Griffith University
Queensland, Australia

Carbon Performance Report

Campus Life 2018

In 2012 the University developed its first Carbon Management Plan, as part of its broader commitment to sustainability.

This plan was updated in 2016 to align with the University's objectives and targets with the government's revised commitment to reduce carbon pollution.

This report provides an update of our progress on achieving the challenging objective we set ourselves in 2016 and compares our overall emissions with the higher education sector.

Our carbon footprint

In 2018 we again appointed Pangolin to calculate the University's total carbon emissions.

These emissions cover activities over which the University has direct control, together with those generated beyond our direct control. This methodology enables us to report on our overall emissions and compare our progress against our emissions reduction target.

CATEGORIES OF CARBON EMISSIONS

Scope 1	Emissions on our campuses, or associated with the University's business, generated through the combustion of fossil fuels in University owned vehicles, natural gas and LPG use as well as refrigerant gas leakage.
Scope 2	Emissions associated with the use of electricity imported from the grid or from a third party supplier of energy in the form of heat or electricity.
Scope 3	Emissions as a direct consequence of the use of goods or services provided to the University to enable it to conduct its business. Sources include: waste disposal, cleaning services, food and beverage services, IT and other equipment, paper and flights.

Year	Scope 1	Scope 2	Scope 3	Total
17/18	2,588.9	53,880.1	24,585.2	81,054.2
16/17	1739.8	55,624	29,020.9	86,384.7
15/16	2,274.7	55,440.4	31,835.4	89,550.5
14/15	1,813.4	53,840.2	32,318.2	87,971.8
13/14	2,124.8	52,604.7	36,459.6	91,189.1
12/13	2,637.1	52,281.1	35,912.2	90,830.4
11/12	2,115.7	55,431.1	31,456.9	89,003.6
10/11	2,114.6	52,694.3	30,535.5	85,344.4

Meeting our low carbon emission target

We continue to make progress towards achieving at least a 26% reduction in Scope 1 and 2 emissions from 2010/11 levels by 2030.

Our Scope 1 and 2 emissions have increased by 3.03% on an absolute basis, compared with the 2010/11 baseline. Contributors to this include new buildings and increased activity implementation of Trimester 3. On a normalised basis, that is taking into consideration GFA, our Scope 1 and 2 emissions have reduced by 22.1% compared with the 2010/11 baseline.

2017/18 PERFORMANCE

Scope 1 'direct emissions' are 48.8% higher than Scope 1 emissions for 2016/17. This is due to an increase in natural gas and refrigerant gas consumption due to poorly functioning plant.

Scope 2 'electricity (indirect) emissions' are 3.1% lower than Scope 2 emissions for 2016/17. The reduction is primarily due to chiller replacement and the LED and BMS optimisation projects (refer page 9 - 13).

Scope 3 'other indirect emissions' are 15.3% lower than Scope 3 emissions for 2016/17. The reduction is primarily a result of reduced expenditure (23%, $868k) in food and catering on campus. (Griffith controlled operations) and reduction in business flights (outlined on page 18).

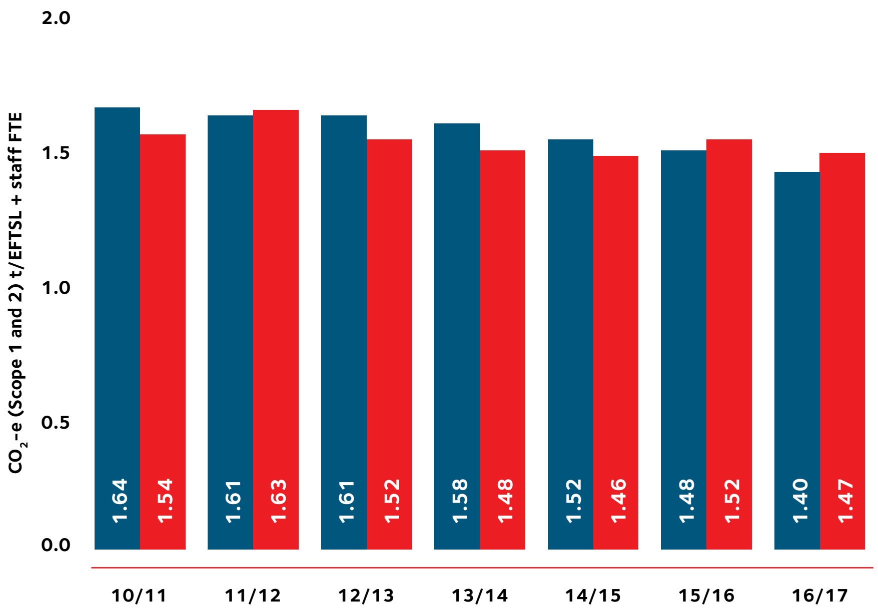
Total Greenhouse Gas emissions per square metre reduced from 177.9kg CO_2-e/m^2 in 2016/17 to 162.5kg CO_2-e/m^2 in 2017/18, a decrease of 8.7%.

TEFMA benchmark data

Carbon performance within the higher education sector

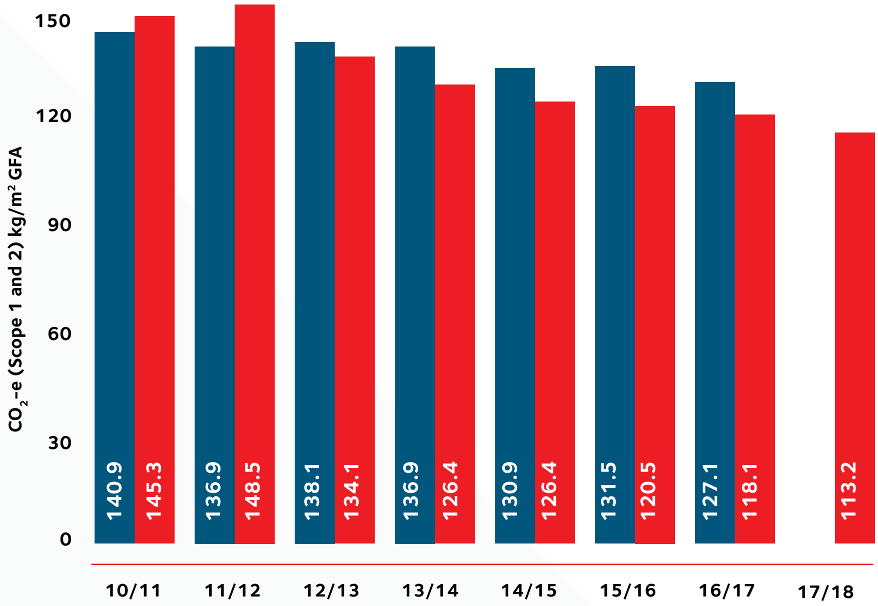
The TEFMA Benchmark data provides the Higher Education sector with information for comparing an institution's performance against the sector on a range of metrics. The charts indicate that the University's overall Green House Gas emissions are slightly above the sector average when compared on a full-time equivalent student and staff member (EFTSL+FTE) and lower when compared by gross floor area.

CO_2 Emissions per staff and student FTE



Note: *From 2014 EFTSL + FTE data includes the digital campus. In 2014, the digital campus was 4.5% of EFTSL + FTE. In 2017 the digital campus was 8.1%. TEFMA does not track the impact of the digital campus.*

CO_2 Emissions per m^2 GFA



Note: *[1]TEFMA excludes residences GFA. [2]2018 TEFMA average value not yet available.*

Our energy footprint

> *In 2018, the University completed the metering project to enable reporting of electricity consumption by building. This allows us to understand our consumption and target areas for improvement.*

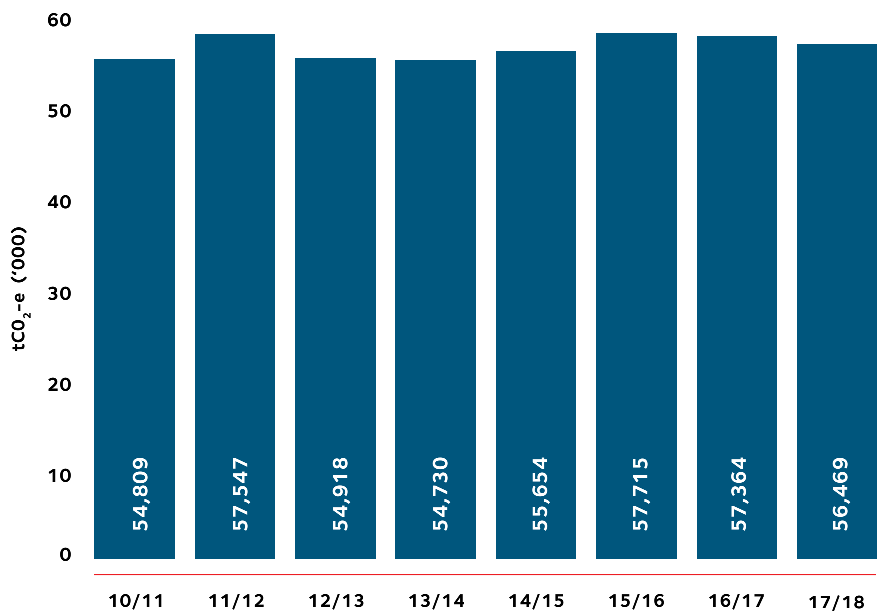
ENERGY PROJECTS

The following projects were in progress over the 2017/18 period:

- Verification of meter data from buildings and implementation of communications to allow data to be relayed to the Historian (central monitoring) system for analysis
- Completion of the Learning Commons (G11) and Graduate Centre (S07) renewable generation projects including remote monitoring of power metering and reporting
- LED replacement continued across Gold Coast, Nathan and Logan campuses
- Chiller replacements at Chiller House 2 (G21), Chiller House 3 (G22) and Chiller House 4 (G29) including BMS upgrade and HLI installation
- Chilled water meter installation to monitor cooling energy consumed by key buildings across all campuses
- Building Management System (BMS) control optimisation for heating, ventilation and air conditioning systems

We are also implementing measures to reduce water waste from our chilled water and cooling tower systems, which do not have a direct carbon impact but will reduce energy consumption over the longer term by reducing water which is cooled and then discharged from the system. Examples include remote monitoring of top up systems for chilled water systems at Nathan and the Gold Coast, and a pilot project for a motorised valve on a cooling tower at Central Chiller Plant (N45) to minimise water discharged to drain when the associated chiller shuts down.

Total scope 1 and 2 emissions 2017/18 performance



PERFORMANCE AGAINST OUR GREENHOUSE GAS EMISSIONS TARGET

In 2016 we set ourselves a target to reduce our Greenhouse Gas emissions (Scope 1 and 2) from energy consumption by 26% against the 2010/11 baseline by 2030.

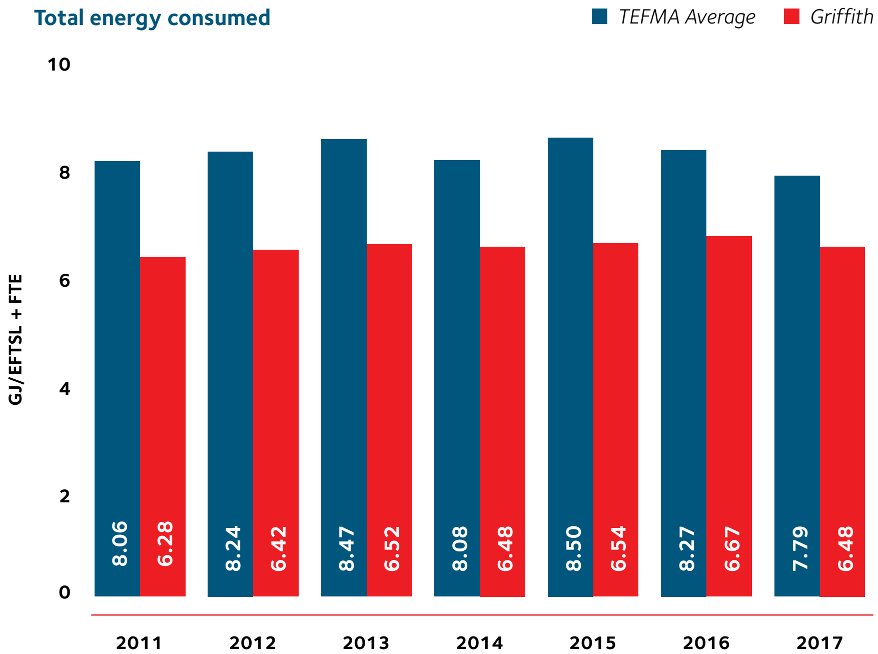
2017/18 PROGRESS

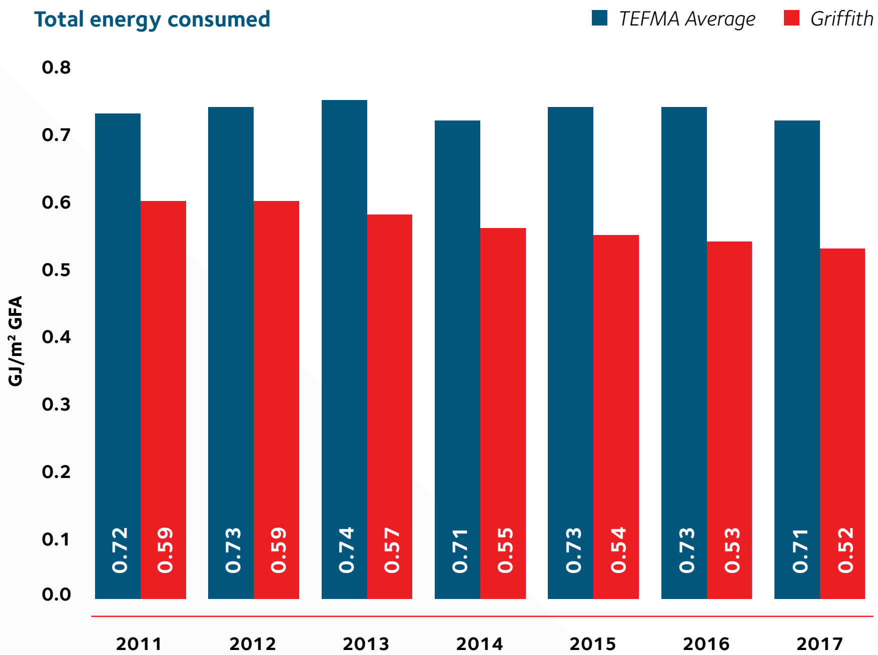
56,469 tCO_2-e, an increase of 1,660 tCO_2-e, 3% on the 2010/11 baseline which is an improvement on 16/17 performance.

TEFMA benchmark data

Energy performance within the higher education sector

A comparison of the TEFMA benchmarks indicates that the University's Energy consumed per student EFTSL and staff FTE and per m² GFA is lower that the sector average.



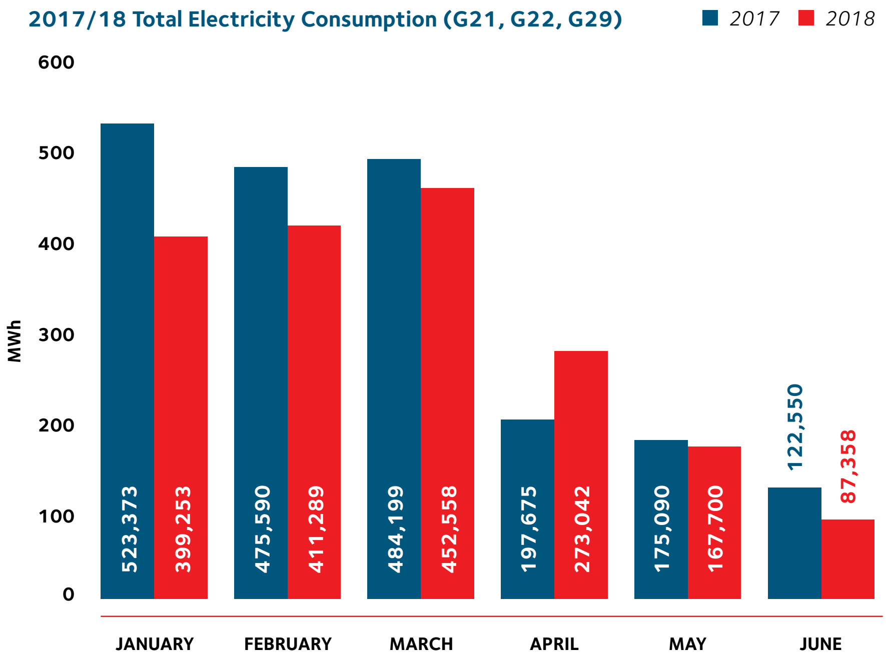


Chiller replacements at the Gold Coast

| *The project occurred during the second half of 2017*

Four new chillers were installed in Chiller House 2 (G21), Chiller House 3 (G22) and Chiller House 4 (G29) to replace end of life assets. The energy consumed by the chillers per month for the first 6 months of 2017 compared with 2018 shows a reduction. The exception was in April 2018 where the campus played a significant role in hosting the Commonwealth Games. The fine tuning of this system continues until April 2019.

2017/18 Total Electricity Consumption (G21, G22, G29)



Note: *April 2018 busier due to Commonwealth Games*

LED upgrade project

> *A key objective of the University's sustainability agenda is to reduce energy consumption.*

A major project is the replacement of fluorescent tube light fittings with more energy efficient (LED) light fittings, across all campuses.

LED fittings have been selected to have a light output as close as possible to the original fluorescent tube light fittings, thereby minimising disruption, speeding up installation time and, as a consequence, reducing the total cost for the works.

The new LED fitting has the following benefits:

- Glare reduction by use of microprism diffusers
- Reduced energy consumption (approximately one-third of the existing fittings)
- Reduced unplanned maintenance

The project also aims to reduce waste during the upgrade project by recycling all the recyclable parts of the redundant light fittings.

Lighting in 65 buildings will be upgraded in this project. The estimated annual energy and carbon emissions savings are as follows.

ESTIMATE OF ANNUAL CARBON REDUCTION *in all buildings planned*

Campus	Estimated annual energy (kWh) saved	Estimated tonnes of CO_2 emissions reduced*
Gold Coast	313,015	247
Nathan	660,302	522
Mt Gravatt	213,822	169
South Bank	212,133	168
Logan	112,794	89
Total	**1,512,066**	**1,195**

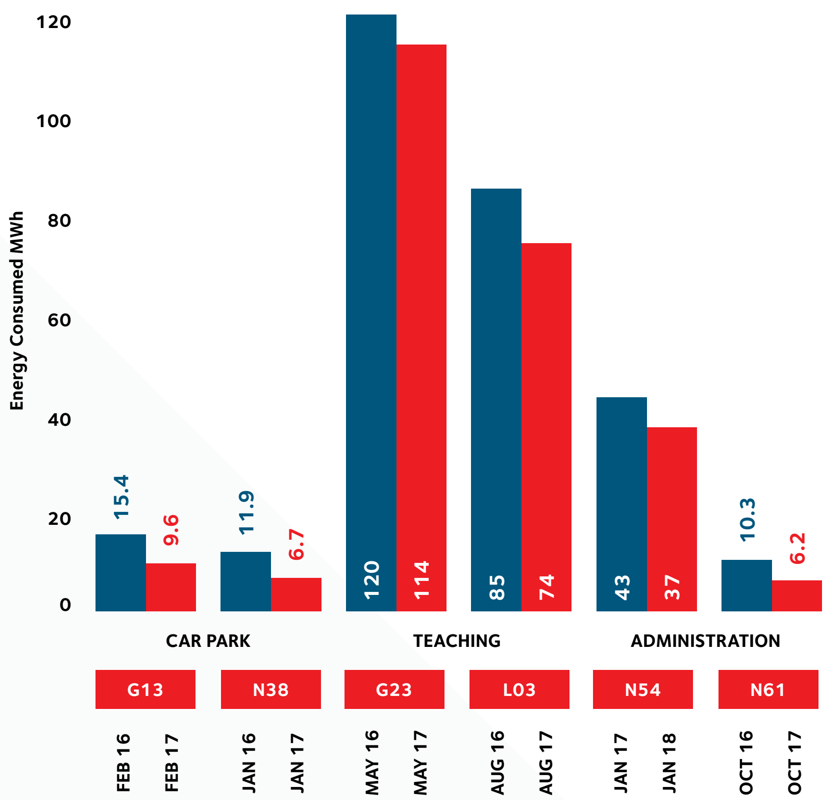
Emission factor of 0.79 kg CO_2/kWh was used to calculate CO_2 emissions.
Source: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)*

ANNUAL CARBON REDUCTION *buildings completed to date*

Building	Estimated annual energy (kWh) saved	Estimated tonnes of CO_2 emissions reduced*
N38, N23, N65, N51, N61, G10, G06, G14, G36, G23, G09, G04, G19	236,912	187

Examples of electrical consumption trends based on actual metered data for some of the completed buildings are illustrated in the charts below:

Electrical consumption trends



Building Optimisation

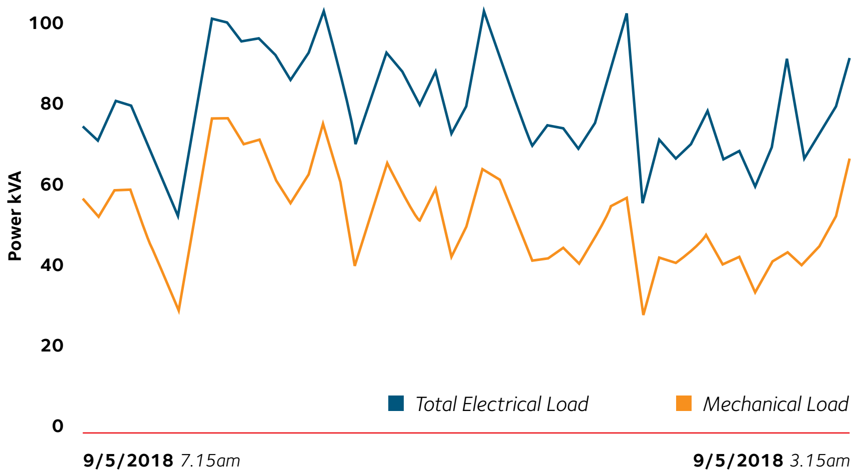
> *In Australia, HVAC (Heating Ventilation and Air Conditioning) is estimated to be in the order of 39% of a building's energy load.*

The University's campuses include a range of dynamic buildings with varying heat loads depending on use. In buildings with high specification requirements such as laboratories, this percentage of HVAC energy usage can be higher.

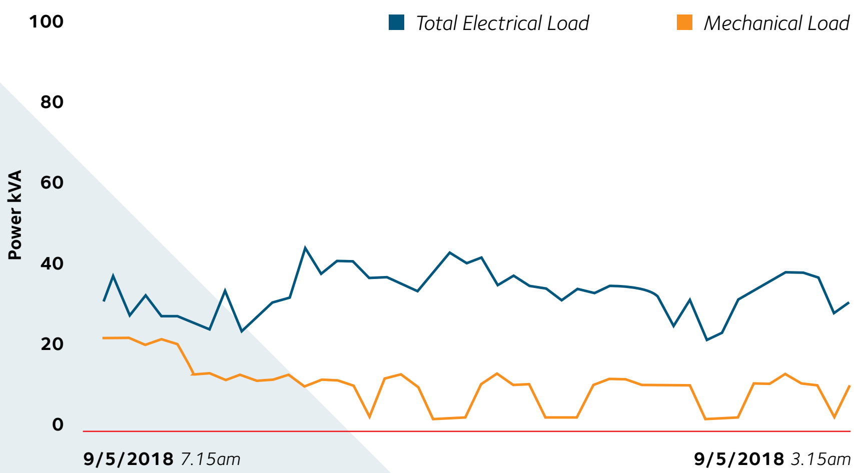
Health Sciences (N48) total electrical and mechanical load comparison

The figure below shows the difference between a mechanically demanding power load Health Sciences (N48) compared to a more standard building such as Languages (N56).

Health Sciences (N48) total electrical and mechanical load comparison



Languages (N56) total electrical and mechanical load comparison



The Building Optimisation Project has been developed to save energy by controlling the HVAC systems in Griffith buildings as efficiently as possible.

During 2017 Campus Life audited all heavy energy use buildings to identify potential energy savings as well as any maintenance tasks that had not been conducted. At the start of 2018 a priority list of 70 buildings was developed. The key factors used to prioritise buildings were potential savings, energy use and user complaints. The top 10 buildings are shown below.

Table of Prioritisation by Energy Use, Complaints and Savings Potential

Building		Building Rank	Energy Rank
G40	Griffith Health Centre	1	85
N45	Central Chiller Plant	2	50
S02	Webb Centre	3	22
G07	The Link (Community Building)	4	17
G10	Library (Graham Jones Centre)	5	16
G02	Clinical Sciences 1	6	15
G20	Chiller House 1 (West)	7	15
G12	Science 2	8	15
G24	Science 1	9	14
G05	Health Sciences	10	12

Scheduling of buildings to be optimised, also included concern for disruption to building occupants. For this reason, the following factors were considered:

- special events (e.g. Commonwealth Games)
- work on chiller houses at low load times (i.e. winter)
- group by location for efficiency

In addition to this, the Bray Centre (N54) and Law (N61) were selected as "proof of concept" buildings to allow the largely Nathan based project team to refine the optimisation process.

> *The goal of building optimisation is to have the air conditioning on only when it is needed and to make sure that all parts of the system are in working order.*

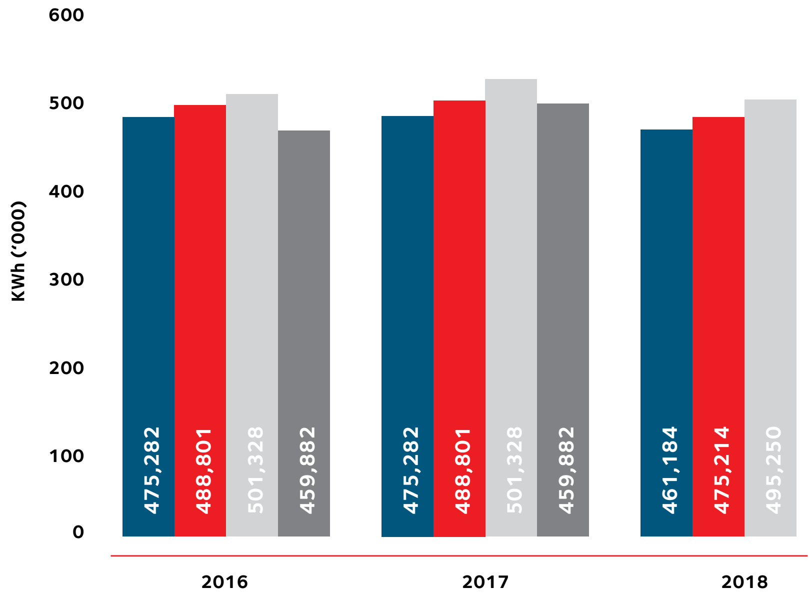
The work undertaken and completed in each building to ensure optimal efficiency is as follows:

- Evaluate original design of mechanical plant and fix if required
- Confirm correct function of all mechanical plant
- Repair any issues identified within the building
- Upgrade control technology to ensure increased energy savings
- Check all scheduling of plant to run plant only when required i.e when occupied
- Check temperature set points are aligned with University guidelines for 23.5°C in summer, 20°C in winter unless the area has an agreed exemption eg. labs and specialist equipment areas.

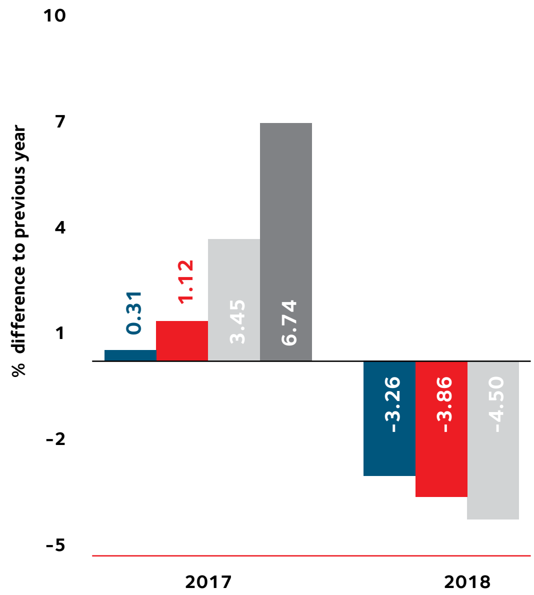
MONITORING OF OUR ENERGY METERS

Monitoring shows past and present energy use. The savings are already evident as illustrated in the Bray Centre (N54) and Science 2 (N34) below.

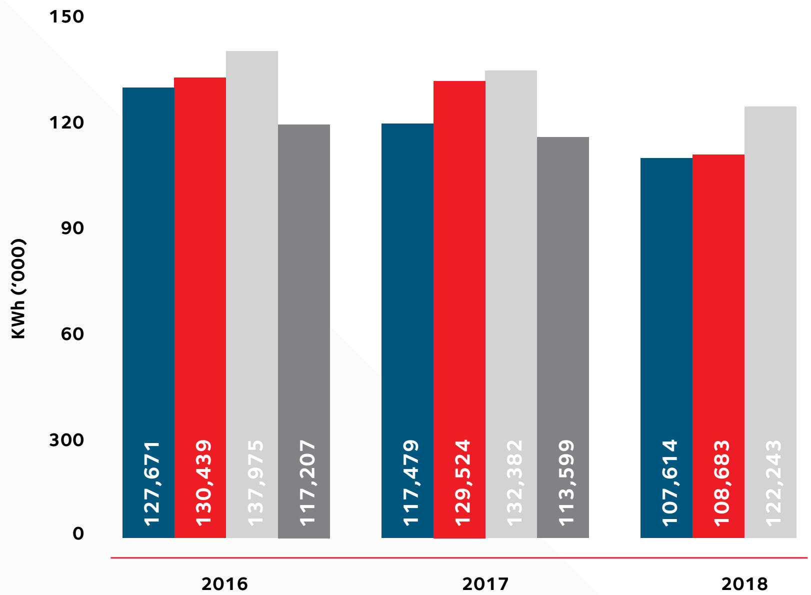
Science 2 (N34) electrical consumption



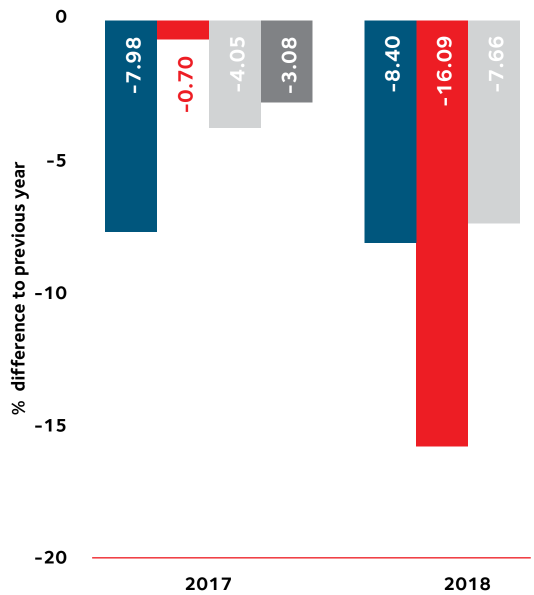
Science 2 (N34) electrical consumption difference by quarter



Bray Centre (N54) electrical consumption



Bray Centre (N54) electrical consumption difference by quarter



Quarter: 1 2 3 4

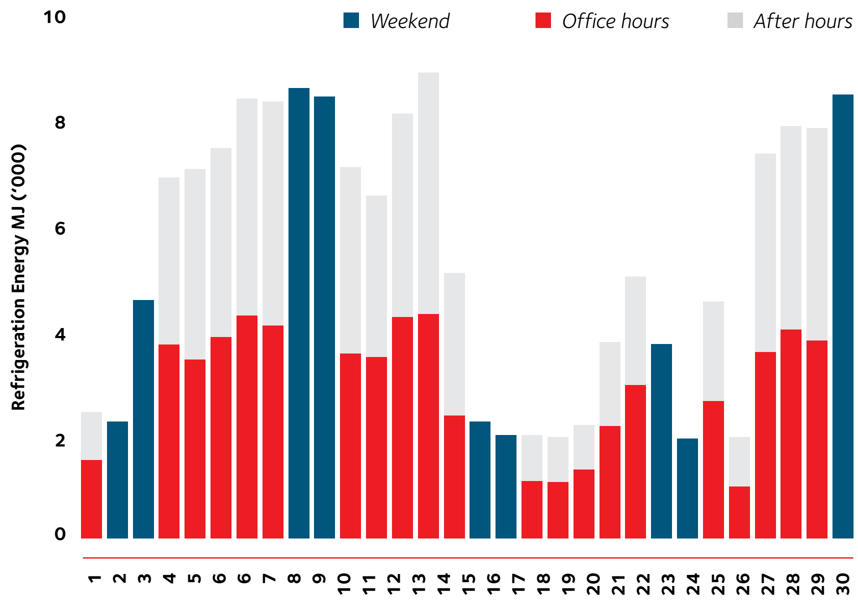
Chilled water usage

Meters measure the hourly rate of energy use for air conditioning a building therefore identifying potential savings.

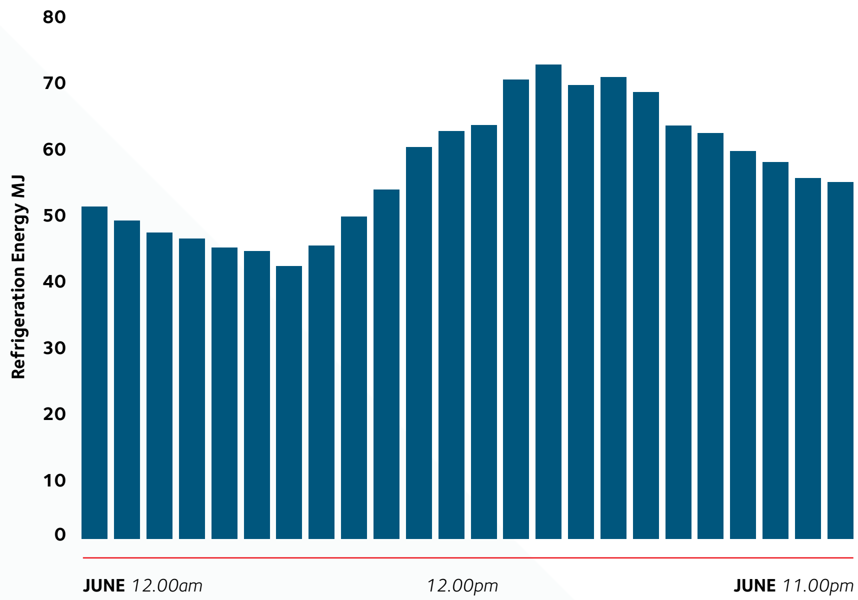
By analysing these, against the space requirements we are able to fine tune building controls to provide optimum conditions whilst the building is occupied and avoid waste in unoccupied areas.

When energy saving measures are implemented, these meters will allow us to confirm the benefits and also identify further areas for improvement e.g. units running when not required, systems consuming above benchmarks and so on.

Health Sciences (N48) daily chilled water energy usage June 2018



Health Sciences (N48) average hourly chilled water energy usage June 2018

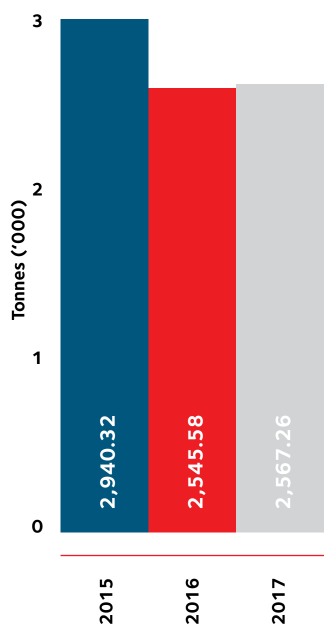


Managing our waste

During the 2017 reporting year our total waste increased by just under 21.68 tonnes, an 0.9% increase on the previous reporting year.

On average the total waste produced by each staff and student FTE has decreased from 67.11 kg per year to 65.5 kg per year.

Tonnes per year

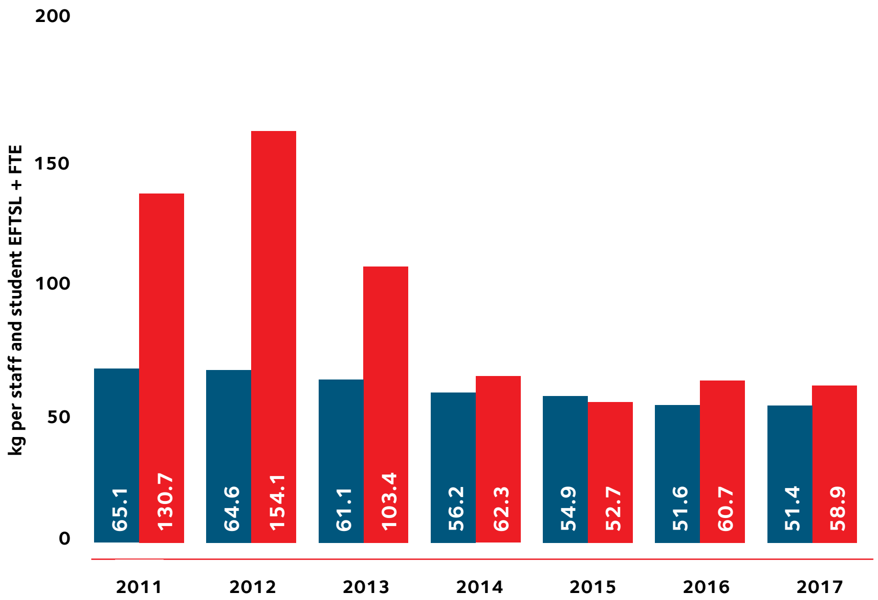


TEFMA benchmark data

Waste performance within the higher education sector

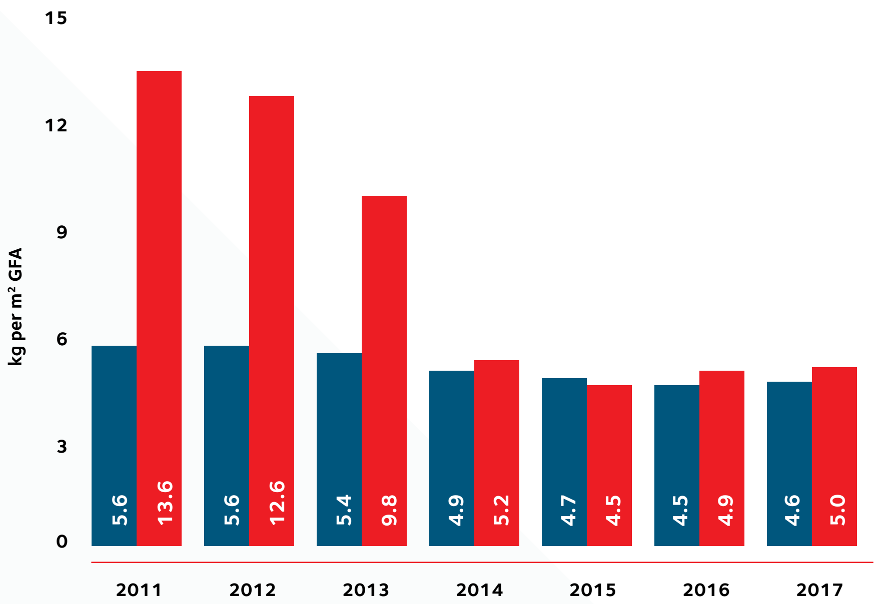
A comparison of the TEFMA Benchmarks indicates our total waste to landfill is above the sector average on a kg/EFTSL and FTE and kg/m^2 GFA basis.

Waste produced kg per EFTSL + FTE (landfill and recyclables)



Note: *From 2014 EFTSL + FTE data includes the digital campus. In 2014, the digital campus was 4.5% of EFTSL + FTE. In 2017 the digital campus was 8.1%. TEFMA does not track the impact of the digital campus.*

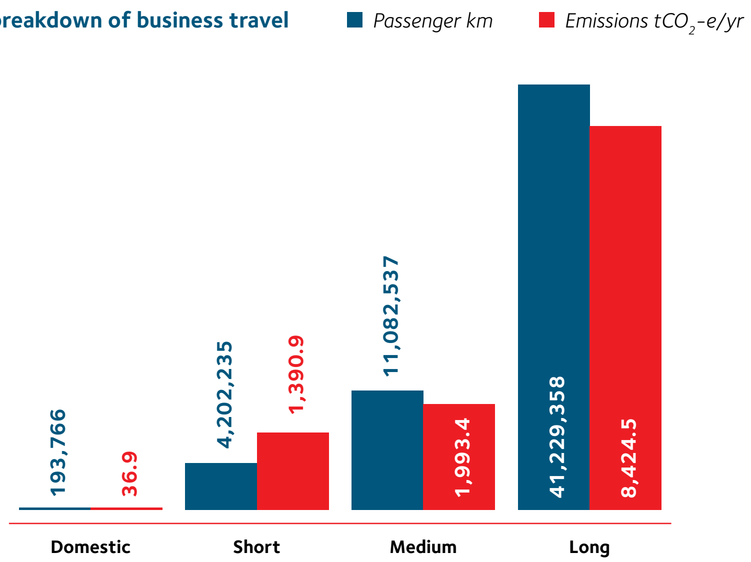
Waste produced kg per GFA (landfill and recyclables)



Managing our flights

In the 2017/18 reporting year our total passenger kilometres were 56,707,895.4, equating to 11,845.6 tCO_2-e. This represented a decrease of 1,308.9 tonnes, a 9.95% decrease on the previous reporting year.

Griffith breakdown of business travel



Haul	Passenger km	Emissions (tCO_2-e/yr)
Domestic Under 400km	193,766	36.9
Short 401 - 1,000km	4,202,235	1,390.9
Medium 1,001 - 3,700km	11,082,537	1,993.4
Long 3,701 - 16,000km	41,229,358	8,424.5
Total	**56,707,896**	**11,845.7**

Carbon emissions baseline

The University's total carbon emissions baseline year is 2010/11. The table identifies the total Greenhouse Gas emissions by activity/sector.

Total emissions include non-residential and residential buildings. Emissions are calculated in accordance with the Department of the Environment and Energy National Greenhouse Accounts.

Emission factors can change over time. To ensure a meaningful comparison of emissions, data is provided over the long term and the data of prior years is re-calculated using the same factors employed in the current year's assessment (when and where applicable).

While scope 1 and 2 do not include flights and waste, the University has chosen to monitor and report against these areas as they have significant potential for improvement.

UNIVERSITY CARBON EMISSION BASELINE FY 10/11 (SCOPE 1 AND 2)

Activity Sector	Emissions tCO_2-e/yr	Emissions % of total scope 1, 2, 3
Utilities	52,725	61.7%
Transport fuels	1,070	1.2%
Stationary fuels	157	0.2%
Synthetic gases	857	1%

EMISSIONS WERE CALCULATED FROM THE FOLLOWING:

Utilities	Direct emissions – data is collected from utility bills from each service provider which includes electricity generation and transmission and distribution losses
Transport fuels	Post 2004 gasoline, diesel oil and LPG - data is collected from utility bills from each service provider
Stationary fuels	LPG data is collected from utility bills from each service provider
Synthetic gases	Refrigerant data collected from contractor

Reduced emission scenarios

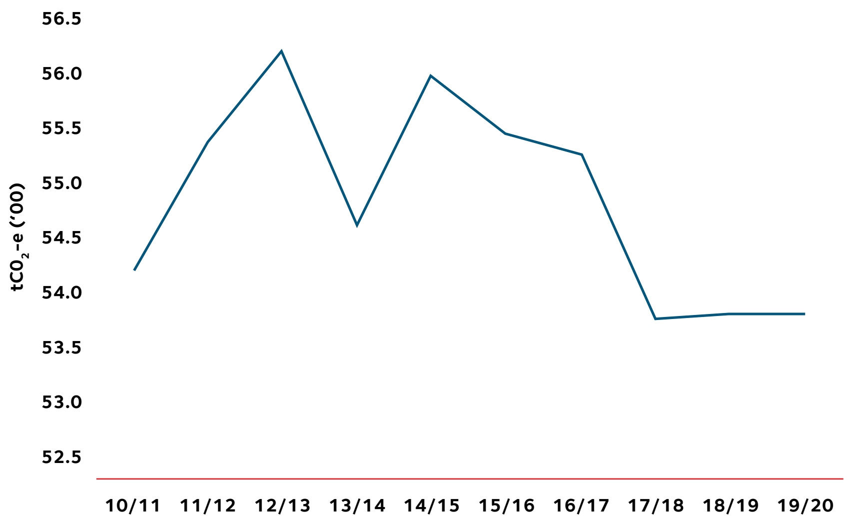
The Carbon Management Plan identified a number of opportunities to reduce carbon emissions. Particularly in energy, waste and flights.

ELECTRICITY

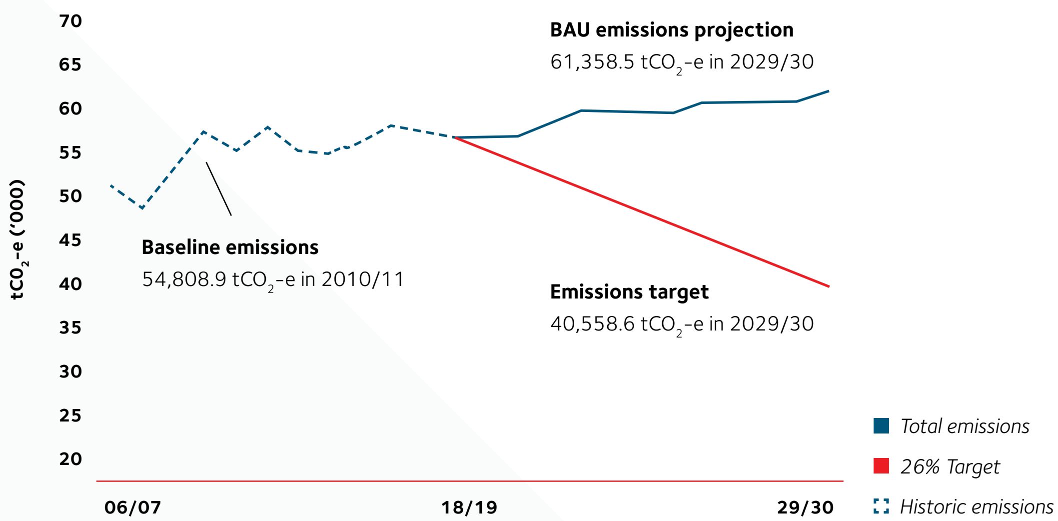
An update of the Business As Usual graphs using current emissions and projected growth rates (GFA and EFTSL) indicates that Greenhouse Gas emissions will increase moderately, from 54,809 tCO_2-e in FY 2010/11 to 61,358 tCO_2-e in FY 2029/30. This is primarily due to limited projected building activity over the period.

For the University to achieve its goal of 26% reduction on 2010/11 Scope 1 and 2 emissions by 2030 there needs to be a substantial reduction from 2017/18 levels. Specifically, electricity consumption needs to reduce by 25% and the overall Scope 1 and 2 emissions need to reduce by 28%.

Electricity emissions (tCO_2-e) based on a BAU scenario



26% target for overall Scope 1 and 2 emissions

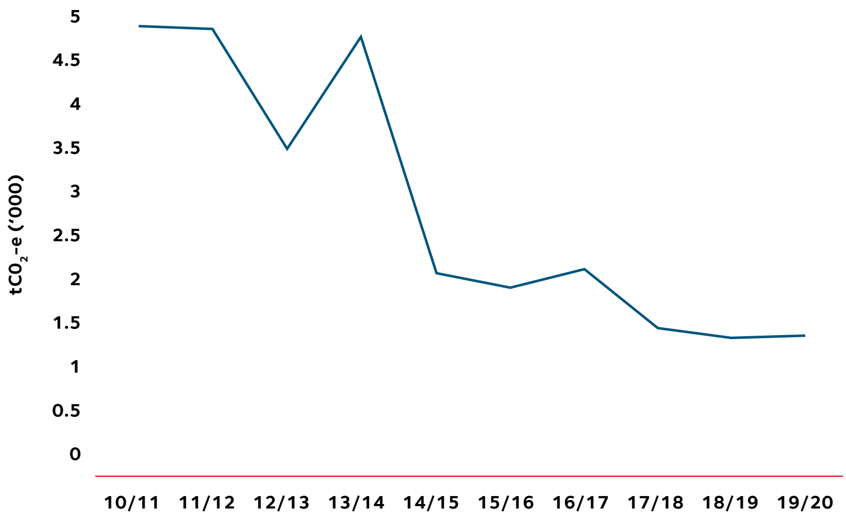


Waste

An update of the Business as Usual graphs using current emissions and projected growth rates (EFTSL & FTE) indicates that Greenhouse Gas emissions have reduced between the reporting years 2010/11 and 2017/18.

This has resulted in emissions projections being 1,363 tCO_2-e for the FY 2019/20 under the BAU scenario.

Waste emissions (tCO_2-e) based on a BAU scenario



Appendix 1

Calculation methodology and emission factor sources

Emission source	Methodology	Factor	Factor Source
Electricity	Method 1 from NGER Technical Guidelines 2010	Scope 2 = 0.878 $kgCO_2$-e/kWh Scope 3 = 0.119 $kgCO_2$-e/kWh	National Greenhouse Accounts (NGA) Factors July 2011
Natural Gas	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 51.33 $kgCO_2$-e/GJ Scope 3 = 8.60 $kgCO_2$-e/GJ	NGA Factors July 2011
Telecommunications	Methodology as in Balancing Act Report. A Triple Bottom Line Analysis of the Australian Economy and up-dated to 2009-2010 financial year. Corrections are applied for inflation, major changes in the economy and state variations.	0.17 kg CO_2-e/$	Input-Output Analysis calculator developed by the Integrated Sustainability Analysis (ISA) Research Team at the University of Sydney (isa.org.usyd.edu.au).
Internet	As above	0.17 kg CO_2-e/$	ISA ibid.
IT Equipment	As above	0.37 kg CO_2-e/$	ISA ibid.
Food & Catering	As above	0.69 kg CO_2-e/$	ISA ibid.
Cleaning Services	As above	0.48 kg CO_2-e/$	ISA ibid.
Business Flights	Calculation based on GHG activity data multiplied by GHG emission factor	Defined by seating class and flight haul length. Average 0.353 kg CO_2-e/passenger.km	DEFRA 2010 Guidelines to GHG Conversion Factors by passenger seating class (economy, business, first) and flight type (short, medium and long haul). RFI 1.9: TRAEOFF FP5 EU Project: Aircraft emissions: contribution of different climate components to changes in radiative forcing-tradeoff to reduce atmospheric impact. cordis.europa.eu/home_en.html
Post 2004 Diesel Oil	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 2.7 $kgCO_2$-e/L Scope 3 = 5.3 $kgCO_2$-e/L	NGA Factors July 2011
Post 2004 Gasoline	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 2.3 $kgCO_2$-e/L Scope 3 = 5.3 $kgCO_2$-e/L	NGA Factors July 2011
Post 2004 LPG	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 1.6 $kgCO_2$-e/L Scope 3 = 5.0 $kgCO_2$-e/L	NGA Factors July 2011
Diesel oil (Stationary)	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 2.68 $kgCO_2$-e/L Scope 3 = 5.3 $kgCO_2$-e/L	NGA Factors July 2011
LPG (Stationary)	Method 1 from NGER Technical Guidelines 2010	Scope 1 = 1.54 $kgCO_2$-e/L Scope 3 = 5.0 $kgCO_2$-e/L	NGA Factors July 2011
Waste to Landfill	Calculation based on GHG activity data multiplied by GHG emission factor	1.10 tCO2-e/tonne	NGA Factors July 2011
Leakage of refrigerants	Direct emissions (tCO2-e)= equipment charge (kg)/1000 x leakage factor (%) x global warming potential of refrigerant gas	Leakage Rates: Commercial A/C 9% GWP: HCFC R123: 120; HFC R134a: 1,300; HCFC R22: 1,810; HFC Blend R-407c: 1,525	Leakage rates: NGA Factors 2011, Table 25, page 47; Greenhouse Warming Potential (GWP) for Kyoto refrigerants: National Greenhouse Accounts (NGA) Factors (Australian Government, July 2011), Appendix 1 Table 26, page 58; GWPs for non-Kyoto refrigerant gases: ghgprotocol.org/files/ghgp/tools/Global-Warming-Potential-Values.pdf (IPCC 2nd Assessment Report)
Paper	Calculation based on GHG activity data multiplied by GHG emission factor	0% recycled = 7.310 $kgCO_2$-e/ream; 80% recycled = 5.143 $kgCO_2$-e/ream; 100% recycled = 4.601 $kgCO_2$-e/ream	Paper Task Force calculator available at: calculator.environmentalpaper.org/resources_and_tools