CUNDALL

4th September 2010

# Bungarribee Industrial Estate

# Sustainability Report

Prepared for

**Goodman**

**Prepared by**
**CUNDALL**

Level 7, 657 Pacific Highway
St Leonards NSW2065
Phone: +61 2 8424 7000
Fax: +61 2 8424 7001

**Contact**: **Tim Elgood**

| Report | Green House Gas Report | Revision: | C | Date: | 04/09/10 |
|---|---|---|---|---|---|

**Author:** Tim Elgood

**Checker:** Rochelle Phillis

**Approver:**

| Revision | Description | Date |
|---|---|---|
| A | Draft | 10.08.10 |
| B | DA submission draft report | 30.08.10 |
| C | Final Report | 04.09.10 |
| | | |
| | | |
| | | |



The success and realisation of the proposed initiatives will be dependant upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved. The use of computer simulation is by its nature predictive with output based on historic weather data and standard assumptions. The results of any computer simulations within this report do not guarantee future performance.

Cundall

Level 7, 657 Pacific Highway
St Leonards NSW2065

Tel: (02) 8424 7000

Fax: (02) 8424 7001

ABN: 16 104 924 370

**www.cundall.com.au**

# Contents

# 1 Executive Summary

The objective of this report is to address the key Director General Requirements for delivering a sustainable Industrial distribution centre, for Metcash, located at the Bungarribee Industrial Estate.

This report outlines the following key elements:

1. A description of how the project will incorporate the principles of sustainability in the design, construction and ongoing operation of the facility.
2. A description of the measures that will be implemented to minimise the energy and water use.
3. Waste reduction strategies throughout construction.

## How has the project incorporated the principles of sustainability in the design, construction and ongoing operation of the facility?

A number of key sustainability strategies have been integrated into the design with a formal certification process to measure this performance using the Green Star Industrial tool.

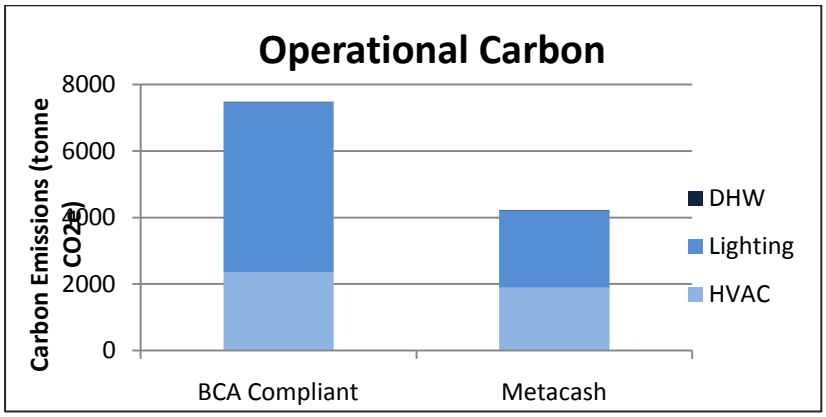
The project has committed to achieving a 4 Green Star rating adopting the following key strategies:

- Improved daylight to warehouse with up to 12% of the roof area as a sky light.
- Daylight controlled fluorescent lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance.
- Improved efficiency in the office energy and indoor environmental quality including:
  - High efficiency glazing and shading to optimise daylight and comfort.
  - Carbon dioxide monitoring of the air quality in the office spaces linked to increased fresh air rates through the ventilation system.
  - Manual over ride of natural ventilation in warehouse areas to improve air quality/ amenity.
  - Fresh air heat recovery system for air conditioning.
- Recycled water for all WC flushing, irrigation and truck wash.
- Provision of break out spaces for staff that have high levels of amenity shaded from summer sun and sheltered from prevailing winds.
- Provision of a high level of cycle facilities for staff including showers, changing rooms and a dedicated cycle way from the main entrance to the changing facilities.
- Waste recycling of 80% during construction.

## What energy and water strategies have been implemented?

The project has developed a carbon reduction strategy that reduces operational carbon by approximately 40% compared to a current BCA section J compliant development. The project also aims to achieve an 80% of the available water points in Green Star.

- The predicted energy consumption of the facility will be modelled in detail during the design phase of the project and these energy profiles established for each energy source such as lighting, power, air conditioning will be used as the reference base case.
- Energy meters for each major energy source will be specified.
- Energy bills will be reviewed on an annual basis to compare the predicted performance against the actual performance.




The report indicates in detail how the carbon reduction has been assessed using the Green Star energy calculator. The graph above illustrates the operational carbon emissions associated with the proposed Metcash facility in comparison to a BCA section J compliant facility. The methodology used to determine this energy performance is the Green Star energy calculator in the Industrial Green Star tool version V1.

# 2 Introduction

## 2.1 The Site and Development

Goodman Limited wish to implement all reasonable and feasible measures to reduce carbon emissions associated with the proposed Metcash NSW Distribution Centre located at the Bungarribee Industrial Estate. Metcash is a leading marketing and distribution company, whom wishes to consolidate their NSW operations to a single distribution centre. This site has been located due to its proximity to the M4 and M7 motorways from which Metcash will best serve their Sydney and NSW customer base.

The development consists of three warehouses with a total warehouse GLA of 91,067m$^2$ and approximately 12,000m$^2$ of office area.

The project consists of 3 warehouses:

- Warehouse 1 – Large Ambient Warehouse
- Warehouse 2 – Fresh Produce Warehouse
- Warehouse 3 – Perishables Warehouse

## 2.2 Equipment

The office aims to achieve the equivalent of a minimum NABERS rating of 4.5 stars using the Green Star energy calculator and the overall development aims to achieve a 4 star Green Star certified rating using the industrial tool. Energy and GHG savings are calculated based on a 3.5 star NABERS rated standard building. Process equipment associated with the function of the building have not been included in this report, only equipment associated with the physical attributes of the building are considered, these can be seen below.

- HVAC Warehouse — Natural ventilation only
- HVAC Office — Improvements in AC controls and zoning with economy cycles
- Lighting — T5 54W fluorescent lighting with motion detection and Light level
- Hot water System — Natural gas 80% thermal efficiency

WELS Star ratings of all water fittings can be seen below, energy savings are calculated based on 3 star ratings for all fittings.

- Toilets 4 star
- Urinals 4 star
- Taps 4 star
- Shower heads 3 star

## 2.3 Building Occupation

Metcash work on a shift basis with the following approximate occupancy densities:

| Shift Staff | | | | | |
|---|---|---|---|---|---|
| Shift 1 | | Shift 2 | | Shift 3 | |
| Number of staff | Working Hours | Number of staff | Working Hours | Number of staff | Working Hours |
| 160 | 5am-2pm | 170 | 8.30am-6pm | 70 | 2pm-11pm |

## 2.4 Tools and Standards

Estimates and calculation methods within this report are all sourced from the following tools and standards:

- BCA Section J - Deemed to satisfy
- Green Star Industrial V1
- National Greenhouse Accounts Factors

The National Greenhouse Accounts Factors, as seen in Table 1 below, quantify the GHG emissions associated with one unit of energy. The factors include all direct and indirect emissions and account for not only CO2 but a number of other significant greenhouse gas emissions.

*Table 15: Greenhouse Gas Emissions Factors for all states and territories in Australia from National Greenhouse Accounts (NGA) Factors Workbook (DCC, 2009)*

| State | Electricity ($kgCO_2$-e /kWh) | Gas ($kgCO_2$-e /MJ) | LPG ($kgCO_2$-e /MJ) | Diesel ($kgCO_2$-e /MJ) | Coal ($kgCO_2$-e /MJ) | Solid Biomass ($kgCO_2$-e /MJ) | Liquid Biofuels ($kgCO_2$-e /MJ) |
|---|---|---|---|---|---|---|---|
| ACT | 1.07 | 0.0677 | 0.0649 | 0.0748 | 0.0930 | 0.0018 | 0.0003 |
| NSW | 1.07 | 0.0677 | | | | | |
| NT | 0.79 | 0.0557 | | | | | |
| QLD | 1.01 | 0.0548 | | | | | |
| SA | 0.92 | 0.0652 | | | | | |
| TAS | 0.25 | 0.0557* | | | | | |
| VIC | 1.31 | 0.0558 | | | | | |
| WA | 0.94 | 0.0557 | | | | | |

**Table 1 National Greenhouse Accounts Factors**

## 2.5 Planning Requirements

The Department of Planning requirements for the project are:

1. Describe the principles of ESD in the design, construction and operation of the facility.
2. Describe the measures to minimise energy and water consumption.

# 3 Green Star Strategy

The project has a target to achieve a 4 Green Star rating using the Industrial tool. In order to achieve this, provisions are taken in each of the Green Star categories as seen below. (See Appendix 1 for a Green Star credit summary)

- Management
  - Commissioning, handover and tuning initiatives along with a building user's guide will ensure the building services operate optimally after handover, while environmental and waste management practices will be adopted to reduce waste associated with construction.

- Indoor Environmental Quality
  - Increased fresh air rates to the office space and higher levels of daylight levels throughout the facility. Break out spaces with far improved amenity have been provided.

- Energy
  - 40% reduction in carbon emissions through the implementation of energy conservation strategies including;
  - Improved daylight to warehouse with up to 12% of the roof area as a sky light.
  - Daylight controlled fluorescent lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance.
  - Improved efficiency in the office energy and indoor environmental quality including:
    - Improved efficiency in the office energy and indoor environmental quality including:

➢ High efficiency glazing and shading to optimise daylight and comfort.
➢ Carbon dioxide monitoring of the air quality in the office spaces linked to increased fresh air rates through the ventilation system.
➢ Manual over ride of natural ventilation in warehouse areas to improve air quality/ amenity.
➢ Fresh air heat recovery system for air conditioning.

- Transport
  - This site has been selected by Metcash to minimise carbon emissions associated with transport with the close location to the M4 and M7 motorways from which Metcash readily service their Sydney and NSW customer base. A high level of cyclist facilities with associated showers and changing facilities will be provided.

- Water
  - Occupant consumption of potable water is reduced through the use of water efficient fittings.
  - Rainwater rain water for WC flushing, irrigation and truck wash down.

- Materials
  - Consideration is taken to reduce embodied energy and resource depletion through the use of environmentally responsible materials.

- Land Use & Ecology
  - While the previous site use was agricultural, it was gazetted as a State Significant site in 2007 and rezoned as 'IN1 General Industrial' to promote employment generating uses on the site.

- Emissions
  - On site stormwater detention and water quality measures will ensure the minimisation of peak stormwater flows and pollutants to the municipal sewerage system.

# 4 Carbon reduction strategy

## 4.1 Operational carbon

The Metcash NSW Distribution Centre located at the Bungarribee Industrial Estate will incorporate a number of energy minimisation initiatives to reduce Greenhouse gas (GHG) emissions. Energy and greenhouse gas savings are estimated based on a standard practice building.

Key energy efficiency strategies include:

- Improved daylight to warehouse with up to 12% of the roof area as a sky light.
- Daylight controlled fluorescent lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance.
- Mixed mode ventilation to the offices.
- Integration of solar electric panels to the office.
- High efficiency glazing and shading for the offices.

Through these measures approximately 40% GHG emission savings can be achieved as seen in Figure 1

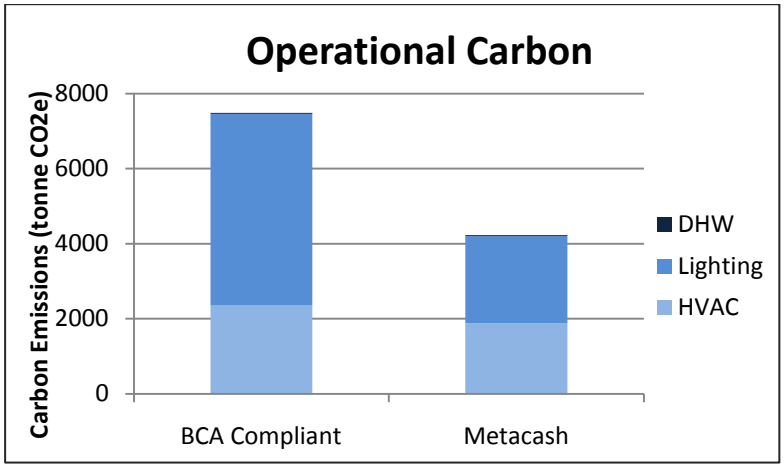



**Figure 1 Operational Carbon Comparison**

The methodology used to determine this energy performance is the Green Star energy calculator in the Industrial Green Star tool version V1.

*HVAC*

The use of mixed mode ventilation in the office is estimated to reduce HVAC energy consumption by a conservative 20%. Based on a standard office with NABERS rating of 3.5star, an annual saving of 440MWh can be achieved.

*Lighting*

A 50% lighting energy reduction can be achieved through the use of a fluorescent lighting system linked to daylight performance rather than a typical high intensity discharge system. The use of skylights and a motion detection and light level sensor can achieve a further energy saving of 50%. An energy audit with further calculations can be seen in Appendix 2.

*Domestic Hot Water*
Annual hot water usage for the site is calculated using the Green Star potable water calculator and can be seen in the Green Star results table below. The BCA specifies the thermal efficiency for hot water systems to be at least 80%, the calculation below also assumes a temperature rise of 40°C.

| | Proposed Building | Standard Practice Building |
|---|---|---|
| Annual Domestic Hot Water Usage (L/year) | 1,494,675 | 1,609,650 |

**Table 2 Green Star potable water calculator results**

An annual reduction of 24,000MJ can be achieved through the use of water efficient fittings as shown in the calculations shown in Appendix 2.

*Summary*
Energy consumption and savings due to the above mentioned energy efficiency strategies can be seen in Table 3 below. The largest reductions come from energy efficiency measures associated with lighting energy.

| Energy consumption | Fuel Type | Standard Building | Proposed Building | Energy savings |
|---|---|---|---|---|
| HVAC System (MWh) | Electricity | 2200 | 1760 | **440** |
| Lighting (MWh) | Electricity | 4774.2 | 2171.6 | **2602.6** |
| Domestic Hot Water | Natural Gas | 337.2 | 313.1 | **24.1** |

**Table 3 Annual energy consumption**

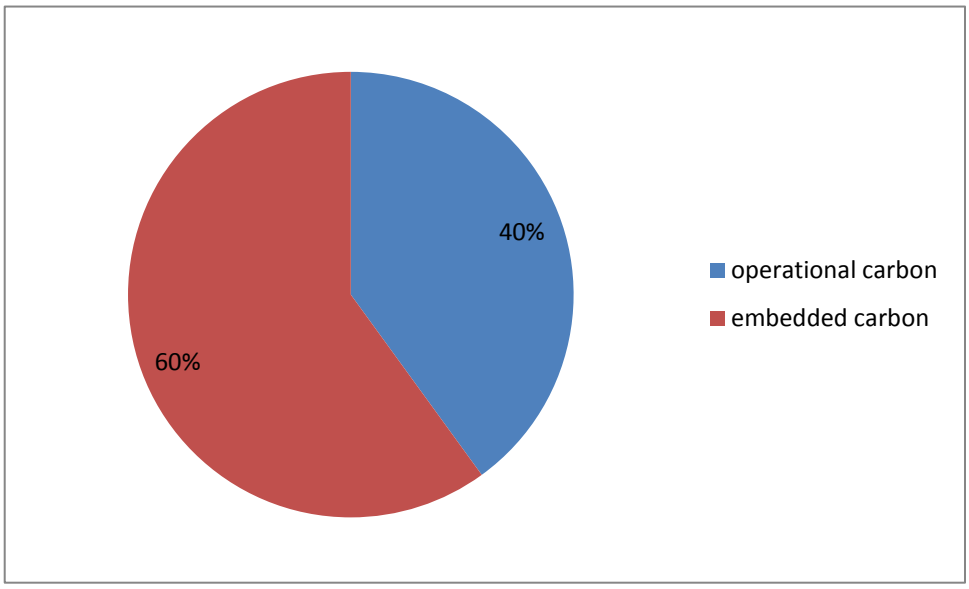
An annual GHG emission reduction of approximately 43.5% can be achieved. GHG emissions are calculated according to the Greenhouse emission factors for NSW.

| GHG emissions | Standard Building Tonne CO2e emissions | Proposed Building Tonne CO2e emissions |
|---|---|---|
| HVAC System | 2354 | 1883.2 |
| Lighting | 5108 | 2323.6 |
| Domestic Hot Water | 22.8 | 21.2 |
| **Annual Savings** | **3256.8 tonne** | **43.5 %** |

**Table 4 Annual CO2e emissions**

## 4.2 Embedded carbon

The content of embedded carbon in materials can have an important impact on the 'whole life carbon' of a building. The report 'Redefining Zero' by Sturgis Associates, estimates embedded carbon accounts for 60% of 'whole life carbon' for a warehouse, as operational energy efficiency increases it is suggested that the embedded carbon contribution could increase to 95% with further increases in energy/ carbon targets.




Where possible, materials will be chosen to reduce the embedded carbon of the development. The use of recycled and low embodied energy materials will be utilised to achieve compliance with Materials credits of the Green Star requirements.

## 4.3 Transport associated

This site has been selected by Metcash to minimise carbon emissions associated with transport with the close location to the M4 and M7 motorways from which Metcash readily service their Sydney and NSW customer base. A high level of cyclist facilities with associated showers and changing facilities will be provided.

CUNDALL

**Appendix 1: Green Star points**

The table below provides an example of the points that can be achieved for the 4 star rating. The individual points might alter in the design development stage but the overall target will be to achieve the 4 Green Star rating.

| Category | Title | Credit No. | Points Available | Points Achieved |
|---|---|---|---|---|
| Management | | | | |
| | Green Star Accredited Professional | Man-1 | 2 | 2 |
| | Commissioning | Man-2 | 1 | 1 |
| | | | 1 | 1 |
| | Building Tuning | Man-3 | 1 | 1 |
| | Independent Commissioning Agent | Man-4 | 1 | 1 |
| | Building Users' Guide | Man-5 | 1 | 1 |
| | Environmental Management | Man-6 | 3 | 3 |
| | Waste Management | Man-7 | 2 | 2 |
| | Metering | Man-16 | 2 | 2 |
| | | | 1 | 1 |
| | | TOTAL | 15 | 15 |
| | | | | |
| Indoor Environment Quality | | | | |
| | Ventilation Rates | IEQ-1 | 3 | 3 |
| | Air Change Effectiveness | IEQ-2 | 2 | 0 |
| | Indoor Pollutant Monitoring & Control | IEQ-3 | 1 | 1 |
| | Daylight | IEQ-4 | 3 | 2 |
| | Thermal Comfort | IEQ-5 | 3 | 0 |
| | Hazardous Materials | IEQ-6 | 0 | na |
| | Internal Noise Levels | IEQ-7 | 2 | 1 |
| | Volatile Organic Compounds | IEQ-8 | 1 | 1 |
| | | | 1 | 0 |
| | | | 0 | na |
| | Formaldehyde Minimisation | IEQ-9 | 1 | 0 |
| | Daylight Glare Control | IEQ-11 | 1 | 1 |
| | Electric Lighting Levels | IEQ-13 | 1 | 1 |
| | External Views | IEQ-14 | 2 | 0 |
| | Air Distribution System | IEQ-17 | 0 | na |
| | Breakout Space | IEQ-19 | 2 | 0 |
| | | TOTAL | 23 | 10 |
| | | | | |
| Energy | | | | |
| | Conditional Requirement | Ene-Con | Conditional Requirement | Yes |
| | Greenhouse Gas Emissions | Ene-1 | 20 | 12 |
| | Peak Energy Demand Reduction | Ene-3 | 2 | 0 |
| | | TOTAL | 22 | 12 |
| | | | | |
| Transport | | | | |
| | Provision of Car Parking | Tra-1 | 2 | 1 |
| | Fuel Efficient Transport | Tra-2 | 1 | 0 |
| | Cyclist Facilities | Tra-3 | 2 | 2 |
| | Commuting Mass Transport | Tra-4 | 5 | 0 |
| | Trip Reduction - Mixed Use | Tra-5 | 2 | 0 |
| | | TOTAL | 12 | 3 |

| Category | Title | Credit No. | Points Available | Points Achieved |
|---|---|---|---|---|
| | | | | |
| Water | | | | |
| | Occupant Amenity Water | Wat-1 | 5 | 5 |
| | Landscape Irrigation | Wat-3 | 1 | 1 |
| | Heat Rejection Water | Wat-4 | 2 | 1 |
| | Fire System Water Consumption | Wat-5 | 2 | 1 |
| | | TOTAL | 10 | 8 |
| | | | | |
| Materials | | | | |
| | Recycling Waste Storage | Mat-1 | 2 | 1 |
| | Building Re-use | Mat-2 | 0 | NA |
| | Recycled Content & Re-used Products and Materials | Mat-3 | 2 | 0 |
| | Concrete | Mat-4 | 3 | 1 |
| | Steel | Mat-5 | 2 | 1 |
| | PVC | Mat-6 | 2 | 1 |
| | Timber | Mat-7 | 1 | 1 |
| | Dematerialisation | Mat-9 | 1 | 0 |
| | | TOTAL | 13 | 5 |
| | | | | |
| Land Use & Ecology | | | | |
| | Conditional Requirement | Eco- | Conditional Requirement | Yes |
| | Topsoil | Eco-1 | 1 | 0 |
| | Re-use of Land | Eco-2 | 1 | 0 |
| | Reclaimed Contaminated Land | Eco-3 | 2 | 0 |
| | Change of Ecological Value | Eco-4 | 4 | 1 |
| | | TOTAL | 8 | 1 |
| | | | | |
| Emissions | | | | |
| | Refrigerant ODP | Emi-1 | 1 | 1 |
| | Refrigerant GWP | Emi-2 | 2 | 0 |
| | Refrigerant Leaks | Emi-3 | 2 | 0 |
| | Insulant ODP | Emi-4 | 1 | 1 |
| | Stormwater | Emi-5 | 3 | 2 |
| | Discharge to Sewer | Emi-6 | 4 | 1 |
| | | | 1 | 0 |
| | Light Pollution | Emi-7 | 1 | 1 |
| | Legionella | Emi-8 | 1 | 1 |
| | Noise Pollution | Emi-10 | 1 | 0 |
| | | TOTAL | 17 | 7 |
| | **Total weighted points:** | **52** | | |

**Appendix 2 Domestic Hot Water Calculations**

$$Annual\ consumption = \frac{specific\ heat\ capacity\ water \times Temperature\ rise\ \times Litres}{thermal\ efficiency}$$

Standard Building Calculation

$$Annual\ consumption = \frac{0.00419MJ/°C \times 40°C \times 1{,}609{,}650L/yr}{0.80}$$

$$Annual\ consumption = 337{,}221MJ/yr$$

Proposed Building Calculation

$$Annual\ consumption = \frac{0.00419MJ/°C \times 40°C \times 1{,}494{,}675L/yr}{0.80}$$

$$Annual\ consumption = 313{,}134MJ/yr$$