UNIVERSITY OF TASMANIA

GREENHOUSE GAS INVENTORY

2021

Infrastructure Services and Development
http://www.utas.edu.au/infrastructure-services-development
University of Tasmania
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CRICOS provider number 00586B

CONTENTS

1 INTRODUCTION

The University of Tasmania is committed to undertaking measures to reduce greenhouse gas emissions including behavioural changes in resource use, infrastructure improvements and the installation of renewable energy infrastructure and to identify carbon offset opportunities for emissions that cannot be reduced or eliminated.

The University also recognises the responsibility that it holds within the Tasmanian and global communities to lead in response to the realities of climate change as evidenced through our own global research efforts as well as reducing greenhouse gas emissions in line with local and State Government goals and community expectations. In line with this, the University:

- Signed the University Commitment to the Sustainable Development Goals – The SDG Accord in 2019, with the SDGs embedded into our highest level strategy documents.
- Signed the Universities Letter declaring a climate emergency in 2021 as part of the Race To Zero global campaign. Race To Zero mobilises a coalition of leading net zero initiatives, representing 708 cities, 24 regions, 2,360 businesses, 163 of the biggest investors, and 624 Higher Education Institutions. The University committed to:
    - Pledge: Having a 2050 or sooner net zero target.
    - Plan*:* explain what steps will be taken toward achieving net zero.
    - Proceed: taking action towards net zero.
    - Publish: commit to report progress annually.
- Recognises that this is a critical time for action on climate, with the University ramping up our commitment to sustainability and carbon emissions reduction. Key initiatives include:
    - Investment in being certified carbon neutral on scopes 1, 2 and 3 emissions to Commonwealth standards since 2016 (one of only two Australian universities).
    - Investment in embodied carbon reduction in our new buildings, such as the targeted 25% reduction in structural embodied carbon in our newest Inveresk Precinct buildings actually achieving a 32% reduction through working with designers, builders and local materials suppliers.
    - Full divestment by the end of 2021 from fossil fuels and a positive screening for investments that help build the future we want to see.

This document follows the initial University of Tasmania Greenhouse Gas (GHG) Inventory developed in 2015, which was defined as the baseline year, and subsequent GHG Inventories. The University GHG Inventory provides the technical underpinnings of the University GHG emissions measurement and emission reduction measures. In 2021 the total organisational emissions were calculated as 27,246 t CO_2-e. A summary of the University carbon emissions for 2021, as well as the percentage change in emissions compared to the previous GHG Inventory, is provided in Appendices A and B.

The University is legally required to report greenhouse gas emissions under the National Greenhouse and Energy Reporting (NGER) scheme. This scheme covers scope 1 emissions (direct release of greenhouse gases from sources that are owned or controlled by the University; e.g., the University vehicle fleet, natural gas use to heat buildings) and scope 2 emissions (emissions released to the atmosphere from the indirect consumption of an energy commodity; e.g., indirect emissions from the generation of purchased electricity). The University reported 12,265 t CO_2-e under NGER in the 2020/2021 reporting year. Reporting of scope 3 emissions (indirect emissions from sources not owned or controlled by the University; e.g., business travel) is not compulsory under NGER; however, the University will continue building its capability to internally report on selected (material) emissions. The development of this greenhouse gas inventory is a step towards regular and consistent reporting to support emissions reduction efforts.

2 MAJOR UPDATES

This section aims to highlight any major changes to the inventory boundaries, data management and quantification methods from the previous University GHG inventory. This section also demonstrates changes such as the use of different emission factors and new ways of collecting data.

2.1 Organisational boundary changes

The following changes to the University's organisational boundary occurred during the reporting year.

Table 1. Changes to the University's organisational boundary in the reporting year

Facility Name	Services	Meters	Dates Reported
The Podium Apartments, 40-42 Melville St	Electricity	8000316354	01/03/21-31/12/21
Atrium Apartments, Cradle Coast Campus	Electricity	8000318838	18/06/21-31/12/21
West Park site	Electricity	8000317744	01/01/21-31/12/21
Midcity Hotel	Electricity	8000001648	01/01/21-30/11/21
The Gasworks, 4 Willis St, Launceston (scope 3 facility)	Electricity	8590213494	01/04/21-31/12/21
125 Elizabeth St (scope 3 facility)	Electricity	Unknown	01/01/21-31/01/21
ABC Centre, Liverpool St, Hobart (scope 3 facility)	Electricity	Unknown	01/01/21-30/06/21
Clarence Integrated Care Centre, Rosny (scope 3 facility)	Electricity	Unknown	01/01/21-15/08/21
2 Menai St Burnie (scope 3 facility)	Electricity	Unknown	04/06/21-09/09/21
KPMG/My State Bldg, 137 Harrington St, Hobart (scope 3 facility)	Electricity	Unknown	01/01/21-31/12/21
Vodafone Bldg, 44 Bathurst St, Hobart (scope 3 facility)	Electricity	Unknown	01/02/21-31/12/21

2.1.1 Operational control review

A review of the facilities under operational control and scope 3 facilities was conducted for this GHG Inventory, resulting in the following changes from previous assessments.

Table 2. Changes to the University's facilities operational control assessment in the reporting year

Facility Name	Previous year status	Reporting year status
40-42 Melville St	Scope 3 facility (construction)	Operational control (completed)
Darlinghurst, NSW	Scope 3 facility	Out of boundary

2.2 Calculation methodology changes

2.2.1 Transport fuels

Private vehicles used to conduct University business have been included as data for distance travelled is now available through the MyHR system.

Fuel used by the UniHopper shuttle between Sandy Bay and Hobart campuses has also been included. The shuttle started operation in semester 2, 2021.

2.2.2 Electricity

The 'latest estimate' emission factors are used instead of the emission factor provided in the 'Indirect emissions from electricity (Scope 2 emission factors)' section of the National Greenhouse Accounts Factors publication, following Climate Active guidelines.

In addition, emissions from scope 3 facilities calculated with the scope 2 emission factor are now reported as scope 2 emissions to follow current Climate Active methodology. In 2021, these emissions represented 4% of the total scope 2 electricity emissions, and 1% of the total inventory, therefore a decision was made not to recalculate previous inventories.

2.2.3 Waste to landfill and recycling

Waste to landfill and recycling from University residences that have been outsourced to a third party is estimated from their waste services provider report, assuming they are 40% full, which is a conservative approach as a 2021 waste audit conducted in several of these residences across various campuses showed an average 33% fullness.

This is a more accurate methodology than previous year, where waste and recycling from these residences was estimated based on historical data for waste to landfill and recycling per resident, and current resident numbers

2.2.4 Staff commuting

More accurate information on car size and power source was obtained in the latest Travel Behaviour Survey, and therefore this information and related emission factor used to estimate GHG emissions, rather than using the medium/unknown fuel emission factor as in previous inventories

As data was obtained during the pandemic and reflects actual commuting habits, estimated avoided emissions from working from home were not subtracted as in the previous GHG Inventory.

Also note that emission factors provided by Climate Active now include ‘well-to-tank’ emissions from fuel use in motorised vehicles.

2.2.5 ICT hardware

The Climate Active provided emission factor for ‘Computer and electrical components, hardware and accessories’ was used instead of the emission factor for ‘Computer equipment’ as the latter is no longer available.

3 GHG INVENTORY DETAILS

The University of Tasmania GHG Inventory provides details of the boundary, data management and the methodology used to calculate the University's carbon footprint. The University's Infrastructure Services and Development (ISD) area collects, records and maintains the source data; ISD also prepares and calculates the GHG Inventory. Ultimate responsibility for these tasks within ISD is with the Chief Sustainability Officer.

3.1 Standards used

Data is collected, and emissions calculated according to the National Greenhouse and Energy Reporting (Measurement) Determination 2008, ("the Measurement Determination") the National Greenhouse Accounts (NGA) Factors workbooks (Department of Industry, Science, Energy and Resources 2021a) and the Australian Standard 14064.1:2006.

The GHG Inventory was completed in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (WRI/WBCSD, 2004), ISO 14064.1: 2006 and the Climate Active Carbon Neutral Standard for Organisations (Department of Industry, Science, Energy and Resources 2020).

3.2 Base year

The first University GHG Inventory was calculated for the 2015 calendar year, which is used as the base year for comparison with the current carbon footprint. Note that the base year inventory was externally audited and a technical assessment of the annual report is conducted at least every three years.

3.3 Annual reporting process

The reporting process, carbon offset purchases and audit requirements for GHG Inventories are set out in Figure 1. Participants in the program can choose to offset their emissions in advance or in arrears. The University of Tasmania will purchase offsets in arrears.

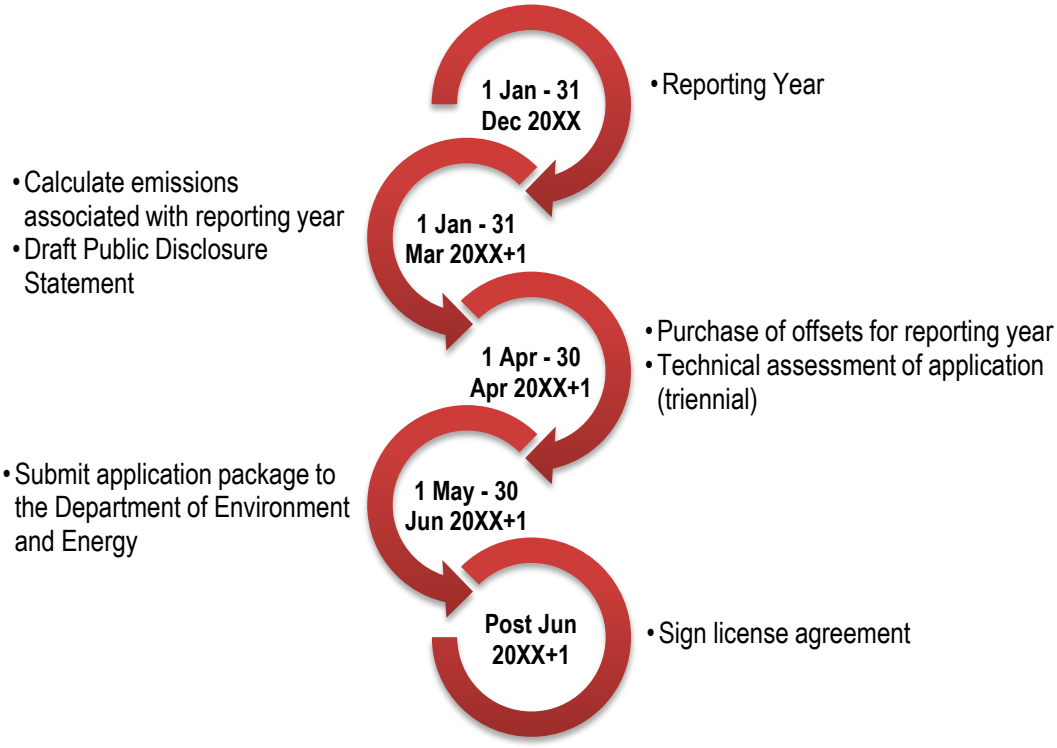

Figure 1: Annual Reporting Process under Climate Active Carbon Neutral Standard – offsetting in arrears of incurring emissions

3.4 Inventory boundaries

3.4.1 Organisational boundary

3.4.1.1 Operational control

The University GHG Inventory includes the emissions associated with teaching and learning, research and operational activities located at all Australian properties occupied by University staff and students for which the University has operational control. Operational control of facilities at all sites was determined according to Section 11; NGER Act 2007 and was based on whether the University had the authority to introduce and implement operational, health and safety, and environmental policies for the activities undertaken on a site occupied by the University, irrespective of whether it is owned or leased, including those that are located outside physical campus boundaries.

The operational control assessment made for the GHG Inventory is consistent in all cases with the evaluation of the facilities reported under the NGER Act annually by the University. The determination of operational control assessment is documented in the "NGER Decisions and Assessments Register" file. This register is reviewed and updated biannually prior to NGER reporting and Climate Active Carbon Neutral submission. An overall summary of the Australian sites included in the University's organisational boundary is provided in Appendix C.

Joint and co-operative ventures

Identified joint and co-operative ventures located in the University facilities are included in the organisational boundary.

Contractors

Contractors such as cleaners and security are within the organisational boundary, as the University has the greater authority regarding operational, health and safety, and environmental policies on its sites. This excludes green field building sites where only building contractor staff can enter.

Student residences

Where student accommodation is operated by the University, this has been included as part of the University's organisational boundary.

From December 2017, a number of student accommodation residences operated by the University on and off campus were outsourced to a third party. However, the University still pays utility costs, is responsible for residents and retains control of infrastructure improvements that could affect energy use. Additionally, the third party will be subjected to the University's policies and procedures. Therefore, for the purposes of this document, these facilities are considered to be under the University's operational control.

3.4.1.2 Scope 3 facilities

For those facilities not under the University's operational control, a subsequent assessment as to whether the facility was relevant as a scope 3 facility was made. The assessment criteria applied is whether the facility would operate in the absence of the University as an organisation.

Where the facility would independently operate, it was determined not to be a scope 3 facility for the University. Where a facility was determined to be a scope 3 facility for the University, all emissions associated with the facility (as available and further documented below) were included in the inventory.

Work experience placements

During their studies, University students may be required to undertake a work experience placement outside campus (e.g., Rural Health rotation placements). The emissions associated with the work conducted by the students during these placements are considered to be scope 3 emissions of the University.

Staff accommodation

The University provides accommodation to select staff as part of the terms of their contract. The University receives and pays some of the invoices associated with these facilities. Despite the University having no operational control over these properties, they have been included as University scope 3 facilities.

3.4.1.3 Out of boundary

International campuses

The University offers services in Hong Kong Universal Education (HKUE), Zhejiang University of Technology (ZUT) and Shanghai Ocean University (SOU). The operations of the University in these countries are not included in this inventory as these campuses have been determined outside of the operational control of the University, whereby the University has no authority to introduce operational, health and safety, and environmental policies as guests of these universities.

On campus organisations and businesses

There are several sites at various campuses that were determined not to be under the operational control of the University. Some of these sites receive invoices directly or are on-charged for their electricity use (if separately metered).

- CSIRO (Sandy Bay Campus)
- TasTAFE (Inveresk Campus)
- AFRDI (Newnham Campus)
- Telstra Antenna (Newnham Campus)
- SpaceX facility (Bisdee Tier)
- Airservices Microwave Tower (Cambridge Farm).
- Tasmanian University Student Association (TUSA) leased facilities (Sandy Bay and Newnham campuses)
- Sports facilities: Cricket and Rugby Pavilions (Sandy Bay Campus); Mowbray Sports Club (Newnham Campus)
- Childcare facilities: Lady Gowrie Child Care Centre and After School Care (Sandy Bay and Newnham campuses)
- All catering facilities except Saltz (Newnham Campus) and Pepperz (Sandy Bay Campus), which service student residents
- Other businesses and organisations in University facilities (all campuses)

These decisions on operational control are consistent with those made under NGER Scheme. The facilities listed above have also been determined not to be scope 3 facilities.

Off campus student accommodation

Where off campus accommodation is leased by the University and made available to students (e.g., Rural Health accommodation sites for work experience placements), this is not part of the defined organisational boundary for the University. In these properties the University acts as a standard tenant and thus does not have operational control of these facilities. These facilities have also been determined not to be scope 3 facilities.

3.4.2 Operational boundary

The emissions of all greenhouse gases included in the Kyoto Protocol (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride) are included in this inventory.

3.4.2.1 Included emissions

Emission sources are grouped in this inventory according to the definitions sourced from the NGA Factors workbooks (Department of Industry, Science, Energy and Resources 2021a). Figure 2 visually depicts what emission sources are included in the three scopes.

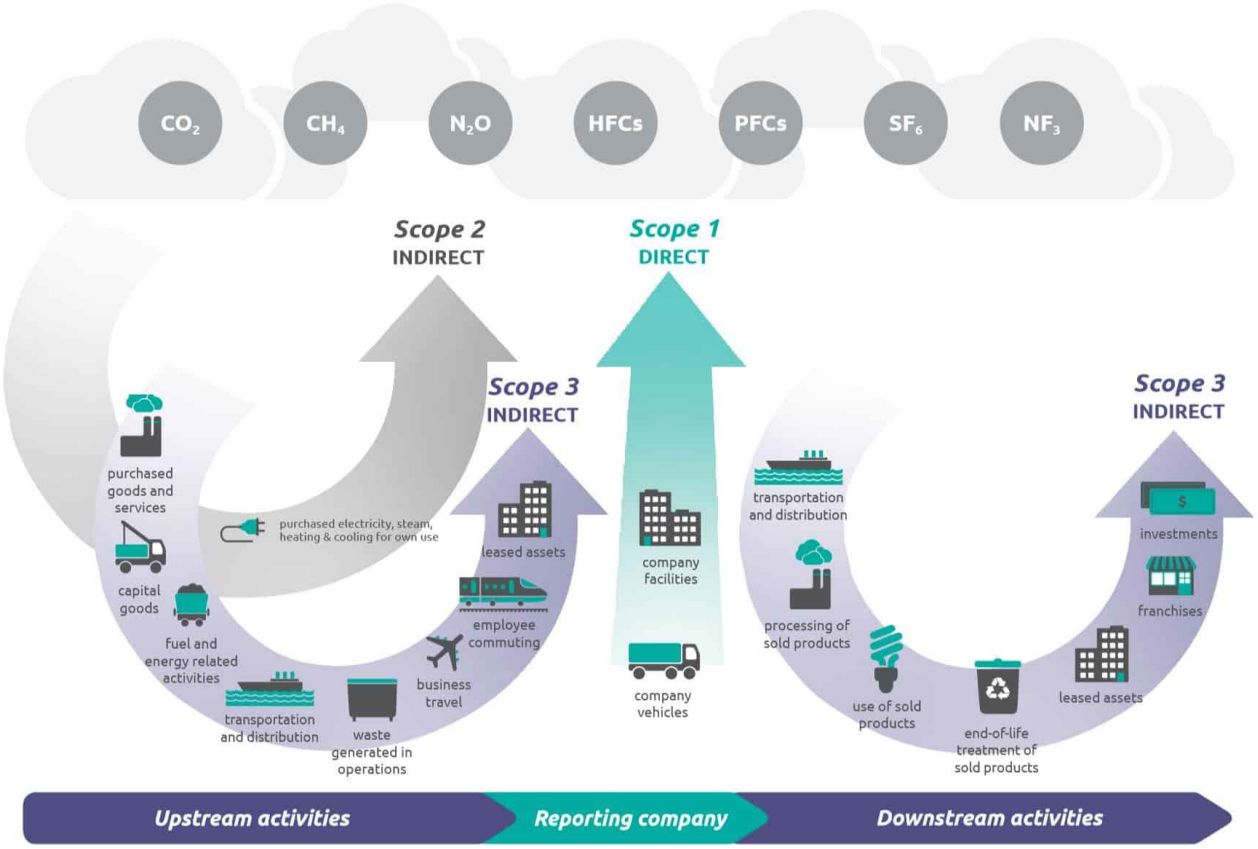

Figure 2. Emission sources classified by scopes. Source: http://www.ghgprotocol.org/

Scope 1 emissions

Scope 1 emissions are direct emissions produced from sources within the boundary of an organisation and as a result of that organisation's activities. The University's scope 1 emissions, consistent with the NGER (Measurement) Determination 2008 arise from the use of natural gas, transport and non-transport liquid fuels and petroleum-based products, refrigerant gases and livestock.

Scope 2 emissions

Scope 2 emissions are indirect emissions associated with a purchased energy product. For the University of Tasmania, the sole energy product purchased which have associated scope 2 emissions is electricity. There are no purchases of heat or steam products within the organisational boundary.

Scope 3 emissions

Scope 3 emissions are other indirect emissions generated in the wider economy as a consequence of an organisation's activities, but which are physically produced by the activities of another organisation. Examples of scope 3 emissions include (but are not limited to) embodied emissions from extraction, production, and transportation of fuel and purchased goods, line loss from electricity transmission and distribution, business travel, waste disposal and outsourced activities (e.g. 'cloud' data storage).

Scope 3 emissions are included in this inventory as recommended by the Climate Active Technical Guidance Manual (Department of Industry, Science, Energy and Resources 2021b) and the GHG Protocol (WRI/WBCSD 2004). Relevant scope 3 emission sources are included where data of sufficient accuracy is available with relative ease of collection.

The following emission sources are included in this inventory (Figure 3).

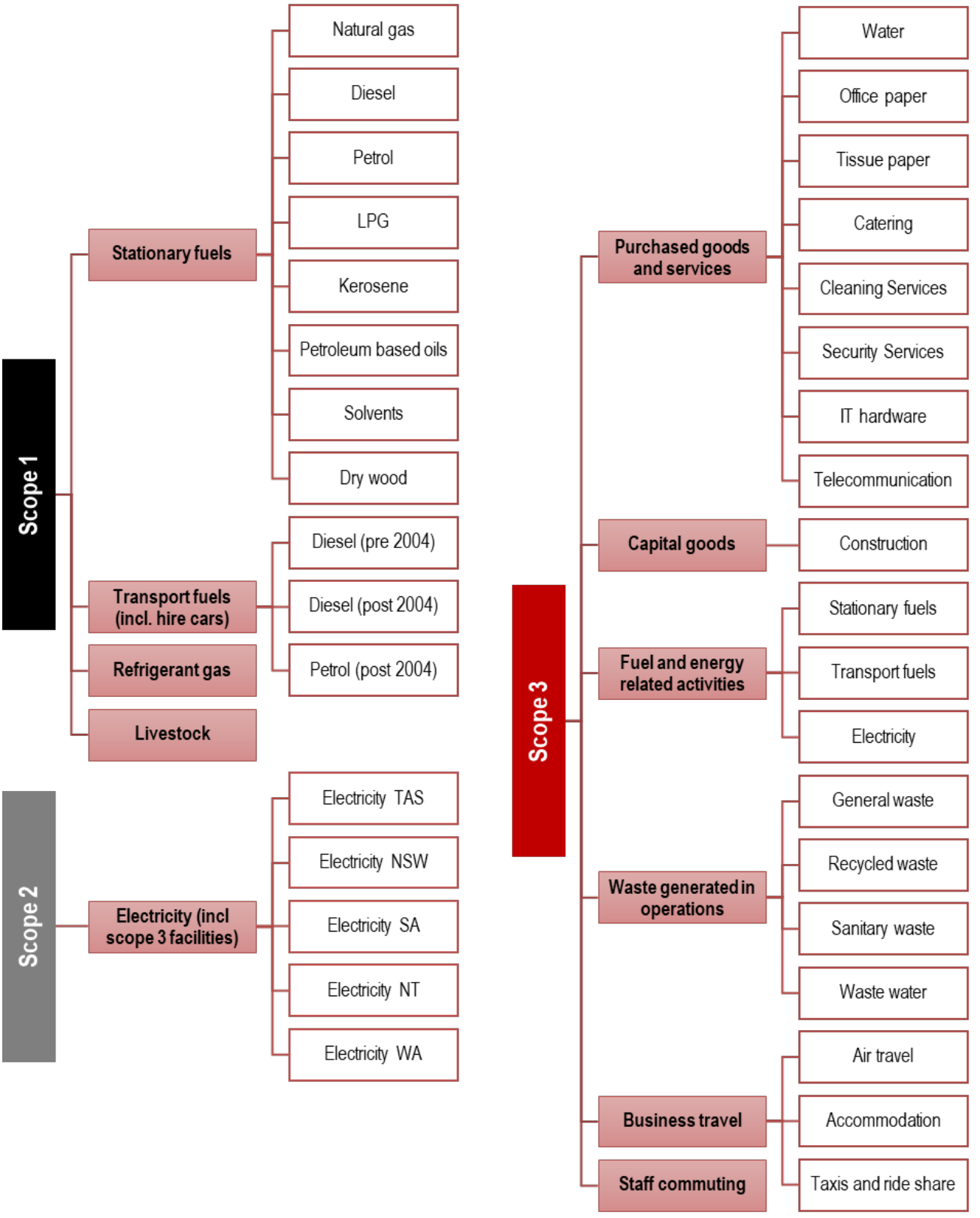

Figure 3. Emission sources reported in this GHG Inventory

3.4.2.2 Non-quantified emissions

Contractors' operations

All contracts were considered, and cleaning and security services included in the inventory. Other contracts were not included as these emissions are immaterial against the full scope of the inventory or are not relevant following the relevance test.

Work experience placements

Emissions from students undertaking a work experience placement outside campus are not estimated given the difficulty in getting data on the myriad of work placements conducted by students and the clear immateriality of these emissions in the context of the reported emissions for the University.

3.4.2.3 Excluded emissions

Postage, courier and freight

Emissions from this source were excluded as it has been deemed not relevant according to the relevance test. These emissions are likely to be low and do not contribute to the University's greenhouse gas risk exposure as the University provides a service. Hence, stakeholders deemed this source not relevant.

Investments

Emissions from invested funds have been excluded as investments also have been deemed not relevant. This is because all funds were divested in 2021 and therefore key stakeholders did not think this source was relevant, the emissions are not likely to be large, and they do not contribute to our greenhouse gas risk exposure.

3.5 Roles and Responsibilities

Management

The Infrastructure Services and Development (ISD) Section, and more specifically the Chief Sustainability Officer, are responsible for managing the University's annual GHG Inventory. ISD sits within the Division of the Chief Operating Officer.

Data provision

The following University departments and external organisations gather and provide data for the development of the GHG Inventory:

- Financial Services: invoices and credit card transactions
- People and Wellbeing: private car travel data
- Tasmanian Institute of Agriculture: livestock data
- Sustainability Team: staff commuting data
- Business Intelligence Unit: staff and student numbers
- ISD: staff on campus numbers
- COS, Airmaster, JJ Richards, Cleanaway, Corporate Travel Management, Central Cleaning, Challenger and Collings: detailed data of office paper, refrigerant gases, waste and recycling, business air travel and accommodation and washroom paper.

Data collation and analysis

The Sustainability Team collects data from all relevant sources and calculates emissions to develop the annual GHG Inventory in line with the GHG Protocol and the Climate Active Carbon Neutral Standard (Department of Industry, Science, Energy and Resources 2020).

Data storage

Financial Services is responsible for retaining the invoice and credit card transactions data utilised in calculating the annual emissions profile for the University. Finance Services uses TechnologyOne; the record keeping abilities of this software comply with all regulations for financial data (5 years retention).

The University's Built Environment, Energy and Emissions Register System (BEEERS) is currently being used to keep record of natural gas, transport and stationary fuels, electricity, air travel, waste and water activity data.

The Sustainability Team is responsible to gather provider reports and other documents used in the emissions calculation of some sources (e.g., office paper, washroom paper) and to store them in a University network drive utilising relevant security best practices and records management system controlling access.

From 2018, provider reports and other documents used in the emissions calculation of some sources (e.g., air travel, office paper) are stored in Micro Focus Content Manager (previously Hewlett Packard Enterprise Records Manager), an electronic document and records management system used by the University of Tasmania to capture, manage and provide access to records and information.

Overview and approval

The University GHG Inventory is presented annually to the Sustainability Committee and the University Executive Team for overview and approval. The Sustainability Committee is currently chaired by Corey Peterson, Sustainability Mission Integrator and Chief Sustainability Officer. Current membership includes representatives from functional areas of the University, academic areas, students and the Education for Sustainability Community of Practice.

After approval, the Inventory is made available on the University Sustainability website (http://www.utas.edu.au/infrastructure-services-development/sustainability), which is open to the University community and to the public.

3.6 Reported emissions

A summary of emission sources included in this University GHG Inventory is provided in Appendix A. To be as comprehensive as possible, all sources are included for which data is reasonably available and that can be accurately estimated at the time (Figure 3).

In 2021 the total organisational emissions were calculated as 27,246 t CO_2-e. The majority of emissions (55%) correspond to scope 3 emissions (Figure 4). Electricity is the main greenhouse gas emissions source when looking at each source individually, followed by waste and natural gas (Figure 5).

Note that there might be a slight variation between this total and the sum of amounts reported in all emission sources in this document due to the rounding associated with reported emissions. Emissions reported with a decimal of 0.5 and above were rounded up.

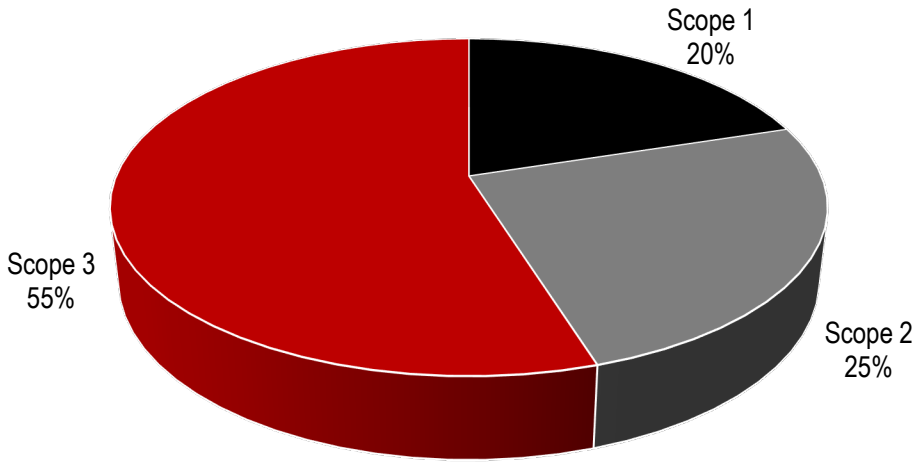

Figure 4. University emissions reported in 2021 by scope.

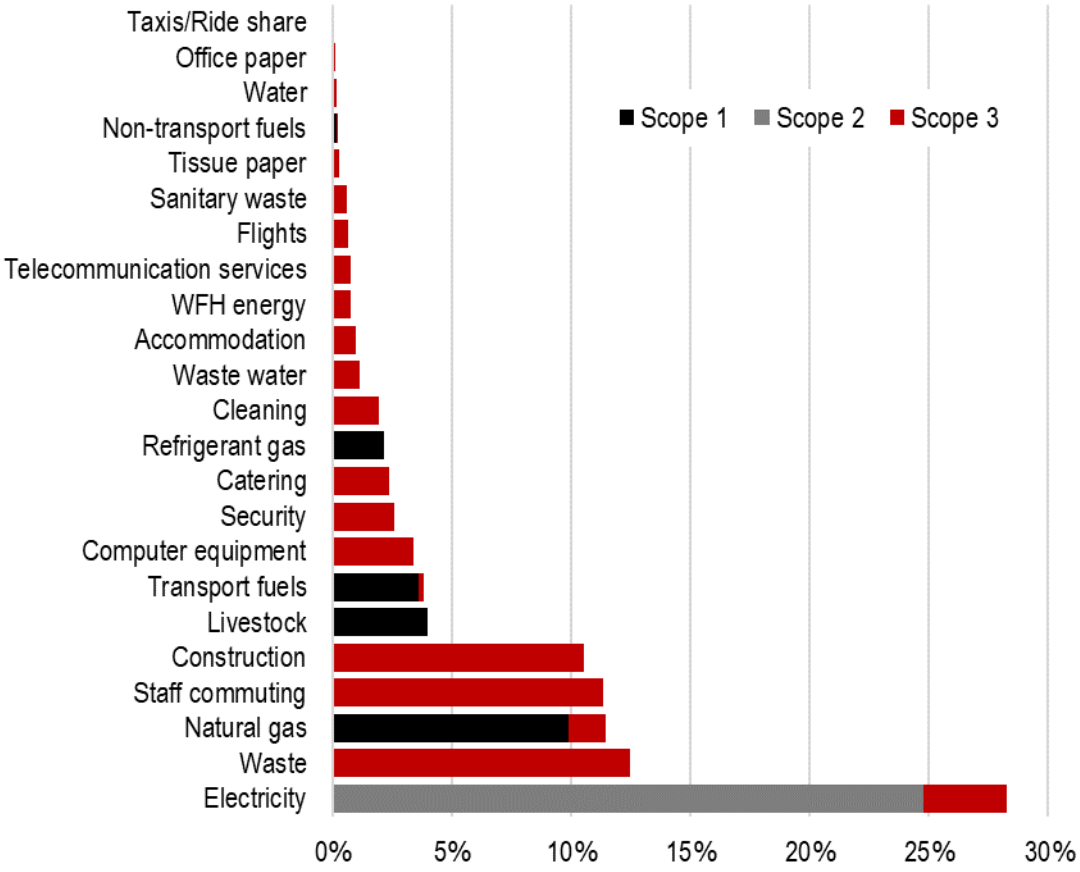

Figure 5. University emissions reported in 2021 by source.

3.6.1 Emission reductions

Examples of emissions reduction initiatives undertaken at the University of Tasmania in 2021 include:

- Energy related initiatives:
  - On-going solar photovoltaic generation. The University of Tasmania reduced their 2021 carbon footprint by generating 156,005 kWh of electricity by on-site renewable energy production, avoiding 25 t CO_2-e of GHG emissions. Note that from 2011 to 2021, total generation was 994,608 kWh, avoiding 158 t CO_2-e.
  - Ongoing energy efficiency initiatives to address issues with old building stock and technologies such as changing older fluorescent and halogen lamps to LED lamps, glazing and insulation works (not quantified).
- Procurement/waste related initiatives:
  - The Re-use program is an online system for the cataloguing and claiming of re-usable furniture and other items. In 2021, the Re-use program avoided the emission of 128 t CO_2-e, as reported by the software provider.
  - Reduction of emissions from waste to landfill because of the rollout of organic waste bins and bin rationalisation program (not quantified).
  - Ongoing reduction of office paper use from the implementation of an online Shared Services forms and approvals solution and deployment of a new On-site Managed Print Service (OMPS). All printers are switched to sleep mode between 6pm and 7am (not quantified).
- Construction related initiatives:
  - Reduction of emissions from the reuse of construction materials and use of low embodied carbon materials in new buildings, resulting in a reduction of 228 t CO_2-e.

- Other initiatives
    - Reduction of emissions from business travel due to implementation of the University's Sustainable Transport Strategy 2017-2021 (not quantified).
    - Water efficiency initiatives at various campuses such as dual flush toilets and water efficient taps (not quantified).
    - Staff engagement strategies that include energy use and waste reduction and sustainable transport choices (e.g., Green Impact program).

4 CALCULATION METHODOLOGY

This section provides the data sources, assumptions and emissions calculations procedures for each source of emissions identified as within the organisational boundary for the University based on the assessments made in Section 3.4.2.2 Emission sources.

4.1 Scope 1

4.1.1 Natural gas

Natural gas at the University is used for heating, domestic hot water for buildings, high temperature hot water ring mains, cooking, and heating pool water.

Activity data

Activity data is collected from direct invoices received from the University's natural gas provider for the reporting year.

The consumption associated with facilities that are not under the University's operational control for natural gas consumed was deducted from the total reported consumption where available. Where this was not available it has been included in the reported total emissions, which is an overestimate of both the University's scope 1 and 3 emissions. The natural gas on-charged was 863 GJ, an inconsequential amount compared to the total reported natural gas within the organisational boundary.

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

The GHG emissions resulting from natural gas are calculated using the total natural gas used, and the specific emission factor for the reporting period.

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content factor	Emission factor (kg CO_2-e/GJ)
1	01/01/21-31/12/21	Natural gas	Invoices	Climate Active inventory	N/A	51.53

$$E = TG * EF_G / 1000$$

Where:

E = GHG emissions (t CO_2-e)

TG = Total natural gas used (GJ)

EF_G = Emission factor for natural gas (kg CO_2-e/GJ)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
1	01/01/21-31/12/21	Natural gas	52,382	GJ	2,699	t CO_2-e
Total for source			**52,382**	**GJ**	**2,699**	**t CO_2-e**

4.1.2 Non-transport fuels

Fuels and other petroleum-based products (unleaded petrol, diesel, liquefied petroleum gas, petroleum-based oils, solvents, kerosene, dry wood) are used on University campuses for purposes other than transport, mainly in generators and as lubricants, but also in firefighting training and farm equipment.

Activity data

The amount of fuel used for non-transport purposes is mainly obtained from invoices provided by suppliers.

Additionally, expenditure data on non-transport fuels from other transactions (business and personal credit cards) is obtained from Financial Services reports, which are coded per natural accounts. Natural account codes relevant for stationary fuel are:

- 36112 Fuel – Equipment.
- 39110 Other energy fuels

A small amount of liquid fuels for non-registered vehicles is also reported in the vehicle fleet fuel cards reports.

Dry wood is also purchased, and the quantity is reported directly by Bell Bay Campus staff.

Assumptions

It is assumed that all fuel in this category is for non-transport use only. A minor quantity is used in non-registered vehicles.

The Financial Services reports do not always specify fuel type or purpose. When fuel type is unknown, it is assumed to be ULP91 (gasoline) as this is the most used fuel type. When fuel purpose is unknown (i.e., not clearly specified in the 'narrative' field), it is assumed that it is intended for the assigned natural code purpose. It is assumed that all fuel used in equipment was purchased in Tasmania.

Calculation methodology

The GHG emissions resulting from non-transport fuel used are calculated using the total fuel of each type used, and the specific energy content and emission factor for each fuel.

Data from Financial Services reports is screened to ensure that only transactions related to non-transport fuels are considered in the calculation. Transactions identified as transport fuels (wrongly coded) are included in Section 4.1.3 Transport fuels.

In cases where fuel amount is not available (Financial Services reports), an estimated quantity of fuel is calculated from fuel cost using the national annual average as published by the Australian Institute of Petroleum (2022). The Tasmanian average is used as all transactions apply to Tasmanian campuses.

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content (GJ/kL or t)	Emission factor (t CO_2-e/GJ)
1	01/01/21-31/12/21	Stationary diesel	Invoices; Financial reports	Climate Active inventory	38.6	70.20
1	01/01/21-31/12/21	Stationary gasoline	Invoices; Financial reports	Climate Active inventory	34.2	67.80
1	01/01/21-31/12/21	Stationary liquefied petroleum gas	Invoices	Climate Active inventory	25.7	60.60
1	01/01/21-31/12/21	Stationary kerosene (not for aircraft)	Invoices	Climate Active inventory	37.5	69.11
1	01/01/21-31/12/21	Stationary petroleum-based oils	Invoices	Climate Active inventory	38.8	13.90
1	01/01/21-31/12/21	Dry wood	Estimate	Climate Active inventory	16.2	1.20

$$E = \sum_{nt} TF_{nt} * EC_{nt} * EF_{nt}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TF_{nt} = Total fuel used of fuel of type nt (kL; t for dry wood)

EC_{nt} = Energy content factor for fuel of type nt (GJ/kL; GJ/t for dry wood)

EF_{nt} = Emission factor for fuel of type nt (kg CO_2-e/GJ)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
1	01/01/21-31/12/21	Stationary diesel	1,894	L	5	t CO_2-e
1	01/01/21-31/12/21	Stationary gasoline	1,325	L	3	t CO_2-e
1	01/01/21-31/12/21	Stationary liquefied petroleum gas	16,317	L	25	t CO_2-e
1	01/01/21-31/12/21	Stationary kerosene (not for aircraft)	6,900	L	18	t CO_2-e
1	01/01/21-31/12/21	Stationary petroleum-based oils	1,049	L	1	t CO_2-e
1	01/01/21-31/12/21	Dry wood	7,000	kg	0	t CO_2-e
Total for source (excluding dry wood in activity data)			**27,486**	**L**	**52**	**t CO_2-e**

4.1.3 Transport fuels

University staff and postgraduate students use University-owned cars and boats, as well as outsourced (long and short-term hire) vehicles and private vehicles, to carry out their teaching, research and administrative activities. Outsourced vehicles, although not owned by the University, are under the University's operational control. Private vehicles used to conduct University business were also included for completeness.

In addition, fuel used by the free UniHopper shuttle between Sandy Bay and Hobart CBD campuses has also been included. The shuttle started operation in semester 2, 2021

Fuels used in these vehicles include unleaded petrol and diesel.

Activity data

Custom vehicle fleet fuel cards are used to purchase fuel by staff for University owned vehicles (including boats) and short-term leased vehicles. The total amount of each fuel purchased by type of fuel and the quantity supplied is extracted from reports from each of the University's suppliers. Additionally, long-term leased vehicles fuel use is obtained from monthly reports provided by the vehicles' provider (also based on fuel card transactions). The amount of fuel used by the training vessel MV Bluefin is obtained from invoices provided by the supplier.

When petrol stations for the University preferred supplier are not readily available, or when using personal vehicles, fuel is purchased with business credit cards. Data for fuel expenses paid by business credit card is then obtained from Financial Services reports, which are coded per natural account. Relevant natural account codes for transport fuel are:

- 31031 Fuel – Domestic
- 36109 Fuel – Vessels

Some staff who use their personal vehicles for University business do not have a business credit card and therefore use personal credit cards to pay for fuel. These staff can claim a reimbursement based on the distance travelled. Data for distance travelled is then obtained from People and Wellbeing reports.

The UniHopper fuel use data is obtained from the service provider.

Assumptions:

All vehicles have been assumed to be post-2004, except for the vessel MV Bluefin for which pre-2004 emissions factors were used. Whilst for some of the farm vehicles this may not be true, using the transport emissions factor is a more conservative estimate and thus minimises any potential impact of this assumption.

Similarly, some of the fuel used in these vehicles may be in non-road registered vehicles. It has been assumed that this fuel is combusted as transport fuel given that this is a higher emissions factor and thus a conservative estimate.

The Financial Services reports do not always specify fuel type or purpose. When fuel type is unknown, it is assumed to be ULP91 (gasoline) as this is the most used fuel type. When fuel purpose is unknown (i.e., not clearly specified in the 'narrative' field), it is assumed that it is intended for the assigned natural code purpose.

Similarly, People and Wellbeing reports do not specify fuel type. It has been assumed that the distribution by fuel type of private vehicles used for University business is similar to that of the respondents of the most recent Travel Behaviour Survey (biennial). Hybrid cars are assumed to use gasoline.

It is assumed that all fuel used in boats was purchased in Tasmania.

Calculation methodology

The GHG emissions resulting from the fuel used in owned and outsourced vehicles are calculated using the total fuel of each type used, and the specific energy content and emission factor for each fuel.

Data from Financial Services reports is screened to ensure that only transactions related to the use of vehicles are considered in the calculation. Transactions identified as non-transport fuels (wrongly coded) are included in Section 4.1.2 Non-transport fuels.

The Financial Services reports do not provide fuel quantity thus, an estimated quantity is calculated from fuel cost as published by the Australian Institute of Petroleum (2022). The Tasmanian annual average was used for transactions for boats and land-based vehicles that were identified to occur in Hobart, Sandy Bay, Launceston, Newnham, Invermay, Burnie, Devonport, Campbell Town and Strahan. The national average is used (instead of the Tasmanian average) for all other transactions because, although most transactions would most likely be for Tasmanian vehicles, location is not always specified, and it would be onerous to identify. As national average prices are lower, this is a conservative approach.

The People and Wellbeing reports for private cars do not provide fuel quantity thus, an estimated quantity is calculated from distance travelled reported by staff and the average consumption for passenger vehicles per fuel type in Tasmania (Australian Bureau of Statistics 2020a).

UniHopper fuel data was provided by the service provider for nine weeks of operation and extrapolated to the whole operation period in the reporting year.

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content (GJ/kL)	Emission factor (kg CO_2-e/GJ)
1	01/01/21-31/12/21	Transport (pre 2004) diesel	Invoices	Climate Active inventory	38.60	70.40
1	01/01/21-31/12/21	Transport (post 2004) diesel	Invoices; Financial reports	Climate Active inventory	38.60	70.41
1	01/01/21-31/12/21	Transport (post 2004) gasoline	Invoices; Financial reports	Climate Active inventory	34.20	67.62

$$E = \sum_t TF_t * EC_t * EF_t/1000$$

Where:

E = GHG emissions (t CO_2-e)

TF_t = Total fuel used of fuel of type t (kL)

EC_t = Energy content factor for fuel of type t (GJ/kL)

EF_t = Emission factor for fuel of type t (kg CO_2-e/GJ)

Calculated emissions

Scope	Reporting Period	Emission source	Activity data	Unit	GHG emissions	Unit
1	01/01/21-31/12/21	Transport (pre 2004) diesel	62,162	L	169	t CO_2-e
1	01/01/21-31/12/21	Transport (post 2004) diesel	121,872	L	331	t CO_2-e
1	01/01/21-31/12/21	Transport (post 2004) gasoline	210,780	L	487	t CO_2-e
Total for source			**394,814**	**L**	**988**	**t CO_2-e**

4.1.4 Refrigerant gas

Refrigerant gases are used at the University of Tasmania for building and vehicle air conditioning, for kitchen and laboratory refrigerators and air compressors. In this GHG Inventory we include only refrigerants that are used to top up or refill equipment.

Activity data

Data is obtained from reports supplied by the University's provider, which include amount of refrigerant recharge purchased during the year per gas type.

Assumptions

The refrigerant gas R22 has not been included as it is not considered to be a reportable greenhouse gas (Clean Energy Regulator 2017).

Calculation methodology

The latest Global Warming Potentials (GWPs) were used. GWPs are consistent with NGER Regulations, which are based on the IPCC Fifth Assessment Report (2013).

Refrigerant gas composition of gases used is as follows:

Refrigerant gas	HFC-32 (%)	HFC-125 (%)	HFC-134a (%)	HFC-143a (%)	R-600 (%)	R-601a (%)
R134a	-	-	100	-		
R404a	-	44	4	52		
R407c	23	25	52			
R410	50	50	-	-		
R438a	8.5	45	44.2		1.7	0.6

Scope	Reporting period	Emission source	Data source	Methodology reference	GWP (kg CO_2-e/kg)
3	01/01/21-31/12/21	Refrigerant gas R134a	Supplier summary	NGER Regulations	1,300
3	01/01/21-31/12/21	Refrigerant gas R404a	Supplier summary	NGER Regulations	3,943
3	01/01/21-31/12/21	Refrigerant gas R407c	Supplier summary	NGER Regulations	1,624
3	01/01/21-31/12/21	Refrigerant gas R410	Supplier summary	NGER Regulations	1,924
3	01/01/21-31/12/21	Refrigerant gas R438a	Supplier summary	NGER Regulations	2,059

The GHG emissions resulting from each type of refrigerant were calculated using the recharged gas quantities and global warming potentials.

$$E = \sum_n RG_n * GWP_n \,/\, 1000$$

Where:

E = GHG emissions (t CO_2-e)
RG_n = Total amount of refrigerant gas type n recharged (kg)
GWP_n = Global warming potential of refrigerant type n (kg CO_2-e/ kg refrigerant)

Calculated emissions

Scope	Reporting Period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Refrigerant gas R134a	10	kg	13	t CO_2-e
3	01/01/21-31/12/21	Refrigerant gas R404a	76	kg	299	t CO_2-e
3	01/01/21-31/12/21	Refrigerant gas R407c	26	kg	41	t CO_2-e
3	01/01/21-31/12/21	Refrigerant gas R410	80	kg	153	t CO_2-e
	01/01/21-31/12/21	Refrigerant gas R438a	40		81	t CO_2-e
Total for source			**230**	**kg**	**588**	**t CO_2-e**

4.1.5 Livestock

Cattle (dairy cows, bulls and heifers) are used in teaching and research activities at the University Elliot Dairy Farm. During digestion of feed, cattle produce methane (CH_4), a greenhouse gas.

Activity data

The Tasmanian Institute of Agriculture (TIA) Dairy Research Facility provides data on the date of birth or entry of each head of cattle, as well as the date in which each head is sold or dies (if relevant). The data delineates dairy cows and other (including heifers, calves and bulls).

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

The GHG emissions resulting from cattle were estimated using the emission factor calculated from the methane production rates listed above and the methane global warming potential.

The 2019 International Panel for Climate Change Good Guidelines for greenhouse gas inventories for the agricultural, forestry and other land use provides tier 1 enteric fermentation emissions factors for Oceania cattle (IPCC 2019) as per the table below:

The GWP of methane has been applied in consistency with NGER Regulations.

Regional characteristics	Cattle category	Emission factor (kg CH_4 $head^{-1}$ yr^{-1})	Comments
Oceania: Commercialised dairy sector based on grazing. Separate beef cow herd, primarily grazing rangelands and hill country of widely varying quality. Growing amount of feedlot feeding with grains. Dairy cows are a small part of the population	Dairy	93	Average milk production of 4,400 kg $head^{-1}$ yr^{-1}
	Other	63	Includes mature males, mature females and young

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CH_4 head^{-1} yr^{-1})	GWP CH_4	Emission factor (t CO_2-e head^{-1} yr^{-1})
3	01/01/21-31/12/21	Dairy cows	Farm summary	IPCC GPG 2019	93	28	2.604
3	01/01/21-31/12/21	Other	Farm Summary	IPCC GPG 2019	63	28	1.764

The data provided by farm managers was analysed to determine the total number of days each animal was held on site. The total number of days per livestock category (dairy cows and other) was divided by the number of days in the year to obtain an equivalent numbers of heads per annum.

$$E = \sum_C N_C * EF_C/1000$$

Where:

E = GHG emissions (t CO_2-e)

N_C = Equivalent number of cattle of type C on the farm for one year

EF_C = Calculated emission factor for cattle of type C (kg CO_2-e head^{-1} year^{-1})

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Dairy Cows	285	Equivalent head yr^{-1}	742	t CO_2-e
3	01/01/21-31/12/21	Other	196	Equivalent head yr^{-1}	346	t CO_2-e
Total for source			**481**	**Equivalent head yr^{-1}**	**1,088**	**t CO_2-e**

4.2 Scope 2

4.2.1 Electricity

Electricity at the University is used for HVAC (heating, ventilation and cooling), building mechanics (e.g., lifts, fire detection), lighting (including security), domestic hot water (DHW), and power for appliances and equipment for teaching, research and administrative activities.

4.2.1.1 Electricity: Operational control

Activity data

For most facilities, invoice data from electricity providers was used to calculate emissions. Where invoices were not provided for the complete reporting period, the average daily electricity use was used to fill data gaps. Where invoices were not available, electricity use was estimated from meter readings.

The consumption by on-campus based organisations that are not under the University's operational control (see section 3.4.1.3) was deducted from the total reported consumption where available. Where this was not available, it has been included in the reported total emissions, which is an overestimate of both the scope 2 and 3 emissions for the University. The electricity use on-charged to these facilities represented 3.1% of the total electricity use across all facilities determined to be within the University organisational boundary.

Assumptions

Rozelle Campus

Electricity billing information was not available for Rozelle Campus (NSW). Monthly meter readings were used to estimate the consumed electricity at this campus. Only two out of four buildings at Rozelle were metered in the reporting year, hence total electricity use was extrapolated to reflect campus electricity use.

Yarragadee Observatory
Electricity use at Yarragadee Observatory (WA) was estimated from meter readings provided by staff at the site. The meter readings provided for the reporting year were used for the calculation of average electricity use per day, and the total electricity use was estimated for the reporting period.

Microwave Towers
Electricity consumption was available from invoices for all microwave towers under the University's operational control but Bagot St Microwave Tower in Beauty Point, for which the electricity consumption for the largest tower was used. This is a conservative approach.

Sites with no electricity
No electricity is supplied to Proctors Quarry and thus no estimates have been made for this facility.

Calculation methodology

The GHG emissions resulting from electricity use are calculated using the total electricity used at different states/territories, and the specific emission factor for each state/territory and reporting period.

Scope	Reporting period	Emission source	Data Source	Methodology reference	Emission factor (kg CO_2-e/kWh)
2	01/01/21-31/12/21	Electricity - TAS	Invoices	Climate Active inventory	0.14
2	01/01/21-31/12/21	Electricity - NSW and ACT	Estimation	Climate Active inventory	0.78
2	01/01/21-31/12/21	Electricity - SA	Invoices	Climate Active inventory	0.30
2	01/01/21-31/12/21	Electricity - NT	Invoices	Climate Active inventory	0.54
2	01/01/21-31/12/21	Electricity - WA	Estimation	Climate Active inventory	0.67
2	01/01/21-31/12/21	Electricity - generation	Meter readings	Climate Active inventory	0.00

$$E = \sum_s TE_s * EF_{es}/1000$$

Where:

E = GHG emissions (t CO_2-e)
TE_S = Total electricity used in state/territory s (kWh)
EF_E = Emission factor for electricity in state/territory s (kg CO_2-e/kWh)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
2	01/01/21-31/12/21	Electricity - TAS	45,171,064	kWh	6324	t CO_2-e
2	01/01/21-31/12/21	Electricity - NSW	90,111	kWh	70	t CO_2-e
2	01/01/21-31/12/21	Electricity - SA	52,887	kWh	16	t CO_2-e
2	01/01/21-31/12/21	Electricity - NT	51,319	kWh	27	t CO_2-e
2	01/01/21-31/12/21	Electricity - WA	23,333	kWh	16	t CO_2-e
2	01/01/21-31/12/21	Electricity - generation	156,005	kWh	0	t CO_2-e
Total for source			**45,544,719**	**kWh**	**6,453**	**t CO_2-e**

4.2.1.2 Electricity: Scope 3 facilities

Activity data

For facilities considered to be scope 3 facilities (see Appendix C), directly billed invoice data from electricity providers was used to calculate the emissions. In some cases, invoices were not provided for the complete reporting period; for these sites the average daily electricity consumption has been used to fill the data gaps.

Electricity use in AMC Darling Harbour and TAFE Newcastle (NSW), clinical schools (TAS), and a number of staff accommodation, teaching and learning and office space in non-University buildings (TAS) was estimated as no invoices are available for these sites (see assumptions below).

Assumptions

AMC Darling Harbour

The electricity consumption at the new AMC facility in Darling Harbour, Sydney, was estimated based on the net lettable area (NLA) occupied in this and similar facilities for which electricity consumption is known.

Clinical schools

The Royal Hobart Hospital on-charges the University for the electricity consumed in its operations for the areas occupied by University staff. However, no invoices were received for the reporting year. In the absence of other data, electricity use is assumed to be the same as the last year for which invoices were received (2019). This is a conservative approach as electricity use was likely lower because of the COVID-19 impact.

Electricity use at the Launceston Clinical School was estimated from meter readings provided by staff at the site. The meter readings were used for the calculation of average electricity use per day, and the total electricity use was estimated for the reporting period.

The Mersey Rural Clinical School (Latrobe) was assumed to have an electricity consumption equivalent to the Burnie Rural Clinical School. Both schools share the same staff and students, who move between campuses during the year. This is likely a conservative approach as the Mersey Rural Clinical School occupies a third of the area of the Burnie Rural Clinical School.

Teaching and learning space in Hobart CBD

The University occupies space in several Hobart CBD buildings for teaching and learning purposes. Electricity use based on meter readings is back charged to the University for MyState building, and other buildings were UTAS occupies a similar area are assumed to have the same electricity consumption.

Staff accommodation and office space

For some staff accommodation and office space in Tasmanian non-University buildings, no electricity consumption data is available. In the absence of any other information, these have been assumed to be equivalent to a 5+ person Tasmanian household, as estimated by the Australian Energy Regulator (n.d.).

Similarly, the electricity consumption in the space occupied by UTAS in TAFE NSW Newcastle has been assumed to be equivalent to a 5+ person NSW household, as estimated by the Australian Energy Regulator.

Sites with no electricity

No electricity is supplied to Wedge Island and thus no estimates have been made for this facility.

Calculation methodology

Although emissions from facilities judged to be outside the operational control of the University but within the organisation reporting boundary (see Section 3.4.1.2 for criteria used in the assessment) are technically scope 3 emissions, the scope 2 emissions have been calculated and reported accordingly, following current Climate Active methodology.

Scope	Reporting period	Emission source	Data Source	Methodology reference	Emission factor (kg CO_2-e/kWh)
2	01/01/21-31/12/21	Electricity - TAS	Invoices	Climate Active inventory	0.14
2	01/01/21-31/12/21	Electricity - NSW and ACT	Estimation	Climate Active inventory	0.78

$$E = \sum_s TE_s * EF_{es}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TE_S = Total electricity used in state/territory s (kWh)

EF_{es} = Scope 2 emission factor for electricity in state/territory s (kg CO_2-e/kWh)

Calculated emissions

Scope	Reporting Period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Electricity – TAS (scope 3 facility)	991,025	kWh	139	t CO_2-e
3	01/01/21-31/12/21	Electricity – NSW (scope 3 facility)	207,968	kWh	162	t CO_2-e
Total for source			**1,198,992**	**kWh**	**301**	**t CO_2-e**

4.3 Scope 3

4.3.1 Natural gas

Activity data

As per Section 4.1.1.

Assumptions

There is no published scope 3 factor for Tasmania in the NGA Factors Workbook due to the requirement for protecting the commercial confidentiality of Tas Gas (Department of Industry, Science, Energy and Resources 2021a). Therefore, an average scope 3 emissions factor (non-metro) was calculated using the data available in other states/territories and following Climate Active guidelines.

Calculation methodology

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content factor	Emission factor (kg CO_2-e/GJ)
3	01/01/21-31/12/21	Natural gas	Invoices	Climate Active inventory	N/A	8.10

$$E = TG * EF_{G3}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TG = Total natural gas used (GJ)

EF_{G3}= Calculated scope 3 emission factor for natural gas (kg CO_2-e/GJ)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Natural gas	52,382	GJ	424	t CO_2-e
Total for source			**52,382**	**GJ**	**424**	**t CO_2-e**

4.3.2 Non-transport fuels

Activity data

As per Section 4.1.2.

Assumptions

Note that the NGA Factors Workbook does not provide a scope 3 factor for dry wood and therefore it has not been included in the inventory. Given that scope 1 emissions for this source are virtually zero, the assumption of zero scope 3 emissions for dry wood is considered inconsequential.

Calculation methodology

The scope 3 emissions resulting from non-transport fuel use are calculated using the total fuel of each type consumed, and the specific scope 3 emission factor for each fuel.

Note that the scope 3 emissions factors are applicable irrespective of whether the fuel was used for stationary or transportation purposes. These are presented separately however for consistency with the relevant sections.

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content (GJ/kL or t)	Emission factor (t CO_2-e/GJ)
3	01/01/21-31/12/21	Stationary diesel	Invoices; Financial reports	Climate Active inventory	38.6	3.60
3	01/01/21-31/12/21	Stationary gasoline	Invoices; Financial reports	Climate Active inventory	34.2	3.60
3	01/01/21-31/12/21	Stationary liquefied petroleum gas	Invoices	Climate Active inventory	25.7	3.60
3	01/01/21-31/12/21	Stationary kerosene (not for aircraft)	Invoices	Climate Active inventory	37.5	3.60
3	01/01/21-31/12/21	Stationary petroleum-based oils	Invoices	Climate Active inventory	38.8	3.60

$$E = \sum_n TS_n * EC_n * EF_{n3}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TS_n = Total energy source used of type n (kL)

EC_n = Energy content factor for fuel of type n, if applicable (GJ/kL)

EF_{n3} = Scope 3 emission factor for energy source n (kg CO_2-e/kL)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Stationary diesel	1,894	L	0	t CO_2-e
3	01/01/21-31/12/21	Stationary gasoline	1,325	L	0	t CO_2-e
3	01/01/21-31/12/21	Stationary liquefied petroleum gas	16,317	L	2	t CO_2-e
3	01/01/21-31/12/21	Stationary kerosene (not for aircraft)	6,900	L	1	t CO_2-e
3	01/01/21-31/12/21	Stationary petroleum-based oils	1,049	L	0	t CO_2-e
Total for source			**27,486**	**L**	**3**	**t CO_2-e**

4.3.3 Transport fuels

Activity data

As per Section 4.1.3.

Assumptions

No additional assumptions for scope 3 emissions from transport fuels were made.

Calculation methodology

The scope 3 GHG emissions resulting from non-transport fuel use are calculated using the total fuel of each type used, and the specific scope 3 emission factor for each fuel.

Note that the scope 3 emissions factors are applicable irrespective of whether the fuel was used for stationary or transportation purposes. These are presented separately however for consistency with the relevant sections.

Scope	Reporting period	Emission source	Data source	Methodology reference	Energy content (GJ/kL)	Emission factor (kg CO_2-e/GJ)
1	01/01/21-31/12/21	Transport (pre 2004) diesel	Invoices	Climate Active inventory	38.60	3.60
1	01/01/21-31/12/21	Transport (post 2004) diesel	Invoices; Financial reports	Climate Active inventory	38.60	3.60
1	01/01/21-31/12/21	Transport (post 2004) gasoline	Invoices; Financial reports	Climate Active inventory	34.20	3.60

$$E = \sum_n TS_n * EC_n * EF_{n3}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TS_n = Total energy source used of type n (kL)

EC_n = Energy content factor for fuel of type n, if applicable (GJ/kL)

EF_{n3} = Scope 3 emission factor for energy source n (kg CO_2-e/kL)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Transport (pre 2004) diesel	62,162	L	9	t CO_2-e
3	01/01/21-31/12/21	Transport (post 2004) diesel	121,872	L	17	t CO_2-e
3	01/01/21-31/12/21	Transport (post 2004) gasoline	210,780	L	26	t CO_2-e
Total for source			**394,814**	**L**	**52**	**t CO_2-e**

4.3.4 Electricity

Activity data

As per Section 4.2.1. This category of emissions relates to the distribution and transmission of electricity in the relative state for the electricity already reported as a scope 2 emissions source.

Assumptions

No additional assumptions for scope 3 emissions from electricity were made.

Calculation methodology

The scope 3 emissions resulting from electricity use at facilities under University operational control and scope 3 facilities are calculated using the total electricity used, and the specific scope 3 emission factor for each state/territory.

Scope	Reporting period	Emission source	Data Source	Methodology reference	Emission factor (kg CO_2-e/kWh)
3	01/01/21-31/12/21	Electricity - TAS	Invoices	Climate Active inventory	0.02
3	01/01/21-31/12/21	Electricity - NSW and ACT	Estimation	Climate Active inventory	0.07
3	01/01/21-31/12/21	Electricity - SA	Invoices	Climate Active inventory	0.07
3	01/01/21-31/12/21	Electricity - NT	Invoices	Climate Active inventory	0.04
3	01/01/21-31/12/21	Electricity - WA	Estimation	Climate Active inventory	0.01

$$E = \sum_s TE_s * EF_{es3}/1000$$

Where:

E = GHG emissions (t CO_2-e)

TE_S = Total electricity used in state/territory s (kWh)

EF_{es3} = Scope 3 emission factor for electricity in state/territory s (kg CO_2-e/kWh)

Calculated emissions

Scope	Reporting Period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Electricity - TAS	45,171,064	kWh	903	t CO_2-e
3	01/01/21-31/12/21	Electricity - NSW	90,111	kWh	6	t CO_2-e
3	01/01/21-31/12/21	Electricity - SA	52,887	kWh	4	t CO_2-e
3	01/01/21-31/12/21	Electricity - NT	51,319	kWh	2	t CO_2-e
3	01/01/21-31/12/21	Electricity - WA	23,333	kWh	0	t CO_2-e
3	01/01/21-31/12/21	Electricity - generation	156,005	kWh	0	t CO_2-e
3	01/01/21-31/12/21	Electricity – TAS (scope 3 facility)	991,025	kWh	20	t CO_2-e
3	01/01/21-31/12/21	Electricity – NSW (scope 3 facility)	207,968	kWh	15	t CO_2-e
Total for source			**46,743,712**	**kWh**	**950**	**t CO_2-e**

4.3.5 Waste to landfill and recycling

The University produces different types of waste as a result of its research, learning and teaching and operational activities.

Activity data

Volume of waste to landfill and recycled waste is supplied in electronic reports by the waste contractors for Tasmanian and Sydney campuses and for student residences. Waste from childcare and the Tasmanian University Students Association locations has been removed from the emissions calculations in accordance with the organisational boundary assessment.

Assumptions

The waste services provider records weights from the scales on some trucks at the time of service. However, if there are technical difficulties with the scales or communications with the truck, and where trucks do not have scales, the volume of each bin is provided and bins are considered to be full. In these instances, the total volume was corrected for partly full bins (75% of total volume). An audit conducted in 2012 showed that bins prior to collection were 55% full in average across three campuses, therefore 75% is a conservative approach.

In 2021, ten skips in two Tasmanian campuses were fitted with bin sensors to improve efficiencies and data accuracy. These skips were only emptied when full and therefore they were excepted from the 75% full rule and considered 100% full.

For waste to landfill and recycling collected from University student residences that have been outsourced to a third party, it is assumed that bins are 40% full. This is a conservative approach as a 2021 waste audit conducted in several of these residences across various campuses in Tasmania showed bins were 33% full on average.

Calculation methodology

Government sources were used for volume to waste conversion factors (Green Industries SA 2017; USDA n.d.). The following assignations have been made for each waste type based on the main waste provider categories of waste.

Waste type	Destination	Waste stream	Conversion factor (t/m^3)	Source
Animal removal	Landfill	Domestic waste to landfill	0.425	Green Industries SA
Batteries	Recycling	Recycled waste	1.131	Green Industries SA
Cardboard	Recycling	Recycled waste	0.094	Green Industries SA
Comingled	Recycling	Recycled waste	0.063	Green Industries SA
Document destruction	Recycling	Recycled waste	0.129	Green Industries SA
Ewaste	Recycling	Recycled waste	0.177	Green Industries SA
General bulk waste	Landfill	Domestic waste to landfill	0.307	Green Industries SA
General waste	Landfill	Domestic waste to landfill	0.150	Green Industries SA
Glass	Recycling	Recycled waste	0.174	Green Industries SA
Hazard	Landfill	Commercial waste to landfill	0.227	Green Industries SA
Liquid	Recycling	Recycled waste	1.000	USDA
Liquid grease trap	Recycling	Recycled waste	0.872	USDA
Medical	Landfill	Domestic waste to landfill	0.227	Green Industries SA
Metal	Recycling	Recycled waste	0.900	Green Industries SA
Organic	Recycling	Recycled waste	0.386	Green Industries SA
Sawdust	Recycling	Recycled waste	0.300	Green Industries SA
Tubes	Recycling	Recycled waste	0.243	Green Industries SA
White paper	Recycling	Recycled waste	0.129	Green Industries SA

As information on specific composition of waste to landfill is not available from the waste services provider or internal waste audits, emissions factors for total waste disposed to landfill by broad waste stream category were used.

Scope	Reporting Period	Emission source	Data source	Methodology reference	Emission factor (t CO_2-e/t)
3	01/01/21-31/12/21	Domestic waste to landfill	Supplier summary	Climate Active inventory	1.6
3	01/01/21-31/12/21	Recycled waste	Supplier summary	Climate Active inventory	0.00

$$E = \sum_{wt} W_{wt} * EF_{wt}$$

Where:

E = GHG emissions (t CO_2-e)
W_{wt} = Total weight of waste category wt (t)
EF_w = Emission factor for waste of category wt (t CO_2-e/t waste)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Domestic waste to landfill	2,124	t	3,399	t CO_2-e
3	01/01/21-31/12/21	Recycled waste	522	t	0	t CO_2-e
Total for source			**2,646**	**t**	**3,399**	**t CO_2-e**

4.3.6 Sanitary waste

Activity Data

The sanitary service suppliers provide reports detailing the number of bins serviced per invoice period, bin volume and visits per year or frequency. Providers were not able to provide any data on the total weight of waste collected, thus the number of bins and collection frequency have been used as the source data.

Assumptions

In the absence of any information on the bin levels, it is assumed that each bin is 50% full based on initial greenhouse gas inventory consultant recommendation.

As sanitary waste is not general waste, an assumption about its relative density is required. Considering the categories published in the NGA Factors, sanitary waste was considered similar to “nappies”.

Calculation methodology

The number of total collections was calculated by multiplying the number of bins serviced by the number of visits during the reporting period. The total number of collections for the reporting year was then multiplied by the bin volume and by the density conversion factor to estimate weight.

The emission factor for “nappies" was then used to calculate emissions from sanitary waste. Given that there is no specific category of waste for sanitary waste in the NGA Factors, this factor was considered to be the most appropriate.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (t CO_2-e/t waste)
3	01/01/21-31/12/21	Sanitary waste	Invoices and estimation	As above	2.0

$$E = \sum_{n} C_n * \frac{V_n}{2} / 1000 * CF_N * EF_N$$

Where:

E = GHG emissions (t CO_2-e)
C_n = Number of collections for bin n
V_n = Volume of bin n (L)
CF_N = Volume to weight conversion factor for nappies (t/m^3)
EF_N = Emission factor for nappies (t CO_2-e/t waste)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Sanitary Waste	79	t	159	t CO_2-e
Total for source			**79**	**t**	**159**	**t CO_2-e**

4.3.7 Water and wastewater

The delivery of water requires energy to be expended by the water authority, which has emissions associated with both the supply of potable water and treatment of sewerage removed from the site.

Activity data

All water supplied to and removed from the Tasmanian University facilities is by TasWater. TasWater provides invoices detailing the quantity of water consumed and sewerage household equivalent (or equivalent tenements – ETs), which were used as the activity data. Water and wastewater emissions are not estimated for the NSW campuses given there is no available data or estimates for this and it is an immaterial emission source.

The consumption associated with facilities within University campuses that are not under the University's operational control was deducted from the total reported consumption where available. Where this was not available it has been included in the reported total emissions, which is an overestimate of scope 3 emissions. The water consumption at these facilities during the reporting period was 25,918 kL, an inconsequential amount compared to the total reported water within the organisational boundary.

Assumptions

For urban water, it is assumed that all water treatment emissions as reported relate to the treatment of urban water. There is insufficient clarifying data from the Tasmanian Economic Regulator report to determine if this is correct, therefore it is a conservative assumption of the two methods available (the potable water emissions are for urban plus regional water supplied, which results in a lower emissions factor).

Calculation methodology

The Office of the Tasmanian Economic Regulator publishes an annual summary of the TasWater activities per financial year. The latest available report at the time of developing this GHG Inventory was for the FY2019-20 (Office of the Tasmanian Economic Regulator 2021). This included the following emissions estimates for the organisation.

Metric	Total volume (ML)	Average volume (kL/household)	Total emissions (t CO_2-e)
Urban Water	65,537	309	12,348
Sewerage	52,493	284	33,156

From this data, it is possible to calculate an emission factor per volume (for water consumed) and an emission factor per installation (for treated sewerage).

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (t CO_2-e/ML or ET)
3	01/01/21-31/12/21	Water	Invoices	As above	0.1884
3	01/01/21-31/12/21	Wastewater	Invoices	As above	0.1794

$$E = W_a/1000 * EF_a$$

Where:

E = GHG emissions (t CO_2-e)

W_a= Quantity of potable water (kL) for water consumption, or equivalent tenements (ETs) for sewerage

EF_a = Emission factor of water type a (t CO_2-e/ML or ET)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Water	220,632	kL	42	t CO_2-e
3	01/01/21-31/12/21	Wastewater	1,764	ETs	316	t CO_2-e
Total for source					**358**	**t CO_2-e**

4.3.8 Construction

The University undertook several construction activities in the reporting year, including construction of new buildings and major refurbishments as part of a major transformation that involves the relocation of Tasmanian campuses to the three major regional cities and major building upgrades to our Sydney campus.

Activity data

Expenditure on construction was provided by Financial Services. Relevant natural account codes are:

- 39202 Geotechnical services
- 39204 Quantity surveying
- 39206 Other building related professional fees
- 39208 Statutory fees
- 39210 Building contracts

Expenditure for specific buildings where significant emissions reduction initiatives were undertaken (e.g., reused of materials; use of low carbon materials) was provided by project managers.

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

The Australian Department of Industry, Science, Energy and Resources reports the total emissions by economic sector per year (Department of Industry, Science, Energy and Resources 2019.). Additionally, the Australia Bureau of Statistics (2019) measures the value of the construction industry quarterly. From these values, an emission factor for GHG emissions per expenditure was calculated for the latest year available.

Scope	2019 Construction emissions (t CO_2-e)	2019 Construction expenditure ($)	Emission factor (kg CO_2-e/$)
3	10,039,259	215,106,394	0.0467

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/$)
3	01/01/21-31/12/21	Construction	Financial Services report	As above	0.0466

Where initiatives to reduce embodied carbon in buildings were implemented, the percentage of reduced emissions provided by consultants (compared to a reference case in the Green Building Council of Australia rating tool) was applied to the expenditure on those buildings and the result subtracted from the total expenditure.

$$E = (CE - \sum CE_B * ER_B) * EF_{CE}/1000$$

Where:

E = GHG emissions (t CO_2-e)
CE = Total construction expenditure ($)
CE_B = Construction expenditure in building B ($)
ER_B = Percentage of emissions reduction estimated for building B (%)
EF_{CE} = Emission factor for construction expenditure (kg CO_2-e/$)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Construction	61,533,091	$	2,872	t CO_2-e
Total for source			**61,533,091**	**$**	**2,872**	**t CO_2-e**

4.3.9 Office paper

Activity data

The total reams of office paper used is obtained from reports provided by the University's major supplier. Data from supplier reports is collected for photocopy and printing paper of different sizes, grammages, percentage content of recycled paper and origin.

Assumptions

Financial reports of expenditure on office paper showed that >99% of paper is bought from the main provider. Therefore, it was assumed that all paper used at the University was bought from the main provider.

Calculation methodology

Ream weight is calculated based on size, grammage and number of sheets per ream.

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 (following EPA Victoria 2013 methodology).

Scope	Reporting Period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/kg)
3	01/01/21-31/12/21	Virgin paper (domestic)	Supplier report	Victorian EPA	1.30
3	01/01/21-31/12/21	Recycled paper (domestic)	Supplier report	Victorian EPA	1.52
3	01/01/21-31/12/21	Virgin paper (international)	Supplier report	Victorian EPA	1.08
3	01/01/21-31/12/21	Recycled paper (international)	Supplier report	Victorian EPA	1.28
3	01/01/21-31/12/21	Carbon neutral paper	Supplier report		0

$$E = \left(\sum_n PW_n * RC_n * EF_{100,n}/1000 + \sum_n PW_n * VC_n * EF_{0,n}/1000\right)$$

Where:

E = Total GHG emissions (t CO_2-e)
PW_n = Weight of paper type n (kg)
RC_n = Content of recycling paper (%)
$EF_{100,n}$ = Emission factor of 100% recycled paper type n (kg CO_2-e/kg)
VC_n = Content of virgin paper (%)
$EF_{0,n}$ = Emission factor of virgin paper type n (kg CO_2-e/kg)

Calculated emissions

Scope	Reporting Period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Virgin paper (domestic)	0	kg	0	t CO_2-e
3	01/01/21-31/12/21	Recycled paper (domestic)	23,012	kg	35	t CO_2-e
3	01/01/21-31/12/21	Virgin paper (international)	911	kg	1	t CO_2-e
3	01/01/21-31/12/21	Recycled paper (international)	81	kg	0	t CO_2-e
3	01/01/21-31/12/21	Carbon neutral paper	45	kg	0	t CO_2-e
Total for source			**24,49**	**kg**	**36**	**t CO_2-e**

4.3.10 Washroom paper

Paper towels and toilet tissue are used throughout all campuses as washroom consumables. The emissions associated with the manufacture of these products are calculated and included in this inventory. It is noted that the emissions associated with the disposal of these products are captured in sections 4.3.6 and 4.3.8.

Activity data

University cleaner contractors provide reports detailing the number of cartons provided per paper towel or toilet tissue type for each facility.

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

As part of the Government's assistance package to Emissions-Intensive Trade Exposed (EITE) Industries, the average emissions intensity of paper towel across Australia was calculated for the financial years FY07 and FY08. Using the results of these as published in the repealed Clean Energy Regulations 2011 (Commonwealth Government n.d.), the emissions factor for paper towels was calculated.

Tissue paper is defined as uncoated tissue paper that:

(a) has a grammage range of 13 g/m^2 to 75g/m^2;
(b) has a moisture content in the range of 4% to 11%; and
(c) is generally useable in sanitary products such as facial tissue, paper towel, bathroom tissue (…).

Accordingly, all toilet tissue and paper towels have been treated as tissue paper in these calculations.

Item	Activity	Basis for issue of free carbon units (t or kL[1])	Baselines		
			EI[a](t CO_2-e/basis)	EP[a](MWh/basis)	NGP[a](TJ/basis)
2.5	Tissue paper manufacturing	Uncoated tissue paper of saleable quality	0.646	1.67	n/a

Note that this program assumed a national average emissions intensity of electricity at 1 t CO_2-e/MWh. This assumption has been applied in this emissions factor for consistency. The use of the EITE factor is likely to result in an overestimate of emissions associated with tissue paper, particularly in comparison to the emissions factors reported for paper. For comparison sake, the EITE factor for paper was compared with the virgin paper factor (1.497 kg CO_2-e/kg paper in EITE legislation versus 1.3 kg CO_2-e/kg paper from EPA Victoria). This is however the best data available at the time of the report for this specific source of paper.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (t CO_2-e / t)
3	01/01/21-31/12/21	Paper towel and toilet tissue	Invoices	As above	2.32

The average weight of a carton per product and the average number of products/rolls are used to calculate the total weight per carton. Weights were obtained from information available online for each product (weight of one pack/roll by number of packs/rolls per carton, or dimensions and grammage).

$$E = \sum_n CW_n * C_n * EF_{PT}$$

Where:

E = Total GHG emissions (t CO_2-e)
CW_n = Weight of individual cartons of type n (t)
C_n = Number of cartons of type n
EF_{PT}= Emission factor of paper towel and toilet tissue (t CO_2-e/t)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Paper Towel and Toilet Tissue	32	t	73	t CO_2-e
Total for source			**32**	**t**	**73**	**t CO_2-e**

4.3.11 Business travel: Air travel

Staff, postgraduate students and visitors use air travel to undertake research, teaching and administrative commitments within Australia and internationally.

Activity data

The University had only one preferred air travel agency in the reporting year, which made available reports detailing flights booked for University travel, including city pairs, distance and seating class.

Assumptions

The University Travel Procedure states that “all University travel paid directly by the University must be booked through the University’s contracted Travel Agent”, so leakage of air travel due to staff booking flights outside the preferred travel providers is unlikely and it is assumed that all trips are booked through the preferred agent. The Travel Procedure also indicates that all University travel expenditure must be for University business, therefore it is assumed that all trips are for business travel.

When seating class is unknown, the economy class emission factor is used as the Travel Procedure indicates that all business travel shall be by this class, with few exceptions.

Calculation methodology

Direct and indirect emissions from well to tank (WTT) are calculated for air travel undertaken for University business. Emission factors (including the radiative forcing factor, a measure of the additional environmental impact of aviation) are provided by Climate Active and sourced from the UK Department for Business, Energy and Industrial Strategy (DBEIS 2020).

Flight categories (by distance travelled) and flight classes (by seating class) have been defined in the table below.

Climate Active haul	DBEIS haul	Distance (km)	Provider's report class	DBEIS class
Very short	Domestic to/from UK	≤ 400	Economy	Average
			Premium Economy	
			Business	
			First	
Short	Short-haul to/from UK	400 – 3,700	Economy	Economy
			Premium Economy	Business
			Business	
			First	
Long	Long-haul to/from UK	> 3,700	Economy	Economy
			Premium Economy	Premium Economy
			Business	Business
			First	First

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/km person)
3	01/01/21-31/12/21	Very Short Haul - All classes	Supplier report	DBEIS 2020	0.27278
3	01/01/21-31/12/21	Short Haul - Economy	Supplier report	DBEIS 2020	0.16756
3	01/01/21-31/12/21	Short Haul - Business	Supplier report	DBEIS 2020	0.25132
3	01/01/21-31/12/21	Long Haul – Economy	Supplier report	DBEIS 2020	0.16406
3	01/01/21-31/12/21	Long Haul – Premium Economy	Supplier report	DBEIS 2020	0.26250
3	01/01/21-31/12/21	Long Haul – Business	Supplier report	DBEIS 2020	0.47578
3	01/01/21-31/12/21	Long Haul - First	Supplier report	DBEIS 2020	0.65624

$$E = \sum_{HC} D_{HC} * (EF_{HC} + WTT\ EF_{HC})/1000$$

Where:

E = Total GHG emissions (t CO_2-e)

D_{HC} = Distance travelled on flights with a haul H and seating class C (km person)

EF_{HC} = Emission factor for direct emissions for flights with a haul H and seating class C (kg CO_2-e/km person)

WTT EF_{HC} = Emission factor for indirect emissions (well to tank) for flights with a haul H and seating class C (kg CO_2-e/km person)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Very Short Haul	7,965	km person	2	t CO_2-e
3	01/01/21-31/12/21	Short Haul	956,701	km person	161	t CO_2-e
3	01/01/21-31/12/21	Long Haul	103,154	km person	21	t CO_2-e
Total for source			**1,067,820**	**km person**	**183**	**t CO_2-e**

4.3.12 Business travel: Accommodation

Staff, postgraduate students and visitors often stay at hotels while travelling to undertake research, teaching and administrative commitments within Australia and internationally.

Activity data

Financial Services provided a report of all expenses related to Tasmanian, mainland and international travel accommodation.

- 31001 Accommodation – Domestic
- 31002 Accommodation – International

The University travel provider made available a report with details of accommodation booked using their services (<25% of total University expense).

Assumptions

As Climate Active-provided emission factors for domestic accommodation are for star-rated hotels (calculated from a Department of Climate Change and Energy Efficiency report on energy consumption and emissions in Australian commercial buildings in 2012), and in the absence of star rating information in the Financial Services report, it is assumed that half of the stays are in 3-star hotels, and half in 4-star hotels. This is a reasonable approach as most of University staff would use this type of accommodation.

It is assumed that the price per night for stays in the University travel provider report is representative of the price for all staff and students stays.

Calculation methodology

The number of nights was estimated from expenditure provided in the Financial Services report by using the average price per night (domestic and international) calculated from the University's travel provider report.

The UK Department of Business, Energy and Industrial Strategy (DBEIS) provides an emission factor for international overnight hotel stays. Different emission factors are provided for a range of countries based on estimates for an overnight stay in an average hotel. The emission factor for international hotel stays was calculated as the average of emission factors for all countries provided, except Australia, as the University Financial Services report does not provide information on countries.

The GHG emissions resulting from travel accommodation are calculated using the number of nights (from total annual expenditure) and the emission factors per night, area and star rating.

Scope	Reporting Period	Emission source	Data Source	Methodology reference	Emission factor (kg CO_2-e/night)
3	01/01/21-31/12/21	Accommodation – Domestic 3-stars	Financial and provider reports	Climate Active Inventory	27.80
3	01/01/21-31/12/21	Accommodation – Domestic 4-stars	Financial and provider reports	Climate Active Inventory	48.65
3	01/01/21-31/12/21	Accommodation – International	Financial and provider reports	DBEIS 2021	45.02

$$E = \sum_R TE_{RS} * EF_{RS}/1000$$

Where:

E = Total GHG emissions (t CO_2-e)
TE_{RS} = Total number of nights for travel accommodation in region R and star rating S (# nights)
EF_{RS} = Emission factor for travel accommodation in region R and star rating S (kg CO_2-e/ night)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Accommodation – Domestic 3-stars	3,421	nights	95	t CO_2-e
3	01/01/21-31/12/21	Accommodation – Domestic 4-stars	3,421	nights	166	t CO_2-e
3	01/01/21-31/12/21	Accommodation - International	152	nights	7	t CO_2-e
Total for source			6,994	**nights**	**268**	**t CO_2-e**

4.3.13 Business travel: Taxis and ride share (domestic)

University staff use taxis and ride share transport for travelling to research, teaching and administrative commitments within Australia.

Activity data

Financial Services provided a report of all expense items (private and University issued credit cards inclusive) recorded against the natural account code below, which include taxi and ride share fares.

- 31021 Other fares/Car hire/Mileage – Domestic

Assumptions

In the absence of more accurate information, ride share average distance and fare per trip were assumed to be the same as for taxis. It is also assumed that the average distance and waiting time per trip has not changed since 2014 (latest data available from the Australian Taxi Industry Association).

Calculation methodology

The reports from Financial Services were analysed to determine which of the expense items related to taxi or ride share fares. This was determined using the 'Narrative Data' of relevant transactions to locate items that contained the words "taxi", "cab" or "yellow" for taxi fares, and "uber" for ride share fares.

Distance per trip was estimated from expenditure by using the national average distance and average price per taxi trip (ATIA 2015). The Australian average was used as there is no information available for Tasmania. In addition, although most transactions would most likely be for Tasmanian transport, location is not always specified in the Financial Services report, which also include trips in the mainland.

Climate Active-provided emission factors for taxi and ride share services (calculated from ATIA statistics), were used to calculate emissions from both sources.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/km)
3	01/01/21-31/12/21	Taxi – national average	Financial Services report	Climate Active inventory	0.1603
3	01/01/21-31/12/21	Ride share – national average	Financial Services report	Climate Active inventory	0.1771

$$E = \sum_T D_T * EF_T/1000$$

Where:

E = GHG emissions (t CO_2-e)
D_T = Total distance by transport mode T ($)
EF_T = Emission factor for transport mode T (kg CO_2-e/km)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Taxi – national average	10,328	km	2	t CO_2-e
3	01/01/21-31/12/21	Ride share – national average	9,011	km	1	t CO_2-e
Total for source			**19,339**	**km**	**3**	**t CO_2-e**

4.3.14 Business travel: Hire cars (domestic)

All fuel used in domestic hire cars has been included in the total fuel reported in Section 4.1.3 Transport fuels. Although these emissions are identified as scope 3 emissions, the scope 1 emissions have been calculated and reported accordingly. Refer to Section 4.1.3 for a detailed explanation.

4.3.15 Staff commuting

Staff at the University of Tasmania use different transport means to travel to and from the different University campuses, including cars, taxis, motorbikes, bicycles, buses, and on foot, as well as train in mainland campuses.

Activity data

The University conducts a biennial Travel Behaviour Survey (TBS; last conducted in 2021) where staff members provide information on their transport habits when travelling to and from the University during a typical week in semester 1. Respondents detail the transport method/s and duration of each trip, together with the suburb in which they reside and the campus they attended, among other information.

Assumptions

TBS 2021 response rate was relatively high (~ 27%), so this is considered to be a representative sample. It is assumed that respondents were representative of all staff.

Only staff driving (either sole or multiple occupant cars) were included. Multi-occupant car passengers are assumed to be already included in those driving multi-occupant cars.

When car size and power source was unknown, cars were considered to be medium size, and the emission factor for unknown fuel used.

It is assumed that all staff use the most direct route between their residence and their main campus. This might not be always the case as some staff undertake other activities on their way to/from work, however as these would not be part of commuting and because of the impossibility of obtaining precise data, this is a reasonable assumption.

It is assumed that all staff take four weeks of paid leave per year. Public holidays were also accounted for (estimated as 10 days, which is less than the current gazetted number of public holidays and thus a conservative estimate). Therefore, it is assumed that commuting was required for 46 weeks a year for all staff.

Calculation methodology

Emissions from commuting were calculated as the emissions from commuting based on the University's TBS 2021. As data was obtained during the pandemic and reflects actual commuting habits, estimated avoided emissions from working from home were not subtracted as in the previous GHG Inventory.

Based on the TBS 2021 results, the number of trips per transport mode was calculated, and the distance between residence and main campus estimated using Google Maps. This data was used to calculate the total distance travelled per transport mode and per state in one typical working week. Distance was then multiplied by the number of working weeks, total number of staff (from the University People and Wellbeing department) and the specific emission factors to estimate the emissions from each transport mode.

Climate Active-provided emission factors (from DBEIS 2021 and ATIA 2015) were used to calculate emissions from staff commuting.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/km)
3	01/01/21-31/12/21	Car – diesel large	Staff survey	Climate Active inventory	0.2578
3	01/01/21-31/12/21	Car – diesel medium	Staff survey	Climate Active inventory	0.2051
3	01/01/21-31/12/21	Car – diesel small	Staff survey	Climate Active inventory	0.1710
3	01/01/21-31/12/21	Car – gasoline large	Staff survey	Climate Active inventory	0.3574
3	01/01/21-31/12/21	Car – gasoline medium	Staff survey	Climate Active inventory	0.2405
3	01/01/21-31/12/21	Car – gasoline small	Staff survey	Climate Active inventory	0.1913
3	01/01/21-31/12/21	Car – hybrid electric large	Staff survey	Climate Active inventory	0.1902
3	01/01/21-31/12/21	Car – hybrid electric medium	Staff survey	Climate Active inventory	0.1381
3	01/01/21-31/12/21	Car – hybrid electric small	Staff survey	Climate Active inventory	0.1330
3	01/01/21-31/12/21	Car – electric only	Staff survey	Climate Active inventory	0
3	01/01/21-31/12/21	Car – unknown medium	Staff survey	Climate Active inventory	0.2216
3	01/01/21-31/12/21	Motorcycle	Staff survey	Climate Active inventory	0.1449
3	01/01/21-31/12/21	Bus	Staff survey	Climate Active inventory	0.1272
3	01/01/21-31/12/21	Taxi TAS	Staff survey	Climate Active inventory	0.1714
3	01/01/21-31/12/21	Taxi NSW	Staff survey	Climate Active inventory	0.1716
3	01/01/21-31/12/21	Train	Staff survey	Climate Active inventory	0.0444

$$E = \sum_{ms} D_{ms} * W * EF_{ms}/1000 * S/SR$$

Where:

E = Total GHG emissions (t CO_2-e)
D_{ms} = Distance travelled for work by survey respondents in a week on transport mode 'm' and state 's' (km)
W = Number of working weeks
EF_{ms} = Emission factor for transport mode m and state s (kg CO_2-e/km)
S = Total number of staff (headcount)
SR = Number of survey respondents (headcount)

Calculated emissions

Travel Behaviour Survey

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Car – diesel large	1,171,977	km	302	t CO_2-e
3	01/01/21-31/12/21	Car – diesel medium	604,599	km	124	t CO_2-e
3	01/01/21-31/12/21	Car – diesel small	319,257	km	55	t CO_2-e
3	01/01/21-31/12/21	Car – gasoline large	809,062	km	289	t CO_2-e
3	01/01/21-31/12/21	Car – gasoline medium	4,914,885	km	1,182	t CO_2-e
3	01/01/21-31/12/21	Car – gasoline small	4,456,297	km	853	t CO_2-e
3	01/01/21-31/12/21	Car – hybrid electric large	25,160	km	5	t CO_2-e
3	01/01/21-31/12/21	Car – hybrid electric medium	262,847	km	36	t CO_2-e

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Car – hybrid electric small	175,496	km	23	t CO_2-e
3	01/01/21-31/12/21	Car – electric only	162,726	km	0	t CO_2-e
3	01/01/21-31/12/21	Car – unknown medium	183,335	km	41	t CO_2-e
3	01/01/21-31/12/21	Motorcycle	272,208	km	39	t CO_2-e
3	01/01/21-31/12/21	Bus	1,081,184	km	138	t CO_2-e
3	01/01/21-31/12/21	Train	658		0	
3	01/01/21-31/12/21	Taxi TAS	13,76	km	2	t CO_2-e
3	01/01/21-31/12/21	Taxi NSW	0	km	0	t CO_2-e
Total for source			14,453,067	**km**	**3,089**	**t CO_2-e**

4.3.16 Working from home (WFH) energy

Some University staff work from home rather than from a University facility. While working from home, staff may use energy for office equipment, lighting and heating/cooling.

Activity data

The number of employees working from home per month was obtained from an internal report on number of staff going through temperature screening stations at University facilities. Going through temperature screening was compulsory and needed for staff to get their access cards activated.

Assumptions

The Climate Active-provided WFH emissions calculator makes several assumptions about average heating/cooling energy use, shared working spaces, type and number of equipment used and the use of lighting. These assumptions have not been altered.

It is assumed that all staff take four weeks of paid leave per year. Public holidays were also accounted for (estimated as 10 days - less than the current gazetted number of public holidays and thus a conservative estimate). Therefore, it is assumed that all staff worked for 46 weeks a year.

Calculation methodology

The Climate Active-provided WFH emissions calculator was used to estimate emissions from energy used by staff working from home.

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	WFH energy	NA		211	t CO_2-e
Total for source			**NA**		**211**	**t CO_2-e**

4.3.17 Catering

Catering is provided for functions on campus such as graduation ceremonies, dinners and receptions, exhibitions and various student, staff and/or community entertainment events.

Activity data

Expenditure on catering was provided by Financial Services. Relevant natural account codes for catering are:

- 32034 Catering
- 33030 Conferences and short courses – Catering/dinners

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

Climate Active-provided an emission factor, which was used to calculate emissions from this source.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2.e/$)
3	01/01/21-31/12/21	Catering	Financial Services report	Climate Active inventory	0.3879

$$E = CE * EF_{CE}/1000$$

Where:

E = GHG emissions (t CO_2-e)
CE = Total catering expenditure ($)
EF_{CE} = Emission factor for catering expenditure (kg CO_2-e/$)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Catering	1,672,702	$	649	t CO_2-e
Total for source			**1,672,702**	**$**	**649**	**t CO_2-e**

4.3.18 Cleaning services

The University outsources cleaning services for facilities under the University's operational control.

Activity data

Expenditure on cleaning services was provided by Financial Services. Relevant natural account codes are:

- 39102 Cleaning – contract
- 39103 Cleaning – non-contract

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

Climate Active-provided an emission factor, which was used to calculate emissions from this source.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2.e/$)
3	01/01/21-31/12/21	Cleaning services	Financial Services report	Climate Active inventory	0.1096

$$E = CS * EF_{CS}/1000$$

Where:

E = GHG emissions (t CO_2-e)
CS = Total cleaning services expenditure ($)
EF_{CS} = Emission factor for cleaning services expenditure (kg CO_2-e/$)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Cleaning services	4,793,239	$	525	t CO_2-e
Total for source			**4,793,239**	**$**	**525**	**t CO_2-e**

4.3.19 Security services

The University outsources security services for facilities under the University's operational control.

Activity data

Total expenditure on security services was provided by Financial Services. Relevant natural account codes for this source are:

- 39112 Security – contract
- 39113 Security – non-contract

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

Climate Active-provided an emission factor, which was used to calculate emissions from this source.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/$)
3	01/01/21-31/12/21	Security services	Financial Services report	Climate Active inventory	0.2319

$$E = SS * EF_{SS}/1000$$

Where:

E = GHG emissions (t CO_2-e)
SS = Total security services expenditure ($)
EF_{SS} = Emission factor for security services expenditure (kg CO_2-e/$)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	Cleaning services	3,012,858	$	699	t CO_2-e
Total for source			**3,012,858**	**$**	**699**	**t CO_2-e**

4.3.20 ICT hardware and telecommunications

University staff and students use Information and Communication Technology (ICT) equipment and telecommunication services for learning and teaching, research and administrative activities.

Activity data

Total expenditure on ICT hardware and telecommunications was provided by Financial Services. Relevant natural account codes for these emission sources are:

- 36310 IT hardware [Asset account]
- 36400 Communications Call Charges
- 36401 Communications Call Charges – Mobiles

- 36418 Internet Charges - AARNET
- 36420 Other Internet Service Providers

Assumptions

No assumptions were required in calculating this emissions source.

Calculation methodology

Climate Active-provided emission factors, which were used to calculate emissions from these sources.

Scope	Reporting period	Emission source	Data source	Methodology reference	Emission factor (kg CO_2-e/$)
3	01/01/21-31/12/21	ICT hardware	Financial Services report	Climate Active inventory	0.1359
3	01/01/21-31/12/21	Telecommunications	Financial Services report	Climate Active inventory	0.1554

$$E = \sum_T IT_T * EF_T/1000$$

Where:

E = GHG emissions (t CO_2-e)
IT_T = Total expenditure on ICT expense type T ($)
EF_T = Emission factor for ICT expense type T (kg CO_2-e/$)

Calculated emissions

Scope	Reporting period	Emission source	Activity data	Unit	GHG emissions	Unit
3	01/01/21-31/12/21	ICT hardware	6,761,496	$	919	t CO_2-e
3	01/01/21-31/12/21	Telecommunications	1,298,431	$	202	t CO_2-e
Total for source			**8,059,927**	**$**	**1,121**	**t CO_2-e**

5 ASSESSMENT OF UNCERTAINTY

There is statistical uncertainty associated with GHG source data, resulting from natural variations (e.g., random human errors in the measurement process) and fluctuations in measurement equipment. Uncertainty associated with quantifying the parameters used as inputs (e.g., activity data and emission factors) arises any time GHG emissions are quantified (The Green House Gas Protocol: Guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty 2003).

An estimate of the data uncertainty has been carried out for each measurement parameter. The total uncertainty is calculated from the square root of the sum of the squares of each uncertainty value. This assessment has been carried out in accordance with the National Greenhouse and Energy Reporting (Measurement) Determination 2008 and the GHG Protocol.

Total uncertainty for the 2021 GHG Inventory was 4.28%.

6 ASSURANCE

The University of Tasmania is committed to periodic (triennial) technical assessment of its carbon footprint. A technical assessment was conducted for the University's 2021 GHG Inventory. Assurance statements when completed are uploaded to the University Sustainability website.

In addition, the University was also audited for its 2019 GHG Inventory by Climate Active as part of their new approach to ensure the ongoing integrity of Climate Active carbon neutral claims.

7 FUTURE IMPROVEMENTS

7.1 Data collection

Bin sensors were trialled in 2021 and will be deployed in all external skips in 2022. Installation of bin sensors will increase data accuracy for waste to landfill and recycling. Additionally, internal audits will be conducted by the new Waste Officer (position created in late 2021).

It is anticipated that transport data for commuting calculations will continue to be collected biennially through the University's Travel Behaviour Survey and associated targeted counting regime. More specific data about car size and fuel will continue to be included in future surveys to increase accuracy.

An investigation of whether more accurate data is possible for business travel accommodation (accommodation stars rating via business travel provider), construction (expenditure on construction materials) and security services (fuel data for security vehicles) is underway.

7.2 Data storage

The University continues to work towards the continuous improvement of the existing Built Environment, Energy and Emissions Register System (BEEERS) so it can be used in the future for the University GHG Inventories record keeping.

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APPENDIX A. SUMMARY OF THE UNIVERSITY GHG INVENTORY 2021

					Emissions by scope (t CO_2-e)			Total emissions (t CO_2-e)
Emissions source		**Activity data**		**Unit**	**1**	**2**	**3**	
Natural gas	Natural gas	52,382	52,382	GJ	2,699		424	424
Stationary fuels and petroleum-based products	Stationary diesel	1,894	27,486	L	5		0	55
	Stationary gasoline	1,325		L	3		0	
	Stationary liquefied petroleum gas	16,317		L	25		2	
	Stationary kerosene	6,900		L	18		1	
	Stationary petroleum-based oils	1,049		L	1		0	
	Dry wood	7,000	7,000	kg	0			
Transport fuels	Transport (pre 2004) diesel	62,162	394,814	L	169		9	1,039
	Transport (post 2004) diesel	121,872		L	331		17	
	Transport (post 2004) gasoline	210,780		L	487		26	
Electricity	Electricity – TAS (incl generation)	45,327,069	46,743,712	kWh		6,324	903	7,705
	Electricity - NSW	90,111		kWh		70	6	
	Electricity - SA	52,887		kWh		16	4	
	Electricity - NT	51,319		kWh		28	2	
	Electricity - WA	23,333		kWh		16	0	
	Electricity – TAS scope 3 facilities	991,025		kWh		139	20	
	Electricity - NSW scope 3 facilities	207,968		kWh		162	15	
Refrigerant gas	Refrigerant gas 134a	10	230	kg	13			588
	Refrigerant gas 404a	76		kg	299			
	Refrigerant gas 407c	26		kg	41			
	Refrigerant gas 410	80		kg	153			
	Refrigerant gas 427a	-		kg	-			
	Refrigerant gas 438a	40		kg	81			

					Emissions by scope (t CO_2-e)			Total emissions (t CO_2-e)
Emissions source		**Activity data**		**Unit**	**1**	**2**	**3**	
Livestock	Dairy cows	285	481	head/yr	742			1,088
	Other livestock	196		head/yr	346			
Waste to landfill and recycling	Domestic waste to landfill	2,124	2,646	t			3,399	3,399
	Recycled waste	522		t			-	
Sanitary waste	Sanitary waste	79	79	t			159	159
Water	Water	220,632	220,632	kL			42	42
Waste water	Waste water	1,764	1,764	ETs/yr			316	316
Construction	Construction	61,533,091	61,533,091	$			2,872	2,872
Office paper	Virgin paper	911	24,049	kg			1	36
	Recycled paper	23,093		kg			35	
	Carbon neutral paper	45		kg			-	
Paper tissue	Paper towels and toilet tissue	32	32	t			75	75
Business travel: Flights	Very Short haul	7,965	1,067,820	km			2	183
	Short haul	956,701		km			161	
	Long haul	103,154		km			21	
Business travel: Accommodation	Accommodation - Domestic	6,842	6,994	nights			262	268
	Accommodation - International	152		nights			7	
Business travel: Taxis	Taxis – Domestic	10,328	19,339	km			2	3
	Ride share - Domestic	9,011		km			2	
Staff Commute	Car	13,085,642	14,453,067	km			2,910	3,089
	Motorcycle	272,208		km			39	
	Bus	1,081,184		km			138	
	Taxi	13,376		km			2	
	Train	658		km			0	
Working from home (WFH)	Energy (WFH)						211	211

					Emissions by scope (t CO_2-e)			Total emissions (t CO_2-e)
Emissions source		**Activity data**		**Unit**	**1**	**2**	**3**	
Catering	Catering	1,672,702	1,672,702	$			649	649
Cleaning services	Cleaning services	4,793,239	4,793,239	$			525	525
Security services	Security services	3,012,858	3,012,858	$			699	699
ICT	ICT hardware	6,761,496	8,059,927	$			909	1,121
	Telecommunication services	1,298,431		$			202	
TOTAL GHG EMISSIONS					**5,415**	**6,754**	**15,076**	**27,246**

APPENDIX B. CHANGE IN EMISSIONS 2020 TO 2021

The following table shows the change in GHG emissions from 2020 to 2021. It is important to note however that comparison between years may not be indicative of emissions reduction measures because of the change in methodology for a number of sources following changes on reporting requirements from Climate Active and NGA emission factor changes, as well as the impact of the COVID-19 pandemic.

Emission sources that had a change in methodology are marked with an asterisk (*) but have not been recalculated.

Emissions source		2020 emissions (t CO_2-e)	2021 emissions (t CO_2-e)	Change in emissions (%)
Natural gas	Natural gas	2,726	3,124	15%
Stationary fuels and petroleum-based products	Stationary diesel	32	5	-83%
	Stationary gasoline	6	3	-48%
	Stationary liquefied petroleum gas	33	27	-17%
	Stationary kerosene	5	19	>100%
	Stationary petroleum-based oils	0	1	>100%
	Dry wood	0	0	40%
Transport fuels (incl hire cars)	Transport (pre 2004) diesel	114	178	56%
	***Transport (post 2004) diesel** *	270	348	29%
	***Transport (post 2004) gasoline** *	322	513	59%
Electricity	Electricity - TAS	7,327	7,386	1%
	Electricity - NSW	2,556	253	-90%
	Electricity - SA	29	20	-32%
	Electricity - NT	35	30	-16%
	Electricity - WA	15	16	4%
Refrigerant gas	Refrigerant gas 134a	232	13	-94%
	Refrigerant gas 404a	336	299	-11%
	Refrigerant gas 407c	4	41	>100%
	Refrigerant gas 410	259	153	-41%
	Refrigerant gas 427a	1	0	-100%
	Refrigerant gas 438a	46	81	76%
Livestock	Dairy cows	970	742	-23%
	Other livestock	362	346	-4%
Waste to landfill and recycling	***Domestic waste to landfill** *	2,362	3,399	44%
	***Recycled waste** *	0	0	NA
Sanitary waste	Sanitary waste	69	159	>100%
Water	Water	46	42	-10%
Wastewater	Wastewater	230	316	38%
Construction	Construction	1,824	2,872	57%

Emissions source		2020 emissions (t CO_2-e)	2021 emissions (t CO_2-e)	Change in emissions (%)
Office paper	Virgin paper	3	1	-71%
	Recycled paper	26	35	37%
	Carbon neutral paper	0	0	NA
Washroom paper	Paper towels and toilet tissue	72	75	4%
Business travel: Flights	Very short haul	12	2	-81%
	Short haul	465	161	-65%
	Long haul	724	21	-97%
Business travel: Accommodation	Accommodation – Domestic	187	262	40%
	Accommodation – International	62	7	-89%
Business travel: Taxis and ride share	Taxis – Domestic	9	2	-81%
	Ride share – Domestic	4	2	-57%
Staff Commuting	***Car** **	1,646	2,910	77%
	Motorcycle	8	39	>100%
	Bus	48	138	>100%
	Taxi	10	2	-79%
	Train	0	0	NA
Catering	Catering	623	649	4%
Cleaning Services	Cleaning Services	812	525	-35%
Security Services	Security Services	860	699	-19%
ICT hardware	ICT hardware	1,507	919	-39%
Telecommunications	Telecommunications	216	202	-7%
TOTAL CHANGE		**28,050**	**27,246**	**-3%**

APPENDIX C. UNIVERSITY OF TASMANIA AUSTRALIAN FACILITIES