

Carbon Footprint Report 2009/10
Department of the Prime Minister & Cabinet



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Carbon Footprint Report for:

Department of the
Prime Minister &
Cabinet - 1 National
Circuit, Barton ACT



Australian Government

Department of the Prime Minister and Cabinet

27th August 2010

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Department of the Prime Minister & Cabinet



Review Tracker

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Reliance Limitation Statement

This Report has been prepared in accordance with the scope of services described in the letter of proposal (Document No. P064), dated 14th May 2009, provided by UGL Services to the Department of the Prime Minister and Cabinet (PM&C).

In preparing the report, UGL Services relied upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, recommendations or conclusions only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by PM&C.

The Report has been prepared solely for use by PM&C and UGL Services accepts no responsibility for its use by other parties.

ABBREVIATIONS

ADO	Automotive Diesel Oil (Diesel)
AGO	Australian Greenhouse Office
AVGAS	Aviation Gas
CPRS	Carbon Pollution Reduction Scheme
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EUI	Energy Use Intensity
FTE	Full time equivalent employees
GHG	Green House Gas
GJ	Gig Joules
hr	Hours
IPCC	Intergovernmental Panel on Climate Change
Kg	Kilogram
KL	Kilolitre
km	Kilometre
kWh	Kilowatt-hour
L	Litre
LPG	Liquefied Petroleum Gas
NGA	National Greenhouse Accounts
OSCAR	Online System for Comprehensive Activity Reporting
PM&C	Department of the Prime Minister & Cabinet
t	Tonnes
tonnes CO₂-e	Tonnes of carbon dioxide, equivalent
TL&P	Tenant light and power

1. EXECUTIVE SUMMARY

UGL Services was commissioned by PM&C to develop a carbon emissions (footprint) report for the organisation's operations at 1 National Circuit Barton for the financial year 2009/10.

The purpose of this report is to establish PM&C's Carbon Footprint in accordance with the Greenhouse Gas (GHG) Protocol. This report documents a baseline from which PM&C can develop a strategy to address its carbon emissions performance.

1.1. PM&C's Emissions Totals

Based on the information obtained during the assessment process, PM&C's net GHG emissions for the 2008/09 financial period were calculated to be **4,940 tonnes carbon dioxide equivalents (CO₂-e)**. In 2009/10 PM&C's net emissions decreased to **3,784 tonnes CO₂-e**. These totals are an accumulative figure of PM&C's emissions sources, less any accredited carbon reduction or offset programs.

A press release by the Department of Climate Change in May 2009 titled Carbon Pollution Reduction Scheme (CPRS): *Support in managing the impact of the global recession*, priced the initial carbon cost at \$10.00 per tonne in 2011. If PM&C were to factor the cost of carbon emissions using this price, the total cost to the department would be **\$49,400** in 2008/09 and **\$37,840** for 2009/10.

A summary of PM&C's GHG emissions for each financial year are presented in Figures 1 and 2 on the following page.

Figure 1: PM&C's GHG Emissions by emissions source 2008/09

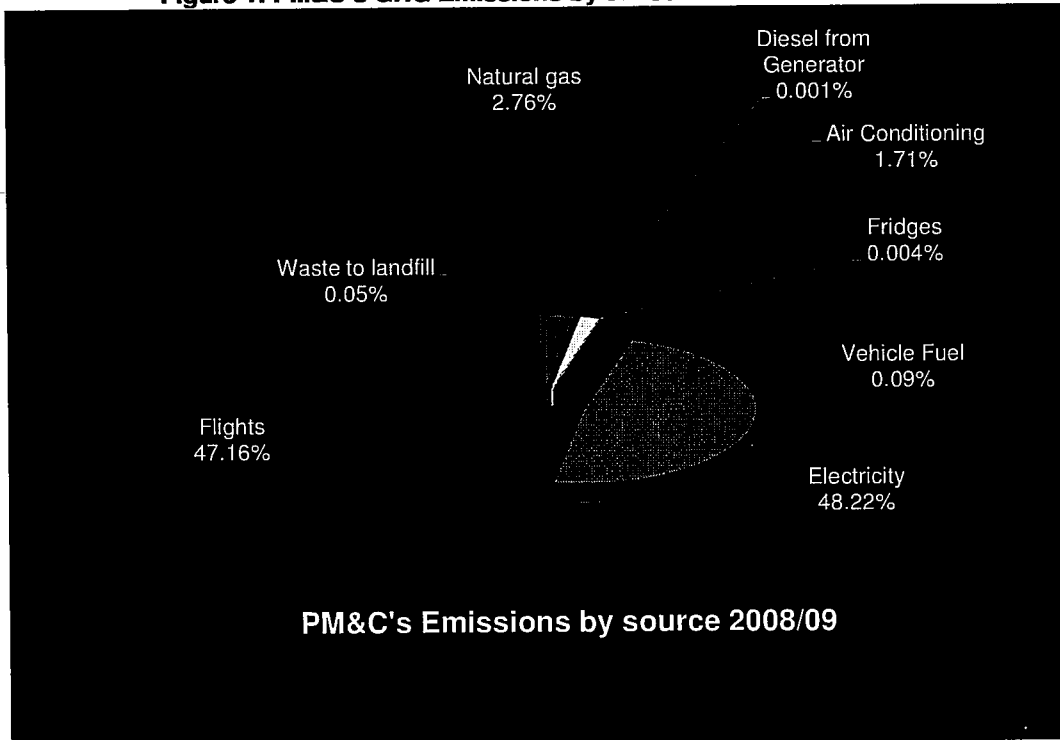
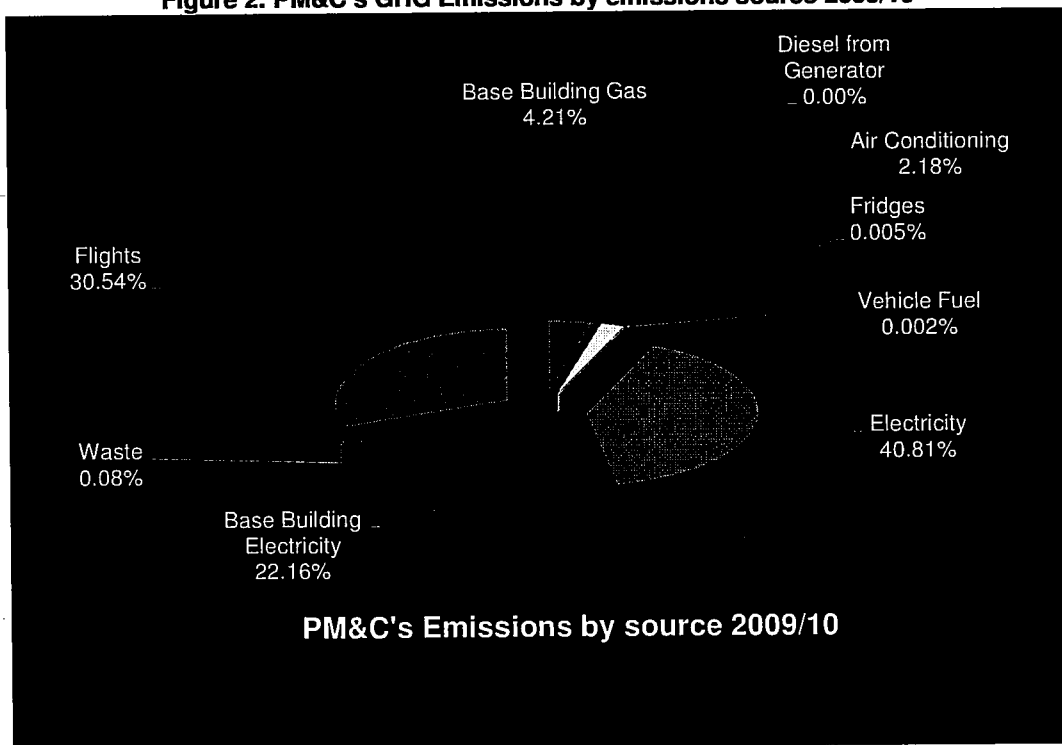


Figure 2: PM&C's GHG Emissions by emissions source 2009/10



1.2. Summary and Recommendations

Based on analysis of the data provided for the 2008/2009 and 2009/2010 financial years the following provide a summary of the key findings of the footprint report:

- Flights contributed 2,421 tonnes CO₂-e to PM&C's emissions in 2008/09. This decreased in 2009/10 to 1,230 tonnes CO₂-e, a decrease of 49%. The decrease is not attributed to a reduction in flights but due to the use of different emission factors in 2009/10 (Guidelines to DEFRA / DECC's Greenhouse Gas Conversion Factors for Company Reporting August 2010), compared to 2008/09 (IPCC radiative forcing index);
- Electricity consumption and supply together were the largest contributors to PM&C's total emissions: 48.22% in 2008/09 and 62.88% in 2009/10. This percentage includes base building electricity for both financial years;
- Emissions from electricity increased from 2,475 tonnes CO₂-e in 2008/09 to 2,537 tonnes CO₂-e in 2009/10, an increase of 3%. Total tonnes include base building electricity;

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- Emissions from base building gas increased from 141 tonnes CO₂-e in 2008/09 to 175 tonnes CO₂-e in 2009/10;
- Refrigerant emissions were static at 88 tonnes CO₂-e each financial year; and
- Waste to landfill emissions increased from 2.5 tonnes CO₂-e in 2008/09 to 3.4 tonnes in 2009/10.

The following recommendations are made in relation to ongoing measurement, management and reporting of PM&C's Carbon Footprint:

- Continue to implement cost-effective measures to minimise emissions from electricity and gas consumption i.e. green power and energy efficiency measures;
- Undertake Carbon Footprint audit in 2010/11, increasing the scope to the whole department (all organisational and operational control);
- Establish a longer-term Carbon Management Strategy with specific carbon reduction targets to transition PM&C to carbon neutral status; and
- Continue to file all documentation associated with energy consumption and products and services which produce GHG emissions.

2. INTRODUCTION

UGL Services was commissioned by PM&C to develop a carbon emissions (footprint) Report for the organisation's operations at 1 National Circuit Barton for the financial year 2009/10.

The purpose of this report is to establish PM&C's Carbon Footprint in accordance with the Greenhouse Gas (GHG) Protocol. This report documents a baseline from which PM&C can develop a strategy to address its carbon emissions performance.

The outcome of the measurement undertaken will be to better define PM&C's position in relation to establishing a carbon reduction target. This will allow PM&C to assess the feasibility of achieving carbon neutrality within a specific timeframe. The key initial element and precursor of any carbon neutral strategy, is the establishment of the Carbon Footprint.

3. BACKGROUND

3.1. Carbon Footprint

The main component in establishing an organisation's Carbon Footprint is to assemble a GHG inventory. The inventory identifies and documents the emission source and categorises it into the appropriate scope for GHG quantification.

A structured and well maintained GHG inventory can serve several business goals, including:

- Reducing input costs:
 - Avoiding or minimising energy use can reduce business costs
- Reducing business risks through exposure to:
 - Increasing energy costs
 - Possible future price on carbon
 - Other future regulation that may impose costs associated with compliance
- Building an organisations reputation:
 - Caring for the environment by reducing emissions
 - Recognition for early volunteer action
- Improving market opportunity:
 - Building capacity to succeed in a low carbon economy
 - Increasing customer loyalty

A GHG inventory will further benefit an organisation by allowing better understanding and management of their GHG risks. This will ensure the long-term success in a competitive business environment, and allow organisations to be prepared for future national or regional climate policies.

4. METHODOLOGY

4.1. The Greenhouse Gas Protocol

The GHG Protocol is the most widely recognised international accounting tool used by organisations to understand, quantify, and manage their greenhouse gas emissions. The GHG Protocol has been used as the key guidance for preparation of this report.

The GHG Protocol consists primarily of two separate but interrelated standards:

- **Corporate Accounting and Reporting Standards, Revised Edition (Corporate Standard):** methodologies for business and other organizations to inventory and report all of the GHG emissions they produce. ("Corporate," in this context, refers to both private and public sector organizations).
- **Project Accounting Protocol and Guidelines:** geared toward calculating reductions in GHG emissions from specific GHG-reduction projects. The Project Protocol is the most comprehensive, policy-neutral accounting tool for quantifying the greenhouse gas benefits of climate change mitigation projects.

The development of PM&C's Carbon Footprint report is generally consistent with the framework and methodologies outlined in the GHG Protocol for Corporate Accounting and Reporting Standard (Corporate Standard).

4.2. Boundary Definition

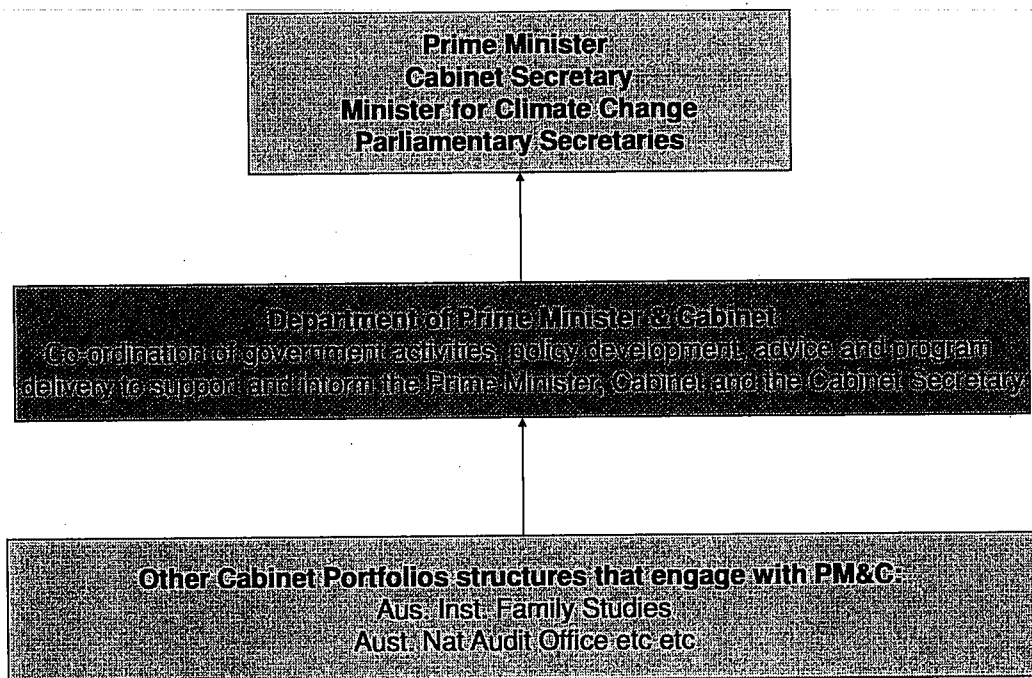
For effective GHG management, setting organisational and operational boundaries are important as they give organisations consistency and scope when accounting for their emissions for the following reasons:

- Organisational boundaries - allows a business to distinguish GHG emitting operations which are and are not attributed to their organisation.
- Operational boundaries - allows a business to identify emissions associated with its operations, categorising them as direct and indirect emissions (see 4.3)

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For the purposes of this report PM&C's operational boundaries are 1 National Circuit, Barton. All GHG emissions associated with PM&C's operations at this office are wholly accounted for within this document. A pictorial overview of PM&C's organisational boundaries (Figure 1) and operational boundaries (Figure 2) are provided on the following page:





-  Considered outside the organisational boundary as PM&C do not have the full authority to introduce and implement operating policies
-  PM&C have full authority to introduce and implement operating policies. Refer to Figure 2 for further detail relating to the operational boundary.

Figure 1 – Organisational Boundaries

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 Co-ordination of government activities, policy development, advice and program delivery to support and inform the Prime Minister, Cabinet and the Cabinet Secretary

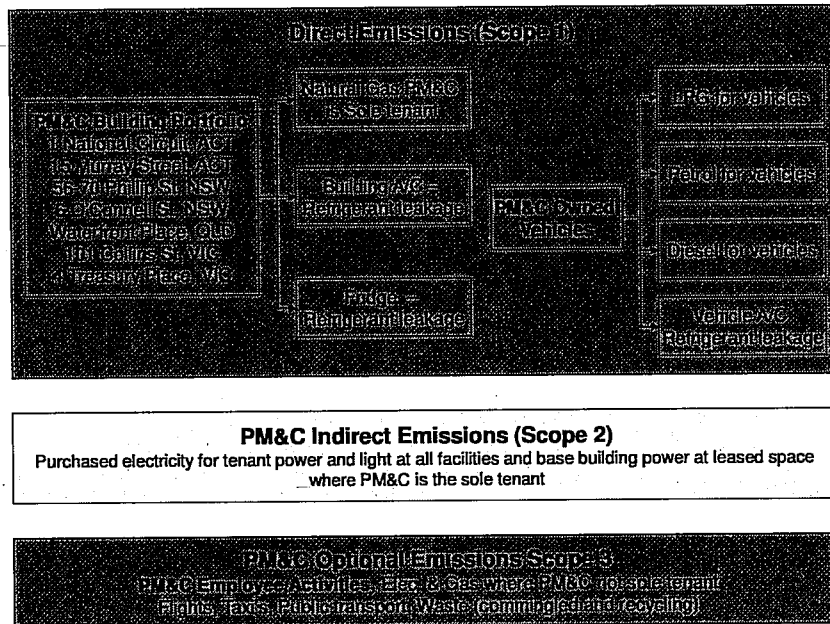


Figure 2 – Operational Boundaries

4.3. Scope of Emissions Sources

To help delineate direct and indirect emission sources, three 'scopes' (scope 1, 2 and 3) are defined for GHG accounting and reporting purposes, as follows:

- **Scope 1 (direct or point-source):** Emissions from a source that is owned or controlled by the organisation. For example: fuel use, energy use, manufacturing process activity, mining activity, on site waste disposal, etc.
- **Scope 2 (indirect):** Emissions from electricity (or steam or heating/cooling) that an organisation consumes but that is generated elsewhere. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station or facility.
- **Scope 3 (indirect):** Emissions that is a consequence of the activities of the business but occur from sources not owned or controlled by the business. Scope 3 is an optional reporting category. For example: extraction and production of purchased materials, transportation of purchased fuels, and the use of solid products and services.

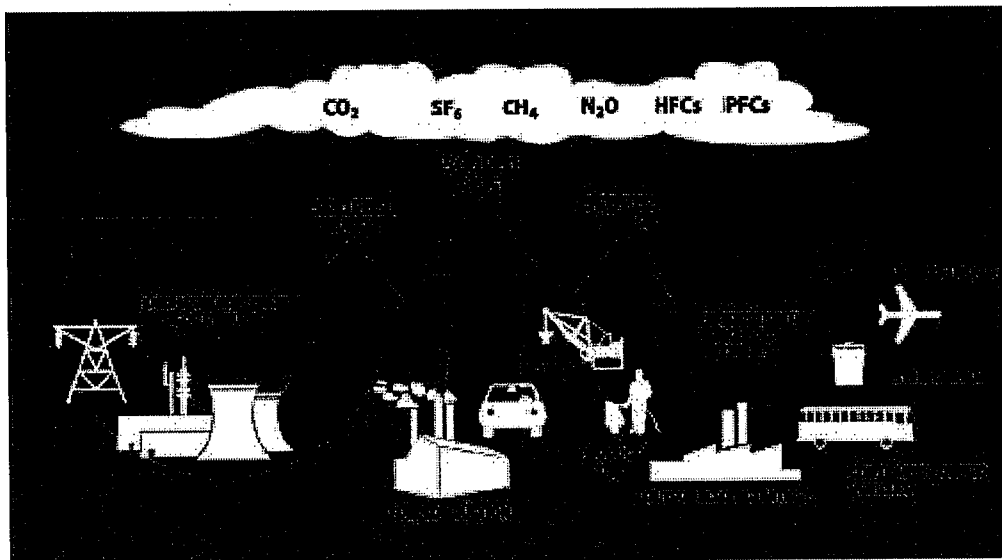


Figure 3: Scope of Emissions (Source: New Zealand business Council for Sustainable Development).

4.4. Reported Emissions

PM&C's buildings, stationary / non-stationary sources were used to measure and quantify total GHG emissions. Emissions reported for PM&C are as follows:

Scope 1:

- Diesel for back-up diesel generators;
- Air-Conditioner and Refrigerator leakage; and
- Petrol for Vehicles.

Scope 2:

- Electricity from Tennant light and power (TL & P).

Scope 3:

- Airline travel (Flights);
- Electricity from Tennant light and power (TL & P);
- Electricity from Base Building;
- General waste to landfill;
- Natural gas for Base Building;
- Petrol for vehicles;
- Diesel for back-up diesel generators; and
- Kitchen and laboratory refrigerant leakage.

Reduction Measures:

- Purchase of accredited green power.

4.5. GHG Analysis

All emissions calculated in this report have been expressed in tonnes of CO₂-e (carbon dioxide-equivalent). Tonnes of CO₂-e encompass the six greenhouse gases listed in the Kyoto Protocol - carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and Sulfur hexafluoride (SF₆).

The following documents were used throughout this document to assist calculation of PM&C's emissions:

- **National Greenhouse Accounts Factors, July 2010:** The NGA Factors has been prepared by the Department of Climate Change and replaces National Greenhouse Accounts Factors, June 2009
- **(Guidelines to DEFRA / DECC's Greenhouse Gas Conversion Factors for Company Reporting August 2010).** Used to calculate GHG emissions for Air Travel for 2009/10 financial year.
- **EPA Victoria's Greenhouse Gas Inventory Management Plan, December 2007:** The Environmental Protection Authority (EPA) Victoria's Greenhouse Gas Inventory Management plan was also used to calculate GHG emissions for Air Travel and waste to landfill. This document reflects the steps the EPA followed in their 2006-07 baseline GHG inventory.
- **J.M.Calm & G.C. Houranhan "Refrigerant Data Summary", Engineered Systems, November 2001:** The Refrigerant Data Summary prepared by J.M. Calm & G.C. Houranhan was used to identify the Global Warming Potential (GWP) of each refrigerant used within PM&C's operations.

CARBON FOOTPRINT

4.6. Emission Portfolio

Based on the information obtained during the assessment process, PM&C's net GHG emissions for the 2008/09 financial period were calculated to be **4,940** tonnes carbon dioxide equivalents (CO₂-e). In 2009/10 PM&C's net emissions increased to **3,784** tonnes CO₂-e. These totals are an accumulative figure of PM&C's emissions sources, less any accredited Carbon reduction or offset programs.

A press release by the Department of Climate Change in May 2009 titled Carbon Pollution Reduction Scheme (CPRS): *Support in managing the impact of the global recession*, priced the initial carbon cost at \$10.00 per tonne in 2011. If PM&C were to factor the cost of carbon emissions using this price, the total cost to the department would be **\$49,400** in 2008/09 and **\$37,840** for 2009/10.

Tables 1 and 2 on the following page provide a detailed summary of PM&C's emissions over the two financial years.

Further information on the calculation procedures can be found in the relevant appendix (referenced far right of the table).

Appendix content:

- How key activity data was sourced;
- The emissions factor for each emissions source; and
- Rationale and methodology for quantifying total emissions.

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Emission Source	Consumption Units	Consumption	CO ₂ e (tonnes)	Percentage of Total Inventory	Calculation Methodology (Appendix #)
Direct emissions (Scope 1)					
Natural gas at leased space where PM&C is the sole tenant	GJ	2093.97	107.48	2.093%	Appendix A
Automotive diesel oil (ADO) for back-up diesel generators at leased space where PM&C is sole tenant	kL	0.19	0.0133	0.0003%	Appendix B
Building airconditioner (A/C) refrigerant leakage at leased space where PM&C is the sole tenant	kg	761.00	87.92	1.712%	Appendix C
Kitchen and laboratory refrigerator refrigerant leakage	kg	29.06	0.20	0.004%	Appendix C
Petrol for vehicles	kL	1.97	4.12	0.080%	Appendix D
Total Scope 1					
Indirect emissions (Scope 2)					
Purchased electricity for tenant power and light at all facilities and base building power at leased space where PM&C is the sole tenant	kWh	2313968.90	2059.43	40.108%	Appendix E
Total Scope 2					
Optional emissions included (Scope 3)					
Flights	km	7,338,655.31	2421.77	47.164%	Appendix F
Municipal solid waste (generic) to landfill	tonnes	2.88	2.56	0.050%	Appendix G
Emissions from fuel extraction and transmission & distribution line losses for all purchased electricity	kWh	2313968.90	416.51	8.112%	Appendix H
Emissions from fuel extraction for natural gas	GJ	2093.97	34.34	0.669%	Appendix H
Emissions from fuel extraction for petrol	kL	1.97	0.38	0.007%	Appendix H
Emissions from fuel extraction for ADO	kL	0.19	0.0390	0.001%	Appendix H
Scope 1			199.73	3.890%	
Scope 1 + 2			2259.16	43.997%	
SCOPE 1 + 2 + 3			5134.77	100.000%	
Reduction measures					
Accredited Green Power	kWh	218593.30	-195	-3.789%	Appendix I
NET EMISSIONS			4940.23		

Table 1: PM&C carbon emissions for the 2008/2009 period

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Emission Source	Consumption Units	Consumption	CO ₂ -e (tonnes)	Percentage of Total Inventory	Calculation Methodology (Appendix #)
Direct emissions (Scope 1)					
Building airconditioner (A/C) refrigerant leakage-Base Building	kg	763.00	88.02	2.18%	Appendix A
Petrol for vehicles-Unleaded	kL	0.03	0.07	0.002%	Appendix B
Petrol for vehicles-Ethanol	kL	1.94	0.0181	0.000%	Appendix B
Automotive diesel oil (ADO) for back-up diesel generators at leased space where PM&C is sole tenant	kL	0.00	0.00	0.00%	Appendix C
Total Scope 1		764.97	88.11	2.19%	
Indirect emissions (Scope 2)					
Purchased electricity for tenant power and light at all facilities and base building power at leased space where PM&C is the sole tenant	kWh	1,536,850.00	1,383.17	34.32%	Appendix D
Total Scope 2		1,536,850.00	1,383.17	34.32%	
Optional emissions included (Scope 3)					
Flights	km	7,386,116.47	1,230.78	30.54%	Appendix E
Emissions from fuel extraction and transmission & distribution line losses for purchased electricity - Tenant Light & Power	kWh	1,536,850.00	261.26	6.48%	Appendix F
Emissions from fuel extraction and transmission & distribution line losses for purchased electricity - Base Building	kWh	834,712.00	893.14	22.16%	Appendix G
Natural gas -Base Building	GJ	2,591.52	169.82	4.21%	Appendix H
Municipal solid waste (generic) to landfill	tn	3.93	3.37	0.0837%	Appendix I
Petrol for vehicles-Unleaded	kL	0.03	0.0058	0.0001%	Appendix J
Petrol for vehicles-Ethanol	kL	1.94	0.00	0.0000%	Appendix J
Kitchen and laboratory refrigerator refrigerant leakage	kg	29.45	0.20	0.0049%	Appendix K
Automotive diesel oil (ADO) for back-up diesel generators at leased space where PM&C is sole tenant	kL	0.00	0.00	0.0000%	Appendix L
Total Scope 3		9,760,305.34	2,558.59	63.49%	
Scope 1 + 2		1,537,614.97	1,471.28	36.509%	
SCOPE 1 + 2 + 3		11,297,920.31	4,029.87	100.000%	
Reduction measures					
Accredited Green Power Tenant Light & Power	kWh	153,685	-164		Appendix M
Accredited Green Power Base Building	kWh	75,996	-81		
			-245.76		
NET EMISSIONS			3,784.11		

Table 2: PM&C carbon emissions for the 2009/2010 period

Appendix A

Scope 1: Refrigerants from air conditioners – base building

Checklist for refrigerants from air conditioners – base building
Data source: Kilograms (kg) of recharge capacity and type of refrigerant for each refrigeration mechanism obtained from the landlord.
Key emissions factors: Default HFC loss rates from: Commercial air conditioning (chillers): 0.09 per annum (NGA Factors 2009, p40) Global Warming Potentials (GWPs) of refrigerants used: 134a = 1300 22 = 1700 410a = 1725 (JMC Refrigerant Data Summary 2001)
Methodology guidance: GHG Protocol, 2005

PM&C's Air Conditioning systems are maintained by the landlord, Knight Frank as part of base building operations.

Knight Frank provided each system's model and description information. Within this information the number of chillers/units, the refrigerant type used and oil charge (kg) were obtained. There were no other refrigeration sources within the base building.

Total GHG emissions were then calculated by using the default annual leakage rate for commercial chillers and the global warming potential (GWP) for each refrigerant. The formula used to calculate total GHG emissions is presented below:

$$GHG = C * L * GWP$$

Where:

GHG = emissions from refrigerants (kg CO₂-e)

C = refrigerant recharge capacity (kg)

L = Default annual leakage rate of gas (j)

GWP = global warming potential of refrigerant

Table A1 over page presents total GHG emissions from PM&C's base building and is for financial years 2008/09 and 2009/10.

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Year	Building scope	Refrigeration	Refrigerant Type	Total Charge capacity (kg)	Leakage Rate	GWP	Tonnes CO2-e	TOTAL Tonnes CO2-e per annum
2008/09	Base Building	Chillers x 4	134a	744.0	0.09	1300	87.0	87.9
	Base Building	Computer AC units x 3	22	12.0	0.03	1700	0.6	
	Base Building	AC Units x 2	410a	5.0	0.03	1725	0.3	
2009/10	Base Building	Chillers x 4	134a	744.0	0.09	1300	87.0	88.02
	Base Building	Computer AC units x 3	22	12.0	0.03	1700	0.6	
	Base Building	AC Units x 2	410a	5.0	0.03	1725	0.3	
	Base Building	PAC Unit Tele Room Installed Jan 2010	410a	2.0	0.03	1725	0.1	

Table A1 Refrigerant GHG Emissions for PM&C's base building

Appendix B
Scope 1: Fuel from vehicles

Checklist for fuel from vehicles	
Data source:	Pool vehicle kilolitres (KL) fuel consumption provided by LeasePlan
Key emissions factors:	Gasoline (other than for use in an aircraft): 66.92kg CO ₂ -e /GJ (NGA Factors 2009, p17) Ethanol (other than for use in an aircraft): 0.4kg CO ₂ -e /GJ (NGA Factors 2009, p17)
Key methodology guidance:	GHG Protocol, 2005

PM&C lease vehicles from LeasePlan for use within their operations at 1 National Circuit. LeasePlan provide monthly fuel consumption reports to PM&C. UGL Services has used this information to calculate fuel emissions produced from vehicles.

PM&C used either Gasoline (Unleaded) or Ethanol in their vehicles, with Ethanol being the majority of fuel consumed.

Under the NGA factors, unleaded has an energy content factor of 34.2 GJ/KL and 66.92kg CO₂-e /GJ whilst Ethanol's energy content factors are 23.4GJ/KL and 0.4kg CO₂-e /GJ.

Fuel type	GJ/KL	kg CO ₂ -e/GJ
Gasoline (unleaded)	34.2	66.92
Ethanol	23.4	0.4

Table B1: Energy Content factors

PM&C's emissions from Vehicles were calculated using the following formula:

$$E = F * Ec$$

$$GHG = E * Fe$$

Where:

E = Energy consumed by vehicle fuel (GJ)
GHG = emissions from vehicle fuel (kg CO₂-e)
F = Fuel consumption (kL)
Fe = Fuel emission factor (kg CO₂-e/GJ)
Ec = Energy Content Factor (GJ/kL)

PM&C's emissions from vehicles for financial years 2008/09 and 2009/10 are presented in Table B2 over page.

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Year	Fuel type	KL	GJ	Tonnes CO2-e	Total Tonnes CO2-e
2008/09	Gasoline (Unleaded)	0.03	1.1	0.073	3.941
	E10	1.9	64.2	3.9	
2009/10	Gasoline (Unleaded)	0.03	1.1	0.073	0.091
	E10	1.9	64.2	0.018	

Table B2: KL consumed and final emissions

Appendix C

Scope 1: Diesel from back-up generator

Figure 2: Checklist for diesel generator

Data source: KL from bills received from diesel supplier
Key emissions factors: Diesel for stationary energy purposes: 69.5kg CO ₂ -e /GJ (NGA Factors 2009, p15)
Key methodology guidance: GHG Protocol, 2005

PM&C's generator is used as back-up to mains power sources. The back-up generator receives monthly maintenance checks by licensed contractors including dip-testing of fuel levels. The generator has required refuelling once in the past two years.

The Automatic Diesel Oil (Diesel) consumed was measured by totalling the amount to re-fill the tank. This information was provided by PM&C's diesel supplier. There was no consumption recorded in the FY 09/10.

Emissions from the diesel generator were calculated by first converting KL to GJ, then using a 69.5kg CO₂-e /GJ emissions factor (NGA Factors 2009, p15). The formula for calculating total emissions from the diesel generator is below:

$$E = De * ECF$$

$$GHG = E * D / 1,000$$

Where:

E = Energy use from diesel (GJ)
GHG = emissions from diesel (tCO₂-e)
D = emission factor for diesel (kg CO₂-e/GJ)
De = tenant diesel use (kL)
ECF = Energy content factor for diesel (GJ/ kL)

Total consumption and emissions calculation for PM&C's back-up generator is presented in the following Table C1:

Diesel consumed by back-up generator	KL	Diesel GJ (38.6GJ/KL)	Emissions factor kg CO ₂ -e/kWh Scope 1	Tonnes CO ₂ -e Scope 1
2008/09	0.19	7.4	69.5	0.013
2009/10	0.00	0.0	69.5	0

Table C1 Emissions from back-up generator

Appendix D

Scope 2: Electricity from tenant light and power

Checklist for TL&P Electricity and energy from base building	
Data source:	TL&P consumption (kWh) from UGL Services Environmental Reporting System
Key emissions factors:	Indirect (scope 2) emissions factors for consumption of purchased electricity from the grid (NSW & ACT): 0.89kg CO ₂ -e /kWh (NGA Factors 2009, p19)
Key methodology guidance:	GHG Protocol 2005

PM&C's Electricity from TL&P and base building were the only emissions sources under Scope 2.

PM&C's Electricity from tenancy and base building were derived from different sources. PM&C's TL&P electricity consumption was obtained from UGL Services' Environmental Reporting System (ERS) which captures PM&C's TL&P consumption from electricity bills.

All PM&C's operations at 1 National Circuit occur within the ACT. Therefore, a factor of 0.89kg CO₂-e/kWh was applied for consumption of indirect electricity purchased from the grid within NSW and ACT. The total kg of CO₂-e was converted into tonnes by dividing by a factor of one thousand. The formula used to calculate PM&C's emissions from scope 2 energy is below:

GHG = Te * E / 1,000	
Where:	
GHG = Emissions from electricity use in facilities under operational control (tCO ₂ -e)	
Te = total electricity consumption under operational control (kWh)	
E = scope 2 electricity emissions factor (kgCO ₂ -e/kWh)	

PM&C's electricity emissions for tenancy and base building for 2008/09 and 2009/10 are presented in Table D1:

Year	Electricity type	Electricity kWh	Emissions factor kg CO ₂ -e/kWh- Scope 2	Tonnes pa CO ₂ -e Scope 2
2008/09	TL & P	1,440,933	0.89	1282.4
2009/10	TL & P	1,536,850	0.9	1383.2

Table D1 Emissions from Electricity (Tenant light and power)

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Appendix E
Scope 3: Airline travel

Checklist for Airline travel
Data source: Kilometres (km) travelled by PM&C staff
Key emissions factors: Domestic Flights Short Haul (less than 1200km): 0.17283 kg CO ₂ /km/person Domestic Flights Long Haul (greater than 1200km) 0.09457 kg CO ₂ /km/person International Flights Short Haul (less than 3700km): 0.14186 kg CO ₂ /km/person International Flights Long Haul (greater than 3700km) 0.23988 kg CO ₂ /km/person (DEFRA)
Key methodology guidance: GHG Protocol, 2005

PM&C provided the total distance of passenger travel direct to UGL Services. Total travel was then divided into Domestic Flights Short Haul (less than 1200km): 0.17283 kg CO₂/km/person, Domestic Flights Long Haul (greater than 1200km) 0.09457 kg CO₂/km/person, International Flights Short Haul (less than 3700km): 0.14186 kg CO₂/km/person, International Flights Long Haul (greater than 3700km) 0.23988 kg CO₂/km/person.

The GHG emissions are calculated by applying the passenger km to the emissions factor that is associated to that particular flight category.

The formula for calculating GHG emissions from PM&C's air travel is provided as follows:

GHG = K * E / 1,000	
Where:	
GHG = emissions from air travel (tCO ₂ -e)	
K = km travelled on a flight	
E = emissions factor for flight (kg CO ₂ -e/km)	

Table E1 provides the emissions factors for types of flights whilst Table E2 over page provides the resultant Tonnes of CO₂-e produced for 2008/09 and table E3 for 2009/10

Type of flight	Distance	Emissions factor kg CO ₂ -e/km
Domestic Flights Short Haul	<1200km	0.17
Domestic Flights Long Haul	≥1200km	0.09
International Flights Short Haul	<3700km	0.14
International Flights Long Haul	≥3700km	0.24

Table E1 Emissions Factors

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Year	Flight type	Total (km)	IPCC Radiative Forcing Index	Tonnes CO ₂ -e	Total Tonnes CO ₂ -e
2008/09	Short-haul	4485067.9	2.7	1574.3	2421.8
	Long-haul	2853587.4	2.7	847.5	

Table E2 Total tonnes CO₂-e from Air Travel 2008/09

Type of flight	Distance	Emissions factor kg CO ₂ -e/km	Km travelled	Tonnes CO ₂ -e	Total tonnes CO ₂ -e
Domestic Flights Short Haul	<1200km	0.17	2,457,087	424.66	1,231
Domestic Flights Long Haul	≥1200km	0.09	2,413,882	228.28	
International Flights Short Haul	<3700km	0.14	260,031	36.89	
International Flights Long Haul	≥3700km	0.24	2,255,116	540.96	

Table E3 Total tonnes CO₂-e from Air travel 2009/10

Appendix F

Scope 3: Electricity transmission and distribution losses for tenant light and power

Electricity transmission and distribution losses for tenant light and power	
Data source:	Based kWh data collected for electricity
Key emissions factors:	Latest estimate of NSW & ACT emissions factors for consumption of purchased electricity scope 3: 0.18 kg CO ₂ -e /kWh (NGA Factors 2009, p59)
Key methodology guidance:	GHG Protocol 2005

Emissions factors from electricity line losses are based on NGA's emissions factors and PM&C's annual consumption of electricity for TL&P

$$GHG = Te * E / 1000$$

Where:

GHG = Emissions from electricity transmission and distribution (tCO₂-e)

Te = total electricity consumption (GJ)

E = scope 3 electricity emissions factor (kgCO₂-e/GJ)

Table F1 shows emissions from fuel extraction and transmission & distribution line losses for all purchased electricity in 2008/09 and 2009/10.

Year	Electricity type	Electricity kWh	Emissions factor kg CO ₂ -e/kWh- Scope 3	Tonnes pa CO ₂ -e Scope 3
2008/09	TL & P	1,440,933	0.18	259.37
2009/10	TL & P	1,536,850	0.17	261.26

Table F1 Electricity transmission and distribution losses for tenant light and power

Appendix G

Scope 3 and 2: (Full Fuel Cycle) Electricity from base building

Checklist for electricity from base building	
Data source:	Base building Consumption bills from Knight Frank.
Key emissions factors:	Indirect (scope 2) emissions factors for consumption of purchased electricity from the grid (NSW & ACT): 0.89kg CO ₂ -e /kWh (NGA Factors 2009, p19) Latest estimate of NSW & ACT emissions factors for consumption of purchased electricity scope 3: 0.18 kg CO ₂ -e /kWh (NGA Factors 2009, p59)
Key methodology guidance:	GHG Protocol 2005

PM&C's Electricity from base building was derived from the landlord, Knight Frank who provided monthly electricity bills.

All PM&C's operations at 1 National Circuit occur within the ACT. Therefore, a factor of 0.89kg CO₂-e/kWh for Scope 2 and 0.18kg CO₂-e/kWh for Scope 3 was applied for consumption of indirect electricity purchased from the grid within NSW & ACT. Although base building electricity is classified as Scope 3, carbon accounting principles state that Scope 2 emissions must be also taken into account to capture the full fuel cycle. The total kg of CO₂-e was converted into tonnes by dividing by a factor of one thousand. The formula used to calculate PM&C's emissions from scope 2 and 3 energy is below:

$$GHG = Te * E / 1000$$

Where:

GHG = Emissions from electricity transmission and distribution (tCO₂-e)

Te = total electricity consumption (GJ)

E = scope 3 electricity emissions factor (kgCO₂-e/GJ)

PM&C's electricity emissions for tenancy and base building for 2008/09 and 2009/10 are presented in Table G1

Year	Electricity type	Electricity kWh	Emissions factor kg CO ₂ -e/kWh Scope 2	Emissions factor kg CO ₂ -e/kWh Scope 3	Tonnes CO ₂ -e Scope 2	Tonnes CO ₂ -e Scope 3	Full Cycle Emissions Scope 1 & 3 Tonnes CO ₂ -e
2008/09	Base Building	873,036	0.89	0.18	777.00	157.15	934.15
2009/10	Base Building	834,712	0.90	0.17	751.24	141.90	893.14

Table G1 Electricity from base building - Full Fuel Cycle

Appendix H

Scope 3 and 1: (Full Fuel Cycle) natural gas for base building

Checklist for natural gas for base building
Data source: GJ from utility bills provided by the landlord.
Key emissions factors: Natural Gas distributed in a pipeline: 51.33kg CO ₂ -e /GJ (NGA Factors 2009, p13)
Key methodology guidance: GHG Protocol, 2005

PM&C consume natural gas through operation of an air-conditioning system. The system is maintained by the landlord, Knight Frank. As the gas falls under base building operations, emissions fall under indirect emissions sources (Scope 3). Although base building gas is classified as Scope 3, carbon accounting principles state that Scope 1 emissions must be also taken into account to capture the full fuel cycle.

PM&C's natural gas consumption data was obtained from Knight Frank for the financial years 2008/09 and 2009/10.

To calculate PM&C's emissions from natural gas, the Gigajoule (GJ) consumption for each financial year was multiplied by the emissions factor for natural gas distributed in a pipeline, 51.33kg CO₂-e /GJ Scope 1 and 14.2kg CO₂-e Scope 3. (NGA Factors 2009, p13). The formula used is below:

$$\text{GHG} = \text{Ge} * \text{G} / 1000$$

Where:

GHG = emissions from natural gas base building (tCO₂-e)

Ge = annual total natural gas consumption base building (GJ)

G = scope 1 emissions factor for natural gas base building (kgCO₂-e/GJ)

$$\text{GHG} = \text{Tg} * \text{E} / 1,000$$

Where:

GHG = Emissions from gas transmission and distribution (tCO₂-e)

Tg = total gas consumption base building (GJ)

E = scope 3 gas emissions factor (kgCO₂-e/GJ)

PM&C's emissions from natural gas consumption for 2008/09 and 2009/10 are in Table H1 below:

Base building gas consumption	GJ	Emissions factor kg CO ₂ -e/kWh	Emissions factor kg CO ₂ -e/kWh	Tonnes CO ₂ -e Scope 1	Tonnes CO ₂ -e Scope 3	Full Cycle Emissions Scope 1 & 3 Tonnes pa CO ₂ -e
2008/09	2,094	51.33	16.40	107.48	34.34	141.82
2009/10	2,592	51.33	14.20	133.02	36.80	169.82

Table H1 Emissions from natural gas for base building

Appendix I
Scope 3: Waste

Checklist for waste
Data source: Kilograms (kg) of waste production provided by PM&C
Key emissions factors: General solid waste: 1.1 tonnes CO ₂ -e per tonne waste (AGO, 2006 p22) Methane capture rate at Australian landfills in 2005: 22.2% (AGO, 2006)
Key methodology guidance: GHG Protocol 2005

PM&C provided all waste data for the two financial years. The monthly totals for each waste stream were measured in kilograms (kg). PM&C's recycling rate at 1 National Circuit is 95.74% of all waste produced, leaving 4.26% general solid waste diverted to landfill.

UGL Services applied the methane conversion factor for General mixed waste and discounted the aggregate methane calculation by the methane capture rate at Australian landfills (AGO, 2006).

The following formula was used to calculate PM&C's total emissions from waste sent to landfill.

$GE = (1 - R) \times (W \times P \times EF)$	
Where:	
GE = PM&C's total emissions from waste to landfill	
R = annual methane recovery rate at Australian landfills in 2005 = 22%	
W = total waste sent to landfill in each year (tonnes)	
P = proportion of waste sent to landfill that is general waste = 100%	
EF = annual methane conversion factor per tonne of general waste = 1.1	

Table I1 below displays PM&C's total emissions from waste to landfill.

Year	Waste stream	Tonnes	Annual methane recovery rate	Methane Conversion Factor	General waste to landfill	Tonnes CO2-e
2008/09	General Mixed	2.88	22%	1.14	100%	2.56
2009/10	General Mixed	3.93	22%	1.10	100%	3.37

Table I1 Emissions from waste to landfill

Appendix J
Scope 3: Petrol for vehicles – unleaded/ethanol

Checklist for unleaded/ethanol
Data source: Based on KL data collected for fuels
Key emissions factors: Scope 3 emissions factors for Gasoline (unleaded petrol) other than for use in an aircraft: 5.3kg CO ₂ -e /GJ (NGA Factors 2009, p58) Scope 3 emissions for Ethanol are currently 0
Key methodology guidance: GHG Protocol 2005

Emissions factors from fuel extraction are based on NGA's emissions factors and PM&C's annual consumption of unleaded/ethanol. The formula used to calculate the emissions factors for each is below:

$$GHG = Td * E / 1,000$$

Where:

GHG = Emissions from fuel transmission and distribution (tCO₂-e)

Td = total fuel consumption (GJ)

E = scope 3 fuel emissions factor (kgCO₂-e/GJ)

PM&C's total GHG emissions from unleaded/ethanol is presented in the following table J1 for the years 2008/09 and 2009/10.

Year	Fuel Type and unit of measurement	Total Fuel Consumption	Conversion to GJ (if required)	Emissions factor for extraction, transmission, line loss	GHG Emissions t CO ₂ -e	Total emissions t CO ₂ -e
2008/09	Unleaded (KL)	0.03	1.09	5.3kg CO ₂ -e/GJ	0.01	0.35
	E10	1.94	64.18	5.3kg CO ₂ -e/GJ	0.34	
2009/10	Unleaded (KL)	0.03	1.09	5.3kg CO ₂ -e/GJ	0.01	0.01
2009/10	E10	1.94	0.00	5.3kg CO ₂ -e/GJ	0.00	

Table J1 Emissions from unleaded/ethanol

Appendix K

Scope 3: Kitchen and laboratory refrigerator refrigerant leakage

Checklist for kitchen and laboratory refrigerator refrigerant leakage
Data source: Kilograms (kg) of recharge capacity and type of refrigerant for each refrigeration mechanism from PM&C.
Key emissions factors: Default HFC loss rates from: Domestic refrigeration: 0.03 per annum (AGO Factors, 2006, p20) Global Warming Potentials (GWPs) of refrigerants used: 134a = 1300 600a = 20 Nh3 = 0 (JMC Refrigerant Data Summary 2001)
Key methodology guidance: GHG Protocol 2005

PM&C provided tenancy refrigeration which consisted of fridges only. As with base building refrigeration, the number of refrigeration units, refrigerant type and oil charge were identified.

Total GHG emissions were then calculated by using the default annual leakage rate for domestic refrigeration and the global warming potential (GWP) for each refrigerant. The formula used to calculate total GHG emissions is presented below:

GHG = C * L * GWP	
Where:	
GHG = emissions from refrigerants (kg CO ₂ -e)	
C = refrigerant recharge capacity (kg)	
L = Default annual leakage rate of gas (j)	
GWP = global warming potential of refrigerant	

Table K1 presents total GHG emissions from PM&C's tenancy for financial years 2008/09 and 2009/10.

Year	Building scope	Refrigeration	Refrigerant type	Total charge capacity (kg)	Leakage rate	GWP	Tonnes CO ₂ -e	Total t CO ₂ -e per annum
2008/09	Tenancy	Fridges	134a	5.00	0.03	1300	0.2	0.2
	Tenancy	Fridges	600a	0.44	0.03	20	0.0	
	Tenancy	Fridges	NH3	23.63	0.03	0	0.0	
2009/10	Tenancy	Fridges	134a	5.02	0.03	1300	0.2	0.2
	Tenancy	Fridges	600a	0.41	0.03	20	0.0	
	Tenancy	Fridges	NH3	24.02	0.03	0	0.0	

Table K1 Emissions from kitchen and laboratory refrigerator refrigerant leakage

Appendix L

Scope 3: Diesel from back-up generator

Checklist for diesel from back-up generator
Data source: Based on KL data collected for fuels
Key emissions factors: Scope 3 emissions factors for Diesel Oil: 5.3kg CO ₂ -e /GJ (NGA Factors 2009, p58)
Key methodology guidance: GHG Protocol 2005

Emissions factors from fuel extraction are based on NGA's emissions factors and PM&C's annual consumption of diesel. The formula used to calculate the emissions factors is below:

$E = De * ECF$ $GHG = E * D / 1,000$ <p>Where:</p> <p>E = Energy use from diesel (GJ)</p> <p>GHG = emissions from diesel (tCO₂-e)</p> <p>D = Scope 3 emission factor for diesel (kg CO₂-e/GJ)</p> <p>De = tenant diesel use (kL)</p> <p>ECF = Energy content factor for diesel (GJ/ kL)</p>

PM&C's total GHG emissions from diesel are presented in the following table L1 for years 2008/09 and 2009/10.

Diesel consumed by back-up Generator	KL	Diesel GJ (38.6GJ/KL)	Emissions factor kg CO ₂ -e/kWh Scope 3	Tonnes CO ₂ -e Scope 3
2008/09	0.19	7.4	5.3	0.039
2009/10	0.00	0.0	5.3	0

Table L1 Emissions from back-up generator

Appendix M

Accredited green power for tenancy and base building

Checklist for accredited green power
Data source: kWh of purchased Green Power electricity from invoices provided by PM&C and Knight Frank.
Key emissions factors: Latest estimate of NSW and ACT emissions factors for consumption of purchased electricity scope 2: 0.89 kg CO ₂ -e /kWh and Scope 3: 0.18 kg CO ₂ -e /kWh (NGA Factors 2009, p59)
Key methodology guidance: GHG Protocol 2005;

PM&C and the Landlord, Knight Frank both purchased accredited green power electricity over the years 2008/09 and 2009/10. PM&C purchased 10% of TL&P electricity from green power. Knight Frank purchased 6,333 kWh green power per month for the base building for the FY 2009/10.

PM&C purchased their green power through ACTEW AGL whilst Knight Frank's purchases came from Origin Energy. Both retailers are accredited green power suppliers.

As green power displaces the use of electricity from fossil fuels, emissions from electricity consumption are deducted using the same emissions factor used in Scope 2 (0.89kg CO₂-e /kWh) and Scope 3 (0.18 kg CO₂-e /kWh). The following formula was used to calculate total emissions avoided through purchasing green power.

$$GHG = Te * E * target / 1,000$$

Where:

GHG = emissions avoided by the use of renewable energy (tCO₂-e)

Te = PM&C's total electricity use (kWh)

E = electricity emissions factor (kgCO₂-e/kWh)

Green power consumption and emissions avoided for the years 2008/09 and 2009/10 are presented in Table M1 below:

Year	Electricity type	Greenpower kWh	Emissions factor kg CO ₂ -e/kWh Scope 2	Emissions factor kg CO ₂ -e/kWh Scope 3	Tonnes pa CO ₂ -e Scope 2	Tonnes CO ₂ -e Scope 3	Full Cycle Emissions Scope 2 & 3 Tonnes pa CO ₂ -e
2008/09	TL & P	144,093	-0.89		-194.55		-194.55
	Base Building	74,500	-0.89				
2009/10	TL & P	153,685	-0.90	-0.17	-138.32	-26.13	-245.76
	Base Building	75,996	-0.90	-0.17	-68.40	-12.92	

Table M1 Emissions avoided from consumption of green power