Report

ENERGY AND GREENHOUSE GAS ASSESSMENT - UPDATE

Dexus Estate Industrial Park - Greystanes Southern Employment Lands Project Hansen Yuncken

CONFIDENTIAL

Revision: 1.0 – For Information
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Table of Contents

1. EXECUTIVE SUMMARY

1.1. Purpose

The purpose of this report is to provide an updated estimation of the energy consumption and carbon dioxide emissions for Dexus Estate Industrial Park Project in the Greystanes Southern Employment Lands.

Subsequent to the Energy and Greenhouse Gas Assessment report dated 06 March 2009 that forms Appendix J of the original project application (MP 08_0259), Dexus Estate Industrial Park has been further developed in response to market demand and in securing end users for the facilities.

The estimated figures have been based on assumptions for energy consumption or loads for each building type. An estimation of carbon dioxide emissions associated with motor vehicles has also been carried out. This has also has been based on assumptions for trip frequency and length and on vehicle emission rates.

The energy and emissions have been estimated for both a typical development where there are no energy saving measures in place, as well as a development where the initiatives described in the Urban Design Plan have been adopted.

The information provided in this report is for information purposes only. It does not provide any guarantee in terms of actual energy consumption and emissions associated with the development.

1.2. Summary

For a typical development (no energy saving measures), the total carbon dioxide emissions has been estimated at 32,418 tonnes CO_2 per annum.

For a development adopting the energy saving initiatives from the Urban Design Plan, the total carbon dioxide emissions for the current master plan is estimated at 18,812 tonnes CO_2 per annum.

The CO_2 saving associated with the proposed development by adopting the energy saving initiates are estimated at 13,606 tonnes CO_2 per annum. This equates to approximately a 42% reduction.

1.3. Information Sources

1. Urban Design Plan (Issue J) by Turner Hughes Architects.
2. DX_G_MP08.01-[G], dated 28/11/2011 - Overall Site Plan, Greystanes Estate Southern Employment Land
3. DX_G_MP08.03-[G], dated 28/11/2011 – Precinct A.
4. DX_G_MP08.04-[G], dated 28/11/2011 - Precinct B.
5. DX_G_MP08.05-[G], dated 28/11/2011 - Precinct C.
6. The Australian Institute of Refrigeration, Air-Conditioning and Heating (AIRAH) Technical Handbook (3rd and 4th Edition).
7. NABERS Office Rating Tool (Whole Building).
8. Green Star - Industrial version1 – Greenhouse Gas Emissions Calculator Guide (2010).
9. Australian/NZ Standard AS/NZS 3000:2007.

1.4. Revision History

Rev	Date Issued	Comment
P0	28 November 2011	Draft for Comments
01	29 November 2011	For Information

2. ANALYSIS

The estimation of the energy consumption and carbon dioxide emissions has been broken down into four main areas.

- Offices
- Warehouses
- Car parking
- Transport

The preceding Energy and Greenhouse Gas Assessment (dated 06 March 2009) has analysed the energy consumption of the development based on 1 proposed master plan and 3 options of development. This report provides an updated energy and greenhouse gas estimation based on the current Master Plan DX_G_MP08.01 rev-G.

Table 1 – Overall Development Area (based on Master Plan DX_G_MP08.01 rev-G)

Area		Office Area (m^2)	Warehouse Area (m^2)	Car park Area (m^2)
Precinct A	Lot 1	3,000	45,300	4845
	Lot 2	2,000	35,500	4676
	Lot 3-data centre	1,500	15,900	3149
Precinct B	Lot 4-Warehouse B	4,000	17,500	4259
	Lot 5-Warehouse A	2,665	22,025	3964
	Lot 6-Symbion	1,165	14,985	6368
	Lot 7-Solaris	615	18,000	1918
Precinct C	Lot 8-Warehouse E	380	5,057	839
	Lot 9-Warehouse D	1,500	16,500	7072
	Lot 10-Warehouse C	1,500	16,500	4199
	Lot 11-Warehouse B	1,100	13,065	3172
	Lot 12-Warehouse A	600	1,800	1250
TOTAL		**20,025**	**222,132**	**45,710**

2.1. Offices

The AIRAH handbook (3rd edition) provides the following ranges for electricity consumption in office buildings. The figures are based on 2500 operating hours per year.

- Electricity 125 - 261 kWh / m^2 per year

The above figures assume all heating and hot water is provided via electricity.

Table 2 – Annual office energy consumption and CO_2 emissions ranges based on typical Office Energy Consumption - AIRAH data

Area	Office Area (m^2)	Electricity Consumption (kWh)		CO_2 Emissions* (tonnes CO_2)	
		Lower	Upper	Lower	Upper
Precinct A	6,500	812,500	1,696,500	869	1,815
Precinct B	8,445	1,055,625	2,204,145	1,130	2,358
Precinct C	5,080	635,000	1,325,880	679	1,419
TOTAL	**20,025**	**2,503,125**	**5,226,525**	**2,678**	**5,592**

* Based on a greenhouse gas coefficient of 1.07 kgCO_2 per kWh of electricity as set out in the National Greenhouse Accounts (NGA) Factors (prepared by the Department of Climate Change and Energy Efficiency)

Compared to the original master plan, the office floor area in the current master plan has only been changed slightly from 20,900 m^2 to 20,025 m^2.

Target Emissions

In line with the target referred to in the Urban Design Plan (UDP), estimation has also been carried out assuming the office areas achieve a 4 Star NABERS Energy for Office rating based on whole building.

In order to achieve a 4-Star NABERS Energy for whole building, the maximum emission rate from the office area is 193 kg CO_2/m^2 based on 50 hour operation per week and 15m^2 per person. This has then been converted to electricity consumption assuming that electricity accounts for 100% of the total energy consumed.

Table 3 – Annual office energy consumption and CO_2 emissions based on NABERS 4 Star Office Energy - Whole Building

Office Area	Office Area (m^2)	CO_2 Emissions (tonnes CO_2)	Electricity Consumption (kWh)
Total office on site	20,025	3,865	3,611,986

2.2. Warehouses

Energy consumption associated with warehouses has been estimated by calculating maximum demand and then applying an assumed profile for a year.

It has been assumed that the warehouse areas are not conditioned (i.e. no heating or cooling), but have mechanical ventilation. Therefore, all energy consumption associated with the warehouses is electricity.

Australian/NZ Standard AS/NZS 3000:2007 (Electrical Installations) provides the following guidance on estimating maximum demand for warehouses.

- Light & Power Range: 5 - 15 VA/m^2 Average: 10 VA/m^2

- Ventilation Range: 5 VA/m^2 Average: 5 VA/m^2

To convert VA to kW a power factor of 0.85 has been used.

The profiles in Appendix A were then assumed and used to model a year's energy consumption. The profiles have been based on those detailed in the Green Star Industrial version 1 Emissions Calculator Guide (2010). Profiles have been assumed for working weekdays and weekends/public holidays. It has been assumed that there are 252 working weekdays per year, with the balance being weekends/public holidays.

Using the warehouse areas based on the current Master Plan arrangement the following ranges have been calculated.

Table 4 – Annual warehouse energy consumption and CO_2 emissions ranges

Warehouse Area (m^2)	Lighting & Power Electricity Consumption (kWh)		Ventilation Electricity Consumption (kWh)	Total Electricity Consumption (kWh)		CO_2 Emissions (tonnes CO_2)	
	Lower	Upper		Lower	Upper	Lower	Upper
222,132	4,773,361	14,320,084	4,282,261	9,055,622	18,602,344	9,690	19,905

In line with the target referred to in the Urban Design Plan (UDP), estimation has also been carried out assuming ventilation is provided via natural means and lighting/power is reduced through maximised daylight penetration. Table 4 below shows our estimation on the basis of light and power density of 12 VA/m^2.

Table 5 – Annual warehouse energy consumption and CO_2 based on UDP

Warehouse Area (m^2)	Lighting & Power Electricity Consumption (kWh)	CO_2 Emissions (tonnes CO_2)
222,132	8,030,258.4	8592

2.3. Car Parking

It is assumed that all car parking areas are provided with lighting.

Australian/NZ Standard AS/NZS 3000:2007 (Electrical Installations) provides the following guidance on estimating maximum demand for car parks.

- Open Air Range: 0 - 10 VA/m^2 Average: 5 VA/m^2

It has been assumed that car parking areas are provided with lighting for 8 hours per day, 252 days per year.

Using the car parking areas provided as measured from the CAD version of DX_G_MP08.01, the following ranges have been calculated.

Table 6 – Annual car parking energy consumption and CO_2 emissions ranges

Car park Area (m^2)	Energy Consumption (kWh)		CO_2 Emissions (tonnes CO_2)	
	Lower	Upper	Lower	Upper
45,710	0	921,515	0	986

The estimation for this development is based on an average maximum demand of 5 VA/m^2. The table below shows the energy consumption and emissions on this basis.

Table 7 – Estimated annual car parking energy consumption and CO_2 emissions

Car park Area (m^2)	Energy Consumption (kWh)	CO_2 Emissions (tonnes CO_2)
45,710	391,644	419

2.4. Transport

The transport element has been split into two sections:

- Staff vehicles
- Delivery vehicles

Emissions level from these vehicles has been based on assumed frequency and trip distance, plus vehicle emission rates.

2.4.1. Staff Vehicles

The number of car parking space has been extracted from the current Master Plan. The following assumptions have been made:

- 90% of the parking spaces are used by staff (10% spare for visitors).
- Each occupied space represents a car doing a round trip of 40km.
- The average vehicle emission rate is 180 g CO_2/km.

Based on these assumptions the following emissions have been calculated.

Table 8 – Annual CO_2 emissions associated with staff vehicles

No. Parking Spaces	CO_2 Emissions (tonnes CO_2)
1,578	2,577

2.4.2. Delivery Vehicles

The following assumptions have been made:

- 1 delivery/pickup per day per 500m^2 of warehouse area.
- Average distance travelled by each delivery vehicle is 100km.
- The average vehicle emission rate is 300 g CO_2/km.

Based on these assumptions the following emissions have been calculated.

Table 9 – Annual CO_2 emissions associated with delivery vehicles

Warehouse Area (m^2)	No. deliveries/ pick-ups per day	CO_2 Emissions (tonnes CO_2)
222,132	444	3,359

3. TOTAL ENERGY CONSUMPTION & EMISSIONS

Based on the analysis in the previous section the following total energy consumption and carbon dioxide emissions have been calculated.

3.1. Typical Development – No Energy Saving Measures

Table 10 below shows the energy consumption and greenhouse gas emissions associated with the development from offices, warehouses, car parking and transport, when there is no energy efficiency measures undertaken.

Table 10 – Annual energy consumption and CO_2 emissions – No Energy Saving Measures

Area Type	kWh-electricity	GHG Emissions (tonnes of CO2)
Office	5,226,525	5,592
Warehouse	18,602,344	19,905
Car park	921,515	986
Transport		5,935
TOTAL		32,418

3.2. Development with Energy Saving Initiatives as Per UDP

Provided the energy efficiency measures are adopted as per the UDP, the energy and greenhouse emissions are expected to be lower than the estimate detailed in table 10. Table 11 below shows the estimated energy consumption and emissions associated with the development from offices, warehouses, car parking and transport as the result of implementing energy saving measures.

Table 11 – Annual energy consumption and CO_2 emissions – with Energy Saving Measures

Area	kWh-electricity	GHG Emissions (tonnes of CO2)
Office	3,611,986	3,865
Warehouse	8,030,258	8,592
Car park	391,644	419
Transport		5,935
TOTAL		18,812

4. APPENDIX A – WAREHOUSE PROFILES

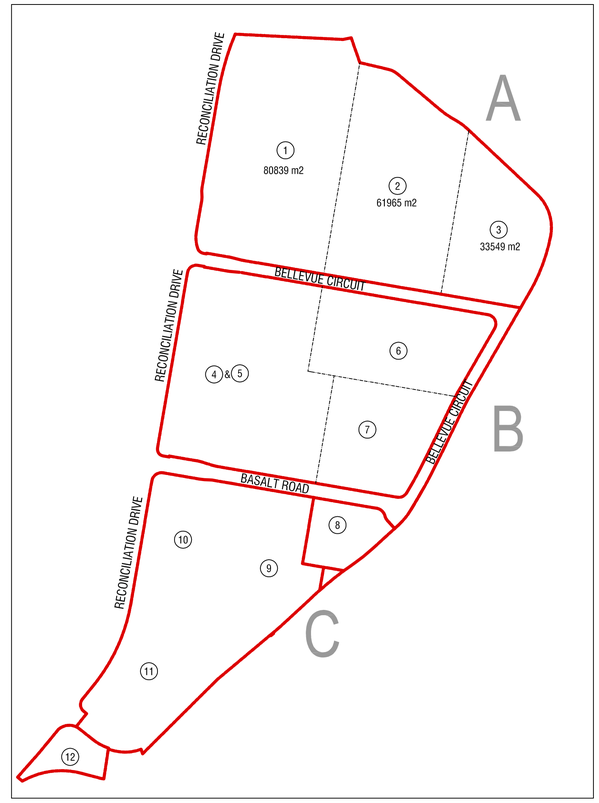
1.1.1 Table A-1 – Warehouse light & power profiles for weekdays & weekends/public holidays

Time	Light and Power load as a percentage of maximum demand	
	Working Weekdays	Weekends and Public Holidays
0000 – 0400	15%	15%
0400 – 0500	40%	15%
0500 – 0600	90%	15%
0600 – 2100	100%	15%
2100 – 2200	80%	15%
2200 – 2300	60%	15%
2300 – 2400	15%	15%

2.1.1 Table A-2 – Warehouse ventilation profiles for weekdays & weekends/public holidays

Time	Ventilation load as a percentage of maximum demand	
	Working Weekdays	Weekends and Public Holidays
0000 – 0400	0%	0%
0400 – 2200	100%	0%
2200 – 2400	0%	0%

5. APPENDIX B – MASTER PLAN



DEVELOPMENT DATA

TOTAL SITE AREA	approx. 472 312 m2
DEVELOPABLE AREA	444 185 m2

PROPOSED DEVELOPMENT SITE AREAS

		BLG AREA	SITE AREA
PRECINCT A			
LOT 1			80839 m2
Office	3000 m2		
Warehouse		45300 m2	
LOT 2			61965 m2
Office	2000 m2		
Warehouse		35500 m2	
LOT 3			33549 m2
Office	1500 m2		
Warehouse		15900 m2	
SUBTOTAL	6500 m2	96700 m2	176353 m2
PRECINCT B			
LOT 4			34732 m2
Office	4000 m2		
Warehouse		17500 m2	
LOT 5			42 898 m2
Office	2665 m2		
Warehouse		22025 m2	
LOT 6			37838 m2
Office	1165 m2		
Warehouse		14985 m2	
LOT 7			31041 m2
Office	615 m2		
Warehouse		18000 m2	
SUBTOTAL	8445 m2	72510 m2	146509 m2
PRECINCT C			
LOT 8			12038 m2
Office	380 m2		
Warehouse		5057 m2	
(LOT 9, 10 & 11)			101324 m2
LOT 9			
Office	1500 m2		
Warehouse		16500 m2	
LOT 10			
Office	1500 m2		
Warehouse		16500 m2	
LOT 11			
Office	1100 m2		
Warehouse		13065 m2	
LOT 12			7465 m2
Office/Cafe	600 m2		
Warehouse		1800 m2	
SERVICE ZONE			628 m2
SUBTOTAL	5080 m2	52922 m2	121455 m2
TOTAL	20025 m2	222132 m2	

DEXUS PROPERTY GROUP

hansen yuncken BUILDING VALUE

project

GREYSTANES ESTATE

SOUTHERN EMPLOYMENT LAND, GREYSTANES. NSW

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title

AMENDED MASTERPLAN

OVERALL SITE PLAN

scale 1:2500 @ A1

1:5000 @ A3

date 28.11.2011

drawing no. DX_G_MP08.01 rev G