Energy and Carbon Annual Report 2022/23

Issue Date	Revision	Authors	Comments
12.06.2024	1st Issue	A. Thomas, S. Shaw, R. Heymer,	New Document
19.06.2024	Final	A. Thomas, S. Shaw, R. Heymer,	Student Travel emissions and dependant totals and charts updated.

List of Charts

Definitions

Scope 1 Carbon emissions are direct emissions from sources owned or controlled by the University. These emissions primarily result from the burning of natural gas in boilers and combined heat and power engines with a small contribution from other fuel sources used for heating and University owned transport.

Scope 2 Carbon emissions are indirect emissions from the generation of energy purchased by the University.

For the University these emissions are wholly due to the purchase of grid electricity. For the 2022/23 reporting year the University purchased 100% renewable (zero carbon) electricity, UK Government guidelines still require that we report Scope 2 emissions based on the grid electricity consumed which, in practice, is a mix of all grid generation sources (fossil fuel generation as well as renewable). In this report, to illustrate the positive impact of purchasing renewable electricity, Scope 2 figures are calculated on the basis of both methodologies (the grid average, referred to as *Location based emissions* and the purchased electricity carbon intensity known as *Market based emissions*)

Scope 3 Carbon emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the University, including both upstream and downstream emissions. The main sources of Scope three emissions at the University are travel and procurement, of which, building construction and maintenance are the largest components.

Abbreviations

BMS – Building Management System

CCSG – Campus Commercial Services Group

CCL – Climate Change Levy

CEC – Cryfield Energy Centre

CHP – Combined Heat and Power. Specifically refers to the gas fired CHP generators used by the University

DESNZ – Department for Energy Security and Net Zero

FTE – Full Time Equivalent

GDP – Gross Domestic Product

GHG – Green House Gas

HVAC – Heating Ventilation and Air Conditioning

EIC – Energy Innovation Centre

IMC – International Manufacturing Centre

IT – Information Technology

ITS – Information Technology Services

kWh – Kilowatt Hour

LPG – Liquid Propane Gas

m^2 – Metre squared

m^3 – Metre cubed

MCCB – Mechanochemical Cell Biology

MEC – Main Energy Centre

MWh – MegaWatt Hour

NUS – National Union of Students

PV - Photovoltaic

tCO_{2e} – Tonnes of Carbon Dioxide Equivalent. (All greenhouse gas emissions combined and expressed in terms of carbon dioxide equivalent)

UWSP – University of Warwick Science Park

WBS – Warwick Business School

WTT – Well to Tank

1 Executive Summary

This report provides an update on energy and water usage, Scope 1, 2 and 3 carbon dioxide emissions for the University during the 2022/23 reporting year and includes discussion on significant changes between years.

This report provides information relevant to the Operational Pathway of the Way to Sustainable Strategy[1]:

The report covers the period from 01st August 2022 to 31st July 2023. Changing working and studying practices that occurred because of the COVID-19 pandemic continued to have both positive and negative impacts on the University's carbon emissions across all scopes and energy and water demands. Despite increasing on 21/22 levels, University water usage, which is linked to campus population, has not returned to pre-pandemic levels and emissions from commuting remain below historical levels. However, the more challenging-to-quantify scope 3 emissions related to energy used by staff working at home have increased.

Absolute location-based scope 1 and 2 carbon emissions, including those resulting from 3rd party operations on the University campuses reduced by 1.8% compared to the previous year to 39,092 tCO_{2e}. Emissions excluding third parties were 37,180 tCO_{2e}, a 2.5% reduction on 2021/22. Despite colder weather in 22/23 compared to the previous year, savings in carbon emissions related to heating were realised through a comprehensive building recommissioning programme and were supported by reduced operation of the Universities significant gas fired combined heat and power installations. The increased volumes of certified renewable electricity purchased in the 2022/23 reporting year resulted in a significant reduction of "market-based Scope 1 and 2 emissions" – those calculated based on the electricity suppliers declared emissions.

University scope three carbon emissions are estimated at 146,412tCO_{2e} for the reporting year 2022/23 using available data and estimates. Ongoing refinement of calculation methods and new data sources are improving reporting of Scope 3 emissions. Following latest guidance from the Environmental Association for Universities and Colleges (EAUC) a major change in the calculation methodology for emissions related to procurement has resulted in significant increases in estimated emissions in this category – a re-baselining exercise has been carried out to enable comparison with historical data.

There are many activities within the Estates Department that directly respond to the University Climate Emergency declaration, including but not limited to, the following.

- *The Department provide leadership, insight into sources of emissions and broad ranging proposals for improvements across all areas of emissions to the Environment and Social Sustainability Action Group (ESSAG) which has Group objectives including the development of a culture of sustainability, raising awareness, and promoting broader environmental and social sustainability.*

- *The Estates Team lead on multiple initiatives within the Energy Action Group (EAG) supporting activities to reduce energy usage and costs with a specific emphasis on Scope 1 and 2 carbon emissions.*

- *The Transport and Mobility team are focussed on continuing to create positive modal shift through the implementation and evolution of new and existing initiatives and disincentivise the use of single occupancy private vehicle use through a daily charging*

[1] https://warwick.ac.uk/sustainability/strategy/the_way_to_sustainable_-_final.pdf

parking system and the promotion of hybrid working. The team will also be focussing on sustainable business travel including creating a carbon allowance for departments to become more accountable for their travel needs.

- *The Energy and Sustainability team continue to support the Behavioural Change programme including the Green Champion network and Laboratory Efficiency Assessment Framework (LEAF), working closely with stakeholders across the University to tackle energy consumption and identify savings and efficiencies that can be actioned. This will include making departments more accountable for their energy use.*

- *The Capital Programme Team are focussed on energy performance improvement in new builds and refurbishments through the implementation of new, ambitious, energy performance and embodied carbon standards.*

- *The Building Optimisation Working Group have been very effective at reducing energy demands through optimisation of existing building management systems.*

- *Working with the Estates information team, the Energy and Sustainability team are providing more energy, water, and carbon data to end users than ever before alongside insight into the drivers of carbon emissions across all scopes.*

- *The Estates Finance, Maintenance and Energy teams are working more closely to improve certainty on energy supply and cost planning in the context of an increasingly volatile cost environment.*

2 University Carbon Targets – A Look Forward

The University of Warwick declared a Climate Emergency on the 20th of September 2019 and has published its Way to Sustainable Strategy.

As part of the Climate Emergency Declaration, the University has committed to reach net zero carbon for scopes 1 and 2 by 2030. We have also committed to achieving net zero for all our direct and indirect emissions (Scope 1, 2 and 3) by 2050.

To achieve this, we need to dramatically increase our carbon efficiency and change to a reduction pathway. We are aware that we will not be able to achieve these ambitious targets without the alignment of policies and infrastructure such as public transport and ongoing decarbonisation of the UK electricity grid. That will depend on national governments (and our partners in local and regional policymaking) delivering on their commitments in those areas and creating and sustaining a supportive and enabling environment.

First Steps

The University has already operated its campus as a local energy system for two decades. Despite significant University growth, including a 40% increase in floor area since 2005/06, a programme of investment alongside the decarbonisation of the electricity grid have reduced Scope 1 (direct) & Scope 2 (indirect) emissions by 10% over the same time. The energy infrastructure developed over recent years has positioned the University well to integrate low carbon technology at scale.

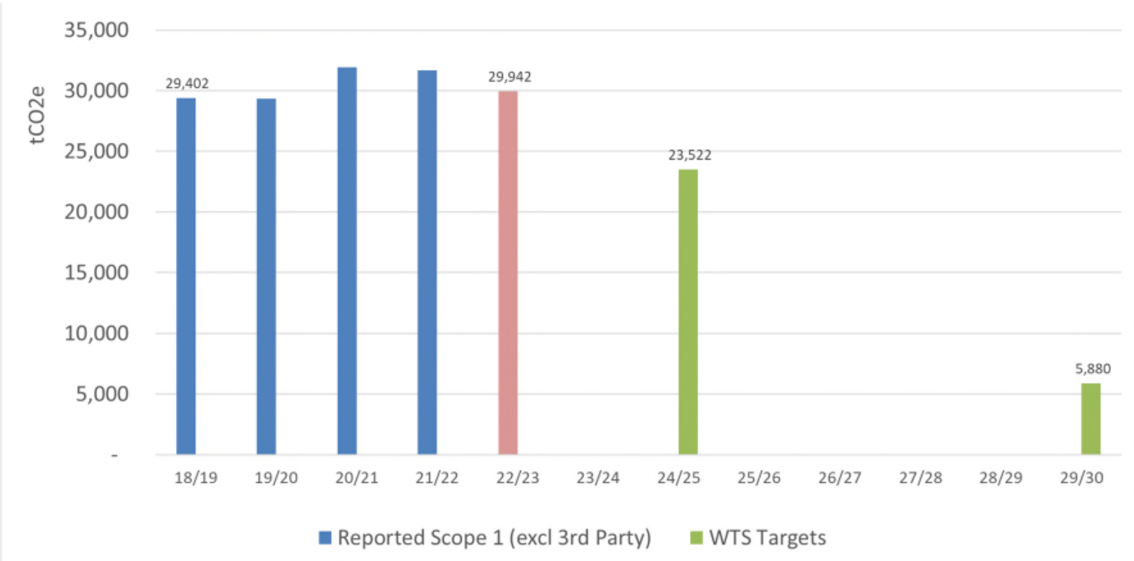
Our Future – Sustainable Operations:

The Way to Sustainable Strategy includes an explicit commitment to develop sustainable transport, energy and a green campus and embed sustainable development principles across our strategies and delivery plans, these are described in the following goals.

Energy

Our overall goal is to get to net zero carbon from the energy we use by 2030. Since October 2021, 100% of the electricity we have purchased has come from green sources, and we are setting a target to reduce the University's Scope 1 emissions by 20% by 2025 and by 80% by 2030 based on a 2018/19 baseline year. The chart below illustrates these targets.

Chart 1: Annual Scope 1 CO_{2e} Emissions – Way to Sustainable targets.



Transport and Mobility

Our goal is to reduce indirect carbon emissions generated through all forms of transport and mobility to achieve net zero by 2050. If we are going to achieve this, we need to work closely with our communities as we introduce, test, learn and champion greener, cleaner forms of transport.

Campus construction, maintenance, and repair

We have aspired to high levels of building quality and performance since 2015, targeting BREEAM 'Excellent' and EPC A standards, well exceeding regulatory building standards. Our mission is to ensure that our new construction projects across our campuses are net zero carbon developments, and to build and refurbish our stock in an environmentally responsible manner, considering the whole life cycle carbon emissions from our real estate.

Ecology and Biodiversity Net Gain

Our goal is to enhance campus biodiversity, targeting a minimum 10% net gain compared with pre-development.

Reducing waste:

Our goal is to reduce the total volume of waste produced by Warwick and increase volumes that are reused and recycled.

Water:

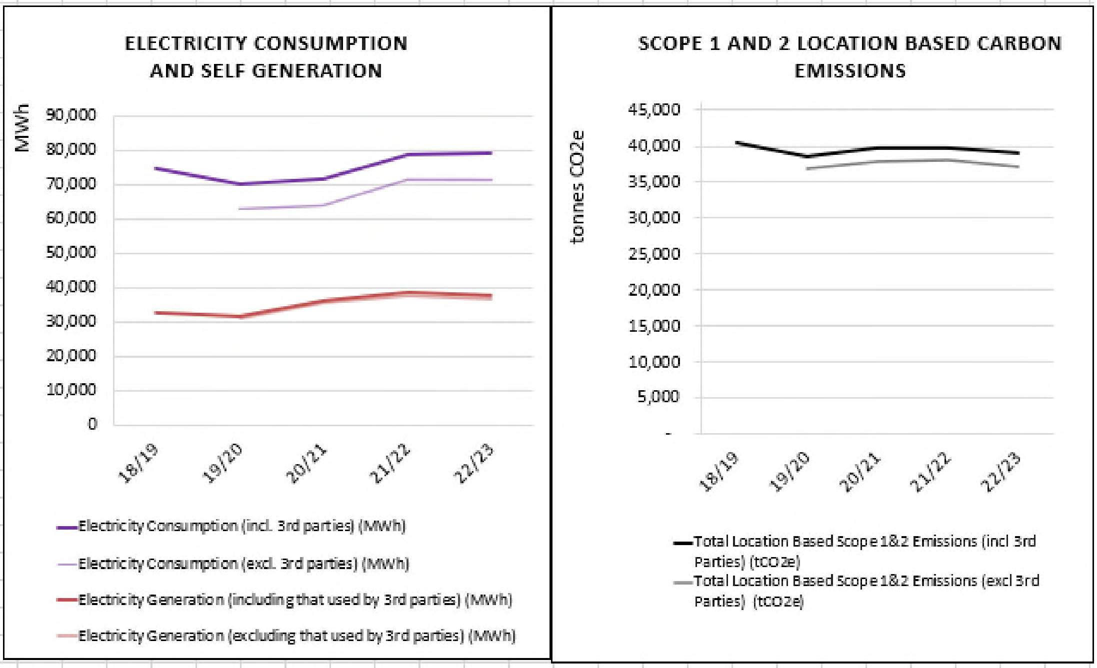
Our goal is to reduce total campus water consumption, in the interest of reducing carbon associated with water treatment but also to ensure that we preserve this valuable resource.

-

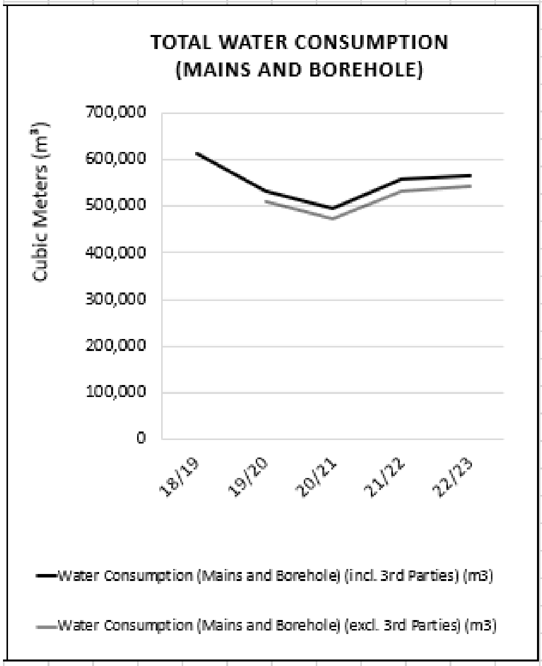
3 Key Statistics

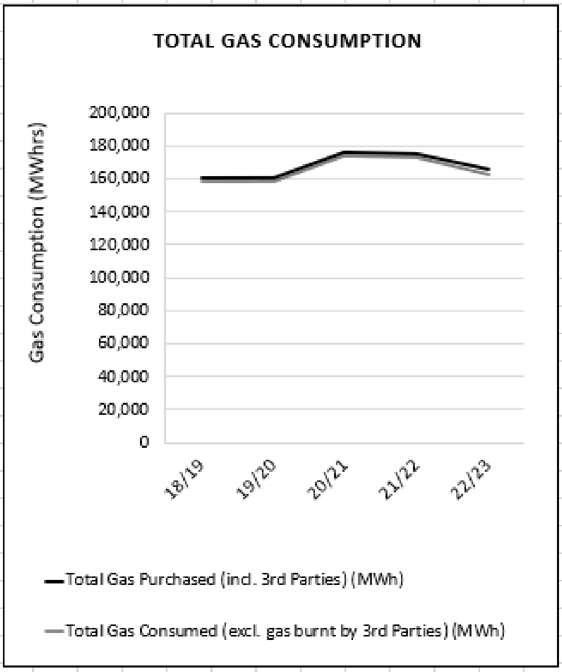
	Budget / Target [excl. 3rd parties]	2022/23 Actuals [excl. 3rd parties]
Electricity Consumption (MWh)	75,545 [68,012]	79,441 [71,562]
Electricity Generation (MWh)	40,251	37,739 [36,606]
Gas Consumption (MWh)	180,346	165,883 [163,069]
Location Based Scope 1 and 2 Carbon Emissions (tCO_{2e})	39,296	39,092 [37,180[2]]
Water Consumption (Mains and Borehole) (m^3)	517,847 [495,267]	565,029 [542,425]

Chart 2: University Tier 1 Energy and Sustainability Metrics



[2] Total Location Based Scope 1 and 2 emissions from University activities (tCO_{2e}) including gas burnt in UoW energy centres for the provision of heat and electricity to 3rd parties.


TOTAL WATER CONSUMPTION
(MAINS AND BOREHOLE)
Cubic Meters (m³)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
18/19
19/20
20/21
21/22
22/23
Water Consumption (Mains and Borehole) (incl. 3rd Parties) (m3)
Water Consumption (Mains and Borehole) (excl. 3rd Parties) (m3)


TOTAL GAS CONSUMPTION
Gas Consumption (MWhrs)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
18/19
19/20
20/21
21/22
22/23
Total Gas Purchased (incl. 3rd Parties) (MWh)
Total Gas Consumed (excl. gas burnt by 3rd Parties) (MWh)

4 Scope 1 and 2 Carbon Emissions

4.1 Carbon Reporting

Coverage: Historically, the University has been reporting energy and Scope 1&2 carbon emissions inclusive of third parties supplied via a University energy contract. In recent years, this method of reporting has included increasing numbers of third parties, organisations based on the University campus who are financially and operationally independent of the University. Several off-campus University facilities have also been identified (where the University is not necessarily the primary energy bill payer) but the University has control over the energy usage and where emissions should be accounted for. To address this, we are now reporting both "inclusive" and "exclusive" energy and carbon data, which will provide a better indication of emissions related to University of Warwick activities and is aligned to the GHG reporting protocol. Appendix 7 lists the 3rd party exclusions and offsite additions that were made for 2022/23.

Scope 1 Carbon emissions are direct emissions from sources owned or controlled by the University. These emissions primarily result from the burning of natural gas in boilers and combined heat and power engines, and a small contribution from other fuel sources and the release of fluorinated gases, primarily from refrigeration equipment. Where emissions occur in the generation of heat or electrical power supplied to third parties these are indicated in our reporting.

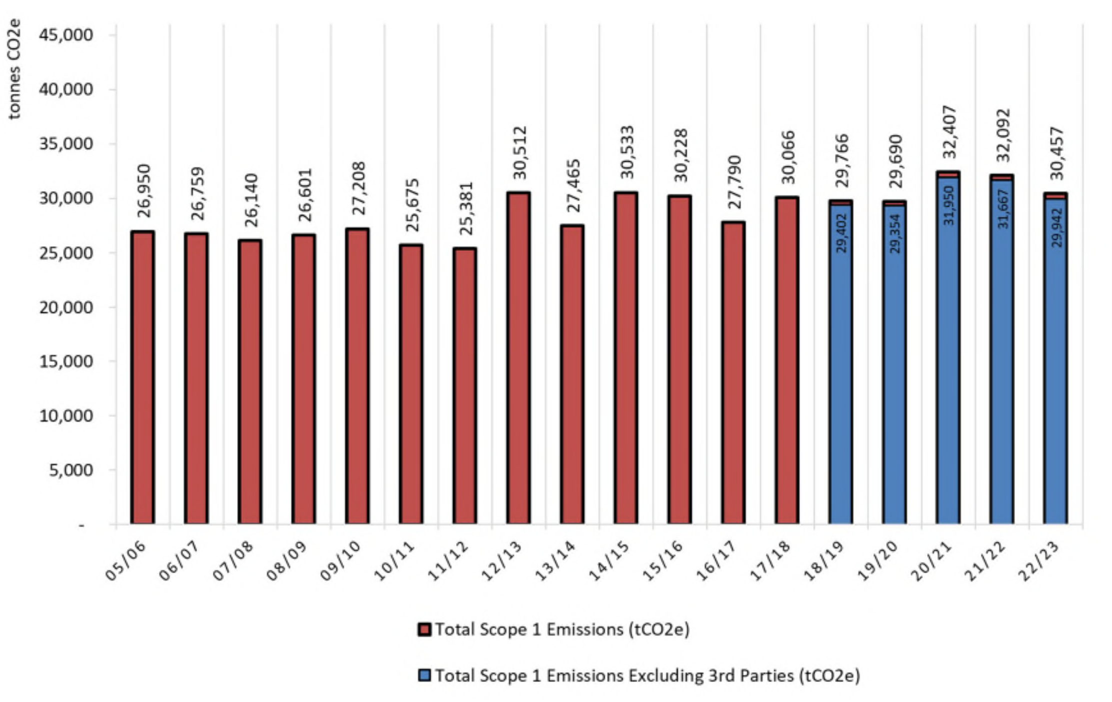
Scope 2 Carbon emissions are indirect emissions from the generation of energy purchased by the University. For the University these emissions are wholly due to the purchase of grid electricity. Although we now purchase 100% renewable (zero carbon) electricity, UK Government guidelines require that we report Scope 2 emissions based on the grid electricity consumed, which, in practice, is a mix of all grid generation sources (fossil fuel generation as well as renewable) – these are referred to as **location-based emissions**. A secondary reporting line is used showing the effect of the type of electricity purchased – and known as **market-based emissions**.

4.2 Scope 1 Emissions

Total University Scope 1 emissions, including third parties, for the year 2022/23 were 30,457 tonnes CO_2e. Total emissions from University of Warwick activities alone were 29,942[3] tonnes CO_2e, a reduction of 5.4% on the previous year.

[3] **Note "University Activities" here include the consumption of gas in energy centres for the supply of heat and electricity to 3rd parties, emissions of 1,520 tCO_{2e} in 2022/23.**

Chart 3: Total Annual Scope 1 CO_{2e} Emissions



The 22/23 reporting year was slightly colder overall than 21/22 (1,943 heating degree days[4] in 2022/23 compared to 1,858 in 2021/22). Despite this, significant efforts to reduce heating in buildings resulted in a reduction in gas consumption. These savings were further improved through a reduction in the operation of the University's substantial gas fired combined heat and power (CHP) installations, resulting in a significant overall reduction in gas consumption and associated Scope 1 carbon emissions. This data currently excludes emissions resulting from leakages of refrigerant gases. We are developing our data processes and will be reporting F gas emissions for 23/24.

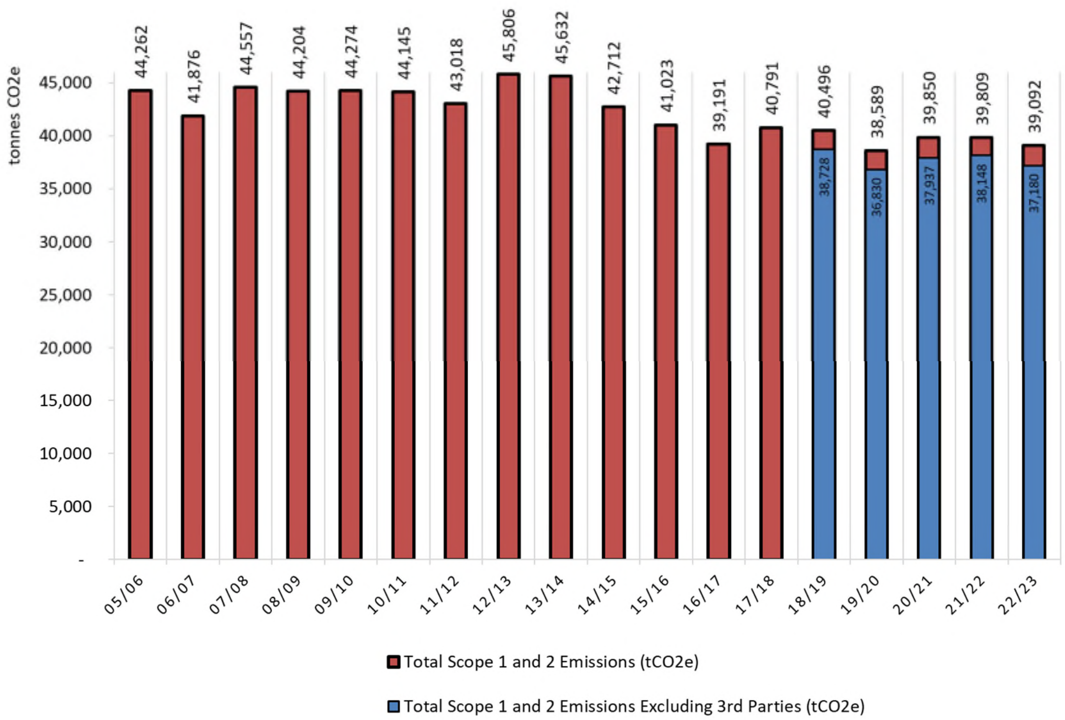
4.3 Total Reportable Scope 1 and 2 Emissions

Total University combined Scope 1 and 2 emissions including third parties for the year 2022/23 were 39,092 tonnes CO_{2e}, a reduction of 1.8% on the previous year. Total emissions from University of Warwick activities alone were 37,180[5] tonnes CO_{2e}, a reduction of 2.5% on the previous year. Emissions from 3rd parties amounted to approximately 5% of emissions. These emissions are shown in the chart below.

[4] Heating degree days give an indication of the thermal energy required for heating based on outside air temperatures.

[5] Total Location Based Scope 1 and 2 emissions from University activities (tCO_{2e}) – excluding 3rd parties. When excluding emissions from UoW energy centres created in the supply of heat and electricity to 3rd parties this figure is 35,660 tonnes CO_{2e}.

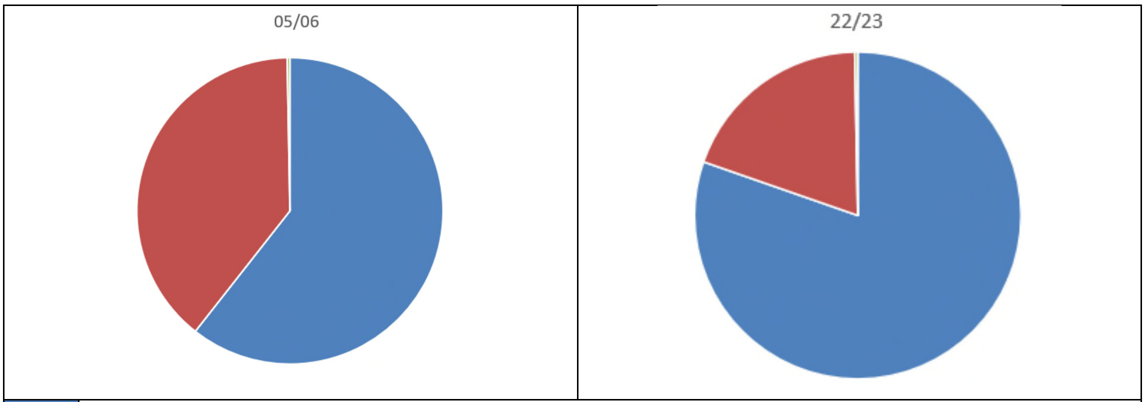
Chart 4: Total Annual Location Based Scope 1 and 2 CO2 Emissions



Location based Scope 1 and 2 emissions, both inclusive and exclusive of 3rd parties showed an overall decrease between 21/22 and 22/23. The changes in Scope 1 emissions are described above. Scope 2 emissions increased by 11.9% compared to 21/22, primarily due to a 7.1% increase in location-based carbon intensity and a 4.5% increase in purchased grid electricity. This increase is due to increased electricity consumption and the reduced generation of electricity onsite from gas fired CHP, leading to increased Scope 2 emissions (but a greater reduction in Scope 1 emissions).

The following charts shows how the decarbonisation of grid electricity and increased utilisation of onsite gas fired combined heat and power has changed the makeup of Scope 1 and 2 emissions since 2005/06.

Chart 5: Total Annual Scope 1 and 2 CO_{2e} Emissions: Changing Sources

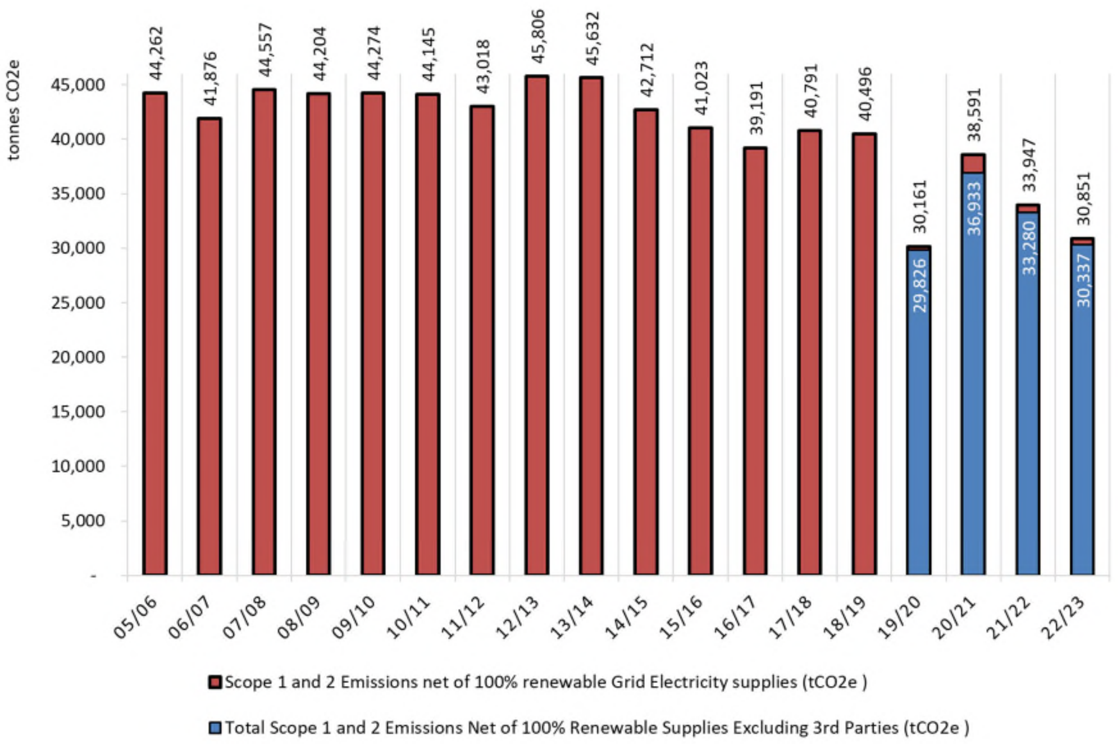


	Total Gas Emissions (tCO_{2e}) - Scope 1
	Total Grid Electricity Emissions (tCO_{2e}) - Scope 2
	Fleet Diesel, Fleet Petrol, Burning Oil and LPG emissions (tCO_{2e}) (<1%) - Scope 1

4.4 Renewable Grid Electricity Contracts

The University is committed to purchasing renewable electricity. The University has had contracts with renewable electricity providers for its main supplies previously, although this has not been continuous through historical reporting periods. Grid electricity purchased during the 22/23 report year was wholly from renewable sources- the chart below shows the impact of a renewable electricity contracts over recent years.

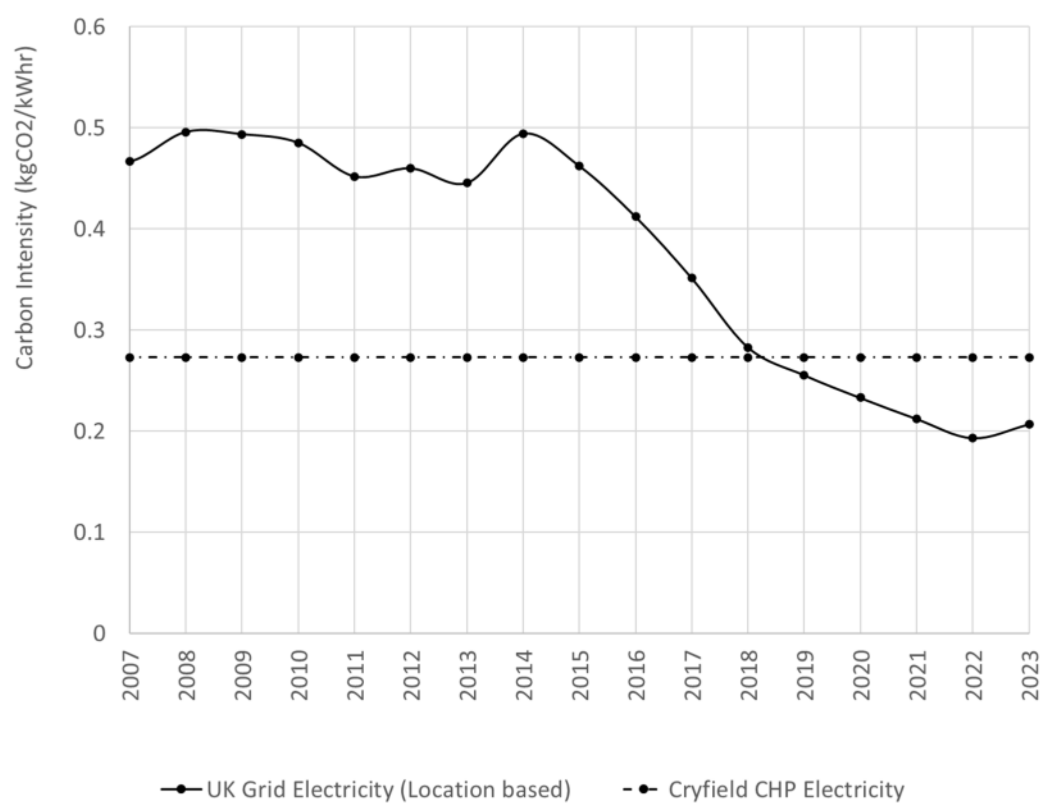
Chart 6: Total Annual Scope 1 and 2 CO2 Emissions net of Grid Electricity Emissions where supply is 100% renewable (Market based emissions).



4.5 Carbon Factors

Scope 1 and 2 CO_{2e} emissions are calculated according to DEFRA guidance using published average annual carbon intensity factors for consumed energy. The carbon intensity of grid electricity increased in 22/23 on the previous year for the first time in several years. The chart below shows the change in grid electricity carbon intensity over the period of University carbon reporting compared to the carbon intensity of electricity generated by Cryfield CHP (the most efficient of the University's combined heat and power engines).

Chart 7: Historical Grid Electricity Carbon Factors and Cryfield CHP Electrical Carbon Factor for Comparison



The carbon content of University self-generated electricity now exceeds the UK grid average. Consequently, our CHP operation does not contribute to reducing the University's carbon emissions. In August 2023 the Main Energy Centre CHP engines were de-prioritised to "heat source of last resort".

Though de-prioritising CHP for our electricity production reduces the University's carbon emissions overall, certain, outdated, reporting standards may show an inverse trend. Display Energy Certificates (DEC) calculate the Operational Rating of a building based on emission factors dating back to the scheme's introduction in 2008, and as such assign a higher emission factor to grid electricity than to CHP-produced electricity, even though this may no longer be accurate. As a result, de-prioritising CHP production and increasing our consumption of grid electricity may mean that the DEC Operational Ratings of campus buildings worsen.

4.6 Relative Carbon Emissions

The following charts show carbon emissions relative to FTE, income, and floor area.

Chart 8: Scope 1 and 2 Location Based Carbon Emissions per Person

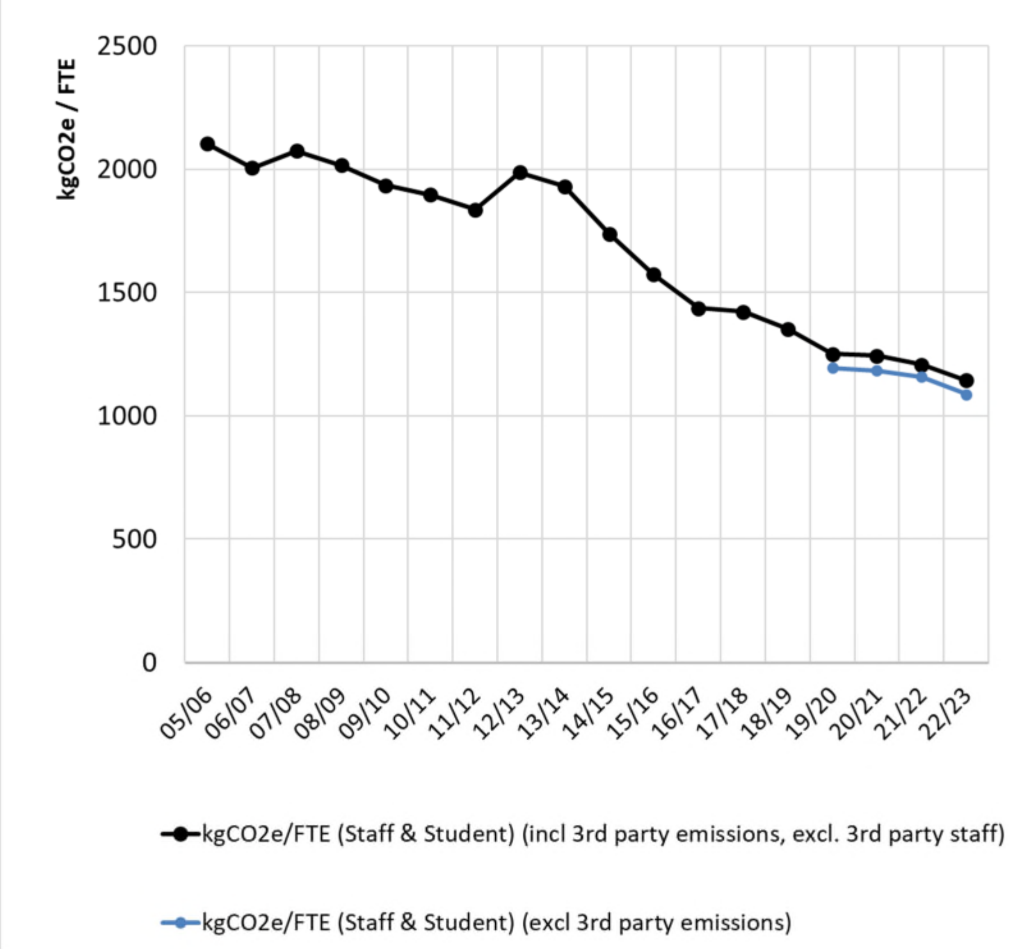


Chart 9: Scope 1 and 2 Location Based Carbon Emissions per £ income (GDP Deflator Applied)

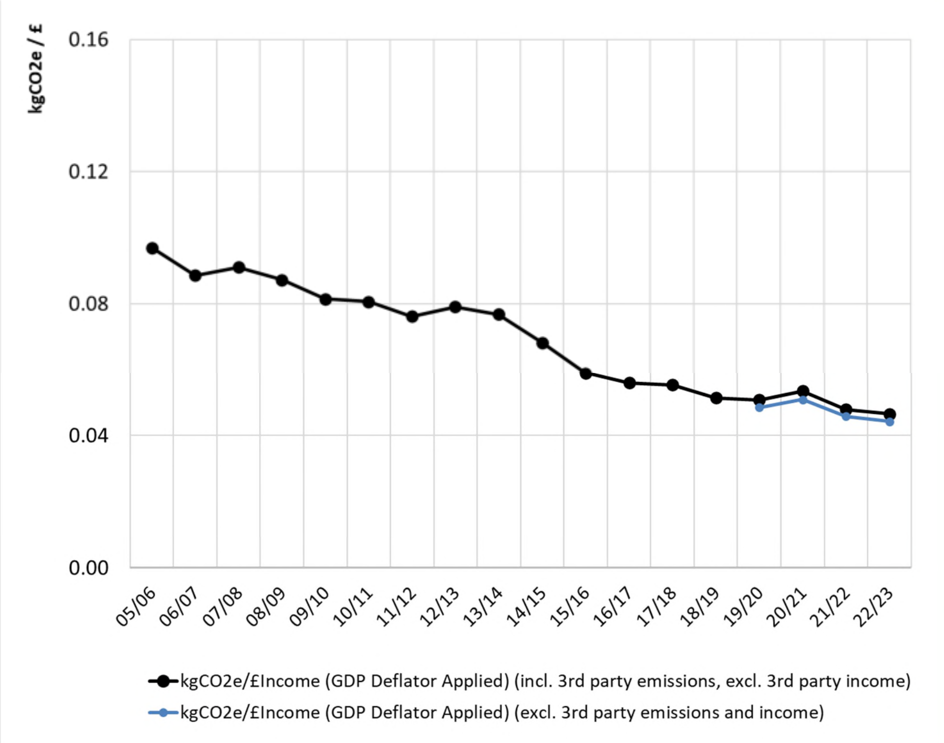
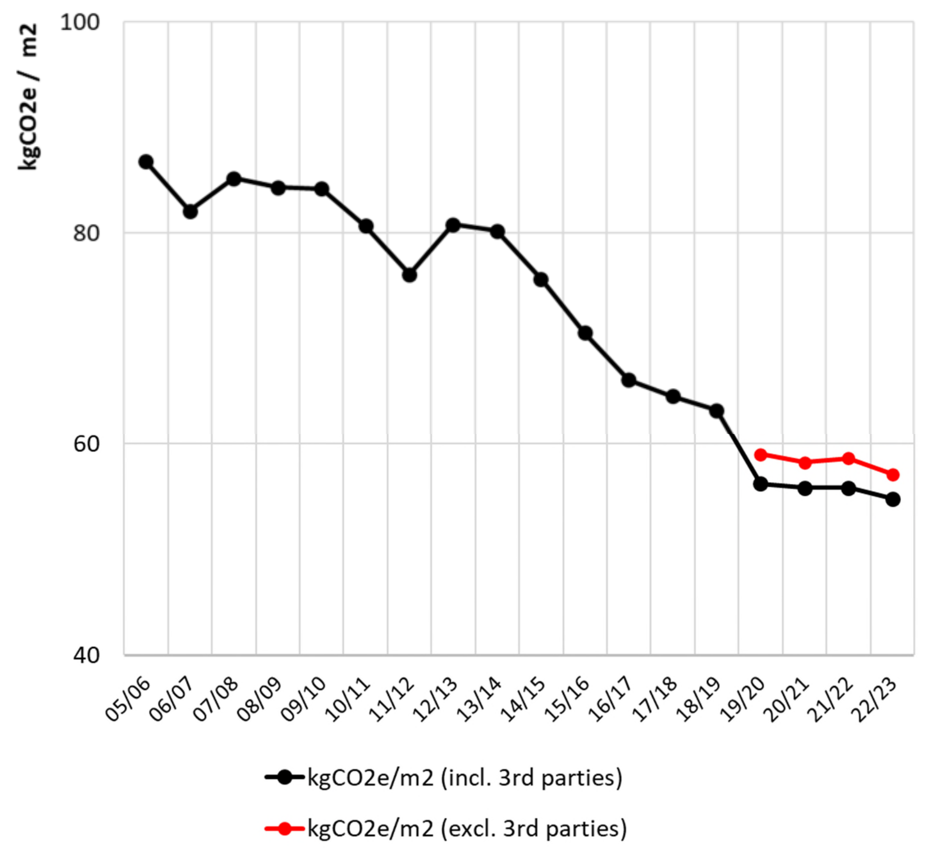


Chart 10: Scope 1 and 2 Location Based Carbon Emissions per m² of Floor area.



4.7 Scope 1 & 2 Carbon Emissions by Building

4.7.1 All Buildings

Table 1 Top 10 Buildings by Total Location Based Scope 1 and 2 CO_{2e} Emissions.

	Building	tonnes CO_{2e}
1	Lord Bhattacharyya Building	2273
2	University House	1099
3	Argent Court Data Centre	887
4	Warwick Arts Centre	852
5	Sports Hub	846
6	Science Block D	841
7	Science Block F	751
8	Gibbet Hill Academic Building	676
9	Physics	675
10	Heronbank Residences N&E Courts	658

The top 10 buildings by carbon intensity are shown below. Science and research buildings make up nine out of the top ten buildings, indicating that building usage as well as building age and design are a strong determinant of emissions.

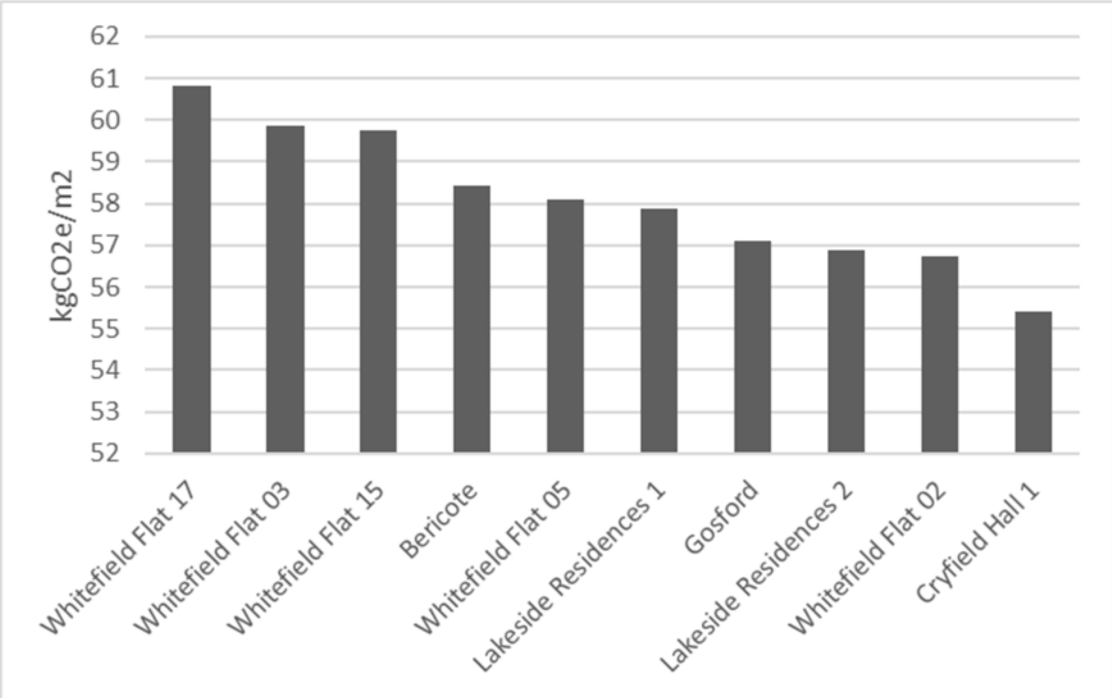
Table 2 Top 10 Buildings by CO_{2e} Emissions per Unit Floor Area

	Building	tonnes CO_{2e} /m^2
1	Argent Court Data Centre	1.94
2	Battery Testing Unit	0.71
3	Biotechnology (Phase 4)	0.33
4	Mechanochemical Cell Biology	0.23
5	Transgenic Plants Laboratory	0.22
6	Phytobiology Facility	0.18
7	Science Block B	0.15
8	Science Block C	0.15
9	Materials and Analytical Sciences Building	0.14
10	Bio-Medical Research Building	0.13

4.7.2 Residences

Tables of the top 10 residences by total emissions and emissions per unit floor area are shown in Appendices 3 and 4. Total annual emissions in residences are strongly influenced by the let period with some residences occupied most of the year while others may have low levels of occupancy for up to 22 weeks. The following chart compares the emissions per unit floor area. The main differences are the emissions from gas and heat consumption. These generally fall in line with the age of the residences (Westwood residences being amongst the oldest). The thermal energy consumption of more recent residences (Sherbourne) is less than half of the worst performing residences on this chart.

Chart 11: Top 10 Residential kgCO$_2$ per m^2 Floor Area



5 Energy

Total energy consumption, including grid and self-generated electricity, heat from energy centres and gas into non-energy centre boilers (firm gas), including third party consumption decreased by 4.7% compared to 21/22. This followed a significant effort on campus Building Energy Management System recommissioning project, reversing a recent upward trend caused by additional buildings and data facilities.

The chart below indicating total energy consumption has been relatively consistent over the full period of reporting despite significant increases in University size, population and activity. The increase between 2016/17 and 17/18 was mainly attributable to the Lord Bhattacharyya building. The relatively small impact of the COVID-19 pandemic in 2019/20 is indicative of some of our most energy intensive energy uses being independent of campus population (e.g. science research and data processing).

Chart 12: Total Energy Consumption (excl. Petrol, Diesel and LPG (<1%))

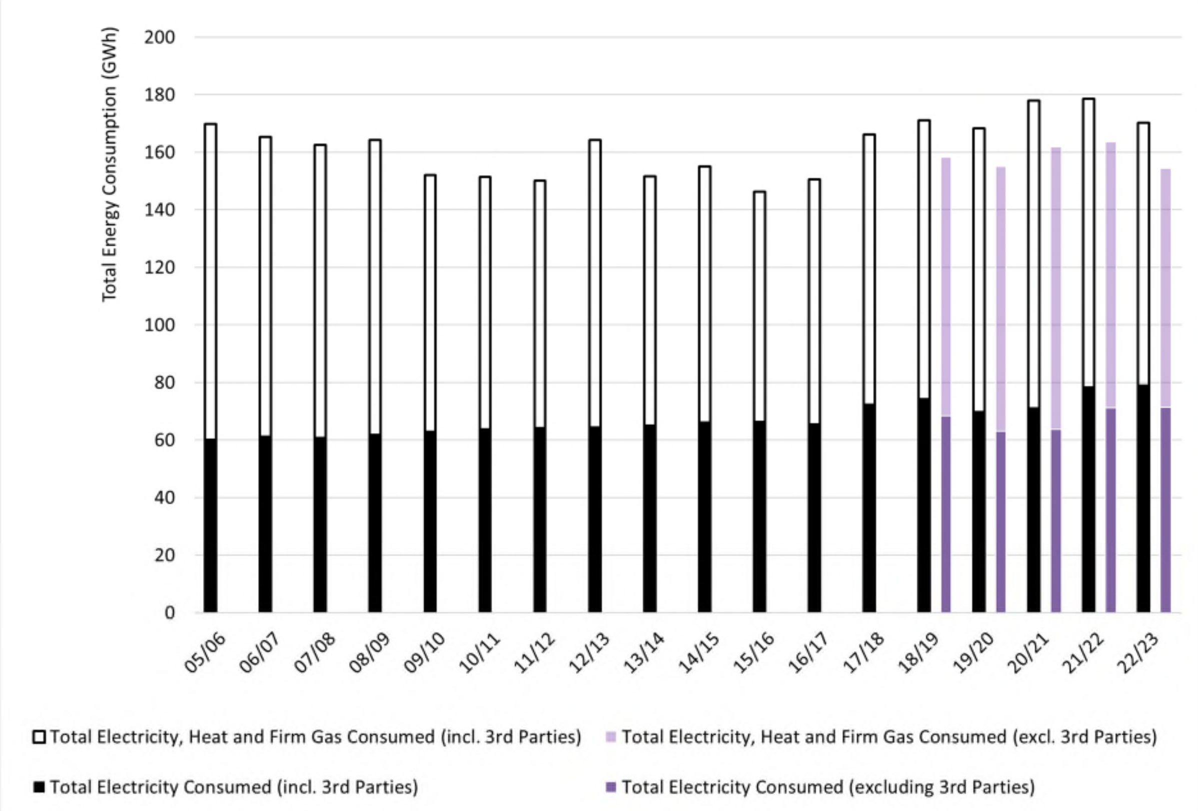
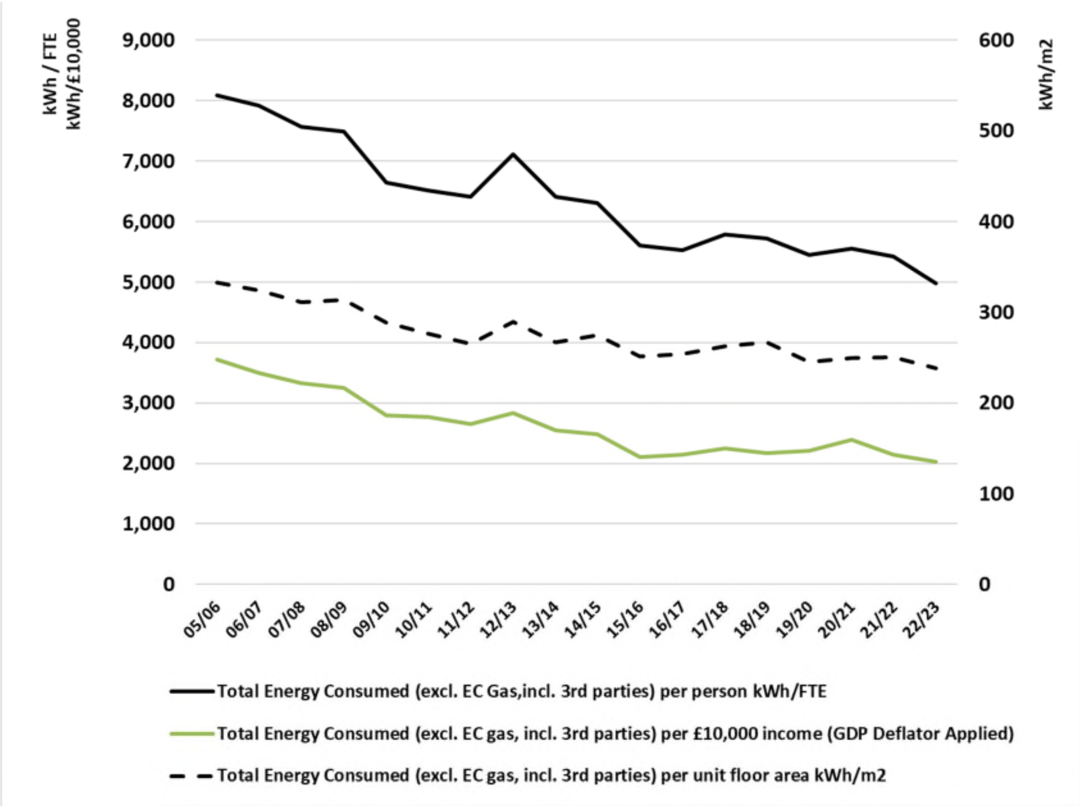


Chart 13: Total Energy consumed per FTE, per £10,000 Income and per m2.

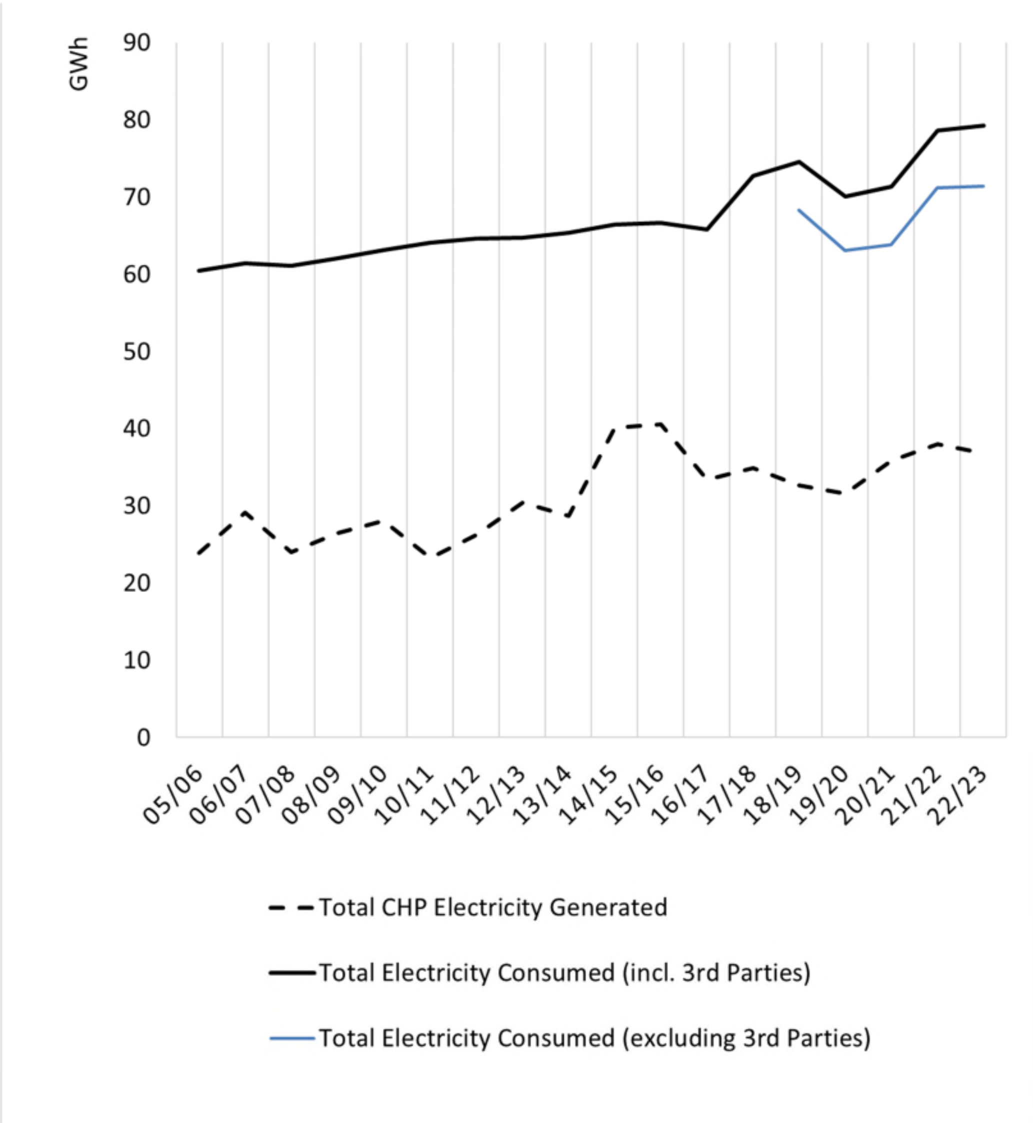


5.1 Electricity

Total electrical consumption (irrespective of source and including third parties) increased by 681 MWh in 2022/23, an increase of 0.9% compared to 2021/22. Electrical consumption for areas excluding 3rd parties increased by 191MWh compared to 21/22, an increase of 0.3%. The chart below shows total electricity consumed and self-generation. On site, generation from CHP fell by 3.1%, due to reduced reliability of engines.

The increase in self-generation in 13/14 – 14/15 was the result of Cryfield energy Centre being switched on. The decline between 15/16 and 16/17 related to the decline in operation of MEC engines due to age, technical issues with engines at CEC and distribution challenges following the upgrade of the primary substations and restrictions imposed by Western Power.

Chart 14: Electricity: Total Consumption and CHP Generation



5.2 Buildings - "Top Electricity Consumers".

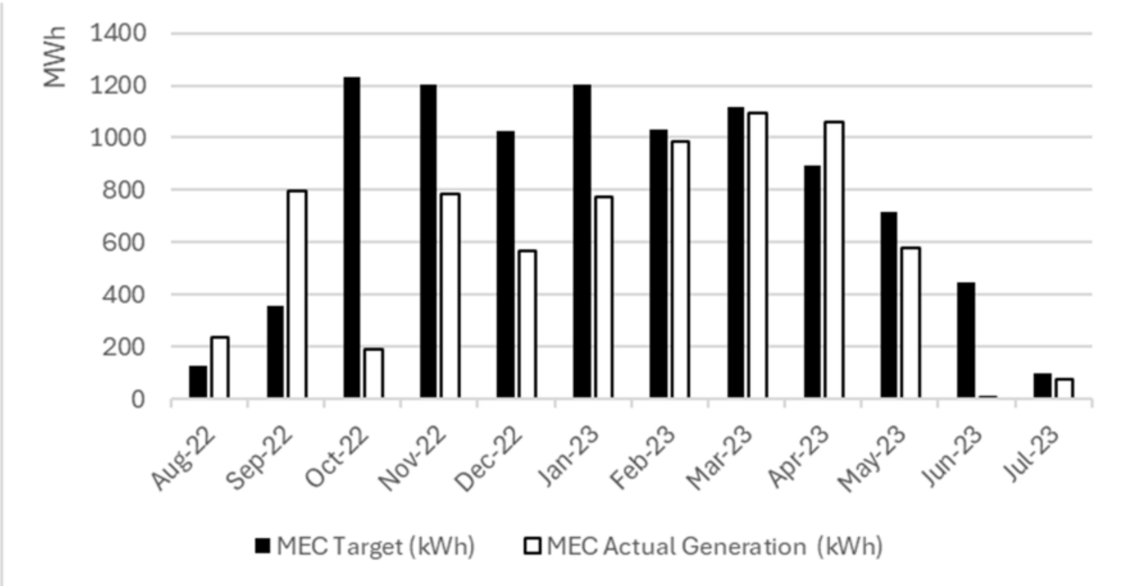
The top 10 electricity-consuming buildings are shown in Appendix 1. The top three energy consuming buildings usage are shown below with the change on previous year.

Position	Building	Electrical consumption (kWhrs) 2022/23	Change vs Previous Year	Notes
1	Lord Bhattacharyya Building	6,236,285	15%	>95% Segregated as "3rd Party" Usage
2	Argent Court Data Centre	4,282,360	9%	Increased data processing activity
3	University House	3,224,520	-6%	Significant Efforts in building schedule reductions

5.3 Self-Generation

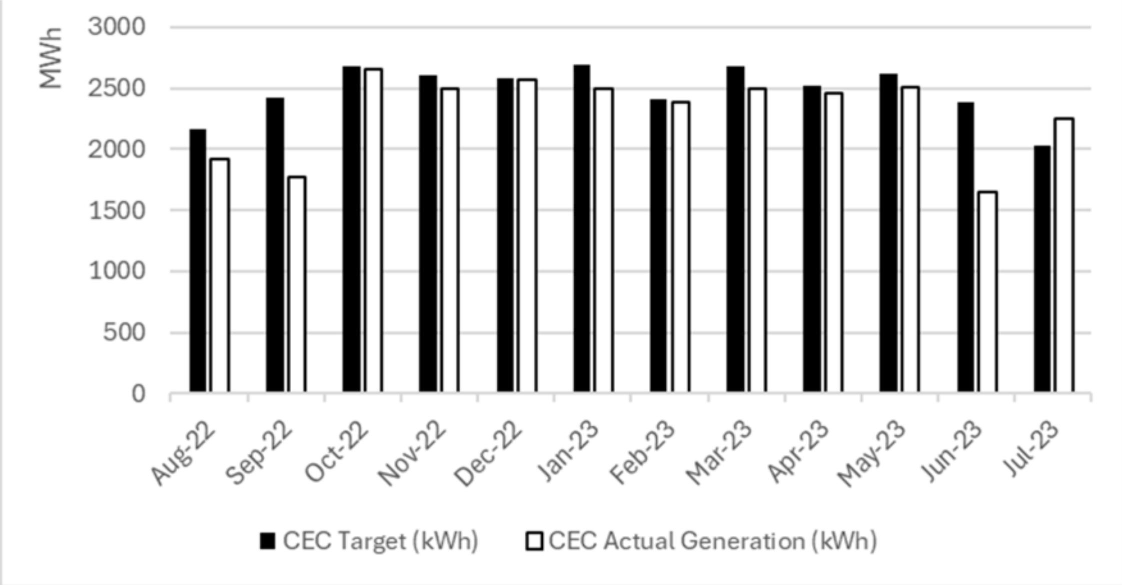
The following charts show the performance of Cryfield Energy Centre (CEC) and Main Energy Centre (MEC) CHP engines against target outputs. Despite targeting an output of only 50% of the theoretical maximum, the MEC engines only exceeded this in 7 out of 12 months due to the age and reliability of the engines. In August 2023 the MEC engines were de-prioritised and, in future, will only operate to support thermal demands at times of system stress.

Chart 15: MEC Combined Heat and Power Actual Electricity Generation vs Target by Month 2022/23



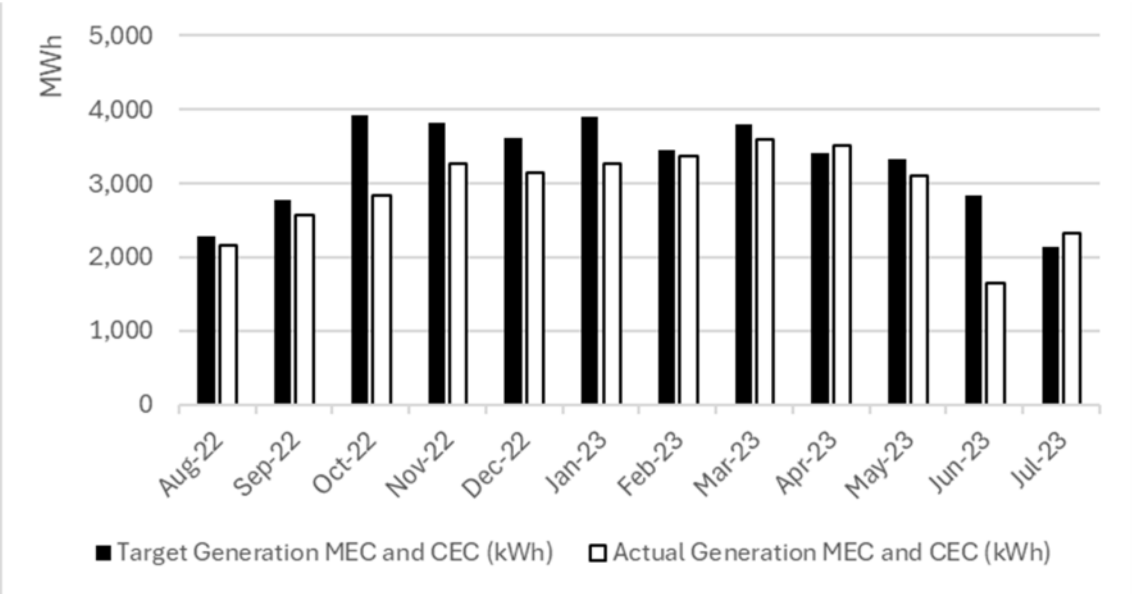
CEC engines on the other hand performed more consistently with significant shortfalls in fewer months where engines were out of service for maintenance and repairs.

Chart 16: CEC Combined Heat and Power Actual Electricity Generation vs Target by Month 2022/23



The overall impact is shown below with actual CHP generation below target levels. Issues with MEC engine reliability present challenges to energy cost and carbon forecasting.

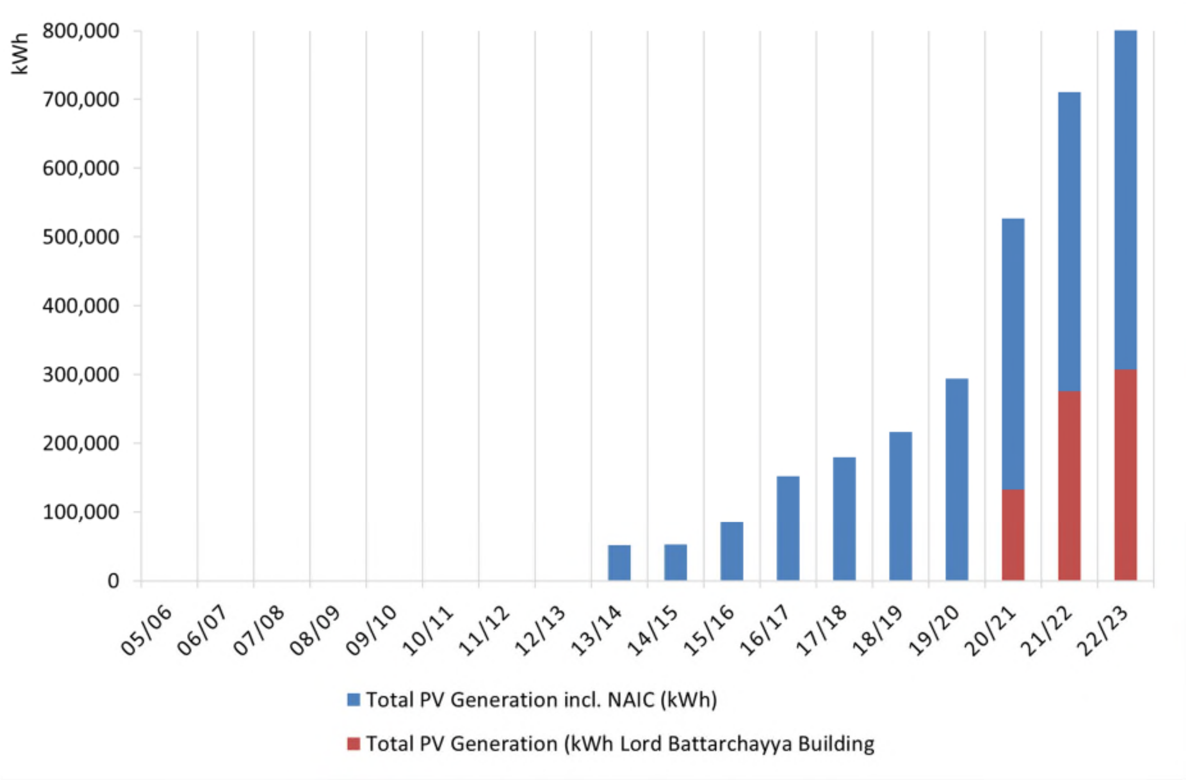
Chart 17: Combined Heat and Power Actual Electricity Generation vs Target by Month 2022/23



5.4 Renewables

Despite only representing a small proportion of total electricity consumption, on site generated renewable electricity has increased more than tenfold since 2013/14 with an output of 941,590kWh during 2022/23 including third party occupied buildings.

Chart 18: Total Onsite Renewable Electricity Generation (kWh)

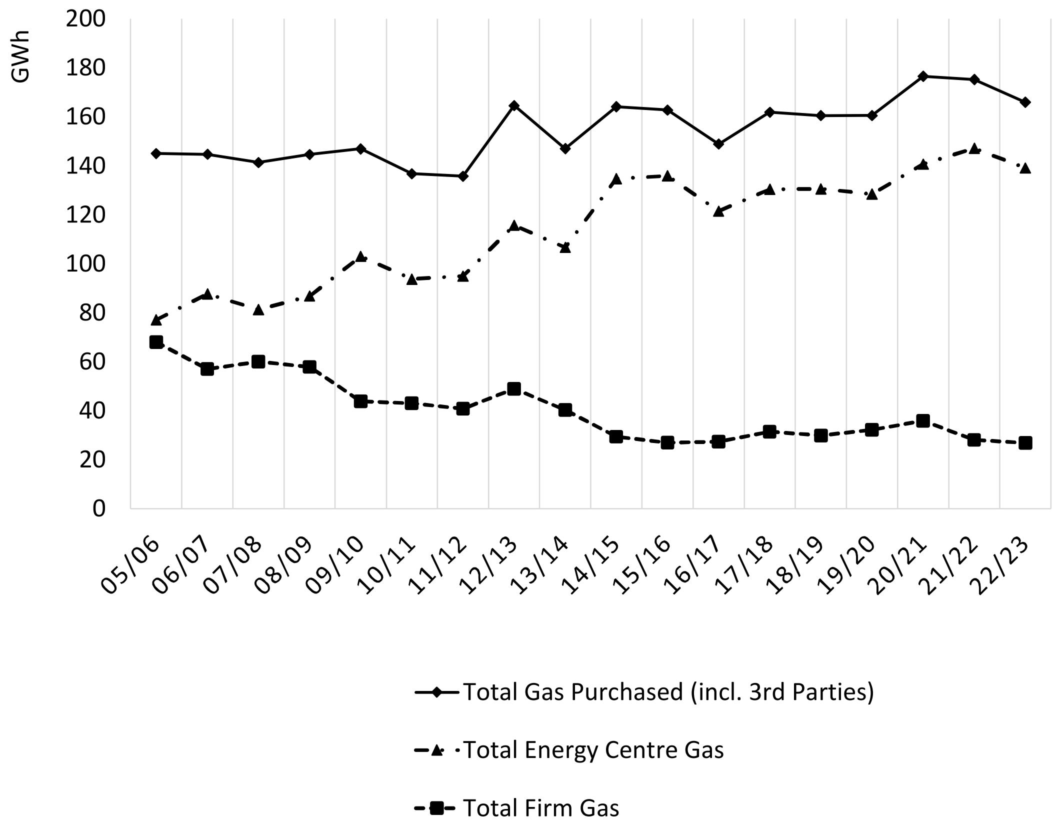


5.5 Gas

Gas is predominantly consumed for electricity and heat generation via CHP and direct heat generation by boilers. Total gas consumed, including that used directly by third parties and in the supply of heat and power to third parties fell by 5.3% compared to the previous year, despite colder weather in 22/23. This reduction was a consequence of a significant re-commissioning of heating set points in over 100 buildings and a reduction in CHP operation.

Unlike bought in electricity which has seen historical reduction in carbon intensity, natural gas remains a pure fossil fuel with limited prospect of decarbonisation in the short term.

Chart 19: Total Annual Gas Consumption by end use.



5.6 Thermal Energy

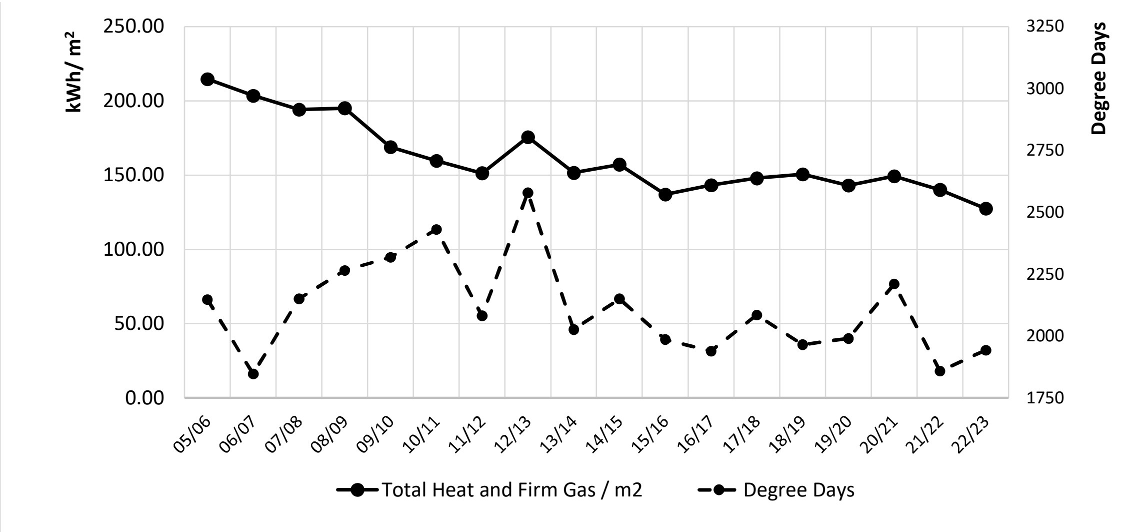
The following chart shows historic annual energy centre heat and local boiler gas energy per unit of campus floor area alongside heating degree-days[6]. The chart shows that the University is using heat more efficiently overall, with a general downward trend in heat demand per

[6] *Heating degree days give an indication of the energy consumption required for heating based on outside air temperatures.*

square metre. Heat consumption reduced by 9.0% in 2022/23 despite colder weather due to efficiency projects.

Appendices 1 and 2 provide the top 10 buildings for absolute thermal energy consumption and thermal energy consumption per unit floor area.

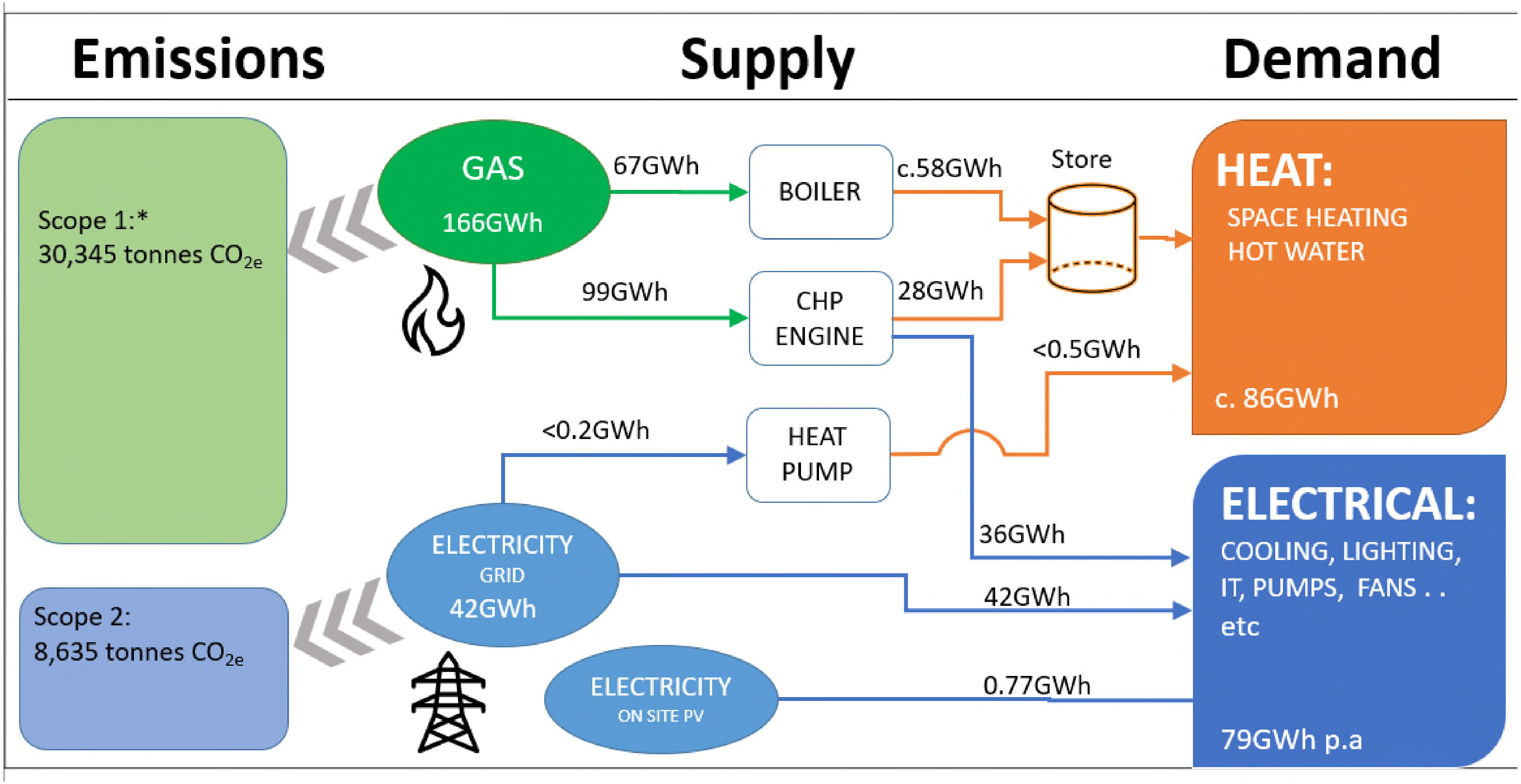
Chart 20: Total Heat and Firm Gas Consumption by floor area and heating Degree-days.



6 Energy and Carbon: One Page Summary.

The energy demands and associated carbon emissions described above are summarised in the graphic on the following page. This graphic shows 22/23 Scope 1 &2 CO_{2e} location-based emissions, energy supplies and demands including 3rd parties. The relatively small emissions from petrol, diesel and LPG are excluded.

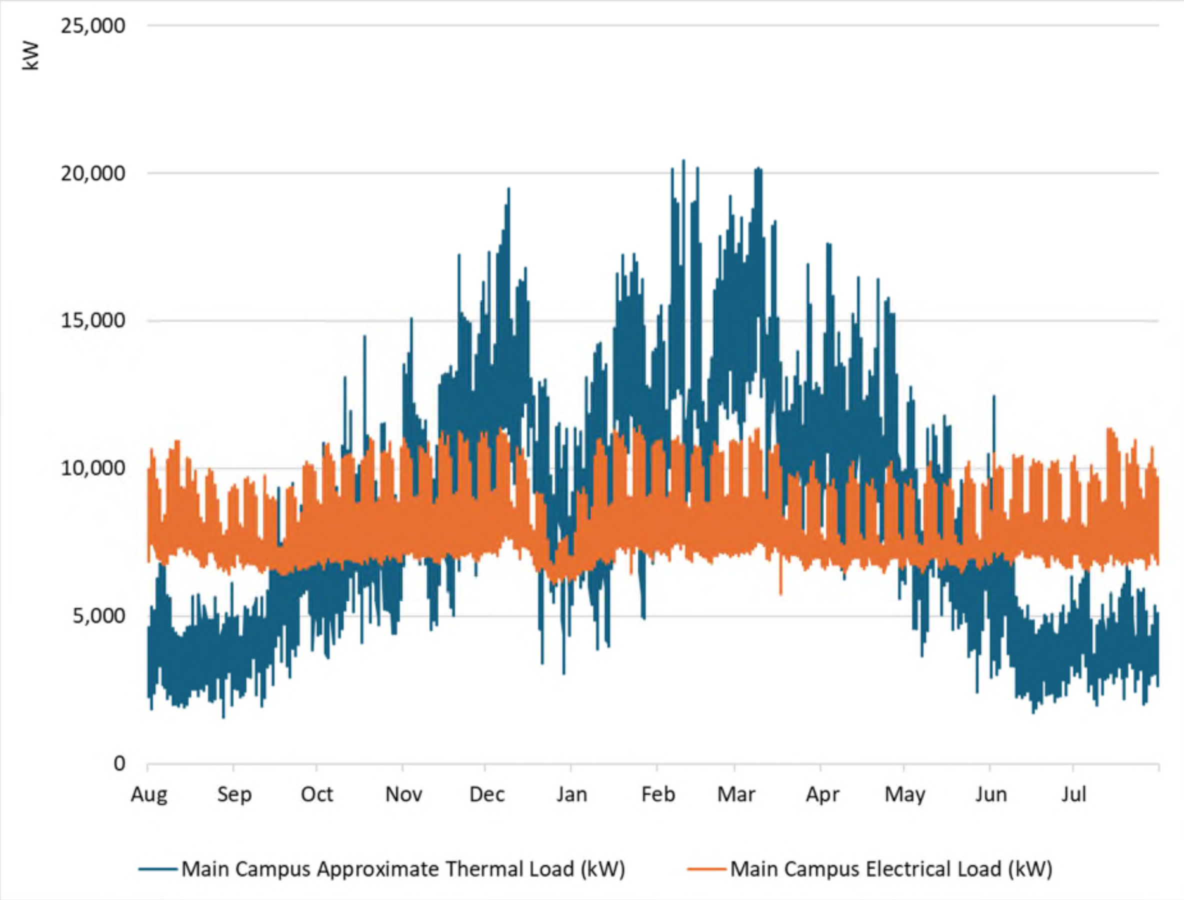
Chart 21: Location Based Scope 1 &2 CO_{2e} Emissions, Energy Supply and Demand (incl. 3rd parties)



7 Energy Demands: A Full Year View.

The sections above have provided full year totals and intensity ratios for the principal energy and fuel usage across the University. The chart below provides an indication of how energy consumption is distributed across a full year, taking an hourly profile for the greatest portion of our energy demands – that used on the "Main Campus".

Chart 22: "Main Campus" Thermal and Electrical Demands (kW)



Electrical Profile:

The electrical profile shows the persistent high baseload that is typically more than 7,000kW and indicative of the many "24 hour" processes on campus - such as experimental and process demands in Laboratories and data centres. Weekends are clearly visible on the profile as the campus population and activities reduce and a clear drop can be seen at Christmas (although the baseload is still present for many activities that must be maintained). Identifying equipment and facilities that are essential overnight and those that are "left on" is a responsibility of all staff and student members as described in the university Energy policy.

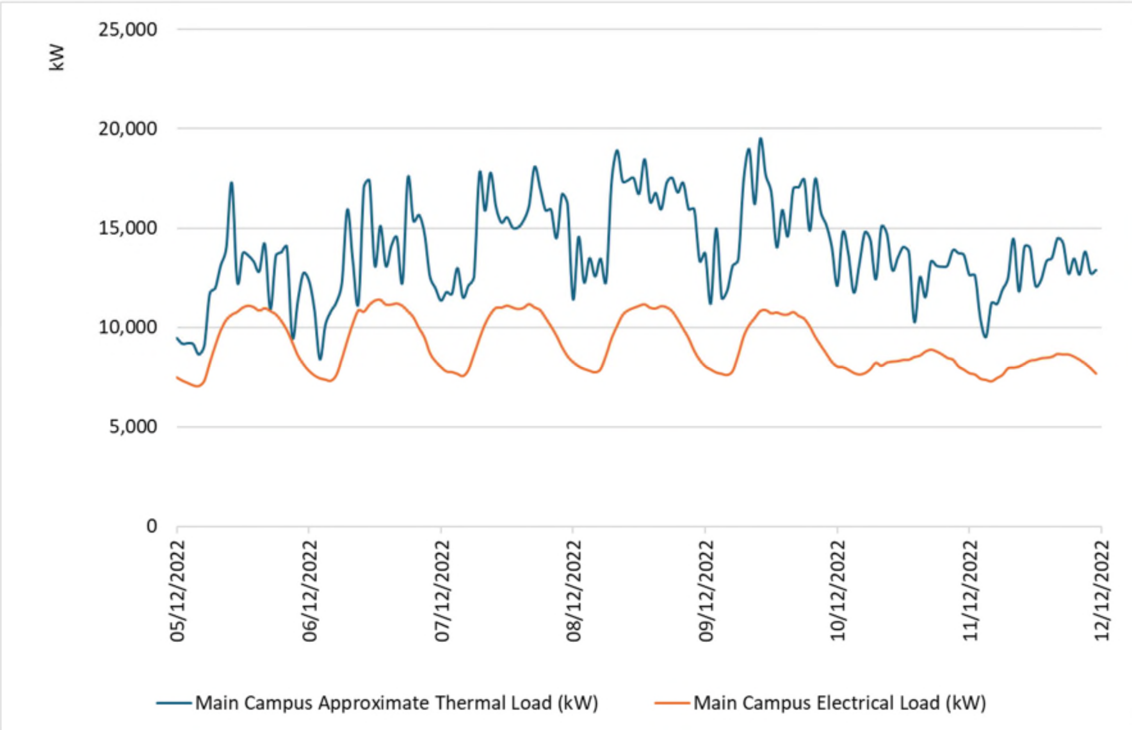
Thermal Profile:

Today, almost all thermal demands are met by gas consumption. As expected, the thermal profile is strongly governed by weather with peaks in the coldest season. A concerted effort to turn down building heating to a frost protection set point through the Christmas break is clearly visible in the demand profile.

7.1 Energy Demands: A Winter Week.

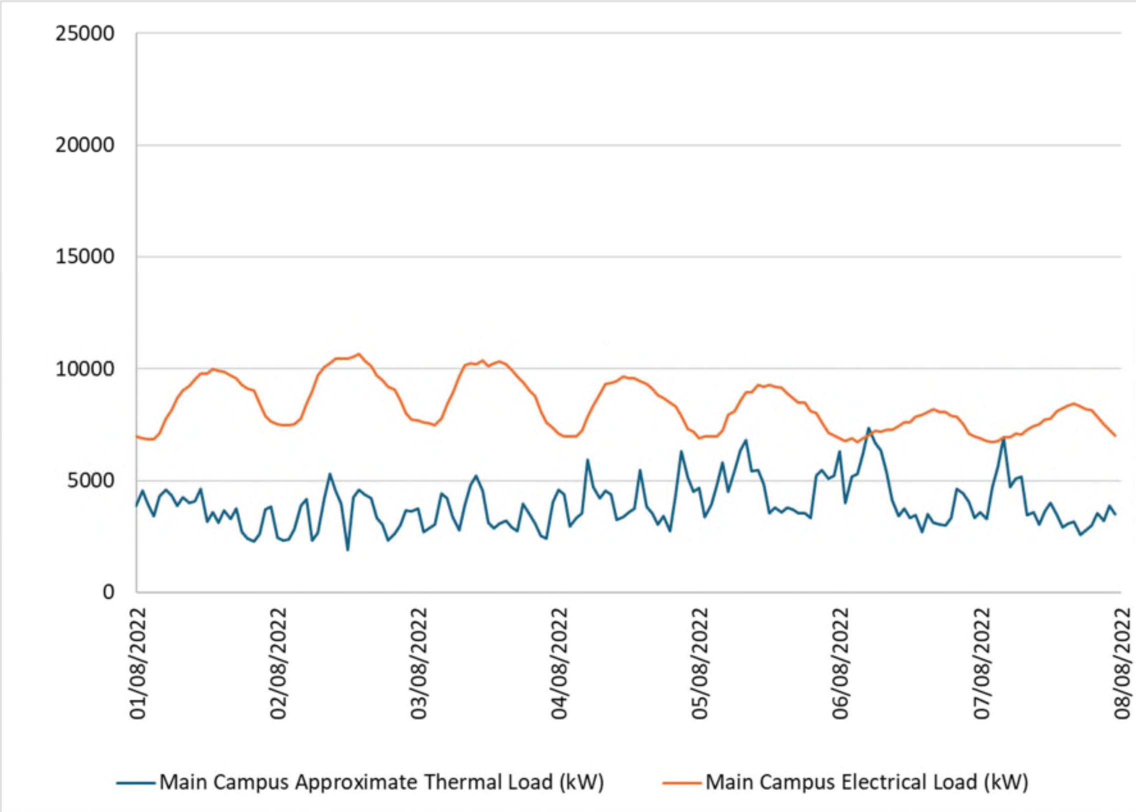
The chart below is taken directly from the data set above and shows the daily electrical and thermal loads during a winter week more clearly.

Chart 23: "Main Campus" Thermal and Electrical Demands – A Winter Week (kW)



What is clear from this profile, is the coincidence of rising electrical and thermal demands in the approach to the start of the working day. Domestic hot water usage, primarily through showers in student residences, tend to peak between 06:30 and 08:00, a time where many buildings are getting up to temperature for the start of the working day. This highlights the key importance of managing thermal demands across the whole system, using hot water storage (charged at times of low demand and deployed during peaks) and building thermal mass to pre-heat buildings where possible. This co-ordinated, systems approach to "smoothing the peaks" will become ever more important as more thermal loads are switched to electrical based generation.

Chart 24: "Main Campus" Thermal and Electrical Demands – A Summer Week (kW)



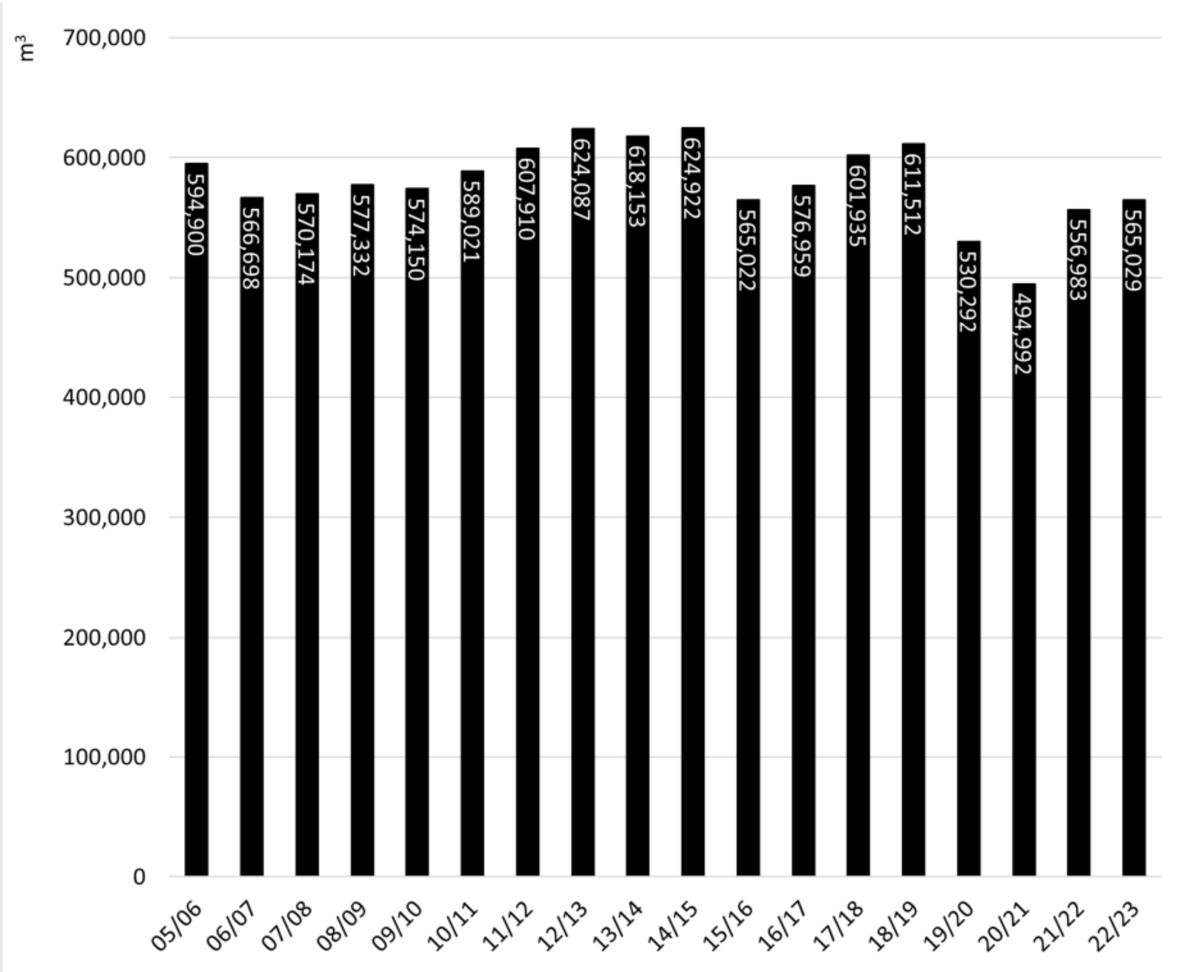
During summer, thermal loads do not follow the same profile as winter. Residences have far fewer occupants, with correspondingly lower demands for domestic hot water and buildings require no heating. At this time of year, a more significant fraction of thermal energy (and therefore gas consumption) will be used to maintain system temperatures (balance heat losses) from the domestic hot water systems across campus.

8 Water

Total University mains water consumption including third parties increased slightly between 2021/22 and 2022/23 by 1.2% to 549,273m^3 as shown in the chart below. Appendices 1 and 2 show the top 10 buildings for absolute water consumption and consumption per unit floor area. The charts below show historical mains and borehole water consumption and mains water consumption per FTE. Borehole water used at Wellesbourne for irrigation increased from 14,072m^3 in 21/22 To 15,756m3 in 2022/23.

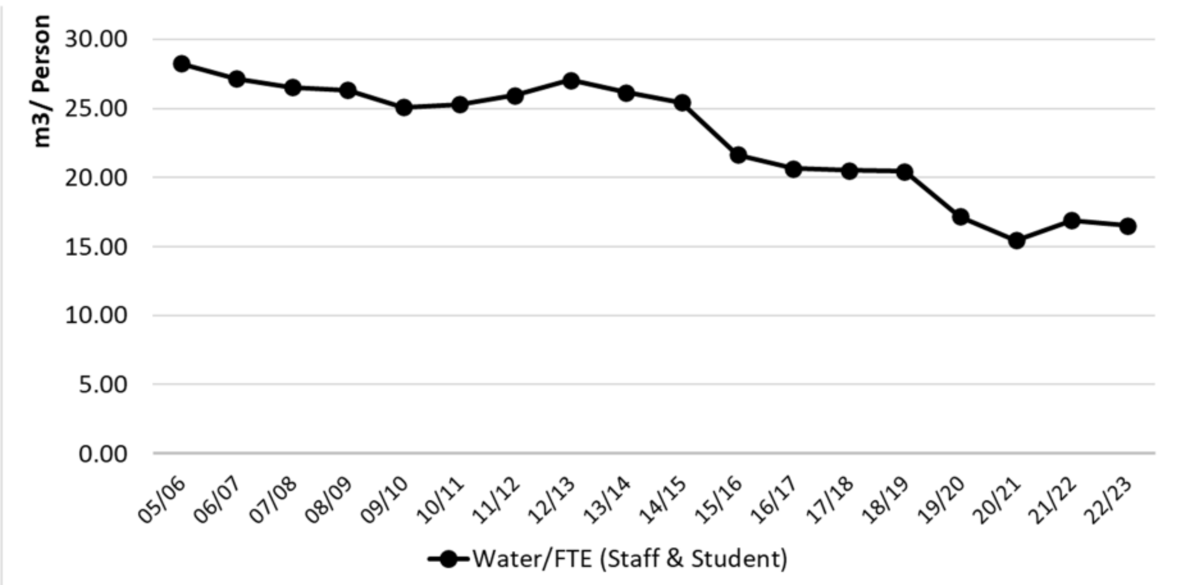
(The 2015/16 step change relates to the installation of shower restrictors in student residences during summer 2015).

Chart 25: Total University Mains and Borehole Water Consumption (including 3rd parties)



The following chart shows the University water consumption per FTE.

Chart 26: Total Mains Water Consumption per FTE



9 Energy Efficiency and Reduction Projects

9.1 Energy Reduction Capital Projects

There were a range of standalone renewable energy and energy saving projects in the reporting year.

Solar photovoltaic panels were installed across Gibbet Hill Academic building and Benefactors buildings with a total peak capacity of 160kWp. These panels have the capacity to generate over 135,000kWhrs per annum. This generation is equivalent to the total annual electricity consumption of approximately 35 typical UK homes.

During the refurbishment of Lakeside 3 residences all fluorescent lighting was replaced with high efficiency LED lighting with improved controls that typically provide a 50% reduction in energy.

These projects represent significant investments. Not included in this list are the investments incorporated in our new buildings that ensure these buildings are more than 30% better than building regulations in terms of energy performance. These enhancements do not reduce overall emissions however, rather they limit the inevitable increase that comes from the additional energy demands from a new building.

9.2 Operational Energy Improvements

Energy consumption in the most energy intensive buildings is continually monitored. The most frequently identified issues are time schedules that are overridden resulting in 24-hour heating, cooling or ventilation in spaces only occupied during working hours.

In the Autumn of 2022 (within the 22/23 reporting year) a major recommissioning of building heating and cooling time schedules and temperature set points was carried out. This intervention reviewed and modified set points across more than 100 buildings. Based on a weather adjusted analysis of the impact of the changes using measured data, a cost saving of £560k per annum based on the prevailing gas cost rates at the time of the intervention alongside an annual carbon saving of 997 tonnes of CO_{2e}.

An Energy Usage Policy that provides indicative temperature and time schedule set points has been reviewed by ESSAG, UEB and UEEC and subject to final approval by the policy oversight group. This document will support Estates Operational staff in the management of space temperatures.

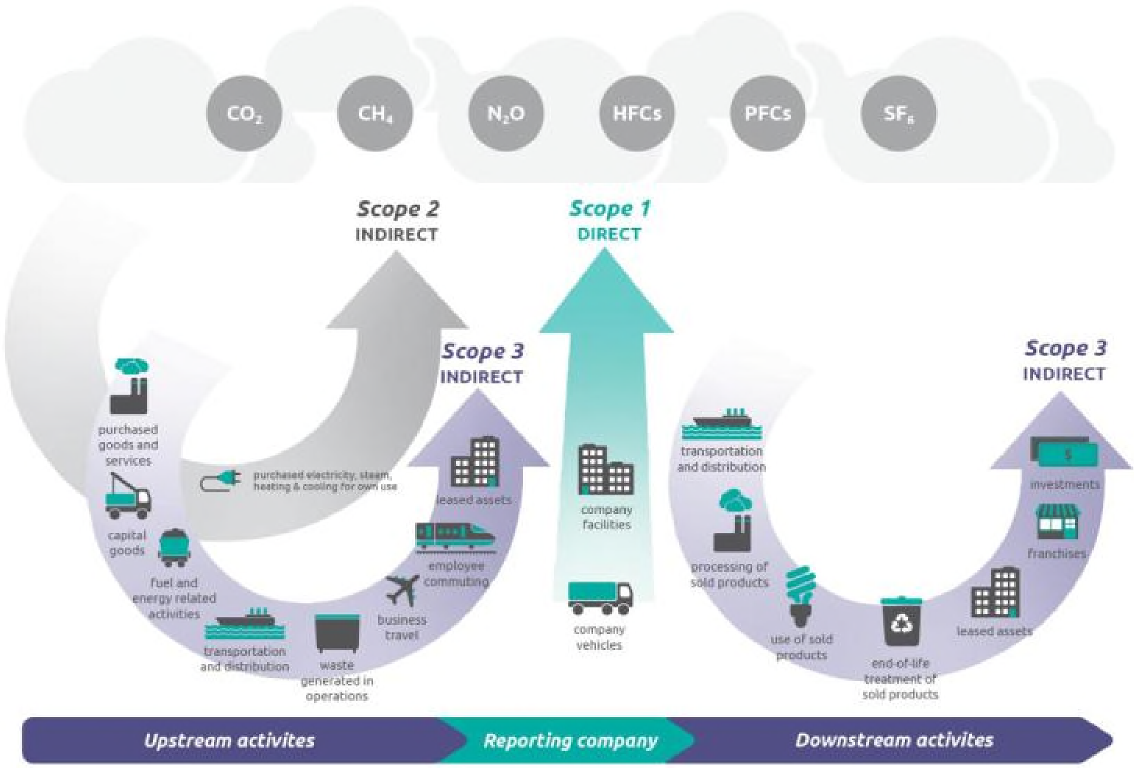
Greater collaboration with departments on actual energy needs can provide much greater savings on energy efficiency, this is underway with several departments and a structured approach to implementation in development.

10 Scope 3 Carbon Emissions

Definition

Scope 3 emissions are indirect greenhouse gas (GHG) emissions that occur in the University value chain including upstream and downstream emissions, and not included in Scopes 1 and 2, as illustrated below.

Chart 27: Overview of GHG Protocol scopes and Emissions.



To date, the most comprehensive set of methodologies to measure and report on Scope 3 carbon emissions is the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Standard which separates Scope 3 emissions into fifteen categories. We are currently estimating the impact of eight categories.

Scope 3 Emission Category	Coverage	Currently Reported
1	Purchased goods and services, including mains water	Y
2	Capital goods	Y
3	Fuel- and Energy- related activities	Y
4	Upstream transportation and distribution	Y
5	Waste generated within operations	Y
6	Business travel	Y
7	Employee commuting	Y
8	Upstream leased assets	N
9	Downstream transportation and distribution	Y
10	Processing of sold products	N
11	Use of sold products	N
12	End-of-life treatment of sold products	N
13	Downstream leased assets	N
14	Franchises	N
15	Investments	N

Target

The University 2050 net-zero carbon target includes all emissions (Scopes 1, 2 and 3), to meet the 2050 target, all Scope 3 carbon emissions must be balanced by an equal level of carbon removals to reach net-zero.

Compiling and Understanding the Data

The University's Scope 3 emissions continue to be reported according to the Greenhouse Gas Protocol, incorporating guidance from the EAUC Standardised Carbon Emissions Framework (SCEF).

It should be noted that due to data availability and quality, the results discussed within this report are estimated, with limitations discussed at each section.

Where there has been a change in methodology, retrospective calculations of previous years' data using updated methodology were also performed. Summaries of the methods can be found at each section, and further information has been appended.

This year there has been a significant increase in the emissions estimated for Scope 3 Category 1 (purchased goods and services), this is due to guidance from the EAUC, which recommends a methodology for the sector that differs to that historically used by the University.

Results & Discussion

Although we are implementing Scope 3 emission reduction measures in certain sectors, we are at the start of the Scope 3 net-zero journey. We are still developing our measurement methodologies in certain sectors, evaluating how to best influence emissions at a 'local' level.

Scope 3 covers all goods, services, and supply chains that the University interacts with. To reduce these emissions the University will require internal and external coordination, sustainable policy changes, increased levels of interdepartmental cooperation, and increased individual understanding.

10.1 Scope 3 Emissions – Results summary

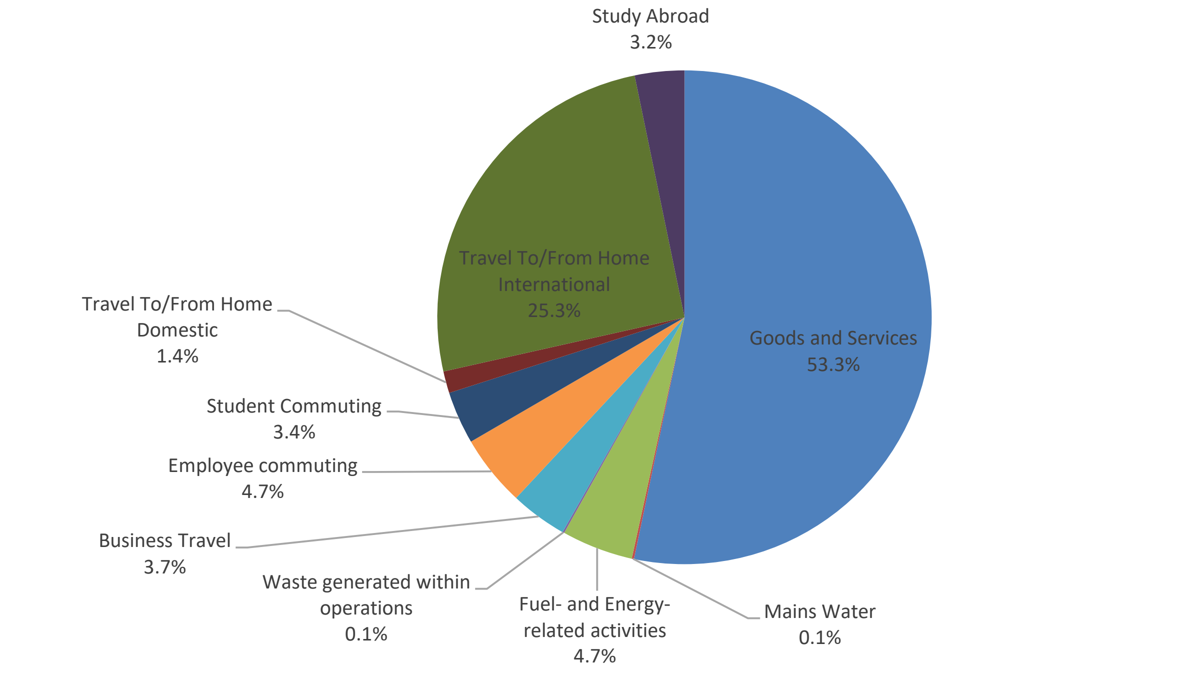
The total estimated Scope 3 emissions for 2022/23 are **146,412 tCO_{2e}**.

			Estimated Scope 3 Emissions (tCO_{2e})		
Cat.	Description	Notes	2022/23	2021/22	2020/21
1	Purchased goods and services, including mains water.	Goods and Services	80,302	104,334[7]	142,565[8]
		Mains Water	208	226	208
2	Capital goods	Included in Cat 1			
3	Fuel- and Energy- related activities		7,071	8,195	8,320
4	Upstream transportation and distribution	Included in Category 1			
5	Waste generated within operations		145	96	241
6	Business travel		5,623	1,537	62
7	Employee commuting (including telecommuting – working from home)		7,034	16,061	11,090
8	Upstream leased assets	Not estimated			
9	Downstream transportation and distribution	Student Commuting[8]	5,179	9,631	15,781
		Travel To/From Home Domestic	2,160	1,636	1,516
		Travel To/From Home International	38,125	34,136	29,413
		Study Abroad	565	961	450
10	Processing of sold products	Not estimated			
11	Use of sold products	Not estimated			
12	End-of-life treatment of sold products	Not estimated			
13	Downstream leased assets	Not estimated			
14	Franchises	Not estimated			
15	Investments	Not estimated			
		Total	**146,412**	**176,813**	**209,646**

[7] 21/22 Procurement emissions re-calculated according to EAUC recommended methodology and presented for comparison. Emissions from procurement in 21/22 we reported in that year at a lower level against an alternative methodology.

[8] There has been a significant change in the methodology for commuting which affects students and employees. Details can be found in the appendices.

Chart 28: Scope 3 Emission Distribution by Category



Grouping the emissions

The emissions currently being monitored, and estimated can be grouped into four categories, goods and services, fuels energy and water, waste, and travel and transportation.

Most Scope 3 emissions fall into two categories – Procurement and Travel and Transport. With the improvement of data accuracy there is an expectation that the proportion attributable to these categories will change as reporting improves in other areas, such as waste, and the inclusion of new areas such as franchises and investments.

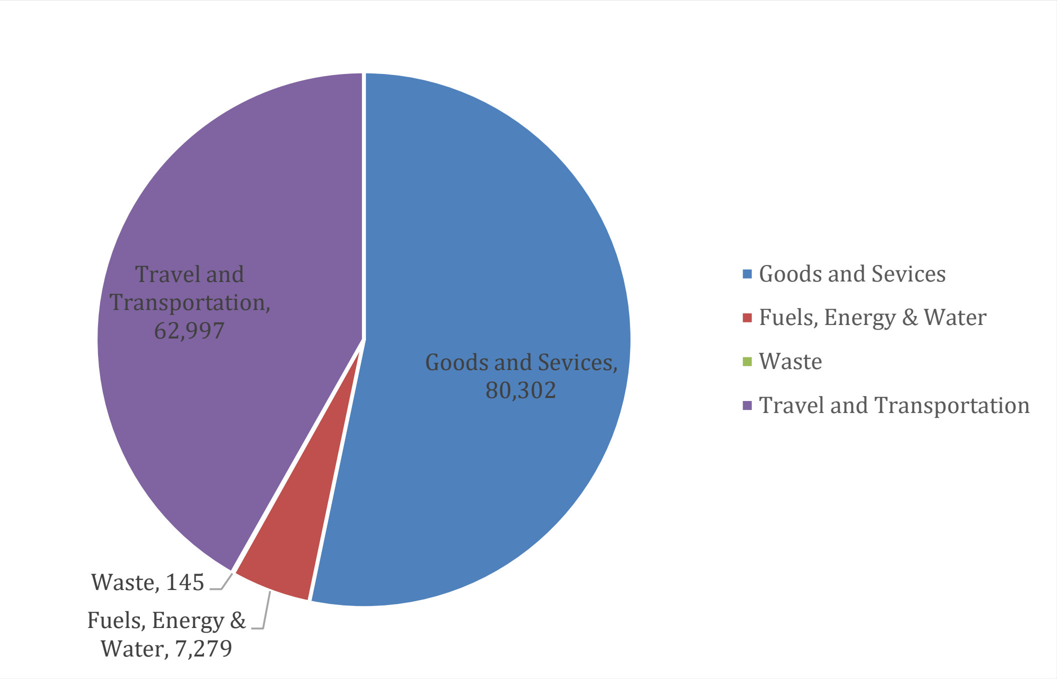
Scope 3 emissions from fuels, energy and water are being reduced by the interventions on these items under ongoing efficiency measures in these areas.

The waste emissions are estimated from all the general and recycled waste across the campus. A new waste contract awarded in 2023 will greatly improve data quality in this area.

Goods and services are currently being analysed together, although the spend is split across three GHG categories, and covers supplier transportation, and capital expenditure.

Emissions from travel and transportation currently make up a very large proportion of University Scope 3 emissions. Initiatives are in place to encourage low carbon business travel alongside a strategy to promote active travel and public transport.

Chart 29: Scope 3 Emission Distribution by Group



10.2 Emission Source: – Purchased Goods, Services, Capital Expenditure, and Upstream Transport (GHG Categories 1.1, 1.2, 2, 4).

10.2.1 Source

The source for this information is the purchasing module within SAP software and provided by the Procurement team. The information includes spend information grouped by department and material code.

10.2.1.1 Opportunity for improvement

With future reporting collated on a *by supplier* basis, there is an opportunity to further improve the accuracy of reporting through the Carbon Reporting action project, run by Nottingham Trent University, in collaboration with Net Positives. This would improve the data accuracy over time with supplier engagement and is the current best practice.

10.2.2 Method Overview

To calculate scope 3 emissions from procurement we follow the EAUC "spend-basis" approach. The cost multiplied by category emission factor approach involves taking University spend data, sorting into categories of expenditure (known as Material Groups) and then using a published factor for emissions per £ spent in that category to calculate emissions per material group.

10.2.1 Limitations

The methodology relies on consistent and accurate categorisation of expenditure in order that the spend can be assigned to the most appropriate group and therefore emission factor, such categorisation is often not achieved.

According to the "*cost multiplied by category emission factor"* approach we are using, we would calculate emissions for purchasing a pint of milk, for example, based only on the cost, with no evaluation of "*supplier level information". T*his information would incorporate factors such as where it was produced, the farming practices, how it was transported to the University and so on. These factors have significant influence on the carbon impact of a good or service. It is these factors that we are seeking to evaluate in construction, where we are requesting supplier level information on the component parts of our new buildings to demonstrate alignment to our scope 3 carbon targets in construction.

10.2.2 Reporting Level

Based on the standardised carbon emissions framework (SCEF), we are currently reporting these emissions according to the "basic" reporting level.

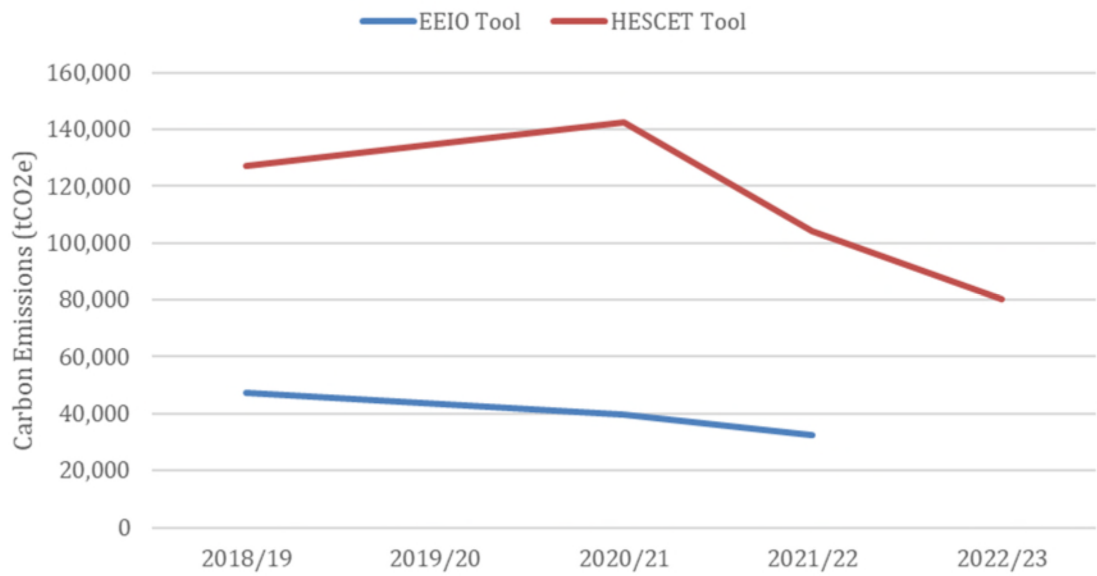
10.2.3 Results

In previous years, emissions in this category have been calculated using Environmentally Extended Input-Output (EEIO) tables. There has been no update to this reference source and the EAUC propose a new methodology for calculating emissions from procurement.

The EAUC methodology uses DEFRA categories and their associated emission factors and is produced by HEPA; this is known as the HESCET tool. This has been used in previous years for comparison purposes, but data not published. This tool has received regular updates and is being adopted by the sector and is therefore now our preferred tool.

There are issues with both tools as they use the same low accuracy methodology of cost multiplied by category emission factor. The issue of inaccurate categorisation results in a high variance in estimated figures. We've been reporting procurement emissions for several years, ahead of many in the sector. Whilst we followed established methods of reporting, the sector is adopting a different approach, and we are re-baselining and changing our approach accordingly. The HESCET tool has consistently reported higher carbon emissions than the EEIO model (see results below).

Chart 30: Scope 3 Emissions from Procurement



10.2.4 HESA Reporting

The figures provided to HESA are from these calculations therefore these changes to the method will be reflected in wider reporting. The HESA categories are specified below.

HESCET Tool

	2020/21	2021/22	2022/23
Business services	25,456	17,094	14,520
Paper products	433	465	158
Other manufactured products	4,114	5,439	2,337
Manufactured fuels, chemicals, and gases	286	440	3,434
Food and catering	527	2,033	1,709
Construction	3,043	2,442	1,134
Information and communication technologies	30,871	19,745	12,585
Waste and water	4	6	2
Medical and precision instruments	75,714	55,719	43,401
Other procurement	2,117	669	795
Unclassified	0	283	225
TOTAL	**142,565**	**104,334**	**80,302**

EEIO Based Tool

EEIO 19/20 Classification	2020/21	2021/22	2022/23
Electrical Equipment	11125	8047	14100
Building & Landscape Services	5813	4661	5103
Computers, Electronics & Opticals	5511	2912	3678
Head Office & Consulting Services	5618	1982	1712
Other Food	153	1313	1620
Other Chemicals	1465	1563	1474
Computer Services	769	845	1107
Furniture	1092	973	1067
Fabricated Metal	869	747	933
Accommodation	94	532	809
Other Professional Services	789	595	785
Total (tCO_{2e})	39,680	32,388	40,283

10.3 Emission source: Purchased Mains Water (GHG Category 1.3).

10.3.1 Source

Water bills are used to source the usage data. Emission factors are provided by DEFRA.

10.3.2 Limitations

There are no limitations to input data within this category although emissions factors are based on national figures and not direct from suppliers.

10.3.3 Reporting Level

Based on standardised carbon emissions framework we are reporting these emissions to “intermediate” reporting level as there are no published local or regional emission factors.

10.3.4 Result

	Scope 3 Emissions (tCO_{2e})				
	2018/19	2019/20	2020/21	2021/22	2022/23
Water Supply	206	176	71	81	97
Water Treatment	423	361	130	148	111
Total	629	537	201	229	208

10.3.5 Discussion

Water usage has varied little over recent reporting years, increasing by only 1% from 2021/22. However, the emission factor for supply increased by 18%, and decreased by 26% for water treatment, leading to an overall 9% decrease in Scope 3 emissions related to water. These emissions remain small compared to the university’s overall Scope 3 emissions (approximately 0.1%).

10.4 Emission Source: – Fuel- and Energy- related activities (GHG Category 3)

10.4.1 Source

The DEFRA emission factors for UK fuel and electricity well to tank (WTT) and distribution are applied to purchased fuel and energy used in University Scope 1 and 2 emissions calculations.

10.4.2 Method Overview

WTT and Transmission and Distribution (T&D) emission factors are multiplied by the University's relevant reported consumption of natural gas, grid purchased electricity, diesel, petrol, burning oil and LPG. Total Scope 3 emissions here are reported both including and excluding 3rd party consumption of natural gas and electricity.

10.4.3 Limitations

A minor limitation for this category is the assumption that all electric fleet vehicles are only charged on university owned and operated chargers. Electricity used for fleet vehicles, however, is a fraction of a percentage of total campus electricity consumption.

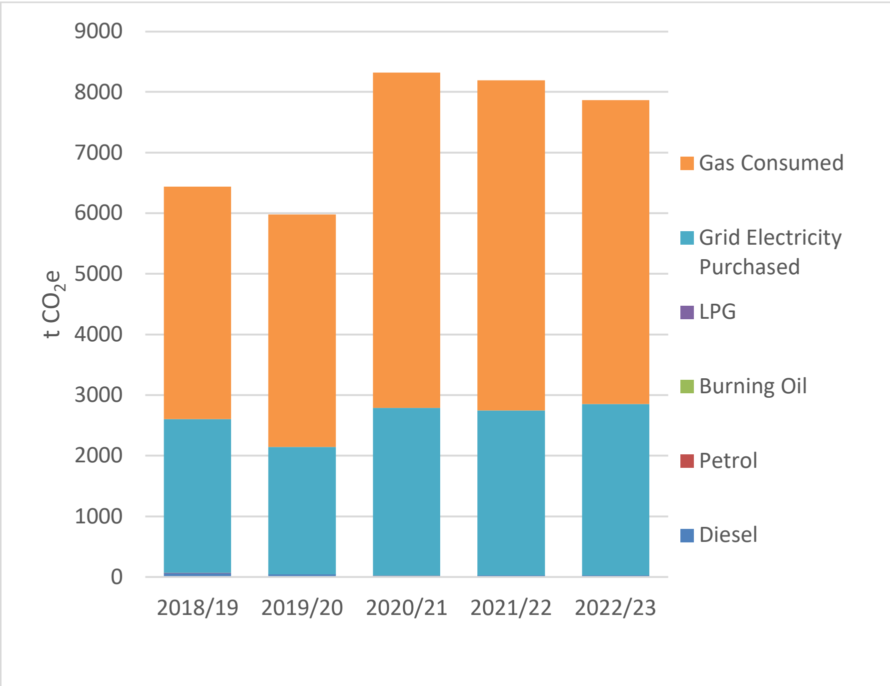
10.4.4 Reporting Level

Based on standardised carbon emissions framework we are reporting these emissions to an "intermediate" reporting level.

10.4.5 Results

		Scope 3 Emissions (tCO2e)				
		2018/19	2019/20	2020/21	2021/22	2022/23
Diesel		64	41	18	25	24
Petrol		1	1	1	2	1
Burning Oil		0	0	0	0	0
LPG		2	1	1	1	1
Grid Electricity	*(Incl. 3rd Parties)*	*2,535*	*2,099*	*2,768*	*2,720*	*2,827*
	(Excl. 3rd Parties)	2,200	1,763	2,227	2,285	2,370
Gas	*(Incl. 3rd Parties)*	*3,837*	*3,838*	*5,532*	*5,447*	*5,011*
	(Excl. 3rd Parties)	3,621	3,641	5,205	5,137	4,675
Total	*(Incl. 3rd Parties)*	*6,438*	*5,981*	*8,320*	*8,195*	*7,865*
	(Excl. 3rd Parties)	5,888	5,448	7,451	7,449	7,071

Chart 31: University of Warwick (incl. 3rd party) Scope 3 Category 3 emissions (well-to-tank and energy distribution)



10.5 Emission Source: – Waste generation (GHG Category 5)

10.5.1 Source

The quantities of material are provided in line with HESA reporting. The 22/23 waste contractor did not provide accurate weight measurement.

10.5.1.1 Improvements in Source

In December 2023 the waste contract changed, and the new provider has the capability to report on waste mass collected from individual corrals. By providing much better data for calculation of associated emissions there is also an opportunity for student engagement, as well as a wider range of recycling streams to improve the handling of waste on site, including food bins within student accommodation and the Food Group.

10.5.2 Method Overview

DEFRA provide emission factors for the different waste streams, with open/closed loop and landfill factors provided across different materials. The quantities of material by waste stream submitted to HESA multiplied by emission factor provide total emissions by stream.

10.5.3 Limitations

The limitations for this category relate to limited waste transfer data from the waste management company utilised in the year 22/23. The quantity of hazardous waste generated is only kept at a department stores level and this is not currently centrally collated.

10.5.4 Reporting Level

Based on the standardised carbon emissions framework we are reporting these emissions to a “basic” reporting level.

10.5.5 Result

Based on the 2023 emissions factors, and the weights provided, the estimated emissions are reported as **144.6 tCO2e.** It is unlikely that this figure is representative of actual emissions associated with university’s waste due to the limitations described.

10.5.5.1 Emissions by Waste Streams

The emission factors below show how diversion of materials from one stream to another can give a carbon benefit, reducing the emissions on the same waste.

The waste stream for natural products such as food, wood, and paper, show the impact of materials sent to landfill that produce methane and other biproducts during decomposition. Although methane does not persist as long in the atmosphere, it has a significantly higher global warming impact than CO2 when present. For food waste there is also the option of anaerobic digestion, which has a similar carbon impact to composting.

- Composting 8.9 kgCO2e/tonne
- Anaerobic Digestion 8.9 kgCO2e/tonne
- Wood Landfill 925.2 kgCO2e/tonne
- Paper Landfill 1,164.4 kgCO2e/tonne
- Food Landfill 700.2 kgCO2e/tonne

Promoting recycling on site, and enabling, where plausible, split waste streams, is a manageable, affordable, and effective carbon reduction strategy.

2022/23 Waste Stream	Mass (t)	Emission Factor (kgCO2e/t)	Emissions (t/CO2e)
Landfill	3.71	508.69	1.9
Waste To Incineration With Energy Recovery	1343	21.281	28.6
Dry Mixed Recycling	1051	21.281	22.4
Paper Recycling		21.281	
Glass Recycling		21.281	
Plastic Recycling		21.281	
Food Waste		8.912	
Hazardous Waste To Landfill			
Hazardous Waste With Energy Recovery			
Construction Waste To Landfill		1.239	
Construction Waste Recycling		0.985	
Composting	30.5	8.834125	0.3
Anaerobic Digestion	89.73	8.912	0.8
Other (Commercial & Industrial Landfill)	174.36	520.335	90.7
TOTAL			144.7

10.6 Emission Source: – Business Travel (GHG Category 6)

10.6.1 Source

This data is provided by the University's business travel provider (Key Travel) in the form of an annual overview. The carbon impact is broken down into types of tickets purchased.

10.6.2 Method Overview

The carbon impact calculations are made by the Universities business travel provider, and are provided with and without radiation factors, and with and without WTW factors. All factors (RF and WTW) are included in these results.

10.6.3 Limitations

A limitation of this category is that not all car travel is booked through the same system.

10.6.4 Reporting Level

Based on standardised carbon emissions framework we are reporting these emissions to an “advanced” level.

10.6.5 Result

The results for business travel are reported by distance travelled and carbon emissions. The changes over the last five years show the significant impact of the global pandemic and a return to the pre-pandemic levels of travel. It should be noted that over the period of the figures provided below there has been a shift toward more travel booked being through the University Travel provider – and therefore captured below, and less booked through other mechanisms. Historical estimates of distances and emissions from business travel are likely to be below actual.

Distance Travelled (km)

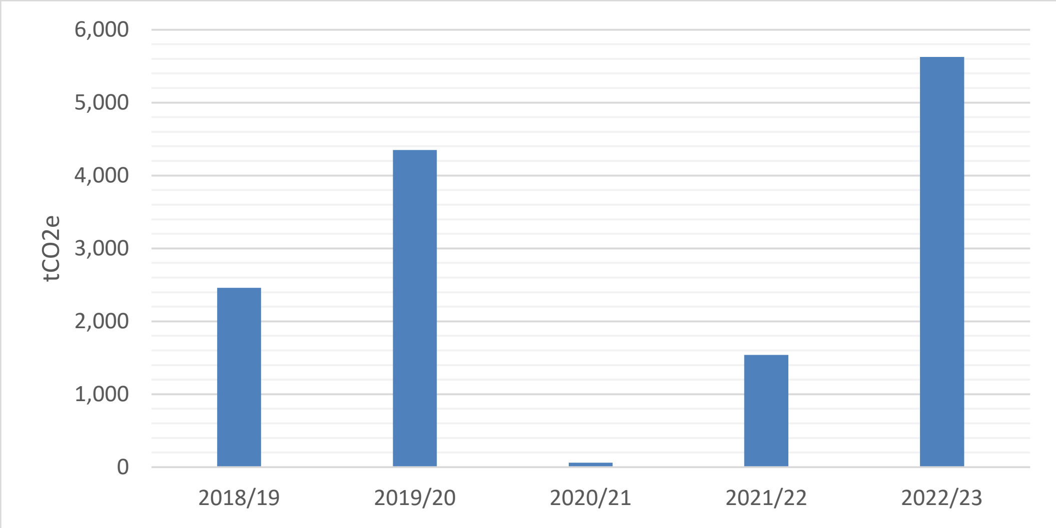
	2018/19	2019/20	2020/21	2021/22	2022/23
Train Travel – Domestic	448,041	625,192	13,503	426,971	704,547
Train Travel – International	20,886	44,444	978	63,504	104,768
Flights – Domestic		30,927	645	6,287	35,381
Flights – Short Haul		1,760,533	232,918	1,458,939	2,777,372
Flights – Long Haul		11,528,502	16,618	4,231,425	12,967,264
Flights - International	12,024,570	10,643,535	101,474	776,645	9,986,801
Grey Fleet[9]					750,678

There has been a notable increase in emissions factors for air travel compared to 2021/22 with a 11% increase in domestic flights, a 21% increase in short haul flights and 35% increase in long haul flights. A change that has contributed to the increase in emissions.

Scope 3 Emissions (kgCO_{2e})

	2018/19	2019/20	2020/21	2021/22	2022/23
Train Travel – Domestic			578	18,962	24,985
Train Travel – International			5	357	467
Flights – Domestic			176	1,715	10,829
Flights – Short Haul			38,367	246,533	574,781
Flights – Long Haul			6,735	754,511	3,281,726
Flights - International			15,832	517,455	1,602,946
Grey Fleet					127,485
Total (kgCO_{2e})	2,458,000	4,404,659	61,680	1,539,533	5,623,219
Total, rounded (tCO_2e)	**2,458[10]**	**4,405[10]**	**62**	**1,540**	**5,623**

Chart 32: Total Emissions from business travel.



10.6.5.1 Domestic Flights

Domestic travel is an area where changes in types of transport could reduce the carbon impact of travel. Domestic flights are more carbon intensive per-kilometre than long haul flights and there has been a total of 211 domestic flights since the University has been organising its business travel through the current provider.

This would suggest that the impact on staff, from limiting domestic flights, would also be minimal. There would be a requirement to further communicate the total costs of domestic travel at departmental levels to encourage policy buy in.

To support any policy change that would include restrictions on domestic travel there would need to be a business case above that of the environmental impact, as the University is not currently far enough along its Scope 3 journey for this to have general support. Therefore, an analysis of the time taken, cost, and carbon intensity of the most frequent domestic flight is considered.

For the two most frequently visited major cities by plane Glasgow (93) and Edinburgh (101), the base travel time is under an hour. When compared to a five-hour train this seems to be the most efficient method in terms of time. With this analysis the door-to-door journey has been considered, including the amount of time available to work whilst travelling. As is recommended when considering air travel this has included the time and cost of taxi transfers – especially as with Glasgow Airport public transport is not readily available.

A comparison[11] of aeroplane vs train travel from the central campus to Edinburgh city centre looks at the three variable and compares their impact.

---

[9] The grey fleet data is calculated from the milage claimed through expenses, using average car emission factors. This is the first year this information has been obtained.

[10] In 2018/19 a potentially significant fraction of Business Travel was booked outside of the University Travel provider Key Travel. This figure represents emissions captured on travel booked through Key Travel and is therefore likely to be an underestimate.

[11] Avanti West coast train offers Wi-Fi across the journey. Ticket prices are based on the actual spend on tickets through Key Travel in 22/23, with taxi prices based on a non-peak Uber.

Chart 33: Cost of travel to Edinburgh.

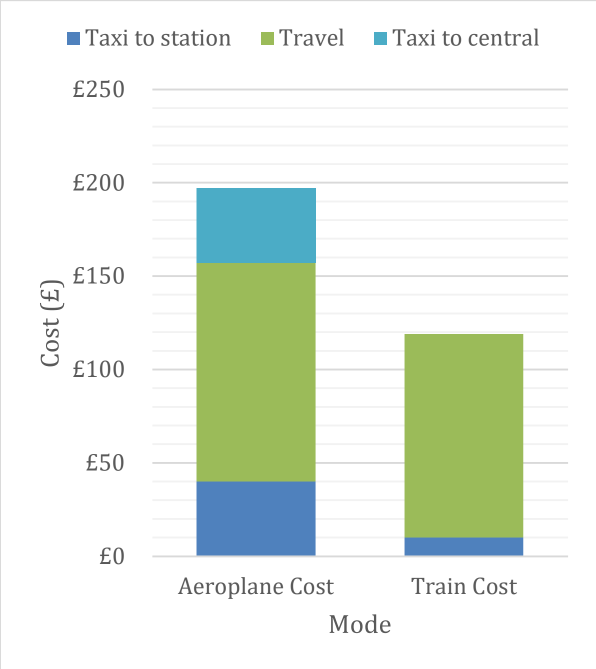


Chart 34: Carbon intensity of travel.

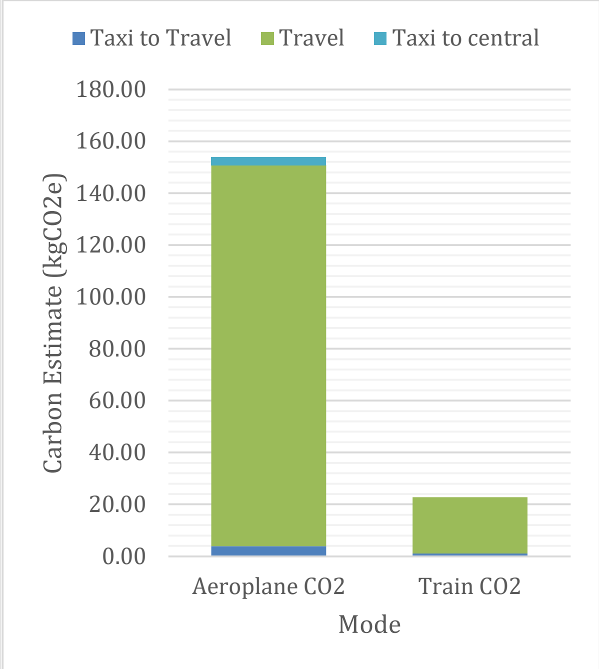


Chart 35: Travel time to Edinburgh.

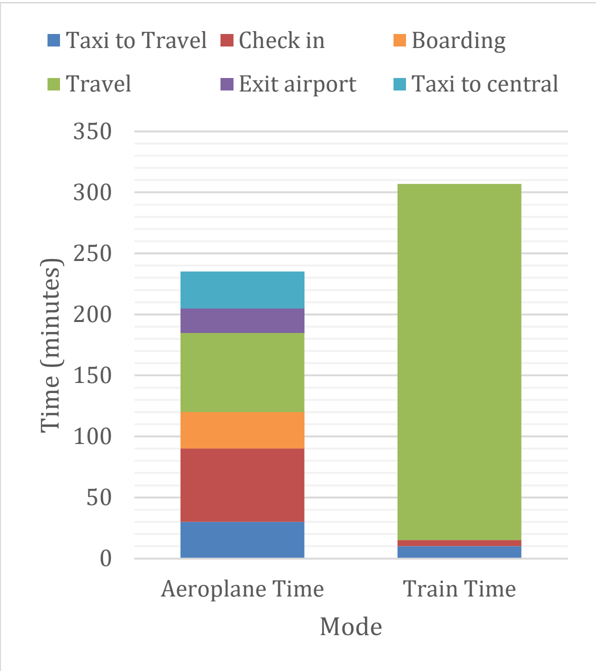
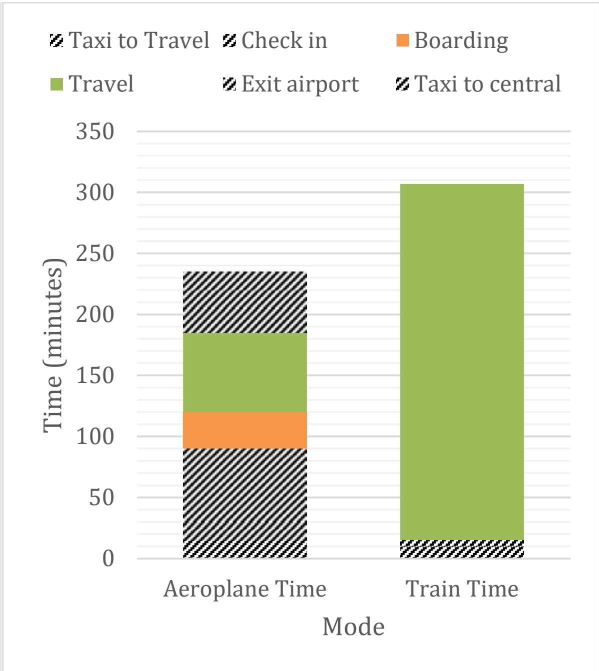


Chart 36: Working time during travel.



10.7 Emission Source: – Employee Commuting (GHG Category 7.1)

10.7.1 Source

For this emission source the annual travel survey was utilised which, based on the number of employee respondents, achieves a 95% confidence level. The assumption is that there are 261 working days in the academic year.

We also compared to Automatic Number Plate Recognition (ANPR) data, which track registered users' entrances and exits from University owned car parks to give a better understanding of the amount of people on campus at any given time. Postcodes of registered users were also utilised to better understand the distances travelled to commute to campus.

The emissions factor for the ANPR data is based on an all-car emissions report from APCOA which provided the fuel type, and then the average car DEFRA 2023 factor and WTT emission factor were applied to the count.

10.7.1 Change of Method Overview

The car parking data was utilised to differentiate staff users, and to further analyse staff commuting habits. Staff were assumed to commute to campus between 0500 and 1000, and the usage was averaged out across the user groups, therefore this analysis is a median outlook and not representative of the modal user.

The distance between home and campus was determined through postcode data, which gives distance-frequency weighting. This identified the areas of most likely car usage, and where there are other transport routes available, such as train, bus, and active travel.

The frequency of car users was proportionally split across the distance groupings and the other methods were considered for practicality and then proportionally distributed.

The emissions factor for car users were calculated from APCOA data that provided engine type of all users in a single, high-volume month. This showed a preference towards petrol engine vehicles, which resulted in a slightly lower emission factor than the general business land travel value provided by DEFRA for GHG calculations.

10.7.1 Limitations

The limitations for this category are the numbers of respondents and accuracy of responses to the University travel survey. There is now more information available on car users based on car parking data available since November 2022 compared to data available on other commuting options that are available to staff.

There is a limitation with regards to people who utilised 2 modes of transport regularly as this is not considered.

10.7.2 Reporting Level

This is a significant change in methodology from previous years and based on standardised carbon emissions framework overview we are now reporting these emissions to an "advanced" level.

10.7.3 Results

10.7.3.1 Transport Survey Staff Count

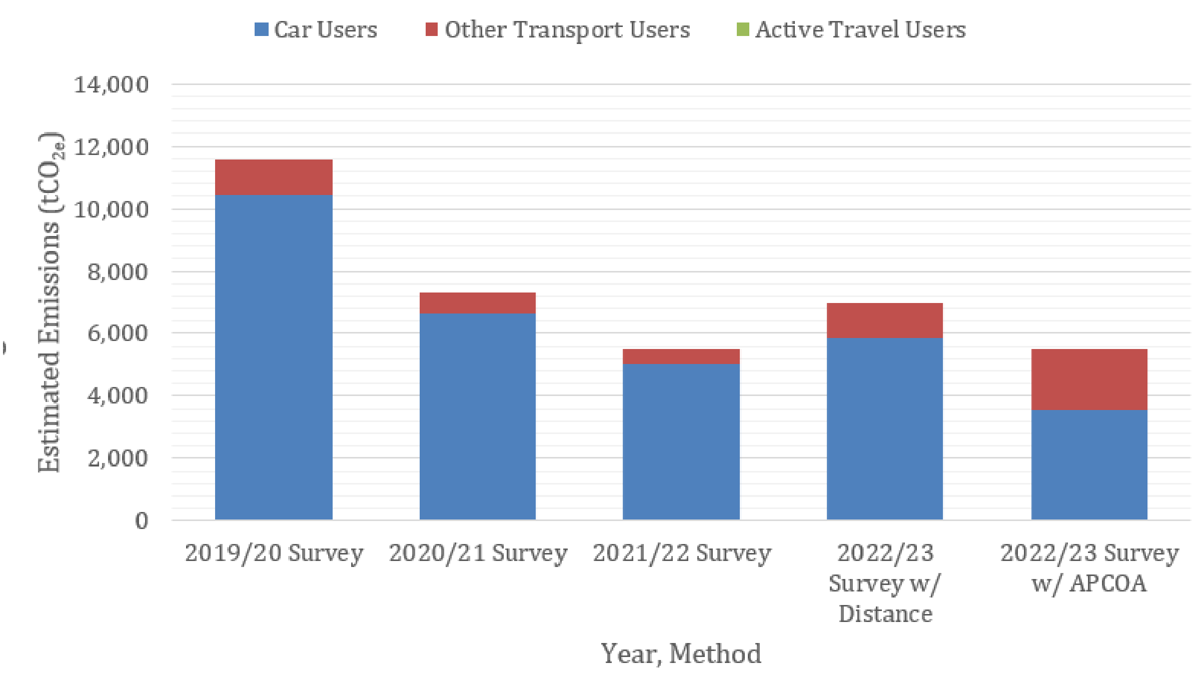
The initial results use the same methodology as previous years, where the splits of the whole staff population into user groups is extrapolated from the transport survey. When the APCOA data is considered, the staff count changes to a reduced number of car users and increase in other transport users. The active travel count (bikes, walking, push-scooters) remains relatively consistent.

STAFF HEADCOUNT		**2019/20**	**2020/21**	**2021/22**	**2022/23**
Transport Survey	Car Users	4799	4799	4852	5748
	Other Transport Users	1046	1046	962	1147
	Active Travel Users	Unknown	Unknown	1165	1305
With APCOA Data	Car Users				4723
	Other Transport Users				2189
	Active Travel Users				1308

10.7.3.2 Estimated Emissions (tCO_{2e})

Where there are uncertainties and improvements to the estimation methodology, the results are expected to vary. The variances in methodology are highlighted, and the resulting emission splits shown.

Chart 37: Estimated emissions from staff commuting.



Estimated Emissions (tCO_{2e})		2019/20 5 Day Week	2020/21 3 Day Week	2021/22 3 Day Week	2022/23 2 Day Week
Transport Survey (tCO_2e)	Car Users	10464	6,640	5,013	
	Other Transport Users	1111	692	491	
	Active Travel Users		0	0	
	Total	11,575	7,332	5,464	
Transport Survey With Distance (tCO_{2e})	Car Users				5,876
	Other Transport Users				1,124
	Active Travel Users				0
	Total				7,000
Transport Survey with APCOA data	Car Users				3,552
	Other Transport Users				1,980
	Active Travel Users				0
	Total				5,532

10.8 Emission source 7.2 – Employee Telecommuting

10.8.1 Source

The FTE of staff is provided by the Information & Digital Group as published on the University webpages. Working from home emissions intensity is sourced from DEFRA.

10.8.2 Method Overview

Telecommuting emissions are calculated in line with the EcoAct Homeworking White paper[12] [2020]. The amount of time spent working from home is based on the residual of the working year after the days on which staff are assumed to commute (above).

10.8.3 Limitations

The limitations for this category are that the frequency of telecommuting is based on the commuting assumptions and number of days of annual leave.

10.8.4 Reporting Level

Based on standardised carbon emissions framework overview we are reporting these emissions to an "advanced" level.

10.8.5 Result

	2019/20 3 Day Week	2020/21 3 Day Week	2021/22 3 Day Week	2022/23 2 Day Week
Gas	1,204	3,108	1,918	1,417
Electricity	264	634	537	133
Homeworking (Total)	1,468	3,742	2,455	1,500

[12] https://info.eco-act.com/en/homeworking-emissions-whitepaper-2020

10.9 Emission source 9.2 – Student Commuting

10.9.1 Source

The transport survey provides the method of travel to the University. ANPR data is used to refine assumptions around frequency of visits. Termtime locations of students is from the Accommodation team. The type of public transport comes from local providers – National Rail, National Express, Stagecoach.

10.9.2 Change of Method Overview

Compared to historical reporting it is assumed that the average number of days students travel to campus has reduced from five to three and is assumed to be 85 days per student per year.

Analysis of student off campus living suggest that the geographical distribution of students has moved closer to the University and, as a result average commuting distances have reduced and the likelihood of using active travel modes has increased.

Car parking data was used to supplement information from the travel survey which had limited student respondents, with non-car weighting based on availability and smaller feedback surveys.

A detailed description of the updated methodology can be found in Appendix 12.

10.9.3 Limitations

The main limitation for this category is the limited student response to the 22/23 transport survey.

10.9.4 Reporting Level

This is a significant change in methodology from previous years and based on the standardised carbon emissions framework overview we are moving toward an "advanced" reporting level.

10.9.5 Result

Although we are still relying on significant assumptions and our results are still estimates, we now have better data sources, including improved information on the geographical distribution of students during term time and high-resolution car parking data that provides an indication of the frequency of visits to campus. These new data sources suggest that we may have overestimated emissions in this category through the unsettled period during and following COVID. We are now working on improving data with improved surveys and other data sources to refine our estimates further.

	2019/20	2020/21	2021/22	2022/23
Estimated Emissions from Student Commuting (tCO_{2e})	10,921	15,781	9,706.5	5,179

10.10 Emission source 9.2 – Student travel to and from home - Domestic

10.10.1 Source

Student home postcodes were provided by IDG. Approximately 15,000 postcodes were provided.

10.10.2 Method Overview

Home postcodes were provided for approximately 90% of the domestic student population. As per the SCEF guidance six journeys were considered in total - at the start and end of each of the three terms. The journeys at the start of term one and end of term three are assumed to be made by car – therefore resulting in two round trips a year. With no specific data on the method of transport within the year, journeys at term breaks are assumed to be made by train.

Additional options such as student car ownership, travelling by coach and all trips made by parents were also calculated to give a range of the possible emissions.

10.10.3 Limitations

The limitations for this category are the variability of student travel modes. The assumption that a car is used for the initial and final trips, and a train for other end of term return journeys, is not a valid option for all students, and they could make these four intermediate trips by car or bus.

The distance between local rail stations and Coventry Station. The GPS location of the UK rail stations is known, the closest in distance to each postcode has been identified. The distance from local stations to main city stations has been calculated with a modifier of 1.4. The distance from the main city station to a national hub – BHM or EUS – is then calculated to better represent the national rail service, with the same modifier of 1.4. The distance between COV and BHM and COV and EUS is the final journey stage.

10.10.4 Reporting Level

Based on standardised carbon emissions framework overview we are reporting these emissions to SCEF "basic" reporting level, to improve this level of reporting we would be required to survey students.

10.10.5 Result

Estimated Travel Emissions (tCO_{2e})

	2018/19	2019/20	2020/21	2021/22	2022/23
Car				1237	1658
Train				399	502
Total	1845	1597	1516	1636	2161

10.11 Emission source 9.2 – Student travel to and from home - International

10.11.1 Source

The home countries of international students are sourced from IDG data sources.

10.11.2 Method Overview

The locations of each of the international airports were used to give an average distance from each country to London Heathrow. The frequency of travel is as per SCEF guidance, below.

For distances less than 2500 km it is assumed that three round trips are made.

For distances over 7000 km, it is assumed that one round trip is made.

For distances between 2500 and 7000 km it is assumed that two round trips are made.

The student headcount, the frequency of travel, the emission factor (per km) and the distance to the country are used to give a calculation per country of emissions.

10.11.3 Limitations

The limitations for this category are the inaccuracies introduced when determining the students starting point within each nation in relation to the UK, especially where countries have multiple international airports or cover wide latitudes. Assumptions made in line with the SCEF guidance as to the frequency of flights taken by students, and the determination of short, medium, and long-haul flight distances. Travel within the international country is not accounted for.

10.11.4 Reporting Level

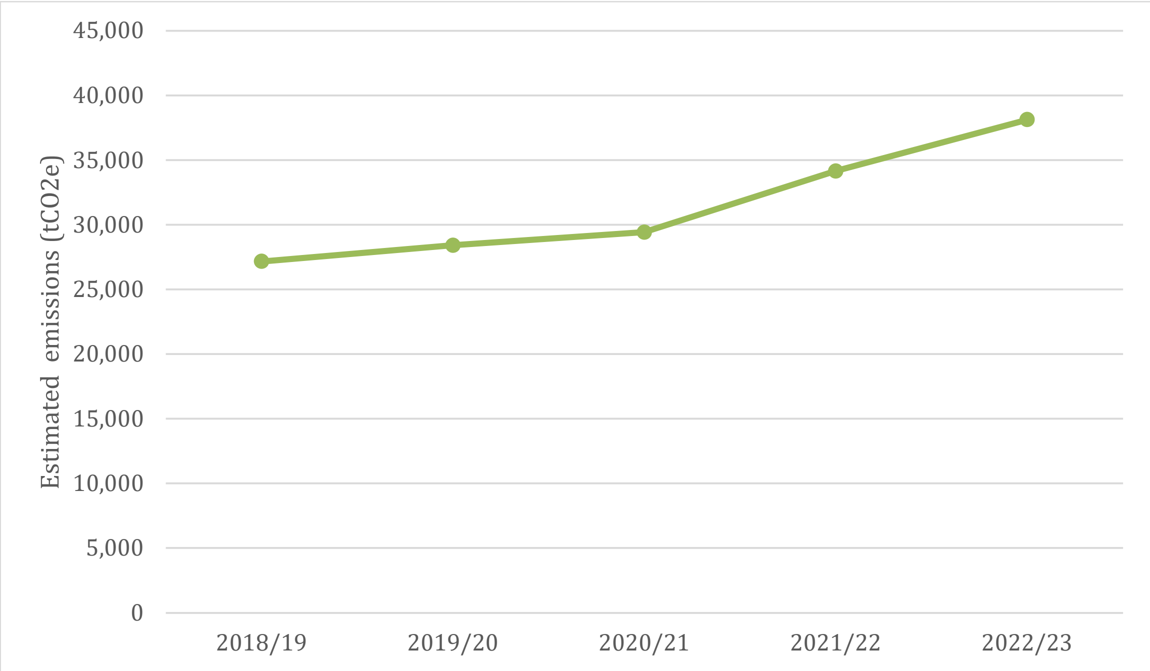
Based on standardised carbon emissions framework overview we are reporting these emissions to a “basic” reporting level. To achieve a higher level of accuracy, a student survey would be required.

10.11.5 Result

Due to the similar nature of the datasets, a re-baselining of previous years’ data using a methodology based on the average distance to international airports for each country, are included from 2018 to date. The combined impact of increasing numbers of international students and greater distances to students’ country of residence has dramatically increased emissions in this category. There has been a notable increase in emissions factors for air travel compared to 2021/22 with a 11% increase in domestic flights, a 21% increase in short haul flights and 35% increase in long haul flights. A change that has contributed to the increase in emissions.

	2018/19	2019/20	2020/21	2021/22	2022/23
Headcount	10,241	10,896	11,264	12,215	12,268
Average Distance (km)	16,178	16,604	16,280	17,447	17,894
Emissions (tCO_{2e})	27,171	28,404	29,426	34,164	38,125

Chart 38: Estimated emissions from International Student travel.



10.12 Emission source 9.3 – Student travel to study

10.12.1 Source

The location of students studying abroad was provided by IDG. This included definition between whole year placements and part year placements.

10.12.2 Method Overview

The same distance calculations were used for international home travel and student travel for study. The frequency of travel to be counted in estimations is provided within the SCEF and considers distance and length of placement.

For distances less than 2500 km it is presumed that three round trips are made.

For distances over 7000 km, it is presumed that one round trip is made.

For distances between 2500 and 7000 km it is presumed that two round trips are made.

For part time placements only one round trip is made.

The student headcount, the frequency of travel, the emission factor (per km) and the distance to the country are used to give a calculation per country of emissions.

10.12.3 Limitations

The limitations for this category are:

1) An unknown amount of visits home during a term time abroad.
2) Uncertainty over which airports are used.
3) Unknown methods of travelling to the airport.
4) A simplified assumption that all air travel takes place from London Heathrow

10.12.4 Reporting Level

Based on standardised carbon emissions framework overview we are reporting these emissions to a "basic" level.

There is an opportunity to survey the relatively small number of students carrying out studies abroad to better understand the travel which would increase the reporting level to advanced or intermediate depending on the intricacies of the data surveys.

10.12.5 Result

	2018/19	**2019/20**	**2020/21**	**2021/22**	**2022/23**
Headcount	753	755	424	673	596
Average Distance (km)	6,898	6,573	4,096	4,863	5,799
Emissions from Study Abroad (tCO_{2e})	1983	1830	450	950	565

10.12.5.1 Location Based Carbon Intensity

The study aboard placements take place on five continents, with no placements being reported in Africa.

The headcount shows significantly more study abroad placements in Europe than other continents, with 64% of all placements.

However, due to the distance, the placements in Asia are having more of an impact on the overall emissions.

Looking at the emissions at a country specific level the most carbon intensive country is Australia, with 112 tCO_2e from 45 placements. It should also be noted that due to the distance, for full time and part time placements the number of flights presumed is the same (a single round trip), and 29 of these placements were part time.

CONTINENT	HEADCOUNT	KG CO2E
SOUTH AMERICA	**21**	41,488
NORTH AMERICA	**53**	65,063
ASIA	**96**	208,868
EUROPE	**383**	137,883
OCEANIA	**45**	111,902

Chart 39: Distribution of Emissions by Study Location.

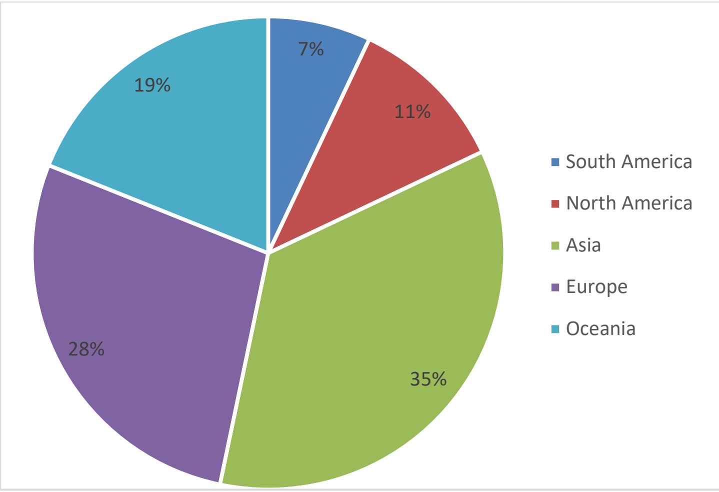
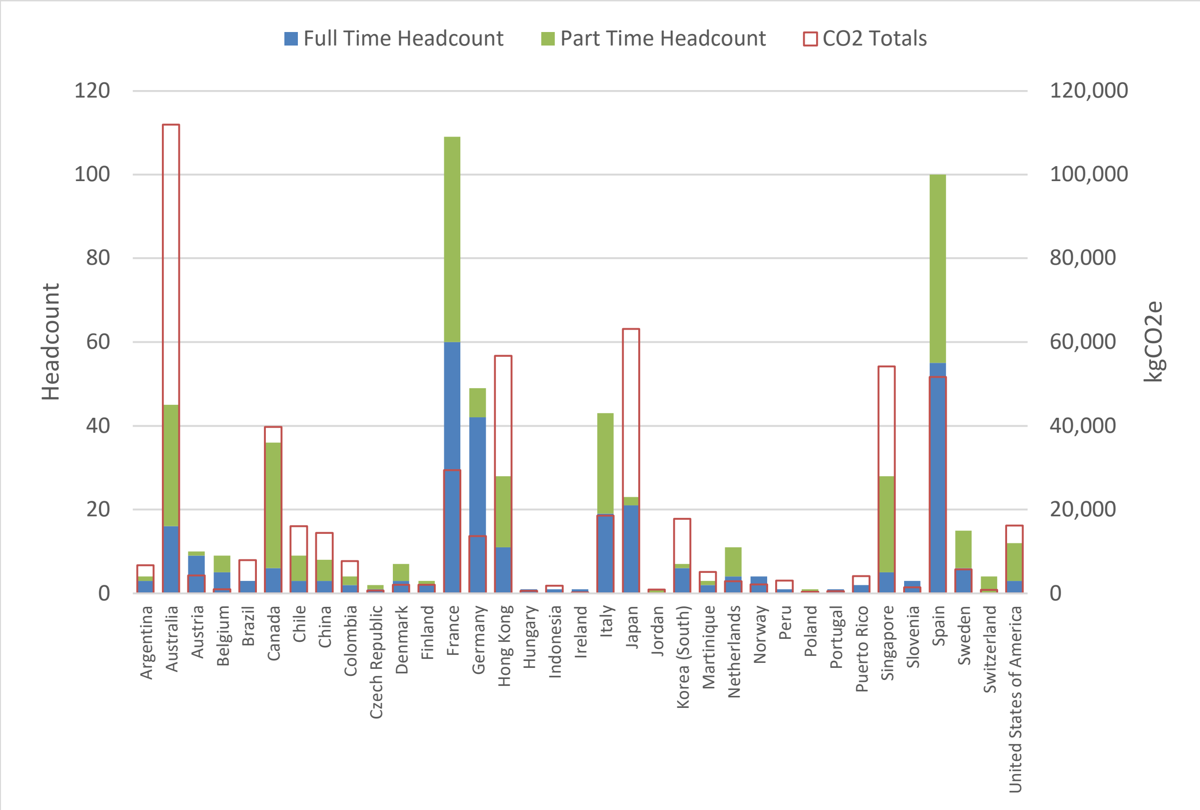


Chart 40: Carbon Intensity of Student Travel for Study



10.13 Emission source 10,11,12 – Processing, Use and End of Life of sold products.

10.13.1 Source

There is no known usage data for products sold on campus.

10.13.1 Limitations

The limitations for this category are a lack of end user data from CCSG products.

10.13.2 Reporting Level

Based on standardised carbon emissions framework overview we are not reporting these emissions in line with the SCEF

10.13.2.1 Actions to improve reporting.

The reporting requirements for these categories are only at an advanced level, where there is a SCAF flow chart for managing the tracking of products within the commercial arms of the University. This will require a substantial level of collaboration with the CCSG team.

10.13.3 Presumption of products

It is presumed that all products that are processed, used, and wasted within these categories are the output of CCSG.

It is presumed that all products produced on site, are using resources captured in Scope 1, Scope 3 and Scope 3 Cat 1 (Water).

It is presumed that all goods are consumed on the premises with the waste entering the waste streams captured in Scope 3 Category 5.

11 Total Estimated University CO_{2e} Emissions

Emissions from all scopes reported above have been combined into the Total University figures below to provide an indication of total emissions.

	2018/19	*2019/20*	*2020/21*	*2021/22*	*2022/23*
Location Based Scope 1 And 2 (tCO_{2e})	40,496	37,903	39,850	39,809	37,180
Scope 3 Emissions (tCO_{2e})[13]	191,530	180,783	209,646	176,813	146,412
Total Scope 1, 2 And 3 (tCO_{2e})	***232,026***	***218,686***	***249,496***	***216,622***	***183,592***

Chart 41: Reported Estimation of University Emissions since Baseline Year

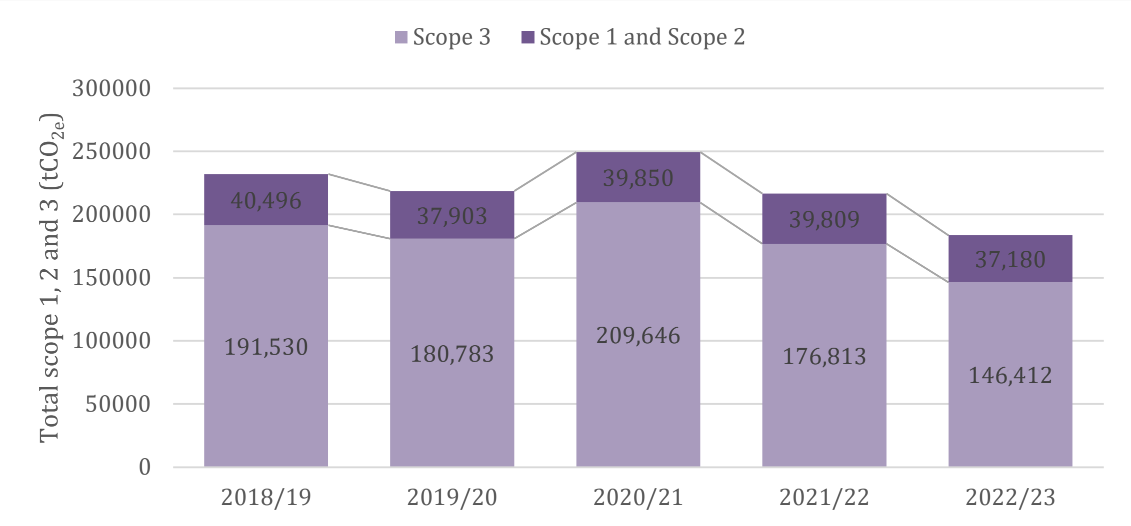
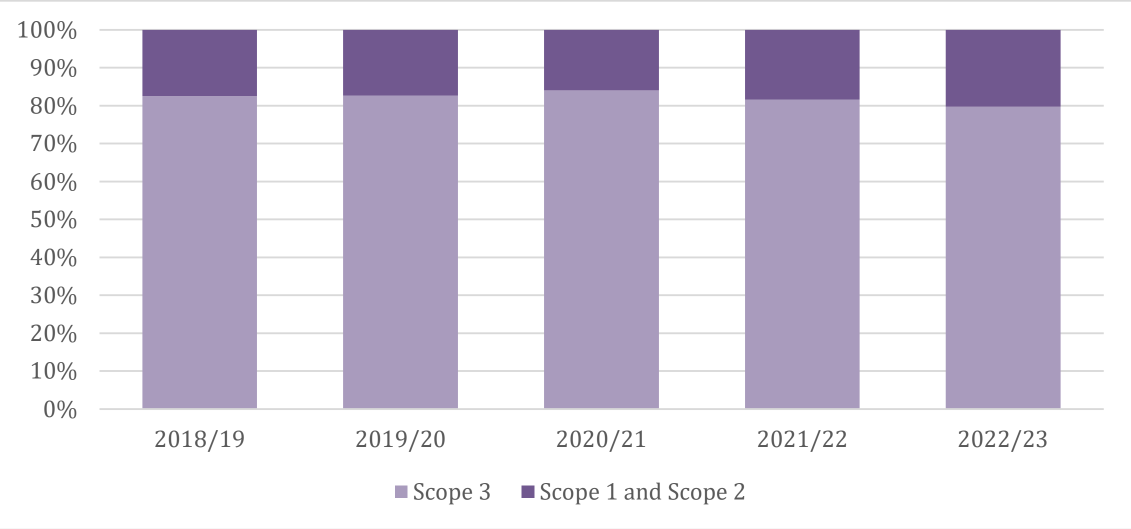


Chart 42: Percentage split of reported Scope 1 and 2 versus Scope 3



[13] Note that these figures are re-baselined values using the HESCET methodology for Scope 3 Category 1 (Procurement) and are greater than values previously reported.

Chart 43: 2022/23 Total estimated University scope 1,2 and 3 CO_{2e} emissions by GHG category including 3rd Party Energy Consumption on University Campus.

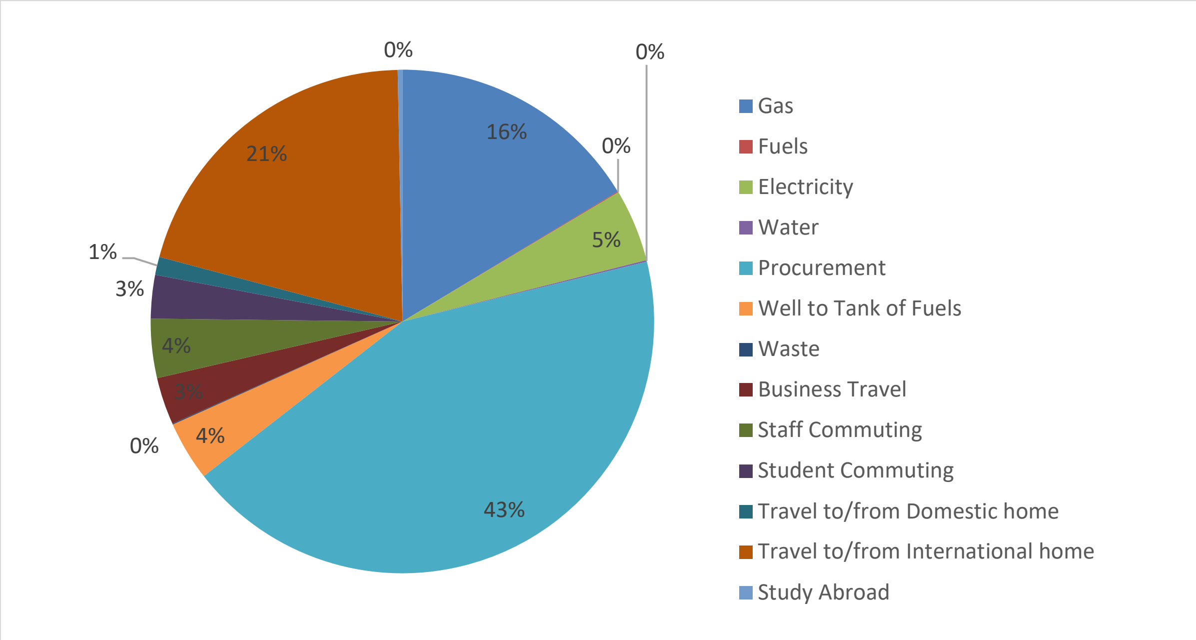
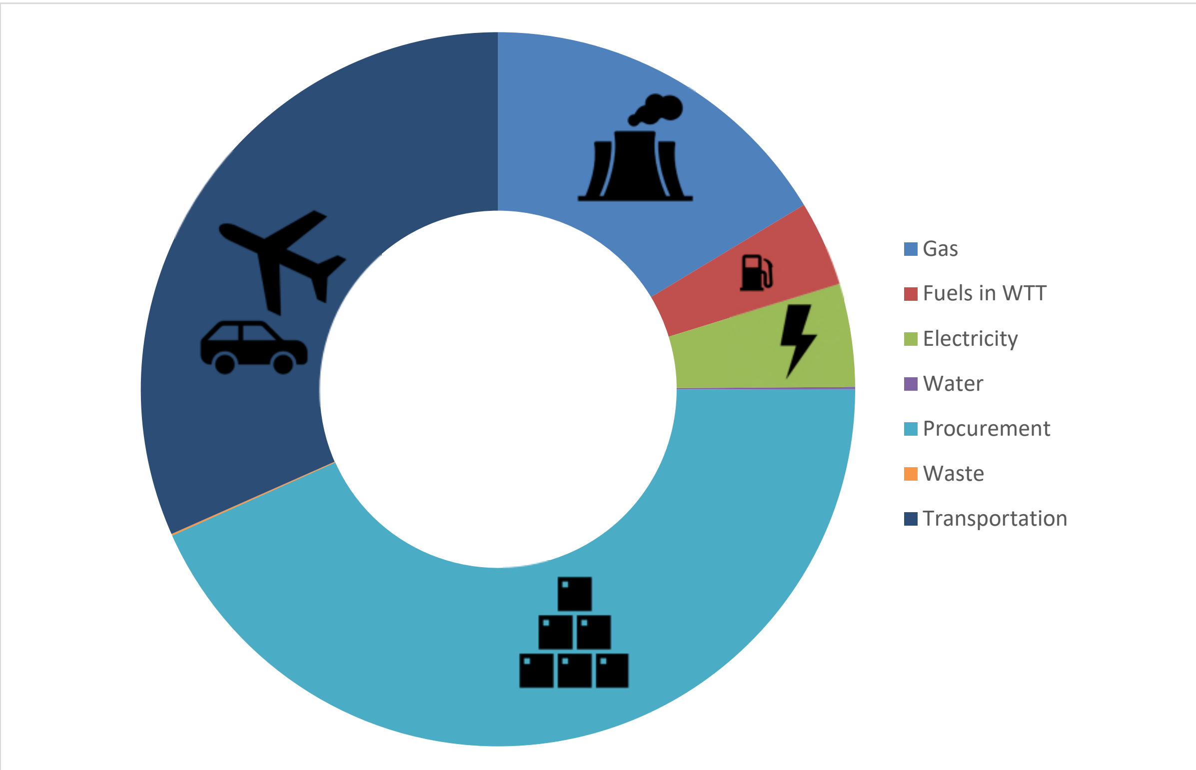


Chart 44: 2022/23 Total estimated University scope 1,2 and 3 CO_{2e} emissions by category including 3rd Party Energy Consumption on University Campus.



12 Recommendation

The *Way to Sustainable Strategy*[14] outlines the University's Sustainability goals and objectives with explicit targets on energy and carbon. The aim of this report is to summaries the performance of the University across all emission sources and detail the progress towards Net Zero emissions.

The Energy Infrastructure Group (EIG) implemented a carbon management plan in 2021, which identified the technologies and interventions required to achieve significant energy and carbon savings and these are being progressed by the Energy Action Group (EAG).

Some general recommendations are provided below.

12.1 Awareness

12.1.1 The Energy Policy

The recently drafted Energy Usage Policy sets guidance for responsible energy usage across the University and defines responsibilities for user groups. The policy will only be effective when followed up with engagement, starting with user groups who can affect the greatest impact on energy use. This work is underway.

12.2 Collaboration and Setting Objectives

12.2.1 Scope 1 and 2 Carbon Management

Campus and infrastructure level interventions should overlay local energy reduction plans where knowledge of building or departmental level operational requirements and reduction opportunities is essential.

The work completed in the Autumn of 2022 (Sec. 8) demonstrated significant energy, cost and carbon savings can be made by scheduling heating and cooling systems more closely to core building operating hours.

The practices of 24 hour and prolonged building operation found in the analysis of building services is highly likely to be repeated in the operation of user-controlled equipment and this is supported by energy metering data.

Certain subgroups within the University, including Campus and Commercial Services Group business units, Warwick Business School and Warwick Manufacturing Group are pro-active in evaluating energy data provided to them and identifying opportunities to reduce.

The wider dissemination of energy usage data, alongside support in the interpretation and implementation of reduction activities is essential to achieving our energy reduction goals. A common platform with intuitive and clear access to energy and carbon data from the campus level down to individual building units is in development with the objective of making data and reduction targets a common objective between the Energy and Sustainability Team and different user groups.

12.2.2 Scope 3 Carbon Management

As carbon becomes more of a topic for the supply chain there will be a growing requirement for education within our teams to understand and be familiar with data within this report, including but not limited to procurement. Working with the departments and teams to ensure that information is available in ana accessible manner will be crucial in ensuring that smaller decisions are made that can have an accumulative impact on the Scope 3 emissions.

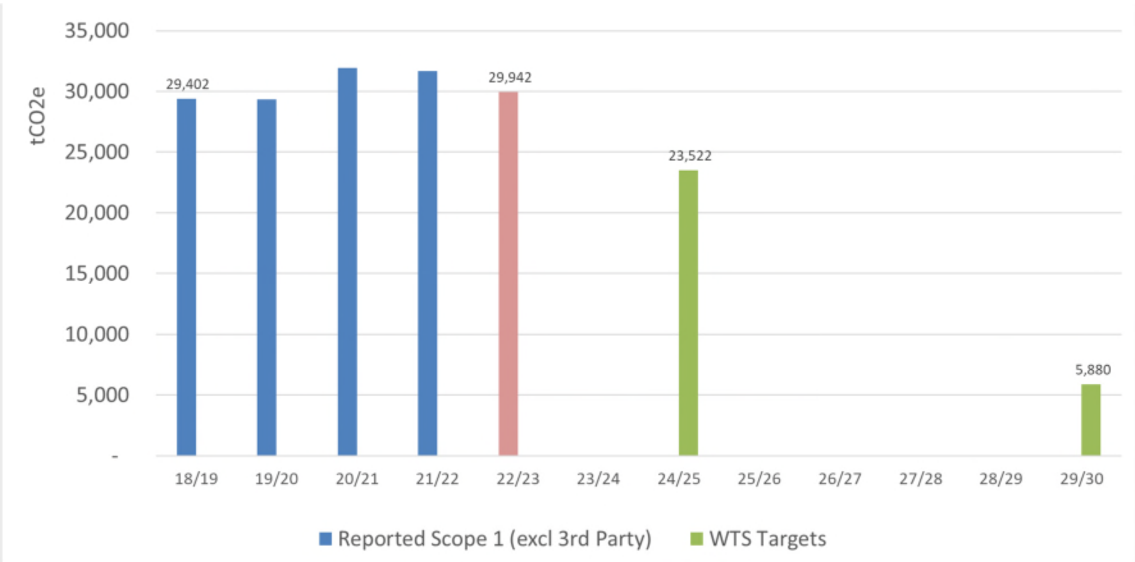
[14] https://warwick.ac.uk/sustainability/strategy/the_way_to_sustainable_-_final.pdf

12.3 Net Zero Targets

The chart below illustrates the target included in the Way to Sustainable strategy for Scope 1 emissions – a reduction of 20% by 2025 and by 80% by 2030 based on a 2018/19 baseline year. Although definitions of Net Zero vary, these targets begin to reflect the scale and rate of emission reduction described in the Net Zero standard[15] published by the Science Based Target initiative, a standard that suggests a 90% reduction in emissions at the point of declaring "*net zero*".

Achieving the 2030 Scope 1 and 2 targets will be transformative in terms of the way we heat and power our campuses but also in our approach to using energy, achieving our Scope 3 targets will impact on all aspects of university life.

Chart 45: Total Scope 1 Emissions Excluding 3rd Parties (tCO2e) - Way To Sustainable Targets



[15] https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf