Energy and Carbon Annual Report 2021/22

Issue Date	Revision	Authors	Comments
27.02.23	1.0	A Thomas, M Jarvis, K Mayfield, M Hope, D Chapman, E Sanderson-Nichols	New Document

Contents

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 minimal contribution from other fuel sources.

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 10 months of the 2021/22 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 three 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 procurement, of which, building construction and maintenance is the largest component, and travel.

Abbreviations

BEIS – (Department for) Business Energy and Industrial Strategy

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

CRC – Carbon reduction Commitment

UKETS – United Kingdom Emissions trading Scheme

FTE – Full Time Equivalent

GDP – Gross Domestic Product

GHG – Green House Gas

HVAC – Heating Ventilation and Air Conditioning

IARC – International Automotive Research Centre

ERA – Energy Research Accelerator

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, and Scope 1, 2 and 3 carbon dioxide emissions for the University during the 2021/22 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 2021 to 31st July 2022. The changes in working practices that occurred as a result 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 20/21 levels, University water usage and emissions from transport 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 0.1% compared to the previous year to 39,809 $tCO_{2e.}$ Emissions excluding third parties were 38,149 $tCO_{2e,}$ a 0.6% increase on 2021/22. The effects of milder weather in 2021/22 were offset by higher electricity demands and increased utilisation of gas fired combined heat and power (CHP) engines. The increased volumes of certified renewable electricity purchased in the 2021/22 reporting year resulted in a significant reduction of "market based Scope 1 and 2 emissions" – those calculated on the basis of the electricity suppliers declared emissions.

The University's gas fired combined heat and power (CHP) operation continues to save costs relative to purchasing electricity from the grid and obtaining heat from boilers, however, due to the continued decarbonisation of grid electricity, gas fired CHP does not save carbon with emissions in 2021/22 approximately 4,900 tCO_{2e} higher than would be achieved by obtaining all electricity from the grid and heat from gas boilers[2].

University scope three carbon emissions are estimated at 104,694tCO_{2e} for the reporting year 2021/22 using available data and estimates. Scope three carbon emissions from procurement, a significant proportion of total emissions, have been broken down by department, this information is being used to raise awareness on environmental impact and develop improvement plans.

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.*

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

[2] The additional carbon emissions presented here are based on obtaining *average* carbon content electricity from the grid not compared to zero carbon electricity provided by our current supplier.

- *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 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.*

- *A Building Optimisation Working Group have been formed and 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.*

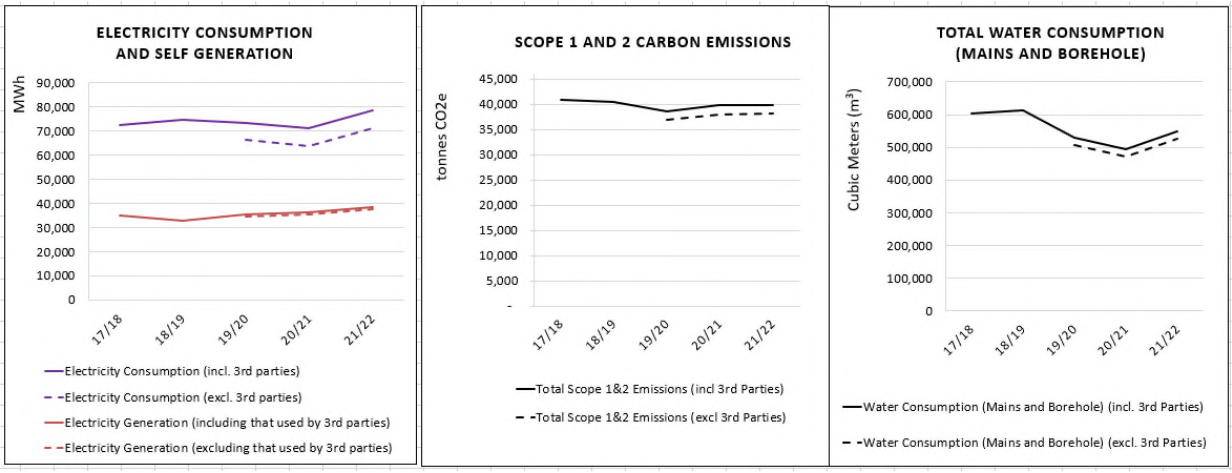
- *The Estates Finance, Maintenance and Energy teams are working more closely to improve certainty on energy supply and cost planning in the context of an increasingly volatile cost environment.*

2 Key Statistics

2.1 University Tier 1 indicators

	Budget / Target	2021/22 Actuals [excl. 3rd parties]	Variance to 5 year Average
Electricity Consumption (MWh)	79,606	78,590 [71,201]	+9.8%
CHP Electricity Generation (MWh)	41,790	37,972	+10.6%
Scope 1 and 2 Carbon Emissions (tCO_{2e})	40,912	39,809 [38,148[3]]	+0.1% [+0.8%[4]]
Water Consumption (Mains and Borehole) (m^3)	625,192	556,983 [533,634]	-10.9%

Chart 1: University Tier 1 Energy and Sustainability Metrics



[3] **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**

[4] Compared to 3 year historical average.

2.2 Energy and Sustainability Key statistics

	Budget / Target *(31 Mar 22)*	2021/22 Actuals: incl. 3rd parties	Variance to: **2020/21** *[Budget/Target]*
Gas Consumption (incl. 3rd parties)	184,442MWh	175,743MWh	**-0.4%** [-4.7%]
Water Consumption (Mains and Borehole)	625,192m³	556,983³	**+12.5%** [-11.0%]
Estimated Scope 3 Carbon Emissions (tCO_{2e})	104,694		
Scope 1 and 2 Carbon emissions/m^2		55.8kgCO_{2e}/m^2	-4.5%*
Water Consumption m3/FTE		16.9m^3/FTE	-4.5%*
Scope 1 and 2 Carbon emissions (excl 3rd party emissions)/£income (GDP Deflator Applied)		0.049kgCO_{2e}/£	-7.0%*

3 Scope 1 and 2 Carbon Emissions

3.1 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, this 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 2021/22.

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.

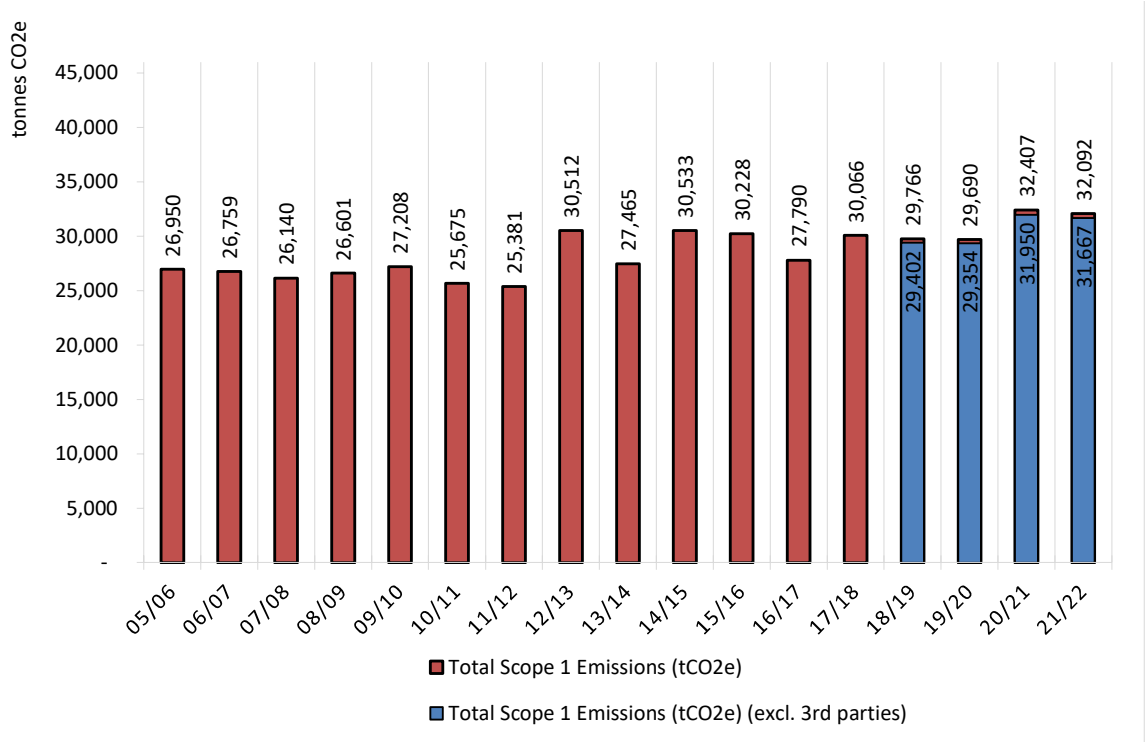
Where emissions occur in the generation of heat or electrical power supplied to third parties these are now indicated in our reporting

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**.

3.2 Scope 1 Emissions

Total University Scope 1 emissions including third parties for the year 2021/22 were 32,092 tonnes CO_{2e}, a reduction of 1% on the previous year. Total emissions from University of Warwick activities alone were 31,667[5] tonnes CO_{2e} a reduction of 0.9% on the previous year.

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



The 21/22 reporting year was one of the mildest in recent years (1,858 heating degree days[6] in 2021/22 compared to 1,990 in 2020/21) and this resulted in a reduction in heating related gas consumption. However, an increase in demand for electricity and

[5] **Note "University Activities" here include the consumption of gas in energy centres for the supply of heat and electricity to 3rd parties, emissions of 1,400 tCO_{2e} in 2021/22**

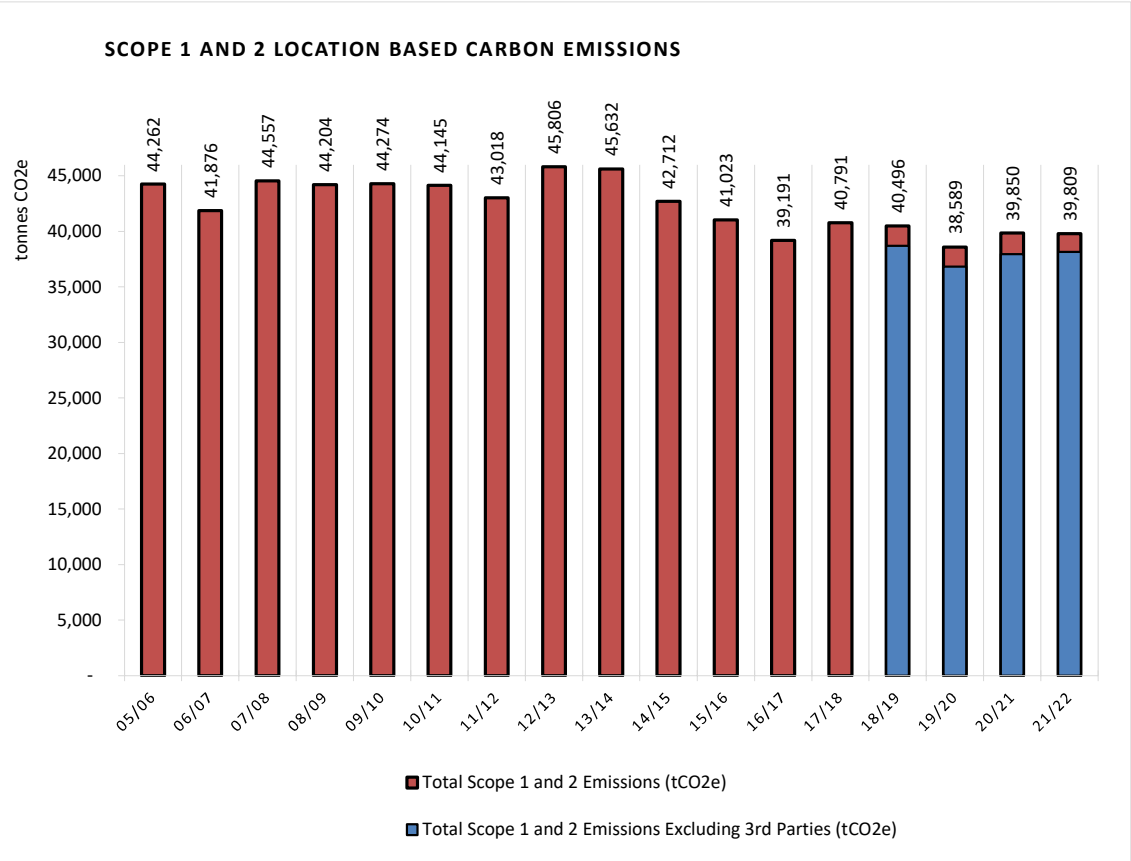
[6] Heating degree days give an indication of the thermal energy required for heating based on outside air temperatures.

improved reliability of the University's substantial gas fired combined heat and power (CHP) installations, enabled an increase in on site electricity generation from CHP, offsetting the gas savings from milder weather.

3.3 Total Reportable Scope 1 and 2 Emissions

Total University combined Scope 1 and 2 emissions including third parties for the year 2021/22 were 39,809 tonnes CO_{2e}, a reduction of 0.1% on the previous year. Total emissions from University of Warwick activities alone were 38,148[7] tonnes CO_{2e} a slight increase of 0.6% on the previous year, emissions from 3rd parties amounted to approximately 4% of emissions. These emissions are shown in the chart below.

Chart 3: Total Annual Location Based Scope 1 and 2 CO2 Emissions



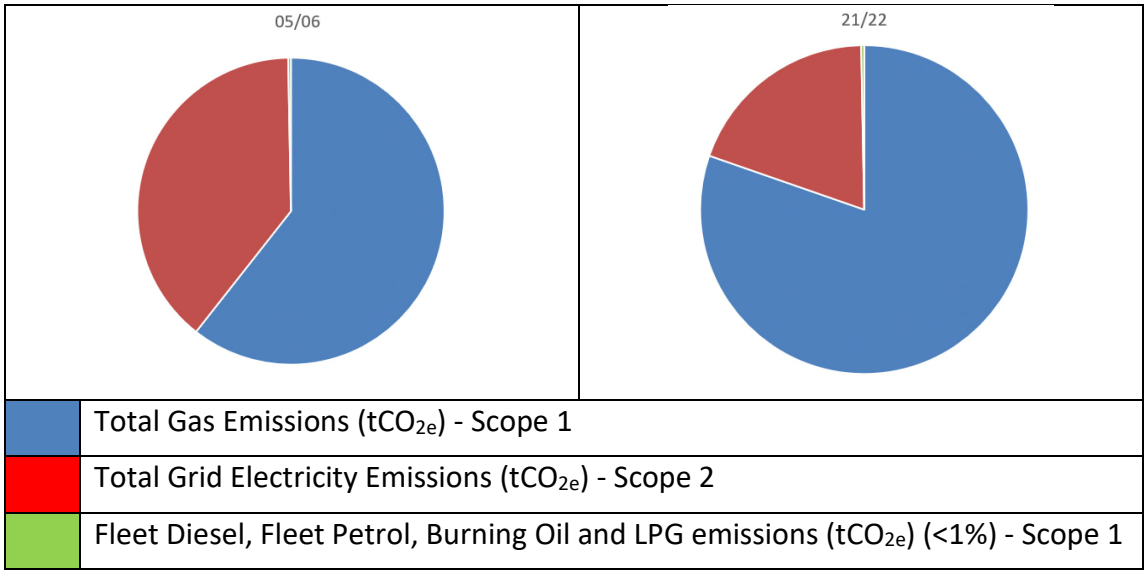
Location based Scope 1 and 2 emissions, both inclusive and exclusive of 3rd parties showed very little change between 20/21 and 21/22 despite underlying movements. The changes in scope 1 emissions are described above; on scope 2, bought in grid electricity carbon intensity fell by 8.9%, however, University grid electricity

[7] 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 36,749 tonnes CO_{2e}.

consumption increased by more than 10%, offsetting the effect of decarbonisation of the supply.

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

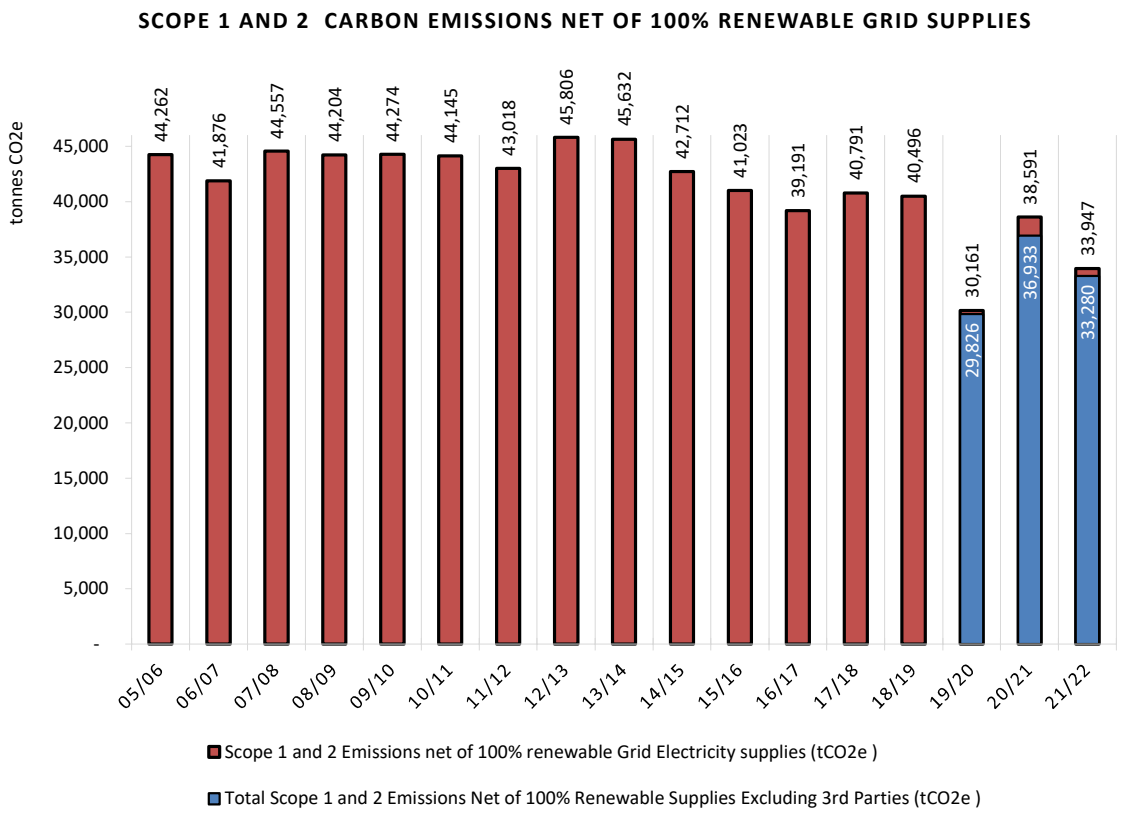


3.4 Renewable Grid Electricity Contracts

The University is committed to renewable purchases for all future electricity contracts.

The University has had contracts with renewable electricity providers for its main supplies previously, although this has not been continuous through recent reporting periods. Grid electricity supplied during the 21/22 report year was predominantly from renewable sources with the contract commencing October 2021, the chart below shows the impact of a renewable electricity contracts over recent years.

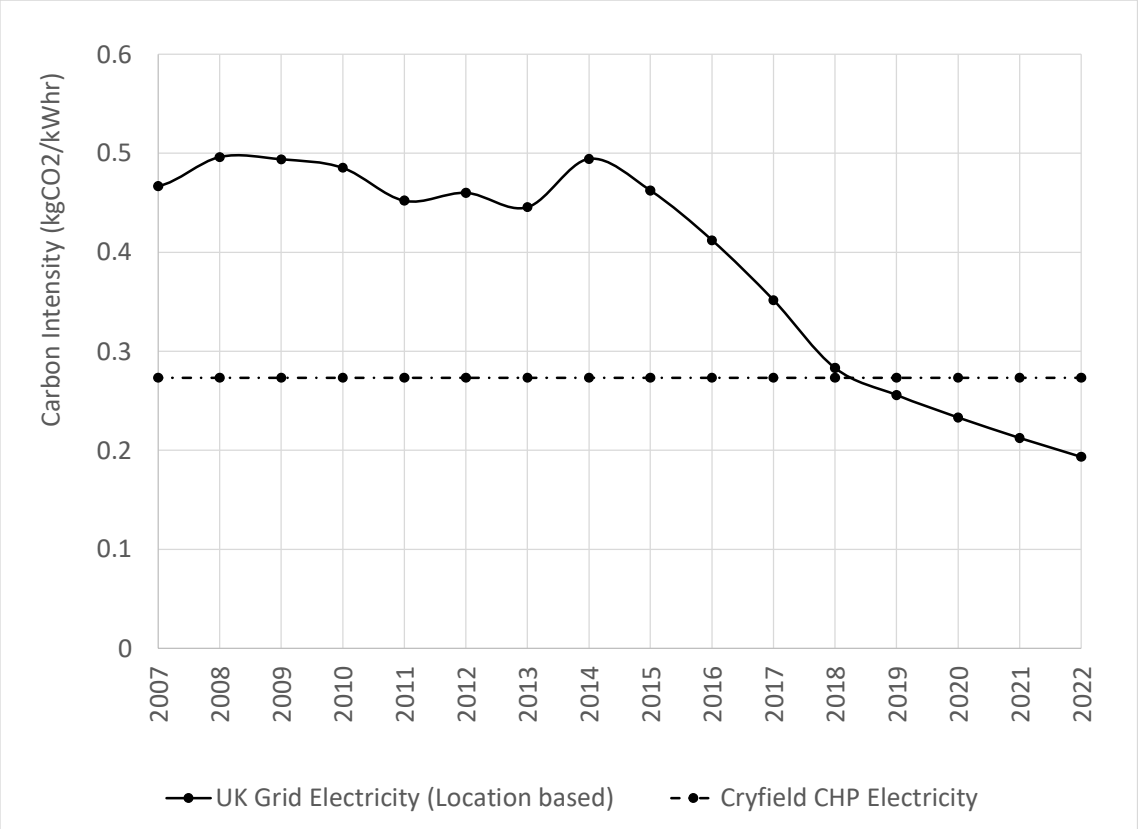
Chart 5: Total Annual Scope 1 and 2 CO2 Emissions net of Grid Electricity Emissions where supply is 100% renewable (Market based emissions).



3.5 Carbon Factors

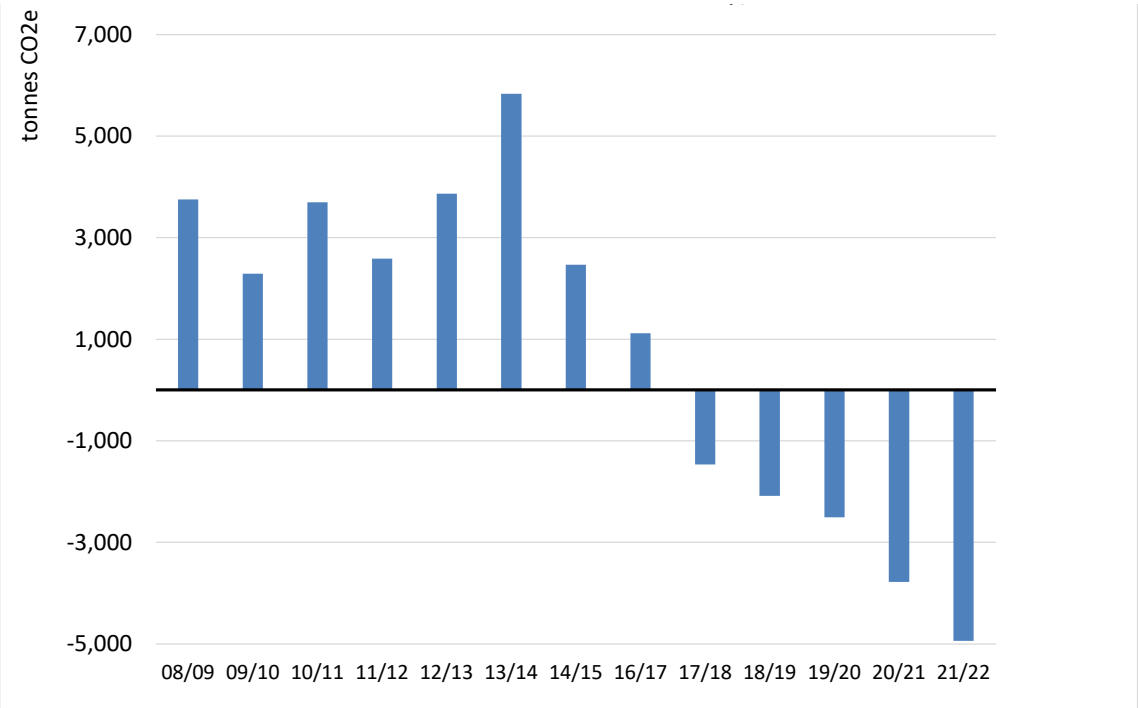
Scope 1 and 2 CO_{2e} emissions are calculated according to BEIS guidance using published average annual carbon intensity factors for consumed energy. The carbon intensity of grid electricity continues to fall as the quantity of grid connected renewable generation increases, with a reduction of 8.9% on the previous year. The chart below shows the change in grid electricity CO_{2e} factors 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 6: 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 reported carbon emissions. The chart below shows how the carbon savings of the University's CHP engines compared to the most common method of supplying heat and electricity (via gas fired boiler and grid electricity) has changed over time due to the falling carbon content of grid electricity. This scenario is somewhat simplified however, since if all UK CHP assets were turned off then the electricity previously generated by CHP would not necessarily come from renewable sources and may come from fossil fuel fired power stations (and hence the grid electricity carbon factor would not be what it is today). However, since the University is purchasing 100% renewable electricity the relative difference between CHP electricity and bought in electricity is marked.

Chart 7: Approximate annual carbon saving from gas fired CHP operation compared to heat from boilers and electricity from grid.



3.6 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

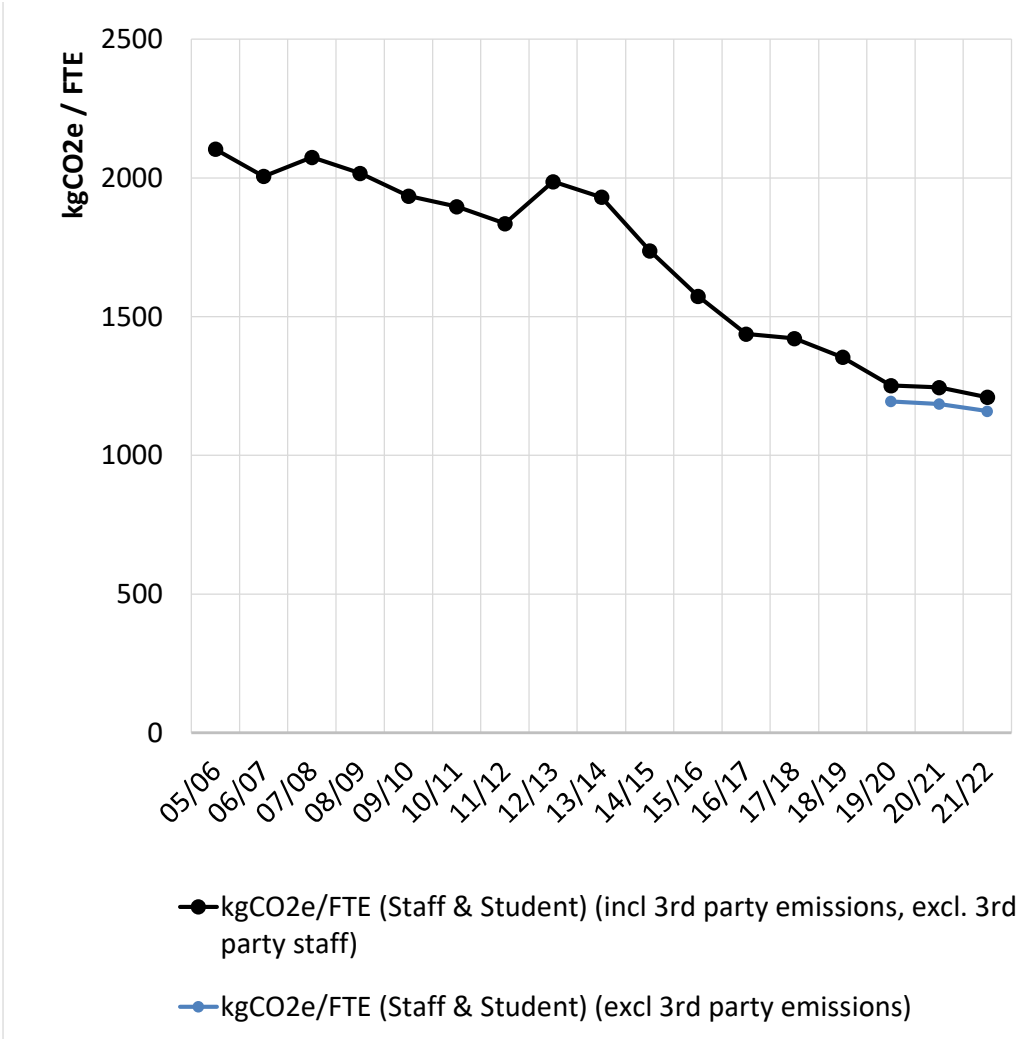


Chart 9: Scope 1 and 2 Location Based Carbon Emissions per £ income (GDP Deflator Applied)

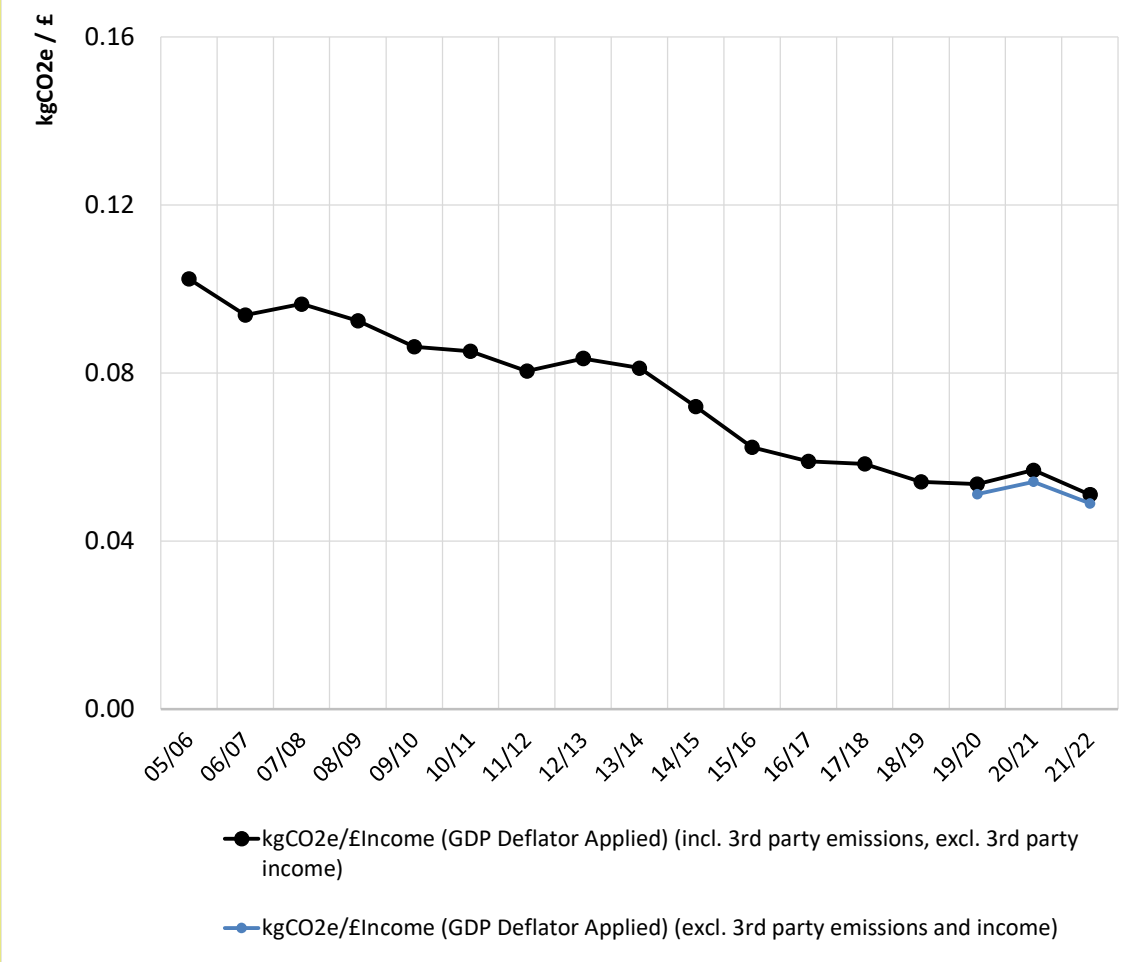
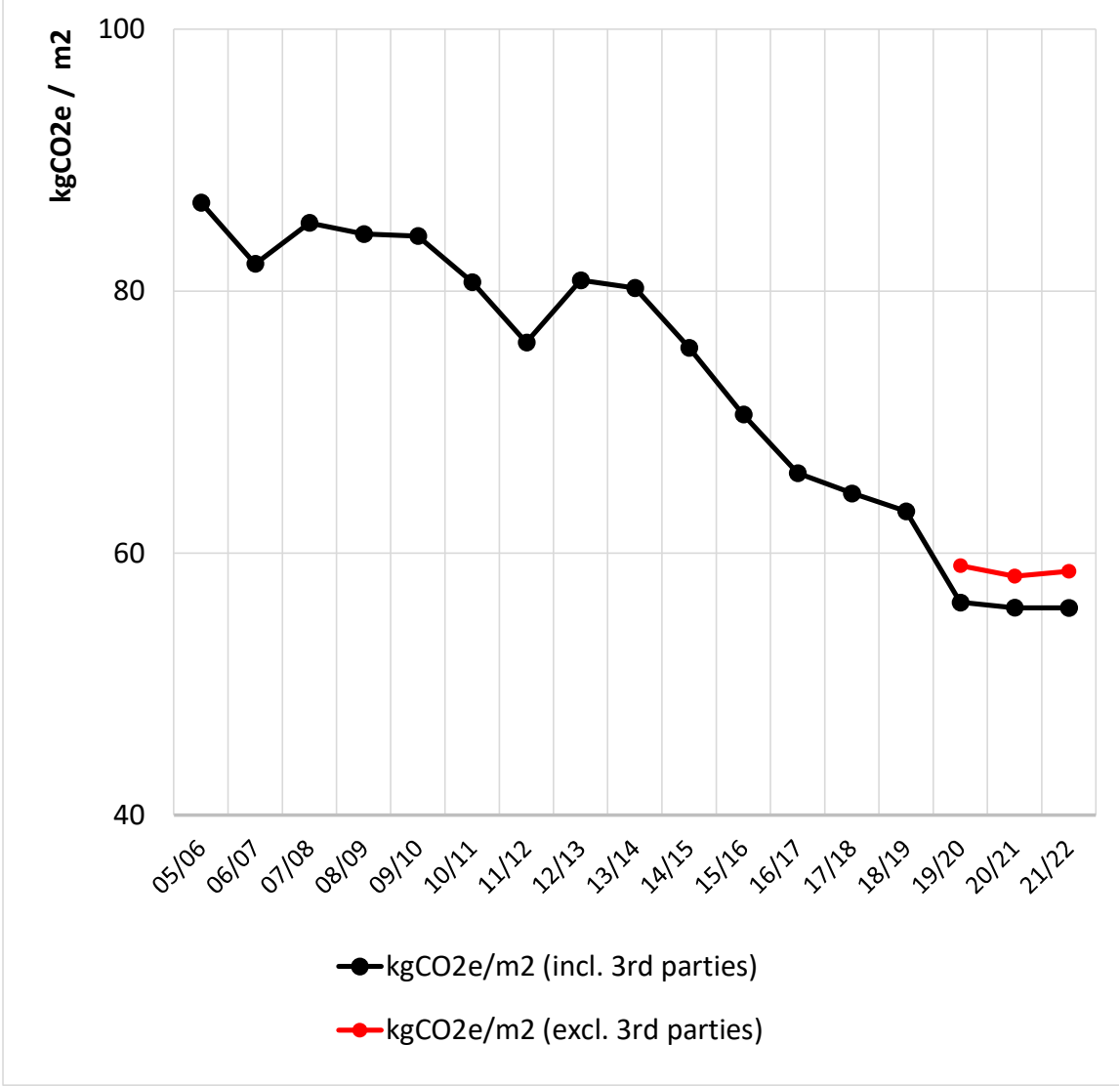


Chart 10: *Scope 1 and 2 Location Based Carbon Emissions per m² of Floor area*



3.7 Scope 1 & 2 Carbon Emissions by Building

3.7.1 All Buildings

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

	Building	tonnes CO_{2e}	% Change against 20/21	Observations
1	Lord Bhattacharyya Building	1951	-5%	Reduction in both electrical and thermal demands
2	University House	1265	15%	Increase in both electrical and thermal demands
3	Warwick Arts Centre	838	59%	Significant increase across all energy demands following re-opening
4	Sports Hub	797	20%	Increase across all energy demands following return to more typical usage after COVID 19 shutdown
5	Argent Court Data Centre	755	33%	Increase following expansion of high-performance computing facility
6	International Manufacturing Centre	745	15%	Increase in electrical energy
7	Heronbank Residences North and East Courts	693		Meter failure in 20/21 prevents accurate comparison to previous year
8	Energy Innovation Centre	682	18%	Increase in electricity and heat demands
9	Millburn House	662	-24%	Reduction in gas consumption due to milder weather and relocation of many occupants to faculty of Arts
10	Bio-Medical Research Building	601	-3%	

The top 10 buildings by carbon intensity are shown below. Science and research buildings make up eight out of the top ten buildings.

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

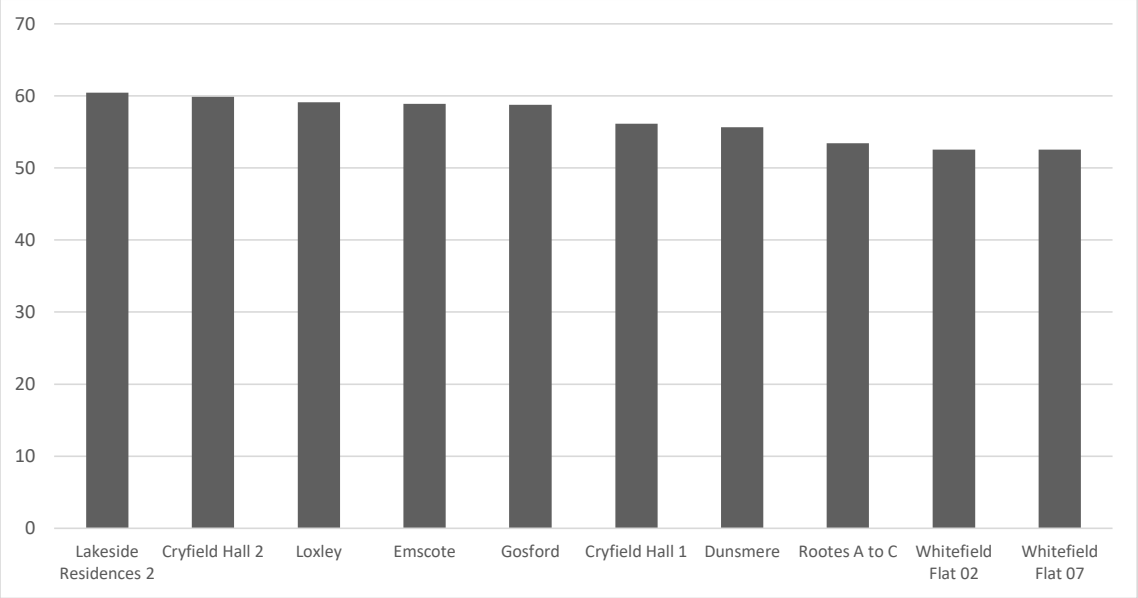
	Building	tonnes CO_{2e} /m^2	% Change against 20/21
1	Argent Court Data Centre	1.65	33%
2	Biotechnology (Phase 4)	0.27	16%
3	Transgenic Plants Laboratory	0.25	3%
4	Mechanochemical Cell Biology	0.22	-4%
5	Physical Sciences	0.20	-7%
6	Phytobiology Facility	0.16	7%
7	Bio-Medical Research Building	0.12	-3%
8	Energy Innovation Centre	0.11	18%
9	University House	0.10	12%
10	Biotechnology	0.10	10%

3.7.2 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 inefficiencies identified below can feed into a focused refurbishment program. A review into the performance of Lakeside residences will focus on heating time schedules, temperature set points and domestic hot water consumption. 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 Highest and Lowest Residential kgCO_2 per m^2 Floor Area



3.8 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 (Scope1, 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.

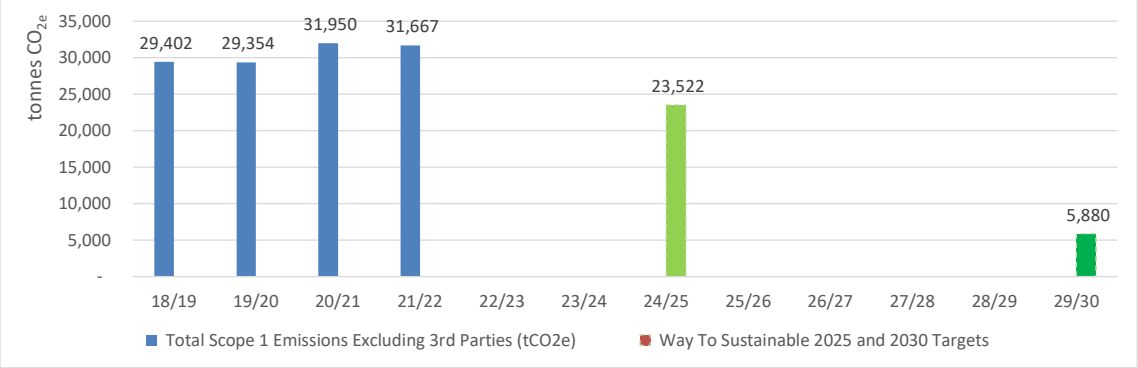
Our Future – Sustainable Operations:

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 12: 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, if that's not possible, reuse and recycle.

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.

4 Energy – Historical Performance

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 increased by 0.4% compared to 20/21.

The chart below indicates 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), additional buildings and data facilities added after 2018/19 have added to a general upward trend.

Chart 13: Total Energy Consumption (excl. Petrol, Diesel and LPG (<1%))

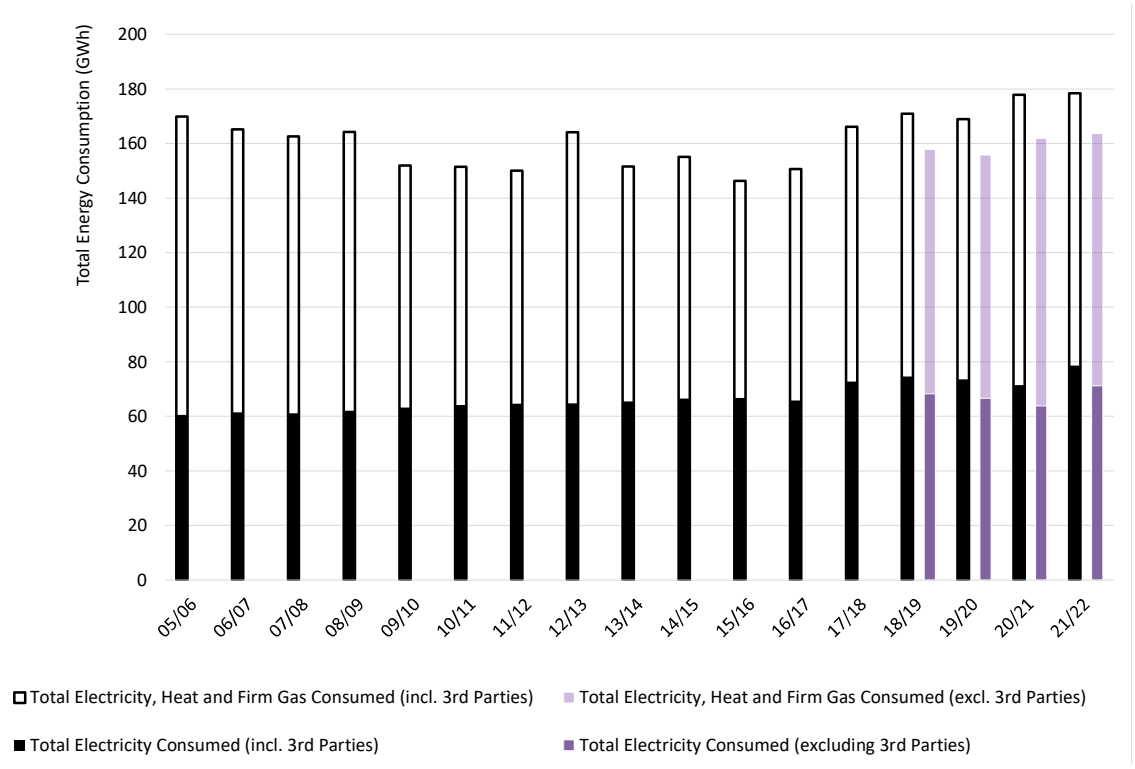
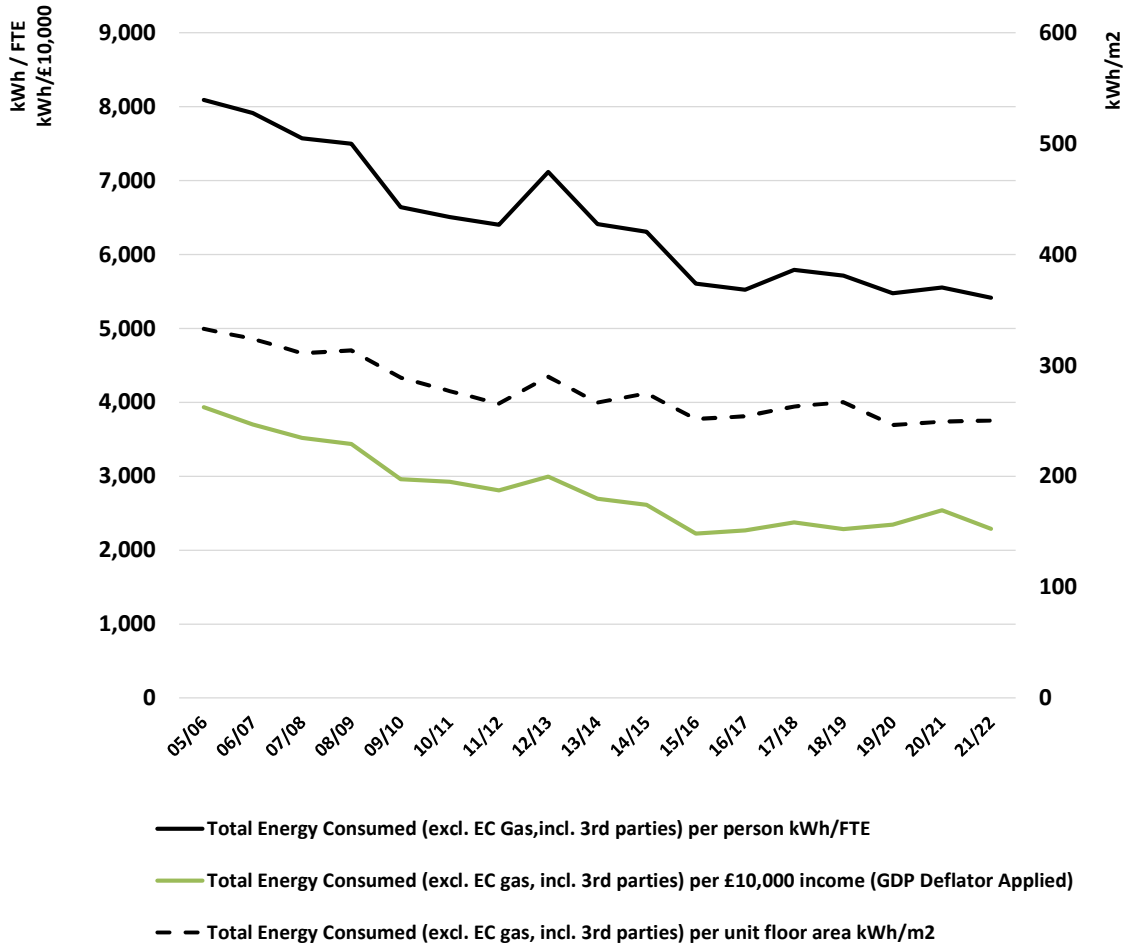


Chart 14: Total Energy consumed per FTE, per £10,000 Income and per m2.



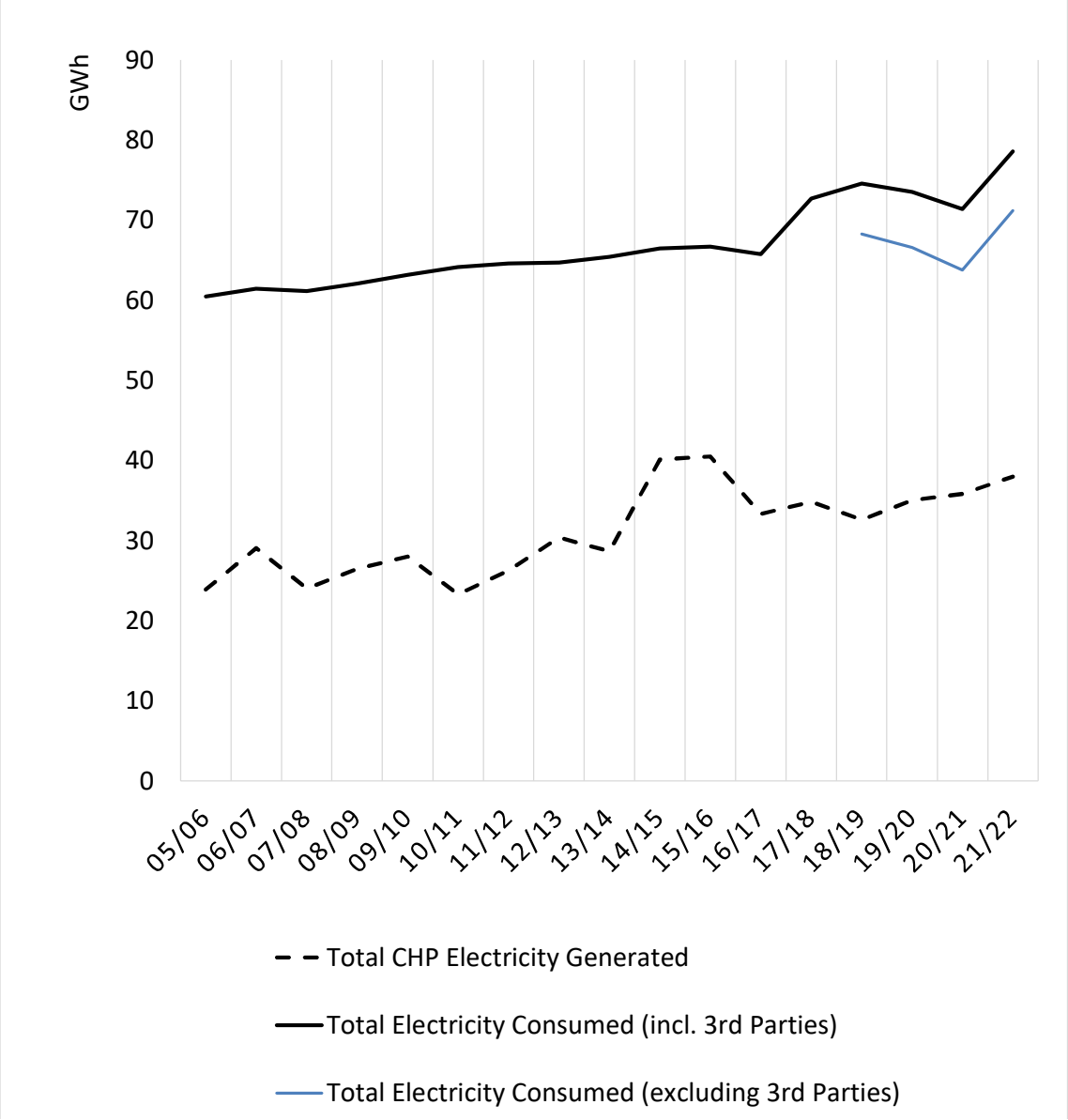
4.1 Electricity

Total electrical consumption (irrespective of source and including third parties) increased by 7,193 MWhrs in 2021/22, an increase of 10.1% compared to 2020/21. Electrical consumption for areas excluding 3rd parties increased by 7,419MWh compared to 20/21, an increase of 11.6%. The chart below shows total electricity consumed and self-generation. On site, generation from CHP increased by 6.0%, due to improved 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 15: Electricity: Total Consumption and CHP Generation



4.2 Buildings - "Top Electricity Consumers".

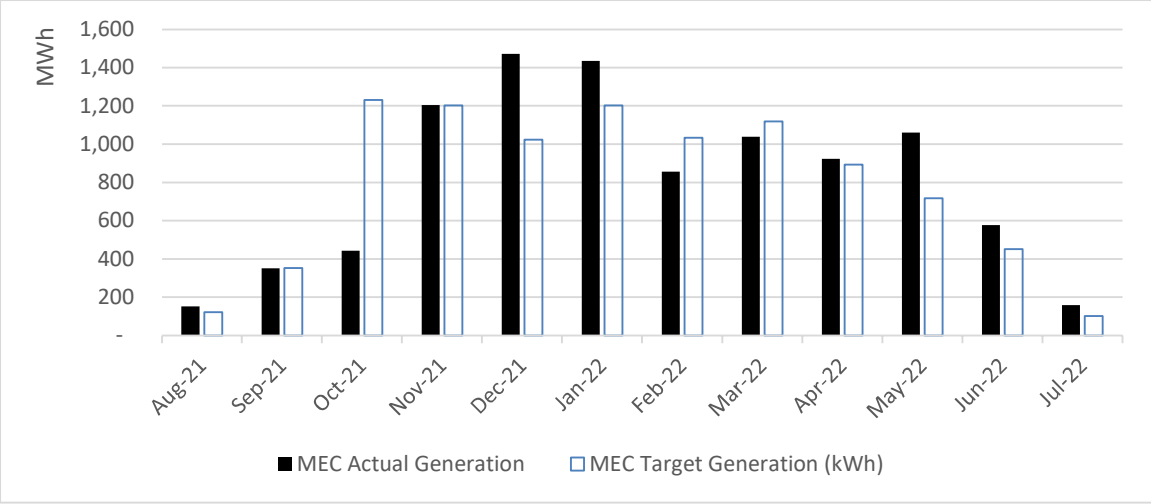
The top 10 electricity-consuming buildings are shown in Appendix 1. The top three energy consuming buildings usage are shown below with the change on previous year.

Position	Building	Electrical consumption (kWhrs) 2020/21	Change vs Previous Year	Notes
1	Lord Bhattacharyya Building	5,297,148	-13%	>95% Segregated as "3rd Party" Usage
2	Argent Court Data Centre	3,905,936	+39%	New High performance data centre
3	University House	3,405,040	+11%	Increasing demands through rising occupancy

4.3 Self-Generation

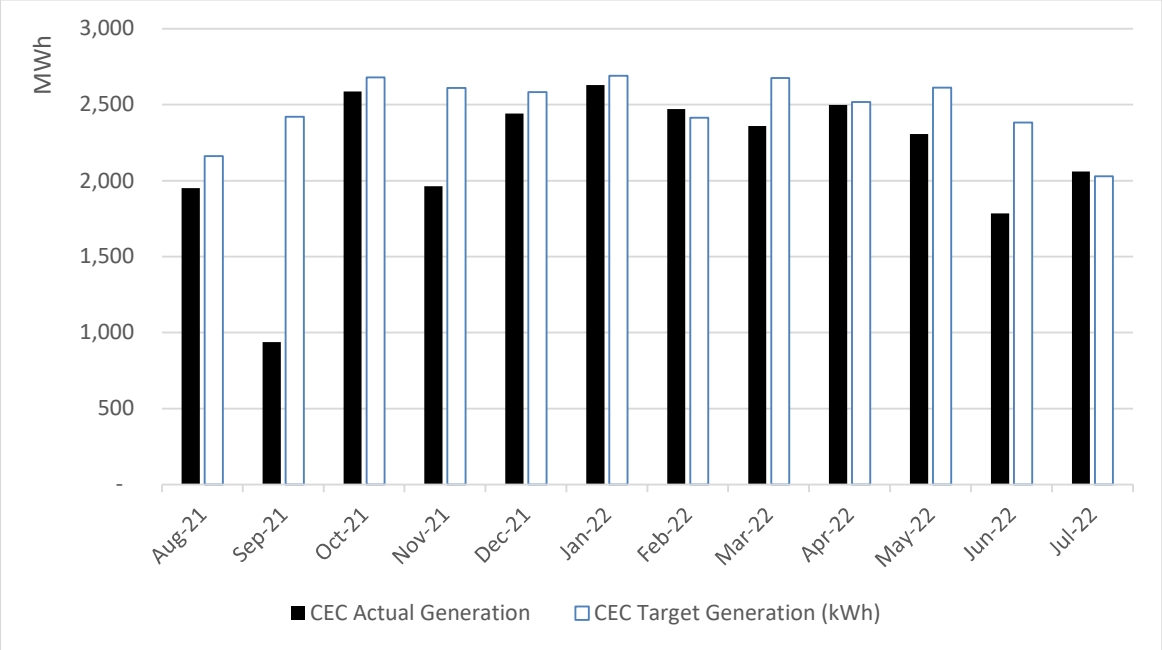
The following charts show the performance of Cryfield Energy Centre (CEC) and Main Energy Centre (MEC) CHP engines against target outputs. Despite targeting an output of only 50% of the theoretical maximum, the MEC engines only exceeded this in 7 out of 12 months due to the age and reliability of the engines.

Chart 16: MEC Combined Heat and Power Actual Electricity Generation vs Target by Month 2021/22



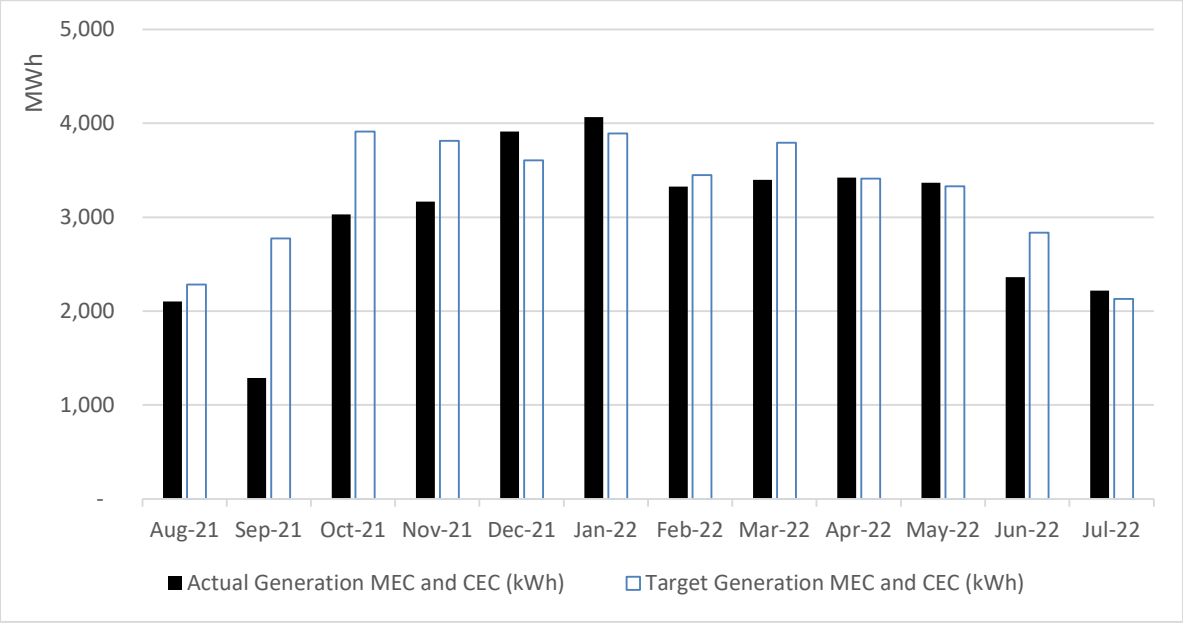
CEC engines on the other hand performed more consistently with significant shortfalls in fewer months where engines were out of service for maintenance and repairs.

Chart 17: CEC Combined Heat and Power Actual Electricity Generation vs Target by Month 2021/22



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.

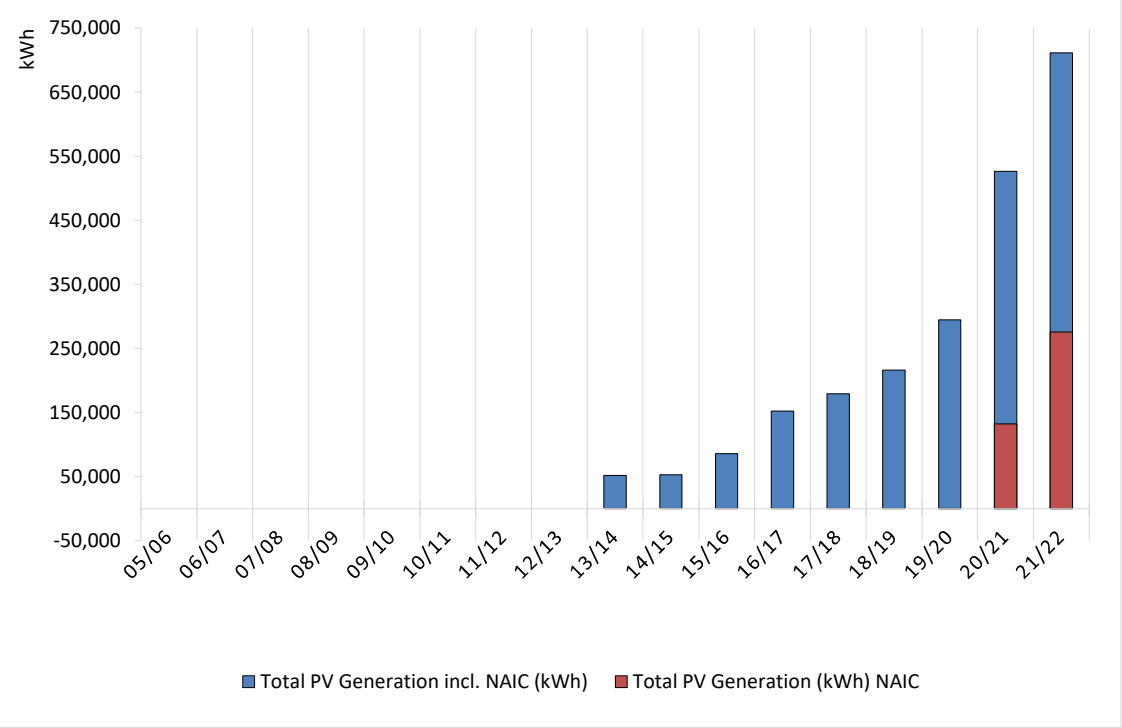
Chart 18: Combined Heat and Power Actual Electricity Generation vs Target by Month 2021/22



4.4 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 710,882 kWh during 2021/22 including third party occupied buildings.

Chart 19: Total Onsite Renewable Electricity Generation (kWh)

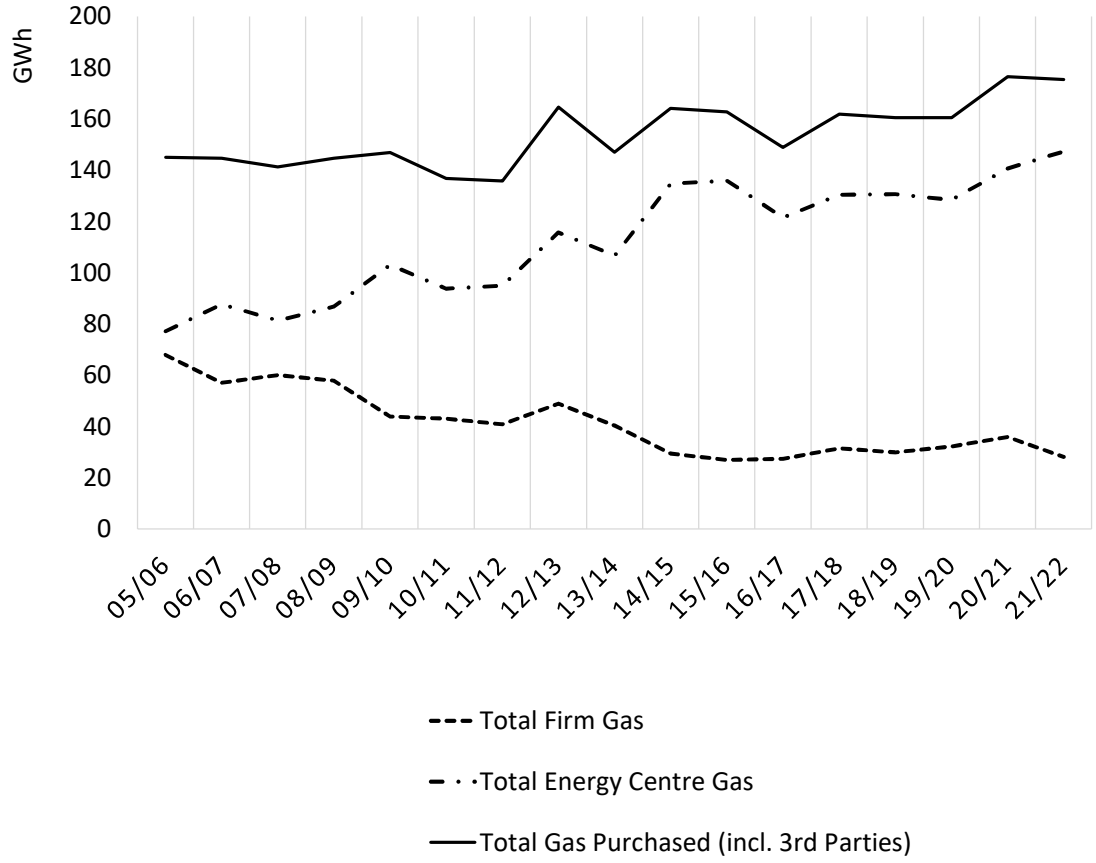


4.5 Gas.

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 0.6% compared to the previous year. The notably milder weather in 21/22 contributed to the reduction in gas consumption although this was offset by an increase in electrical generation by our CHP plant.

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 20: Total Annual Gas Consumption by end use.



4.6 Thermal Energy.

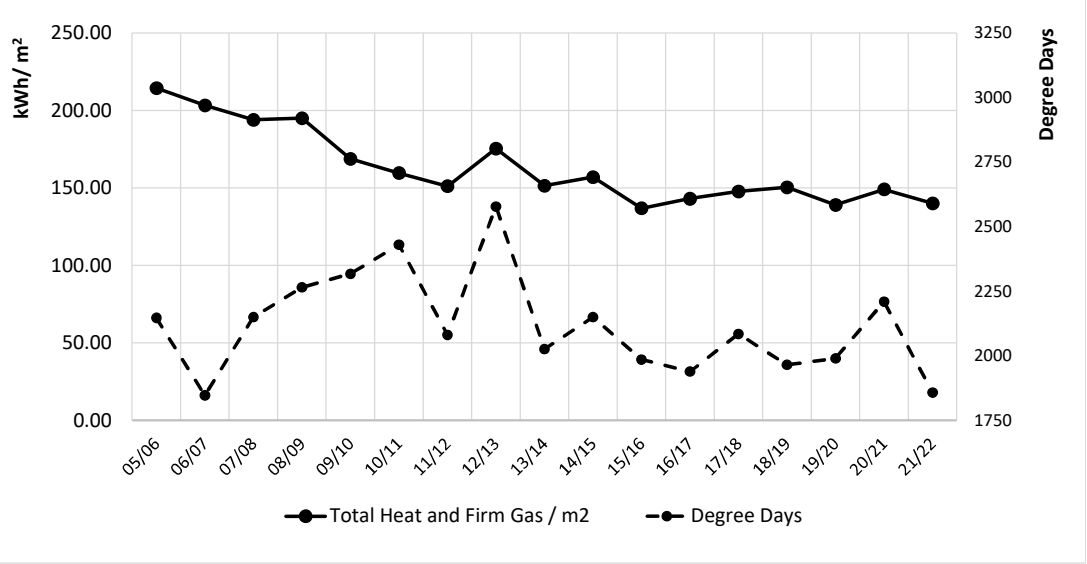
The following chart shows historic annual energy centre heat and local boiler gas energy per unit of campus floor area alongside heating degree-days[8]. The chart shows that the University is using heat more efficiently overall, with a general downward

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

trend in heat demand per square metre. Heat consumption reduced in 2021/22 because of the milder weather.

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

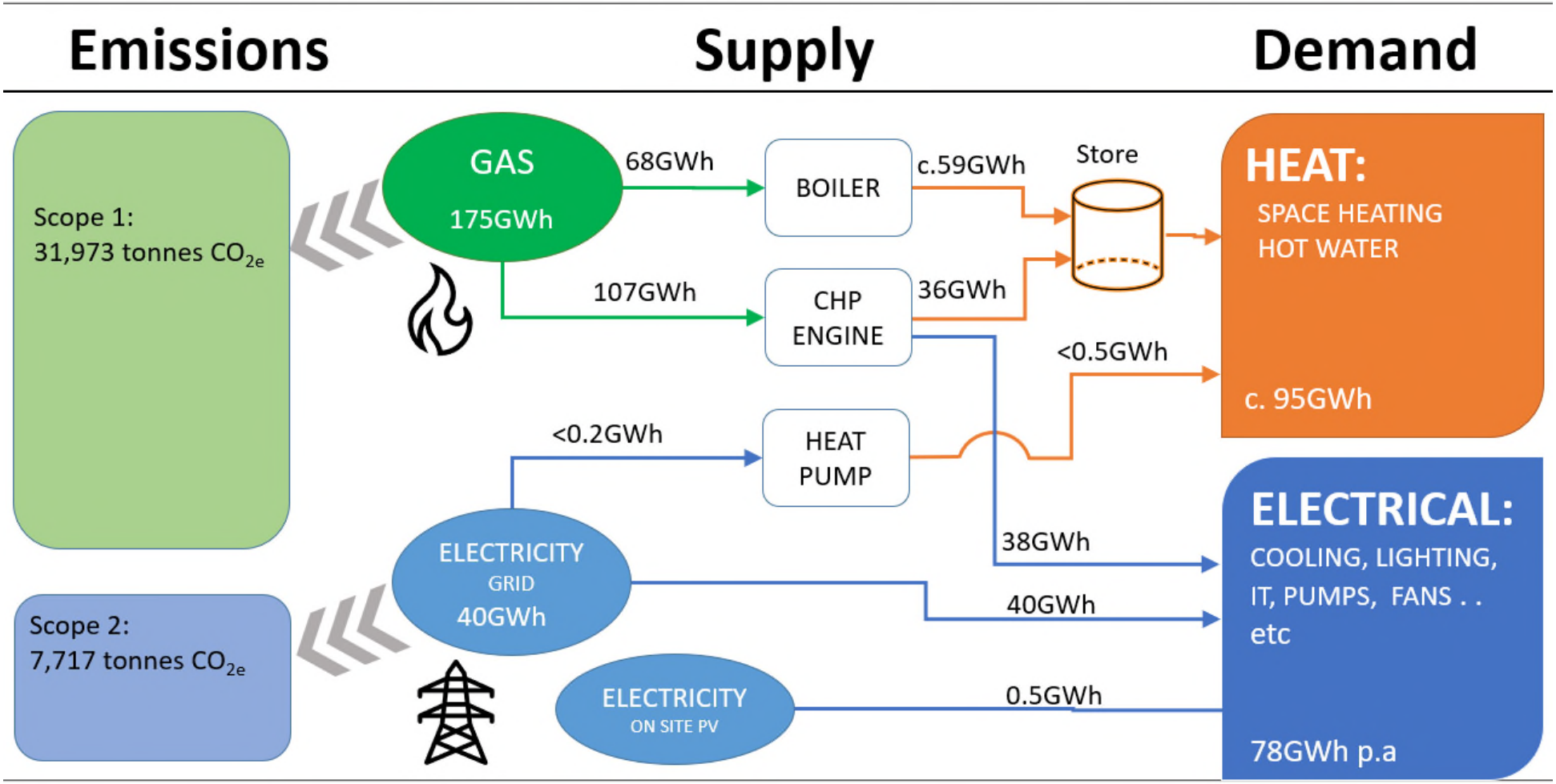
Chart 21: Total Heat and Firm Gas Consumption by floor area and heating Degree-days.



5 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 21/22 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.

21/22 Scope 1 &2 CO_{2e} Location Based gas and Electricity Emissions, Supply and Demand (incl. 3rd parties)

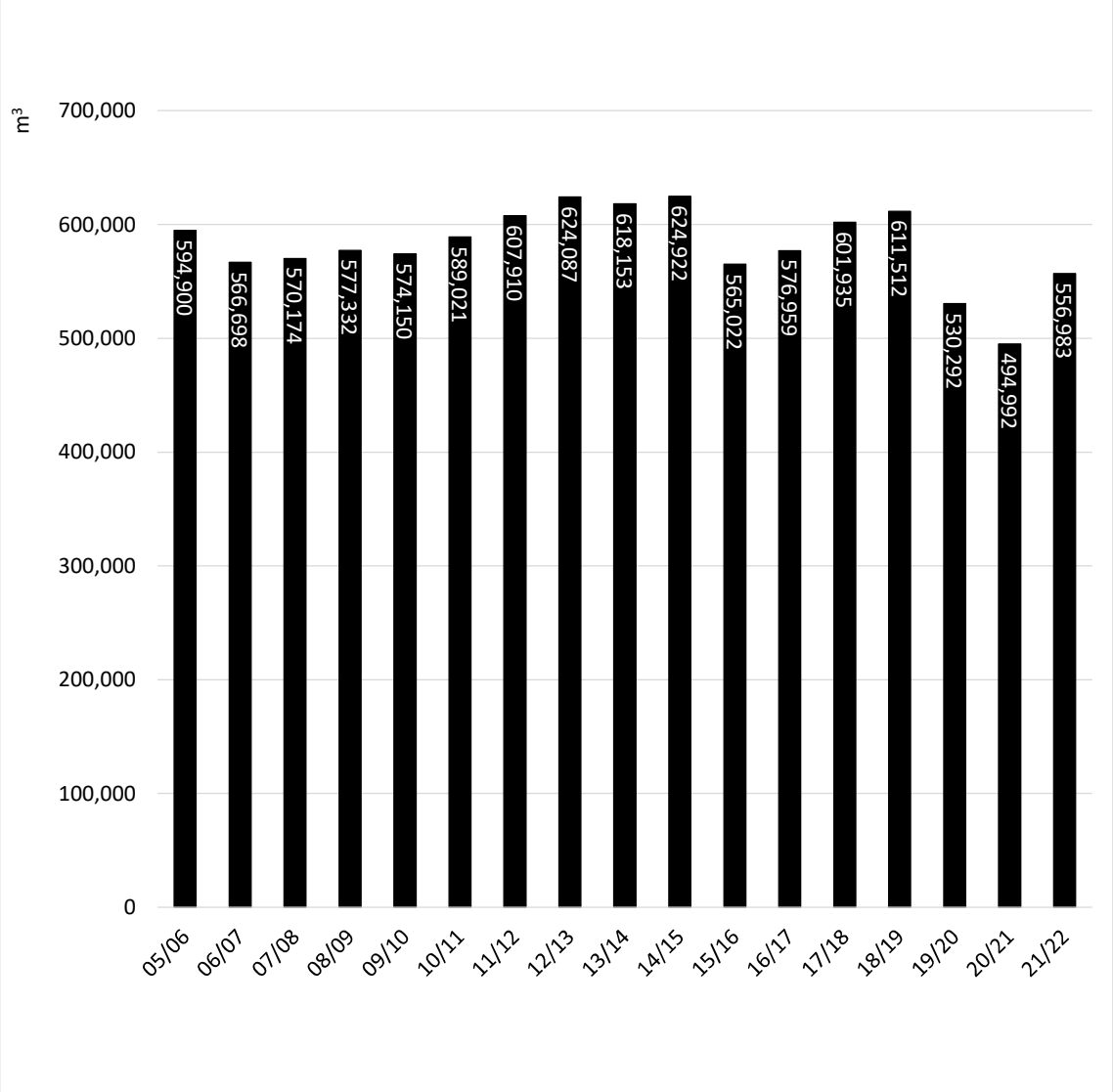


6 Water.

Total University mains water consumption including third parties increased between 2020/21 and 2021/22 by 13.8% to 542,911m^3 as shown in the chart below. This is reflective of the general increase in campus population. 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 reduced significantly from 17,853m^3 in 20/21 to 14,072m^3 in 21/22.

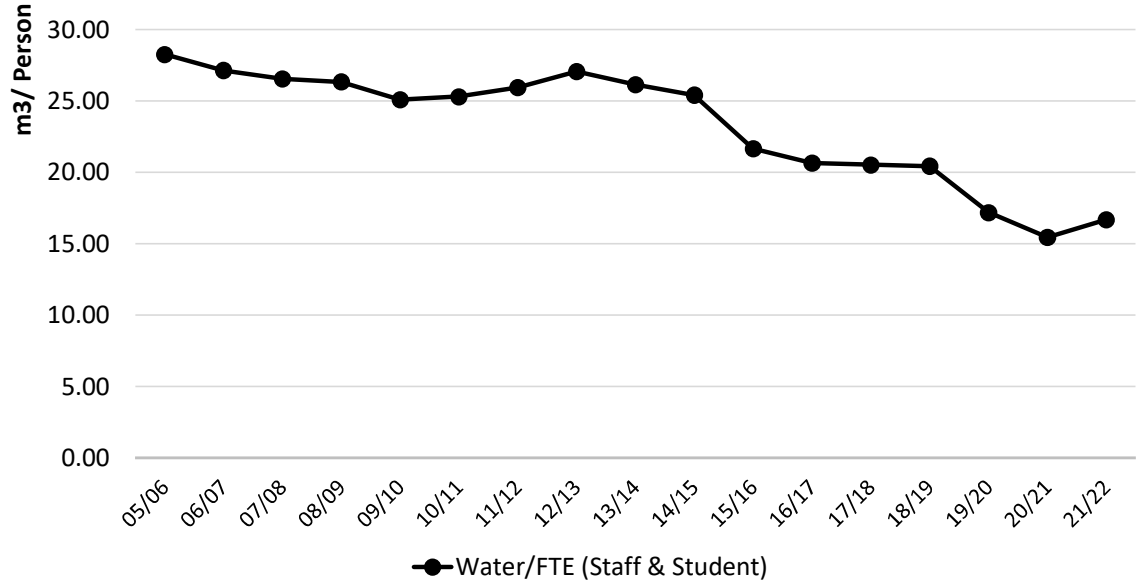
(The 2015/16 step change relates to the installation of shower restrictors in student residences during summer 2015).

Chart 22: Total University Mains and Borehole Water Consumption (including 3rd parties)



The following chart shows the University water consumption per FTE.

Chart 23: Total Mains Water Consumption per FTE



7 Energy Efficiency and Reduction Projects

7.1 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.

7.2 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, an annual carbon saving of 997tonnes of CO_{2e} has been calculated.

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.

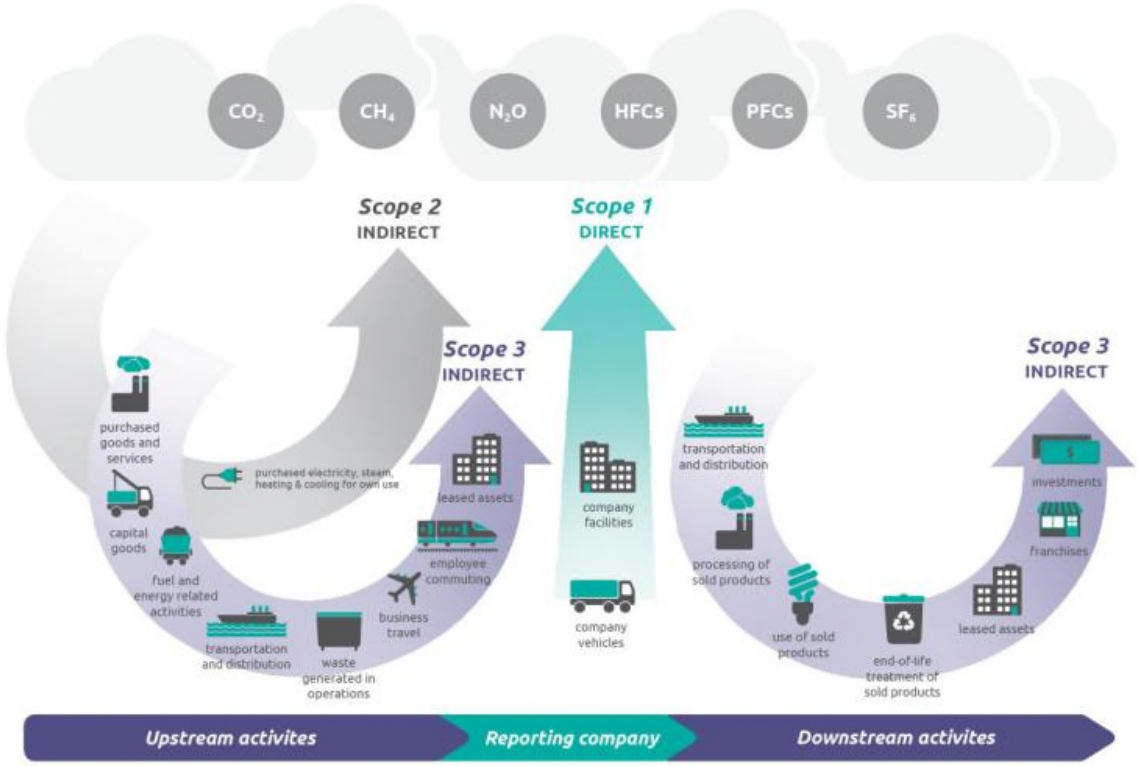
Greater collaboration with departments on actual energy needs can provide much greater savings on energy efficiency, this is underway with several departments and a structured approach to implementation in development.

8 Scope Three Carbon Emissions.

The University 2050 net-zero carbon target includes all carbon emissions (scopes 1, 2 and 3). This section provides baseline information on Scope 3 emissions.

Scope 3 emissions are indirect emissions that occur in the value chain including upstream and downstream emissions, and not included in scopes 1 and 2. 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.

Chart 24: Overview of GHG Protocol scopes and Emissions



The total estimated Scope 3 emissions for 2020/21 total to **146,728 tCO_{2e}**.

	2018/19	2019/20	2020/21	2021/22
Scope 1 and 2 Emissions (tCO_{2e})	40,496	37,903	39,850	39,809
S/Total Scope 3 Emissions (tCO_{2e})	110,458	106,727	106,878	104,694
Total scope 1, 2 and 3 (tCO_{2e})	**150,954**	**144,630**	**146,728**	**144,503**

8.1 Compiling and Understanding the Data

To meet the University 2050 target, Scope 3 carbon emissions must reach net-zero in the same way as Scope 1 and 2 carbon emissions must meet net-zero by 2030. We are at the start of the net-zero Scope 3 journey.

The University's Scope 3 emissions for 2017/18 to 2021/22 have been previously reported according to the Greenhouse Gas Protocol. In this report, Scope 3 emissions for 2021/22 are estimated. Retrospective calculations of previous years' data using updated methodology is also performed.

Previously, Scope 3 emissions have been reported in three categories: procurement, buildings, and mobility. To ensure greater coverage of the Scope 3 categories as defined by Greenhouse Gas Protocol, further categories have been assessed.

The following sections describe the methods and emissions calculated for each of these categories for 2021/22.

8.1.1 Procurement

Scope:

Emissions related to purchased goods and services, capital goods, upstream transport and distribution and upstream leased assets, procured by the University through SAP.

Data Sources:

Direct procurement spend amounts were taken from invoices logged in University accounting software SAP for the year 2021/22.

Methodology Overview:

Expenditure within SAP is categorised into uniquely coded material groups, each material group is given a high level description of what the expenditure relates to

e.g Material Code Group: RD1000000,

Description: Accountancy Services including Audit

Using a tool developed by Action Sustainability, spend against each material code group is mapped to a defined list of DEFRA categories, for which emission factors are allocated. These emission factors are based on environmental economic input-output (EEIO) data from the Scottish Government in 2019/20. Spend is multiplied by the emission factor to give an estimate of the carbon emission arising from that spend.

SAP expenditure in areas already accounted for in Scopes 1, 2 & 3 (such as fuels, electricity and water) was excluded from this analysis.

Limitations and Exclusions.

The methodology provides an indication only of the Scope 3 emissions resulting from expenditure. As such, resultant emissions are not indicative of the true emissions related to the embodied carbon of procured materials, but only on the spend within different sectors. Amongst others, the following factors limit the accuracy of the process

- The suitability of the code selected by the University for a given spend
- The availability of conversion factors that match the description / scope of the University expenditure types.
- Any combination of expenditure types under one code can prevent the most suitable conversion factor being used.

Results:

Total University expenditure in 21/22 is estimated to have led to emissions of 32,388 tCO_{2e}.

Chart 25: Procurement: Spend and Scope 3 emissions (tCO_{2e}) per year.

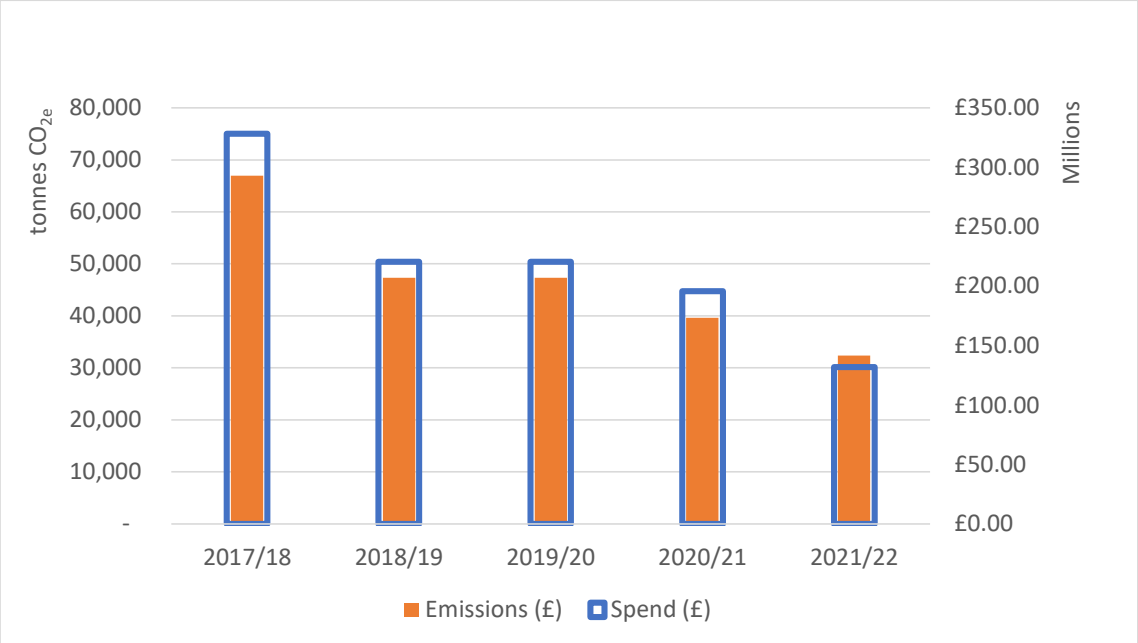


Chart 26: 2021/22 Scope 3 emissions from Procurement by Department (top 10) (tCO_{2e})

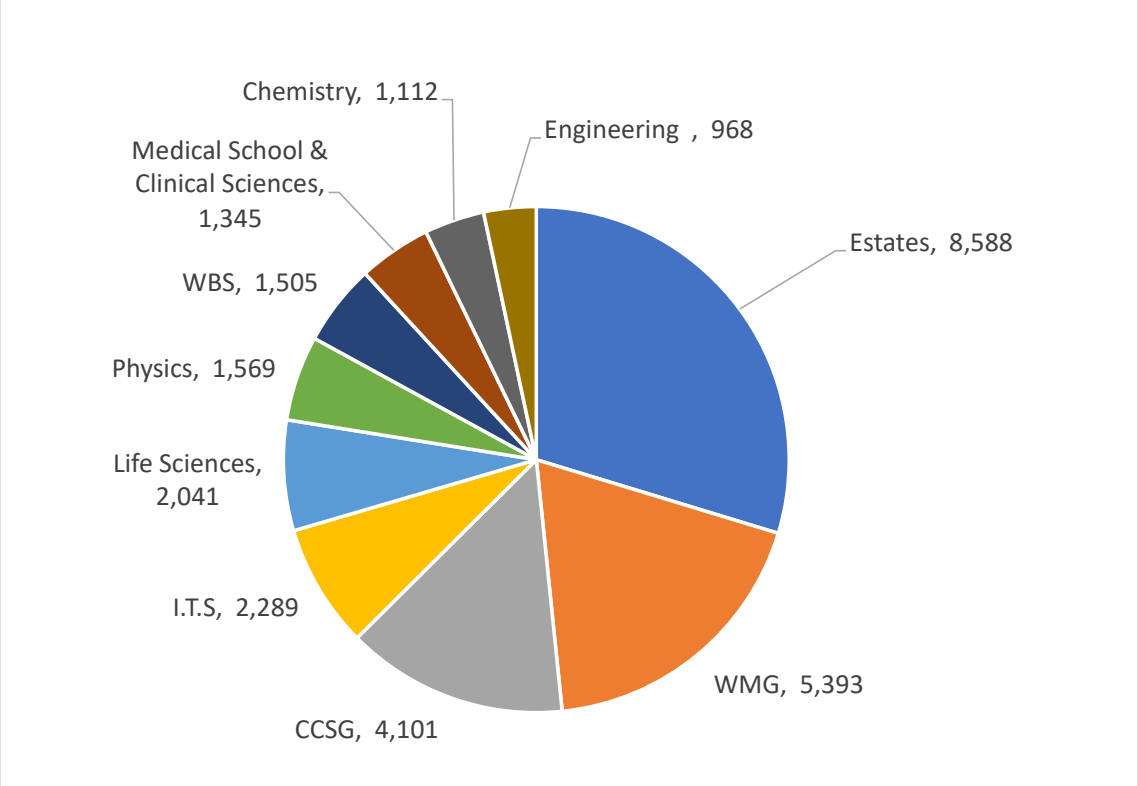
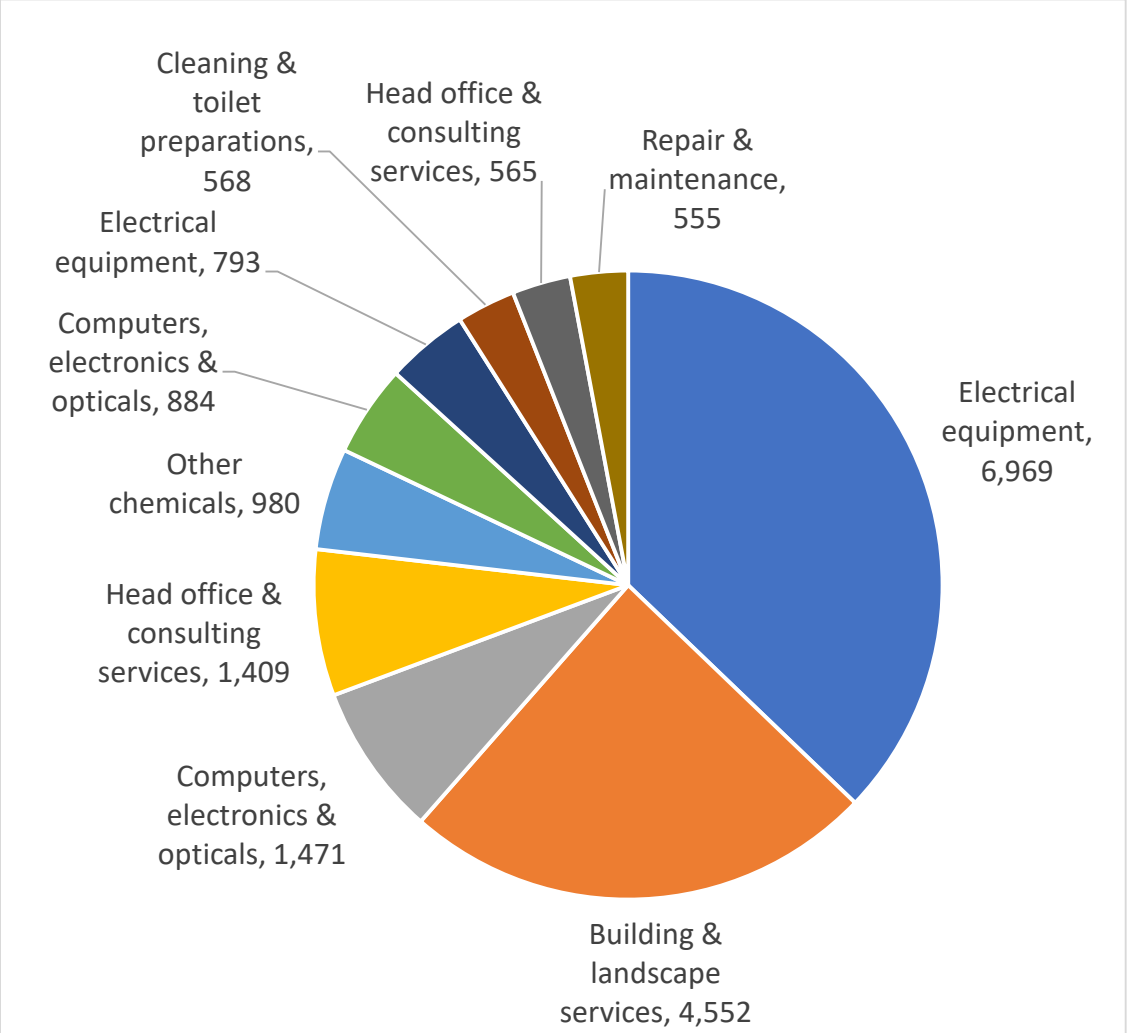


Chart 27: Top 10 2021/22 Scope 3 emissions from Procurement by Spend Category (tCO_{2e})



Discussion:

Total estimated Scope 3 emissions arising from procurement have decreased year on year since 2017/18. This is due only to decreasing procurement spend however, as emissions in this category do not account for the exact embodied carbon in procured goods and services, but only an estimate based on the spend sector.

For this year of reporting, the faculty with the highest emissions arising from procurement was the Estates Department, contributing to 30% of the emissions, almost all of these emissions were incurred in the construction and maintenance of buildings on behalf of other departments.

Emissions analysed here will be reported back to departments to inform and advise them on the impact of their procurement activities.

The largest contributor to embodied carbon emissions is procurement of electrical equipment. This category of purchase includes procurement of some laboratory and workshop equipment and consumables, contributing to 37% of the Scope 3

procurement emissions in 2021/22. As this category makes up a large proportion of the University's overall Scope 3 emissions, it is recommended that assessment of emissions related to procurement in this area should be reported more accurately.

"Procurement" here includes Scope 3 emissions for multiple categories as defined by Greenhouse Gas Protocol:

- Category 1: Purchased goods and services
- Category 2: Capital goods
- Category 4: Upstream transportation and distribution
- Category 8: Upstream leased assets

Ideally, these should be reported separately, but it is difficult to separate spends into each category from the current procurement system. Efforts are ongoing to understand how to best report on these categories.

The spend-based method used here does not truly assess the embodied carbon emissions in the University's expenditure, as only the transaction cost and sector is assessed, rather than the specific product or company. The University aims to improve reporting on this by engaging more directly with suppliers and contractors to gain better estimates of the areas where emissions are significant, such as construction. Solutions to transition to a hybrid method (including some spend-based and some supplier-specific assessment) have been investigated.

As well as using the Action Sustainability tool to assess emissions arising from University procurement, other Scope 3 tools were also used to assess the accuracy of the estimation. HESCET (Higher Education Supply Chains Emissions Tool) developed by HEPA (Higher Education Procurement Association) was also used to assess the carbon footprint of the University procurement for 2021/22. HESCET works in a similar way to the methodology described above, prescribing a category to each spend code, and an emission factor to each category. HESCET differs by using different categories and emission factors.

HESCET analysis estimated that procurement emissions in 2021/22 were 3.2 times higher than the Action Sustainability analysis estimated, this indicates the level of uncertainty of measurement in this field. The variances in this comparison are due to the different categorisation of spends between the two tools, and, consequently, different allocation of emission factors. Particularly in the area of laboratory and workshop purchases, HESCET allocates a much higher emission factor, based on embodied emissions of medical supplies. This is one of the University's largest areas of spend, and as such the estimated emissions are much higher. Many areas where the University has large spend are also areas where there is greatest uncertainty in emission factor.

It is not simple to state whether one tool gives a more "correct" estimate of the embodied emissions, as each make their own assumptions and choices of how best to categorise spend. The estimates given by these models are presented to give the scale of the uncertainty when using spend-based assessment of emissions. The only way to increase the accuracy of our reporting in this area is to engage directly with suppliers to understand their emissions, and to develop processes in coordination with the Procurement team to ensure that the carbon impact of procurement is considered.

8.1.2 Construction

Procurement data suggests that emissions from “Building and landscape services” led to the emission of 4,552 tCO_{2e}, 24% of the total scope 3 emissions in procurement. Spend data is a crude measure of the Scope 3 emissions from building construction and operation. Material selection and construction techniques have a very significant impact on embodied carbon that may not be reflected in construction costs. The Estates Office has created and Embodied Carbon Guidance note, is starting to measure embodied carbon in buildings and understand the building techniques that impact this, to establish policies for future construction.

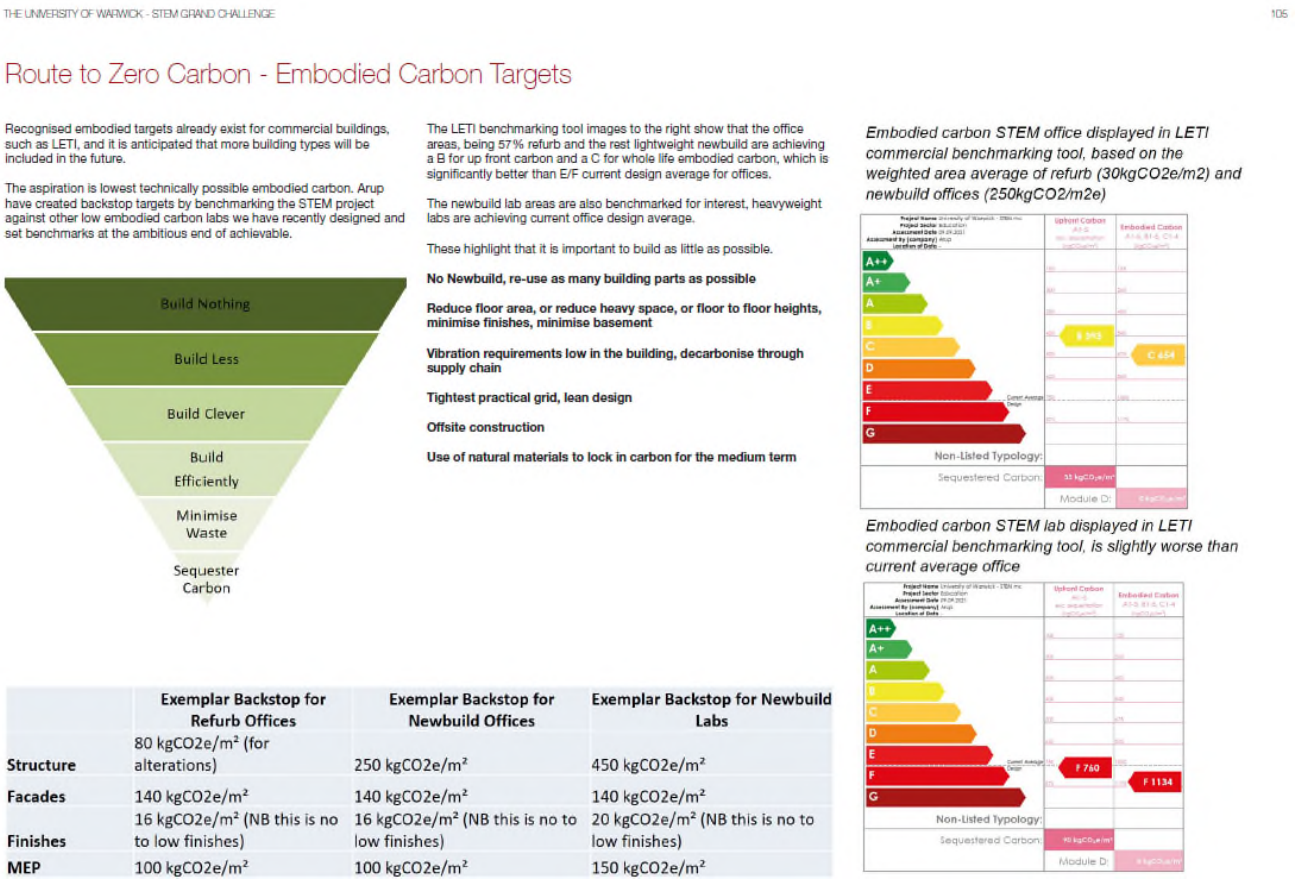
Eventually, this more nuanced approach will be taken for many more Scope 3 emission categories where we need to distinguish between better alternatives to reduce the impact of our activities. We have started with our largest area of emissions.

Retrospective whole life embodied carbon analyses of the Lord Bhattacharyya building, IBRB, Faculty of Arts, the Sports Hub and the design of Phase 4 of the Warwick Business school have been completed.

The Interdisciplinary Biomedical Research Building (IBRB), which completed construction in March 2021, made use of modern and off-site construction techniques to reduce the embodied carbon of the building, as well as installing 390 PV solar panels to offset emissions further. A study was undertaken to assess the full life cycle carbon emissions of the building by Willmott Dixon, who constructed the facility.

Challenging targets have been set for the upcoming STEM and Social Science Grand Challenge developments, based on guidance from LETI and UKGBC. Construction needs will be centred on the sustainable building hierarchy, and embodied carbon in construction materials will meet the targets set.

Embodied Carbon Targets for STEM Grand Challenge



THE UNIVERSITY OF WARWICK - STEM GRAND CHALLENGE

105

Route to Zero Carbon - Embodied Carbon Targets

Recognised embodied targets already exist for commercial buildings, such as LETI, and it is anticipated that more building types will be included in the future.

The aspiration is lowest technically possible embodied carbon. Arup have created backstop targets by benchmarking the STEM project against other low embodied carbon labs we have recently designed and set benchmarks at the ambitious end of achievable.

The LETI benchmarking tool images to the right show that the office areas, being 57% refurb and the rest lightweight newbuild are achieving a B for up front carbon and a C for whole life embodied carbon, which is significantly better than E/F current design average for offices.

The newbuild lab areas are also benchmarked for interest, heavyweight labs are achieving current office design average.

These highlight that it is important to build as little as possible.

No Newbuild, re-use as many building parts as possible

Reduce floor area, or reduce heavy space, or floor to floor heights, minimise finishes, minimise basement

Vibration requirements low in the building, decarbonise through supply chain

Tightest practical grid, lean design

Offsite construction

Use of natural materials to lock in carbon for the medium term

Embodied carbon STEM office displayed in LETI commercial benchmarking tool, based on the weighted area average of refurb (30kgCO2e/m2) and newbuild offices (250kgCO2/m2e)

Embodied carbon STEM lab displayed in LETI commercial benchmarking tool, is slightly worse than current average office

	Exemplar Backstop for Refurb Offices	Exemplar Backstop for Newbuild Offices	Exemplar Backstop for Newbuild Labs
Structure	80 kgCO2e/m² (for alterations)	250 kgCO2e/m²	450 kgCO2e/m²
Facades	140 kgCO2e/m²	140 kgCO2e/m²	140 kgCO2e/m²
Finishes	16 kgCO2e/m² (NB this is no to low finishes)	16 kgCO2e/m² (NB this is no to low finishes)	20 kgCO2e/m² (NB this is no to low finishes)
MEP	100 kgCO2e/m²	100 kgCO2e/m²	150 kgCO2e/m²

8.1.3 CCSG (Campus and Commercial Services Group)

In early 2020, CCSG published their "Food Sustainability – Making a Difference" impact goals, aiming to reduce their emissions, reduce their wastes and improve their sustainability in sourcing. These emissions fall under Scope 3.

Although the pandemic led to a large decrease in footfall, some of these initiatives have been successful and CCSG continuously aim to improve their sustainability and reduce their Scope 3 emissions.

Examples of successful initiatives include recycling all used oils, composting of used coffee grounds, implementation of wooden takeaway food cutlery, launch of TooGoodToGo to prevent waste of excess food, increasing the plant-based food offerings, and discontinuing sales of disposable and "bag for life" bags from Rootes Grocery Store.

8.1.4 Water

Scope:

Emissions resulting from treatment and supply of water used by the University in 2021/22, including by 3rd parties (excluding borehole water).

Data Sources:

Water meters across the campus.

Methodology:

Emission factors for the supply and treatment of water, as defined in the Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting, were used to convert the metered water usage for the University into equivalent CO_2 emissions.

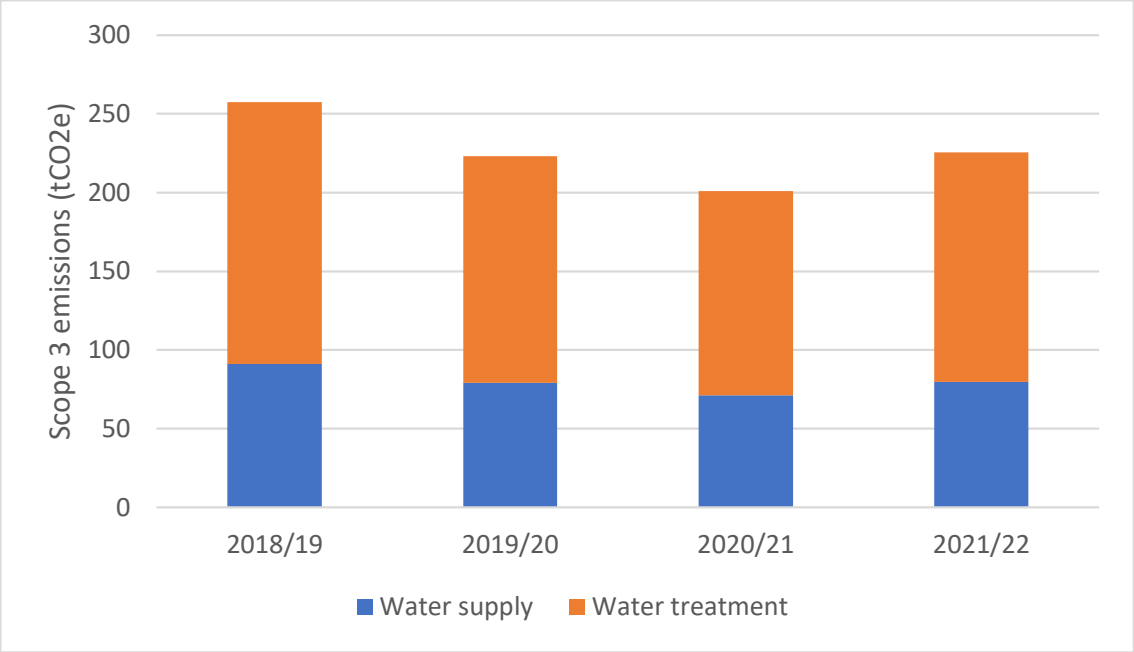
Limitations and exclusions:

Accuracy of this data is limited by the accuracy of the emission factor, which is generic for the UK, and may differ based on location and supplier.

Results:

In 2021/22 the University used 542,911m^3 of water including 3rd parties. The total Scope 3 carbon emissions from this was 226 tCO_{2e}.

Chart 28: Scope 3 emissions from water supply and treatment (tCO_{2e})



Discussion:

Under the Greenhouse Gas Protocol, emissions from water usage are included in Category 1: Purchased Goods and Services.

As discussed in Section 5, annual water usage has increased in line with increasing campus population following the covid 19 pandemic..

8.1.5 Fuel and energy-related activities not included in Scopes 1 & 2

Scope:

Emissions resulting from:

- Transmission and distribution (T&D) losses, and well-to-tank (WTT) emissions (from generation and T&D) of the University's electricity supply

- WTT emissions from the University's gas supply (including emissions associated with extraction, refining and transportation of the natural gas)
- WTT emissions from fuel used by the University vehicle fleet

Emissions here include those related to use of electricity and gas by third parties.

Data Sources:

Electricity and gas meters across the campus, and fuel receipts for the University vehicle fleet.

Methodology:

Emission factors for the T&D and WTT losses for electricity, WTT emission factors for natural gas, diesel, petrol and LPG as defined in the Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting, were used to convert the electricity, gas and fuel usage for the University into equivalent CO_2 emissions.

Limitations and exclusions:

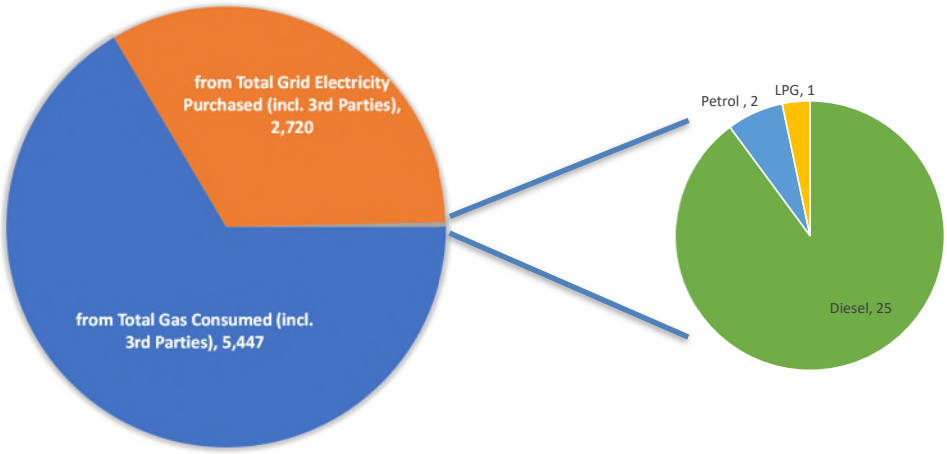
Accuracy of this data is limited by the accuracy of the emission factors, which are generic for the UK, and may differ based on location and supplier.

Results:

The total Scope 3 carbon emissions related to fuel and energy use is 8,195 tCO_{2e}.

Source		Emissions (tCO_{2e})	
Natural gas WTT emissions	University use	5,375	5,447
	3rd party use	72	
Electricity T&D and WTT emissions	University use	2,285	2,721
	3rd party use	436	
Fleet fuel WTT emissions	Diesel	25	28
	Petrol	2	
	LPG	1	
Total		8,195	

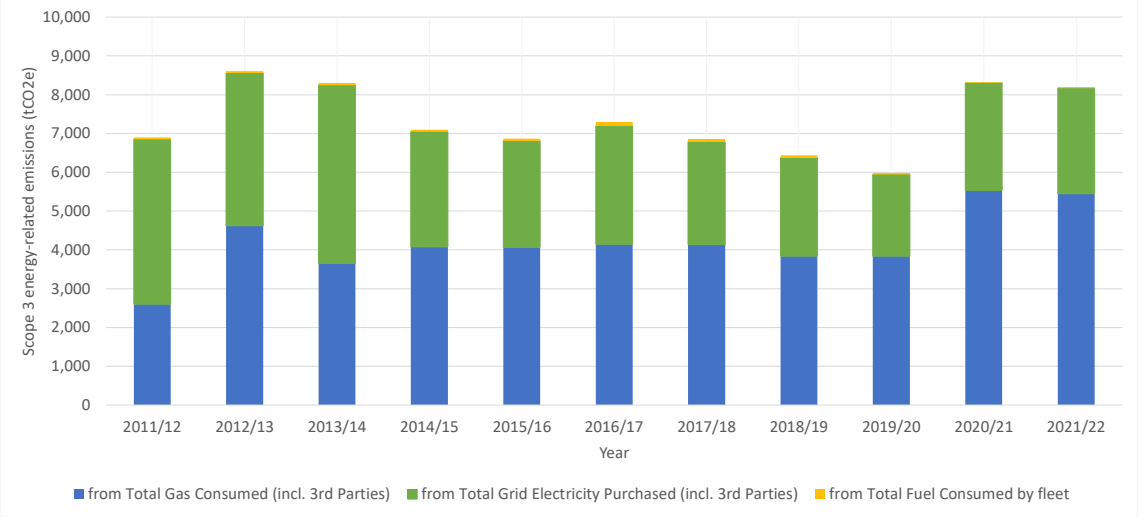
Chart 29: 2020-21 Scope 3 Emissions from fuel and energy related sources (tCO_{2e})



Discussion:

Emissions here are categorised as Category 3: Fuel- and energy-related activities (not included in Scopes 1 and 2), and coverage within this category is relatively complete. These calculations have been backdated to 2011/12, the earliest year that WTT emissions factors were available for fuels.

Chart 30: Historical Scope 3 Emissions from fuel and energy related sources (tCO_{2e})



The Scope 3 emissions reported here follow the same trends as those seen in emissions from electricity and gas usage, as the Scope 3 emissions are proportional to usage. It is worth noting that the well-to-tank emissions for gas supply are more significant than those arising from T&D electricity losses.

The published emission factors used in this analysis are UK average values, and may not be representative of the University's chosen suppliers and energy sources.

8.1.6 Waste

Scope:

Emissions resulting from the treatment of University waste sent to landfill, recycled, composted, used in anaerobic digestion or combustion for energy production.

Data sources:

University waste masses sent to different waste treatment methods reported under the HESA Estates Management Record.

Methodology:

The masses of waste treated in different disposal routes was multiplied by treatment-specific emission factors provided in Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting.

Emissions arising from previous years' waste treatment have been retrospectively estimated.

Limitations and Exclusions:

The emission factors used only consider the treatment route, not the waste form; disposal of different materials gives rise to different emissions. Reporting is limited in this area, and as such there is room for improvement to improve the accuracy of Scope 3 reporting in this area.

Results:

Year	Method of disposal (tonnes of waste)						Estimated emissions (tCO_{2e})
	Recycling	Anaerobic digestion	Landfill	Other	Combustion	Total	
2016/17	24,102	28	91	1,225	1,264	26,711	1,329
2017/18	7,949	61	277	0	1,120	9,407	358
2018/19	14,153	67	1,038	0	1,352	16,610	940
2019/20	6,263	52	487	0	660	7,461	361
2020/21	4,019	43	307	0	872	5,241	241
2021/22	1,038	103	45	59	1253	2,499	96

Discussion:

Emissions from waste are categorised under Category 5: Waste under the GHG Protocol Scope 3 Standard.

Scope 3 emissions in this area are typically less significant than other areas reported on. However, reporting in this area is not robust. A significant reduction in recorded construction waste was due to the reduced number of active construction projects on the campus during the 2021/22 reporting year.

8.1.7 Business Travel

Scope:

Emissions arising from all business travel booked through the University travel booking provider, Key Travel.

Data sources:

Distances and method of travel were recorded by Key Travel for each journey.

Methodology:

Total distance travelled by a method of transport is multiplied by the relevant emission factor from Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting. Emissions factors included well-to-tank (WTT) and radiative forcing (RF) factors where appropriate.

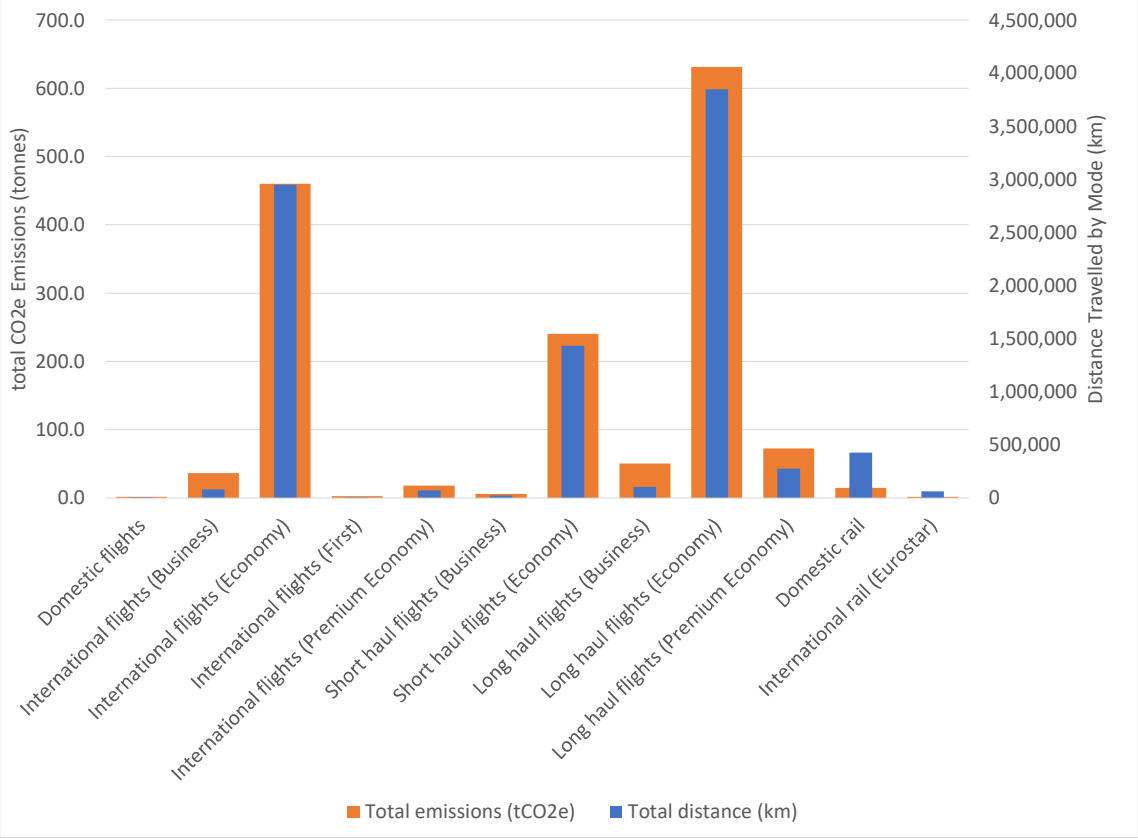
Limitations and Exclusions:

Business travel that is not booked through Key Travel (for example, use of a personal car, bus or taxi) is excluded from this analysis. Emissions from business travel in University-owned vehicles in included in Scope 1 reporting.

Results:

In 2021/22, business travel resulted in emissions of 1,537 tCO_{2e}, of which 1387 tCO_{2e} arises from direct emissions and 150 tCO_{2e} arises from well-to-tank emissions, related to the extraction, refinement and transport of the fuel used in the travel.

Chart 31: 2020-21 Scope 3 Emissions and Distances travelled from business travel by mode (tCO_{2e})



Discussion:

Business travel emissions fall under Category 6 of the Greenhouse Gas Protocol Standard.

Emissions from business travel have increased significantly over the past year as travel becomes more frequent since the COVID-19 pandemic. In 2019/20, approximately 25 million kilometres were flown; in 2020/21, only 351,000 kilometres were flown, a reduction of over 98% on the previous year. In 2021/22 flight distances increased significantly on 20/21 figures to 8.8 million kilometres but this is still considerably lower than 2019/20.

Though not previously recorded, well-to-tank emissions are not insignificant in travel, and it is recommended that these emissions continue to be reported.

It is important to continue to push for booking all business travel through Key Travel, the University travel provider, to ensure that as much business travel as possible is reported.

8.1.8 Travel related to study abroad

Scope:

Emissions arising from travel involved in student study abroad.

Data sources:

Student mobility data of the number of students each year studying abroad.

Methodology:

For each student studying abroad, the distance between Heathrow Airport and the centre of their recorded country of study was calculated and multiplied by the relevant economy class air travel emission factor (including WTT related emissions and radiating forcing). The emissions from rail travel between Heathrow Airport and Coventry station were calculated and added to this to give the total emissions per one-way journey and doubled to give the total emissions per return journey.

Students who study a full year abroad were assumed to make two return trips, and students who study only part of a year abroad are assumed to make one return trip.

Data was retroactively analysed for 2018/19 and 2019/20 also.

Limitations and Exclusions:

This analysis includes only the straight-line distance for air travel, and does not consider the extra distance of connecting flights that may have been taken. It also assumes all travel is by air, where some travel to European countries may be done by road or rail. Travel within the country of study is also not considered, as location-specific data was not available.

Results:

In 2020/21, the total emissions due to travel related to study abroad was 961 tCO_{2e}. This is an increase from emissions from 2020/21 but has not returned to pre-pandemic levels.

Chart 32: Scope 3 emissions arising from travel related to study abroad (tCO_{2e})

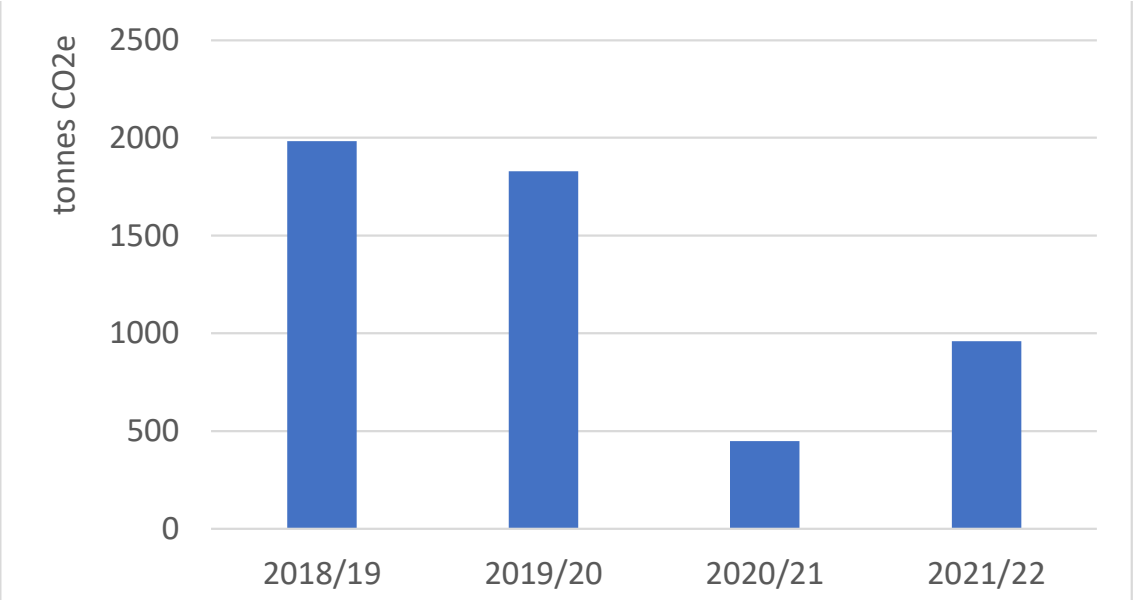
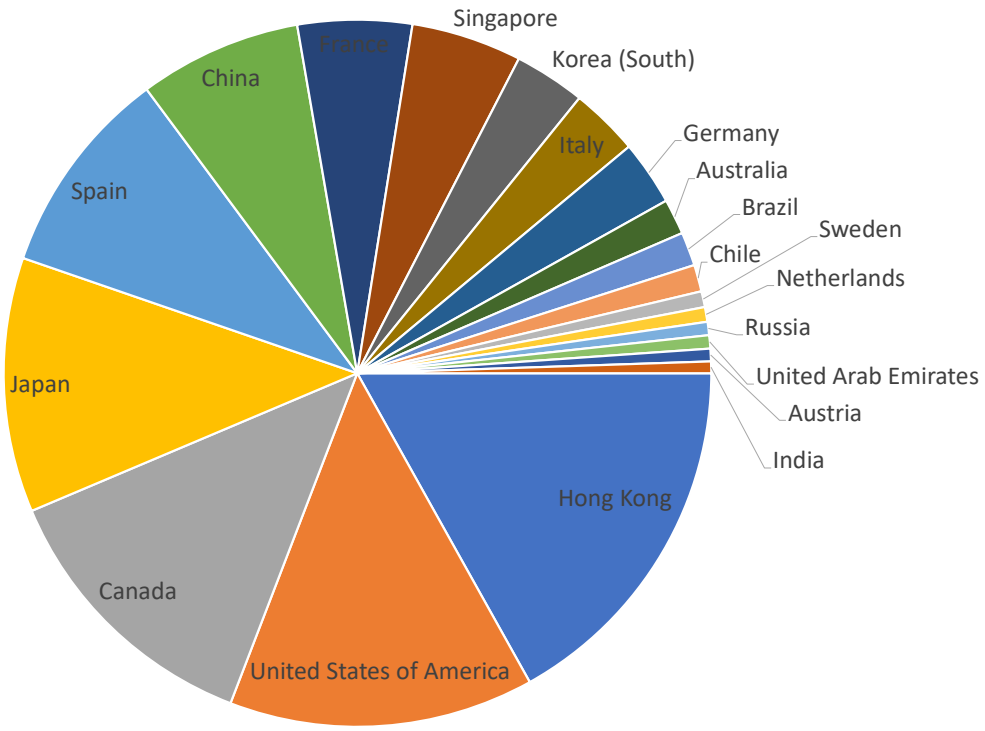


Chart 33: Scope 3 emissions arising from travel related to study abroad by country (tCO_{2e}) (Top 20 locations)



Discussion:

Study abroad is however an important part of student education. While the number of students studying abroad may not be influenceable without affecting their education, the method of travel is influenceable and could have a significant impact on emissions. 38% of emissions from studying abroad arise from travel to mainland European countries, which could be accessed by rail, significantly reducing the emissions related with study abroad in these locations.

8.1.9 Staff and Student Commuting

Scope:

Emissions arising from undergraduate students, postgraduate students and staff commuting to and from University campus.

Data sources:

Commuting data to and from campus, including distance and method of transport, comes from the 2022 University Transport survey. This survey is designed primarily to assess staff and student current modes of transport, assess attitudes to alternatives and therefore inform strategy on Sustainable Transport. The survey is not currently designed to accurately assess full year carbon emissions for all staff and students from commuting but results can be used to provide an indication, future surveys will be adapted to provide more data for this purpose.

Methodology:

The methods of transport and postcodes of 1290 staff, undergraduate and postgraduate students were extracted from the results of the travel survey. For those commuting using road transport methods, the straight-line distance between their home and University was calculated. For those travelling via rail transport methods, the straight-line road distance between their home and nearest station, the straight-line distance between interchanges on their rail route to Coventry, and the bus distance between Coventry station and the University were all accounted for. Where no postcode or only partial address was given, the approximate location or approximate distance from the University (as given in another survey question) were used.

The actual distance travelled by car for 50 car-commuting postcodes and by bus for 30 bus-commuting postcodes were found and compared to the straight-line distances to attain distance conversion factors (1.323 and 1.309 respectively). The straight-line distances were multiplied by these distance factors to estimate the actual road distances.

The number of journeys per week provided by different categories of survey respondent was used to estimate the total number of journeys in one year, with annual working weeks applied to staff and annual term weeks applied to students.

These total distances were multiplied by the relevant conversion factor (from Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting) for the method of transport specified to find the total emissions from commuting for each person.

The average emissions per member of staff, undergraduate student and postgraduate student was calculated and multiplied by the total number of staff, undergraduates and postgraduates in 2020-21 to estimate the total Scope 3 emissions arising from commuting.

Limitations and Exclusions:

The number of journeys per week provided by respondents was based on a single week of travel and this may not be applicable to every week throughout the year.

The sample size extrapolated from the survey is small, and may be liable to inaccuracy and bias. Some methods of transport (e.g. National Express electric buses used in the nearby area) may have a significantly different emission factor to the national averages in Government Greenhouse Gas (GHG) Conversion Factors for Company Reporting. Some methods of transport (e.g. "car driver with passenger" and "car passenger, dropped off") could be interpreted differently and the conversion factors may not be adjusted correctly. All rail travel was assumed to be to Coventry station rather than Canley station, which may limit accuracy of short rail commutes.

Results:

The total emissions from commuting is estimated at 14,919 tCO_{2e}, the reduction on 2020/21 data is due to improved data on number of journeys to campus per week. With no historical data on this previously it was assumed that all staff and students travelled to campus on average 3 days per week.

	Average emissions per person (tCO_{2e})			Total emissions per category (tCO_{2e})			Total (tCO_{2e})
	Staff	Undergraduate students	Postgraduate students	Staff	Undergraduate students	Postgraduate students	
Total	0.79	0.26	0.45	5,488	4,781	4,650	14,919

Chart 34: 2021-22 Scope 3 total commuting emissions (tCO_{2e}) by most common modes

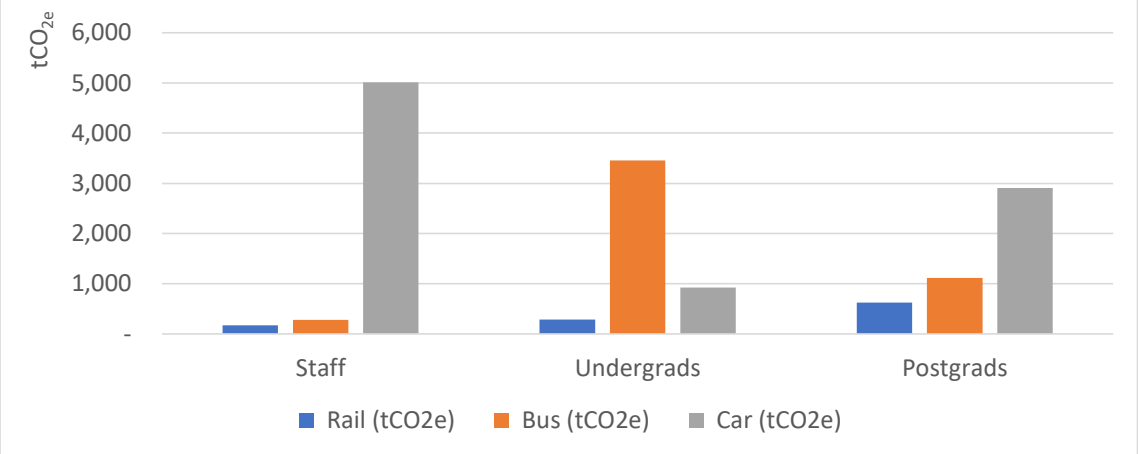
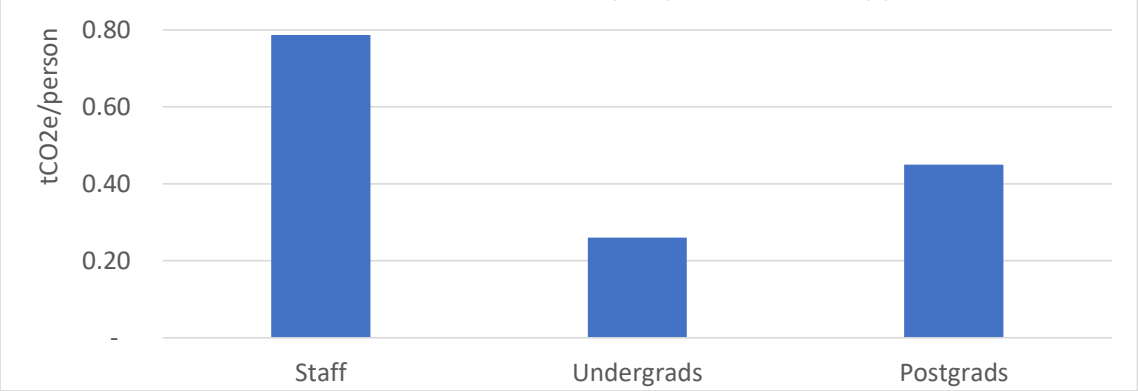


Chart 35: 2020-21 Scope 3 average commuting emissions per person (tCO_{2e}/person)



Discussion:

These emissions are categorised as Category 7: Commuting in the Greenhouse Gas Protocol Standard. This area of emissions is a significant contribution to the University's Scope 3 emissions, and as such is an area where initiatives to reduce such emissions are urgently required.

Staff and postgraduate students on average produce significantly more emissions on average than undergraduate students. This is likely due to generally living further away from the University, and greater use of cars instead of public transport than undergraduate students.

In 2019, Arup analysed student and staff commuting emissions, and estimated direct emissions of 22,496 tCO_{2e}. 2020/21 shows a 33% reduction in direct emissions, mainly due to the increase in working from home as estimated here. The Arup 2019 analysis was performed before the COVID-19 pandemic affected the UK, so did not account for working from home.

8.1.10 Working from Home

Scope:

Emissions resulting from heating, lighting, and workstation use, from staff and students working from home / teleworking.

Data sources:

There is currently no data on frequency of teleworking or home energy usage for staff and students at the University and this has been estimated. In 2022 DEFRA published, for the first time, carbon emissions factors for homeworking.[9]. These factors were based on the Homeworking emission Whitepaper (EcoAct, 2020)[10], our source for last years estimates of homeworking emissions.

Methodology:

[9] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022
[10] https://info.eco-act.com/en/homeworking-emissions-whitepaper-2020

The number of days per week spent working from home for staff, undergraduate and postgraduate students was estimated based on the 2022 travel survey responses. The number of hours per year spent working from home per person was estimated based on 7.5 hours per day for the staff working year duration and student term time respectively.

The number of students working from University-owned accommodation were excluded, as these emissions are accounted for in Scope 1 and 2.

Limitations and Exclusions:

The estimated frequency of teleworking is based on a single reference week from respondents to the travel survey, a potentially significant source of error. It also assumes that teleworking has no impact on University energy usage, and that when working in the office, heating, lighting, and workstations at home are turned off.

Results:

The emissions arising from teleworking for 2021-22 are estimated at 10,573 tCO_{2e}.

Discussion:

Emissions resulting from teleworking are included under the Greenhouse Gas Protocol Standard Category 7: Commuting.

As these results are based on significant estimates, changes and improvements to emissions in this area are challenging to quantify. The primary recommendation is to survey the working patterns, home energy use and home energy supply of staff and students to improve the accuracy of estimates of emissions in this area and enable better measurement of initiatives to improve the University's Scope 3 emissions. In future, promoting use of low-carbon energy suppliers at home could lead to significant improvements.

8.1.11 Student travel between home and University

Scope:

Emissions arising from air and rail travel between home country and Coventry for overseas students, and arising from car and rail travel between home postcode and campus for UK students.

Data Sources:

Student travel data was determined from records of the home postcode of University students and based on an assumption that each mainland UK student makes a single trip from and back to their home in a given year by car, and two further return trips by rail.

The number of overseas students from each country was taken from student enrolment statistics.

Methodology:

For mainland UK students, the straight-line distance between their home postcode and the University was calculated. The actual distance and straight-line distance between

100 postcodes and the University was found, to calculate a distance conversion factor to convert between straight line distance and actual road distance (1.251).

The straight-line distance was multiplied by the distance conversion factor and the emission factor for an average car from the 2022 Greenhouse Gas Conversion Factors for Company Reporting to calculate the average emissions per car journey and doubled to calculate the emissions for one assumed return trip per year.

The rail route between Coventry station and the nearest station to each postcode was found. The straight-line distance between each change on the route was calculated and totalled to find the approximate total rail distance per rail journey. This was multiplied by the emission factor for UK national rail travel from the 2021 Greenhouse Gas Conversion Factors and multiplied by 4 to calculate the emissions resulting from two return trips by rail per year. The emissions resulting from driving between their home postcode and nearest station was calculated as described in previous paragraphs also.

The emissions for the average student were calculated and multiplied by the number of UK students enrolled during 2021/22.

For overseas students, the distance between Heathrow Airport and the centre of their recorded country of domicile was calculated and multiplied by the relevant economy class air travel emission factor. The emissions from rail travel between Heathrow Airport and Coventry station were calculated using the same methodology as above and added to this to give the total emissions per one-way journey and doubled to give the total emissions per return journey.

For non-mainland UK students, the same calculations were done but assuming that flights are made to Birmingham International Airport.

It was assumed that those living less than 2500km away are assumed to make three return trips, between 2500-7500km make two return trips, and those with home countries further away make one return trip per year.

Limitations and Exclusions.

There is significant uncertainty in the number of journeys each student makes per year between home and University, and uncertainty in the method of transport used for this. It is assumed that both full- and part- time students make the same amount of travel.

The flight distance for overseas students is assumed to be between Heathrow Airport and the centre of each country; this is unlikely to be true, as the airport may be in any location within the country. Travel between the airport and home is also not accounted for and may be significant.

Though not as significant as the previously mentioned assumptions, it is also assumed that all rail travel is in straight lines between changes, and that the distance conversion factor calculated is representative for all travel.

Results:

Emissions from overseas students travelling to and from their home countries is estimated at 34,163 tCO_{2e} for 2021/22 compared to 29,413 tCO_{2e} for 2020/21, and 28,624 tCO_{2e} for 2019/20 based on the same assumptions.

Emissions from mainland UK students travelling to and from their home postcode is estimated at 1,636 tCO_{2e} for 2021/22, of which 1,237 tCO_{2e} arises from road travel and 399 tCO_{2e} arises from rail travel.

Discussion:

Though significant, student travel between home and University is not easily influenceable for overseas students, as often air travel is the only feasible method. 87% of the emissions from overseas students arises from travel to and from countries over 2500km away, and as such it is likely to be difficult to reduce these emissions significantly in the future. For UK students, emissions from travelling between home and University are much less significant, estimated at 97 kgCO2e per student for 2021/22. These emissions are however more easily influenceable. For the average student, travelling between home and University by car produces over 6 times as much CO2e than travelling by rail. Initiatives to promote travelling by rail rather than by road when feasible could help to reduce Scope 3 emissions in this category.

There is no standard on how to report emissions resulting from student travel. The frequency of travel here has been selected based on estimates only. To improve these estimates, students should be surveyed to assess how often both UK and overseas students travel between home and University, and the method of transports used.

However, there is an argument that students only need to travel between home and University one time per year, and that any surplus journeys are the students' own decisions which the University are not responsible for. As with other Scope 3 reporting, assumptions and decisions on how best to report these emissions have large impacts and should always be understood and stated clearly.

To improve future reporting on this significant emissions category, it is recommended that both UK and overseas students are surveyed to attain more accurate estimates of the frequency and methods of transport between their homes and universities.

8.1.12 Investments

Investments are another area in which the University may have Scope 3 emissions, further work is needed to understand the emissions.

The University updated their Socially Responsible Investment Policy in 2022, outlining the University's investment approach with regards to environmental sustainability, as well as various social concerns. The University will not knowingly invest in fossil fuel extraction or production[11].

8.2 Estimated Total Scope Three Emissions

It is important to note that many practices to account for Scope 3 carbon emissions are based on estimates and assumptions, and that the choice of methodology can have a large impact on the results. As far as possible, previous years' data has been

[11] https://warwick.ac.uk/services/finance/corporate_information/socially_responsible_investment_policy/

retrospectively calculated using the same methodology and recorded in the table below. Please see individual sections above for methodology, assumptions and caveats.

GHG Protocol Standard Category	Emissions source	Scope 3 emissions (tCO_{2e})			
		2018/19	**2019/20**	**2020/21**	**2021/22**
1, 2, 4, and 8	Procurement	47,298	47,298[12]	39,677	32,388
1. Purchased Goods and Services	Water treatment and supply	257	223	208	226
3. Fuel and energy-related activities not included in Scopes 1 & 2	Fuel and energy-related activities not included in Scopes 1 & 2	6,438	5,981	8,320	8,195
5. Waste generated in operations	Waste	940	361	241[13]	96
6. Business travel	Business travel	2,458[14]	4,348	62	1,537
6. Business travel	Travel related to study abroad	1,983	1,830	450	961
7. Employee commuting	Staff and student commuting	22,496[15]	14,997[16]	23,129[17]	14,919[18]
7. Employee commuting	Teleworking	0	1,468[19]	3,742	10,573[20]
7. Employee commuting	Student home to University travel (UK)	1,845	1,597	1,516	1,636
7. Employee commuting	Student home to University travel (overseas)	26,743	28,624	29,413	34,163
Total		**110,458**	**106,727**	**106,758**	**104,694**

[12] 2019/20 procurement data has not yet been analysed, so has been estimated at the same value as 2018/19. This may not be the best estimate due to reduced campus activity during this period.
[13] 2020/21 waste data from HESA EMR submission Spring 2022.
[14] Centralised travel booking was not fully established in 2018/19 and data provided here from Key Travel, University travel provider in that year may not have captured all travel bookings.
[15] 2019 commuting data was assessed by Arup. This does not include WTT emissions, whereas 2020/21 data does. Methodology may also slightly differ.
[16] 2019/20 commute data is based on the 2019 Arup estimate, reduced accordingly to account for 4 months of working from home during the Apr-Jul lockdown. This did not include WTT emissions.
[17] Includes WTT emissions.
[18] A question on working from home frequency included in the 2022 Travel Survey enabled a change in a fundamental assumption used previously on working from home frequency
[19] 2019/20 working from home data assumes staff and students only worked from home 23/03/2020-31/07/2020, after lockdown restrictions were announced.
[20] New assumptions on frequency of home working from the 2022 travel survey and new guidance from DEFRA on carbon emission intensity of homeworking resulted in a significant increase on the previous year

8.3 Scope 3 Emissions Compilation: Lessons Learnt

Accurate accounting of scope 3 carbon emissions is limited not only at the University but across higher education and the wider economy. Challenges stem from a lack of regulation, diverging accounting methods and limited disclosure by suppliers.

New guidance from the EAUC, setting out a Standardised Carbon Emissions reporting Framework (SCEF[21]), will improve consistency across Universities and Warwick is well placed having used the Greenhouse Gas protocol standard (the basis of the new SCEF) for a number of years. These standards do not however, resolve the challenges of accurately capturing underlying data.

However, Scope 3 carbon figures presented in this report are a useful indication of the sources of emissions and can be used to prioritise areas of action until more accurate methods are validated.

Under the guidance of the Environment and Social Sustainability Action Group (ESSAG), actions will be further reviewed as Faculties and Departments embed sustainability in their planning and operation and actions plans are developed.

Collaborative work with other institutions is taking place in parallel to inform best methods to account and report scope 3 carbon emissions.

9 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
Scope 1 and 2 Emissions (tCO_{2e})	40,496	37,903	39,850	39,809
S/Total Scope 3 Emissions (tCO_{2e})	110,458	106,727	106,878	104,694
Total scope 1, 2 and 3 (tCO_{2e})	**150,954**	**144,630**	**146,728**	144,503

21 https://www.eauc.org.uk/scef#:~:text=The%20Department%20for%20Education%20has,their%20Sustainability%20%26%20Climate%20Change%20Strategy.

Chart 36: Estimated Total Scope 1, 2 and 3 University CO2e Emissions

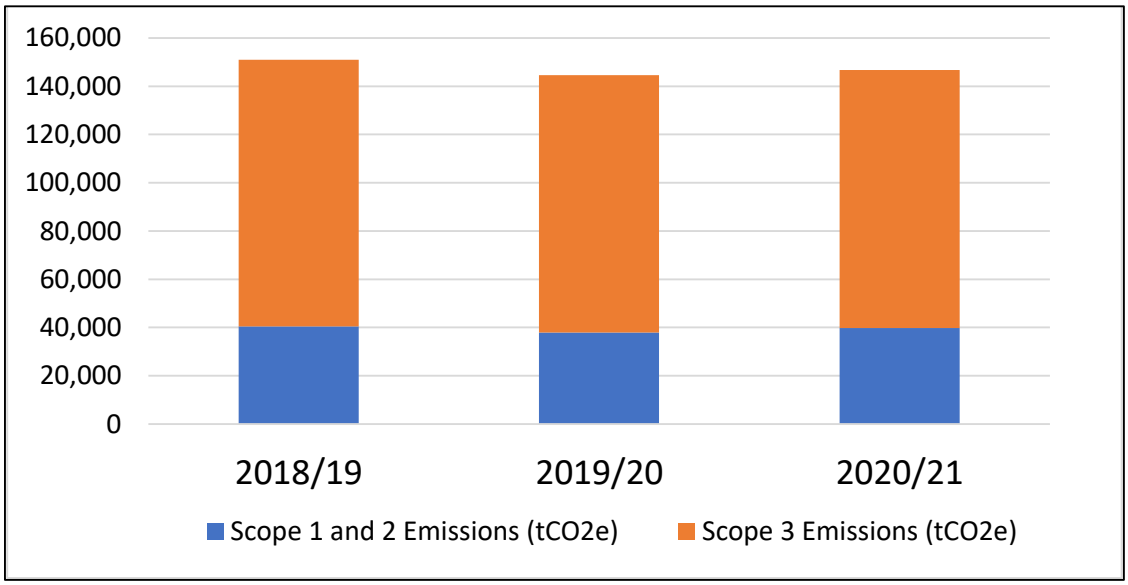
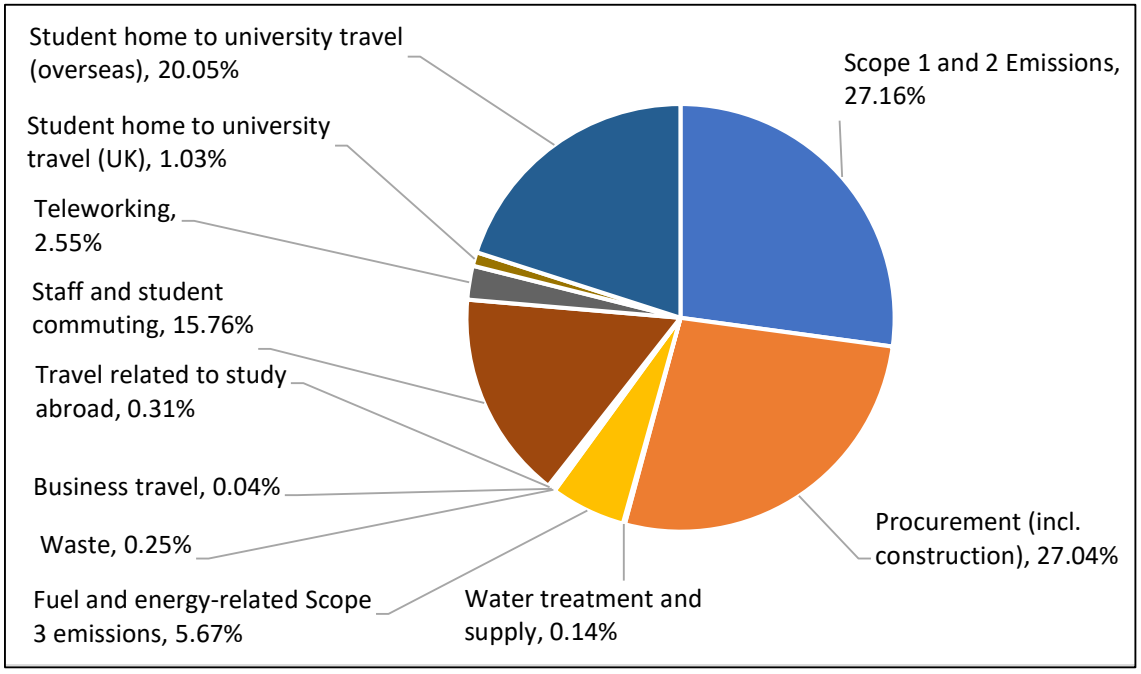


Chart 37: 2020/21 Total estimated University scope 1,2 and 3 CO_{2e} emissions by category.



10 Engagement

Greater emphasis on engagement around sustainabiltiy is being developed across the University.

ESSAG, a subgroup of the University Estate and Environment Committee (UEEC) has engagement embedded within its terms of reference with, amongst other things, a remit to recommend:

- Proposals for the development of a culture of sustainability within the institution to include raising awareness, building confidence and providing support.

- Substantive proposals to encourage and promote locally generated sustainability initiatives, including recommendations for resourcing implications as required.
- Environmental sustainability communication programmes to raise awareness and promote broader environmental and social sustainability.

The following sections describe some discrete engagement projects.

10.1 Green Champions

The Green Champion network is open to all staff and students who want to help make the University environment and community a greener, healthier, happier place to live, work and study. The role has been in existence for a number of years and is entirely flexible with no commitment necessary. At its core, it's about staff and students being enthusiastic and passionate about sustainability and sharing that with others.

During 2021/22 the number of staff Green Champions rose from approximately 230 for 250 people with representatives from across the faculties and professional service departments. Online monthly meetings were started and held every other month with a total of 246 people attending. These meetings discussed topics such as energy consumption and associated projects, the University's sustainability strategy and capital programmes.

The number of student Green Champions remained static at approximately 600 people.

10.2 Warwick Green Action and LEAF

Warwick Green Action was developed during 2018/19 with the aim of empowering individuals and teams (made up of Green Champions) to make positive changes within their departments. Due to the impact of COVID, and more people working from home, the number of teams fell. In 2019/20 there were 16 teams, however in 2021/22 there were only six teams covering the following areas:

- Chemistry
- Engineering
- Gibbet Hill (School of Life Sciences and Warwick Medical School)
- Psychology
- Sociology
- WMG

Teams in Chemistry, Life Sciences and the Medical School encouraged labs to be involved in the Laboratory Efficiency Assessment Framework (LEAF) to implement actions to reduce their environmental impact. In 2020/21 five labs were involved, in 2021/22 this increased to 22 labs who achieved bronze (x12), silver (x6) or gold (x2) awards.

10.3 Cut the Flow

Cut the Flow is an inter-block energy and water saving competition across the halls of residence on campus. As well as reducing consumption, the initiative is designed to raise awareness of energy usage and to prepare students to become responsible citizens as they leave University accommodation and live-in rented accommodation off site. It also raises awareness to students of recycling on campus and the importance of reducing waste production.

Unfortunately, due to COVID-19 the 2019/20 competition did not include Term 3 and the 2020/21 competition could not take place. Engagement started again in 2021/22 with four Cut the Flow Assistants being employed to undertake walkabouts of accommodation to speak to students. Unfortunately no walkabouts were allowed to take place during term 2 because of COVID restrictions and therefore the students supported engagement stands across campus. Winning blocks for water and electricity at the end of each term received a hamper of zero waste and sustainable products per kitchen.

10.4 Hedgehog Friendly Campus

The University got involved in the Hedgehog Friendly Campus initiative from August 2021 and was awarded with the Bronze award in December 2021. A core Working Group was set up with staff and student representation and a number of other staff and students got involved in various aspects of the initiative including:

- The Carpenters built hedgehog houses which were installed across campus;
- Grounds and Gardens staff built bug hotels;
- Litter picks took place with Warwick Plogging and staff volunteers; and
- Posters, social media posts and news articles promoted how people could get involved and make a difference both on and off campus.

Staff, students and the community continue to be involved in the initiative and the University will be submitting for the Silver award in December 2022.

10.5 Events

The Energy and Sustainability Team are involved in several events throughout the year to raise awareness of environmental sustainability to a cross section of the University, as well as the local community and prospective students. The number of events and participants increased after a year significantly affected by COVID, however the number was still not up to pre-COVID levels; more than 30 events were held and 900 people engaged with. Some of the events held include:

- Pay As You Feel market - supporting the University move towards circular economy also raised money for local charity Emmaus.
- Green Champion lunchtime meetings
- Environmenstrual awareness and craft sessions
- Hedgehog Friendly Campus awareness
- Green Week

Chart 38: Staff and Student Engagement: Annual Contact Numbers

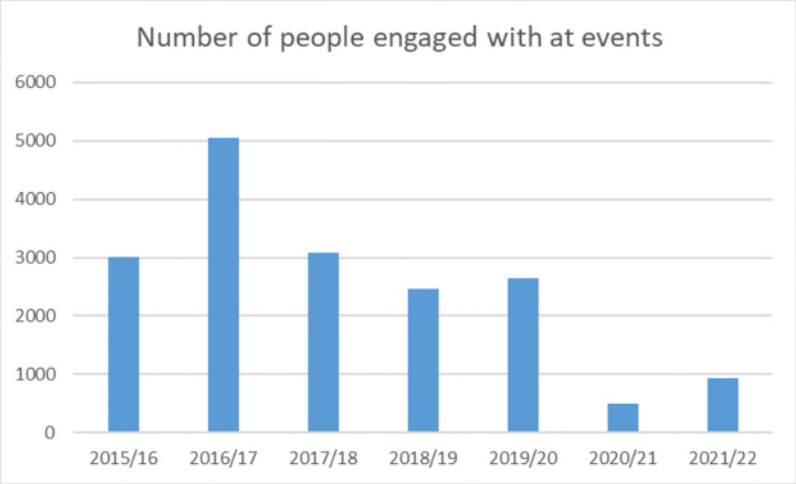
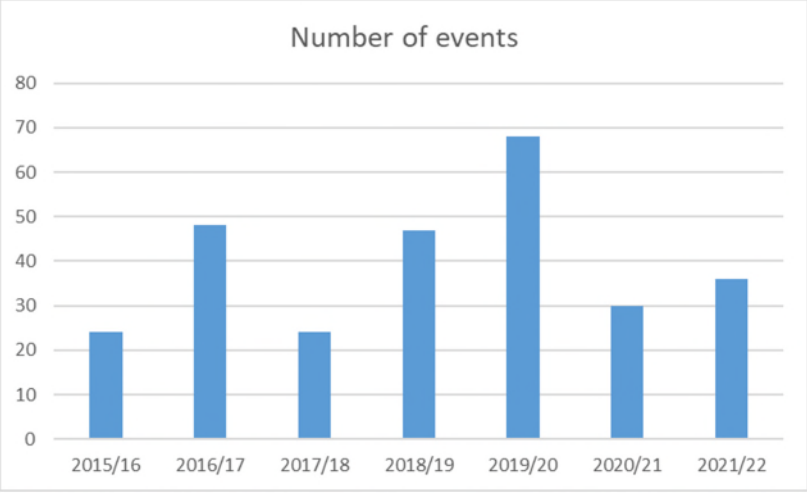


Chart 39: Staff and Student Engagement: Number of Events



10.6 Website and social media

During 2021/22 a new website was launched - https://warwick.ac.uk/sustainability/. It is clearly split into two sections:

1. Strategy, performance and case studies; and
2. Sustainability + You – how people can get involved and take action as well as news and events.

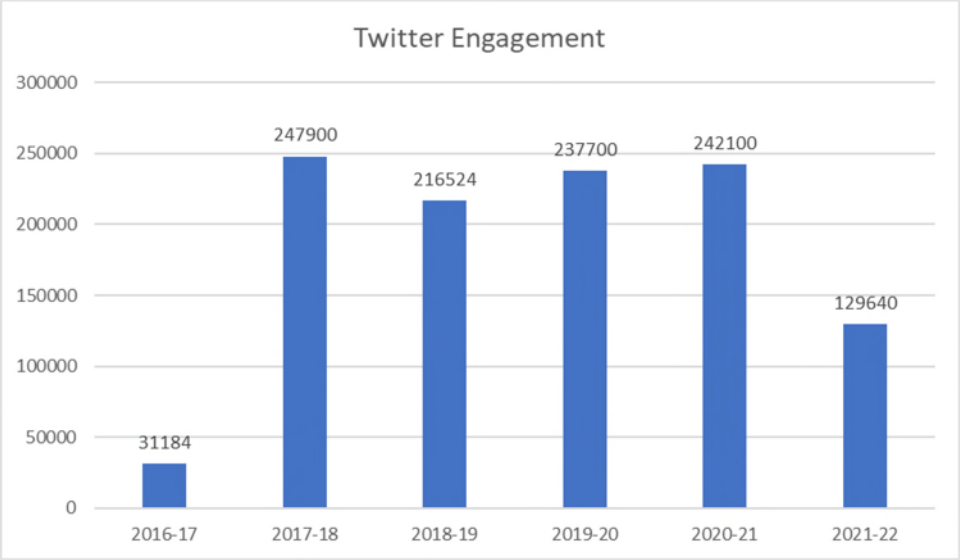
News, updates and events are regularly posted on social media platforms to engage with various audiences. @WarwickUniSust has a presence on Twitter, Instagram and Facebook.

There are regular themes including:

- Move Mondays to raise awareness of sustainable travel options;
- Wildlife Wednesdays to promote exploring campus and biodiversity projects on campus; and
- Eco Switches to encourage switches to more sustainable products.

The following chart shows twitter engagement over recent years.

Chart 40: Twitter Engagement



10.7 Newsletter

A monthly newsletter is produced, distributed to Green Champions and made available on the website. The following chart shows readership per month.

Month	2018/19	2019/20	2020/21	2021/22
August	90	202	299	258
September	67	246	273	270
October	127	482	267	430
November	171	512	281	389
December	117	460	273	420
January	182	No edition	272	219
February	159	435	272	365
March	175	COVID-19 Mini-series 4520	267	371
April	No edition		277	443
May	148		261	365
June	193		289	370
July	223	461	244	352

10.8 SDG Accord

The United Nations Sustainable Development Goals (SDGs) were introduced in 2015 as a 'blueprint to achieve a better and more sustainable future for all'. The 17 goals (169 targets) cover areas such as poverty, hunger, equality, economic growth, climate change and justice, and were adopted by all UN Member States as part of the 2030 Agenda for Sustainable Development.

Vice Chancellor Stuart Croft signed the SDG Accord in February 2020 to demonstrate the University's intention to work towards the SDGs and commit to annually reporting on contributions and progress. The University submitted its third annual submission in May 2022 and has produced two annual SDG reports to date (2018/19 and 2019/20), which provide case studies on how the SDGs are embedded into the University.

10.9 UI Green Metrics

The UI GreenMetric World University Rankings started in 2010. The ranking looks at location and infrastructure, energy and climate change, waste, water, transportation, and education & research.
The University of Warwick started submitting information in 2018 and is one of an increasing number of universities taking part.

In 2021, 956 universities submitted data. The University of Warwick was ranked 36th in the World and 4th in the UK.

11 Recommendation

The *Way to Sustainable Strategy*[22] outlines the University's Sustainability goals and objectives with explicit targets on energy and carbon. The carbon management implementation plan developed by the Energy Infrastructure Group (EIG) in 2021 identifies the technologies and interventions required to achieve significant energy and carbon savings and these are being progressed by the Energy Action Group (EAG).

This report is focussed on reporting historical performance with some comparison to reduction trajectories. Detailed recommendations to achieve carbon reductions across all carbon emission sources (from Scope 1 to 3) are beyond the scope of this document, however, some general recommendations are provided below.

11.1 Energy and Carbon Management – The need for collaboration, shared data and objectives.

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.

11.2 Energy Usage Policy - Awareness

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

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

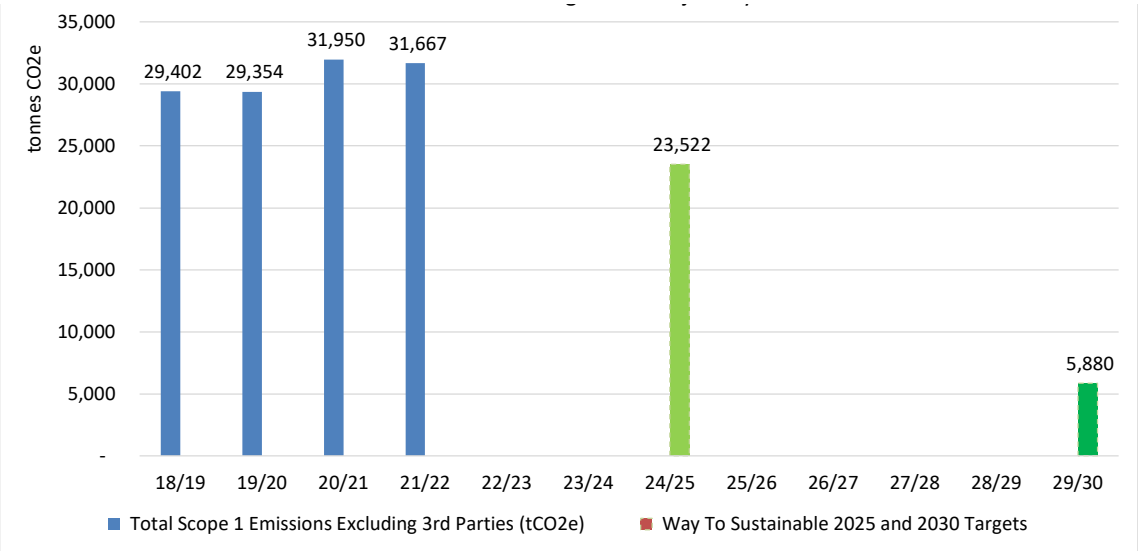
affect the greatest impact on energy use. This work is underway and is supported by the Strategic Change team in the Information and Digital Group (IDG).

11.3 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[23] 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 41: Total Scope 1 Emissions Excluding 3rd Parties (tCO2e) - Way To Sustainable Targets



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

12 Appendix

Appendix 1: Absolute Building Rankings.

RANK	Carbon Emissions		Gas		Electricity		Approx. Total Thermal Energy[24]		Total Energy[25]		Water	
	Building	Tonnes CO_2	Building	kWh	Building	kWh	Building	kWh	Building	kWh	Building	m3
1	Lord Bhattacharyya Building	1,950.76	Millburn House	1,908,957	Lord Bhattacharyya Building	5,297,148	Lord Bhattacharyya Building	3,909,111	Lord Bhattacharyya Building	9,482,082	Heronbank Residences North and East Courts	25,015
2	University House	1,265.02	Heronbank Residences North and East Courts	996,998	Argent Court Data Centre	3,905,936	Heronbank Residences North and East Courts	2,494,618	University House	5,370,456	Heronbank Residences West Court	15,995
3	Warwick Arts Centre	867.29	Computer Science Building	552,940	University House	3,405,040	Warwick Arts Centre	2,251,642	Argent Court Data Centre	3,905,936	Sports Hub	14,775
4	Sports Hub	797.13	Heronbank Staff Flats	443,602	Energy Innovation Centre	2,079,326	University House	1,965,416	Warwick Arts Centre	3,756,012	Scarman House	9,984
5	Argent Court Data Centre	755.33	Lakeside staff flats	435,089	Physics	1,904,095	Millburn House	1,908,957	Millburn House	3,531,763	Lakeside Residences 1	9,981
6	International Manufacturing Centre	745.37	Cryfield Hall 2	428,064	Biotechnology	1,752,201	Sports Hub	1,881,600	Sports Hub	3,464,228	Library	9,249
7	Heronbank Residences North and East Courts	692.77	Loxley	414,820	International Manufacturing Centre	1,675,863	Interdisciplinary Biomedical Research Building (IBRB)	1,798,310	Interdisciplinary Biomedical Research Building (IBRB)	3,215,471	Bluebell 1	8,746
8	Energy Innovation Centre	682.11	Cryfield Hall 1	408,094	Millburn House	1,622,806	Bio-Medical Research Building	1,538,165	International Manufacturing Centre	3,161,173	Heronbank Staff Flats	8,463
9	Millburn House	662.28	Gosford	387,952	Sports Hub	1,509,192	Warwick Business School	1,496,584	Heronbank Residences North and East Courts	3,158,564	Claycroft 2	7,754
10	Bio-Medical Research Building	600.87	Emscote	377,002	Materials and Analytical Sciences Building	1,504,395	International Manufacturing Centre	1,485,310	Energy Innovation Centre	2,975,794	Claycroft 3	7,686

[24] Gas consumption x 0.8, Heat and Coolth

[25] Including Gas, Electricity and Heat and Coolth where provided from external sources.

Appendix 2: Relative Building Rankings.

RANK	Carbon Emissions		Gas		Electricity		Approx. Total Thermal Energy[26]		Total Energy[27]		Water	
	Building	Tonnes CO_2/m^2	Building	kWh/m^2	Building	kWh/m^2	Building	kWh/m^2	Building	kWh/m^2	Building	m^3/m^2
1	Argent Court Data Centre	1.65	Emscote	276.7	Argent Court Data Centre	8547.1	Biotechnology (Phase 4)	820	Argent Court Data Centre	8547	Whitefield Flat 02	2.9
2	Biotechnology (Phase 4)	0.27	Loxley	276.7	Transgenic Plants Laboratory	1065.7	Mechanochemical Cell Biology	646	Biotechnology (Phase 4)	1123	Heronbank Residences West Court	2.6
3	Transgenic Plants Laboratory	0.25	Cryfield Hall 2	265.1	Phytobiology Facility	446.4	Physical Sciences	452	Transgenic Plants Laboratory	1066	Whitefield Flat 03	2.3
4	Mechanochemical Cell Biology	0.22	Gosford	258.6	Biotechnology	420.8	Bio-Medical Research Building	309	Mechanochemical Cell Biology	1053	Whitefield Flat 04	2.3
5	Physical Sciences	0.20	Dunsmere	254.7	Physical Sciences	406.8	Emscote	277	Physical Sciences	859	Tocil Flats 01-06	2.2
6	Phytobiology Facility	0.16	Cryfield Hall 1	252.8	Mechanochemical Cell Biology	401.5	Loxley	277	Phytobiology Facility	707	Gosford	2.2
7	Bio-Medical Research Building	0.12	Bericote	230.5	Science Block A	380.7	Cryfield Hall 2	265	Bio-Medical Research Building	567	Heronbank Staff Flats	2.2
8	Energy Innovation Centre	0.11	Hampton	228.3	Energy Innovation Centre	339.1	Phytobiology Facility	260	Energy Innovation Centre	485	Lakeside Residences 1	2.1
9	University House	0.10	Whitefield Flat 02	227.2	Materials and Analytical Sciences Building	320.7	The Slate	259	Interdisciplinary Biomedical Research Building (IBRB)	449	Whitefield Flat 06	2.1
10	Biotechnology	0.10	Whitefield Flat 07	227.1	Biotechnology (Phase 4)	303.3	Gosford	259	University House	442	Tocil Flats 19-24	2.1

[26] Gas consumption x 0.8, Heat and Coolth

[27] Including Gas, Electricity and Heat and Coolth where provided from external sources.

Appendix 3: Top 10 Residential Buildings by Total Emissions.

RANK	Building	Tonnes CO_2
1	Heronbank Residences North and East Courts	693
2	Rootes D to H	284
3	Lakeside Residences 2	275
4	Heronbank Residences West Court	248
5	Claycroft 1	230
6	Rootes M to P	214
7	Rootes A to C	213
8	Lakeside Residences 4	209
9	Claycroft 2	201
10	Lakeside Residences 3	179

Appendix 4: Top 10 Residential Buildings by Emissions Intensity

RANK	Building	$kgCO_2$ / m^2 Floor Area
1	Lakeside Residences 2	60.5
2	Cryfield Hall 2	59.9
3	Loxley	59.1
4	Emscote	58.9
5	Gosford	58.8
6	Cryfield Hall 1	56.2
7	Dunsmere	55.7
8	Rootes A to C	53.4
9	Whitefield Flat 02	52.5
10	Whitefield Flat 07	52.5

Appendix 5: University Metrics used in this Report.

	Source	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Degree Days	**Bablake Weather Station**	2,147	1,847	2,150	2,265	*2,318*	*2,430*	*2,081*	*2,579*	*2,026*	*2,150*	*1,986*	*1,939*	*2,085*	*1,965*	*1,990*	*2,210*	*1,858*
Floor Area (m^2)	**Estates Office**	510,147	510,147	522,985	524,032	525,788	547,112	565,410	566,649	568,751	564,368	581,270	592,855	631,794	640,795	681,008	713,706	713,242
Student FTE	**UoW Stat. Accounts**	16,701	16,530	16,982	17,397	18,434	18,900	19,086	18,528	18,711	19,366	20,677	21,579	22,761	23,776	24,289	25,638	26495
Staff FTE	**UoW Stat. Accounts**	4,295	4351	4,496	4,523	4,448	4,375	4,351	4,536	4,932	5,221	5,403	5,690	5,932	6,142	6,554	6,382	6456
Total FTE (Staff & Student)	**Calculated**	20,996	20,881	21,478	21,920	22,882	23,275	23,437	23,064	23,643	24,587	26,080	27,269	28,693	29,918	30,843	32,020	32,951
£ Income	**UoW Stat. Accounts**	£310,601k	£330,511k	£350,181k	£375,656k	£408,500k	£419,100k	£440,100k	£459,600k	£480,500k	£512,800k	£573,600k	£591,000k	£631,500k	£688,600k	£679,900k	£703,700k	£779,000k
GDP Deflator	**ONS[28]**	71.893	74.046	75.795	78.533	79.584	80.912	82.346	83.773	85.514	86.456	87.144	88.933	90.416	92.032	94.425	100.476	100.000
£ Income (GDP Deflator Applied)	**Calculated**	£432,030k	£446,361k	£462,009k	£478,339k	£513,293k	£517,973k	£534,454k	£548,629k	£561,896k	£593,138k	£658,221k	£664,544k	£698,437k	£748,222k	£720,044k	£700,368k	£779,000k

[28] 'Financial year values applied to University reporting years; outturn data are as at the Quarterly National Accounts from ONS - last updated 30 September 2021.

Appendix 6: UI Green Metric Certificate.

CERTIFICATE

This certificate is awarded to

University of Warwick

as The 25th World's Most Sustainable University
in 2019 UI GreenMetric World University Rankings

Jakarta, December 3, 2019

Prof. Dr. Ir. Muhammad Anis. M. Met
Rector of Universitas Indonesia

Prof. Riri Fitri Sari, M.M., M.Sc
Chairperson of UI GreenMetric
World University Rankings

Appendix 7: Offsite Locations Added to Reporting

The Venture Centre UWSP Conference Room
The Venture Centre UWSP Store
The Venture Centre UWSP Admin/Projects
The Venture Centre Director office
UHCW Clinical Sciences
UHCW External Storage Unit 1
UHCW External Storage Unit 2
UHCW External Storage Unit 3
Millennium Point, Birmingham
Leamington Town Hall Learning Grid
The Shard

Appendix 8: Third Party Operations and Activities Segregated in Reporting

Aroma
Barclays Bank
Cafe Nero
Coventry City Council Street Lighting
Godiva Harriers
Hairdressers
Health Centre
Oak Tree Cottage
Pharmacy
Pret-A-Manger
Santander
Students Union
The Lord Bhattacharyya Building
Wireless Infrastructure Group - HUTCHINSON
Wireless Infrastructure Group - O2
Wireless Infrastructure Group - T-Mobile
Wireless Infrastructure Group - VODAFONE
Bericote 1 Tutors Flat
Bericote 2 Tutors Flat
Bungalow

Compton 1 Tutors Flat
Compton 2 Tutors Flat
Crescent housing
Cryfield cottages 2-14
Dunsmere 1 Tutors Flat
Dunsmere 2 Tutors Flat
Emscote 1 Tutors Flat
Emscote 2 Tutors Flat
Farmhouse
Heronbank staff
Lakeside apartments
Tarl Lea
Telefonica UK Limited
Housemark Limited
Dassault Systemes UK Ltd
Robert Bosch Limited
Warwickshire Rural Community Council
Association of Applied Biologists
EBI Software Ltd
TSA Marketing Limited

Aplica Consulting Ltd
Stoli Catalysts Ltd
Wolley & Co Ltd
Asis Solutions Limited
TVS Motor Company Ltd
Aztec Solar Energy Limited
Innovatus Safety Limited
Cool Refreshments Limited
W B Warwickshire Limited
Fluxys limited
Dow AgroSciences Ltd
Lyra Electronics Limited
Project 3 Mobility R&D UK Ltd
Lotus
Polkadot Day Nurseries Limited
Natural Green Creative Spaces Ltd