

# Energy consumption and carbon emissions of hospitals

## An analysis by functional end use

### Background

The Department of Health modelled total energy use and carbon emissions of a large Melbourne metropolitan hospital of approximately 40,000m<sup>2</sup> gross floor area. Melbourne climatic conditions (BCA Climate Zone 6) were used and it was assumed that all electricity was bought off the Victorian grid.

The modelling was part of a nationwide study undertaken by the Australasian Healthcare Infrastructure Alliance (AHIA) to understand the current energy baseline at existing hospitals and inform energy and greenhouse gas reduction targets for new capital works. The energy modelling was based on constructing a hospital to the minimum applicable energy efficiency standards in the 2010 Building Code of Australia.

### Functional end use

For the purposes of this exercise a set of defined functional end uses were agreed for the project. These are explained below. It should be noted that these may not be directly relevant to all hospitals.

The *Ward* area is defined as areas predominantly used for patient accommodation. In BCA terms this is defined as a Class 9a Ward Area (sometimes referred to as Inpatient Accommodation). For this modelling exercise these areas included circulation spaces served by the same air handling unit and as such could not be separated for analysis.

The *Administration and office* area includes all areas of predominantly office or clerical nature, such as admissions, reception and medical records. In BCA terms this is defined as Class 5. For this modelling exercise these areas include circulation spaces served by the same air handling unit and as such could not be separated for analysis.

*Surgery* areas are predominantly operating theatres. In BCA terms this is defined as Class 9a Clinic, Day Surgery or Procedure Unit (sometimes referred to as Operating Theatre/Surgery).

*Consulting* areas are dominated by services such as x-ray, physiotherapy and professional suites. In BCA terms this is defined as Class 9a Clinic, Day Surgery or Procedure Unit (sometimes referred to as Diagnostic Treatment Labs).

*Corridors* represent stand alone circulation spaces and are assumed to be operating 24 hours a day. In BCA terms this is defined as a Class 9a Ward Area as this best represents the 24 hour nature of the corridor.

The *Back of house* is a combination of many spaces ranging from cleaners, cupboards, computer rooms and kitchenettes (basically any area that cannot reasonably be assigned to another functional use). In BCA terms this is defined as a Class 5 area. This area is sometimes referred to as kitchen, laundry and stores.

Emergency Department, kitchens and 12/16hr corridors were not represented in the modelling.

## Energy consumption and carbon emissions by functional end use

The modelling showed that the average energy consumption for large metropolitan hospitals across all functional areas is 918 mega-joules of energy and 224 kilograms CO<sup>2</sup>-e per metre squared per annum.

Ward areas have the highest energy use of all functional areas, at close to 50 per cent above the average. This is largely due to their continuous operation and increased domestic hot water energy requirements (17 times that of other areas). Surgery has the second highest energy use, at just below the average energy use. The different ratio of carbon emissions is due to the variation in electricity and gas usage across the functional end uses.

As the highest energy loads are attributable to wards and surgery areas, these areas should be prioritised for energy efficiency measures. It should be noted that actual results may vary depending on area definitions, equipment, load and operational profile and these figures should only be used as a guide.

**Table 1:** Energy consumption and carbon emissions of a large hospital

Functional end use	Energy consumption (MJ/m <sup>2</sup> /annum)	Carbon emissions (Kg CO <sub>2</sub> -e/m <sup>2</sup> /annum)
Ward	1,350	293
Surgery areas	844	268
Back of house	619	176
Consulting	510	166
Administration & office	474	154
Corridors (24hrs)	349	95
<b>Weighted Average</b>	<b>918</b>	<b>224</b>

The carbon emissions were calculated using the following Scope 3 emission factors for Victoria: 1 Kwh electricity = 1.35 kilograms CO<sup>2</sup>-e and 1 GJ of gas = 55.7 kilograms CO<sup>2</sup>-e.

### Use of this information

This information is generic in nature and based on energy modelling of a specific metropolitan Melbourne hospital. It is not based on actual energy use at the hospital and as such does not relate to real-life conditions. It is recognised that energy consumption (and carbon emissions) will differ between hospitals due to the services supplied, patient profile, age & design, and operation of the facility.

It should be noted that the carbon emissions do not allow for provision of any energy through low emission technologies, such as tri-/co-generation, solar domestic hot water and/or photo-voltaics.

The modelled energy consumption and carbon emissions do however provide a broad benchmark that can be used to inform the design of new and significant upgrades of large hospitals in Victoria.

### For further information

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Further case studies and the Department of Health *Guidelines for sustainability in health care capital works* can be found at <http://www.capital.health.vic.gov.au/Sustainability/>

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