Consultant Advice Note

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This Consultants Advice Notice (CAN) has been prepared by Steensen Varming for the Hornsby Hospital Stage 2 Significant state developement redevelopment in responce to the Government Architect NSW providing the following comment;

"Introduce spatial design strategies to introduce more natural light and where appropriate, natural ventilation"

The purpose of this CAN is to provide information on the Mechanical and Electrical design approach of building services performance recommendations to contribute to achieving a minimum of 10% energy improvement when compared with the deemed to satisfy reference building of the national construction code (NCC).

In the planning and design of the Hornsby Ku-Ring-Gai Hospital Stage 2 there has been several key guiding documents which inform the implementation of ESD principals within the facility.

These include:
1. National Construction Code (NCC) – Section J;
2. Australasian Health Facilities Guidelines (AHFGs), Part E – Building Services and Environmental Design;
3. NSW Government Efficiency Resource Policy; and
4. Environmental Planning and Assessment Regulations – Schedule 2.

Note, this does not list relevant Australian Standards, and general good design principles considered in all engineering disciplines within Australia.

Each of these industry guidelines inform the NSW Health Engineering Services Guidelines which forms the basis for Health Infrastructures approach to design and delivery of ESD initiative in all health facilities. The Health Infrastructure approach is detailed in the following section.

A summary of each Industry Specific ESD guidance document is outlined below.

National Construction Code (NCC) – Section J
The National Construction Code (NCC) Volume 1 - Section J stipulates the performance requirements and deemed to satisfy (DtS) provisions required to ensure the efficient use of energy through the operational life of a building. The

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measures are implemented through the design and construction stages of the building process.

The energy efficiency requirements of the NCC Volume 1 Section J consider:

- Energy efficiency (Part J0);
- Performance of the building fabric (Part J1);
- External glazing and shading (Part J2);
- Sealing of the building (Part J3);
- Performance of the heating, ventilation and air-conditioning systems (Part J5);
- Artificial lighting (Part J6);
- Heated water supply system (Part J7); and
- Facility to monitor energy use (Part J8).

HEALTH INFRASTRUCTURE APPROACH TO ENVIRONMENTAL SUSTAINABLE DESIGN (ESD)

Each of the industry guidelines detailed in the previous section inform the NSW Health Engineering Services Guidelines. The Engineering Services Guidelines (ESGs) form the basis for Health Infrastructure's (HI's) approach to design and delivery of ESD initiative in health facilities.

Section 2.5.8 of the NSW Health Engineering Services Guidelines outlines the Sustainability and Energy Targets of redevelopment under its management. This demonstrates HI's commitment to delivering environmentally responsible projects. For each project the following criteria apply:

Energy Targets
As part of the design process user comfort is the foremost consideration. This is supported by an engineering solution which considers plant, equipment and systems selected on the basis of efficient, user friendly, reliable operation.
Hornsby Ku-Ring-Gai Hospital Stage 2 ESD INITIATIVES

In response to the ESD guidance documents, established ESD targets, and design developed, the Hornsby Ku-Ring-Gai Hospital Stage 2 incorporated a myriad of ESD initiatives. These initiatives have been provided in response to target benchmarks detailed in the above section, summarised below:

- Target 10% improvement on national construction code (NCC) section J;
- Engineering design considers plant, equipment and systems selected on the basis of efficient, user friendly, reliable operation.
- Major plant and reticulation systems designed with consideration to capital and recurrent costs, payback periods and life-cycle energy costs.
- The building envelope rationalised for energy efficiency and thermal/visual comfort

The design of the Hornsby Ku-Ring-Gai Hospital Stage 2 been developed to achieve best practice performance standards for energy efficiency, whilst maintaining high levels of indoor environmental quality and occupant comfort. The ESD initiatives give consideration to both active and passive measures in order to achieve the targeted benchmarks. Each measure currently being incorporated into the design solution is detailed below:

Indoor Environment Quality + Mechanical

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- High air change rates and ventilation effectiveness promote a healthy, comfortable environment.
- Mechanical systems deliver high levels of control and thermal comfort.
- Acoustic controls to minimise unwanted noise
- Volatile organic compounds and other indoor pollutants will be avoided.
- Lighting designed to minimise visual strain.
- Façade design and dealing to prevent outdoor pollutants entering the building.
- Energy efficient plant selections including Fan Coil Units, Air Handling Units, and chiller selection which meet building demand profile in a stable and economical manner.
- Chillers and cooling towers shall be selected to accept low entering condenser water to maximise efficiency, based on favourable wet bulb conditions
- Building Management System (BMS) to schedule and optimise plant efficiency.
- The air-conditioning system to be designed to either shut down or be set to a wider temperature control band, when a space is unoccupied
- Heating and cooling systems - Air side systems selected to match thermal zones and individual departments, served from zoned secondary heating and cooling circuits to apportion energy use
- Heating Hot Water - Heating coils selected with a high temperature differences and low return water temperature to maximise condensing water efficiency.
- Heat recovery - Heat is recovered from ventilation systems through direct return air
- Zero ODP and Low GWP refrigerants specified in the design.

<u>Energy Efficiency + Electrical</u>

- High efficiency plant and equipment selections.
- High efficiency LED lighting.
- Comprehensive metering to facilitate ongoing energy management.
- External lighting in accordance with AS/NZS1158 and Security Requirements. External lighting controlled via light sensors where appropriate and include LED fittings.
- Generally individual rooms will be locally switched, public waiting areas and corridors will be controlled via the Intelligent lighting control system and switched from staff stations as indicated in the documents . Daylight and occupancy sensors shall be provided to increase the energy efficiency of the building.
- Emergency exit design to minimise ongoing maintenance and operational costs. Centrally monitored system, LED fittings, long life batteries.
- Use of high quality materials and minimisation of PVC cabling where possible.

<u>Constraints on adopting ESD Mechanical principles in HORNSBY KU-RING-GAI HOSPITAL STAGE 2</u>

Ventilation and air conditioning systems are used extensively in all types of healthcare facilities to provide a safe and comfortable environment for patients and staff. More specialised ventilation is provided in healthcare buildings for the prevention and control of healthcare-associated infections. This is the case for the

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Hornsby Ku-Ring-Gai Hospital Stage 2 accommodates primary patient treatment areas such as emergency department, Medical imaging, Pharmacy, critical care areas, ICU, IPU, and isolation units.

The sophistication of air conditioning and ventilation systems in healthcare facilities is ever increasing. Mechanical systems are relied on to help prevent contamination, closely control the environment, dilute contaminants and contain hazards.

For Hornsby Ku-Ring-Gai Hospital Stage 2, the specific function and activities within the facility necessitates the provision of specialised ventilation and air conditioning systems to achieve and maintain specific conditions. These are required in order to assist with the treatment of patients and maintain the health and safety of staff.

The more specialised ventilation systems allowed for in the design are included in order to:

- Remove, contain or dilute specific contaminants and fumes;
- Ensure the isolation of one space from another;
- Preserve a desired air-flow path from a clean to a less clean area;
- Provide control of the cleanliness of a space;
- Provide close control of temperature;
- Provide close control of humidity.

Ventilation systems play a key role in providing infection control within healthcare facilities and general rely on air change rates a measure of how frequently the air within a space is change and replaced, pressure gradients or differentials between spaces and air filtration which establish regimes that reduce the risk of infection through air borne contaminates.

The primary purpose of infection control, is to minimise the risk of infection during the provision of health care services. The appropriate design of a health care facility may assist in achieving this primary purpose by providing optimal physical conditions for the implementation of standard and additional precautions.

Increased health risks to patients will occur if ventilation systems do not achieve and maintain the required standards.

Due to the specific demands placed on the air conditioning and ventilation systems employed in Hornsby Ku-Ring-Gai Hospital Stage 2 the use of alternative low energy ventilation approaches such as natural ventilation has not been considered due to a number of reasons as summarised below;

- Natural ventilation induced by wind pressures can induce high air-change rates through a building, provided air is allowed to move freely within the space from the windward to the leeward side. However due to the number of internal subdivisions will restrict and prevent this effect.
- It is almost impossible to maintain consistent flow rates and ensure that minimum ventilation rates will be achieved at all times. However, this variability is normally acceptable in such areas as office accommodation, staff areas, library/seminar rooms and dining rooms
- If natural ventilation is “single-sided” it will usually only be effective for a three-metre depth within the space. Beyond that it will need to be supplemented by forced ventilation.

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- Current guidance restricts the opening of windows for safety reasons; also, as many designs are top hung, their ability to permit natural ventilation is limited.
- Although the maintenance cost of simple natural ventilation systems can be low, if a natural ventilation system cannot be installed properly or maintained due to a shortage of funds, its performance can be compromised, causing an increase in the risk of the transmission of airborne pathogens.
- Natural ventilation precludes the use of particulate filters. Climate and security may dictate that windows and vents remain closed; in these circumstances, ventilation rates may be much lower which reduces the effectiveness of the natural ventilation system.
- Other issues include system operation interruption from windows or doors not open, equipment failure, power interruption, poor design, poor maintenance or incorrect management.