NORTHROP

Warehouse and Distribution Facility

2 Hume Highway, Chullora

Greenhouse Gas Emissions Report

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Project: Warehouse and Distribution Facility – 2 Hume Highway Chullora

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EXECUTIVE SUMMARY

The intent of this report is to provide a quantitative assessment of potential Greenhouse Gas emissions and a qualitative assessment of the potential impacts of these emission on the environment for the proposed Warehouse and Distribution Facility, located at 2 Hume Highway, Chullora.

The proposed facility is designed to operate for 24 hours a day, 7 days a week. Due to the nature and duration of activities, the facility is considered a State Significant Development (SSD) and is required to report against Secretary's Environmental Assessment Requirements (SEARs).

This report describes an example of typical energy efficiency measures that could be implemented at the facility and the predicted energy savings. The Greenhouse Gas (GHG) emissions have also been predicted, as part of meeting the Secretary's Environmental Assessment Requirements.

The proposed development has been assessed against the following standards/guidelines:

- Building Code of Australia (BCA) section J;
- Australian Greenhouse Office (AGO) Factors and Methods Workbook; and
- Guidelines for Energy Savings Action Plans (Department of Energy, Utilities and Sustainability (DEUS), 2005)

Based on the typical energy savings initiatives described in this report, the facility is predicted to have a total annual energy consumption of 3,386 MWh/yr. This compares to a predicted benchmark energy consumption of 4,367 MWH/yr for an equivalent facility without these initiatives.

The facility is predicted to have total greenhouse gases emissions of 3,024 tonnes of CO2-e per annum, with a total saving of 875 tonnes of CO2-e pa compared to the reference building without the suggested typical energy savings initiatives.

The tenant will commit to implementing all reasonable energy savings initiatives and will comply with all legislative requirements to ensure sustainable development. This will include an internal monitoring and review process to ensure legislative compliance.

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1 INTRODUCTION

Northrop Sustainability has been engaged to prepare a quantitative and qualitative assessment of the potential greenhouse gas impacts of the proposed Warehouse and Distribution Facility, located at 2 Hume Highway, Chullora.

The proposed facility is designed to operate for 24 hours a day, 7 days a week. Due to the nature and duration of activities, the facility is considered a State Significant Development (SSD) and is required to report against Secretary's Environmental Assessment Requirements (SEARs).

The intent of this Plan is identify typical energy efficiency initiatives that could be incorporated in the design to promote energy efficiencies to comply with all legislative requirements.

1.1 Project Overview

The project scope involves the construction of a warehouse and distribution facility, a bulk building, administration offices including gatehouse, on grade car parking and internal vehicle circulation areas.

1.2 Report Limitations

This report is intended as a guide to illustrate typical energy efficiency features to be considered in the development. It should be read in conjunction with the other design documentation and specific applications may vary during the development of the project.

The methods used to determine energy use and efficiency improvement estimates are generally based on a standard set of data aligned with national standards (e.g. BCA, Guidelines for Energy Savings Action Plans (DUES 2005) and AGO Factors). The standards set out principles and rules for obtaining, interpreting and using data in order to calculate a buildings greenhouse gas emissions and energy performance. Where assumptions were derived, 'rule of thumb' engineering calculations and industry experience has been applied. All calculations are based on conservative data.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Northrop for detailed advice which will take into account that party's particular requirements.

2 BENCHMARK DEVELOPMENT FOR ASSESSMENT

2.1 BCA Section J Energy Efficiency

The proposed facility is Class 5 and Class 7b in accordance with the Building Code of Australia (BCA). As per Table A1.1 in Part A1 of the 2015 BCA, the building location is assessed under the BCA Climate Zone 6.

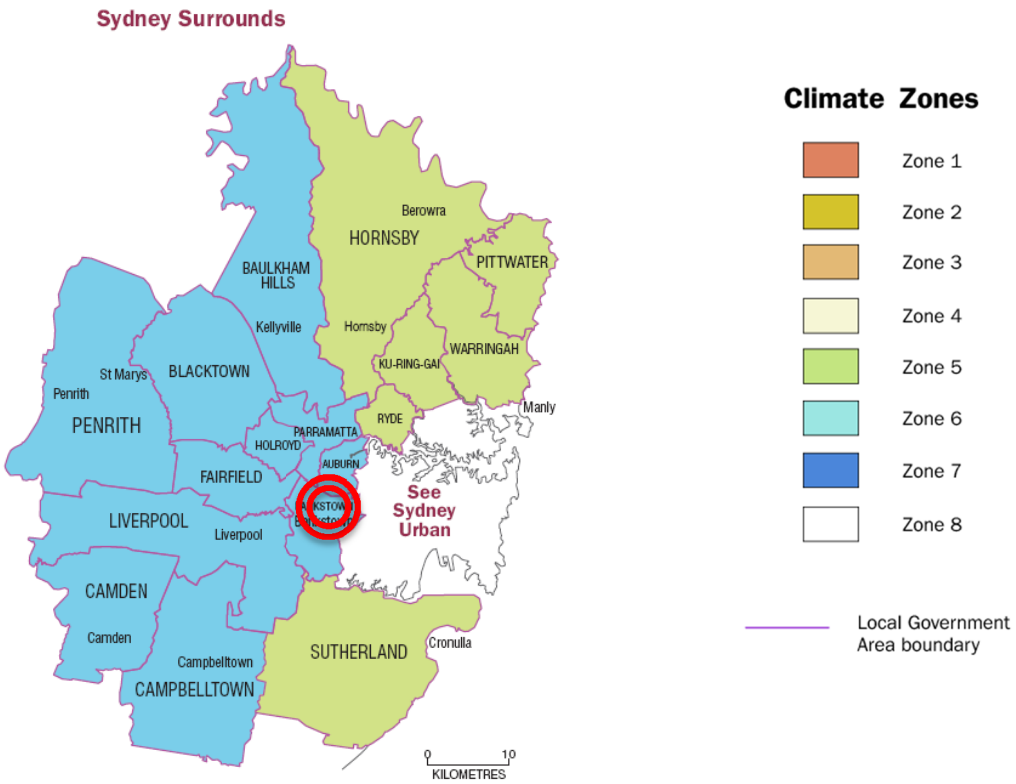

Figure 1: BCA Climate Zones for Sydney Urban

Section J of the BCA introduces a mandatory compliance criteria for the design and construction of new Class 2 to Class 9 facilities. It introduces a minimum level of energy efficient performance for the facility specifically relating to the requirements in Table 1.

The proposed facility will comply with all of legislative requirements by incorporating components of the typical energy efficiency features suggested in this report

Table 1: BCA Section J Minimum Energy Efficiency Requirements

Section J Energy Efficiency	Minimum Requirement
Part J1 Building Fabric	The building envelope must meet minimum total R-Value requirements: • Roof and ceiling construction = R3.2 • External envelope wall construction = R2.8 • Internal envelope wall construction = R1.0 and R1.8 for walls to non-conditioned spaces with ac/h<1.5 and ac/h>1.5 respectively. • Floor construction (suspended slab) = 1.0 and R2.0 for floors to non-conditioned spaces with ac/h<1.5 and ac/h>1.5 respectively.
Part J2 Glazing	Aggregate air-conditioning value attributable to glazing must not exceed nominated allowances
Part J3 Building Sealing	Sealing requirements for chimneys, flues, exhaust fans, building elements, windows and doors
Part J4	Not applicable
Part J5 Air-conditioning and Ventilation Requirements	Requirements for air-conditioning and ventilation systems
Part J6 Artificial Lighting and Power	Requirements for lighting and power energy consumption
Part J7 Hot Water and Swimming Pool and Spa Plan	Minimum requirements for hot water systems
Part J8 Facilities for Energy Monitoring	Maintenance requirements and monitoring of energy consumption for larger buildings

All of the above parts have been considered in the design. The proposed facility meets the minimum requirements of the BCA.

3 EMISSIONS REDUCTION MEASURES

3.1 Proposed Measures

The following initiatives shall be included in the development to address the SEARs objectives.

3.1.1 Energy Efficient HVAC Systems

A high efficiency air-cooled VRV heat recovery system is currently proposed to condition office areas in Warehouse B. This system consists of external condenser units and refrigerant pipework recirculated to individual fan-coil units (FCU's) in each zone requiring air conditioning.

The system achieves improved efficiency through the use of heat recovery during simultaneous heating and cooling operation. In cooling mode and part heating mode, the system recycles heat exhausted from the cooling operation to use for heating. In heating mode and part cooling mode, the system uses cooled post-heating operation refrigerant for cooling. Efficiency improves the more simultaneous operation is performed.

The design also incorporates an economy cycle, which uses 100% outside air to supply the conditioned space when the outdoor conditions are cooler then the return air in cooling mode. This allows the plant to turn off the cooling and reduce energy consumption.

3.1.2 Natural Ventilation of Car parking

The current design incorporates natural ventilation of the undercroft car parking areas minimizing ventilation energy use for these spaces.

3.1.3 Insulate Hot Water Heaters, Steam Condensate and Other Pipe Work

All hot water plant and pipework will be insulated to minimise heat loss to the external environment.

3.1.4 Energy Efficiency Lighting and Controls

The lighting system design will assess the feasibility of a programmable system incorporating timeclocks, photo electric (PE) cells and motion sensors.

LED lighting will be used as a substitute to T5 or T8 fittings as well high bay fittings throughout office, amenity, awning, carpark and entry areas. LEDs will also be used for external security lighting.

3.1.5 Energy Metering

An energy monitoring system that facilities effective metering and monitoring of energy consumption will be installed to separate out energy consumption for areas with differing functional uses in accordance with the BCA.

3.2 Energy Consumption – Benchmark Vs. Proposed

Energy consumption for the various facility components has been modelled for both a benchmark and proposed facility which incorporates typical energy efficiency initiatives.

Table 2: Proposed Design and Energy Efficiency Measures

System Description	Benchmark Facility (Energy Consumption DTS Compliant Facility) (kWh/annum)	Proposed Facility Energy Consumption including Typical Energy Efficiency Measures (kW/annum)
Heating Ventilation & Air Conditioning (HVAC) Benchmark based on 100W/m2 of air conditioning for general office and amenities as per the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) cooling load figures. Assumed ventilation loads for the facility are based on a fan motor power consumption of 2W/m2. (*Assumes office area and amenities areas only conditioned for 8 hrs per day and ventilated for 2hrs per day)* ***Proposed Facility:*** • The incorporation of economy cycle to packaged units with 10% more efficiency. • The incorporation of VRV heat recovery HVAC system (or better) with 14% more efficiency. • Energy metering.	677,952	583,066
Lighting Benchmark based on Table J6.2a Maximum Illumination Power Density the BCA. Office = 9 W/m2 Warehouse = 10 W/m2 (*Assumes office area, amenities and lighting operation for 8 hrs per day 5 days a week. Warehouse operation is assumed as 24/7).*	3,185,866	2,398,549
Domestic Hot Water Benchmark based on Domestic Hot Water heating requirement for a total demand of 550 kL/yr.	163,946	163,946

System Description	Benchmark Facility (Energy Consumption DTS Compliant Facility) (kWh/annum)	Proposed Facility Energy Consumption including Typical Energy Efficiency Measures (kW/annum)
Miscellaneous Benchmark based on miscellaneous loads (computers, small power equipment etc.) of 10 W/m2 for the offices & 50W/m2 for the warehouse sortation equipment.	338,880	338,880
Total Energy Consumption (kWh/yr.)	**4,366,644**	**3,484,441**

The predicted benchmark energy consumption for the facility is 4,367 MWh/yr. The predicted energy consumption including the range of typical energy savings measures suggested is 3,484 MWH/yr.

4 GREENHOUSE GAS EMISSIONS – BENCHMARK FACILITY

As part of addressing the SEARs, a broad assessment of indicative greenhouse gas emissions associated with the operation of the building was undertaken. This assessment has been undertaken in general accordance with the requirements of the Australian Greenhouse Office (AGO) Factors and Methods Workbook (December 2006).

4.1 Definitions and Methodology

There are three 'scopes' of greenhouse gas emission categories:

- **Scope 1** – covers direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes;
- **Scope 2** – covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope; and
- **Scope 3** – includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation.

In accordance with the Australian Greenhouse Office Factors and Methods Workbook (December 2006), the assessment has covered scopes 1 & 2 greenhouse gas emissions of the development.

4.2 Greenhouse Gases Calculations

4.2.1 Fuel Combustion Emissions – Electricity

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in kWh, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 2, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 2.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (t CO2-e) = 4,366,644 kWhrs x 0.893 / 1000

= **3,899 tonnes of CO2-e per annum**

4.2.2 Fuel Combustion Emissions – Gas

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO_2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in GJ, and

EF is the emission factor (CO_2-e) obtained from the AGO workbook

Emission factors are reported for scope 1, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 1.

Calculations are based on electricity as the fuel source to the facility. Gas connections are not confirmed at this stage, but will be investigated further as part of the detailed design development.

4.3 Total Green House Gases

Based on the above, the benchmark facility will have total greenhouse gases emissions of 3,899 tonnes of CO_2-e per annum.

5 GREENHOUSE GAS EMISSIONS - PROPOSED FACILITY WITH ENERGY EFFICIENCY MEASURES

5.1 Greenhouse Gases Calculations

5.1.1 Fuel Combustion Emissions – Electricity

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in kWh, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 2, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 2.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (t CO2-e) = 3,484,441 kWhrs x 0.893 / 1000

= **3,112 tonnes of CO2-e per annum**

5.1.2 Fuel Combustion Emissions – Gas

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in GJ, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 1, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 1.

Calculations are based on electricity as the fuel source to the facility. Gas connections are not confirmed at this stage.

5.2 Total Greenhouse Gases

Based on the above, by including typical energy efficiency measures the facility could have a total greenhouse gases emissions of 3,112 tonnes of CO2-e per annum.

Therefore, the proposed facility will reduce its emission of greenhouse gases into the atmosphere by up to 787 tonnes of CO2-e per annum when compared to the reference building.

The harmful effects of greenhouse gases in atmosphere include global warming, climate change, sea level rise, adverse effects on biodiversity etc. A number of human activities, processes and consumptions produce waste gases or greenhouse gases that are either directly or indirectly harmful to the environment. The reduction in energy consumption from energy efficiency measures will reduce the emission of greenhouse gases into the atmosphere.

6 CONCLUSION

Based on the information provided within this report it can be seen that there are a number of energy efficiency initiatives available to the design team of the proposed Warehouse and Distribution Facility at 2 Hume Highway to lower the facility's greenhouse gas emissions. Through implementing some or all of these measures the project team will ensure that the development is sustainable and complies with all applicable legislation.

The Specific energy efficiency initiatives and measures will be resolved at the detailed design stage of the project and will be in accordance with this report.