Carbon Management Report

November 2020

Engineering Services | Corporate Services

Griffith UNIVERSITY
Queensland, Australia

Executive Summary

The annual Carbon Performance report reflects on our progress in managing the carbon footprint of the University, with a focus on electricity, waste and air travel. It notes our targets, outlines our carbon emissions for the year ended 30 June 2020 and compares our performance to the baseline, the previous year and the higher education sector TEFMA benchmarks.

Overall, the total carbon emissions for the 2019/20 year were 73,306 tonnes of carbon dioxide. 2019/20 emissions were 14% below the 2010/11 baseline and 15% lower than the prior year. There was a 40% reduction in airline travel, reflecting the travel ban put in place in March as part of the response to the COVID-19 pandemic. Electricity emissions reduced by 8% from 2018/19 levels, partly associated with the reduced campus activity aspect of the pandemic response.

Performance of scope 1, 2, and 3 emissions for 2019/20 can be summarised as follows:

- Scope 1 emissions relate to the direct consumption of fossil fuels. Scope 1 only accounts for 2.2% of the total carbon emissions for the year. 2019/20 scope 1 emissions were 1,593 tonnes of $CO_{2\text{-}e}$, a close to 40% decrease on 2018/9 and a 25% decrease on 2010/11. The primary driver of the reduction was a reduction in unplanned refrigerant releases from chiller plant, and some reduction in fuel consumption resulting from reduced activity in the University car fleet whilst the COVID 19 travel restrictions were in place.
- Scope 2 emissions are the emissions associated with the consumption of electricity generated off campus. These account for 66% of the total Carbon footprint for the year. 2019/20 scope 2 emissions were 48,499 tonnes of CO2-e, a 8.1 % decrease on 2018/19 and 8% below 2010/11 levels. Scope 2 emissions declined relative to prior years as a result of on-going efficiency projects, namely:
    - LED light fittings replacement across all campuses was completed
    - Building Optimisation for heating, ventilation and air conditioning systems across all campuses was completed
    - HVAC monitoring
    - Energy Dashboards
    - Sir Samuel Griffith Centre (N78) chilled water upgrade
    - Logan Campus chilled water plant controls upgrade

    The closure of Logan, South Bank and Mount Gravatt Campuses during April, May and June also assisted in reducing consumption.
- Scope 3 emissions, the emissions as a direct consequence of the University's goods or services e.g. waste, paper, flights and distribution losses from the electricity counted under Scope 2. These form the remaining 31.8% of our emissions with total 2019/20 emissions being 23,215 tonnes $CO_{2\text{-}e}$, a 25% decrease on 2018/19 and a 24% decrease on 2010/11. There was a notable reduction in flights due to the travel ban and in emissions related to paper consumption due to a shift to carbon neutral paper.

Since 2010/11 the University has successfully mitigated the additional emissions that come with student load, staff and campus expansion. The 2019/20 emissions levels show a 14% reduction on the baseline, following a 2018/19 total similar to the reference year. To achieve its strategic objectives, the University will need to focus on how it uses energy and how regularly (and in which class) staff choose to travel. This year's results show that reducing campus activity, air and road travel contributes directly to reducing emissions.

The final section of the report focuses on reducing our emissions and sets out our pathway to achieve the Strategic goal of halving 2010 net emissions by 2030 and net zero emissions by 2050. This includes detail on the projects in progress for completion in 2021.

The appendix gives examples of using data to identify opportunities to reduce energy consumption.

Introduction

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. Since then, we have committed to aligning Griffith with the Intergovernmental Panel on Climate Change by halving carbon emissions from 2010 levels by 2030 and reducing them to zero by 2050. This report provides an update of our progress on reducing emissions and compares our overall emissions with the higher education sector.

Our carbon footprint

In 2020, Pangolin Associates were appointed again 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 monitor our progress against our emissions reduction target.

Table 1: Griffith Carbon Footprint - Emissions in Tonnes of Carbon Dioxide Equivalent from Baseline 2010/11 to present

Year	Scope 1	Scope 2	Scope 3	Total
2019/20	1,592.5	48,499.1	23,214.6	73,306.2
2018/19	2,627.8	52,775.1	31,148.9	86,551.8
2017/18	2,588.9	53,880.1	24,585.2	81,054.2
2016/17	1,739.8	55,624	29,020.9	86,384.7
2015/16	2,274.7	55,440.4	31,835.4	89,550.5
2014/15	1,813.4	53,840.2	32,318.2	87,971.8
2013/14	2,124.8	52,604.7	36,459.6	91,189.1
2012/13	2,637.1	52,281.1	35,912.2	90,830.4
2011/12	2,115.7	55,431.1	31,456.9	89,003.6
2010/11	2,114.6	52,694.3	30,535.5	85,344.4

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.

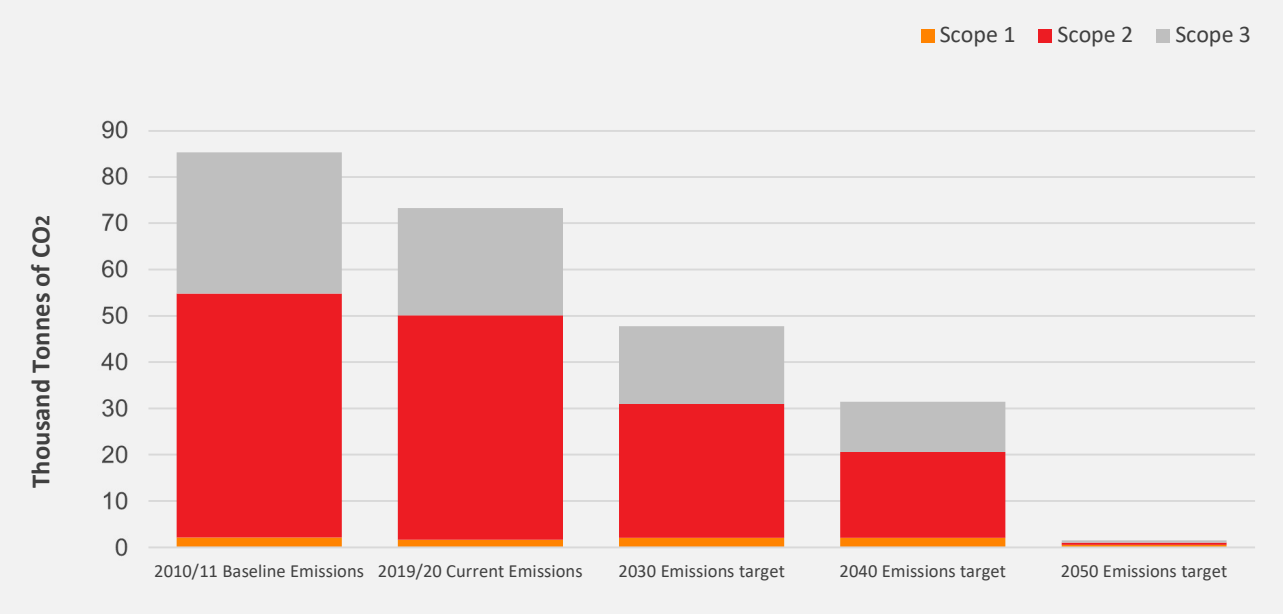
Scope 2
Emissions associated with the use of electricity imported from the grid or from a third-party supplier of energy in the form of heat or electricity.

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 transmission and distribution losses from electricity.

Our carbon emissions target

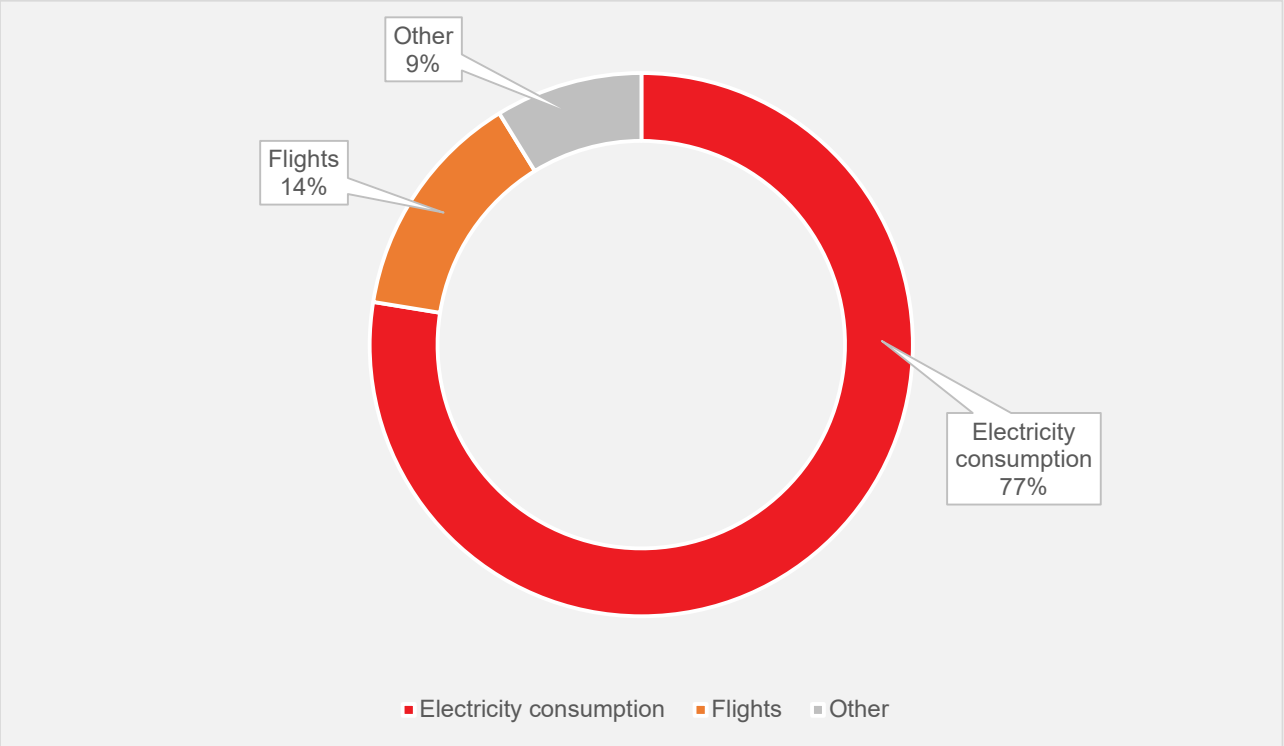
The University Strategy 2020 – 2025 “Creating a future for all” commits to developing an action plan to align Griffith with the recommendations of the Intergovernmental Panel on Climate Change by halving carbon emissions by 2030 from 2010 levels and reducing them to net zero by 2050. The Net Zero Carbon Emissions Report outlines the plan and was endorsed by Council in December 2019.

Comparison of 2010/11 baseline emissions, current emissions and targets to meet the IPCC targets.



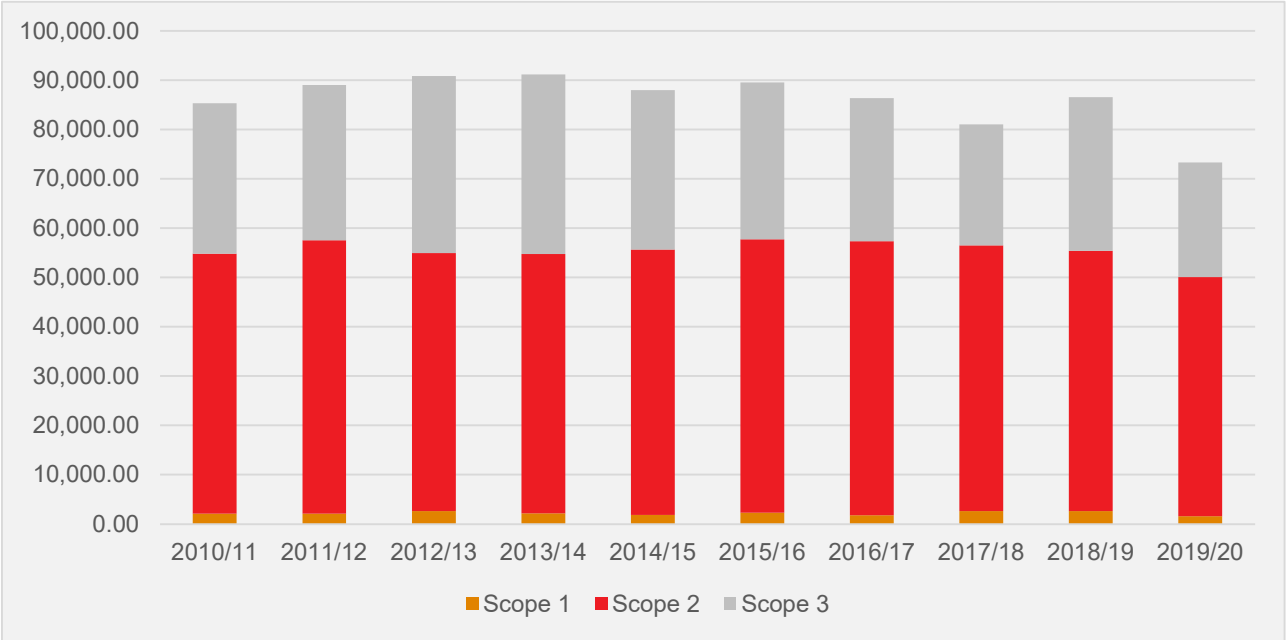
For the 2019/20 year, the carbon emissions breakdown by source is as follows

2019/20 carbon emissions breakdown



This report illustrates how Griffith compares against the sector on a scope 1 and 2 emissions, and electricity consumption basis; reviews scope 1, 2 and 3 emissions and projects to reduce each, and forecasts our 2030 emissions based on implementing further project initiatives including a new power contract including 50% renewable energy.

Scope 1, 2 and 3 emissions by year



2019/20 progress

Overall, the total carbon emissions for the 2019/20 year are 14.1 % below the 2010/11 baseline.

Comparing against the 2010/11 baseline:

- Scope 1 'direct emissions' are 25% lower due to reduced fuel consumption for vehicles and plant over the period.
- Scope 2 'electricity (indirect) emissions' are 8% lower due to the progress on on-going efficiency projects and the reduced campus activity across all campuses
- Scope 3 'other indirect emissions' are 24% lower with reduced flights, paper, waste, cleaning and food related emissions

Comparing against the previous year (2018/9):

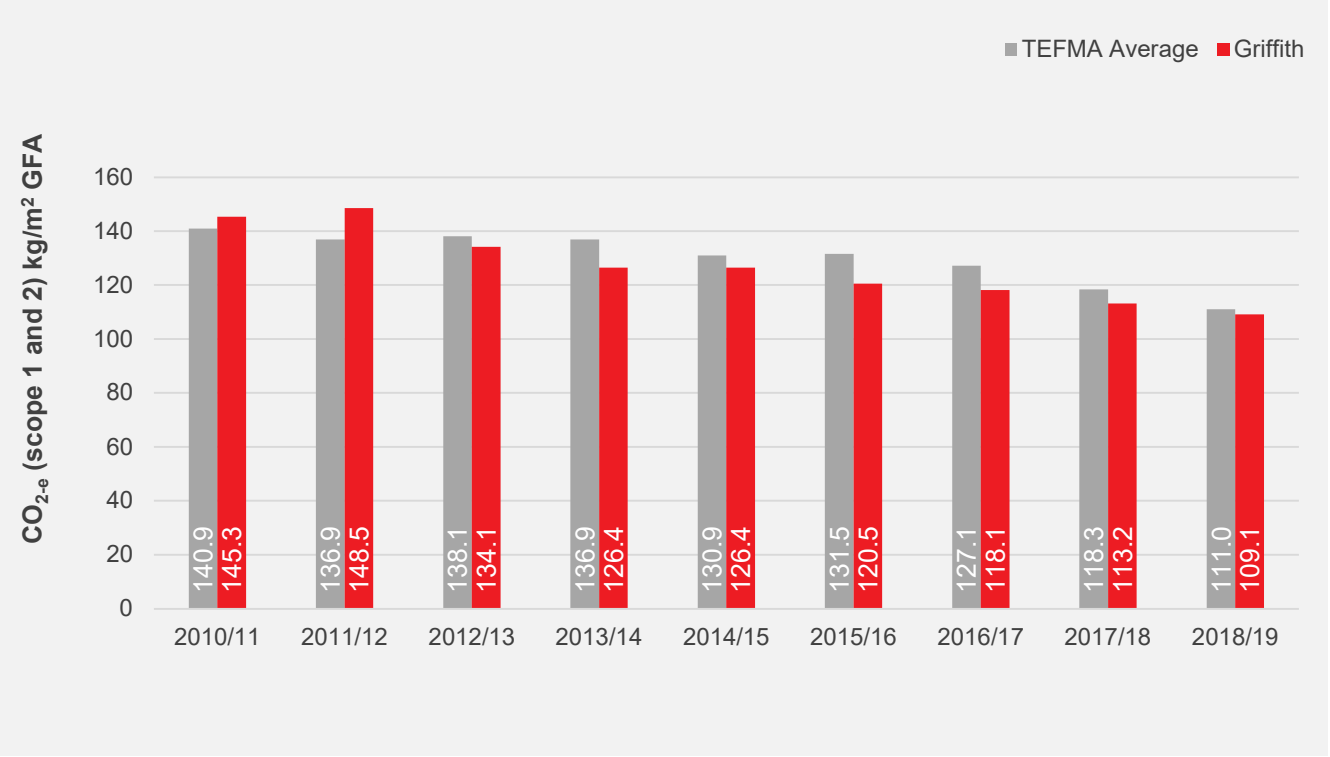
- Scope 1 'direct emissions' are nearly 40% lower. This is due to reduction in unplanned refrigerant releases from chiller plant and reduced vehicle fleet consumption whilst the COVID-19 restrictions were in place.
- Scope 2 'electricity (indirect) emissions' are 8.1 % lower. The reduction is primarily due to the LED and BMS optimisation projects and the closure of Logan, South Bank and Mount Gravatt Campuses from April to June
- Scope 3 'other indirect emissions' are 25% lower. This is primarily a result of the reduction in business flights, partly related to the travel ban imposed from March onwards, and also a shift to carbon neutral paper.

TEFMA benchmark data

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 below indicate that the University's Scope 1 and 2 Green House Gas emissions are slightly less than the sector average when compared by gross floor area.

TEFMA does not provide benchmark data on scope 3 emissions.

Scope 1 and 2 CO_{2-e} Emissions per m^2 GFA



Note: [1]TEFMA excludes residences GFA. [2]2020 TEFMA average value not yet available. 3. Comparison relates to campus net consumption only.

Scope 1 emissions

Scope 1 emissions were 2.2 % of our total emissions for 2019/20. These include:

- Natural gas consumption for boilers, hot water heating and cooking
- Transport fuels i.e. fuel for fleet cars and other university vehicles
- Stationary fuels - for fixed equipment e.g. generators
- Synthetic gases e.g. refrigerant for cold rooms, air conditioning units, chillers

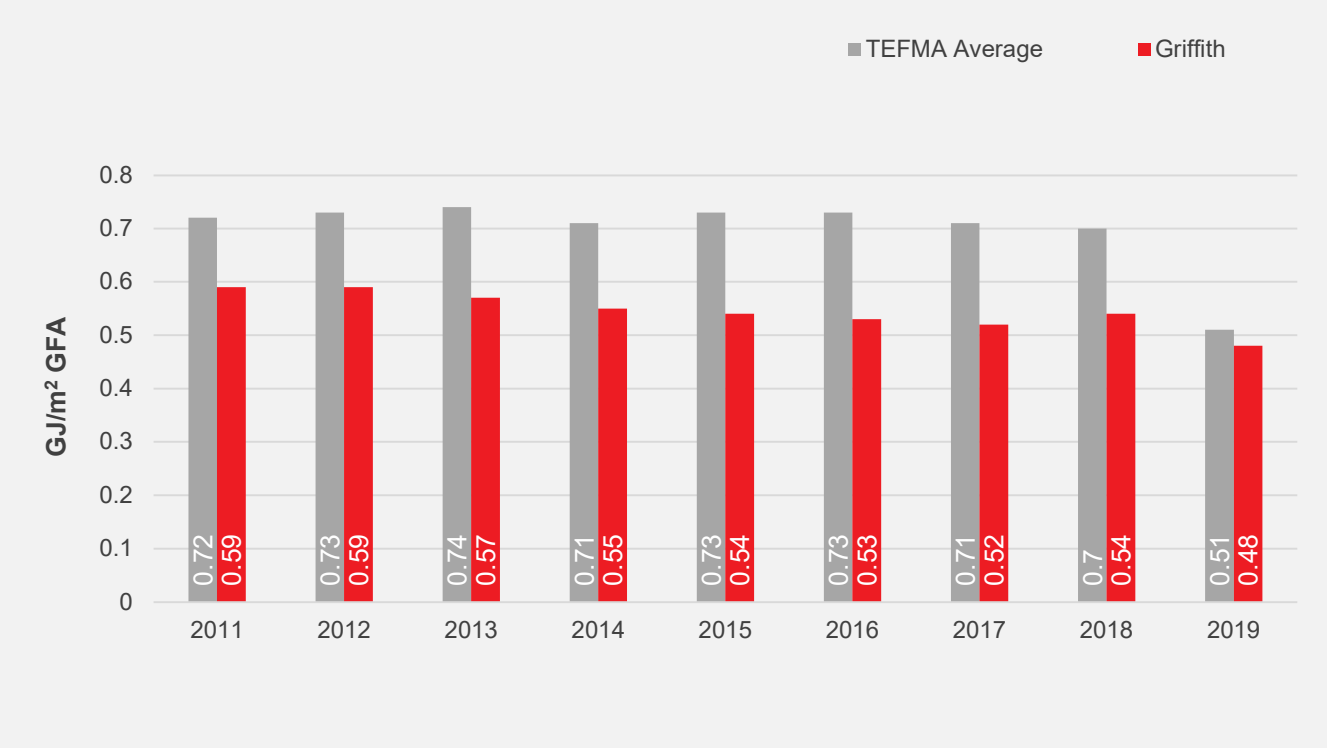
Savings are being made progressively as the car fleet shifts from petrol to hybrid vehicles and the opportunities to move to electric cars are being investigated. Refrigerant gases are another opportunity for reductions, as we replace aged chillers. When old chillers breakdown there is often a release of refrigerant. For our older chillers, these are gases of high global warming potential so the associated carbon emission is high.

Scope 2 emissions - Our energy footprint

The largest part of our carbon footprint is the Scope 2 indirect emissions associated with the generation of electricity consumed on campus. To meet our carbon target, we will need to focus on reducing our electricity consumption.

A comparison of the TEFMA benchmarks indicates that the University's electricity consumption per m^2 GFA is slightly lower that the sector average. The benchmark has reduced considerably this year, expected to be due to other universities reporting results related to their investments in energy efficiency, green power and renewable generation (both on and off site),

Electricity consumption – per m² GFA



Note: [1]TEFMA excludes residences GFA. [2]2020 TEFMA average value not yet available.

Energy efficiency projects

Each year we commence new projects and continue ongoing projects aimed at reducing our energy consumption.

Over the 2019/20 period, the following projects were completed:

- LED light fittings replacement across all campuses was completed
- Building Optimisation for heating, ventilation and air conditioning systems across all campuses was completed including the Ian O'Connor Building (G40).
- HVAC monitoring
- Energy Dashboards
- Sir Samuel Griffith Centre (N78) chilled water upgrade
- Logan Campus chilled water plant controls upgrade

These projects are described in more detail on the following pages. Projects in progress and planned for future years are described in the final part of this report.

LED upgrade project

One of our major energy efficiency projects was the replacement of fluorescent tube light fittings with higher energy efficiency (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 upgrade work in the nominated buildings at Logan, Gold Coast, South Bank, Mount Gravatt and Nathan campuses has been finished including a second phase completed in June 2020.

Table 2: LED project summary

LED project estimated savings	
LED fittings installed to date	29,890
Number of buildings upgraded to date	76
Percentage of completed buildings (70/74)	100%
Estimated kWh energy saved per year	1,825,497
Estimated $tCO_{2\text{-}e}$ saved per year (scope 2 and 3)	1,698
Percentage $CO_{2\text{-}e}$ reduction	2.3%
Approved Project Value	$2,158,579.00
Total project spend	$1,558,572.56
Estimated $ saved per year	$388,660.40
Estimated ROI	5.1 years
Project completion	April 2020
Recycled waste: steel + PVC	48 tonnes
Recycled waste: fluorescent tubes	4 tonnes

The LED upgrade project has increased the visual amenity and lighting level in the upgraded areas. The new fittings typically use one third of the electricity to achieve similar or better lighting levels.

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 buildings with varying HVAC loads depending on use. In buildings with high specification requirements such as laboratories, this percentage of HVAC energy usage can be higher.

During 2017 Campus Life audited all high energy use buildings to identify potential energy savings as well as any maintenance tasks that had not been conducted. The Building Optimisation Project is a $1.3 million initiative formed to "optimise" these buildings by implementing many of the recommendations from the audits. The goal of building optimisation is to have the existing building systems working as well as possible, ensure the system is only on when needed, and overall reduce the energy consumption and ultimately, improve the comfort of the building occupants. Along with energy savings, outcomes of the project included various legacy system replacements, improved system reliability and monitoring capability and cyber security risk reduction. The upgraded controls allowed scheduling of buildings to be overridden to switch off the air conditioning in buildings closed during the COVID pandemic response. Now the code is updated, it is simple to turn off buildings for holidays or other closure.

The Building Optimisation Project concluded in 2020 and consisted of the optimisation of 41 buildings. The overall reduction in energy consumption for the 41 buildings was 12% measured year over year from before the project started to after the project finished. This compares to an average reduction in energy consumption of 5% over the same period by buildings and services outside the scope of the project.

An estimated return on investment is shown in the table below allowing for a 7% reduction in annual energy consumption for the buildings optimised to be attributed to the project. The figures below include the works to the Ian O'Connor building (G40) which were funded by a dedicated project.

Table 3: Building Optimisation project summary

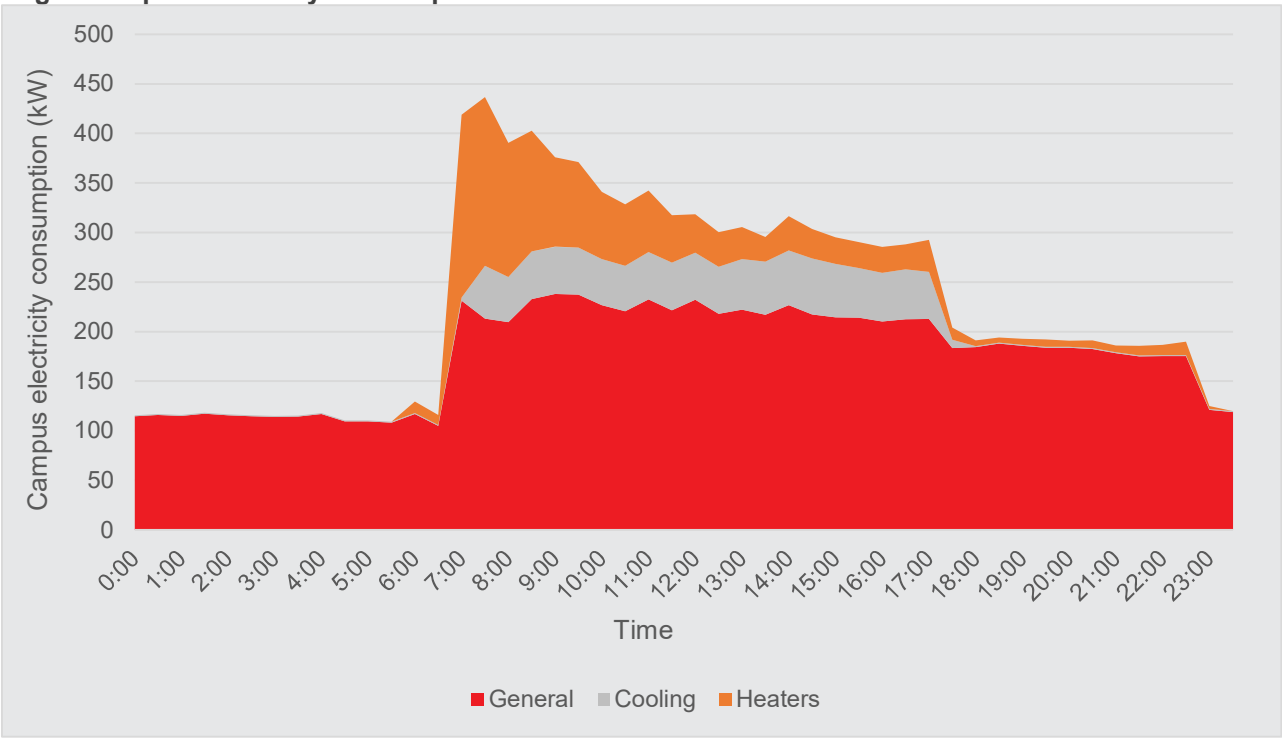
Building Optimisation project estimated savings	
Total cost of works	$1,502,285
Annual power savings	2,600,000 kWh
Annual $tCO_{2\text{-}e}$ reduction	2,100 $tCO_{2\text{-}e}$
Project spending per annual tCO2-e saved	$710
Annual electrical bill savings	$370,000
Annual electrical bill savings per dollar of project spending	$0.24
Return on investment	4 years

HVAC Monitoring

With over 4000 air conditioning systems in use across the University, it is important to be able to monitor system health as problems can often go unnoticed. To supplement traditional means of monitoring HVAC systems such as routine inspections, the University has invested in sensors and IT systems that allow for centralised collection of data about building HVAC systems across our campuses. This data can be analysed to detect issues such as systems running when they are not required, erratic control behaviour, faulty sensors, overcooling or overheating, and water leaks.

An example of HVAC data that is collected and can be used in the context of energy is shown in the graph below. This is a breakdown of energy consumption at Logan campus for a typical August day. This data can be further broken down by building and, in some cases, by floor and individual systems. In this case, a surge in heater use is shown early in the morning which was identified for investigation and reduction.

Logan campus electricity consumption breakdown on 20/8/2020



Issues found using monitoring data can often be fixed at minimal cost to the University. Some examples of where data has been used to reduce energy consumption are given in Appendix A.

Energy dashboards

The existing metering data collected in the PI historian database has been made available to the University community via new Tableau dashboards that compare usage by building and campus for the current and previous year, by month and on an annual basis. A weekly option was implemented for the Engineering Services team which is used to check trends and identify whether solutions implemented are achieving the required results.

Sir Samuel Griffith Building (N78) Chilled Water Upgrades

The N78 chilled water system provides chilled water to the building for air conditioning. The system includes a large chilled water tank which acts like a battery, allowing water to be chilled, stored and then used later. The tank allows water to be chilled overnight when the chiller is more energy efficient and then water is used as needed through the day.

Issues with the system had been causing the chilled water tank to routinely overflow and forced the tank to be isolated to prevent major losses of water. In 2019, a long-term solution to the issue was developed and the system was modified accordingly. Works were completed in November 2019 and the tank returned to service.

The modifications are estimated to reduce the N78 chilled water system power consumption by 25% based on the change in energy consumption before and after the works[1]. Estimated energy savings are shown in the table below. The water savings are approximately 39,000 litres for the year with savings both for the cost of the water and the chemicals used to treat the water within the system.

Table 4: N78 chilled water upgrade project summary

N78 chilled water upgrades project estimated savings	
Total cost of works	$160,100
Annual power savings	61,000 kWh
Annual $tCO_{2\text{-}e}$ reduction	49 $tCO_{2\text{-}e}$
Project spending per annual $tCO_{2\text{-}e}$ saved	$3,260
Annual electrical bill savings	$8,590.10
Annual electrical bill savings per dollar of project spending	$0.05
Return on investment	19 years

[1] A 25% reduction in energy usage was observed from the period 12/2018-02/2019 to the period 12/2019-02/2020.

Logan Campus Chilled Water Upgrades

Logan campus is provided with chilled water for air conditioning by the L02 chiller plant. This plant was running on legacy controllers which were controlling the plant poorly. From November 2019 to January 2020, the controllers were replaced and variable flow control was implemented. Based on the limited data available for comparison[2], the energy consumption of the plant dropped 16% year-on-year following the completion of the works (refer below graph). Estimated energy savings are summarized in the table below. This project was largely undertaken by the Engineering Services team reducing project costs to materials and equipment only.

Logan campus chilled water plant energy consumption year on year energy consumption (February/March only)

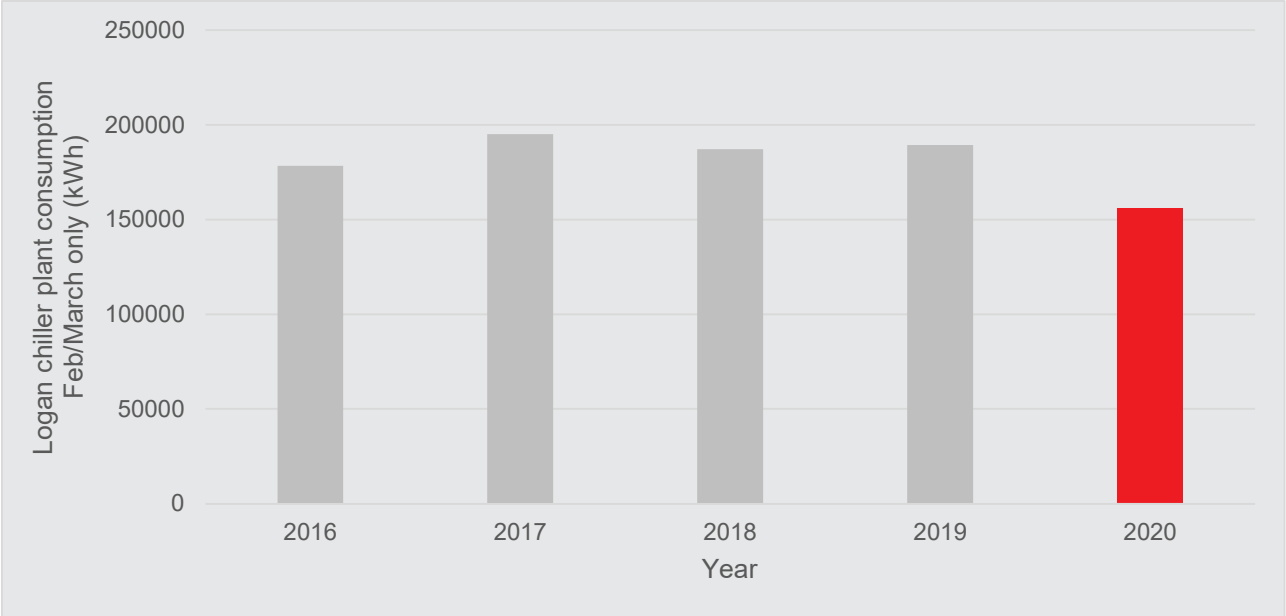


Table 5: Logan chilled water plant project summary

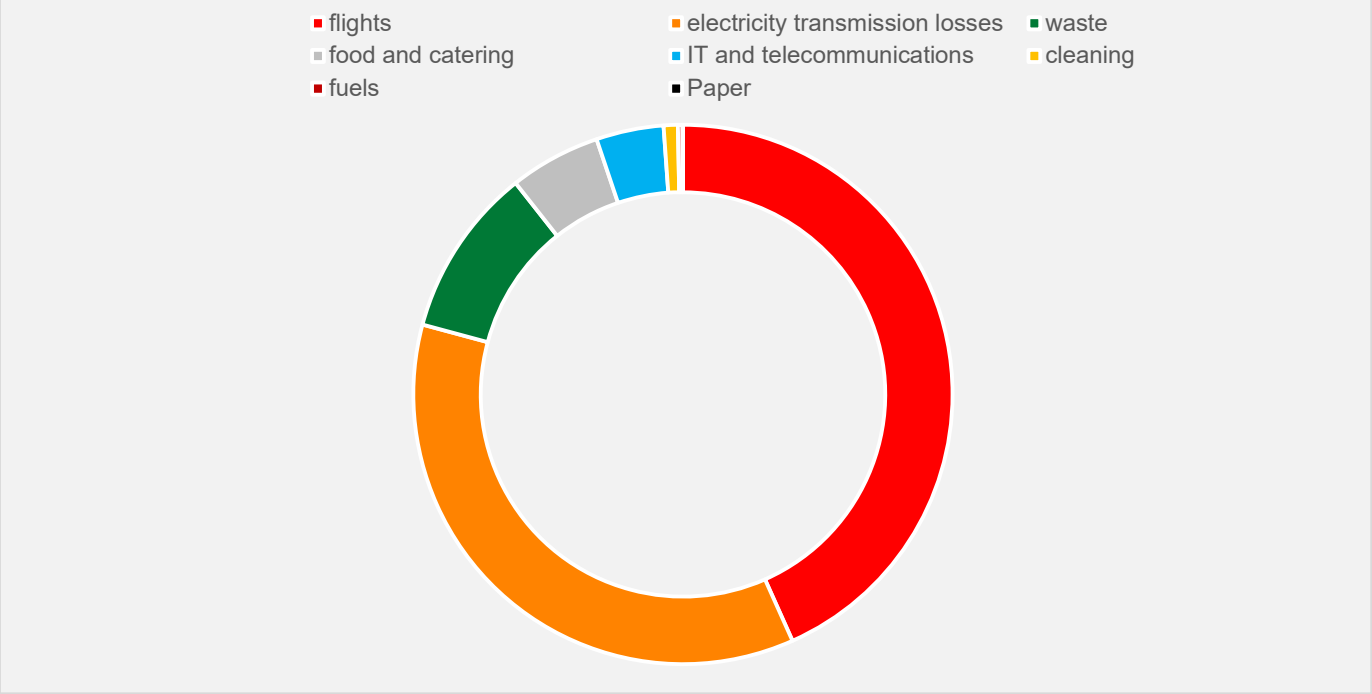
Logan chilled water plant project estimated savings	
Total cost of works excluding staff time	$10,000
Annual power savings	190,000 kWh
Annual $tCO_{2\text{-}e}$ reduction	150 $tCO_{2\text{-}e}$
Project spending per annual $tCO_{2\text{-}e}$ saved	$65
Annual electrical bill savings	$27,000
Annual electrical bill savings per dollar of project spending	$2.70
Return on investment	5 years

[2] As the works were completed in January 2020 and the building energy profile changed in April 2020 due to COVID-19, the only data used in the year on year analysis is for February/March.

Scope 3 emissions

The University has monitored Scope 3 emissions from 2010/11 onwards and reported on progress on managing waste and flight related emissions as they have significant potential for improvement. The breakdown of Scope 3 emissions for 2019/20 is as follows:

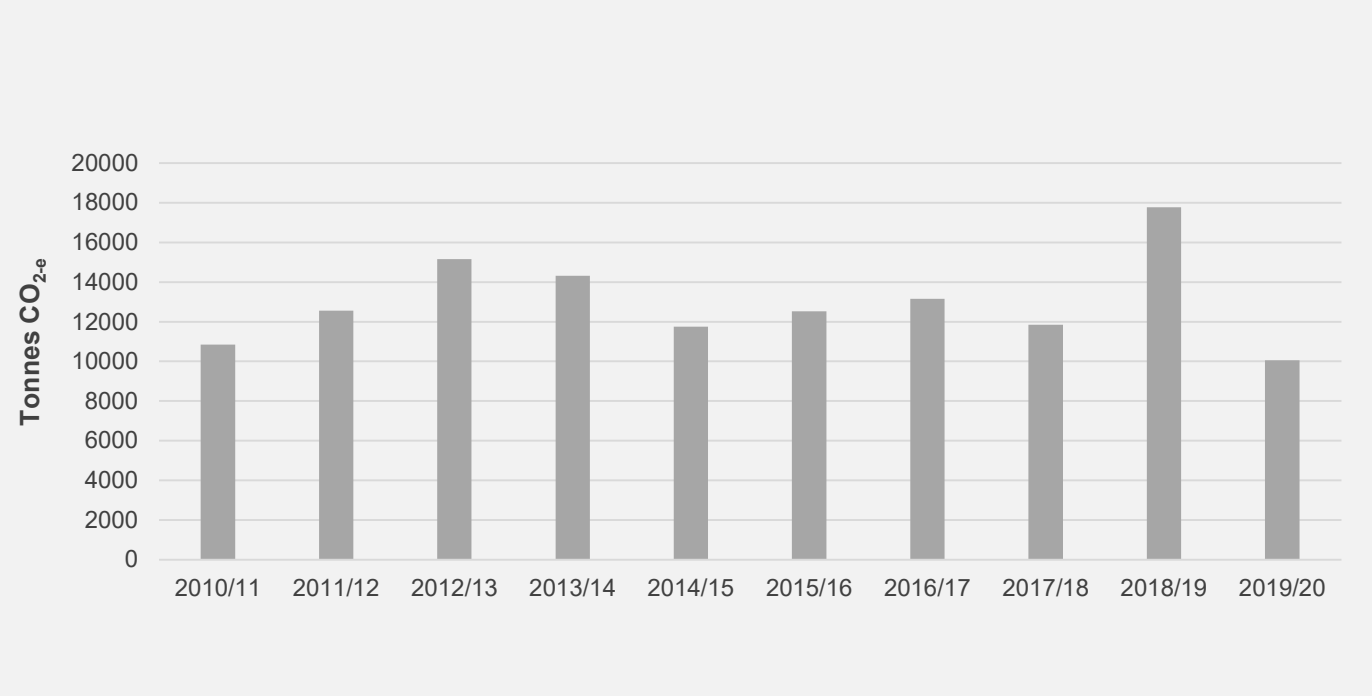
2019/20 Scope 3 emissions



Managing our flights

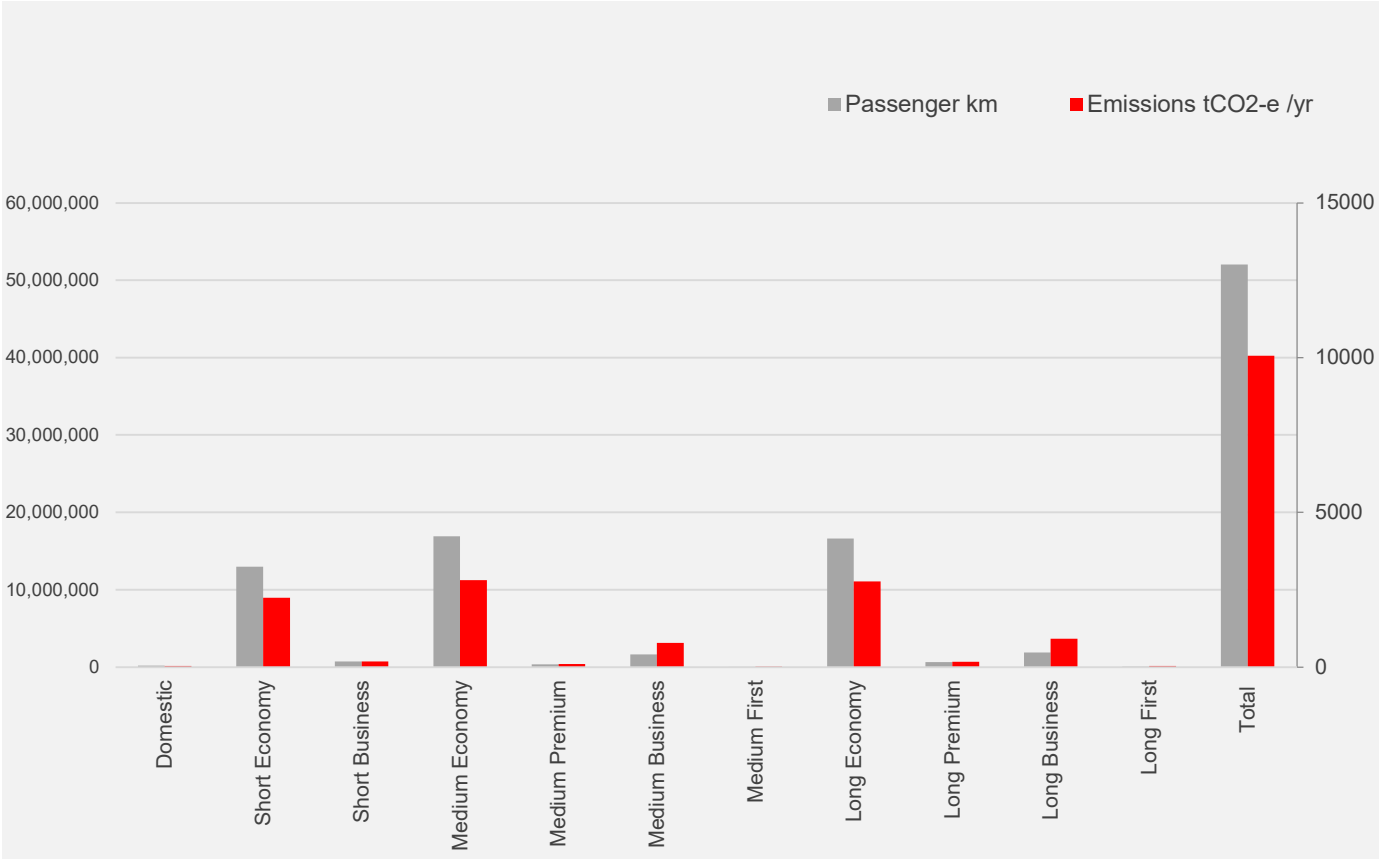
In the 2019/20 reporting year our total passenger kilometres were 52,036,880 equating to 10,060.3 tCO_{2-e}. This represents decrease of 43% on the previous reporting year. This is expected to be due to the travel ban imposed from March as part of the COVID19 pandemic measures. However, there is also an initiative to meet the target of reducing air travel by 25% so there may also be some contribution from the focus on reducing air travel.

Carbon emissions from business travel from baseline year until present



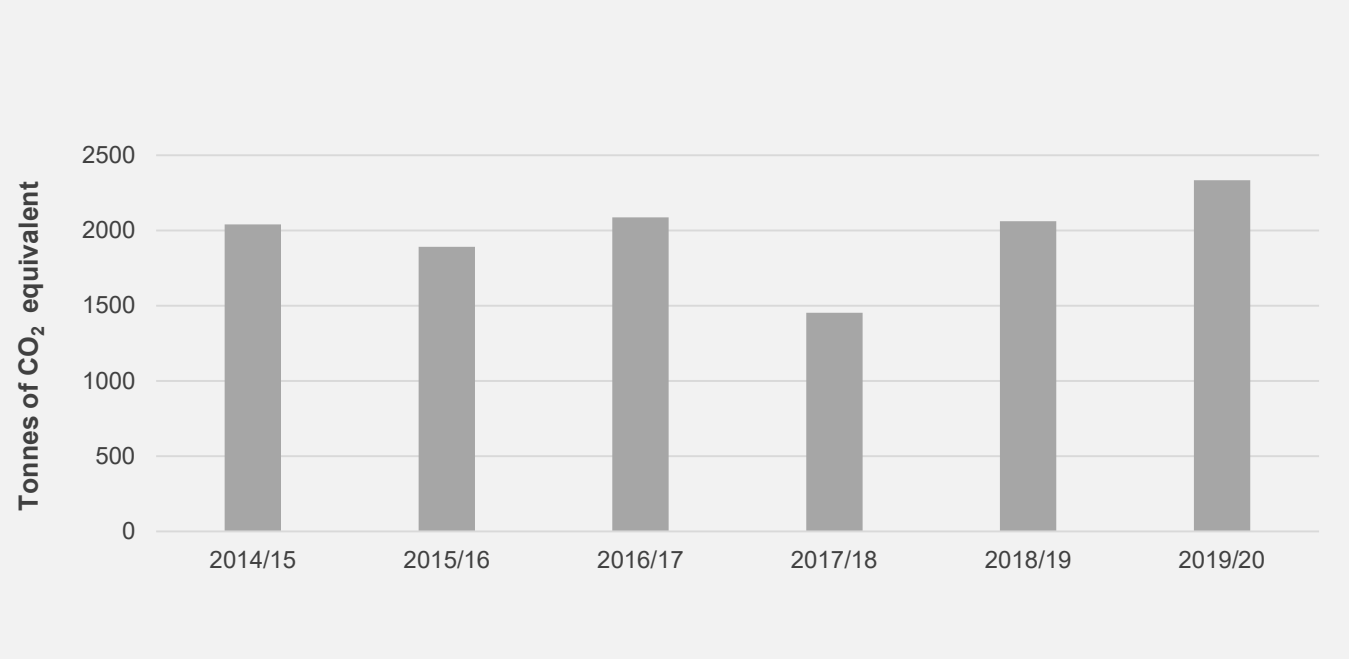
The breakdown of the business air travel data is as follows:

Business air travel



Managing our waste

Annual Carbon emissions from Landfill Waste



There was a large increase in 2019, as the new waste contractor changed the methodology to an average bin weight rather than weighing the waste as per the previous contract. The total waste has continued to increase this year, despite three months of reduced activity and this issue continues to be discussed in detail with the contractor. New initiatives for waste handling are being developed for implementation.

The TEFMA benchmark data is for landfill and recyclable waste combined. As the data on recyclable waste is considered unreliable, a comparison to TEFMA benchmark data is not presented here.

Pathway to 2030 target

The Net Zero Emissions report written in 2019 outlined the University's approach to meeting the recommendations of the Intergovernmental Panel on Climate Change, for inclusion in the Vice Chancellor's Strategic Plan 2020-2025: Creating a future for all. The report outlined three key strategies for reducing our carbon footprint:

- avoiding emissions
- reducing emissions
- generating and purchasing clean energy

The report set out a pathway to the 2030 target, which includes the following key levers

- high efficiency chiller replacements for replacements planned for end of life assets including the Nathan central chiller facility
- Carbon storage and sequestration in forests
- Energy efficiency measures including review of building and server room temperature set points, fitting VSD drives to mechanical equipment where applicable, occupancy sensors etc
- Off site renewables – purchase of 50% renewable power - our new electricity sourcing agreement will commence late 2020. The arrangement includes a 50% renewable portion (together with the associated certificates) from a new solar farm which is planned to start producing in in 2021.
- On site renewables – investment of $13.8 m in roof top solar generation and other onsite renewable measures
- Reduction in air travel of 25%
- Reduction in paper use, waste, behavioural change programme
- Migration to electric car fleet or other low carbon transport options
- Water cooled chiller plant at the Gold Coast Campus.

As the largest contributions to our carbon footprint, the first initiatives focus on reduction in energy consumption and flight related emissions as follows:

Flights

The University community will work together to target a reduction in air travel of 25% by 2030 by looking at initiatives such as investing in digital technology to enable virtual meetings and conferences, to incentivise travel reduction and to review University policy relating to international collaboration.

Electricity

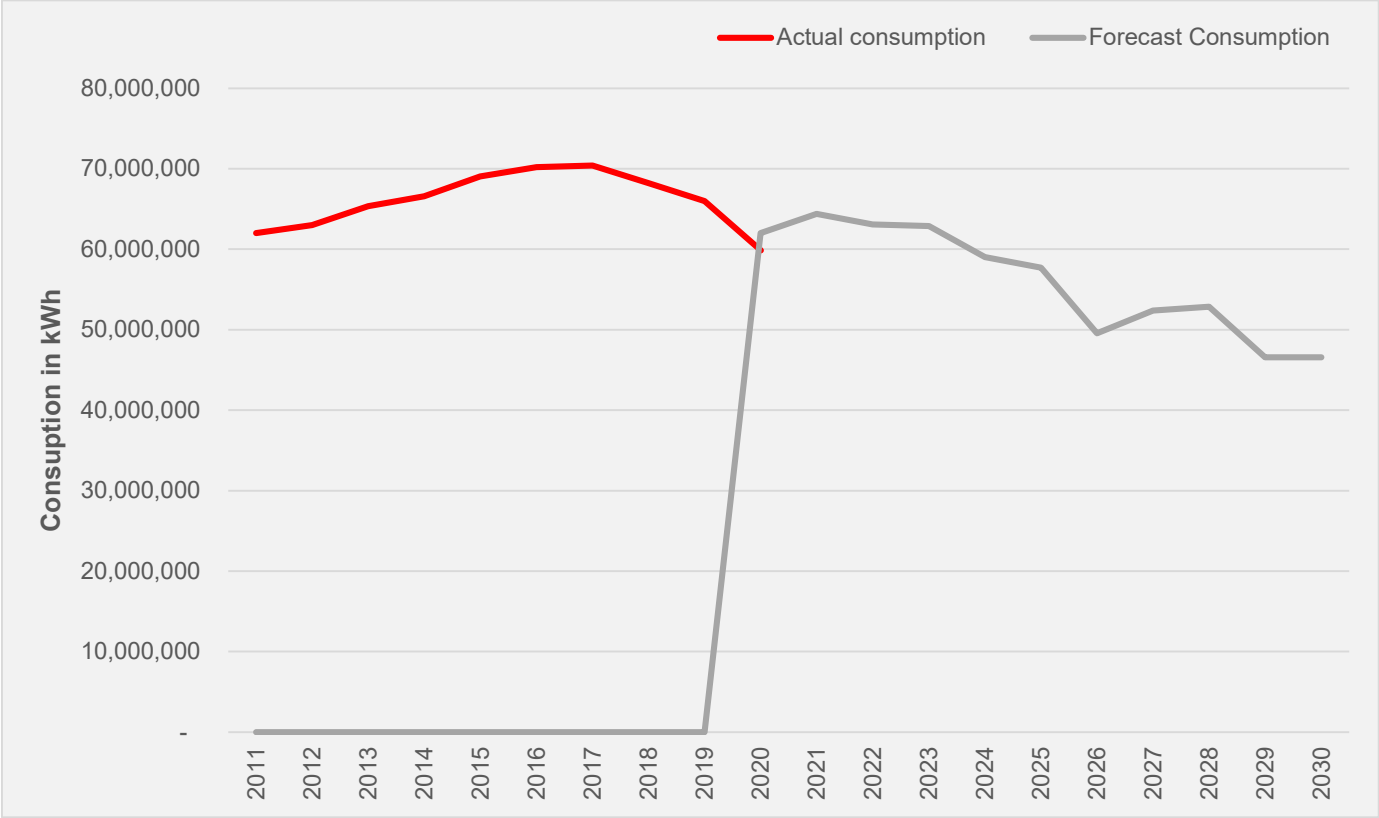
The scope 2 electricity emissions remain the greatest part of our emissions. Energy reduction projects in progress and planned for next year are as follows:

- Design and procurement of replacement chillers for GRIDD 1 (N27), Psychology (M24) – both projects completed in Q3 2020 so savings will be reported on in 2021
- Queensland Conservatorium (S01) chiller replacement – installation is in progress in late 2020 for completion March 2021 with reporting on benefits to follow
- Appointment of the construction contractor for the replacement of the Central Chiller Plant (N45) with a new Chiller Plant West (N80) is expected in mid-November for completion mid-2021
- Installation of additional ventilation louvres at Chiller Plant (G20) was completed in September 2020. This is expected to reduce energy consumption and improve reliability of machines
- Installation of a piping connection between S02 and S07 to allow the S07 chiller to be decommissioned will be completed in December 2020

- On site renewables – the roof top photovoltaic panel installations project will commence in 2021 with the initial focus on scoping for Nathan and Gold Coast.
- Energy efficiency initiatives – the project planned for 2020 will commence in 2021, reviewing temperature set points, installing variable speed drives, occupancy sensors and other energy efficiency projects
- The end of life replacement of the G38 chiller with a piping connection to the existing chiller plant at G22 is planned for 2021 (subject to CMP approval).

Our forecast electricity consumption to 2030 shown in the graph below includes the proposed exit from Mount Gravatt, development of the new Professional Education Building and Sciences Building at Nathan, ADaPT building at the Gold Coast and the new city campus:

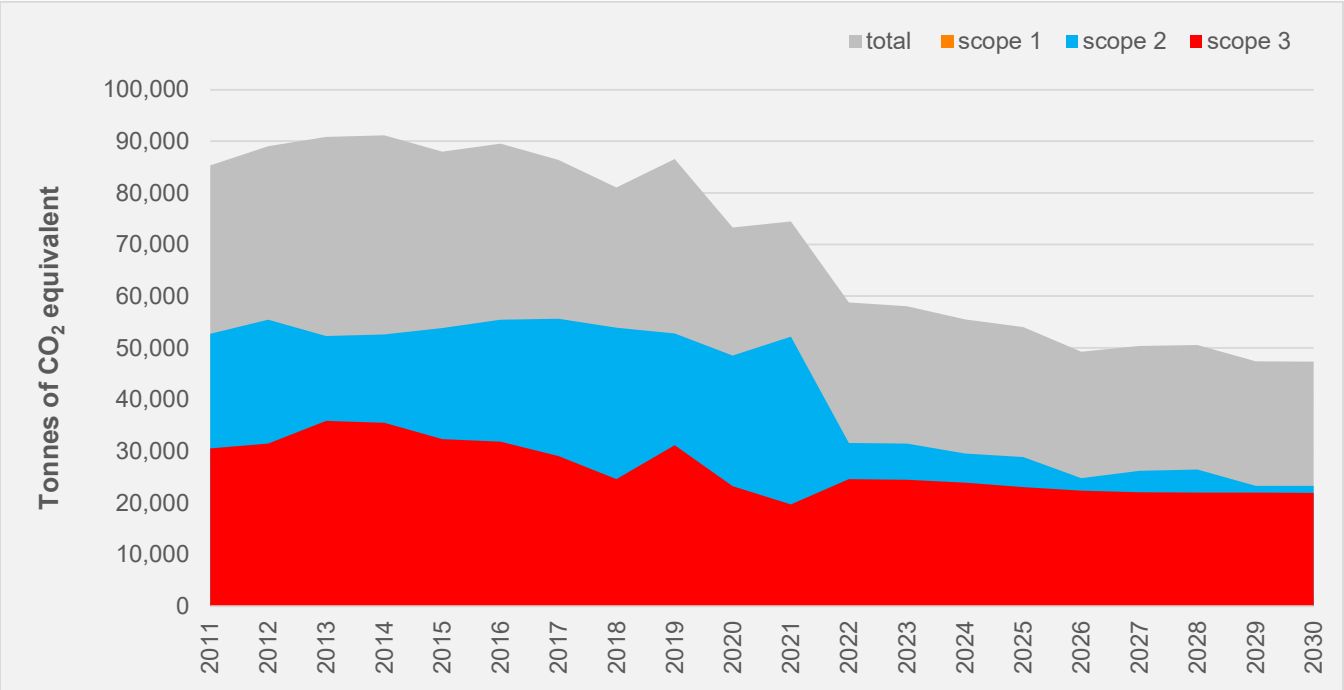
Annual electricity consumption forecast to 2030



The carbon emissions associated with our electricity consumption will include the benefits of the renewable energy from 2021.

Our pathway to halving our emissions by 2030 is:

Annual carbon emissions to 2030



With the outcome of the coronavirus pandemic not yet known, the forecast for 2020/21 is based on

- activity levels on campus similar to 2018/19
- no renewable portion from the electricity sourcing agreement (allowing for delay in the solar farm construction and commissioning)
- fewer flights than the 2019/20 year (8,000 tCO2-e estimated) as there are unlikely to be international flights until late 2021 and there have been few domestic flights in the first half of the year.

Appendix A: Examples of using data to identify opportunities to reduce energy consumption

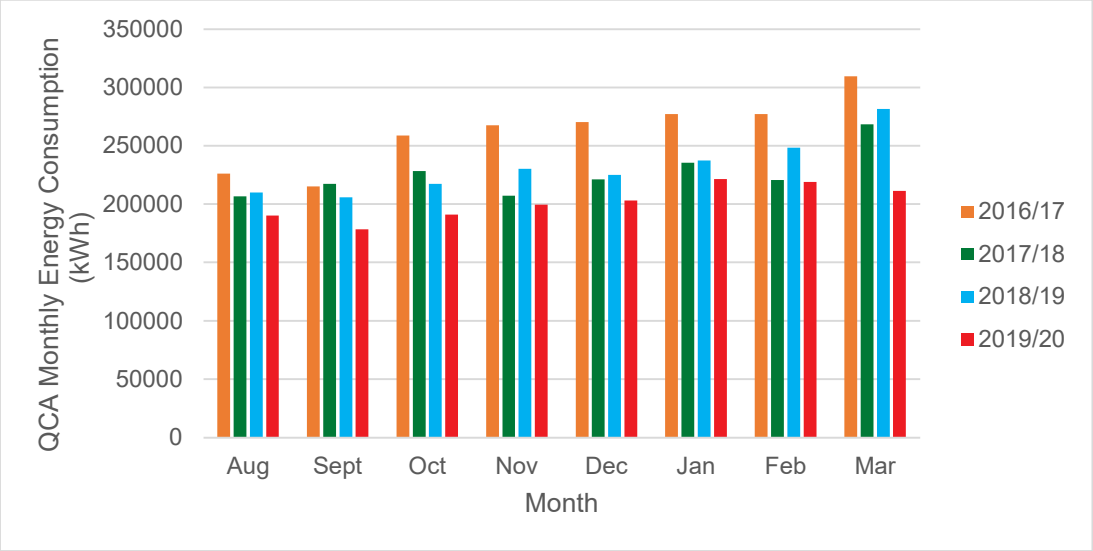
Nathan Chilled Water Monitoring

A central chiller plant (N45) provides chilled water for air conditioning for most of the Nathan campus. Historically it has been difficult to determine which buildings are using the chilled water provided by N45. With the installation of 12 chilled water meters at the campus by the Chilled Water Metring project, it is now possible determine for which buildings are consuming the chilled water provided by N45. In addition to allowing a better understanding of where air conditioning energy is consumed, this data has allowed for identification and resolution of several issues where buildings or systems have been using excessive chilled water.

Queensland College of Art Control Issues

At the Queensland College of Art (QCA), several control issues were identified which, when fixed in May to July 2019, resulted in an estimated saving of 217 $tCO_{2\text{-}e}$ and $38,000 in power costs annually. The graph below shows the year on year energy consumption for comparison of energy consumption before and after the issues were resolved.

QCA monthly energy consumption year over year following resolution of issues



Logan Campus Heating Control Issues

At Logan campus several air conditioning systems were identified which were both heating and cooling at the same time unnecessarily due to control issues. The issue was fixed at minimal cost to the University resulting in an estimated saving of 74 $tCO_{2\text{-}e}$ and $13,000 in power costs annually. The graph below shows a profile of heater energy consumption for a typical August day before and after the changes were made.

Logan heater consumption on similar temperature days before and after control changes