



Umow Lai

TNT Warehouse and Distribution Facility, Erskine Park NSW

Greenhouse Gases & Energy Efficiency Report



REPORT AUTHORISATION

PROJECT: TNT WAREHOUSE AND DISTRIBUTION FACILITY, ERSKINE PARK NSW
GREEN HOUSE GASES AND ENERGY EFFICIENCY REPORT

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EXECUTIVE SUMMARY

The intent of this report is to highlight energy efficiency initiatives that will be incorporated in the proposed TNT Warehouse and Distribution Facility, Erskine Park NSW.

The facility has been assessed against the following standards:

- Design brief documentation package;
- Industry standard operational patterns; and
- Building Code of Australia (BCA) section J.

The proposed facility is to be designed to operate 24 hours per day, 7 days per week. The development is predicted to have a total annual energy consumption of **3.08** Giga Watt Hours (GWhrs). This compares to a predicted benchmark energy consumption of **3.18** GWhrs for an equivalent benchmark facility that is Designed to Satisfy (DTS) the Building Code of Australia (BCA) Section J requirements.

The facility is predicted to have total green house gases emissions of **2,716.4** tonnes of CO₂-e per annum.

The tenant will commit to submitting an Energy Savings Action Plan and annual report detailing the progress of the Plan. The annual report will outline energy consumption for a defined 12 month period and reports the status of actions and measures identified in the plan. These plans have been developed as per the guidelines issued by Department of Energy, Utilities and Sustainability.

The energy management action plan will comprise the following sections;

- Template 1 – Baseline Energy use
- Template 2 – Management Review
- Template 3 – Energy Management Actions; and
- Template 4 – Energy Savings Measures



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1.0 INTRODUCTION

The intent of this report is to highlight proposed energy efficiency initiatives to be incorporated in the proposed TNT Warehouse and Distribution Facility, Erskine Park NSW.

In addition to initiatives contributing to the facility's energy efficiency, the report also includes a holistic energy efficiency strategy for the site, as well as reporting the predicted greenhouse gases emissions in line with the Director General's Requirements.

1.1 PROJECT DESCRIPTION

The project scope involves the construction and operation of a warehouse and distribution facility (transport terminal), an administration office, multi-level car parking, truck and trailer storage, service buildings, and internal vehicle circulation areas.

1.2 REPORT LIMITATIONS

Due care and skill has been exercised in the preparation of this report.

This report is intended as a guide to illustrate the 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.

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 Umow Lai for detailed advice which will take into account that party's particular requirements.



2.0 BENCHMARK DEVELOPMENT FOR ASSESSMENT

2.1.1 Building Code of Australia (BCA Section J)

The facility is of BCA Class 7b - for storage, or display of goods or produce for sale by wholesale, Class 5 - an office building used for commercial purposes and class Class 7a — a carpark and is in Climate Zone 6.

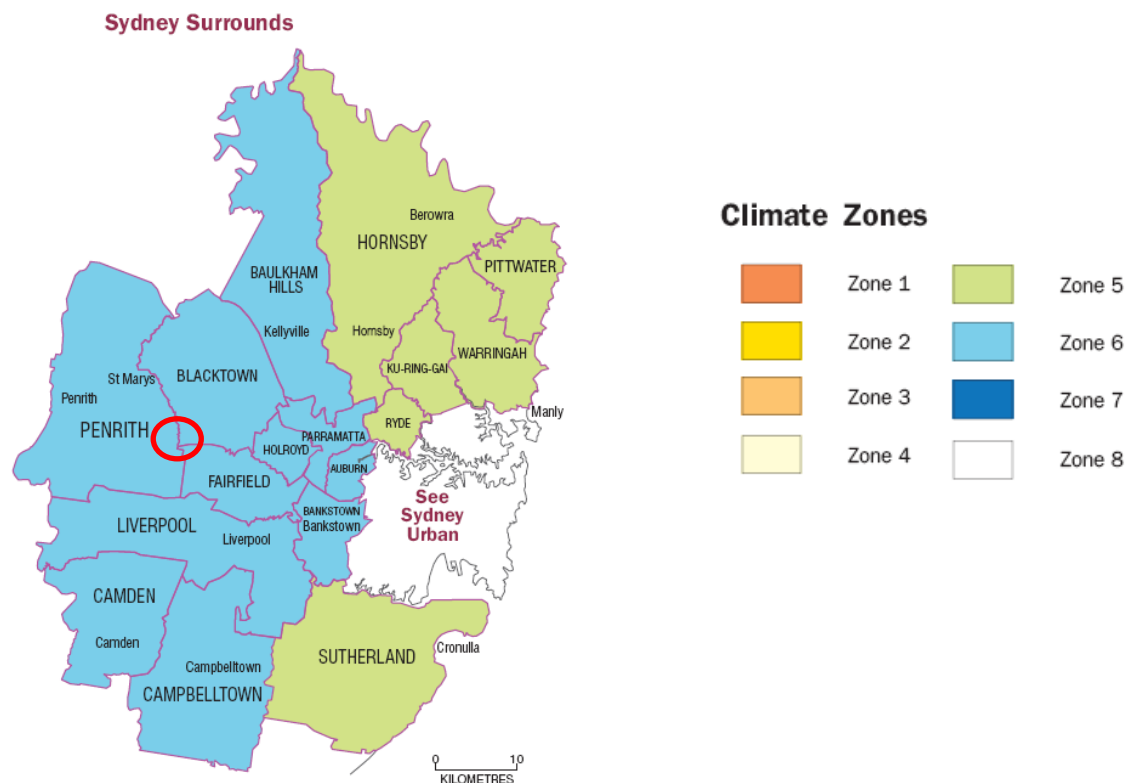


Figure 2 Map of BCA Climate Zones for NSW.



As Section J of the Building Code of Australia is a mandatory compliance criteria for the design of new facilities, it introduces a minimum level of energy efficient performance in the facility. This specifically relates to:

Part J1	Building Fabric The building envelope must meet minimum total R-Value requirements
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 Systems Requirements for air-conditioning and ventilation systems
Part J6	Artificial Lighting and Power Requirements for lighting and power energy consumption
Part J7	Hot Water Supply and Swimming Pool and Spa Pool Plant Minimum requirements for hot water systems, swimming pools and spas
Part J8	Access for Maintenance and Facilities for Monitoring Maintenance requirements and monitoring of energy consumption for larger buildings

Table 1 BCA Section J Energy Efficiency

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



3.0 ENERGY EFFICIENCY MEASURES

3.1 PROPOSED EFFICIENCY FEATURES

The following efficiency initiatives will be included in the development of the proposed TNT Warehouse and Distribution Facility.

3.1.1 Solar Boost for Office and Warehouse Hot Water Generation

Solar boosted hot water generation is proposed for Hot Water supplied to the Office and Warehouse portions of the project. Solar hot water panels will be installed in the system as a pre heat system. Solar hot water generation is well suited to this development due to ample roof space and access to sunlight.



Figure 1 Solar Hot Water Roof Mounted Collectors

3.1.2 Efficient HVAC Systems

HVAC will be provided to conditioned spaces via a VRF / VRV heat recovery system. The system consists of roof-top condenser units and refrigerant pipework recirculated to individual fan-coil units (FCU's) in each zone requiring air conditioning

The system achieves good efficiency through heat recovery during simultaneous heating and cooling operation.

In mainly cooling, partly heating mode, the system recycles heat exhausted from the cooling operation to use for heating. In mainly heating, partly cooling mode, the system uses cooled post-heating operation refrigerant for cooling. Efficiency improves the more simultaneous operation is performed.

3.1.3 Selection of Efficient Plant & Equipment

Water Boilers shall be specified to achieve operating efficiency over 80%.

Variable Speed Drive motors will be used on all 3 phase fans and pumps.

3.1.4 Ventilation Rates

The ventilation system proposed for the building will be designed to provide 100% outside air at greater than 100% above the minimum AS1668.2 requirements. Supply air will be passed through an air to air heat exchanger to reclaim energy before entering the building.

It will be provided to counteract the build-up of indoor pollutants, reducing the exposure of building occupants to carbon dioxide and other pollutants.



3.1.5 Metering

Metering systems will be installed to facilitate effective metering and monitoring of water and electricity consumption. Data logging and leak detection software will be incorporated to alert maintenance personnel of irregular meter data.

3.1.6 Specification of Materials

All refrigerant used in the project will have an Ozone Depleting Potential (ODP) of zero.

All insulation will be specified and installed will have zero ODP in its manufacture or composition.

Adhesives and sealants will all be selected to meet the VOC content limits specified in this credit. These are now readily available and can generally be selected without additional cost.

All engineered wood products to be selected with low formaldehyde.

PVC Components of construction will be specified as "Best Practice Certified"

3.1.7 Commissioning and Building Tuning

An independent commissioning agent will be employed to act on behalf of the client and oversee all commissioning activities. This will ensure an effective commissioning process.

Commissioning in accordance with ASHRAE and CIBSE standards would be undertaken. Commissioning and handover initiatives will ensure that all building services can operate to optimal design potential.

Quarterly tuning sessions during the defects liability period and recommissioning after 12 months will be undertaken. This will ensure that building services can operate to optimal design potential after handover.

3.1.8 Building Users' Guide

A Building Users Guide will be prepared for the TNT Warehouse and Distribution Facility. This will enable the building users to optimise the building's environmental performance.



3.2 ENERGY CONSUMPTION - BENCHMARK VS. PROPOSED

Energy consumption for the various facility components has been projected for both a benchmark and the proposed facility.

The development is predicted to have a total annual energy consumption of **3.08 Giga Watt (GW)**. The table below provides a breakdown of the predicted energy consumption.

Description	Benchmark Facility; Energy Consumption DTS compliant Facility (kW) / Annum	Proposed Facility; Energy consumption including efficiency measures (kW) / Annum
Heating Ventilation & Air Conditioning (HVAC) – Based on 150 W/m ² of air conditioning for offices and amenities, efficiency as per BCA Section J requirements, A sum of ventilation loads for the facility with fan motor power consumption of 2W/m ² Proposed facility: The proposed facility will be approximately 10% more efficient based on the following : • The incorporation of a VRF/VRV heat recovery HVAC system • Energy metering • Commissioning	666,771 kW	600,094 kW
Lighting – Based on BCA Section J lighting illumination power densities	2,190,762 kW	2,190,762 kW
Domestic Hot Water – Benchmark: Based on Domestic Hot water heating requirements for a total annual demand of 588 kL Proposed facility: Energy saving met via solar boost	84,378 kW	50,627 kW
Miscellaneous – Based on a miscellaneous load of 10W/m ² for the offices	240,498 kW	240,498 kW



Description	Benchmark Facility; Energy Consumption DTS compliant Facility (kW) / Annum	Proposed Facility; Energy consumption including efficiency measures (kW) / Annum
Total Energy Consumption	3.18 GW 3.1 GW (Electricity) 0.08 GW (Gas)	3.08 GW 3.03 GW (Electricity) 0.05 GW (Gas)

Table 2 Current design and energy efficiency measures

The figure below provides a breakdown of the predicted energy consumption;

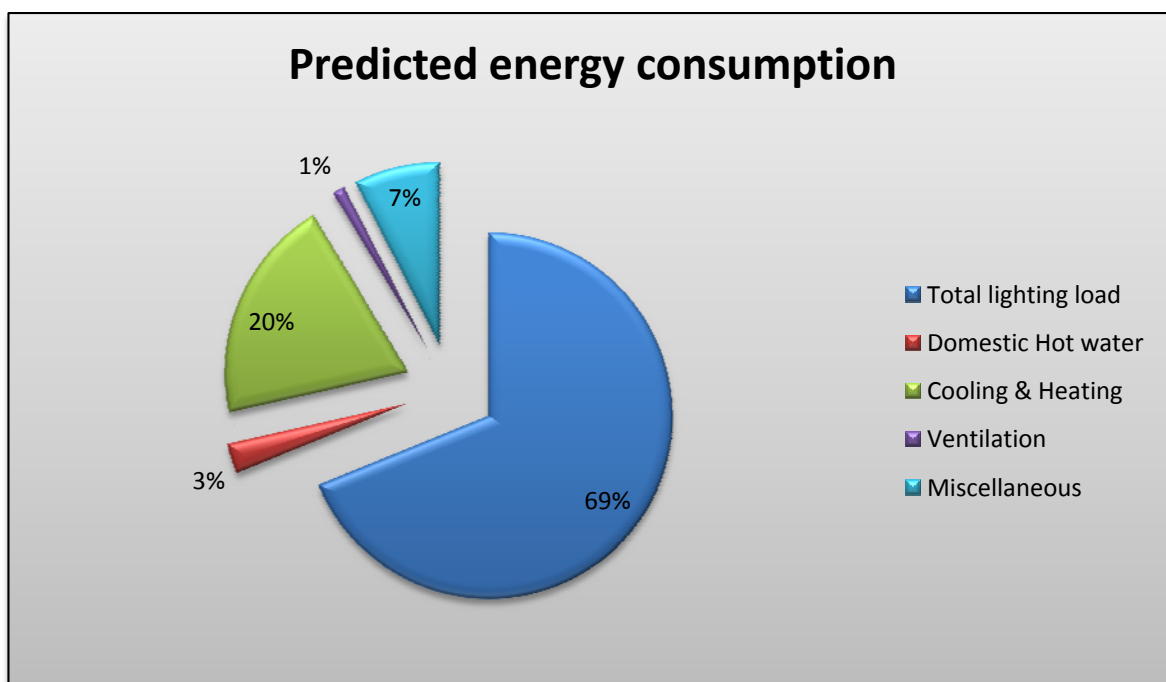


Figure 3 TNT Warehouse and Distribution Facility predicted energy consumption



4.0 GREENHOUSE GASES – CURRENT FACILITY DESIGN

4.1 OVERVIEW

As part of meeting the Director General's Requirements, an assessment of greenhouse gases associated with the operation of the building's operation was undertaken. This assessment has been undertaken as per the requirements of the Australian Greenhouse Office Factors and Methods Workbook (December 2006).

4.2 DEFINITIONS & METHODOLOGY

The Green House Gas (GHG) Protocol defines three 'scopes' of 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.

4.3 GREENHOUSE GASES CALCULATIONS

4.3.1 Fuel combustion emissions (Electricity)

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

$$\text{GHG emissions (t CO}_2\text{-e)} = Q \times \text{EF} / 1000$$

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;

$$\text{GHG Emissions (t CO}_2\text{-e)} = 3,098,031 \text{ kWhrs} \times 0.893 / 1000$$

$$= 2,766.5 \text{ tonnes of CO}_2\text{-e per annum}$$



4.3.2 Fuel combustion emissions (Gas)

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

$$\text{GHG emissions (t CO}_2\text{-e)} = Q \times EF / 1000$$

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.

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

$$\text{GHG Emissions (t CO}_2\text{-e)} = (84,378 \text{ kWhrs} \times 3.6 / 1000) \times 51.7 / 1000$$

$$= 15.7 \text{ tonnes of CO}_2\text{-e per annum}$$

4.4 TOTAL GREEN HOUSE GASES

Based on the above, the facility will have total greenhouse gases emissions of **2,782.2 tonnes of CO₂-e per annum**.



5.0 GREENHOUSE GASES – DESIGN WITH EFFICIENCY MEASURES

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:

$$\text{GHG emissions (t CO2-e)} = Q \times EF / 1000$$

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;

$$\begin{aligned} \text{GHG Emissions (t CO2-e)} &= 3,031,354 \text{ kWhrs} \times 0.893 / 1000 \\ &= \mathbf{2,706.9 \text{ tonnes of CO2-e per annum}} \end{aligned}$$

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:

$$\text{GHG emissions (t CO2-e)} = Q \times EF / 1000$$

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.

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

$$\begin{aligned} \text{GHG Emissions (t CO2-e)} &= (50,627 \text{ kWhrs} \times 3.6 / 1000) \times 51.7 / 1000 \\ &= \mathbf{9.4 \text{ tonnes of CO2-e per annum}} \end{aligned}$$



5.2 TOTAL GREEN HOUSE GASES

Based on the above, by including energy efficiency measures the facility will have total greenhouse gases emissions of **2,716.4 tonnes of CO₂-e per annum**.

Therefore, the facility will reduce its emission of greenhouse gases into the atmosphere by **66 tonnes of CO₂-e per annum**.

The harmful effects of presence of greenhouse gasses in atmosphere are global warming, climate change, ozone depletion, sea level rise, adverse effects on biodiversity etc. One way or another these adverse impacts are all directly or indirectly related to the presence of greenhouse gases in the atmosphere. A number of human activities, processes and consumptions produce waste gasses or greenhouse gasses that are harmful to the environment. The reduction in energy consumption from energy efficiency measures will reduce the emission of greenhouse gases into the atmosphere.



6.0 ENERGY SAVINGS ACTION PLAN

The proposed facility is designed to operate 24 hours per day, 7 days per week. Due to the nature of activities in the development, the facility is considered a high intensity energy using site. As a result, energy savings action plans are required to be submitted on an annual basis, as required by the Director General's Requirements. These plans have been developed as per the guidelines issued by the NSW Department of Energy, Utilities and Sustainability (DEUS).

The tenant is committing to carrying out a review of the environmental performance of the facility. This review is to identify opportunities for improvement in environmental performance, in relation to energy savings and greenhouse gas reduction opportunities, and provide an energy management action plan to be utilised in the operation of the facility.

The tenant will also commit to submitting an energy savings action plan and annual report detailing the progress of the Plan. The annual report will outline energy consumption for a defined 12 month period and report the status of actions and measures identified in the plan.

This review will be based on the 'Guidelines for Energy Savings Action Plans'. There are a number of tasks identified in these Guidelines:

- Gather 12 months of energy usage data to identify existing baseline energy use;
- Involve senior management levels at the outset to gain commitment to, and understanding of, the requirements for Energy Savings Action Plans;
- Determine how energy is used. It will help assess what appliances and processes are consuming energy, and will facilitate the assessment of energy utilisation and opportunities for improvement;
- Put the Energy Savings Action Plan Together; and
- Implement and Review Energy Savings Action Plans.

The energy management action plan will comprise the following sections:

- Template 1 – Baseline Energy Use;
- Template 2 – Management Review;
- Template 3 – Energy Management Actions; and
- Template 4 – Energy Savings Measures.

The following sections provide sample templates based on the plans.



TEMPLATE 1 – BASELINE ENERGY USE

Organisation name	
Address	
Baseline start date	
Baseline end date	
A = baseline energy use per annum (kWh)	
Greenhouse emissions	
Is baseline representative of normal energy use YES/ NO	
B = Impact of variation on energy use (i.e. variation from normal) kWh p.a.	
C = A-B baseline energy use corrected for variation (kWh)	
Business Activity Indicator	
D = Quantity of Site Business Activity Indicator p.a. (corrected for variations)	
E = C/D baseline energy use key performance indicator (KPI)	
Baseline KPI units	
Baseline summer peak electrical use (KVa)	
Baseline winter peak electrical use (KVa)	



TEMPLATE 2 – SAMPLE MANAGEMENT REVIEW

Area	Review Area	Rating				
		Low	Moderate	Minimum Sustainable	Industry Leader	Best Practice
A	Senior management commitment					
B	Understanding of energy savings potential					
C	Energy targets and key performance indicators					
D	Energy metering and monitoring					
E	Energy management reporting					
F	Energy supply management					
G	Operating and maintenance procedures					
H	Accountabilities for energy management					
I	Training and awareness procedures					
J	Compliance with legal and/or regulatory requirements					



TEMPLATE 3 – ENERGY MANAGEMENT ACTIONS

Proj No.	Energy Management Action	Planned Responsibility	Planned Completion Date	Actual Completion Date
1	Incorporate energy efficiency into the site environmental policies.	TBC	TBC	TBC
	Step 1. Review existing policy and prepare updated draft.	TBC	TBC	TBC
	Step 2. Gain approval and sign off by CEO.	TBC	TBC	TBC
	Step 3. Communicate changes to all staff	TBC	TBC	TBC
2	Implement an energy savings awareness program	TBC	TBC	TBC
	Step 1. Prepare tenancy information brochure	TBC	TBC	TBC
	Step 2. Staff meeting to advise energy savings awareness	TBC	TBC	TBC
	Step 3. Prepare awareness for service areas and plantrooms encouraging energy savings	TBC	TBC	TBC
3	Assign specific responsibility for energy efficiency to operation managers, including targets.	TBC	TBC	TBC
4	Prepare energy usage balance and Inventory	TBC	TBC	TBC
5	Calculate energy usage across site	TBC	TBC	TBC
6	Investigation of energy consumption at each metered point	TBC	TBC	TBC
7	Investigation of usage trends	TBC	TBC	TBC
8	Investigation of out of hours energy consumption	TBC	TBC	TBC
9	Implement action plan	TBC	TBC	TBC

