

# NCC 2019 Proposed Provisions – Insights from Case Study

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## Team Catalyst

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## THE CASE STUDIES – OBJECTIVES

- illustrate impact of proposed changes
- become communication materials for the industry
- demonstrate compliance with current (2016) provisions of Section J, and
- document variations in the design to meet the 2019 proposed provisions

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## THE CASE STUDIES – INTENT

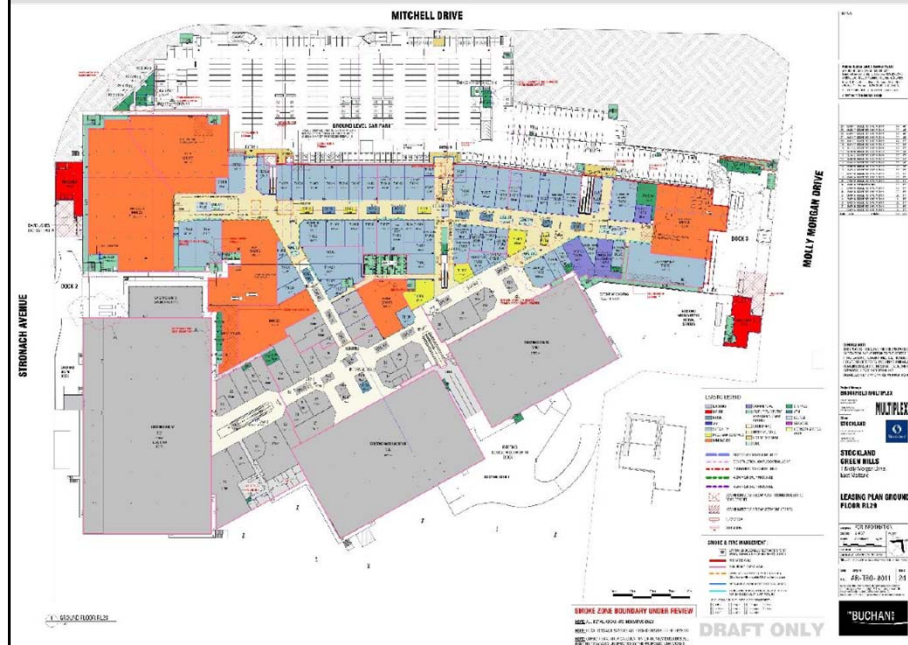
To illustrate

- practicability of proposed changes
- ease of compliance, and
- to test and uncover deficiencies

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## STOCKLAND GREENHILLS SHOPPING CENTRE



Maitland, NSW  
Climate zone 5  
Class 6  
New 34,000m<sup>2</sup>  
addition  
Targeting 5 star  
GreenStar

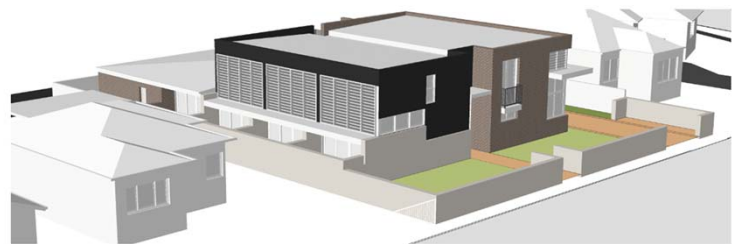
## STOCKLAND GREENHILLS SHOPPING CENTRE



Proposed JV2 GreenStar verification method

Detailed HVAC model

## CLASS 3 – KENNEDY ASSOCIATES



Roselands, NSW  
9 Boarding House Units  
Overnight operating building  
Climate zone 5  
Class 3

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## STOCKLAND WILLOWDALE CLUBHOUSE RLV

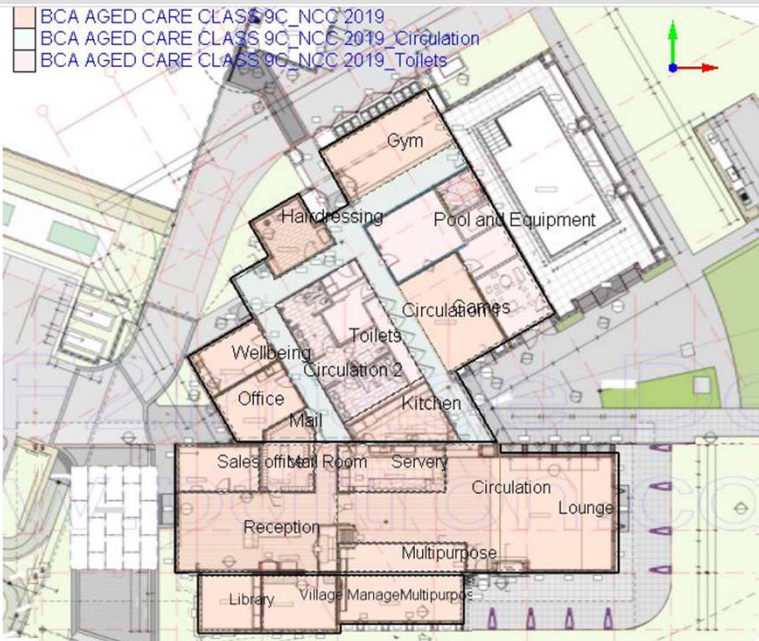


## WILLOWDALE CLUBHOUSE

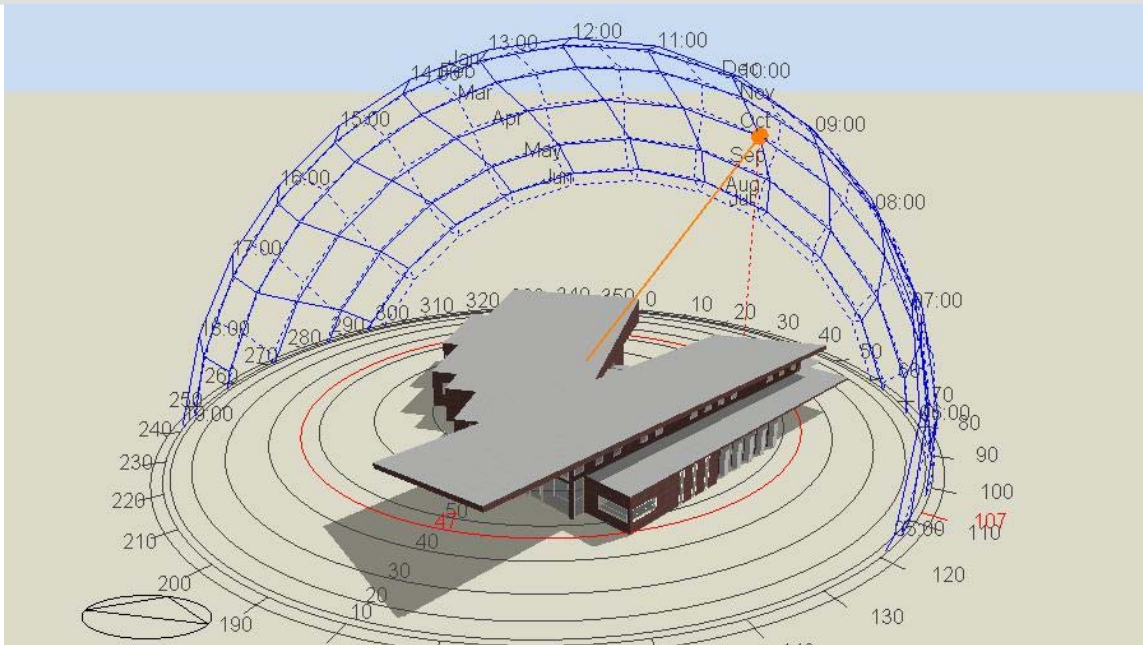
- Denham Court, Western Sydney, Climate Zone 6
- social hub for retirement village
- Class 9c
- operates in the daytime till late evening
  
- pre-DA compliance route with JV3
- building envelope compliance
- DTS services

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## BUILDING ZONES



## SIMULATION MODEL



## Deemed to Satisfy (DTS) PROVISIONS

|      | Building Element            | NCC 2016 DTS   | Model Input NCC 2016 Reference building | NCC 2019 DTS   | Model Input NCC 2019 Reference Building |
|------|-----------------------------|--|---|--|---|
| J1   | Quality of Insulation       | ***  |   | ***  |   |
| J1.3 | Roof & Ceiling Construction | R 4.2 @ 0.7 Sol Abs  | yes                                     | R 3.7 @ 0.4 Sol Abs  | yes                                     |
| J1.5 | Walls                       | R 2.8 @ 0.6 Sol Abs  | yes                                     | Wall and Glazing in combination                                  | R 1.4, R 0.72 @ 0.6 Sol Abs             |
|      | Envelope Walls              | All other envelope walls R1 for 1.5ACH ; R1.8 elsewhere                      | yes                                     | n/a  | n/a                                     |
| J1.6 | Floor                       | R1 to floor above enclosed space<br>R2 to floor above unenclosed floor space | Concrete Slab on ground                 | Total Construction to meet R2 (50mm XPS and 250mm concrete slab) | yes                                     |
| J2   | Glazing                     | DTS Glazing calculator   | yes                                     | Wall and Glazing in combination                                  | yes                                     |

## 2016 GLAZING CALCULATOR

Building name/description: **Willowdale Aged Care** Application: **Class 9c aged care** Climate zone: **6**

Storey: **Ground**

| Facade areas |  | N      | NE     | E      | SE     | S      | SW     | W      | NW     | Internal |
|--------------|--|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| Option A     |  | 66.8m² | 46m²   | 20.4m² | 152m²  | 43.6m² | 60.3m² | 68.2m² | 65m²   |          |
| Option B     |  | 14.8m² | 19.5m² | 4.32m² | 40.9m² | 11.1m² | 27.9m² | 1.08m² | 19.6m² |          |

Number of rows preferred in table below: **26** (as currently displayed)

| ID | Description (optional)  | Facing sector    |                  | Size       |           |           | Performance                 |                          | SHADING |       | CALCULATED OUTCOMES OK (if inputs are valid) |                                       |                           |                |                                      |              |
|----|-------------------------|------------------|------------------|------------|-----------|-----------|-----------------------------|--------------------------|---------|-------|--|---------------------------------------|---------------------------|----------------|--------------------------------------|--------------|
|    |                         | Option A Facades | Option B Facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m)   | H (m) | Shading PH (m)                               | Multipliers Heating (S <sub>g</sub> ) | Cooling (S <sub>g</sub> ) | Area used (m²) | Element share of % of allowance used |              |
| 1  | High Level Window x 11  | SE               |                  | 1.18       |           | 12.10     | 4.0                         | 0.89                     | 1.900   | 1.400 | 1.36   | 0.22                                  | 0.61                      | 0.53           | 12.10                                | 28% of 100%  |
| 2  | High Level Window x 1   | SE               |                  | 1.18       |           | 1.18      | 4.0                         | 0.89                     | 1.900   | 1.400 | 1.36   | 0.22                                  | 0.61                      | 0.53           | 1.18                                 | 3% of 100%   |
| 3  | Lobby Window x 3        | SE               |                  | 2.70       |           | 7.29      | 4.0                         | 0.89                     | 4.000   | 2.700 | 1.48   | 0.00                                  | 0.47                      | 0.44           | 7.29                                 | 18% of 100%  |
| 4  | Village Manager x 3     | SE               |                  | 2.70       |           | 4.05      | 4.0                         | 0.89                     |         |       |  | 0.00                                  | 1.00                      | 1.00           | 4.05                                 | 11% of 100%  |
| 5  | Multipurpose x 5        | SE               |                  | 2.70       |           | 10.80     | 4.0                         | 0.89                     | 0.600   | 2.700 | 0.22   | 0.00                                  | 0.89                      | 0.86           | 10.80                                | 27% of 100%  |
| 6  | Library x 1             | SE               |                  | 1.00       |           | 2.54      | 4.0                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 2.54           | 7% of 100%                           |              |
| 7  | Reception Window        | SE               |                  | 2.90       |           | 2.90      | 4.0                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 2.90           | 8% of 100%                           |              |
| 8  | Reception Window        | SW               |                  | 4.30       |           | 21.40     | 2.2                         | 0.89                     | 9.000   | 4.300 | 2.09   | 0.00                                  | 0.38                      | 0.38           | 21.40                                | 82% of 99%   |
| 9  | Library x 1             | SW               |                  | 1.00       |           | 2.65      | 2.2                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 2.65           | 4% of 99%                            |              |
| 10 | Multipurpose            | NE               |                  | 2.40       |           | 7.20      | 6.0                         | 0.60                     | 10.000  | 2.700 | 3.70   | 0.30                                  | 0.00                      | 0.31           | 7.20                                 | 36% of 100%  |
| 11 | Lobby Window 1          | NE               |                  | 2.70       |           | 2.70      | 6.0                         | 0.60                     | 4.000   | 2.700 | 1.48   | 0.00                                  | 0.00                      | 0.31           | 2.70                                 | 14% of 100%  |
| 12 | Lobby Window 2          | NE               |                  | 2.40       |           | 7.20      | 6.0                         | 0.60                     | 4.000   | 2.700 | 1.48   | 0.30                                  | 0.32                      | 0.37           | 7.20                                 | 35% of 100%  |
| 13 | Lobby Window 3          | NE               |                  | 1.50       |           | 2.40      | 6.0                         | 0.60                     | 4.000   | 2.700 | 1.48   | 1.20                                  | 0.69                      | 0.53           | 2.40                                 | 15% of 100%  |
| 14 | Lobby x 4               | NW               |                  | 2.70       |           | 19.60     | 4.0                         | 0.36                     | 1.400   | 3.600 | 0.39   | 0.90                                  | 0.98                      | 0.93           | 19.60                                | 100% of 100% |
| 15 | Office                  | S                |                  | 1.50       |           | 2.70      | 5.7                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 2.70           | 24% of 99%                           |              |
| 16 | Well Being              | S                |                  | 1.50       |           | 2.70      | 5.7                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 2.70           | 24% of 99%                           |              |
| 17 | Hairdressing            | S                |                  | 1.20       |           | 1.90      | 5.7                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 1.90           | 17% of 99%                           |              |
| 18 | Gym                     | S                |                  | 2.70       |           | 3.80      | 5.7                         | 0.89                     |         |       | 0.00   | 1.00                                  | 1.00                      | 3.80           | 34% of 99%                           |              |
| 19 | Circulation W           | W                |                  | 1.00       |           | 1.08      | 6.0                         | 0.89                     | 0.000   |       | 0.00   | 1.00                                  | 1.00                      | 1.08           | 100% of 12%                          |              |
| 20 | North Corridor Entrance | N                |                  | 2.70       |           | 11.04     | 6.0                         | 0.66                     | 1.000   | 2.700 | 0.37   | 0.00                                  | 0.84                      | 0.66           | 11.04                                | 62% of 99%   |
| 21 | Games Entrance          | E                |                  | 2.40       |           | 4.32      | 3.6                         | 0.50                     |         |       | 0.00   | 1.00                                  | 1.00                      | 4.32           | 100% of 100%                         |              |
| 22 | Sales Office            | SW               |                  | 4.30       |           | 3.80      | 2.2                         | 0.89                     | 9.000   | 4.300 | 2.09   | 0.00                                  | 0.38                      | 0.38           | 3.80                                 | 15% of 99%   |
| 23 | Gym North               | N                |                  | 2.70       |           | 3.80      | 6.0                         | 0.66                     |         |       | 0.00   | 1.00                                  | 1.00                      | 3.80           | 38% of 99%                           |              |

## GLAZING 2016 VS 2019

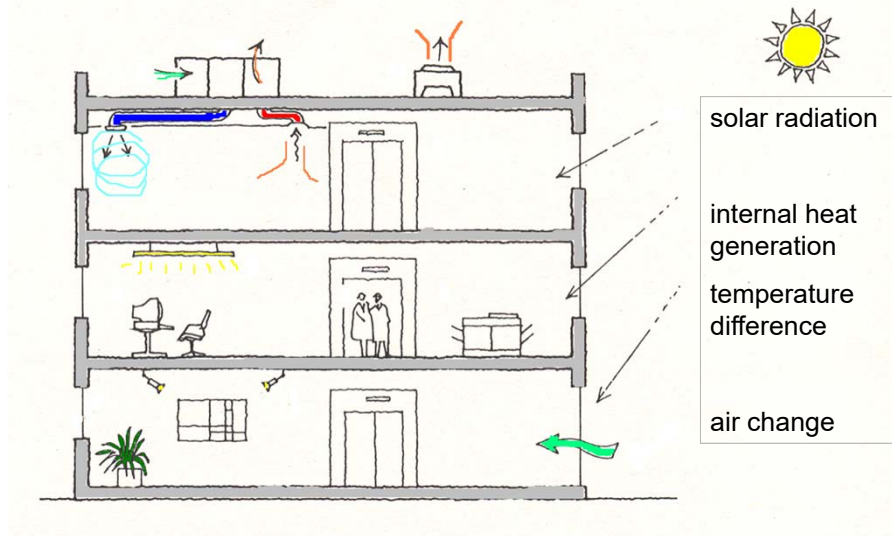
2019 combined window/wall provisions

| Orientation | SHGC   |         | WWR  | target<br>Utotal | R-wall | Solar    | U value  |
|-------------|--------|---------|------|------------------|--------|----------|----------|
|             | Window | Uwindow |      |                  |        | Aperture | Aperture |
| North       | 0.66   | 5.000   | 0.31 | 2.5              | 0.726  | 0.20     | 0.27     |
| South       | 0.45   | 5.000   | 0.42 | 2.5              | 1.450  | 0.19     | 0.36     |
| East        | 0.60   | 5.700   | 0.26 | 2.5              | 0.727  | 0.16     | 0.26     |
| West        | 0.70   | 12.000  | 0.16 | 2.5              | 1.448  | 0.11     | 0.33     |

2016 windows from glazing calculator; and DTS J1 wall provisions

| Orientation | SHGC<br>Window | Uwindow | WWR  | R-wall |
|-------------|----------------|---------|------|--------|
| North       | 0.66           | 6.0     | 0.22 | 2.80   |
| South       | 0.89           | 5.7     | 0.25 | 2.80   |
| East        | 0.50           | 3.6     | 0.21 | 2.80   |
| West        | 0.89           | 6.0     | 0.02 | 2.80   |
| North East  | 0.60           | 6.0     | 0.43 | 2.80   |
| South East  | 0.89           | 4.0     | 0.27 | 2.80   |
| North West  | 0.36           | 4.0     | 0.30 | 2.80   |
| South West  | 0.89           | 2.2     | 0.55 | 2.80   |

## BUILDING LOADS



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## LIGHTING

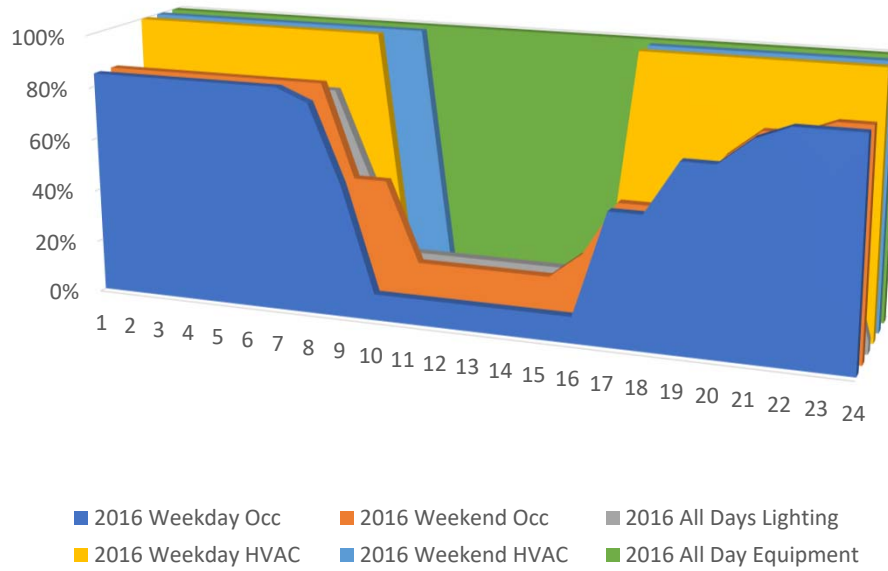
| Building Element         | NCC 2016 DTS     | Model Input NCC 2016 Reference building | NCC 2019 DTS     | Model Input NCC 2019 Reference Building |
|--------------------------|------------------|---|------------------|---|
| Lighting                 | W/m <sup>2</sup> |   | W/m <sup>2</sup> |   |
| Lounge Area for Class 9c | 10.0             | y                                       | 3.0              | y                                       |
| Library for class 9c     | 10.0             | y                                       | 4.5              | y                                       |
| Office in Class 9c       | 9.0              | y                                       | 4.5              | y                                       |
| Kitchen in 9c            | 8.0              | y                                       | 3.0              | y                                       |
| Plant room in 9c         | 5.0              | y                                       | 1.5              | y                                       |
| Toilets in 9c            | 6.0              | y                                       | 2.0              | y                                       |
| Corridors in 9c          | 8.0              | y                                       | 2.5              | y                                       |

## OTHER SIMULATION PARAMETERS

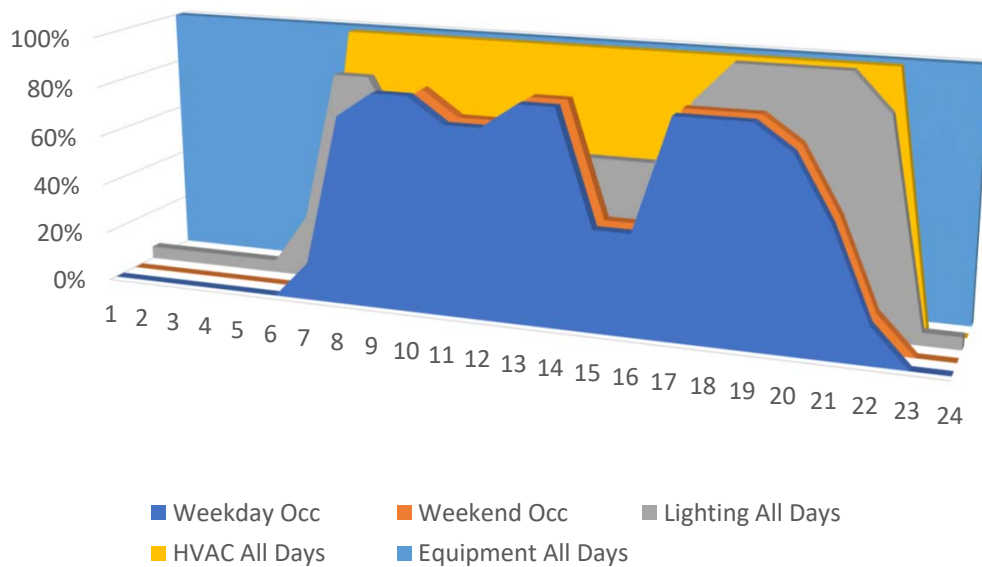
| Building Element   | NCC 2016 DTS  | Model Input NCC 2016 Reference building | NCC 2019 DTS   | Model Input NCC 2019 Reference Building |
|--------------------|---|---|--|---|
| Equipment Class 9C | 5W/m <sup>2</sup> averaged; 8760 h  | y                                       | 5W/m <sup>2</sup> averaged ; 8760 h  | y                                       |
| Occupancy          | 75W & 55W   | y                                       | 75W & 55W  | y                                       |
| Density            | 10m <sup>2</sup> / person   | y                                       | 10m <sup>2</sup> / person  | y                                       |
| Infiltration       | 1.5ACH when plant is OFF in all zones<br>1 ACH for perimeter zones and 0 for center zone when plant is ON | y                                       | 0.7 ACH when plant is OFF for all Zones<br>0.35 ACH when plant is ON for all zones | y                                       |
| Thermostat         | 18C to 26C for all conditioned zones  | y                                       | 18C to 25C for transient zones<br>21C to 24C for all other zones                   | y                                       |
| Schedules          | User Schedule   | y                                       | User Schedule  | y                                       |



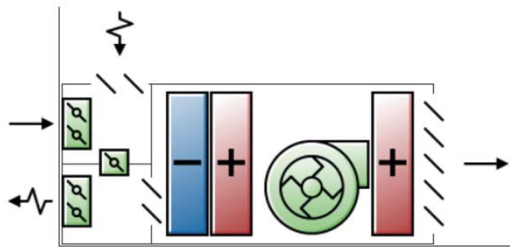
## 2016 CLASS 9c OPERATING SCHEDULES



## USER DEFINED SCHEDULES



# HVAC – PTHP



**General**

Name: Amenities Circulation1 PTHP DX Cooling Coil

Rated total cooling capacity (W): Autotize

Rated sensible heat ratio (SHR): Autotize

Rated COP: 3.100

Rated air flow rate (m3/s): Autotize

Rated evaporator fan power per volume flow rate (W/(m3/s)): 773.300

**Operation**

Availability schedule: AgedCare Living HVAC Schedule

**Performance Curves**

Total cooling capacity function of temperature curve: DXClgCoilTotalClgCapFuncTemp

Total cooling capacity function of flow fraction curve: DXClgCoilTotalClgCapFuncFlowFract

Energy input ratio (EIR) function of temperature curve: DXClgCoilEnergyInputRatioFuncTemp

Energy input ratio (EIR) function of flow fraction curve: DXClgCoilEnergyInputRatioFuncFlowFract

Part load fraction correlation curve: DXCoilPartLoadFractCorrelat

**Condenser**

Condenser type: 1-Air cooled

**Latent Capacity Degradation**

Crankcase Heater

Basin Heater

DOAS Settings

Use DX cooling coil for DOAS

**Packaged Terminal Heat Pump (PTHP) | Target**

**General**

Title: Amenities Circulation1 PTHP

**Fan**

Fan placement: 2-Draw through

Fan operating mode: 2-Continuous

**Supply Air Flow Factors**

Cooling operation (m3/s): Autotize

Heating operation (m3/s): Autotize

When no heating or cooling is needed (m3/s): Autotize

**Compressor**

Minimum outdoor dry-bulb temperature for compress...: -8.000

**Supplemental Heater**

Maximum supply air temperature from supplemental h...: Autotize

Maximum outdoor dry-bulb temperature for suppleme...: 21.00

**Outdoor Air Supply**

Outdoor air supply

Outdoor air flow rate during cooling operation (m3/s): Autotize

Outdoor air flow rate during heating operation (m3/s): Autotize

Outdoor air flow rate when no cooling or heating is n...: Autotize

**Operation**

Availability schedule: AgedCare Living HVAC Schedule

Advanced

**Fan | Target**

**General**

Name: Amenities Circulation1 PTHP Supply Fan

Type: 1-Constant Volume

Fan total efficiency: 0.700

Pressure rise (Pa): 150.0

End-use subcategory: General

**Flow Rates**

Minimum flow rate (m3/s): Autotize

**Motor**

Motor efficiency: 0.850

Motor in airstream fraction: 1.800

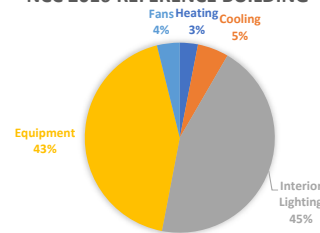
**Availability schedule**

AgedCare Living HVAC Schedule

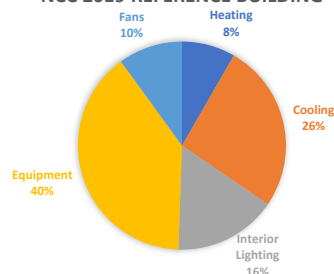
# ENERGY/GHG RESULTS

| Run Plan                                    | NCC 2016 Reference Building | GFA 618m2   | NCC 2019 Reference Building | GFA 618m2   |
|---|-----------------------------|-------------|-----------------------------|-------------|
| Energy End Uses                             | kWh                         | kWh/m2      | kWh                         | kWh/m2      |
| Heating                                     | 1,590                       | 2.6         | 4,711                       | 7.6         |
| Cooling                                     | 2,747                       | 4.4         | 14,819                      | 24.0        |
| Interior Lighting                           | 23,077                      | 37.3        | 9,055                       | 14.7        |
| Interior Equipment                          | 22,312                      | 36.1        | 22,312                      | 36.1        |
| Fans  | 1,992                       | 3.2         | 5,648                       | 9.1         |
| <b>Total End Uses</b>                       | <b>51,718</b>               | <b>83.7</b> | <b>56,545</b>               | <b>91.5</b> |
| <b>Total HVAC</b>                           | <b>6,329</b>                | <b>10.2</b> | <b>25,179</b>               | <b>40.7</b> |
| <b>Greenhouse Gas Emissions kgCO2-e /GJ</b> | <b>49,339</b>               | <b>79.8</b> | <b>53,944</b>               | <b>87.3</b> |

NCC 2016 REFERENCE BUILDING



NCC 2019 REFERENCE BUILDING

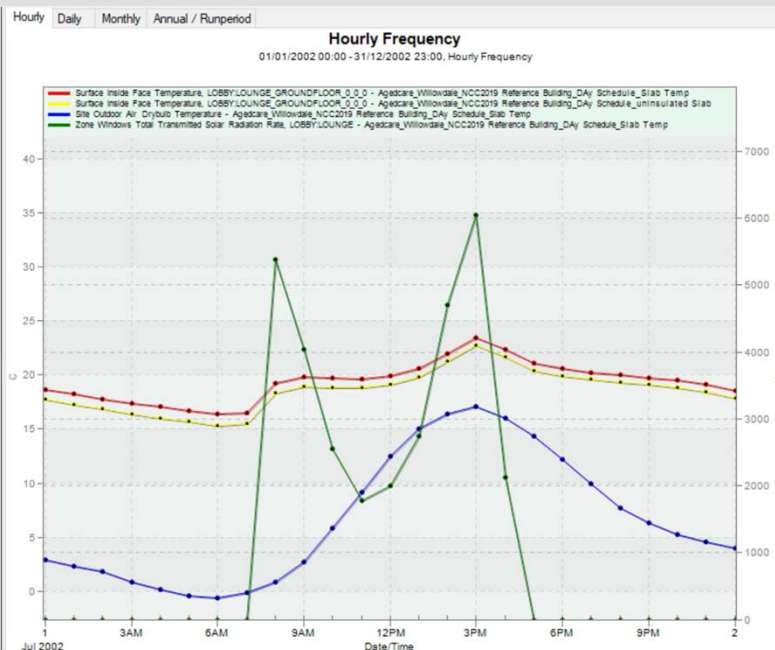


## ENERGY/GHG RESULTS

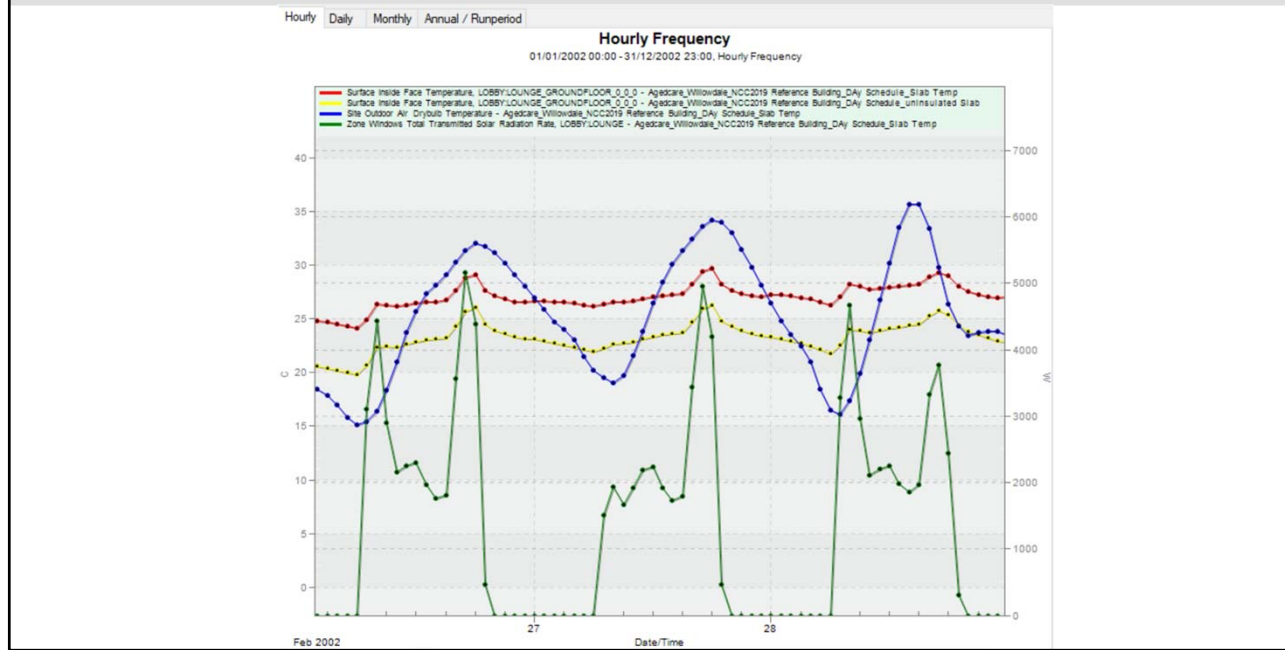
| Run Plan                             | NCC 2016 Reference Building | GFA 618m2   | NCC 2016 Ref Bldg Envelope + NCC 2019 (ltg + Thermostat+ Infiltration) | GFA 618m2   | NCC 2019 Reference building | GFA 618m2   |
|--------------------------------------|-----------------------------|-------------|--|-------------|-----------------------------|-------------|
| Energy End Uses                      | kWh                         | kWh/m2      | kWh  | kWh/m2      | kWh                         | kWh/m2      |
| Heating                              | 1,590                       | 2.6         | 3,929  | 6.4         | 4,711                       | 7.6         |
| Cooling                              | 2,747                       | 4.4         | 4,823  | 7.8         | 14,819                      | 24.0        |
| Interior Lighting                    | 23,077                      | 37.3        | 9,055  | 14.7        | 9,055                       | 14.7        |
| Interior Equipment                   | 22,312                      | 36.1        | 22,312   | 36.1        | 22,312                      | 36.1        |
| Fans                                 | 1,992                       | 3.2         | 2,215  | 3.6         | 5,648                       | 9.1         |
| <b>Total End Uses</b>                | <b>51,718</b>               | <b>83.7</b> | <b>42,334</b>  | <b>68.5</b> | <b>56,545</b>               | <b>91.5</b> |
| <b>Total HVAC</b>                    | <b>6,329</b>                | <b>10.2</b> | <b>10,967</b>  | <b>17.7</b> | <b>25,179</b>               | <b>40.7</b> |
| Greenhouse Gas Emissions kgCO2-e /GJ | <b>49,339</b>               | <b>79.8</b> | <b>40,386</b>  | <b>65.4</b> | <b>53,944</b>               | <b>87.3</b> |

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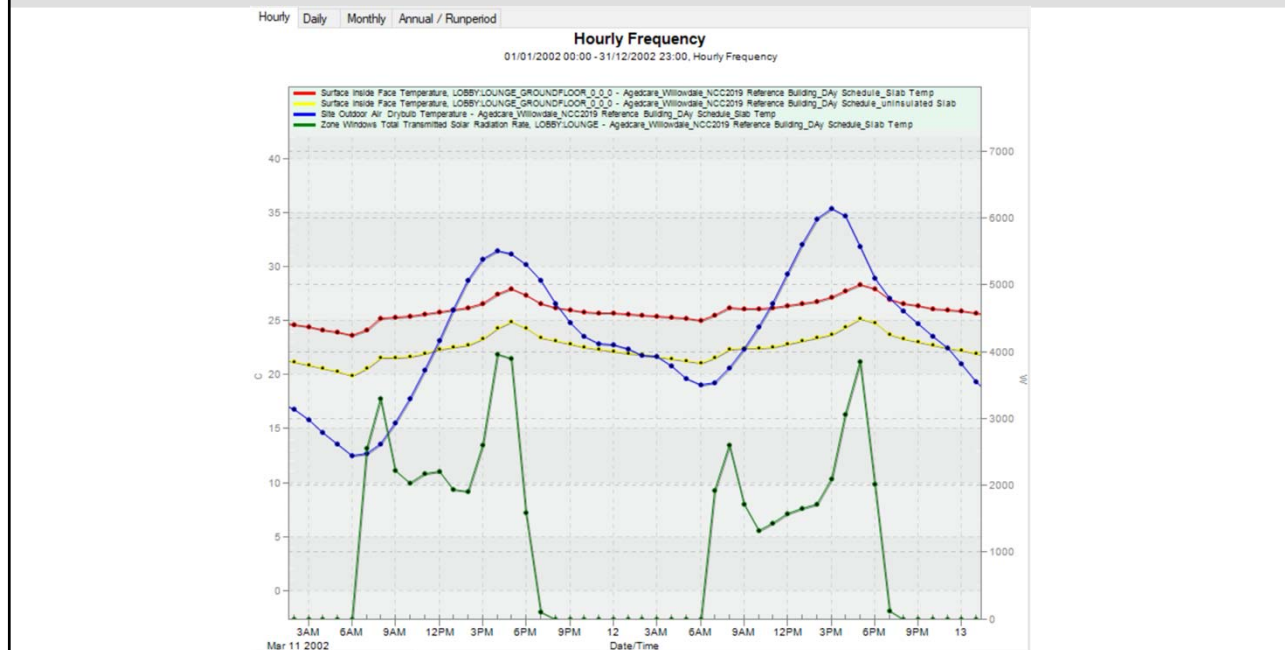
## SLAB RESPONSE – WINTER



## SLAB RESPONSE – SUMMER



## SLAB RESPONSE – MID SEASONS



## ENERGY/GHG RESULTS

| Run Plan   | NCC 2016 Reference Building | GFA 618m <sup>2</sup> | NCC 2016 Ref Bldg Envelope + NCC 2019 (ltg + Thermostat+ Infiltration) | GFA 618m <sup>2</sup> | NCC 2019 Reference building | GFA 618m <sup>2</sup> | NCC 2019 Reference Building + Uninsulated Slab | GFA 618m <sup>2</sup> |
|--|-----------------------------|-----------------------|--|-----------------------|-----------------------------|-----------------------|--|-----------------------|
| Energy End Uses  | kWh                         | kWh/m <sup>2</sup>    | kWh  | kWh/m <sup>2</sup>    | kWh                         | kWh/m <sup>2</sup>    | kWh  | kWh/m <sup>2</sup>    |
| Heating  | 1,590                       | 2.6                   | 3,929  | 6.4                   | 4,711                       | 7.6                   | 5,943  | 9.6                   |
| Cooling  | 2,747                       | 4.4                   | 4,823  | 7.8                   | 14,819                      | 24.0                  | 8,761  | 14.2                  |
| Interior Lighting                                      | 23,077                      | 37.3                  | 9,055  | 14.7                  | 9,055                       | 14.7                  | 9,055  | 14.7                  |
| Interior Equipment                                     | 22,312                      | 36.1                  | 22,312   | 36.1                  | 22,312                      | 36.1                  | 22,312   | 36.1                  |
| Fans   | 1,992                       | 3.2                   | 2,215  | 3.6                   | 5,648                       | 9.1                   | 4,944  | 8.0                   |
| <b>Total End Uses</b>                                  | <b>51,718</b>               | <b>83.7</b>           | <b>42,334</b>  | <b>68.5</b>           | <b>56,545</b>               | <b>91.5</b>           | <b>51,015</b>                                  | <b>82.5</b>           |
| <b>Total HVAC</b>                                      | <b>6,329</b>                | <b>10.2</b>           | <b>10,967</b>  | <b>17.7</b>           | <b>25,179</b>               | <b>40.7</b>           | <b>19,648</b>                                  | <b>31.8</b>           |
| <b>Greenhouse Gas Emissions kgCO<sub>2</sub>-e /GJ</b> | <b>49,339</b>               | <b>79.8</b>           | <b>40,386</b>  | <b>65.4</b>           | <b>53,944</b>               | <b>87.3</b>           | <b>48,668</b>                                  | <b>78.8</b>           |

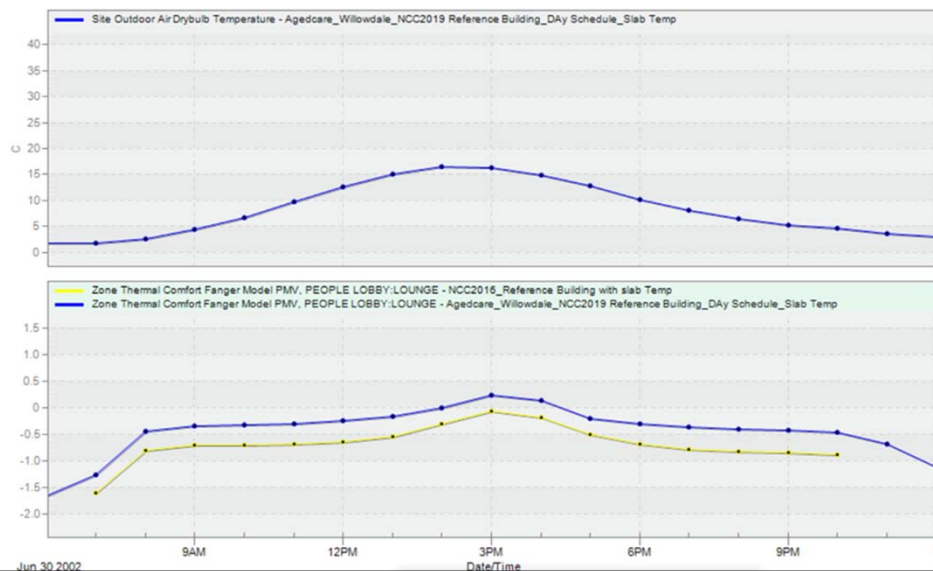
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 'Driving Sustainability through Teamwork'

## WINTER DAY COMFORT – PMV

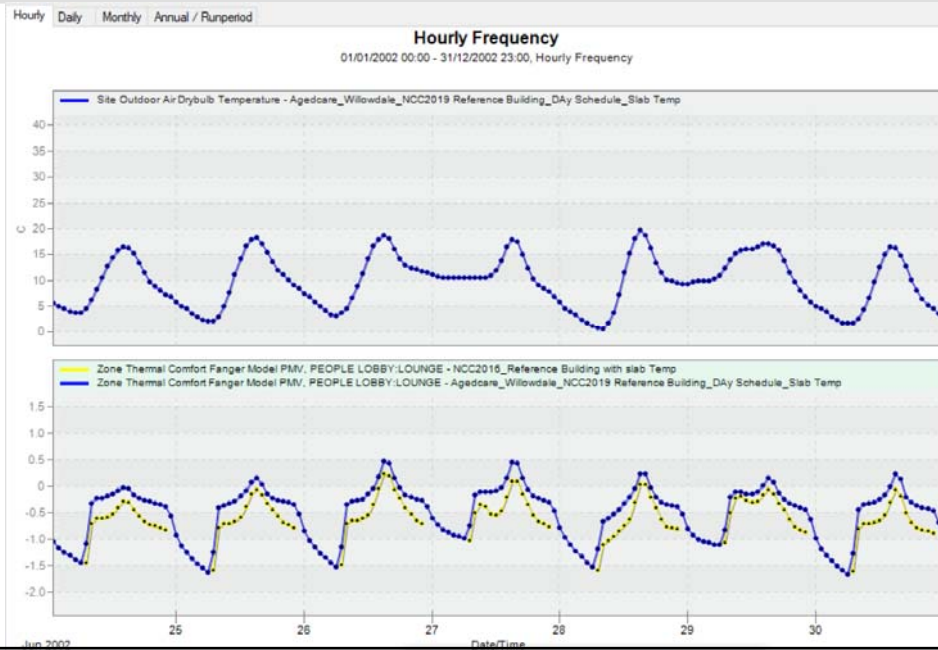
Hourly Daily Monthly Annual / Runperiod

### Hourly Frequency

01/01/2002 00:00 - 31/12/2002 23:00, Hourly Frequency



## WINTER WEEK COMFORT – PMV



## SUMMER WEEK COMFORT – PMV

