EPA Victoria's greenhouse gas inventory management plan: 2012–13 update

Protocol for environmental management

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1 The purpose of this document

EPA's Greenhouse Gas Inventory Management Plan outlines the steps undertaken as part of the 2012–13 annual greenhouse gas (GHG) inventory. EPA has made this document public and transparent. While it will serve as an internal guide for future inventories, it is not intended to serve as a manual for other organisations.

This document includes the following topics:

Section	Subject	Content
Section 1	Introduction	Summarises EPA's carbon neutral strategy, the protocol followed for GHG inventories and the external assurance of the Strategy and GHG inventory for 2012–13. Includes major updates to inventory boundaries, data management or quantification methods.
Section 2	Boundaries	Describes the inventory boundaries, including which parts of the organisation and sources are covered in the inventory.
Section 3	Methodology	Outlines the sources of activity data and quantification methods (including equations and emissions factors) for each inventory item, as well as recommended tasks to improve the item in the future.
Section4	Reduction Measures	Discusses reduction measures, including onsite reductions and offset product purchases to neutralise emissions.
Section 5	Process Management	Outlines roles and responsibilities of EPA staff in the inventory process.
Section 6	Assurance and Verification	Summarises EPA's carbon neutral strategy assurance and inventory verification process.
Section 7	References	Documents sourced for the development of this document.

1.1 GHG inventory – A Component of EPA's carbon neutral strategy

EPA Victoria achieved 'carbon neutrality' for the first time for the financial year 2005–06 and pledged to remain carbon neutral every year until 2010. Following evaluation of the carbon neutral strategy, EPA again pursued a carbon neutral status in 2010-11, 2011-12 and 2012-13.

During this process EPA developed the Carbon Management Principles (see Figure 1), a step-by-step decision-making framework to guide the carbon neutral strategy. Under these principles, an organisation should measure their impacts, then set an objective, implement avoidance and reduction strategies, and finally look at offsetting residual emissions.

In line with this strategy, EPA established a target to reduce emissions by 15% from the 2005-06 baseline emissions inventory by 2010. EPA exceeded this target by reducing emissions by 17 per cent. A new target was established to reduce emissions by a further 15% from the 2009-10 emissions inventory by 2015. So far EPA has achieved a 9.5 per cent reduction in emissions between 2009-10 and 2010-11 and a further 16.3 per cent reduction in emissions between 2010-11 and 2011-12. In 2012-13 EPA decreased emissions by 1 per cent.

A summary of EPA's 2012-13 emissions inventory is available in Appendix A.

This document contains the EPA's Greenhouse Gas Inventory Management Plan which provides the technical underpinnings of EPA's GHG emissions measurement, emission reduction measures and offset product purchases undertaken in 2012–13. The inventory describes EPA's current approach to achieving carbon neutrality: addressing emissions from direct sources, purchases of electricity and hot water, other accurately measurable, indirect sources that are critical to operations, and a range of indirect life-cycle emission sources.

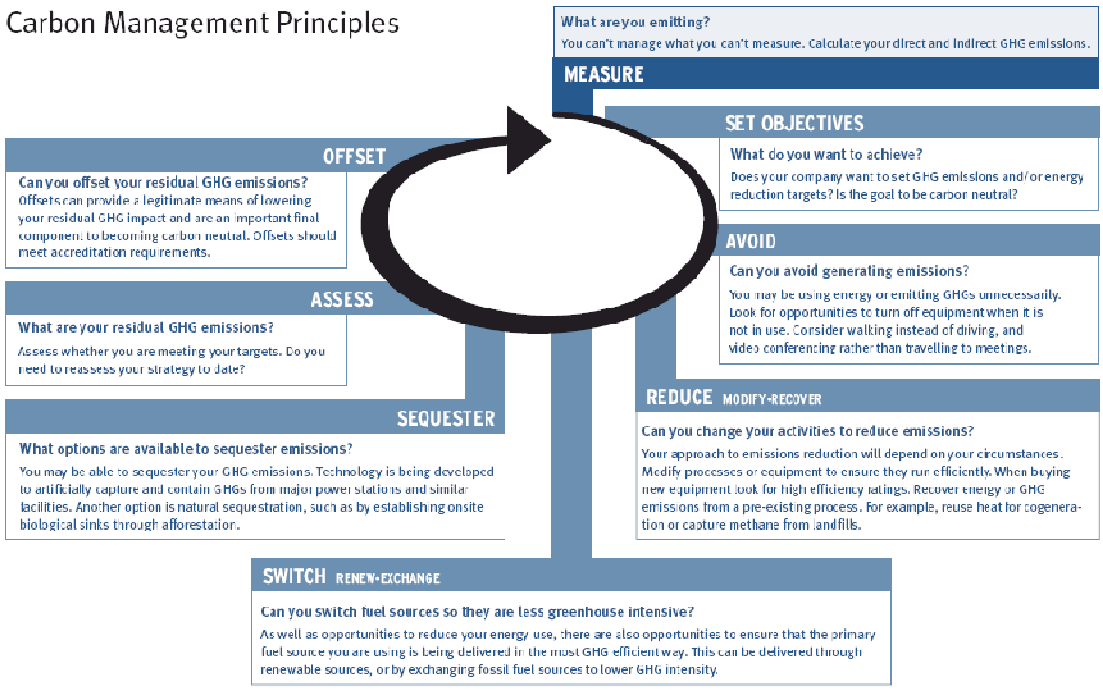

Figure 1: Carbon Management Principles

EPA developed its GHG inventory in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (GHG Protocol) developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) in 2004. The GHG Protocol is used and endorsed by many organisations, including the Global Reporting Initiative, Carbon Disclosure Project, International Organization for Standardization, EU Emissions Trading Scheme, and Chicago Climate Exchange. The Protocol provides guidance on what emission sources to include, how to ensure transparency and avoid double counting, and how to quantify emissions.

EPA is committed to having its GHG inventory and carbon neutral strategy statement externally assured each year. For the years 2005–06 to 2012–13, EPA engaged Net Balance Management Group to perform this task. Its assurance statement for EPA for 2012–13 is available in Appendix B.

EPA has previously published annual greenhouse gas inventories for 2010-11, 2009–10, 2008–09, 2007–08, 2006–07 and 2005–06. These inventories are available online. The inventory for 2011-12 is available in Appendix C.

1.2 Major Updates to Inventory Boundaries, Data Management or Quantification Methods

This section aims to highlight any major changes to the inventory boundaries, data management and quantification methods from EPA's baseline inventory in 2005–06. This section also demonstrates changes such as the use of different emissions factors and new ways of collecting data.

a) Backcasting

For all significant changes to EPA's methodology for calculating GHG emissions in 2012-13, EPA has recalculated the 2011-12 inventory to allow GHG emissions to be accurately compared between years. The revised 2011-12 inventory can be found in Appendix C. In previous years EPA has used backcasting to calculate the impacts of the revised methodologies on the 2005–06 baseline year. This has not been completed for 2012-13. For previous years, backcasting to 2005-06 baseline year has been adopted where appropriate. This means baseline data (2005–06) has been recalculated using the new methodologies with all new emission sources included. All aspects of the inventory for which this was conducted are outlined below.

b) Reticulated water and office paper

EPA's 2006–07 GHG inventory included two new emission sources. These were emissions associated with the provision of reticulated water and office paper. The steps taken to quantify these emissions have been outlined in sections K and L in part V of this document. Emissions associated with purchased office paper and reticulated water were also calculated for the 2005–06 year based on EPA usage for that year, to allow for comparison. In 2012-13 new calculation methodologies and emissions factors were used to estimate emissions from the supply of reticulated water and office paper. 2011-12 emissions from these sources were revised to allow comparison with 2012-13 results.

c) Staff commuting and catering

EPA's 2007–08 GHG inventory included two new emission sources. These were emissions associated with the mode of transport EPA staff members use to travel to and from work each day and the growth, production, preparation and delivery of catering purchased. The steps taken to quantify these emissions have been outlined in sections O and P of part V of this document. Emissions associated with staff commuting and catering were also calculated for the 2005–06 and 2006–07 years based on usage for these years, to allow for comparison. For 2011-12 onwards the emission factors adopted for catering were revised to account for annual inflation with the 2010-11 inventory also recalculated for comparison.

d) Courier services and colour publications

EPA's 2009-10 GHG inventory included two new emission sources. These were emissions associated with provision of courier services and colour publications. The steps taken to quantify these emissions have been outlined in sections Q and R of Part V of this document. Emissions associated with colour publications have also been calculated from 2005–06 onwards based on available usage data from each year, to allow for comparison. The calculation methodology for publications was revised in 2011-12 with new emission factors adopted. Emissions from publications were recalculated for 2010-11 for comparison. In 2012-13 the emissions factor for publications was again revised to account for annual inflation using data sourced from the Reserve Bank of Australia. The emissions factor for courier services was also revised in 2012-13 to account for annual inflation and to incorporate updated emissions factors published by the UK Government's Department of Environment, Food & Rural Affairs (DEFRA) for freight transport. The 2011-12 emissions from publications and courier services was recalculated for comparison against 2012-13 results.

e) Non-Kyoto refrigerants from building air conditioning and kitchen and laboratory refrigerators

EPA's 2009–10 GHG inventory included two new emission sources. These were emissions associated with non-Kyoto greenhouse gas emissions used as refrigerants in building air conditioning and refrigerators. The steps taken to quantify these emissions have been outlined in Section C of this document. In 2012-13 refrigerant global warming potential factors were updated. The 2011-12 results for refrigerant emissions were recalculated to allow comparison with 2012-13 results.

f) Flights

The methodology applied to calculate emissions from flights has changed from the baseline calculation in 2005–06. In 2010–11 EPA included an uplift factor in addition to the radiative forcing factor. A new radiative forcing factor has also been adopted, based on published methodologies (outlined in section H). This resulted in emissions associated with EPA flights appearing much lower for 2010-11 than in the previous five years. Therefore, emissions for 2005–06, 2006-07, 2007–08, 2008–09 and 2009–10 were backcast to allow for comparison. The calculation methodology for flights was revised again in 2011-12 and 2012-13 based on audit recommendations. Emissions from flights were recalculated using revised methodologies for 2010-11 and 2011-12.

g) Public transport

The methodology applied to calculate EPA public transport emissions has changed from the baseline calculation in 2005–06. For the 2010–11 GHG inventory, public transport was separated into metropolitan and regional use with appropriate emissions factors applied. This resulted in a more accurate calculation of emissions associated with public transport use. EPA also backcast using this new methodology from 2005–06 onwards to allow for comparison. For background on the quantification method used, see Appendix D.

h) High-temperature hot water

The methodology used to calculate EPA's 2010-11 use of high-temperature hot water (HTHW) at its Centre for Environmental Sciences (CES) changed from the baseline calculation in 2005–06. For the 2010–11 GHG inventory, the proportion of natural gas attributable to losses and auxiliary services associated with HTHW consumed (%) is assumed constant, based on metered data available from 2005–06. This approach was used to ensure that the overall consumption of the cogeneration plant was incorporated into the calculations. This differs from previous calculations, in which EPA assumed that the monthly quantities of natural gas consumed remained constant. This approach is more suitable, as changes in EPA's use of HTHW may reflect overall changes in natural gas consumption by the cogeneration plant. EPA has backcast emissions calculations using the updated approach from 2005–06 onwards. It should be noted that high-temperature hot water consumption for EPA is based on limited metered data from 2005-06 and may not represent actual 2012-13 consumption. Refer to Section F for more information on HTHW calculations.

2 Inventory Boundaries

2.1 Organisational boundary

EPA follows the operational control approach for consolidating GHG emissions throughout the organisation, as defined by the GHG Protocol. All operations where EPA has full authority to introduce and implement operating policies have been included. For leased facilities, EPA has determined that operational control includes tenant light and power (TL&P) (since operating policies can be implemented regarding lighting, computer use and other appliance energy demand regardless of whether EPA is directly billed for TL&P). EPA cannot claim full operational control of base building power, such as power for air conditioning and elevators, central heating or air conditioning refrigeration in leased facilities. As such, these sources are only deemed within EPA 'operational control' if EPA are the sole tenant in the building.[1] Those emissions considered outside EPA's full operational control, but for which EPA has some responsibility, have been included as scope 3.

EPA includes emissions from the following facilities:

Table A: EPA Victoria sites

Site	Address	Is EPA the sole tenant?
Head Office: 200 Victoria St, Carlton (from November 2009)	200 Victoria Street, Carlton, Victoria 3053 Phone: 1300 372 842 or 1300 EPA VIC	No
Air monitoring sites	Various	Yes
Centre for Environmental Sciences	Ernest Jones Drive, Macleod, Victoria 3085 Phone: 1300 372 842 or 1300 EPA VIC	No
EPA Gippsland	7 Church Street, Traralgon, Victoria 3844 Phone: 1300 372 842 or 1300 EPA VIC	Yes
EPA North East	27–29 Faithful Street, Wangaratta, Victoria 3677 Phone: 1300 372 842 or 1300 EPA VIC	No
EPA North West	43 Williamson Street, Bendigo, Victoria 3550 Phone: 1300 372 842 or 1300 EPA VIC	No
EPA South West	State Government Offices, Corner Little Malop and Fenwick Streets, Geelong, Victoria 3220 Phone: 1300 372 842 or 1300 EPA VIC	No
EPA Southern Metro	35 Langhorne Street, Dandenong, Victoria 3175 Phone: 1300 372 842 or 1300 EPA VIC	Yes

2.2 Operational boundary

EPA has included the six gas sources covered by the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perflourocarbons (PFCs) and sulphur hexafluoride (SF_6). EPA reports emissions of these gases in units of carbon dioxide equivalents (CO_2-e).

From 2009–10 EPA has also included the non-Kyoto Protocol gases used as refrigerants in building air conditioning systems, kitchens and laboratory refrigerators.

1 Base building power, heating and air conditioning refrigeration emissions from leased facilities where EPA is not the sole tenant are included as scope 3 emission sources in EPA's inventories, as outlined in section IVb, Operational boundary.

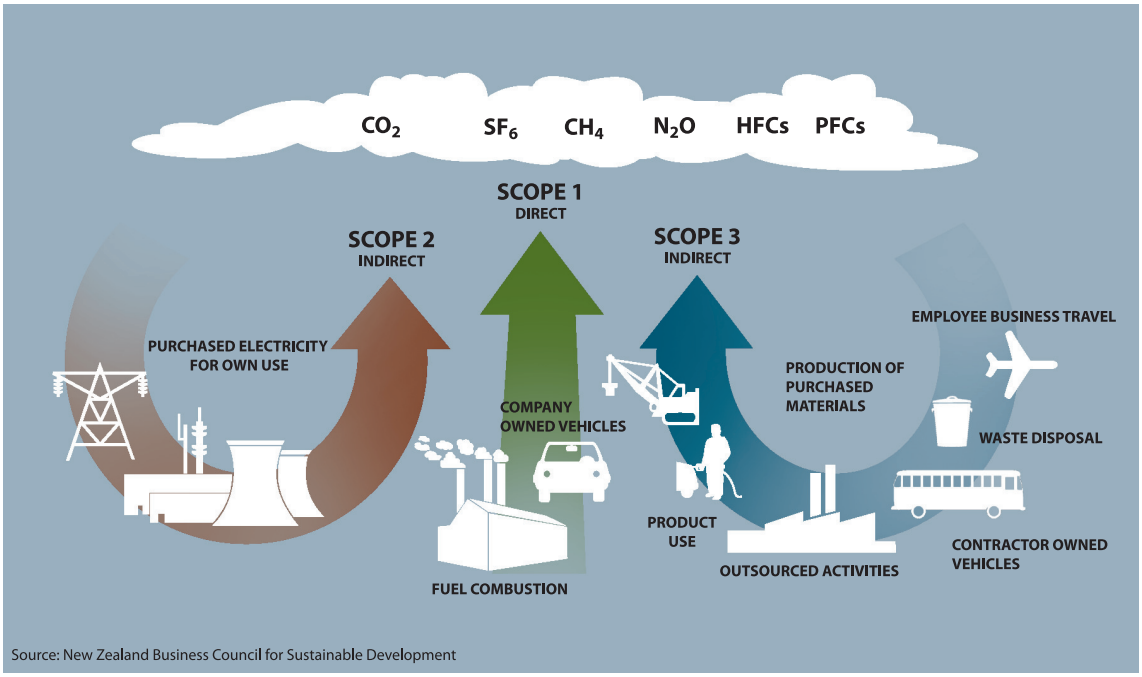

Figure 2: Overview of scopes and emission sources

Figure 2 demonstrates the composition of the three scopes that make up a GHG Protocol greenhouse gas inventory. Scope 1 includes all direct emissions, scope 2 is emissions from purchased electricity and steam and scope 3 includes all other indirect emissions. Scope 3 can include a range of emission sources such as public transport, embedded carbon in paper, catering, business travel, waste disposal and emissions associated with contractors.

EPA's GHG inventory includes direct emission sources (scope 1) and emissions from electricity and hot water purchases (scope 2) from all operations where EPA has the full authority to introduce and implement operating policies. Other accurately measurable indirect sources (scope 3) are also included that are critical to EPA's operations, including shared emission sources at leased facilities where EPA is not the sole tenant. Emissions are grouped according to the GHG Protocol scope categories, which are to be transparent and to identify inventory items that could be double-counted by other organisations (e.g. scope 2 and 3). Figure 2 illustrates the types of emission sources under each scope category.

A summary list of emission sources contained in EPA's 2012–13 GHG inventory is in Appendix A.

EPA consults members of its Green Stars committee[2], its external assurer and staff from the Corporate Strategy and People and Culture units to ensure accurate and relevant scope 1 and 2 emission sources within its organisational boundary have been included each year.

Additional emission sources and/or calculation expansion that are not material but could be included are:

- solvents at EPA laboratories at the Centre for Environmental Studies (CES) in Macleod
- emissions from the installation and disposal of refrigeration and air-conditioning equipment
- life-cycle emissions of materials such as:
    - stationery
    - uniforms
    - personal protective equipment
    - communication equipment
    - electronics and electric hardware
    - audiovisual equipment
    - materials used in construction of buildings occupied/retrofits
- contractor and consultant activities as part of EPA projects (e.g. EPA's auditors)

2 EPA's Green Stars committee is an organisational environmental committee that develops and implements projects to minimise EPA's environmental impacts. Its role also includes implementing behaviour change educational programs.

- other life-cycle emission sources critical to EPA's operations
- expansion of publication type already included in GHG inventory (i.e. annual reports, marketing material, information sheets and other sources)
- provide more detail on glossy publications printed
- other areas of procurement, such as electronic equipment
- external IT and data centres, or separate these emissions to show the significance, if any, of these centres
- external electronic data houses such as search engines, website hosting, and email storage.

3 Inventory Data Management and Emissions Quantification

Overview

The following sections outline:

1. activity data management – how EPA collects and manages 'activity data', e.g. kWh consumed, kilometres travelled on flights etc
2. quantification method – how EPA calculates emissions (including computing final activity data and applying emissions factors to final activity data)
3. future tasks – recommended annual tasks and steps to improve the inventory.

Activity data management

EPA does not monitor emissions from any of the inventory items and instead relies on activity data. The primary sources of data are utility bills and records kept by EPA's facility landlords, travel agents, suppliers, People and Culture Unit, Finance Unit and the Corporate Sustainability Coordinator. All inventory data, including additional detail on the following sections (such as individual refrigerator charge capacity and refrigerant type), are stored in a limited-access spreadsheet on EPA's network.

Quantification method

EPA seeks to follow best practice when calculating GHG emissions. Therefore, the GHG Protocol calculation guidance and tools, based on the Intergovernmental Panel on Climate Change (IPCC) GHG inventory guidelines are used.

For 2012-13 EPA applied emissions factors from the latest National Greenhouse Accounts (NGA) Factors (Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE), July 2013) to activity data for all sources except for refrigerants, flights, staff commuting, couriers, catering, public transport, reticulated water and office paper, because NGA factors were not available for these sources. EPA uses the most recently released NGA factors (e.g. 2013 factors for the 2012–13 inventory) for consistency with the rest of the Victorian Government and to align with the Victorian Government Financial Reporting Directive on reporting for environment data. However, EPA recognises that, for reporting under the National Greenhouse and Energy Reporting Act (NGER), previous year's factors are used (e.g. 2012 factors for the 2012–13 inventory).

Refrigerant emission factors are sourced from the Australian National Greenhouse Accounts: National Inventory Report 2011, Australian National Greenhouse Accounts: National Greenhouse Accounts Factors 2013 and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007; the flights emission factors are sourced from DEFRA, 2013; the public transport and staff commuting emissions factors are sourced from the Victorian Department of Transport; the reticulated water emissions factor is derived from published data available from Victoria's Metropolitan Water Authorities; and catering and office paper emissions factors are sourced from the Royal Melbourne Institute of Technology's Centre for Design.

A full list of reference sources used for 2012-13 is available in the bibliography of this publication.

Pro rating methodology

When collecting activity data from utilities, including electricity, natural gas, and water invoices, data can often overlap outside the annual reporting period of 1 July to 30 June. For example, bills received will be from 20 June 2012 to 20 June 2013. Where this occurs, EPA has used the preceding and following utility invoices and applied a pro-rata figure in order to calculate for the whole reporting period. Where following utility invoices are not available, an extrapolated figure based on the most recent invoice has been used.

Future tasks

EPA will update the essential inventory items annually, with the exception of diesel used in backup generators, building refrigeration and vehicle refrigeration. These inventory items will be updated less frequently, as the resources required to collect this data are intensive while their contribution is relatively small. However, EPA will ensure any significant changes to backup generators and building and vehicle refrigeration are picked up in the annual inventory.

EPA will aim to use the most up-to-date versions of inventory guidelines and individual calculation tools – such as the GHG Protocol – before starting each annual inventory. EPA's Corporate Sustainability Coordinator will also consult the most recent version of the DIICCSRTE's NGA Factors for emissions factors and GHG global warming potentials.

3.1 Scope 1 emissions

There are two types of fossil fuel energy sources used at EPA facilities:

- transport fuel used in vehicle and boat fleet
- natural gas used in buildings

Data management and emissions quantification for each of these energy types is detailed in the following sections.

a) Vehicle and boat fuel

Checklist for vehicle and boat fuel
Key activity data
Fuel purchased for each type of fuel based on fuel card data and/or non-fuel card expenditures (kL).
Key emissions factors
Consumption of fuel for transport use – Post-2004 vehicles (vehicle fleet) • LPG: 26.2 GJ/kL x 60.20 kg CO_2-e/GJ = 1,577 kg CO_2-e/kL • Unleaded petrol (ULP): 34.2 GJ/kL x 66.92 kg CO_2-e/GJ = 2,289 kg CO_2-e/kL • Diesel (DSL): 38.6 GJ/kL x 69.81 kg CO_2-e/GJ = 2,695 kg CO_2-e/kL (DIICCSRTE, July 2013, page 18, Table 4 – 'post-2004 vehicles'). Consumption of fuel for transport use – general transport (boat fleet) • Unleaded petrol (ULP): 34.2 GJ/kL x 69.60 kg CO_2-e/GJ = 2,380 kg CO_2-e/kL • Diesel (DSL): 38.6 GJ/kL x 69.90 kg CO_2-e/GJ = 2,698 kg CO_2-e/kL (DIICCSRTE, July 2013, page 18, Table 4 – 'general transport').
Key methodology guidance
DIICCSRTE, July 2013

Activity data management

There are three types of fuel used in EPA's fleet:

- LPG
- Petrol
- Automotive diesel oil (ADO).

Each motor vehicle is equipped with fuel cards that EPA drivers must use to purchase fuel. As part of monthly billing, fuel suppliers send the Finance Unit consumption data linked to individual fuel cards. The Fleet Manager manipulates the data and produces reports, which are emailed to the Corporate Sustainability Coordinator. The Finance Unit also puts the monthly fuel consumption for each vehicle into the Finance system.

The Fleet Manager also collects driver log sheets documenting kilometres travelled on each vehicle and stores this data along with fuel consumption in a spreadsheet; however, this data is not used in inventory development.

In line with current leasing arrangements, EPA replaces vehicles approximately every three years. The inventory captures fuel use from all vehicles that were in service throughout the year, including those that were replaced partway through the year.

The Monitoring and Assessment Unit keeps receipts for all boat fuel purchases and reports them annually to the Corporate Sustainability Coordinator. This information includes boat fuel use as well as cost data for each boat used. Additional fuel purchases for boats are also made using fuel cards with the data collected from the Finance Unit.

Quantification method

EPA then applies the DIICCSRTE scope 1 fuel combustion emission factors (post-2004 vehicles) for LPG, petrol and automotive diesel oil to the final activity data (kL of fuel purchased) for vehicle fleet emissions. For boats the DIICCSRTE scope 1 fuel combustion emission factors for general transport are used for petrol and diesel oil with the final activity data.

Future tasks

- Update data annually
- Investigate ability to track vehicle kilometres travelled per driver/unit with new GPS systems that have been installed in operational vehicles for navigation
- Double-check that no vehicle fuel is purchased by any other method than the fleet fuel card
- Streamline reporting of boat fuel data to ensure timely provision of data

b) Natural gas

Checklist for natural gas
Key activity data
Natural gas consumption from utility bills and/or overall building data from landlords (GJ); amount of EPA-occupied space (m^2).
Key emissions factors
Consumption of natural gas distributed in a pipeline: 51.33 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 14, Table 2).
Key methodology guidance
DIICCSRTE, July 2013 GHG Protocol 2005b

Only two of EPA's facilities were directly responsible for natural gas consumption in 2012–13. Details on the sources of natural gas data for each facility are available in Table B.

Activity data management

The landlord at the South West site, Brookfield Multiplex, sends quarterly spreadsheets to EPA's Corporate Sustainability Coordinator that indicates the GJ attributed to EPA's share of natural gas consumption at the site. The Corporate Sustainability Coordinator keeps copies of these spreadsheets and inputs the gas consumption data into the relevant spreadsheet.

The People & Culture Unit receives all natural gas bills for CES directly from the natural gas provider and then the Corporate Sustainability Coordinator enters the start and finish dates for the billing period, the number of days in the billing period, the GJ consumption and the cost into spreadsheets on EPA's shared network space. The People & Culture Unit then signs and approves individual invoices and forwards them on to the Finance Unit for payment processing.

Table B: Natural gas data source by facility

Site	Is EPA the sole tenant?	Landlord	Natural gas provider	Billing source
South West	No	Victorian Government – Brookfield Multiplex	N/A	Property manager
Centre for Environmental Sciences (CES)	No	La Trobe University	TRU Energy	Utility

Quantification method

EPA considers emissions from natural gas consumption for TL&P as Scope 1, emissions from natural gas consumption for base building as Scope 3 and emissions from extraction and transport of fuel for TL&P and base building natural gas as Scope 3.

For facilities where EPA is not the sole tenant (South West and CES), the Corporate Sustainability Coordinator estimates the proportion of TL&P and base building natural gas consumption. The Corporate Sustainability Coordinator also calculates the natural gas consumption in MJ for EPA's share of TL&P and base building natural gas consumption based on the percentage of the buildings' leasable floor space that EPA occupies (see Figure 3). The People & Culture Unit maintains information on square metres of EPA's leased space and landlords provide information on total building space.

$$B_e = (F_e/F_t) * B_t$$

Where:

B_e = EPA's share of base building natural gas use (GJ)

F_e = Floor space of EPA's leased space (m^2)

F_t = Floor space of building (m^2)

B_t = Total base building natural gas use (GJ)

Figure 3: Equation for estimating EPA's share of total building natural gas use

EPA then applies the DIICCSRTE Scope 1 emissions factor for consumption of natural gas distributed in a pipeline to the final activity data for both TL&P and base building. For Scope 3 emissions associated with fuel extraction and transport, refer to Section N.

Future tasks

- Update data annually.
- Seek more regular updates from landlords on natural gas use for EPA and total-building gas use.
- Spot-check landlord natural gas data spreadsheets for errors.

c) Building, kitchen and laboratory refrigeration

Checklist for refrigeration
Key activity data
Refrigerant recharge capacity (kg); type of refrigerant from direct readings or equipment manual consultation; number of each type of unit.
Key emissions factors
Default loss rates per annum from: • commercial air conditioning: 0.09 (DIICCSRTE, July 2013, page 51, Table 24). • commercial standalone chiller – large (>500L): 0.08 • commercial standalone freezer – small (<300L): 0.08 • commercial standalone freezer – large (>500L): 0.08 • kitchen fridge – large (>300L): 0.03 • kitchen fridge – medium (150-300L): 0.03 • kitchen fridge – small (<150L): 0.03 • water cooler: 0.03 (DIICCSRTE, April 2013, Table 4.22, Pages 176). Global warming potentials (GWPs) Kyoto gases – R134a (HFC-134a): 1300, R404a (44% HFC-125; 4% HFC-134a; 52% HFC-143a): 3260, R407b (10% HFC-32; 70% HFC-125; 20% HFC-134a): 2285, R407c (23% HFC-32; 25% HFC-125; 52% HFC-134a): 1526, R410A (50% HFC-32; 50% HFC-125): 1725, R507A (50% HFC-125; 50% HFC-143a): 3300 (DIICCSRTE, July 2013, Appendix 1 - Table 26, Page 60) Non-Kyoto gases – R12 (CFC-12): 8100, R123 (HCFC-123): 90, R13 (CFC-13): 14400, R141b (HCFC-141b): 725, R22 (HCFC-22): 1500, R502 (50% CFC-115; 50%HCFC-22): 4505 (IPCC 2007, Chapter 2, Table 2.14)
Key methodology guidance
DIICCSRTE, July 2013 GHG Protocol 2005a

EPA estimates operating HFC emissions from facility refrigerant systems, but does not include emissions from installation or disposal of these systems, since these are deemed outside operational control due to current leasing arrangements. In 2009–10 the inventory was expanded beyond Kyoto Protocol gases ('Kyoto gases'), to include chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants ('non-Kyoto gases'). CFCs and HCFCs are ozone-depleting substances being phased out under the Montreal Protocol which also have a global warming potential.

Operating emissions include refrigerant leakage during normal operations and as part of servicing. Due to limited data, EPA employs the GHG Protocol screening approach (i.e. the 'emissions factor based approach'), which is based on the IPCC Good Practice Tier 2 Bottom-Up approach (GHG Protocol 2005a).

A complete survey of building, kitchen and laboratory fridges was completed during 2009–10. This data was updated for 2011-12 due to changes at Victoria Street and CES facilities. No changes were recorded for 2012-13.

Activity data management

There are two main types of refrigeration systems in EPA facilities:

- air conditioning chillers and modular units
- kitchen and laboratory refrigerators

For air conditioning chillers and modular units, the Corporate Sustainability Coordinator seeks data on the refrigerant charge capacity and type of refrigerant through the following collection methods and sources:

- visual readings, equipment manual consultation or estimates based on experience from landlords at Victoria Street, EPA Southern Metro, Gippsland, North East, South West and North West sites
- visual readings or equipment manual consultation from EPA's Facility Manager at CES
- air monitoring station equipment manual consultation from the Environmental Monitoring Unit.

For kitchen and laboratory refrigerators, the Corporate Sustainability Coordinator takes visual readings of refrigerant charge capacity and type of refrigerant from all sites.

Quantification method

EPA then applies the DIICCSRTE default loss rate factors for different types of refrigeration and air conditioning systems and the global warming potential factors for different types of refrigerants, which are based on NGA Factors, the IPCC Fourth Assessment Report and ASHRAE Standard 34. EPA also accounts for shared tenancy use of air conditioning systems by apportioning emissions based on % of EPA occupied floor space. See Figure 4 for a sample calculation.

GHG emissions (kg CO_2-e) = [C * L * GWP * %EPA] / 1000 = 4,477 kg CO_2-e for EPA North East air conditioner

Where:

C	=	Refrigerant recharge capacity (grams)	=	32,600g for EPA North East air conditioner in 2012–13
L	=	Annual loss rate (according to refrigeration technology)	=	0.09 (commercial air conditioning-chillers)
GWP	=	Global warming potential of refrigerant	=	1526 for R407c
%EPA	=	Proportion of system used by EPA	=	100% for Wangaratta air conditioner

Figure 4: Equation for estimating annual GHG emissions from building refrigerant losses

Future tasks

- Update data, at a minimum, when EPA changes facilities, or when major infrastructure changes occur.
- Estimate and incorporate installation and disposal emissions for refrigerators and air conditioning systems at leased facilities where EPA is the sole tenant (scope 1), and consider doing the same for any air conditioning systems at leased facilities where EPA is not the sole tenant (scope 3).
- Work with landlords and service repairmen to document recharge rates for refrigeration and air conditioning equipment in order to follow the GHG Protocol 'sales-based approach' or 'life-cycle stage approach' for quantifying HFC emissions from refrigerants.
- Update Global Warming Potential factors where appropriate

d) Vehicle refrigeration

Checklist for vehicle refrigeration
Key activity data
Refrigerant recharge capacity (kg); type of refrigerant from direct vehicle bonnet readings; number of each type of unit.
Key emissions factors

Default loss rate per annum: 15% DIICCSRTE, April 2013, Table 4.22 Global Warming Potential (GWP): R134a: 1300 (DIICCSRTE, July 2013, Appendix 1 - Table 26, Page 60).
Key methodology guidance
GHG Protocol 2005a.

EPA estimates operating HFC emissions from vehicle air conditioning systems, but does not include emissions from installation or disposal of these systems, since these operations are deemed outside of EPA control due to current leasing arrangements. Operating emissions include refrigerant leakage during normal operations and as part of servicing. Due to limited data, EPA employs the GHG Protocol screening approach (i.e. the 'emissions factor-based approach'), which is based on the IPCC Good Practice Tier 2 Bottom-Up Approach.

The data used in the 2010–11 inventory was collected by the Corporate Sustainability Coordinator in July 2011. Data has been updated for the change in vehicle makeup for the 2012-13 reporting period.

Activity data management

The Corporate Sustainability Coordinator or Fleet Manager takes visual readings of refrigerant charge capacities and types of refrigerants from a representative sampling of the full EPA vehicle fleet found in the Victoria Street vehicle pool. Where visual readings of certain types of vehicles were not possible, the Corporate Sustainability Coordinator or Fleet Manager contacted the vehicle manufacturer to obtain the refrigerant charge capacity and type of refrigerant. The Corporate Sustainability Coordinator then extrapolates these readings to the entire fleet of vehicles on EPA's official roster as of July each financial year based on the type of vehicle (e.g. hybrid sedan, conventional sedan, 4WD or station wagon).

Table D lists the refrigerant recharge capacities used in the 2012–13 inventory, which were based on readings from 2009–10.

Table D: Vehicle refrigerant recharge capacity

Vehicle	Refrigerant charge capacity
Hybrid – Toyota Prius	440 g
Sedan – Toyota Camry/Ateva	600 g
Sedan – Toyota Altise	500 g
Sedan – Holden Commodore/Cruze/Berlina	650 g
4WD – Holden Rodeo/Colorado, Toyota Hiace/Hilux/Rav4, Mitsubishi Canter, Ford Territory	700 g
AWD – Subaru Outback	700 g
Station wagon – Holden Captiva	700 g
Station wagon – Ford Falcon, Holden SV6	650 g

All vehicles use the refrigerant type HFC–134a.

Quantification method

The Corporate Sustainability Coordinator determines the percentage of time each vehicle has been in EPA's fleet for the year and then multiplies this percentage by the refrigerant recharge capacity specific to the vehicle type. The sum of these results provides the total refrigerant recharge capacity of the EPA fleet. The DIICCSRTE default loss rate factors for mobile air conditioning systems is then applied along with the DIICCSRTE global warming potential factor for HFC–134a. See Figure 5 for a sample calculation.

GHG emissions (g CO_2-e) = [C * L * GWP] / 1000 = 127 kg CO_2-e for Holden Commodore

Where:

C =	Refrigerant recharge capacity of vehicle (kilograms)	=	650 g for Holden Commodore
L =	Annual loss rate for mobile air conditioners	=	0.15
GWP =	Global warming potential of HFC–134a	=	1300

Figure 5: Equation for estimating GHG emissions from vehicle refrigerant losses and illustrative example

Future tasks

- Update data, at a minimum, when major changes in the make-up of the vehicle fleet occur.
- Investigate ability to document refrigerant type and charge amount in the vehicle tracking system.
- Investigate working with smash repairers and/or mechanics who service EPA's vehicles to document recharge rates for air conditioning equipment in order to follow the GHG Protocol 'sales-based approach' or 'lifecycle stage approach' for quantifying HFC emissions from refrigerants.

3.2 Scope 2 emissions

There are two types of scope 2 emissions sources associated with EPA facilities:

- Electricity used for TL&P (and for whole of building where EPA is the sole tenant).
- High-temperature hot water (HTHW).

Data management and emissions quantification for each of these energy types is detailed below. For all energy sources, EPA uses data from billing cycles and direct readings covering the financial year (01 July 2012 to 30 June 2013). Where data does not align with the financial year dates, estimates are made based on the most relevant data available (e.g. using previous month's readings).

a) Electricity

Checklist for electricity
Key activity data
Electricity consumption from utility bills and/or overall building data from landlords (kWh); amount of EPA-occupied space (m^2).
Trigeneration electricity consumption for EPA Head Office and corresponding quantity of natural gas consumed provided by utility provider.
Key emissions factors
Victorian end-user electricity for scope 2: 1.17 kg CO_2-e/kWh (DIICCSRTE, July 2013, page 20, Table 5).
Consumption of natural gas distributed in a pipeline: 51.33 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 14, Table 2).
Key methodology guidance
GHG Protocol 2010. DIICCSRTE, July 2013

Activity data management

There are two general categories of electricity use at EPA facilities: tenant light and power (TL&P) and base building power. TL&P consists of electricity used for lighting, computers, unit air conditioners and other appliances. Base building power is electricity used for services such as central air conditioning, elevators and lighting in lobbies and other shared spaces. The way EPA obtains data related to these two categories of electricity consumption varies for each site.

EPA receives the majority of TL&P data directly from electricity providers, either in a flat file or from invoices, while EPA estimates base building power at most facilities based on total building electricity consumption data and EPA's share of the floor space. The source of electricity data for each facility is outlined in Table C.

Table C: Electricity data sources by facility

Site	Is EPA the sole tenant?	Landlord	Electricity provider	TL&P billing source	Base building billing source	GreenPower via utility bill (%)
Head Office: 200 Victoria St, Carlton	No	Drapac	Cogent	Utility	Cogent	0
Air monitoring sites x14	Yes	EPA Victoria	Various	Utility	Utility	1
Centre for Environmental	No	La Trobe University	Origin	Utility	Utility	0

Sciences (CES)						
EPA Gippsland	Yes	Two private companies	TRU	Utility	Utility	15
EPA North East	No	Arandem Pty Ltd Lloyd Pty Ltd	TRU	Utility	Landlord	100
EPA North West	No	Becklegal	Origin	Landlord	Landlord	0
EPA Southern Metro	Yes	KH Implex Pty	TRU	Utility	Utility	0
EPA South West	No	Victorian Government – Brookfield Multiplex	TRU	Landlord	Landlord	0

The People & Culture Unit receives all electricity bills coming directly from the electricity provider and then the Corporate Sustainability Coordinator enters the start and finish dates for the billing period, the number of days in the billing period, the kWh consumption (split between normal grid and GreenPower) and the cost (split between normal grid and GreenPower) for CES into spreadsheets on EPA's shared network space. The People & Culture Unit then signs and approves individual invoices and forwards them on to the Finance Unit for payment processing.

The Corporate Sustainability Coordinator receives a monthly flat file from TRU energy detailing the electricity use at the EPA Southern Metro, North East and Gippsland sites. The Corporate Sustainability Coordinator then enters the start and finish dates for the billing period, the number of days in the billing period, the kWh consumption (split between normal grid and GreenPower), and the cost (split between normal grid and GreenPower) into the same spreadsheets on EPA's shared network space.

Brookfield Multiplex, the property manager for the EPA North West and South West facilities, sends quarterly spreadsheets to the Corporate Sustainability Coordinator that indicate the energy usage (in kWh) attributed to EPA TL&P, as well as total base building power. The Corporate Sustainability Coordinator keeps copies of these spreadsheets and inputs the TL&P data into the relevant spreadsheet.

The Corporate Sustainability Coordinator contacts the utility provider for Head Office for TL&P and base building electricity and gas consumption data and for information to assist with calculating emissions from the trigeneration power system. The utility provider calculates the breakdown of grid electricity and trigeneration electricity consumed for both EPA TL&P and for the base building. Grid electricity and trigeneration electricity for EPA TL&P are considered scope 2, whilst base building emissions are considered scope 3. Emissions from grid electricity are calculated using the Victorian end-user electricity factor (see below), whilst trigeneration electricity is calculated using the natural gas emissions factor (see Natural Gas section above) and the quantity of natural gas provided by the utility provider.

The Corporate Sustainability Coordinator also contacts the landlord for EPA North East for total base building power on an annual basis.

Quantification method

EPA considers emissions from electricity consumption for TL&P as Scope 2, emissions from electricity consumption for base building as Scope 3 and emissions from extraction and transport of fuel for TL&P and base building electricity as Scope 3.

For facilities where EPA is the sole tenant (AMS, Gippsland and South Metro) and for North West, usage data covering both TL&P and base building electricity consumption is provided and no further quantification of activity data is required. For facilities where EPA is not the sole tenant (North East, South West, CES and Victoria Street), the Corporate Sustainability Coordinator is required to separate TL&P and base building electricity consumption. For North East and Victoria Street facilities, TL&P and base building data are provided separately. In the case of South West and CES facilities, an estimate of the proportion of base building and TL&P is used.

In addition, for facilities where EPA is not the sole tenant (North East, South West, CES and Victoria Street), the Corporate Sustainability Coordinator also calculates the kWh consumption for EPA's share of base building electricity consumption based on the percentage of the buildings' leasable floor space that EPA occupies (see Figure 6). The People & Culture Unit maintains information on square metres of EPA's leased space and landlords provide information on total building space. For South West and CES facilities, this methodology is also used to calculate EPA's TL&P consumption.

$$B_e = (F_e/F_t) * B_t$$

Where:

B_e = EPA's share of base building electricity use (kWh)

F_e = Floor space of EPA's leased space (m^2)

F_t = Floor space of building (m^2)

B_t = Total base building electricity use (kWh)

Figure 6: Equation for estimating EPA's share of base building power

EPA then applies the DIICCSRTE emissions factor for consumption of purchased electricity by end-users in Victoria (Scope 2) to the final activity data for both TL&P and base building for all EPA electricity consumption except Head Office. For Head Office electricity scope 2 emissions, the DICCSRTE emissions factor for consumption of purchased electricity by end-users in Victoria is applied to EPA's portion of TL&P and base building grid electricity, whilst the DIICCSRTE emissions factor for consumption of natural gas distributed in a pipeline is applied to EPA's portion of TL&P and base building gas consumed by the trigeneration system. For Scope 3 emissions associated with fuel extraction and transport, refer to Section N.

Future tasks

- Update data annually.
- Seek the most up to date methodology for calculating emissions from electricity used in trigeneration plants.
- Seek more regular updates from landlords on electricity use for TL&P and base building power use.
- Spot-check landlord electricity data spreadsheets for errors.

b) High-temperature hot water (HTHW)

Checklist for HTHW
Key activity data
Natural gas consumption at La Trobe University cogeneration plant (GJ); EPA HTHW natural gas consumption from landlord (GJ); proportion of natural gas energy content dedicated to HTHW generation from landlord-sponsored energy audit (%).
Key emissions factors
Consumption of natural gas distributed in a pipeline: 51.33 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 14, Table 2).
Key methodology guidance
None for 2012–13. In the future, GHG Protocol 2006.

EPA purchases high-temperature hot water (HTHW) from the cogeneration plant at La Trobe University to heat and cool EPA's Centre for Environmental Sciences (CES) facility at Macleod. La Trobe University transports the HTHW through a pipeline roughly two kilometres to the energy centre adjacent to the CES facility.

The GHG Protocol guidance for calculating emissions for energy products derived from cogeneration (GHG Protocol 2006) is EPA's preferred quantification methodology for this emission source. However, there is not enough activity data available to follow any of the GHG Protocol suggested calculation methods. Additionally, EPA has difficulty determining the amount of HTHW that is delivered to the CES facility versus the amount lost along the transmission pipeline, the latter of which is not within EPA's operational control per GHG Protocol guidance. EPA's People & Culture Unit believe there is a significant amount of energy loss along the line between the plant and the energy centre, but metering at both ends of the pipeline has been malfunctioning for several years so there is no accurate data. The methodology below reflects EPA's best attempt at estimating emissions from the CES facility's HTHW consumption.

Activity data management

The data used by La Trobe University to estimate EPA's HTHW consumption is based on 2005–06 metered output at the cogeneration plant, which is then delivered via the pipeline to the CES. La Trobe does not account for line losses, since it does not have functioning meters to measure the HTHW received at CES. In the absence of further metering, this data represents the best available estimate of the CES facility's actual consumption and is likely to be an overestimate rather than an underestimate.

Quantification method

In order to translate EPA's consumption of HTHW into GHG emissions, EPA must determine how much natural gas La Trobe uses to generate the HTHW and, therefore, how much natural gas EPA uses as a proportion of this. La Trobe's Energy Manager provides the total GJ of natural gas used at the cogeneration plant. La Trobe's cogeneration plant Facility Manager provides information on the proportion of energy content of natural gas used at the cogeneration plant dedicated to HTHW, electricity, losses, and auxiliary services[3]. As of November 2011-12, EPA is no longer the sole tenant at the site and subsequently, the proportion of total floor space occupied by EPA has been used to account for EPA's component of natural

[3]For 2011-12, this data was based on an energy audit conducted by Sinclair Knight Merz in 2003.

gas use for HTHW. EPA then applies the DIICCSRTE scope 1 emissions factor for consumption of natural gas distributed in a pipeline to the final activity data.

The full calculations for estimating natural gas consumption attributable to CES's HTHW use are detailed in Figure 7.

Step 1 **Calculate GJ of HTHW generated at the cogen plant (H_t):**				
$H_t = N_t * EC_h$ = 140,164 GJ in 2012-13				
Where:				
Nt	=	Total natural gas used at cogen plant (GJ)	=	400,469 GJ in 2012-13, as supplied by Latrobe University.
EC_h		Proportion of energy content of natural gas used at cogen plant dedicated to HTHW		0.35 in 2012-13
Step 2 **Calculate GJ of natural gas attributable to losses and auxiliary services at the cogen plant (A_t), assuming 55% of losses and auxiliary services are attributable to HTHW generation:**				
$A_t = 0.55 * N_t * EC_a$ = 78,842 GJ in 2012-13				
Where:				
N_t	=	Total natural gas used at cogen plant (GJ)	=	400,469 GJ in 2012-13, as supplied by Latrobe University.
EC_a	=	Proportion of energy content of natural gas used at cogen plant dedicated to losses and auxiliary services	=	0.36 in 2012-13
Step 3 **Calculate proportion of natural gas attributable to HTHW consumed at CES site (A_e),:**				
$A_e = (H_e * 12)/ H_t$ = 0.0414395				
Where:				
H_e	=	Monthly HTHW consumption at CES facility (GJ)	=	475 GJ per month in 2005-06, based on latest metered data available.
H_t	=	Total HTHW generated at the cogen plant (GJ)	=	137,550 GJ per year in 2005-06, based on latest metered data available.
Step 4 **Calculate total GJ of natural gas associated with CES's HTHW consumption (N_e):**				
$N_e = A_e*(H_t + A_t)$ = 9,076 GJ in 2012-13				
Where:				
A_e	=	Proportion of natural gas attributable to HTHW consumed at CES site (%)	=	0.0414395
H_t	=	GJ of HTHW generated at the cogen plant (GJ)	=	140,164 GJ in 2012-13
A_t	=	GJ of natural gas attributable to losses and auxiliary services at the cogen plant (GJ)	=	78,842 GJ in 2012-13
Step 5 **Calculate EPA's proportion of natural gas consumption (N_{EPA}) based on occupied floor area:**				
$N_{EPA} = N_e * F_{EPA}$ = 5,082 GJ in 2012-13				
Where:				
N_e	=	GJ of natural gas associated with CES's HTHW consumption	=	9,076 GJ in 2012-13
F_{EPA}	=	EPA occupied floor space (%)	=	56% in 2012-13

Figure 7: Equation for estimating annual GHG emissions from HTHW at CES

Future tasks

- Update data annually.
- Work with La Trobe University to install better metering of the separate energy products at the cogeneration plant, HTHW delivered to the pipeline and HTHW delivered to the energy centre.
- Work towards following the preferred method – the 'efficiency' method – for attributing fuel use to cogeneration products outlined in the GHG Protocol tool (GHG Protocol 2006).
- Update inventory to reflect actual data; separating CES consumption into scope 2 and line losses into scope 3.
- Investigate commissioning a new energy audit to determine EPA's consumption of HTHW.

3.3 Scope 3 emissions

a) Diesel for backup generators

Checklist for diesel generators
Key activity data
Backup generator diesel oil consumption based on landlord dipstick readings or estimates (kL).
Key emissions factors
Scope 1 Stationary energy diesel oil emissions factor = 38.6 GJ/kL x 69.5 kg CO_2-e/GJ = 2,683 kg CO_2-e/kL (DIICCSRTE, July 2013, page 16, Table 3).
Scope 3 Diesel oil (full fuel cycle) emissions factor = 38.6 GJ/kL x 5.3 kg CO_2-e/GJ = 205 kg CO_2-e/kL (DIICCSRTE, July 2013, page 72, Table 40).
Key methodology guidance
GHG Protocol, 2005b. DIICCSRTE, July 2013

In October 2009, EPA's head office relocated from the HWT and IBM office sites to 200 Victoria Street in Carlton. The Victoria Street site does not have a backup diesel generator. However backup generators are used at the CES site. As EPA is not the sole tenant and this system is outside the operational control of EPA, emissions from diesel use at CES have been designated as Scope 3 emissions. EPA also includes emissions from extraction, production and transport of diesel fuel as Scope 3 emissions.

Activity data management

The Corporate Sustainability Coordinator contacts La Trobe University's Facility Manager for an estimate of average annual diesel use in the CES backup generator.

Quantification method

For the CES facility, the Corporate Sustainability Coordinator calculates the proportion of diesel usage (in kLs) attributable to EPA based on the percentage of total leasable area occupied by EPA. The Corporate Sustainability Coordinator then converts the final activity data from kL to GJ (using the energy content of stationary energy diesel oil from DIICCSRTE, July 2013), and then applies DIICCSRTE's Scope 1 emissions factor for stationary diesel oil combustion to the final activity data. For emissions from extraction, production and transport of fuel, the DCCEE Scope 3 emission factor is applied to the final activity data (refer to Section N).

Future tasks

- Update data from CES, when EPA changes facilities, or when major blackout events occur.
- Work with La Trobe University to more accurately quantify annual diesel usage in the CES backup generator.

b) Flights

Checklist for flights
Key activity data
Distance travelled on short, medium and long-haul flights from travel agent (km) and class of flight (economy, business or first class)
Key emissions factors
Direct • Short-haul flights (less than 500 km): ○ 'Average passenger' EF_{DSA} = 0.326615 kg CO_2-e/km/person • Medium-haul flights (between 500 and 3700 km): ○ 'Economy class' EF_{DME} = 0.183404 kg CO_2-e/km/person ○ 'Business class' EF_{DMB} = 0.275101 kg CO_2-e/km/person • Long-haul flights (more than 3700 km): ○ 'Economy class' EF_{DLE} = 0.165362 kg CO_2-e/km/person ○ 'Business class' EF_{DLB} = 0.479574 kg CO_2-e/km/person ○ 'First class' EF_{DLF} = 0.66147 kg CO_2-e/km/person • IPCC radiative forcing index (1.9) and uplift factor (1.08) is already included in the emissions factors listed above Reference: DEFRA 2013 Indirect • Short-haul flights (less than 500 km): ○ 'Average passenger' EF_{ISA} = 0.035618 kg CO_2-e/km/person • Medium-haul flights (between 500 and 3700 km): ○ 'Economy class' EF_{IME} = 0.020012 kg CO_2-e/km/person ○ 'Business class' EF_{IMB} = 0.030013 kg CO_2-e/km/person • Long-haul flights (more than 3700 km): ○ 'Economy class' EF_{ILE} = 0.018047 kg CO_2-e/km/person ○ 'Business class' EF_{ILB} = 0.052326 kg CO_2-e/km/person ○ 'First class' EF_{ILF} = 0.072166 kg CO_2-e/km/person Reference: DEFRA 2013
Key methodology guidance
GHG Protocol 2006; IPCC 2007; DEFRA 2013

Activity data management

Hard copy of data outlining the origin, destination, flight class, date and cost of all EPA flights is provided by Flight Centre Management (FCM). FCM provides electronic data files quarterly, outlining origin, destination, flight class, date, cost and distance. The Corporate Sustainability Coordinator inputs this data into a summary spreadsheet on EPA's network. The list of flights is then sorted into short, medium and long-haul flights, economy, business and first class based on their distance.

Quantification method

EPA applies the DEFRA direct and indirect emissions factors for short, medium and long-haul flights, based on passenger kilometres travelled and class of flights (see Figure 8).

The DEFRA factors used by EPA include the impacts of radiative forcing index (RFI) on total GHG emissions from air travel. This factor takes into account the impact of non-CO_2-e aviation emissions – for example, NOx compounds, ozone, methane, water, contrails and particles – on the atmosphere, as these compounds have a greater potential to effect anthropogenic radiative forcing in the stratosphere than CO_2-e alone. An RFI value of 1.9 (DEFRA 2013) has been applied to the CO_2 emission factor for direct emissions only. In 2009–10, EPA chose to use a conservative RFI of 5.0, based on emerging science.

However, because this has not been published, EPA has chosen to revert to adopt DEFRA's recommended emission factors which include a radiative forcing factor of 1.9.

In 2010–11, EPA also added an additional multiplier to both direct and indirect emissions by incorporating an uplift factor of 1.09, which refers to the additional fuel use and associated emissions that arise from circling, take-off and indirect routes. In 2012-13 uplift factors are incorporated into the direct emission factors provided by DEFRA. No uplift factor is applied to indirect emissions.

GHG emissions (t CO_2-e) = Short-haul emissions + Medium-haul emissions + Long-haul emissions

Where:

Short-haul emissions (t CO_2-e)

= Direct short-haul emissions + Indirect short-haul emissions

= $(D_{SA} * EF_{DSA}) + (D_{SA} * EF_{ISA})$

Medium-haul emissions (t CO_2-e)

= Direct medium-haul emissions + Indirect medium-haul emissions

= $(D_{ME} * EF_{DME}) + (D_{MB} * EF_{DMB}) + (D_{ME} * EF_{IME}) + (D_{MB} * EF_{IMB})$

Long-haul emissions (t CO_2-e)

= Direct long-haul emissions + Indirect long-haul emissions

= $(D_{LE} * EF_{DLE}) + (D_{LB} * EF_{DLB}) + (D_{LF} * EF_{DLF}) + (D_{LE} * EF_{ILE}) + (D_{LB} * EF_{ILB}) + (D_{LF} * EF_{ILF})$

Where:

D_{SA}	=	Kilometres travelled on all short-haul flights (<500 km per flight)
EF_{DSA}	=	Direct emissions factor for 'average passenger' short-haul flights
EF_{ISA}	=	Indirect emissions factor for 'average passenger' short-haul flights
D_{ME}	=	Kilometres travelled on 'economy class' medium-haul flights (between 500 km and 3700 km per flight)
D_{MB}	=	Kilometres travelled on 'business class' medium-haul flights (between 500 km and 3700 km per flight)
EF_{DME}	=	Direct emissions factor for 'economy class' medium-haul flights
EF_{DMB}	=	Direct emissions factor for 'business class' medium-haul flights
EF_{IME}	=	Indirect emissions factor for 'economy class' medium-haul flights
EF_{IMB}	=	Indirect emissions factor for 'business class' medium-haul flights
D_{LE}	=	Kilometres travelled on 'economy class' long-haul flights (>3700 km per flight)
D_{LB}	=	Kilometres travelled on 'business class' long-haul flights (>3700 km per flight)
D_{LF}	=	Kilometres travelled on 'first class' long-haul flights (>3700 km per flight)
EF_{DLE}	=	Direct emissions factor for 'economy class' long-haul flights
EF_{DLB}	=	Direct emissions factor for 'business class' long-haul flights
EF_{DLF}	=	Direct emissions factor for 'first class' long-haul flights
EF_{ILE}	=	Indirect emissions factor for 'economy class' long-haul flights
EF_{ILB}	=	Indirect emissions factor for 'business class' long-haul flights
EF_{ILF}	=	Indirect emissions factor for 'first class' long-haul flights

Figure 8: Equation for estimating GHG emissions from air travel

Future tasks

- Update data annually.
- Incorporate improved estimates of the greenhouse impact from air travel and associated emissions factors as research improves over time.

c) Taxis

Checklist for taxis
Key activity data
Taxi expenditure ($); type of fuel; % of LPG vehicles; average fare ($/km); average fuel consumption from local taxi companies (L/km).
Key emissions factors
Consumption of fuel for transport use – Post-2004 vehicles • LPG: 26.2 GJ/kL x 60.20 kg CO_2-e/GJ = 1,577 kg CO_2-e/kL • Unleaded petrol (ULP): 34.2 GJ/kL x 66.92 kg CO_2-e/GJ = 2,289 kg CO_2-e/kL (DIICCSRTE, July 2013, page 18, Table 4 – 'post-2004 vehicles').
Key methodology guidance
EPA's draft EMS Standard operating procedure – Public transport and taxi data collection and assessment (see Appendix D).

Activity data management

The Finance Unit accounts for all Cabcharge vouchers and cab receipt reimbursements under a specific cost centre. The Corporate Sustainability Coordinator then queries the financial database for annual taxi expenditure.

Quantification method

EPA estimates emissions from business travel in taxis via expenditure data and assumptions regarding type of fuel, percentage of LPG vehicles in Victorian taxi fleet, average fare charge ($/km) and average fuel consumption (L/km). In July 2012, EPA contacted the Victorian Taxi Association (VTA) for the average litres of LPG per kilometre travelled (0.1725 litres/km)[4] and average charge per taxi kilometre travelled ($2.52 per km). In 2012-13 the VTA confirmed that the 2012 figures remained the most accurate data available with the exception of changes to the make-up of the fleet with additional hybrid vehicles brought online. This information was used with total EPA taxi expenditure to estimate fuel consumption for EPA taxi use. To calculate emissions, EPA applies the DIICCSRTE scope 1 emissions factor for LPG combustion for transport purposes to the final activity data. See Figure 9 for a summary of the calculation.

$$\text{GHG emissions (t } CO_2\text{-e)} = [(Exp/F) * \%LPG * LPK_{LPG} * EF_{LPG}] + [(Exp/F) * \%Hybrid * LPK_{ULP} * EF_{ULP}]$$

Where:

Exp	=	EPA expenditure on taxis ($)
F	=	Average fare per taxi kilometre travelled ($/km)
%LPG	=	Percentage of LPG vehicles in Victorian taxi fleet
%Hybrid	=	Percentage of Hybrid vehicles in Victorian taxi fleet
LPK_{LPG}	=	Average LPG consumed by taxis per kilometre travelled (kL/km)
LPK_{ULP}	=	Average petrol (ULP) consumed by taxis per kilometre travelled (kL/km)
EF_{LPG}	=	Emissions factor for LPG (t CO_2-e/kL)
EF_{ULP}	=	Emissions factor for ULP (t CO_2-e/kL)

Figure 9: Equation for estimating GHG emissions from taxis

[4] The VTA indicated that 98% of all taxis use LPG with a small mix of other fuels and hybrids across the fleet. EPA assumes that all taxi trips take place in LPG-fuelled taxis and extrapolates this data for all business travel in taxis.

Future tasks

- Update data annually, including expenditures and assumptions regarding type of fuel, percentage of LPG/Hybrid vehicles in Victorian taxi fleet, $/km and litre/km assumptions.
- Revisit data received by taxi companies, Victorian Taxi Association and Australian Tax Office, i.e. average charge per taxi kilometre travelled, fuel mix of the local taxi fleet and average litres of LPG per kilometre travelled.
- Investigate whether number of trips can be calculated, so flagfall figure can be removed to achieve a more accurate estimate of emissions.

d) Public transport

Checklist for public transport
Key activity data
Public transport expenditure for each office ($); fares for different types of public transport ($); distance travelled by EPA staff on average journey for each type of public transport (km); distance to and from Melbourne from regional offices (km); percentage breakdown of types of EPA public transport use (%).
Key emissions factors
Full fuel cycle emissions: • bus: 171 g CO_2-e/passenger km • rail: 150 g CO_2-e/passenger km • tram: 179 g CO_2-e/passenger km (Victorian Department of Transport 2012). V/Line emission factor: • 85.9 g CO_2-e/passenger km (Victorian Department of Transport 2012).
Key methodology guidance
EPA's EMS Standard operating procedure – Public transport and taxi data collection and assessment (see Appendix D).

Activity data management

The Finance Unit accounts for all public transport ticket purchases – including bus, rail and tram– under a specific cost centre. The Corporate Sustainability Coordinator then queries the financial database for annual expenditure per EPA office and separates it into metropolitan and regional public transport use.

Quantification method

Metropolitan public transport use

EPA uses an emission coefficient for metropolitan public transport expenditure (2.936 x 10^{-4} t CO_2-e/$ public transport expenditure). This was developed by the Green Stars Committee based on bus, rail and tram usage patterns at EPA, emissions associated with these types of transport and fares for these types of transport.

Regional public transport use

EPA uses an emission factor provided by Victorian Department of Transport (0.859 x 10^{-4} t CO_2-e/passenger km). Distance travelled by EPA regional staff is calculated based on each regional office's public transport expenditure, distance of their regional town to and from Melbourne on V/Line, and fare.

The full quantification method for both metropolitan and regional public transport use (which includes sources of emissions factors) is outlined in Appendix D, which is sourced from EPA's EMS Standard operating procedure – Public transport and taxi data collection and assessment.

Future tasks

- Update expenditure data annually.
- Update input data assumptions every two years, including the breakdown of public transport modes for EPA business travel, public transport ticket rates, and public transport emissions factors.
- Investigate availability of new data sources and developments in the Victorian-specific public transport emissions factors.
- Verify that financial data does not include purchases unrelated to public transport.

- Investigate staff trips that are not charged to EPA (e.g. people may already have a daily ticket).

e) Reticulated water

Checklist for reticulated water
Key activity data
Reticulated water consumed (l).
Key emissions factors
Reticulated water emissions factor: 1.36 kg CO_2-e/kL (Derived from greenhouse gas emissions data and total water supply data published by Victoria's Metropolitan Water Authorities - Melbourne Water Corporation; City West Water; Yarra Valley Water; and South East Water in their 2010-11 annual reports)
Key methodology guidance
EPA's EMS Standard operating procedure – GHG emissions associated with reticulated water (Appendix E).

Activity data management

The Corporate Sustainability Coordinator obtains water data from either water retailers or landlords. The source of water data for each of EPA's sites is outlined in Table E. Water data is received in litres used, which is multiplied by 1,000 to convert to cubic metres. The Corporate Sustainability Coordinator inputs this data into the relevant spreadsheet. Details of EPA's water consumption during 2012–13 are given in Table E below.

Table E: Mains water used at each EPA site

Site	Data source	2012-13 usage (kL)
Head Office	Property Manager	2,824.23
CES	Water retailer	1,341.32
EPA Gippsland	Water retailer	75.42
EPA North East	Water retailer	143.82
EPA North West	Landlord	35.34
EPA South West	Landlord	115.08
EPA Southern Metro	Landlord	53.05
Total		**4,588.26**

Quantification method

EPA uses an emissions factor for overall water use that was derived from greenhouse gas emissions data and total water supply data published by Victoria's Metropolitan Water Authorities (Melbourne Water Corporation, City West Water, Yarra Valley Water and South East Water) in their 2010-11 annual reports.

The full quantification method (including sources of emissions factors) is outlined in Appendix E which is sourced from EPA's EMS Standard operating procedure – GHG emissions associated with reticulated water.

Future tasks

- Update data annually.
- Investigate more accurate quantification of water consumption data. For example installation of water meters.
- Check for annual updates to Melbourne Water emissions and water supply

f) Office paper

Checklist for office paper
Key activity data
Reams of paper purchased; weight per ream (kg); source of paper supplied (international or domestic)
Key emissions factors
• Domestic: ○ 100% recycled: 1.52 kg CO_2-e/kg ○ 0% recycled: 1.30 kg CO_2-e/kg • International: ○ 100% recycled: 1.28 kg CO_2-e/kg ○ 0% recycled: 1.08 kg CO_2-e/kg (RMIT Centre for Design 2011).
Key methodology guidance
EPA's EMS Standard operating procedure – GHG emissions associated with office paper (Appendix F).

Activity data management

The Corporate Sustainability Coordinator receives monthly reports on the quantity of office paper purchased by EPA from its stationery provider, Corporate Express. This data is received in 'total weight purchased', 'recycled content' and 'Australian made'. The Corporate Sustainability Coordinator inputs this data into the relevant spreadsheet. The Corporate Express reports are also saved on the shared network space.

Quantification method

EPA uses four different emissions factors, which account for the quantity of recycled content and the location of manufacture (i.e. international or Australian made). These factors were developed by Royal Melbourne Institute of Technology's Centre for Design, based on emissions associated with office paper manufacturing and transportation.

The full quantification method (including sources of emissions factors) is outlined in Appendix F, EPA's EMS Standard operating procedure – GHG emissions associated with office paper.

EPA has recently reviewed its paper factors and an updated version of emissions factors for office paper has been released as EPA publication 1374.1.

Future tasks

- Update data annually.

g) Waste

Checklist for waste
Key activity data
Waste audit and assessment data for all EPA facilities except air monitoring stations.
Key emissions factors
• Commingled: 0.0 t CO_2-e/tonne waste • Paper and cardboard: 2.5 t CO_2-e/tonne waste • Food: 1.6 t CO_2-e/tonne waste (DIICCSRTE 2013, page 77, table 42). • General municipal solid waste: 1.2 t CO_2-e/tonne waste (DIICCSRTE 2013, page 79, table 44).
Key methodology guidance
DIICCSRTE 2013

EPA estimates the amount of methane released into the atmosphere as a result of the waste sent to landfill.

Activity data management

EPA estimates the weight of various types of waste it sends to landfill per year based on the results of waste audits undertaken throughout 2012-13 at all offices and CES laboratories (excluding air monitoring stations). Data from the waste audits is provided as extrapolated annual waste quantities (kg) for each waste type (commingled, paper and cardboard, food and general municipal solid waste) sent to landfill over the 2012-13 period for each EPA site. The Corporate Sustainability Coordinator then utilises the FRD reporting spreadsheet provided by the Department of Sustainability and Environment (DSE) to calculate a weighted average for each landfill waste type based on the proportion of Full Time Equivalent (FTE) staff at each site.

Quantification method

DIICCSRTE's NGA Factors waste type categories are applied to the weighted average waste data calculated by the FRD reporting spreadsheet. EPA then applies the DIICCSRTE annual methane conversion factors for each waste type.

Calculations for estimating methane attributable to EPA's waste are detailed in Figure 10.

GHG emissions (t CO_2-e) = (Wt * PP * EFP) + (Wt * Pc * EFc) + (Wt * Pf * EFf) + (Wt * Pm * EFm) = 5.09 t CO_2-e

Where:

W_t	=	Total EPA waste sent to landfill (tonnes)	=	3.88 tonnes
P_p	=	Proportion of paper and cardboard waste (from audit) sent to landfill	=	13.3%
EF_p	=	Annual methane conversion factor for paper and cardboard waste	=	2.5 t CO_2-e/tonne waste
P_c	=	Proportion of commingled waste (from audit) sent to landfill	=	6.5%
EF_c	=	Annual methane conversion factor for commingled waste	=	0.0 t CO_2-e/tonne waste
P_f	=	Proportion of food waste (from audit) sent to landfill	=	25.6%
EF_f	=	Annual methane conversion factor for food waste	=	1.6 t CO_2-e/tonne waste
P_m	=	Proportion of general municipal solid waste (from audit) sent to landfill	=	54.6%
EF_m	=	Annual methane conversion factor for general municipal solid waste	=	1.2 t CO_2-e/tonne waste

Figure 10: Equation for estimating methane emissions attributable to EPA waste and illustrative example

Future tasks

- Update data annually to reflect new emissions factors, landfill methane recovery rates and waste audit data.

h) Fuel extraction, production, transportation and electricity line losses

Checklist for fuel extraction, production, transportation and electricity line losses
Key activity data
Based on GJ and kWh data collected for fuels and electricity (see inventory items 'Electricity', 'Natural gas', 'High-temperature hot water', 'Diesel for backup generators', 'Vehicle and boat fuel', 'Flights' and 'Taxis' above).
Key emissions factors
• Victorian end-user electricity (full fuel cycle and transmission losses): 0.15 kg CO_2-e/kWh (DIICCSRTE, July 2013, page 73, table 41). • Victorian small user natural gas (full fuel cycle): 3.9 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 71, table 37). • Diesel oil (full fuel cycle): 5.3 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 72, table 40). • Petrol (full fuel cycle): 5.3 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 72, table 40). • LPG (full fuel cycle): 5.0 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 72, table 40). • Gasoline for use as fuel in an aircraft: 5.3 kg CO_2-e/GJ (DIICCSRTE, July 2013, page 72, table 40).
Key methodology guidance
DIICCSRTE 2013

EPA estimates the scope 3 full fuel cycle emissions associated with all energy consumption (electricity, gas and fuel), including:

- Extraction, production, and transportation of fuel burned to generate electricity.
- Electricity lost in the delivery of EPA's electricity along the transmission and distribution network.
- Extraction, production and transportation of natural gas, automotive diesel oil, petrol, LPG and aircraft gasoline.

Activity data management

Electricity, gas and fuel data is based on the activity data collected for the following emission sources discussed above:

- Building electricity, gas, diesel and HTHW consumption.
- Vehicle and boat fuel.
- Taxis.

Quantification method

EPA then applies the DIICCSRTE scope 3 emissions factors for each energy type to the activity data.

Future tasks

- Update data annually.

i) Catering

Checklist for catering	
Key activity data	
Catering expenditure ($); percentage spent on catering categories from Elizabeth Andrews catering company (%).	
Key emissions factors	
Source	kg CO_2-e/(2012$)
Meat and meat products	4.77
Dairy products	1.32
Vegetable and fruit growing, hay, plant nurseries, flowers	0.76
Oils and fats	1.08
Flour, cereal foods, rice, pasta and other flour mill products	0.76
Bread, cakes, biscuits and other bakery products	0.56
Confectionery	0.41
Other (EPA calculation – average of all EF)	1.38
(RMIT Centre for Design)	
Key methodology guidance	
EPA's EMS Standard operating procedure — Greenhouse gas emissions associated with catering (Appendix G)	

EPA estimates the amount of GHG emissions associated with the production, preparation and supply of catering (both internal and external).

Activity data management

EPA obtained a breakdown of the percentage of dollars spent on each catering category in 2007–08 from preferred catering supplier Elizabeth Andrews. EPA then obtains the total dollar spent on internal catering from its Finance Unit. The catering categories and their associated emissions factors were originally provided by RMIT's Centre for Design however, these factors were based on 2005 cost figures and have subsequently been indexed to account for equivalent 2012 costs using the Reserve Bank of Australia Inflation Calculator (RBA 2013).

Quantification method

The dollar amount spent on each catering category is determined by multiplying the percentage breakdown (provided by Elizabeth Andrews Catering) by the total catering expenditure for the year. EPA then multiplies the dollar spent on each food type by the appropriate emission factor, as outlined in Figure 11.

$$\text{GHG emissions (kg } CO_2\text{-e)} = (C_t * P_m * EF_m) + (C_t * P_d * EF_d) + (C_t * P_v * EF_v) + (C_t * P_o * EF_o) + (C_t * P_f * EF_f) + (C_t * P_b * EF_b) + (C_t * P_c * EF_c) + (C_t * P_{ot} * EF_{ot})$$

Where:

C_t = Total EPA expenditure on catering ($)

P_m = Proportion of expenditure spent on meat and meat products (%)

EF_m = Emissions factor for meat and meat products (kg CO_2-e/$)

P_d = Proportion of expenditure spent on dairy products (%)

EF_d = Emissions factor for dairy products (kg CO_2-e/$)

P_v = Proportion of expenditure spent on vegetable and fruit growing, hay, plant nurseries and flowers (%)

EF_v = Emissions factor for vegetable and fruit growing, hay, plant nurseries and flowers (kg CO_2-e/$)

P_o = Proportion of expenditure spent on oils and fats (%)

EF_o = Emissions factor for oils and fats (kg CO_2-e/$)

P_f = Proportion of expenditure spent on flour, cereal foods, rice, pasta and other flour mill products (%)

EF_f = Emissions factor for flour, cereal foods, rice, pasta and other flour mill products (kg CO_2-e/$)

P_b = Proportion of expenditure spent on bread, cakes, biscuits and other bakery products (%)

EF_b = Emissions factor for bread, cakes, biscuits and other bakery products (kg CO_2-e/$)

P_c = Proportion of expenditure spent on confectionery (%)

EF_c = Emissions factor for confectionery ((kg CO_2-e/$)

P_{ot} = Proportion of expenditure spent on other (%)

EF_{ot} = Emissions factor for other (kg CO_2-e/$)

Figure 11: Equation for estimating GHG emissions from catering

Future tasks

- Update data annually.
- Update proportion of expenditure data with EPA's preferred catering supplier.
- Update to account for annual inflation

k) Staff commuting

Checklist for staff commuting	
Key activity data	
Distance travelled; mode of transport; frequency of travel	
Key emissions factors	
Mode	**Emissions factor (kg CO_2-e/km)**
Small car (e.g. Toyota Corolla)	0.172
Super-efficient car, i.e. hybrid (e.g. Toyota Prius)	0.106
Medium car (e.g. Toyota Camry)	0.210
Large car (e.g. Holden Commodore Executive)	0.256
Small 4WD (e.g. Land Rover Freelander)	0.224

Medium 4WD (e.g. Jeep Wrangler)	0.273
Large 4WD (e.g. Jeep Grand Cherokee)	0.352
Unspecified car type	0.213
Train – metropolitan	0.150
Train – regional	0.0859
Tram	0.179
Bus	0.171
Motorbike, scooter	0.112
Walk	–
Cycle	–
Worked from home	–
Did not go to work	–
Calculated from Green Vehicle Guide 2008; DOT 2012; CES 2008.	
Key methodology guidance	
EPA's EMS Standard operating procedure – Staff commuting data collection and assessment (Appendix H)	

Activity data management

EPA uses the data collected from an annual survey of staff regarding their commuting modes and distances, that was completed in May 2013. The survey activity data is extrapolated to all of EPA, based on the total number of full-time employees at EPA at the end of June 2013.

Quantification method

EPA applies the appropriate emissions factors to the distance travelled to each of the modes of transport, as outlined in Figure 12. Information on data collection for staff commuting patterns is provided in Appendix H, which is sourced from EPA's EMS Standard operating procedure – Staff commuting data collection and assessment.

$$\text{GHG emissions (kg } CO_2\text{-e)} = (D_{SC} * EF_{SC}) + (D_t * P_d * EF_d) + (C_t * P_v * EF_v) + (C_t * P_o * EF_o) + (C_t * P_f * EF_f) + (C_t * P_b * EF_b) + (C_t * P_c * EF_c) + (C_t * P_{ot} * EF_{ot})$$

Where:

D_{SC} = Total staff commuting distance travelled by small car (km)

EF_{SC} = Emissions factor for small car (kg CO_2-e/km)

D_{SEC} = Total staff commuting distance travelled by super-efficient car (e.g. hybrids) (km)

EF_{SEC} = Emissions factor for super-efficient car (e.g. hybrids) (kg CO_2-e/km)

D_{MC} = Total staff commuting distance travelled by medium car (km)

EF_{MC} = Emissions factor for medium car (kg CO_2-e/km)

D_{LC} = Total staff commuting distance travelled by large car (km)

EF_{LC} = Emissions factor for large car (kg CO_2-e/km)

D_{S4WD} = Total staff commuting distance travelled by small 4WD (km)

EF_{S4WD} = Emissions factor for small 4WD (kg CO_2-e/km)

D_{M4WD} = Total staff commuting distance travelled by medium 4WD (km)

EF_{M4WD} = Emissions factor for medium 4WD (kg CO_2-e/km)

D_{L4WD} = Total staff commuting distance travelled by large 4WD (km)

EF_{L4WD}	=	Emissions factor for large 4WD (kg CO_2-e/km)
D_{UC}	=	Total staff commuting distance travelled by unknown car size (km)
EF_{UC}	=	Emissions factor for unknown car size (kg CO_2-e/km)
D_{MTN}	=	Total staff commuting distance travelled by metropolitan train (km)
EF_{MTN}	=	Emissions factor for metropolitan train (kg CO_2-e/km)
D_{RTN}	=	Total staff commuting distance travelled by regional train (km)
EF_{RTN}	=	Emissions factor for regional train (kg CO_2-e/km)
D_{TM}	=	Total staff commuting distance travelled by tram (km)
EF_{TM}	=	Emissions factor for tram (kg CO_2-e/km)
D_{B}	=	Total staff commuting distance travelled by bus (km)
EF_{B}	=	Emissions factor for bus (kg CO_2-e/km)
D_{MS}	=	Total staff commuting distance travelled by motorbike or scooter (km)
EF_{MS}	=	Emissions factor for motorbike or scooter (kg CO_2-e/km)

Figure 12: Equation for estimating GHG emissions from catering

Future tasks

- Update staff commuting data annually.
- Investigate availability of new data sources and developments in the Victorian-specific public transport emissions factors.

k) Courier services

Checklist for courier services
Key activity data
Courier services expenditure ($); percentage of different types of courier modes of transport and distances travelled by TNT (most used courier service provider by EPA)
Key emissions factors
• Emissions factor: 1.55 x 10^{-4} t CO_2-e/$ (Based on EPA courier services data 2008–09, DEFRA 2013 emissions factors and indexed for inflation).
Key methodology guidance
EPA's EMS Standard operating procedure – GHG emissions associated with courier services (Appendix I).

EPA estimates the amount of GHG emissions associated with transporting all couriered items.

Activity data management

EPA obtains a breakdown of the dollars spent on courier services each year from the Finance Unit. In order to estimate the emissions per dollar spent on courier services, EPA contacted its most-used courier service provider, TNT, in 2008-09. Each individual transaction undertaken with TNT was analysed to work out the average GHG emissions per dollar spent by EPA when engaging this courier service provider. EPA was unable to obtain a revised breakdown of courier services for 2009–10, 2010–11, 2011-12 or 2012-13. Despite not being able to obtain this data, the emissions factor was revised in 2012-13 to incorporate more up-to-date emissions factors for freight transport published by DEFRA (2013) and to account for annual inflation. EPA's 2012–13 courier expenditure is used with the updated emissions factor for courier services to calculate Scope 3 courier emissions. Emissions associated with fuel extraction, production and transportation of the fuel used in courier services is also included.

Quantification method

EPA's total courier services expenditure for 2012–13 is multiplied by EPA's courier services emissions factor (2012–13).

Future tasks

- Update data annually including DEFRA emissions factors and inflation
- Work with courier companies to update emissions factor and obtain a better breakdown of services provided annually

l) Printing and publication services

Checklist for printing and publication services
Key activity data
Total spent on printing and publication services.
Key emissions factors
Emissions factor (kg CO_2-e/$10,000): Commercial in confidence.
Key methodology guidance
Finsbury Green 2012.

EPA estimates the amount of GHG emissions associated with printing and publication services.

Activity data management

The Corporate Sustainability Coordinator obtains a list of companies that have provided printing and publications services for the EPA from the Publications Manager. The Corporate Sustainability Coordinator provides this list to the Finance Unit to obtain the total amount spent by EPA on publications from each service provider for the year.

Quantification method

The emissions factor is multiplied by EPA's total amount spent on publications and printing services for 2012–13.

Future tasks

- Update data annually.
- Identify a more accurate and up-to-date emissions factor for printing and publications services.
- Work with service providers to obtain emission factors specific to their operations.

4 Reduction measures

4.1 Onsite reductions

Any measures that directly reduce emissions sources in EPA's inventory should automatically be reflected in activity data. This section briefly outlines EPA's onsite reductions to date and proposed steps for facilitating onsite reductions in the future.

Following significant investments over a number of years to improve operational environmental performance, EPA's focus for 2012-13 was on maintaining environmental performance and setting practical goals for continual improvement. EPA established a target to reduce overall greenhouse gas emissions by 5 per cent. To achieve this goal, EPA proposed a number of environmental performance targets for 2012-13 (outlined below).

Environmental aspect	Target performance
Greenhouse gas emissions	Reduce overall greenhouse gas emissions by 5%
Stationary energy consumption	Reduce EPA's stationary energy consumption per full time equivalent (FTE) by 5%
Fuel use	Maintain current levels of fuel efficiency
Waste management	Reduce overall waste produced by 5% Reduce current levels of waste to landfill by 5% Maintain proportion of total waste that is recycled at 85%
Water consumption	Maintain current levels of water consumption
Paper use	Reduce paper use from 7.94 reams to 6 reams per FTE
Transport	Maintain the current levels of employees regularly (>75% of work attendance days) using public transport, cycling or walking to and from work

To date, EPA has implemented the following initiatives to reduce GHG emissions:

- upgrading regional offices to incorporate a wide range of environmentally-friendly features
- greening the EPA fleet by purchasing hybrid and LPG-dedicated vehicles and smaller cars
- undergoing fuel-efficient driver training for staff
- promoting car-pooling and public transport for business travel
- improving facilities for cyclists
- hosting lighting and appliance turn-off campaigns
- running paper-use reduction campaigns
- installing energy efficient lighting systems and timers on electrical equipment
- re-using excess lighting from one office to use in another office
- installing a new switch board to segregate EPA tenancy power and installing individual power boards at Bendigo
- installing insulation
- delamping and removing excess lighting where possible
- replacing existing computer screens with low-energy intensity flat screens
- replacing existing computers and monitors with small, low-wattage PCs and monitors
- reducing the number of printers
- increasing the virtualisation of servers and implementing server room efficiency upgrades
- undertaking energy audits and energy behaviour change programs at all sites
- undertaking water audits and water behaviour change programs at all sites
- undertaking waste audits and waste behaviour change programs at all sites

- upgrading video and teleconferencing facilities across all EPA sites
- an internal carbon cap and trade scheme across all EPA's sites
- developing a Sustainable Purchasing Framework that considers greenhouse implications of purchases
- relocating EPA's head office to a 6 green star building (including 5.5 star energy and 5 star waste NABERS ratings) and incorporating environmental considerations in operating and maintaining infrastructure.
- Choosing to relocate EPA's head office to a building with a trigeneration plant as the main source of electricity
- a PIN-based printing system to reduce printing volumes and trialing 'follow-me' printing
- implementing a comprehensive waste management system including the recycling of organic, commingled, paper, soft plastics and electronic waste across all of EPA sites.
- undertaking an Energy Efficiency Opportunities (EEO) Review project
- developing a Standard Operating Procedure (SOP) for EPA office energy audits
- providing electronic tablets to executive team to reduce paper use in meetings

4.2 GreenPower purchases

In 2012–13, 2 per cent of EPA's electricity use came from GreenPower. This was a significant decrease from previous years, however GreenPower has not been counted towards emissions reductions or offsets. Australian Government policy changes and accounting practices have created uncertainty regarding the inclusion of GreenPower in achieving total carbon reductions. As a result, EPA chose instead to purchase internationally accredited carbon offsets to offset emissions rather than purchase GreenPower.

EPA will continue to review its carbon neutral strategy, including the relevance of GreenPower in offsetting greenhouse gas emissions. As renewable energy sources are critical to transition to a low carbon economy, EPA will continue to assess the value of purchasing GreenPower to support innovation and growth in this industry.

4.3 Offset product purchases

EPA seeks robust, transparent, externally verified and cost-competitive offset products that deliver positive environmental co-benefits. EPA undertakes a rigorous review process to investigate offset products, the primary aim of which is to ensure that the offsets purchased provide real reductions in greenhouse gases entering the atmosphere. Before making a purchase, EPA evaluates the characteristics and the accounting methods of potential products by contacting offset providers and asking to be provided with:

- technical documentation of accounting methods and monitoring and verification protocols
- evidence of third-party verification and accreditation
- documentation that the carbon credits are retired upon purchase.

EPA acquired 3,300 tonnes of carbon offsets to balance its residual emissions. This includes a 'buffer' to cover any potential margin of error in inventory or carbon credit calculations. A portfolio of offsets was purchased from four main sources. The following sources of offsets are discussed in more detail below:

- Carbon Financial Services Gold Standard accredited Suzhou Qizi Mountain Landfill Gas Recovery offsets (1,000 t CO_2-e)
- Climate Friendly VCS accredited Gunung Salak Geothermal offsets (1,000 t CO_2-e)
- Cleaner Climate VCS accredited Gujurat Bundled Wind Energy Generation offsets (1,300 t CO_2-e)

Carbon Financial Services Gold Standard accredited Suzhou Qizi Mountain Landfill Gas Recovery offsets (1,000 t CO_2-e)

Sourced through Carbon Financial Services (http://www.carbonfinancialservices.com.au/), these offsets are accredited under the Gold Standard (http://www.cdmgoldstandard.org/). The offsets are generated by capturing methane landfill emissions and generating onsite renewable electricity with subsequent reductions in offsite non-renewable fossil fuel electricity generation. Additional documentation related to this project is available in Appendix J.

Climate Friendly VCS accredited Gunung Salak Geothermal offsets (1,000 t CO_2-e)

Sourced through Climate Friendly (https://climatefriendly.com), these offsets are accredited under the Voluntary Carbon Standard (www.v-c-s.org). The offsets are sourced from the Gunung Salak Geothermal project in Indonesia. The project involves an efficiency upgrade of geothermal power plant turbines to increase grid electricity capacity by an extra 200,000 MWh of electricity per annum from renewable, low emission sources. This will lead to a decrease in the carbon intensity of the local grid, thereby displacing greenhouse gas emissions. Additional documentation related to this project is available in Appendix K.

Cleaner Climate VCS accredited Gujurat Bundled Wind Energy Generation offsets (1,300 t CO_2-e)

Sourced through Cleaner Climate (http://www.cleanerclimate.com), these offsets are accredited under the Voluntary Carbon Standard (www.v-c-s.org). The offsets are sourced from the Gujurat Bundled Wind Energy Generation project in India. The project activity involves installation of 75 wind turbines with a total capacity up to 59.4 MW. The electricity generated is exported to the local grid, reducing the greenhouse gas intensity of the grid and reducing reliance on fossil fuel derived electricity. Additional documentation related to this project is available in Appendix L.

5 Roles and Responsibilities

Structure

The Corporate Strategy Unit and, more specifically, the Corporate Sustainability Coordinator are responsible for managing EPA's annual GHG inventory and implementing EPA's carbon neutral strategy. The Corporate Strategy Unit sits within the Corporate Services Directorate.

Corporate Sustainability Coordinator and Carbon Neutral team

EPA's Corporate Sustainability Coordinator, gathers data from the People & Culture and Finance units to develop an annual GHG inventory in line with the GHG Protocol. The Corporate Sustainability Coordinator will also work cooperatively with an internal and external verification and assurance team to allow smooth implementation of the process.

Manager, Corporate Strategy

EPA's Corporate Strategy Manager will oversee, review and approve EPA's annual Greenhouse Gas Inventory Management Plan and associated communication documents. It is the responsibility of the Corporate Strategy Manager to ensure adequate resources are available to develop and deliver EPA's carbon neutral strategy annually.

Director, Corporate Services

EPA's Corporate Services Director will oversee the development of EPA's annual Greenhouse Gas Inventory Management Plan and carbon neutral strategy. The Corporate Services Director will review the Greenhouse Gas Inventory Management Plan and carbon neutral strategy, and assume ultimate responsibility for the achievement of targets set through the carbon neutral strategy.

Executive Management Team

EPA's Executive Management Team will review and approve EPA's annual Greenhouse Gas Inventory Management Plan and carbon neutral strategy. Members of the Executive Management Team will also be responsible for communicating the strategy at senior conferences, meetings and discussions, where appropriate.

Green Stars committee

EPA's Green Stars will assist with data provision and internal verification wherever applicable.

Finance Unit

EPA's Finance Unit will review and provide all relevant data that sits with this unit.

People & Culture Unit

EPA's People & Culture Unit will review and provide all relevant data that sits with this unit.

6 External Verification and Assurance of Inventory and carbon neutral strategy

Each year, EPA will seek the services of an external verification/assurance provider to independently assure the EPA GHG Inventory Management Plan and strategy. Net Balance Management Group was used to provide this service for the 2012–13 GHG inventory and carbon neutral strategy (see Appendix B for external assurance statement). Contact details for Net Balance Management Group are provided below:

Terence Jeyaretnam
Director, Net Balance Management Group Pty Ltd
Level 4, 460 Bourke Street, Vic, 3000
T: +61 3 8641 6401
F: +61 3 9600 1295
Email: terence@netbalance.com

EPA will consider available independent assurance providers each year before engaging a company. The decision will include consideration of the following:

- familiarity with EPA
- experience in verifying robust GHG Protocol inventories and carbon reduction strategies
- value for money.

7 References

Department of Environment Food and Rural Affairs (DEFRA) 2013, UK Government Conversion Factors for Company Reporting, Department of Environment Food and Rural Affairs and Department of Energy and Climate Change, United Kingdom, July 2013. http://www.ukconversionfactorscarbonsmart.co.uk

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) April 2013, Australian National Greenhouse Accounts National Greenhouse Inventory Report 2011, Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, April 2013. Available at:

http://www.climatechange.gov.au/climate-change/greenhouse-gas-measurement-and-reporting/tracking-australias-greenhouse-gas-emissio-0/national-inventory-report-2011

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) July 2013, Australian National Greenhouse Accounts National Greenhouse Accounts Factors, Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, July 2013. Available at:

http://www.climatechange.gov.au/climate-change/greenhouse-gas-measurement-and-reporting/tracking-australias-greenhouse-gas-emissions/national-greenhouse-accounts-factors%E2%80%94july-2013

GHG Protocol 2004, The GHG Protocol: A Corporate Accounting and Reporting Standard, WRI/WBCSD GHG Protocol, Revised Edition, March 2004. Available at http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

GHG Protocol 2005a, Calculating HFC and PFC Emissions from the Manufacturing, Installation, Operation and Disposal of Refrigeration and Air-conditioning Equipment, Guide to calculation worksheets, GHG Protocol, v 1.0, January 2005. Available at http://www.ghgprotocol.org/files/ghgp/tools/hfc-cfc.pdf

GHG Protocol 2005b, Calculation Tool for Direct Emissions from Stationary Combustion, WRI/WBCSD GHG Protocol Stationary Combustion Guidance, v 3.0, July 2005. Available at http://www.ghgprotocol.org/files/ghgp/tools/Stationary_Combustion_Guidance_final.pdf

GHG Protocol 2006, Allocation of GHG Emissions from a Combined Heat and Power (CHP) Plant, Guide to calculation worksheets v 1.0, September 2006. Available at :

http://www.ghgprotocol.org/files/ghgp/tools/CHP_guidance_v1.0.pdf

GHG Protocol 2010, Indirect CO_2 emissions from the Consumption of Purchased Electricity, Heat, and Steam: Guide to calculation worksheets v 1.2, a WRI/WBSCD GHG Protocol Initiative calculation tool, September 2010. Available at http://www.ghgprotocol.org/files/ghgp/tools/ElectricityHeatSteamPurchase_guidance1.2.pdf

Grant T 2007, Carbon Emissions Factors Developed for EPA Personal Footprint Calculator, Royal Melbourne Institute of Technology, Calculator available at www.epa.vic.gov.au/ecologicalfootprint/calculators/default.asp

Green Vehicle Guide 2008, Australian Government, www.greenvehicleguide.gov.au/GVGPublicUI/home.aspx

IPCC 2007 Forster PV et al., 'Changes in Atmospheric Constituents and in Radiative Forcing', in Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, USA.

Reserve Bank of Australia 2013, 'Inflation Calculator', Available online: www.rba.gov.au/calculator

Appendix A: Summary of EPA's 2012-13 GHG emissions inventory

2012-13 GHG inventory

Emissions source	Consumption units	Consumption	2012-13 Emissions (tonnes CO_2-e)	Proportion of total inventory (%)	2012-13 change in emissions inventory compared to 2011-12
Direct emissions (Scope 1)					
Natural Gas where EPA is the sole tenant	GJ	160.92	8.26	0.26%	-1.31%
Back-up Diesel Generators at Leased Space where EPA is Sole Tenant (CES)	kL	0.00	0.00	0.00%	N/A
Building AC Refrigerants Leakage at Leased Space where EPA is the Sole Tenant (Kyoto Gases)	kg	3.65	5.71	0.18%	0.00%
Building AC Refrigerants Leakage at Leased Space where EPA is the Sole Tenant (Non-Kyoto Gases)	kg	2.95	4.42	0.14%	0.00%
Kitchen & Lab Refrigerator Refrigerant Leakage (Kyoto Gases)	kg	0.28	0.62	0.02%	0.00%
Kitchen & Lab Refrigerator Refrigerant Leakage (Non-Kyoto Gases)	kg	0.26	0.81	0.03%	0.00%
LPG for vehicles	kL	19.79	31.21	0.97%	-32.41%
Petrol for vehicles (ULP)	kL	76.25	174.52	5.44%	15.14%
Automotive Diesel Oil for vehicles (ADO)	kL	12.89	34.73	1.08%	-27.05%
Petrol for boats (ULP)	kL	13.83	32.92	1.03%	-6.44%
Automotive Diesel Oil for boats (ADO)	kL	0.00	0.00	0.00%	N/A
Vehicle AC Refrigerant Leakage	kg	7.32	9.51	0.30%	1.87%
Total Scope 1			**302.73**	**9.43%**	**-2.29%**
Indirect emissions (Scope 2)					
Purchased Electricity for Tenant Power & Light at All Facilities and Base Building Power where EPA is the Sole Tenant	kWh	855909.05	1001.41	31.20%	-2.18%
Gas used in the generation of Purchased Electricity for Tenant Power & Light at Head Office (Trigeneration)	GJ	3080.43	158.12	4.93%	8.78%
Purchased High Temperature Hot Water	GJ	5082.29	260.87	8.13%	44.27%
Total Scope 2			**1420.41**	**44.25%**	**5.22%**
Optional emissions (Scope 3)					
Purchased Electricity for Base Building Power at Leased Space where EPA is Not the Sole Tenant	kWh	375033.59	438.79	13.67%	10.13%
Purchased Trigeneration Electricity for Base Building Power at Head Office	GJ	2017.68	103.57	3.23%	-8.29%
Natural Gas at Leased Space where EPA is Not the Sole Tenant (Geelong, Macleod)	GJ	111.54	5.73	0.18%	-14.75%

Back-up Diesel Generators at Leased Space where EPA is Not the Sole Tenant	kL	0.20	0.53	0.02%	-9.68%
Building AC Refrigerant Leakage at Leased Space where EPA is Not the Sole Tenants (Kyoto Gases)	kg	8.65	11.30	0.35%	-13.77%
Building AC Refrigerant Leakage at Leased Space where EPA is Not the Sole Tenants (Non-Kyoto Gases)	kg	2.13	3.19	0.10%	0.05%
Flights	km	360,443.17	99.39	3.10%	-5.49%
Taxi	$ expenditure	19,973.90	2.10	0.07%	-41.40%
Public Transport	$ expenditure	32,400.89	11.66	0.36%	5.55%
Reticulated water supply	kL	4588.26	6.24	0.19%	-29.52%
Office Paper	kg	5775.46	7.52	0.23%	-20.94%
Staff Commuting	km	2783576.00	385.83	12.02%	-14.24%
Catering	$ expenditure	100103.68	147.57	4.60%	-29.23%
Inert recyclable waste (commingled)	tonnes	0.25	0.00	0.00%	0.00%
Paper & Cardboard Waste	tonnes	0.52	1.29	0.04%	152.00%
Food Waste (Organics)	tonnes	0.99	1.59	0.05%	-13.40%
Municipal Solid Waste (generic)	tonnes	2.12	2.54	0.08%	-8.99%
Couriers	$	9565.35	1.48	0.05%	-45.90%
Colour Publications	$	80936.19	9.53	0.30%	8.87%
Emissions from Fuel Extraction and T&D Line Losses for all Purchased Electricity	kWh	1230942.64	184.64	5.75%	3.00%
Emissions from Fuel Extraction for Natural Gas	GJ	10452.86	40.77	1.27%	16.61%
Emissions from Fuel Extraction for LPG	kL	19.79	2.59	0.08%	-32.41%
Emissions from Fuel Extraction for Petrol (ULP)	kL	90.08	16.33	0.51%	11.21%
Emissions from Fuel Extraction for ADO	kL	13.09	2.68	0.08%	-26.84%
Total Scope 3			**1486.85**	**46.32%**	**-6.17%**
Scope 1 + 2			**1723.13**	**53.68%**	**3.82%**
SCOPE 1 + 2 + 3			**3209.98**	**100.00%**	**-1.06%**
Reduction measures					
Offsets					
GS – Landfill Gas Recovery, China	tonnes CO_2-e	1,000	–1,000		
VCS – Geothermal power, Indonesia	tonnes CO_2-e	1,000	–1,000		
VCS - Wind power, India	tonnes CO_2-e	1300	–1300		
NET EMISSIONS			-90.02		

Appendix B: EPA's carbon neutral external assurance statement

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INDEPENDENT VERIFICATION STATEMENT
Greenhouse Gas Inventory: 2012-13

To the Chairman and Management of EPA Victoria:

The Environment Protection Authority, Victoria (EPA Victoria) commissioned Net Balance Management Group Pty Ltd (Net Balance) to provide independent verification of the organisation's Greenhouse Gas (GHG) Inventory for the period 1 July 2012 to 30 June 2013. This GHG Inventory forms part of the overall strategy for maintaining the organisation's carbon neutral status. EPA Victoria was responsible for the preparation of the GHG inventory and this statement represents the verification provider's independent opinion. Net Balance's responsibility in performing our verification activities is to the Chairman and Management of EPA Victoria alone and in accordance with the terms of reference agreed with them. Other stakeholders should perform their own due diligence before taking any action as a result of this statement.

Verification objectives

The objective of the verification process is to provide the Chairman and Management of EPA Victoria, as well as its stakeholders, with an independent opinion on the accuracy of the GHG inventory. This is achieved through a review of the underlying systems, information and calculations supporting the GHG inventory.

Verification scope and methodology

The verification engagement was undertaken between July and August 2013 against the requirements of the *GHG Protocol* and the *ISO 14064-3* international standard series for the quantification, validation and verification of greenhouse gas emissions. The verification scope covered EPA Victoria's complete GHG inventory, including Scope 1, 2 and 3 emissions. As factors contributing to the inventory, total use metrics for energy, paper use, organics and recyclable materials to processors, waste to landfill, potable water consumption, staff commuting, taxi travel, courier use, catering and total air travel associated with EPA Victoria's operations were also within the verification scope. The verification process involved:

- Sighting of calculation methodologies and re-performing calculations to substantiate the accuracy of the GHG inventory.
- A sampling based approach to verify source data, where sufficient evidence is obtained to support the statement, such that the risk of Net Balance's conclusions being in error is reduced.
- Interviews with data owners and the EMS coordinator responsible for calculating the GHG inventory in order to understand data sources, reliability of data, completeness of data and the basis of key assumptions used in reporting.
- Evaluation of supporting documentary evidence.
- Reviewing EPA Victoria's carbon neutral status for 2012-13, including a review of the quantity of offsets purchased by EPA Victoria. The portfolio consisted of a suite of offsets purchased from a combination of Gold Standard and Verified Carbon Standard (VCS) carbon offsets.
- Providing a written statement and supporting report on the findings, conclusions and recommendations.

Our findings and conclusions have been used by EPA Victoria to adjust their methodology and revise their 2011-12 GHG inventory. Further information on the verification process is presented in the management report.

Our competency and independence

The verification process was carried out by a team of greenhouse and energy technical specialists. Net Balance was not responsible for preparing any part of the GHG inventory. Net Balance has provided advice to EPA Victoria on air quality and contaminated sites during the reporting year. This work was determined not to be in conflict with our objectivity in relation to this verification engagement in accordance with our Independence Policy, a copy of which is available at http://www.netbalance.com/services/assurance.

Our opinion

Based on the scope of the verification process and procedures conducted, the following represents our opinion:

- The findings of the verification engagement provide confidence in the systems and processes used for managing and reporting GHG emissions.
- EPA Victoria's GHG inventory is a fair and accurate representation of the organisation's GHG emissions during the reporting period.
- Data trails selected were easily identifiable and traceable, and the personnel responsible were able to reliably demonstrate the origin(s) and interpretation of data.
- Any errors identified during the verification were rectified prior to finalising the GHG inventory.
- The declaration of EPA Victoria's carbon neutral status for 2012-13 appropriately reflects the GHG inventory.

On behalf of the verification team
27 September 2013
Melbourne, Australia

Terence Jeyaretnam, FIEAust
Director, Net Balance, Lead CSAP (AccountAbility, UK)

Appendix C: EPA's revised 2011–12 GHG emissions inventory

2011-12 GHG inventory

Emissions source	Consumption units	Consumption	2011-12 Emissions (tonnes CO_2-e)	Proportion of total inventory (%)	2011-12 change in emissions inventory compared to 2010-11
Direct emissions (Scope 1)					
Natural Gas where EPA is the sole tenant	GJ	163.06	8.37	0.26%	-58.15%
Back-up Diesel Generators at Leased Space where EPA is Sole Tenant (CES)	kL	0.0000	0.00	0.00%	N/A
Building AC Refrigerants Leakage at Leased Space where EPA is the Sole Tenant (Kyoto Gases)	kg	3.65	5.71	0.18%	0.00%
Building AC Refrigerants Leakage at Leased Space where EPA is the Sole Tenant (Non-Kyoto Gases)	kg	2.95	4.42	0.17%	-28.42%
Kitchen & Lab Refrigerator Refrigerant Leakage (Kyoto Gases)	kg	0.28	0.62	0.02%	-23.35%
Kitchen & Lab Refrigerator Refrigerant Leakage (Non-Kyoto Gases)	kg	0.26	0.81	0.03%	-22.45%
LPG for vehicles	kL	29.28	46.18	1.43%	-55.16%
Petrol for vehicles (ULP)	kL	66.22	151.56	4.69%	3.94%
Automotive Diesel Oil for vehicles (ADO)	kL	17.67	47.61	1.47%	16.31%
Petrol for boats (ULP)	kL	14.78	35.19	1.09%	-2.01%
Automotive Diesel Oil for boats (ADO)	kL	0.00	0.00	0.00%	N/A
Vehicle AC Refrigerant Leakage	kg	7.18	9.34	0.29%	0.72%
Total Scope 1			**302.72**	**9.55%**	**-16.08%**
Indirect emissions (Scope 2)					
Purchased Electricity for Tenant Power & Light at All Facilities and Base Building Power where EPA is the Sole Tenant*	kWh	860262.94	1023.71	31.55%	-34.01%
Gas used in the generation of Purchased Electricity for Tenant Power & Light at Head Office (Trigeneration)*	GJ	2831.88	145.36	4.48%	43.11%
Purchased High Temperature Hot Water	GJ	3522.72	180.82	5.57%	-60.60%
Total Scope 2			**1349.89**	**41.61%**	**-36.08%**
Optional emissions (Scope 3)					
Purchased Electricity for Base Building Power at Leased Space where EPA is Not the Sole Tenant*	kWh	334818.80	398.4344	12.28%	88.93%
Purchased Trigeneration Electricity for Base Building Power at Head Office*	GJ	2199.96	112.92	3.48%	58.84%
Natural Gas at Leased Space where EPA is Not the Sole Tenant (Geelong, Macleod)	GJ	130.84	6.72	0.21%	29.62%

Back-up Diesel Generators at Leased Space where EPA is Not the Sole Tenant	kL	0.20	0.58	0.02%	8.51%
Building AC Refrigerant Leakage at Leased Space where EPA is Not the Sole Tenants (Kyoto Gases)	kg	10.04	13.10	0.40%	15.96%
Building AC Refrigerant Leakage at Leased Space where EPA is Not the Sole Tenants (Non-Kyoto Gases)	kg	2.12	3.19	0.10%	44.59%
Flights*	km	356162.31	105.16	3.24%	20.29%
Taxi	kL	2.27	3.58	0.11%	-33.79%
Public Transport	$ expenditure	28,289.16	11.05	0.34%	-2.49%
Reticulated water supply	kL	6511.14	8.85	0.27%	31.78%
Office Paper*	kg	7207.48	9.52	0.29%	-11.77%
Staff Commuting*	km	3065956.19	449.88	13.87%	7.19%
Catering*	$ expenditure	139,125.40	208.52	6.43%	-5.06%
Inert recyclable waste (commingled)*	tonnes	0.37	0.00	0.00%	N/A
Paper & Cardboard Waste*	tonnes	0.20	0.51	0.02%	-16.94%
Food Waste (Organics)*	tonnes	1.15	1.84	0.06%	7.57%
Municipal Solid Waste (generic)*	tonnes	2.33	2.80	0.09%	84.05%
Couriers	$	17,585.01	2.74	0.08%	215.55%
Colour Publications*	$	73,209.61	8.75	0.27%	-69.35%
Emissions from Fuel Extraction and T&D Line Losses for all Purchased Electricity	kWh	1195081.74	179.26	5.53%	-17.94%
Emissions from Fuel Extraction for Natural Gas	GJ	8848.46	34.96	1.08%	-30.20%
Emissions from Fuel Extraction for LPG	kL	29.28	3.84	0.12%	-55.16%
Emissions from Fuel Extraction for Petrol (ULP)	kL	81.00	14.68	0.45%	2.80%
Emissions from Fuel Extraction for ADO	kL	17.87	3.66	0.11%	16.21%
Total Scope 3			**1584.54**	**48.8%**	**14.0%**
Scope 1 + 2			**1659.71**	**51.2%**	**-33.1%**
SCOPE 1 + 2 + 3			**3244.25**	**100.00%**	**-16.19%**
Reduction measures					
Offsets					
Greenhouse Friendly – Methane Avoidance, Australia	tonnes CO_2-e	1,000	–1,000		
VCS – Small Hydro, Vietnam	tonnes CO_2-e	1,000	–1,000		
VCS – Wind farm, China	tonnes CO_2-e	1,000	–1,000		
VCS- Biomass, Brazil	tonnes CO_2-e	450	–450		
NET EMISSIONS			-205.75		

*2011-12 results revised in 2012-13 using updated calculation methodologies.

Appendix D: Background for public transport and taxi qualification method

1. PURPOSE

This standard operating procedure (SOP) sets out the methodology for public transport and taxi data collection and assessment. It ensures that EPA assesses the greenhouse gas (GHG) emissions associated with EPA's public transport and taxi use are in a consistent manner so that results can be compared over time.

2. BACKGROUND

For a true account to be given of EPA's environmental performance, the effects of public transport and taxi use must be assessed. This is particularly important when studying the effects of transport mode choice (e.g. car or train), and also in accounting for the effects of increased mobility via means other than via the EPA vehicle fleet.

3. REQUIREMENTS

This SOP is divided into two sections:
(i) public transport
(ii) taxis

3.1 Public Transport

Public Transport trips have been separated into metropolitan and regional trips.

The total greenhouse gas emissions associated with public transport can be found by adding the sum of the regional offices emissions and the metropolitan emissions:

Total Public Transport GHG Emissions (t CO_2-e) = $\sum$ Regional Office Public Transport GHG Emissions (t CO_2-e) + Metropolitan Public Transport GHG Emissions (t CO_2-e)

3.1.1 Metropolitan Public Transport Trips

INPUT	UNITS OF MEASUREMENT	SOURCE
EPA's city-based offices' public transport expenditure	$ (public transport expenditure)	Finance
Metropolitan public transport emissions factor	t CO_2-e / $ (public transport expenditure)	Refer to Appendix A

The method for calculating the greenhouse gas emissions associated with EPA's metropolitan public transport use is:

Metropolitan Public Transport GHG Emissions (t CO_2-e) : Total Melbourne offices' expenditure ($) **Metropolitan public transport emissions factor (t CO_2-e/$)**

3.1.2 Regional Public Transport Trips

INPUT	UNITS OF MEASUREMENT	SOURCE
EPA's regional offices' public transport expenditure	$ (public transport expenditure)	Finance
V/Line emissions factor	t CO_2-e / passenger km	V/Line Website*
Single Fare	$ (one-way)	V/Line Website*
Distance (Melbourne to each regional office)	km (one-way)	V/Line Website*

*Refer to Appendix B

The method for calculating the greenhouse gas emissions associated with EPA's regional public transport use is:

$$\textbf{Number of trips} = \frac{\text{Regional office public transport expenditure (\$)}}{\text{Single fare (\$)}}$$

$$\textbf{Regional Office Passenger Kilometres (pass. km)} = \text{Number of trips} \times \text{Distance (km)}$$

$$\textbf{Regional Office Public Transport GHG Emissions (t } \mathbf{CO_2}\textbf{-e)} = \text{Regional office passenger kilometres (pass. km)} \times \text{V/Line emissions factor (t } CO_2\text{-e/pass. Km)}$$

The calculation is completed for each regional office, using the corresponding office expenditure amount, fare and distance between regional office and Melbourne. It is assumed that expenditure on public transport by the regions is on V/Line services to and from Melbourne.

The total greenhouse gas emissions from regional public transport is found by adding the emissions calculated from each regional office.

3.2 Taxis

The inputs required for calculation of the taxi use environmental impact are as follows:

INPUT	UNITS OF MEASUREMENT	SOURCE
EPA's total taxi expenditure	$ (taxi expenditure)	Finance
Average taxi earnings per vehicle kilometre	$/km	Refer to Appendix C
Fuel consumption of LPG taxi	L/100km	Refer to Appendix C
Fuel consumption of Hybrid taxi	L/100km	Refer to Appendix C
Emissions factor for LPG	t CO2-e/kL	Refer to Appendix C
Emissions factor for Hybrid	t CO2-e/kL	Refer to Appendix C

The method for calculating the greenhouse gas emissions associated with EPA's taxi use is:

Total Distance Travelled (km)	=	$\frac{\text{Total taxi expenditure (\$)}}{\text{Average taxi earnings (\$/km)}}$				
Total LPG Fuel Consumption (L)	=	Total distance travelled (km)	X	% LPG vehicles in Victorian taxi fleet	X	LPG fuel consumption (L/km)
Total Petrol (ULP) Fuel Consumption (L)	=	Total distance travelled (km)	X	% Hybrid vehicles in Victorian taxi fleet	X	ULP fuel consumption (L/km)

Taxi LPG GHG Emissions (t CO2-e)	=	Total LPG fuel consumption (kL)	X	LPG emissions factor (t CO_2-e/kL)
Taxi Petrol (ULP) GHG Emissions (t CO2-e)	=	Total ULP fuel consumption (kL)	X	ULP emissions factor (t CO_2-e/kL)

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
Corporate Sustainability Coordinator	Facilitate communication of data inputs/outputs
Corporate Sustainability Coordinator	Maintain SOP
Carbon Neutral team	Perform calculation

5. REVIEW OF PROCEDURE

The Corporate Sustainability Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Corporate Sustainability Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
21 August 2013	Melanie Turner MANAGER CORPORATE STRATEGY	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0			Signed by Director Sustainable Development
2.0	24/11/09	Kim le Cerf	Signed by Director Business Development
3.0	30 Nov 2011	O Tattam	Reviewed and updated, signed by Manager Service Growth
3.1	16 August 2012	W Kershaw	Update to factors in Appendix A and Appendix B
4	29 July 2013	W Kershaw	Change to taxi methodology and update to factors in Appendix A and Appendix B

Appendix A – Metropolitan Public Transport Emissions Factor

= 2.936 x 10^{-4} t CO_2-e / $ (Metropolitan Public Transport Expenditure)

This factor is designed to take into account such issues as train, tram and bus greenhouse gas emissions, and EPA's pattern of public transport usage.

The methodology, references and reasoning behind this calculation are shown below. If new input data is obtained that would affect this calculation, the supporting spreadsheet "8.11.11 SOP Public Transport & Taxis.xls" will also be updated to calculate the total emissions.

(i) Metropolitan Public Transport Greenhouse Gas Emissions

The following data has been sourced regarding greenhouse gas emissions of various transport modes:

Mode of Transport	Greenhouse Gas Emissions (g CO_2/passenger km)
Bus	171
Rail	150
Tram	179

Source: Simmons, G., Department of Transport, July 2012

EPA's metropolitan public transport usage patterns are assumed as follows:

Mode of Transport	Average Distance Travelled (km)	Reasoning	Share of EPA's Metropolitan Public Transport Use (%)
Bus	4	1 x intermodal/ inner city return	10
Rail	30	1 x return trip 200 Vic-Macleod	50
Tram	2	1 x CBD return	40

On this basis a composite metropolitan public transport greenhouse gas emissions factor may be calculated as follows:

Metropolitan Public Transport Emissions (t CO_2-e / fare) =

$$\sum \left(\text{Transport Mode Emissions (g } CO_2\text{-e/pass. km)} \times \text{Average Distance Travelled (km)} \times \text{Share EPA's Public Transport Use} \right)$$

= (171 x 4 x 0.1) + (150 x 30 x 0.5) + (179 x 2 x 0.4) g CO_2-e / fare

= 2462 g CO_2-e / fare

= 2.462 x 10^{-3} t CO_2-e / fare

(ii) EPA's Metropolitan Public Transport Expenditure

EPA Finance accounts for the expenditure on public transport tickets for each EPA office. This expenditure takes into account both all-day and 2-hour tickets, and on this basis a composite figure must be calculated, based on this and EPA's estimated of ticket use.

Fare Type	Zone	Cost ($)*	Ticket Use by EPA (%)	Reasoning
2-hour	1	3.50	20	CBD trips represent majority for 200 Vic
	2	2.42	5	Small fraction of tickets used by Macleod
All-day	1	7.00	20	CBD trips represent majority for 200 Vic
	2	4.84	5	Small fraction of tickets used by Macleod
	1+2	11.84	50	200 Vic/Macleod trips represent majority of tickets

**Source: Myki website July 2013 (http://www.myki.com.au/Fares/Metro-fares)*

Metropolitan Public Transport Expenditure Composite Ticket Price = $\sum$ Fare Cost X Ticket Use by EPA

$ (Metropolitan Public Transport Expenditure) / fare
= (3.50 x 0.2) + (2.42 x 0.05) + (7.00 x 0.2) + (4.84 x 0.05) + (11.84 x 0.5)

= $8.38 / fare

(iii) Metropolitan Public Transport Emissions Factor Calculation

The figures above may then be used to calculate the emissions factor to apply to EPA's Public Transport Use GHG Emissions:

Metropolitan Public Transport Emissions Factor (t CO_2-e / $)

$$= \frac{\text{Metropolitan public transport emissions (t } CO_2\text{-e/fare)}}{\text{Metropolitan public transport expenditure composite ticket price (\$/fare)}}$$

$$= \frac{2.462 \times 10^{-3} \text{ t } CO_2\text{-e/fare}}{\$8.38/\text{fare}}$$

$$= 2.936 \times 10^{-4} \text{ t } CO_2\text{-e/\$}$$

Appendix B – Regional Public Transport Input data

Regional Office	Single Fare ($)*	Distance (km)
Bendigo	$27.00	162
Geelong	$11.00	73
Traralgon	$25.20	158
Wangaratta	$26.60	234

**Source: V/Line ticket price, July 2013 (www.vline.com.au/fares-and-tickets/fares/intro.html)*

Appendix C – Taxi Input Data

INPUT	UNITS OF MEASUREMENT	Value
Average taxi earnings per vehicle kilometre	$/km	2.52*
Fuel consumption of LPG taxi	L/100km	0.1725*
Fuel consumption of Hybrid taxi	L/100km	0.052*
Emissions factor for LPG	t CO_2-e/kL	1.577#
Emissions factor for Petrol (ULP)	t CO_2-e/kL	2.289#

** Source: Victorian Taxi Association, Personal Communication with Paul Theobald, July 2012 and Georgia Nicholls, July 2013*
 # Source: Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, July 2013, Australian National Greenhouse Accounts National Greenhouse Accounts Factors, Table 4, Page 18

Appendix E: Background for reticulated water quantification method

Standard Operating Procedure – GHG emissions associated with reticulated water

Responsible Manager: Corporate Sustainability Coordinator
Subject: Environmental Management System
Reference number: 8.11.18

1. PURPOSE

This procedure sets out the methodology for calculating total usage and GHG emissions from reticulated water used. This procedure ensures that calculation of reticulated water and associated GHG emissions are undertaken in a consistent manner so that results can be compared over time.

2. BACKGROUND

For a comprehensive account to be given of EPA's Greenhouse impact, the emissions associated with reticulated water provided must be accounted.

3. REQUIREMENTS

INPUT	UNITS OF MEASUREMENT	SOURCE
Reticulated water	Kilolitres used	EPA's EMS
Reticulated Water GHG Emission Factor	Kilograms (CO_2e)/ kilolitre of reticulated water used	Refer Appendix A

The calculation of the Greenhouse Gas Emissions of EPA's reticulated water is then completed as follows:

Reticulated Water GHG Emissions (kg CO_2-e)	=	Kilolitres (reticulated water)	X	Kilograms (CO_2e)/ kilolitre of reticulated water

3.1 Monitoring and Reporting Plan

The Corporate Sustainability Coordinator will monitor water use data quarterly. Results will be used to assess options to reduce water use further.

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
Corporate Sustainability Coordinator	Facilitate communication of data inputs/outputs
Corporate Sustainability Coordinator	Maintain SOP
Carbon Neutral team	Perform calculation

Suppliers and landlords	Provide water usage data

5. REVIEW OF PROCEDURE

The Corporate Sustainability Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Corporate Sustainability Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
21 Aug 2013	Melanie Turner MANAGER CORPORATE STRATEGY	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0	Feb 2008	B.McLachlan	Signed by Director Sustainable Development
2.0	Dec 2009	B. McLachlan	Reviewed and updated
3.0	9 Dec 2011	O Tattam	Reviewed and updated
3.1	16 Aug 2012	W Kershaw	Update to Appendix A
4.0	25 Jul 2013	W Kershaw	Reviewed emission factor

Appendix A – Reticulated Water GHG Emissions Factor

= 1.36 kg CO_2-e/kL (for 2012-13)

The emissions factor for reticulated water has been derived using greenhouse gas emissions and water supply data reported by Melbourne Metro Water Authorities (Melbourne Water, Yarra Valley Water, City West Water and South East Water). These Authorities supply the majority of water consumed annually by EPA Victoria.

The emissions factor is calculated as the sum of wholesale and retail greenhouse gas emissions per kilolitre of water supplied. Total greenhouse gas emissions per kilolitre of water supplied by the wholesaler (Melbourne Water) is summarised in the table below.

	Water supply* (ML)	Total emissions** (tonnes CO_2-e)	Emissions factors (kg CO_2-e/kL)
2011-12	365,559	422,015	1.15
2010-11	351,761	451,035	1.28
2009-10	361,362	420,000	1.16

* Melbourne Water Corporation, 2012, *Melbourne Water Annual Report 2011-12*, page 11
** Melbourne Water Corporation, 2012, *Melbourne Water Annual Report 2011-12*, page 37

The total greenhouse gas emissions reported by Melbourne Water take into account:

- Water treatment and pumping
- Wastewater treatment
- Transport
- Other energy use (including offices)

Greenhouse gas emissions from all three Melbourne Metro retail water Authorities could only be obtained for 2010-11 (summarised below).

	Greenhouse gas emissions (tonnes CO_2-e)	Reference
Yarra Valley Water	28151	Yarra Valley Water Annual Report 2010-11 (page 60)
City West Water	12552.69	City West Water Sustainability Report 2011 (page 26)
South East Water	31351	South East Water Annual Report 2011-12 (page 23)
Total retail emissions	**72054.69**	

Total water consumption for all three retailers for 2010-11 was reported as 343,600 ML (Yarra Valley Water Annual Report 2010-11, Page 64 and South East Water Annual Report 2011-12, Page 10)

The retail emissions factor was therefore calculated at 0.21 kg CO_2-e per kL.

The total reticulated water emissions factor is then calculated as the annual wholesale emission factor plus the 2010-11 retail emissions factor. Results are summarised in the following table.

	Wholesale Emission Factor (kg CO_2-e/kL)	Retail Emission Factor (kg CO_2-e/kL)	Total reticulated water Emission Factor (kg CO_2-e/kL)
2012-13	1.15	0.21	1.36
2011-12	1.15	0.21	1.36
2010-11	1.28	0.21	1.49
2009-10	1.16	0.21	1.37

The total reticulated water emissions factor is then used with the following methodology to calculate EPA greenhouse gas emissions from the consumption of reticulated water. The methodology, references and reasoning behind the calculation is shown below. If new or updated emissions factors are obtained that would affect this calculation, this document will be updated to reflect the changes.

(i) EPA's Total Reticulated Water Usage

EPA obtains water data from either water retailers or landlords, depending on the site. Water is received in litres used. Total water purchased by EPA for 2012-13 was 4,588 kilolitres.

Site	Data Source	Water purchased 2012-13 (kL)
Head Office	Property Manager	2,824.23
CES	Water retailer	1,341.32
EPA Gippsland	Water retailer	75.42
EPA North East	Water retailer	143.82
EPA North West	Landlord	35.34
EPA South West	Landlord	115.08
EPA Southern Metro	Landlord	53.05
	Total	**4,588.26**

(ii) EPA's Reticulated Water GHG Emissions Calculation

The total water purchased (as above) may then be used to calculate the GHG emissions associated with reticulated water consumed.

Step 1 Convert litres consumed to meters cubed.

$$\text{Water used (kL)} = \frac{\text{Water used (L)}}{1000}$$

Step 2 Apply the reticulated water emissions factor

$$\textbf{Reticulated Water Use GHG Emissions} = \text{Reticulated water consumed (kL)} \times \text{Emissions factor (kg } CO_2\text{-e/kL)}$$

(kg CO_2-e)

Step 3 Convert GHG emissions from kilograms (kg) to tonnes (t)

$$\textbf{Reticulated Water Use GHG Emissions (t } CO_2\textbf{-e)} = \frac{\text{Reticulated Water Use GHG Emissions (kg } CO_2\text{-e)}}{1000}$$

Appendix F: Background for office paper quantification method

1. PURPOSE

This standard operating procedure (SOP) sets out the methodology for calculating the greenhouse gas (GHG) emissions associated with office paper purchased. This procedure ensures that calculation is undertaken in a consistent manner so that results can be compared over time.

2. BACKGROUND

For a true account to be given of EPA's environmental performance, the emissions embedded in the office paper purchased must be accounted.

3. REQUIREMENTS

INPUT	UNITS OF MEASUREMENT	SOURCE
Total weight of paper purchased	kg	Corporate Strategy
Percentage of recycled content	%	Corporate Strategy
Source of paper supply (domestic or international)	kg CO_2-e/kg	Refer Appendix A
Office paper emissions factor	kg CO_2-e/kg	Refer Appendix A

The method for calculating the greenhouse gas emissions associated with the office paper purchased by EPA is:

Office Paper GHG Emissions (kg CO_2-e)	=	Total weight of paper purchased from domestic sources (kg)	X	Percentage of recycled content (%)	X	Emissions factor for domestic recycled paper (kg CO_2-e/kg)
	+	Total weight of paper purchased from domestic sources (kg)	X	Percentage of virgin content (%)	X	Emissions factor for domestic virgin paper (kg CO_2-e/kg)
	+	Total weight of paper purchased from international sources (kg)	X	Percentage of recycled content (%)	X	Emissions factor for international recycled paper (kg CO_2-e/kg)
	+	Total weight of paper purchased from international sources (kg)	X	Percentage of virgin content (%)	X	Emissions factor for international virgin paper (kg CO_2-e/kg)

3.1 Monitoring and Reporting Plan

The Corporate Sustainability Coordinator will monitor office paper data quarterly. Results will be used to assess options to reduce paper use further.

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
Corporate Sustainability Coordinator	Facilitate communication of data inputs/outputs
Corporate Sustainability Coordinator	Maintain SOP
Carbon Neutral team	Perform calculation
Contractors and suppliers	Provide paper purchase data

5. REVIEW OF PROCEDURE

The Environmental Management System Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Environmental Management System Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
21 Aug 2013	Melanie Turner MANAGER CORPORATE STRATEGY	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0	Feb 2008	Beth McLachlan	Signed by Director Sustainable Development

2.0	Dec 2009	Beth McLachlan	Revision and update
3.0	30 Nov 2011	O Tattam	Revision and update
4.0	31 Jul 2012	W Kershaw	Revision of methodology
5.0	23 Jul 2013	W Kershaw	Revision of methodology

Appendix A – Office Paper GHG Emissions Factor

Domestic		Imported	
Virgin paper	**Recycled paper**	**Virgin paper**	**Recycled paper**
1.3	1.52	1.08	1.28

Source: RMIT, Centre for Design, 2011

Details of these emissions factors can be found in the EPA Publication 1364, *Greenhouse Gas Emissions Factors for Office Paper*.

(i) EPA's Total Office Paper Usage

EPA's contract with Corporate Express requires regular reporting on stationery and office paper purchases including recycled content of paper. Corporate Express provides the following data on EPA paper use:

- Total weight of EPA paper consumption (kg)
- Percentage of recycled content (% recycled)
- Source of paper supplied (domestic or international)

(ii) Office Paper GHG Emissions Calculation

The data provided by Corporate Express can then be used to calculate the GHG emissions associated with office paper.

Step 1 Summarise the total weight of paper purchased by EPA within the specific period (i.e. 01 July 2012 to 30 June 2013)

Sum the total weight of 100% recycled and virgin office paper supplied from domestic and international sources. When the office paper purchased has more than 0%, but less than 100% recycled content, then the proportion of recycled content is added to the 100% recycled weight and the proportion of virgin content is added to the virgin weight. e.g. 1kg of 80% recycled weight:

- 0.8 kg is added to the 100% recycled weight total
- 0.2 kg is added to the virgin weight total.

Step 2 Determine GHG emissions of office paper (kg CO_2-e), for both 100% Recycled and Virgin from domestic and international sources

GHG emissions of 100% Recycled Office Paper (kg CO_2-e)	=	Weight of recycled paper sourced from domestic production (kg)	X	Emissions factor for recycled paper from domestic production (kg CO_2-e/kg)
	+	Weight of recycled paper sourced from international production (kg)	X	Emissions factor for recycled paper from international production (kg CO_2-e/kg)
	=	Weight of recycled paper	X	1.52

		sourced from domestic production (kg)		
	+	Weight of recycled paper sourced from international production (kg)	X	1.28
GHG emissions of Virgin Office Paper (kg CO_2-e)	=	Weight of virgin paper sourced from domestic production (kg)	X	Emissions factor for virgin paper from domestic production (kg CO_2-e/kg)
	+	Weight of virgin paper sourced from international production (kg)	X	Emissions factor for virgin paper from international production (kg CO_2-e/kg)
	=	Weight of virgin paper sourced from domestic production (kg)	X	1.30
	+	Weight of virgin paper sourced from international production (kg)	X	1.08

Step 3 Convert GHG emissions from kilograms (kg) to tonnes, for both 100% Recycled and Virgin.

$$\textbf{100\% Recycled Office Paper GHG Emissions (t } CO_2\textbf{-e)} = \frac{\text{100\% recycled office paper GHG emissions (kg } CO_2\text{-e)}}{1000}$$

$$\textbf{Virgin Office Paper GHG Emissions (t } CO_2\textbf{-e)} = \frac{\text{Virgin office paper GHG emissions (kg } CO_2\text{-e)}}{1000}$$

Step 5 Add together the 100% Recycled and Virgin Office Paper GHG Emissions.

Total Office Paper GHG Emissions (t CO_2-e)	=	100% Recycled GHG Emissions (t CO_2-e)	+	Virgin GHG Emissions (t CO_2-e)

Appendix G: Background for catering services quantification method

Standard Operating Procedure – GHG emissions associated with Catering

Responsible Manager: Corporate Sustainability Coordinator
Subject: Environmental Management System
Reference number: 8.11.25

1. PURPOSE

This standard operating procedure (SOP) sets out the methodology for calculating the total greenhouse gas (GHG) emissions associated with catering. This procedure ensures that calculation of catering purchases and associated GHG emissions are undertaken in a consistent manner so that results can be compared over time.

2. BACKGROUND

For a comprehensive account to be given of EPA's greenhouse impact, the emissions embedded in the catering purchased by EPA must be accounted.

3. REQUIREMENTS

INPUT	UNITS OF MEASUREMENT	SOURCE
Total catering expenditure for reporting period	$ (Dollars spent)	FinanceOne
Percentage of total consumption for each food category	%	Catering company – see Appendix A
Catering emissions factor for each food category	kg CO2-e / $	RMIT University – see Appendix A
CPI Inflation rate between baseline year (2008) and reporting year)	%	Reserve Bank of Australia

The method for calculating the greenhouse gas emissions associated with EPA's catering services is:

Catering GHG Emissions (kg CO_2-e) =

$$\sum \text{Total catering expenditure ($)} \times \text{Percentage of total consumption for each food category (\%)} \times \text{Food category emissions factor adjusted for inflation (kg CO2-e/\$)}$$

3.1 Monitoring and Reporting Plan

The Corporate Sustainability Coordinator will collect data on catering expenditure on an annual basis.

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
Corporate Sustainability Coordinator	Facilitate communication of data inputs/outputs
Corporate Sustainability Coordinator	Maintain SOP
Carbon Neutral team	Perform calculation
Finance Unit	Provide annual catering expenditure

5. REVIEW OF PROCEDURE

The Environmental Management System Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Environmental Management System Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
21 Aug 2013	MELANIE TURNER MANAGER CORPORATE STRATEGY	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0	01 Aug 2013	W Kershaw	Develop SOP for sign-off

Appendix A – EPA's Catering GHG Emission Factor

GHG Emissions per Dollar Spent on Catering Services for 2012-13 (t CO_2-e/$) = 1.47 x 10^{-3}*

** This figure is based specifically on the type and quantity of EPA's catering expenditure and therefore may not be an accurate representation of general emissions associated with catering services.*

In order to estimate emissions from all EPA catering services, an average emissions factor per dollar spent on catering was calculated. The methodology and reasoning behind this calculation is shown below. Should new or updated emissions factors be obtained that would affect this calculation, this document will be updated to reflect the changes.

EPA uses a number of catering service providers each year. In 2007-08 Elizabeth Andrews Catering Company (EPA's largest catering service provider at the time) provided an estimated breakdown of EPA's catering expenditure, as shown below:

Food Category	Percentage of total consumption (%)
Meat and meat products	15%
Dairy products	20%
Vegetable and fruit growing, hay, plant nurseries, flowers	20%
Oils and fats - End consumer purchases	5%
Flour, cereal foods, rice, pasta and other flour mill products	15%
Bread, cakes, biscuits and other bakery products	15%
Confectionery	5%
Other	5%
Total	**100%**

EPA uses the breakdown of catering expenditure and applies emission factors that correspond to the food categories, as follows:

Food Category	Emissions factor (kg CO_2-e/2005$)
Meat and meat products - End consumer purchases $2005	5.8250
Dairy products - End consumer purchases $2005	1.6150
Vegetable and fruit growing, hay, plant nurseries, flowers - End consumer purchases $2005	0.9244
Oils and fats - End consumer purchases $2005	1.3120
Flour, cereal foods, rice, pasta and other flour mill products - End consumer purchases $2005	0.9243
Bread, cakes, biscuits and other bakery products - End consumer purchases $2005	0.6890
Confectionery - End consumer purchases $2005	0.5019
Other	1.6845

Source: RMIT, Centre for Design, 2007

These food category emissions factors are also adjusted to account for inflation using the following formula:

Food category emissions factor adjusted for inflation (kg CO_2-e/$)	=	2005 food category emissions factor (kg CO_2-e/2005$)	X	Inflation rate between 2005 and reporting year (e.g. 2005$/2012$)

The method for calculating the greenhouse gas emissions associated with EPA's catering is:

Catering GHG Emissions (kg CO_2-e)	=			
$\sum$ Total catering expenditure ($)	X	Percentage of total consumption for each food category (%)	X	Food category emissions factor adjusted for inflation (kg CO_2-e/$)

Appendix H: Background for staff commuting quantification method

Standard Operating Procedure – Staff Commuting Data Collection and Recording

Responsible Manager: Corporate Sustainability Coordinator
Subject: Environmental Management System
Reference number: 8.11.11

1. PURPOSE

This procedure sets out the methodology for collecting staff commuting data for monitoring, measurement and reporting purposes. The procedure also covers the recording of this data in a consistent manner.

2. BACKGROUND

EPA is required to report commuting data via the annual report under *FRD 24C – Reporting of Office-Based Environmental Impacts by Government Departments*. A guidance manual for FRD24C reporting details the required indicators to be reported, data sources, collection methods and analysis recommendations. This information is included in appendix A.

TravelSmart used to conduct an annual survey of commuting behaviour across participating Victorian Government departments. In 2009, EPA was encouraged to conduct an internal travel survey.

3. REQUIREMENTS

3.1 Collecting Data

The EMS Coordinator submits a travel survey to staff using SurveyMonkey. Information asked in this survey can be found in appendix A.

3.2 Recording Data

An excel survey summary from SurveyMonkey can be analysed to determine the following:

- Percentage of employees regularly (>75% of work attendance days) using public transport, cycling, walking, or car pooling to and from work or working from home by locality type. This is an FRD24C requirement.
- Total annual kilometres for:
  - Walking
  - Cycling
  - Motorbike / scooter
  - Tram
  - Train - metropolitan
  - Train – long distance (VLine)
  - Bus
  - Taxi
  - Hybrid Car (e.g. Toyota Prius)
  - Small Car (4-cylinder, e.g. small hatchback)
  - Medium Car (6-cylinder, e.g. small to medium sedan)
  - Large Car (6-cylinder, e.g. 4-wheel drive, V8 or people mover)

3.3 Monitoring and Reporting Plan

The EMS Coordinator will monitor staff commuting data. Results will be used to assess options to promote and encourage sustainable commuting. Any unusual trends or barriers preventing the use of sustainable options will be investigated.

The commuting data will be available for annual FRD24 reporting and greenhouse gas reporting. Survey results will also be disseminated on an annual basis to staff and will be used to re-assess against EPA's annual Sustainable Transport Plan.

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
EMS Coordinator	• Prepare survey and coordinate collection of survey data.
EMS Coordinator	• Preparation of FRD24 annual reports.
EPA Staff	• Provide transport data by responding to the annual survey in a timely manner.

5. REVIEW OF PROCEDURE

The Environmental Management System Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Environmental Management System Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
9/12/2011	CLAIRE BLEWITT MANAGER SERVICE GROWTH	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0	8 June 06	Energy Subcommittee	Signed by Director Sustainable Development
2.0	2 Sep 09	N Reid	Periodic review
3.0	14 Nov 11	O Tattam	Signed by Manager, Service Growth

Attachment 1 – Typical *SurveyMonkey* Travel Survey

EPA Travel Survey for 2011

Thank you for taking 3 minutes to complete EPA's Annual Travel Survey. The EPA Travel Survey is vital so that we can record the distance and mode of transport staff use for commuting to and from work. Not only does it help us understand our staff commuting behaviour but it's also a mandatory requirement for Victorian Government annual reporting and for our Greenhouse Gas Inventory.

In 2009-10, staff commuting was EPA's second largest category of emissions (14.6%) after power & heating for our buildings (66%), and ahead of our use of EPA vehicles (8%). So thank you again for helping EPA reduce it emissions impact by filling in this survey.

***1. Which EPA office do you mainly work at?**

- 200 Victoria St
- Bendigo
- Wangaratta
- Macleod
- Dandenong
- Traralgon
- Geelong

***2. Do you work full time?**

- Yes
- No

If no, how many days a week do you work (on average)? e.g. 2.5

***3. On an average working week, how many days do you work from home?**
Please enter 0 if you don't work from home at all

***4. On an average working week, how many days would you use the mode(s) of transport listed below to get to and from work?**

Please note:
- If you use more than one mode of transport, just list your main mode.
- A single one way journey should be recorded as 0.5
- The sum of all boxes below should add up to the number of days you work per week (in Q2)less the number of days you work from home.

Example 1: If you work 5 days per week, walk to work every morning and catch the tram home every evening you would put Walk=2.5, Tram=2.5.
Example 2: If you work 3 days per week including 1 day from home and ride your bike on the other 2 days, you would put Bike=2.

Walk	
Bike	
Motorbike / Scooter	
Tram	
Train	
Train – long distance (VLine)	
Bus	
Taxi	
Car pooling	
Hybrid Car (e.g. Toyota Prius)	
Small Car (4-cylinder, e.g. small hatchback)	
Medium Car (<6-cylinder, e.g. small to medium sedan)	
Large Car (>6-cylinder, e.g. 4-wheel drive, V8 or people mover)	

***5. What is the average estimated journey distance (in kilometres) for a single one way journey for each transport mode(s) that you use?**

Please note:
- You should only provide a figure for the mode(s) you nominated in Q4.
- Only estimate the distance for your main mode of transport.

To help estimate distance visit Google Maps. If you catch public transport there is no precise way of calculating distance however using the maps within the Metlink Journey planner will help.

Just enter the number below

Walk	
Bike	
Motorbike / Scooter	
Tram	
Train	
Train – long distance (VLine)	
Bus	
Taxi	
Car pooling	
Hybrid Car (e.g. Toyota Prius)	
Small Car (4-cylinder, e.g. small hatchback)	
Medium Car (<6-cylinder, e.g. small to medium sedan)	
Large Car (>6-cylinder, e.g. 4-wheel drive, V8 or people mover)	

Appendix I: Background for courier services quantification method

Standard Operating Procedure – GHG emissions associated with Courier services

Responsible Manager: Corporate Sustainability Coordinator
Subject: Environmental Management System
Reference number: 8.11.22

1. PURPOSE

This procedure sets out the methodology for calculating the total greenhouse gas (GHG) emissions associated with EPA's courier services. This procedure ensures that calculation of our courier services and associated GHG emissions are undertaken in a consistent manner so that results can be compared over time.

2. BACKGROUND

For a comprehensive account to be given of EPA's greenhouse impact, the emissions embedded in the courier services we use must be accounted.

3. REQUIREMENTS

INPUT	UNITS OF MEASUREMENT	SOURCE
Courier expenditure	$ (Dollars spent)	FinanceOne
Conversion Factor	t CO_2-e/$ (GHG emissions per dollar spent)	See Appendix A

The method for calculating the greenhouse gas emissions associated with EPA's courier services is:

Courier Services Emissions (t CO_2-e) = Courier expenditure ($) X GHG emissions per dollar spent (t CO2-e/$)

3.1 Monitoring and Reporting Plan

The Corporate Sustainability Coordinator will collect data on courier expenditure on an annual basis.

4. RESPONSIBILITIES

Individual/Group of Individuals	Responsibilities
Corporate Sustainability Coordinator	Facilitate communication of data inputs/outputs
Corporate Sustainability Coordinator	Maintain SOP
Carbon Neutral team	Perform calculation

Contractors and suppliers	Provide courier service data

5. REVIEW OF PROCEDURE

The Corporate Sustainability Coordinator will review this procedure every two years.

In addition, this procedure is required to be reviewed and changed to reflect current and best EPA practice. The Corporate Sustainability Coordinator is required to ensure that this procedure is current at all times.

6. APPROVAL OF PROCEDURE

Date	***Content Authorisation***	
	Name	*Signature*
21 Aug 2013	MELANIE TURNER MANAGER CORPORATE STRATEGY	

7. DOCUMENT REVISION HISTORY

Version	***Revision Date***	***Revised by***	***Section and change/s***
1.0	Dec 2009	B McLachlan	Signed by Director Business Development
2.0	Jan 2011	B McLachlan	To include emissions associated with fuel extraction, production and transportation of the fuel used in courier services
3.0	30 Nov 2011	O Tattam	Reviewed and updated, signed by Manager Service Growth
4.0	30 Jul 2013	W Kershaw	Reviewed calculation methodology signed by Manager Corporate Strategy

Appendix A – EPA's Courier Services GHG Emission Factor

GHG Emissions per Dollar Spent on Courier Services (t CO_2-e/$)
= 1.55 x 10^{-4}*

** This figure is based specifically on the type and frequency of EPA's usage of courier services and therefore may not be an accurate representation of general emissions associated with courier services.*

EPA uses a number of courier service providers each year. Six different courier service providers were engaged to provide services to EPA during 2008-09. In order to estimate emissions from all our courier services, an average emissions factor per dollar spent on courier services was developed.

Each individual transaction undertaken with TNT, EPA's most used courier service provider in 2008-09, was analysed to work out the average emissions per dollar spent for the services EPA engaged the courier to undertake. This emissions factor was then multiplied by EPA's total courier expenditure for 2012-13 to estimate its total annual GHG emissions from courier services. Unfortunately EPA was unable to allocate time to getting updated information from its courier providers to calculate a more accurate emissions factor for 2009-10, 2011-12 or 2012-13. The factor has been revised to include updated emissions factors from freight transport based on DEFRA guidelines and to account for inflation between 2008 and 2012.

This factor takes into account emissions associated with the combustion of transport fuel to courier EPA packages from origin to destination.

The methodology and reasoning behind this calculation is shown below. Should new or updated emissions factors be obtained that would affect this calculation, this document will be updated to reflect the changes.

(i) EPA's Courier Services GHG Emission Factor

In order to calculate an average factor for emissions per dollar spent on courier services, the most commonly engaged courier provider data has been used. This data relates specifically to services provided to EPA in 2008-09.

DEFRA emissions factors for freight were used to calculate air and road freight emissions.

Using the following calculation EPA was able to establish the total GHG emissions from its TNT courier services based on 2008-09 courier service breakdown of expenditure and DEFRA 2013 emissions factors:

Step 1: Calculation of GHG emissions per trip for air freight

$$\text{Total} = \text{Air freight emissions factor } (CO_2\text{-e/ tonne.km}) \times \frac{\text{Weight (kg)}}{1000} \times \text{Distance (km)}$$

Step 2: Calculation of GHG emissions per trip for road freight

$$\text{Total} = \begin{array}{c}\text{Road freight}\\ \text{emissions factor}\\ (CO_2\text{-e/ tonne.km})\end{array} \times \frac{\text{Weight (kg)}}{1000} \times \text{Distance (km)}$$

This calculation was undertaken for each individual courier service (air freight and road freight) and the results were added together. EPA then divided the total GHG emissions by the total dollars spent (converted to 2012 equivalent expenditure accounting for inflation) to get an emissions factor of 1.55×10^{-4} t CO_2-e/$.

(ii) Courier Services GHG Emissions

The figure given above was then used to calculate the total GHG emissions associated with our courier services by multiplying it by the total dollar spent on couriers for the 2012-13 year.

Appendix J: Carbon Financial Services Gold Standard Accredited Suzhou Qizi Mountain Landfill Gas Recovery Offset Certificate

CARBON FINANCIAL SERVICES

CARBON OFFSET CERTIFICATE

Presented to

EPA VICTORIA

for offsetting

1000 tonnes of EPA Victoria's 2012/13 CO2-e footprint with Gold Standard Landfill Gas Recovery Carbon Credits from the Jiangsu Province in China, Serial Number:
GS1-1-CN-397-21-2008-4376980 to 77979

Ben Stuart, Director
13th of September 2013

Appendix K: Climate Friendly VCS Accredited Gunung Salak Geothermal Offset Certificate

Certificate of Climate Action

Carbon emissions offset
1,000
tonnes CO_2e

This certificate is in recognition that

EPA Victoria

has offset 1,000 tonnes of greenhouse gas emissions as part of their 2012/2013 Carbon Neutral Program.

Climate Friendly commits to retiring the equivalent in VCS carbon credits from the Gunung Salak Geothermal Project in Indonesia to offset emissions as part of their 2012/2013 Carbon Neutral Program.

Thank you for taking meaningful action on climate change.

Joel F. Fleming

Joel Fleming
Founding Chairman

Issue Date: 30/08/2013
Certificate: #00012732

climate® friendly

Appendix L: Cleaner Climate Australia VCS Accredited Gujurat Bundled Wind Energy Generation Offset Certificate

Carbon Offset Certificate

CLEANER CLIMATE

The Cleaner Climate Team

0000668935

This certifies that	EPA VICTORIA	has offset their carbon footprint through energy efficiency and renewable energy projects in developing countries.	1300 Tonnes	20 AUGUST 2013