefits the offices and write-up spaces in this part of the building.

Through incorporation of passive design principles, the mechanical systems can be more efficient, and the associated energy consumption reduced. A key servicing design philosophy has been to reduce the carbon emissions associated with the building's energy use. This has been achieved through adoption of chillers driven by gas engines rather than electric motors.

Renewable energy generation is going to play an increasingly important role in limiting carbon use in our energy consumption. CODCD proposes to make a large contribution of renewable energy through extensive deployment of photovoltaic panels.

Sustainable Construction and Operational Management

Brookfield Multiplex will take steps to minimise the environmental and social impacts during the construction process. Brookfield Multiplex is ISO14001 certified, with all operational procedures complying with legislative requirements. In addition, a comprehensive Environmental Management Plan shall be in effect for the duration of the construction works. Further, all construction waste removed from the site will be sorted in order to maximise recycled material and minimise landfill.

Building commissioning is recognised as one of the key factors in determining the ongoing operational efficiency of a building. Brookfield Multiplex will ensure the management and incorporation of best practice commissioning practices. Post completion, a process of ongoing building tuning shall be undertaken to ensure the building is optimised for seasonal variations.

Brookfield Multiplex will communicate the ESD intent and initiatives of the design to the building users to assist in ensuring that the operation of the building is consistent with the design intent. Occupant controllable features will be user-friendly and clearly visible so as to encourage user interaction and a didactic approach to building sustainability.

Passive Design

As the cornerstone of the building's ESD initiatives, passive building design has been the underlying principle of development of this scheme.

Good passive design is particularly important because for every hour of every day that the building is in existence, its demands on the environment are reduced. This translates to

reduced energy consumption, greater comfort of the users and reduced ongoing maintenance requirements.

Building Orientation and Massing

The building's east/west orientation is ideally aligned for passive solar control. The high sun angles in summer make any north glazing easy to effectively shade, and the south is largely free of solar gain allowing for large glazed openings.

The massing and design of the building footprint allows for a compact building form with a good ratio of external surface to internal floor area. This helps to mitigate the effects of the external environment on the internal conditioned spaces.

Planning

The internal planning sees the areas without need for natural light on the north and those that do need good lighting on the south. This allows the north facade to be largely free from vision glazing and provide a shield from solar gain.

Natural Lighting

As well as the extensive southerly vision glazing, the building features a naturally lit atrium located over the central part of the building. These are the areas that are furthest from the building perimeter so benefit most from overhead natural light.

The atrium roof takes the form of a south facing glazed pitch that controls against direct solar gain and glare whilst retaining good natural lighting access.

Thermal Mass

Cooling and heating outside air is one of the main energy uses associated with building operation. In this building, we have incorporated a subterranean thermal labyrinth to passively pre-cool and warm incoming air. This takes advantage of the relatively stable ground temperatures that are consistently cooler than outside in summer and warmer than outside in winter. This thermally passive construction runs around the building basement perimeter and connects to the air-conditioning and ventilation systems to reduce air-conditioning energy consumption.

Materials Selection

The choice of materials used in building construction plays a large part in how the building reacts to the external environment, which in turn contributes to the building's passive performance.

Selected deployment of thermally passive and lightweight materials where beneficial not only reduces energy consumption, but also contributes to improved occupant comfort. The building will incorporate high performance glazing that both minimises the energy needed to condition the building, while simultaneously maximising the visual properties to improve the quality of the space for occupants.

Energy Conservation

Gas Driven Chillers

From a carbon perspective, the use of electricity from the mains grid is very inefficient due to inefficiencies at the power stations, transmission and distribution losses. Per unit energy, mains electricity is roughly five times more carbon intensive than gas.

In this building, the intention is to deploy gas driven chillers as a carbon abatement strategy. These machines are similar to conventional chillers in that they use compression and expansion of a refrigerant to produce cooling, but instead of being driven by an electric motor a gas engine is used.

Energy Reclaim

During normal operation of buildings, a lot of energy is needlessly wasted. By careful planning and incorporation of passive heat reclaim systems these losses can be minimised. It is proposed that air-conditioning and ventilation systems will be designed to minimise wasted heating and cooling that is normally exhausted from the building.

Thermal Storage

Coupled with the gas driven chillers, the intention is to provide a thermal storage system. This acts like a battery for storing cooling. The system comprises phase change material which when charged by the chillers, freezes. Later when cooling is required, water is pumped through which thaws the phase change material allowing the cooling to be released.

This provides several environmental benefits. It allows for smoothing of peaks and troughs in the building's energy consumption. This in turn enables selection of smaller sized plant and for equipment to run for longer at its optimum efficiency. It also provides a ready capacity to deal with intermittent requirements without having to inefficiently start and stop large plant items.

Solar Energy

The project is proposing the installation of approximately 1,000 m^2 of passive Photovoltaic (PV) cells. The installation of the photovoltaic cells substantially reduces the requirement for electricity from the grid, saving utility costs and substantially reducing carbon emissions through operation.

Solar hot water panels will be utilised to provide heating for hot water, again reducing the energy required to heat domestic hot water.

Objective

The building is to be designed to achieve a maximum annual energy use for the overall building of 1650 MJ per m^2 GBA. This shall be calculated and demonstrated in accordance with the methodology outlined in "Green Star Education v1 Energy Calculator Guide" revision B.1 dated January 2010.

This protocol assesses the performance of the building under standardised profiles such that comparisons may be undertaken between similarly modelled facilities. It therefore allows a

comparison between project designs without considering the variable nature of operational performance.

The building shall also target a maximum annual gas use for Heating and Hot Water for the Overall Building (design) of 65 MJ/m^2. However, it may be demonstrated that an alternate strategy which may exceed this number holistically provides a bigger net benefit.

Potable Water Conservation

The supply of potable water to cities is becoming a particularly important issue, particularly in Sydney. During previous droughts, water stores throughout the Sydney Basin have been reduced, threatening continuing supply.

The project intends to capture rainwater from hard surfaces on the building for use in several non-potable applications. This will likely include heat rejection water for cooling towers, irrigation, WCs and urinals. It is expected that all water requirements for WCs and urinals can be met from rainwater captured, while surplus water will be used for cooling towers and irrigation.

Up to 50% of water used in typical education facilities is required for occupant amenity. To mitigate water demand of the building the project will utilise WELS rated taps, showerheads, WCs and urinals that will contribute to a reduction in potable water consumption.

Indoor Environment Quality

The quality of the indoor environment is paramount in dictating the how the building users experience the space. Good levels of IEQ also help contribute to the users' health and wellbeing.

The project commits to increasing the amount of fresh air above the minimum statutory requirements to ensure fresh air is provided for occupants.

Thermal comfort, acoustic performance, glare, daylighting and access to views all are addressed and help ensure the desired high levels of IEQ.

Materials

Construction projects will inevitably produce impacts on the environment including energy usage, water usage, ecological impacts and resource usage. The proposed design reduces the overall impact the building generates on the environment through appropriate material selection.

- Certified PVC or PVC replacements will be used
- Supplementary cementitious materials will be used within concrete,
- Reinforcing Steel will incorporate recycled content

- Timber will not be sourced from old growth rainforests or Australian high conservation forests

Transport

Environmental emissions associated with transport to and from the building are mitigated through provision of extensive facilities for cyclists. Facilitating this sustainable mode of transport also assists in mitigating the strains that the Centre for Obesity, Diabetes and Cardiovascular Diseases has on society.

The proximity of the CODCD to public transport corridors along Parramatta Road, also City Road and Missenden Road and Redfern railway station contributes to the lessening of the building's impact on the environment from daily commuters.

Social Impacts

Brookfield Multiplex has a commitment to create value that reduces capital and recurrent costs, producing higher performing assets and creating a ripple effect of positive outcomes flowing to the users, the community and ultimately the global impact of the project. The optimised design further enhances interaction within the facility, promoting a high performance outcome for users of the building.

High performance buildings are driven by a process of continuous learning. At Brookfield Multiplex we collaborate with the world's leading international research institutions and thought leaders to ensure proper evidence based design solutions are integrated into every building and work place we deliver. Our past collaborations include Nils Kok (Maastricht University, Netherlands and University of California, Berkeley), Frank Becker (Cornell University), Esther Sternberg (National Institute of Mental Health, USA) and Erik Velhoen.

Our commitment to measuring these benefits has produced world leading research on the quantification of the social value of green buildings in terms of productivity, health and the impact the built environment has on people. Our research illustrates the financial benefits of a high performance asset far exceeds environmental cost savings alone.