Cardiff University Climate Emergency Paper Summary Report:
Our Route to Net Zero

[This document summarises a full report submitted to University Executive Board on 2nd November 2020, accepted in principle on 19 January 2021 and received by University Council on the 8th February.

Background

Cardiff University's vision is to build towards an inclusive, sustainable and resilient future for our community and to bring about environmental benefits not only to Cardiff and Wales but to the wider world. On the 29th April 2019, the Welsh government declared a Climate Emergency and set a target for the country's emissions to reach net zero carbon by 2050. As an integral part of this target, the government also declared its intention for the public sector to be carbon neutral by 2030 and to coordinate action to help other areas of the economy, involving academia, industry and the third sector to make a decisive shift away from fossil fuels. These targets are a necessary (but not sufficient) part of our contribution to maintain the average global temperature well within 2˚C above pre-industrial levels, a threshold that is linked to catastrophic change. Cardiff University followed with its own declaration of a Climate Emergency by signing the Global climate letter on the 29th November 2019 and pledged to be carbon neutral by 2030 recognising the need for a fundamental societal shift to combat the growing threat of climate change. As signatories, we committed to:

1. Mobilizing more resources for action-oriented climate change research and skills creation;
2. Committing to achieving carbon neutrality for scopes 1 & 2 by 2030, while, for Scope 3 we seek to achieve this by 2050 at the latest, although aim to reach this as soon as possible.
3. Increasing the delivery of environmental and sustainability education across curriculum, campus and community outreach programmes

The declarations have been accompanied by the announcement of actions to reduce climate emissions and to divest from fossil fuel investment, a commitment, that Cardiff University fulfilled in November 2019, two years ahead of schedule.

Our actions in climate change

In June 2018, we published our environmental sustainability strategy, aligned to the United Nations Sustainable Development Goals and the Wellbeing of Future Generations Act wellbeing goals this reaffirmed our commitment to sustainability leadership in and improving environmental performance. Following our 2019 climate emergency declaration, a Climate emergency Task and Finish Working Group was set up to prepare this White Paper detailing the University's path to net zero and enabling us to take the time to review and strengthen our KPI's and environmental objectives , particularly around carbon emissions. This work is reflected in the updated KPIs embedded in the recast (November 2020) of the Environmental Sustainability Enabling Strategy:

- We will reduce scope 1 and 2 emissions by at least 15% by 2023.
- We will rank within the top 50 of the THE Impact Rankings by 2023.
- As signatories of the EAUC Accord, we will submit an annual report on embedding of the SDG's into all University activities
- By 2023, we will reduce our waste sent to Energy Recovery Facility/Refuse Derived Fuel to <= 30% in line with Welsh Government targets for Municipal waste by 2025
- By following the waste hierarchy, we will work towards achieving the Welsh Government recycling target of 70% by 2024/25
- Through our Biodiversity Action Plan, we will enhance the University's green infrastructure by ameliorating the environmental conditions of 30% of the green estate by 2023.

Carbon Modelling Project

A 3-month project was undertaken up to July 2020 to identify our scope 1, 2 and 3 carbon emissions and to develop a series of scenarios for our route to net zero; provding an update to the 2013 Carbon Management Plan and a new estimate of the university's carbon emissions. These new base line calculations were used to model a range of possible carbon emission scenarios for the university. This paper outlines both direct (Scope 1) and indirect (Scope 2 and 3) emissions resulting from the university's activities for the years 2017, 2018, and 2019 (Table 1 – describes the boundaries of these scopes). Where possible we also include emissions resulting from 2020 up to the collation of the data within this report.

Table 1. The boundaries of this study

Scope 1	Scope 2	Scope 3
Natural gas usage	Electricity usage	Goods, works and services procured
University owned vehicles		Student travel
		Staff travel
		Waste disposal
		Water usage
		Emissions related to natural gas and electricity transmission

We collected data for each scope and the activities within them with a monthly resolution wherever possible. The data sources, resolution and accuracy for each activity are presented in Appendix 1.

Part 1: Baseline emissions

On average the university produces 133,761±5719 tonnes CO_2e per year. This estimate is made from a combination of average estimates and annual data from 2017, 2018, 2019. Of estimate 5.4% was from scope 1, 9.5% was from scope 2 and 85.1% was from scope 3 (Figure 1).

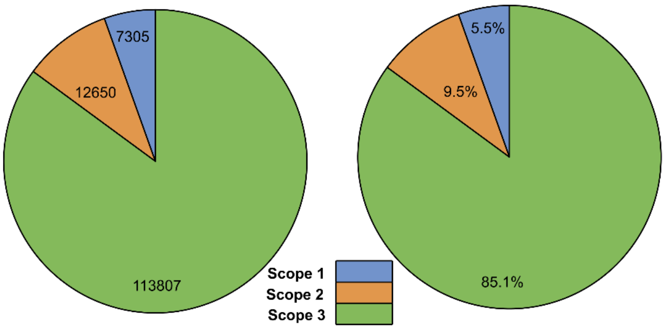

Figure 1 Cardiff University Emissions by scope. A) Tonnes CO_2e, B) As a % of the university's total

The breakdown of emissions from each recorded activity is shown in Figure 2. Goods, works and services procured, and student travel are the greatest emitters of CO_2 accounting for 47.9% and 26.7% of the total carbon emissions, respectively when using the tools currently available.

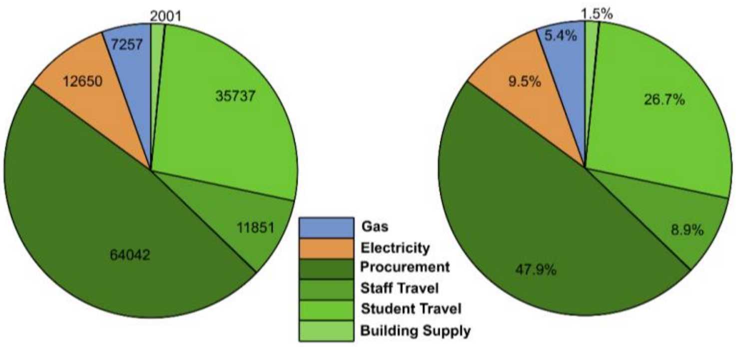

Figure 2 Cardiff University Emissions by category. A) Tonnes CO^2e, B) % with one decimal place.

Table 2 compares the current carbon budget to that last measured in 2012/13. The total emissions have increased by 4.6% over that period. However, emissions produced by water usage and waste disposal have decreased by 78% and 80%. The increase in emissions is linked to a rise in external spend, likely linked to increased construction activity, and travel, due to the inclusion of international student flights within the scope of this study. The total emissions presented here are comparable to those reported by other similar sized Universities with city-centre locations (Fig 3).

Table 2 Comparison of this report's estimate of emissions to the previous report in 2012/13

Scope and category	Total emissions (tonnes CO^2e per year) 2012/13	Average emissions (tonnes CO^2e per year) 2017 - 19
Scope 1 - Gas & University Fleet	13,806	7305
Scope 2 - Electricity	23,982	12,650
Scope 3 - Water	577	121
Scope 3 - Waste & recycling	314	56
Scope 3 - Other goods, works & services procured	56,128	64,041
Scope 3 - Student & staff travel	31,642	47,587
Total	**126, 676**	**131,760**

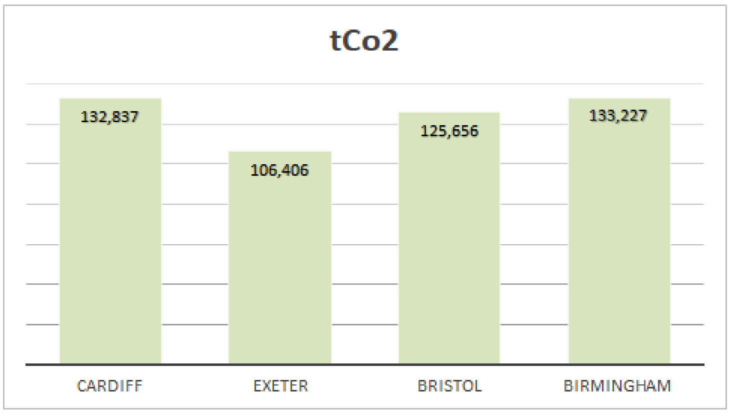

Figure 3 Total carbon emissions (tCO_2e) for Universities (Complete scope 1,2 and 3 emissions)

Scope 1 and 2 emissions

Scope 1 includes emissions from onsite gas combustion in academic and residential buildings as well as combustion emissions from diesel and petrol use in University owned vehicles. The baseline emissions for scope 1 are 7304.8 (±44) tCO_2e per year. Scope 2 includes emissions from our use of purchased electricity in our buildings, producing a total of 12,649 (±541) tCO_2e per year.

Gas - we estimated gas usage from 226 monthly meter readings for all University owned building, taken either manually or automatically. However, this was not possible for some buildings, which required estimates of consumption. Due to the number of estimated readings gas consumption is reported as a single annual figure rather than an average, with baseline emissions for gas of 7257 (±40) tCO_2e /year, 5.4% of the total carbon budget.

Fleet vehicles - vehicle registrations were provided by the Estates department and the network of School Environmental Compliance Officers (ECO's) , where mileage data was derived from publicly available MOT data. Where this was not available, we assumed an average yearly mileage. While appropriate DEFRA carbon emission factors were used to convert the mileage into emissions. Vehicle emissions produce 47 (±3) tCO_2e per year, 0.035% of the total.

Electricity - we derived the electricity consumption from 178-meter readings from university owned buildings, where nearly all had regular meeting readings allowing us to report a highly accurate estimate. The baseline emissions for electricity were 12650 (±541) tCO_2e, accounting for 9.5% of the total carbon budget.

Scope 3 emissions

The total Scope 3 emissions are 113,807 (±5132) tCO_2e /year, these are broken down into components in Table 3. We estimated **water usage** using meter readings from 9 university owned buildings, converted into emissions via DEFRA conversion factors related to treatment and transport. However, many buildings are not closely monitored and as a result this emission total is likely to be a minimum. Emissions from **waste disposal** were calculated from the weights of waste collected from all sites, which were converted into CO_2e by using the appropriate waste disposal conversion factor (i.e. incineration, recycling, or landfill).

Staff travel is a combination of emissions related to the daily commute of staff to and from the university and travel, primarily via airplane, on university business. Commute emissions are derived from a 2012/13 travel survey which collected information on the mode and distance of travel of staff members. Emissions from business travel were calculated via travel insurance data and the MyClimate tool which estimates flight emissions based upon the distance between two locations among other factors. Student travel is a combination of emissions from field trips, daily commute, and flights to and from the UK taken by international students attending the university. Accounting for a return trip to and from the UK has not been previously considered in estimates of the university's carbon emissions.

Emissions from goods, works and services procured are derived from categorised spend data which is converted into CO_2e via the Higher Education Supply Chain Emissions Tool (HESCET) provided by the Environmental Association of Universities and Colleges (EAUC). The building supply category is derived from the emissions related to the energy lost through transmission of natural gas or electricity from the source to the university. These are defined as scope 3 as the university has no control over these emissions, other than by controlling the consumption of electricity.

Table 3 Scope 3 activities and their emissions.

Scope 3 Category	Tonnes CO_2e	% of Total Emissions
Water	121	0.09
Waste	56	0.04
Staff travel	11,851	8.86
Student travel	34,737	26.7
Other goods, works & services procured	64,041	47.9
Building Supply (Gas & elecitricity - Scope 3 emissions)	2001	1.50

Water and Waste

Water consumption in cubic meters was collected from meter readings across the University campus. The baseline emission for water consumption and treatment was 121 tCO_2e per year contributing 0.09% of the total carbon budget. Waste data from our residential sites were provided to us by our residences waste contractors for 2017 to 2020. The data provided included general, mixed recyclables, glass and food waste streams. A pilot food collection was undertaken at Cartwright Court between April and June 2019. We multiplied the weight of collected waste in metric tonnes for each category by the appropriate Defra emission factor to calculate the CO_2

equivalent emissions (kgCO_2e). Glass collected from residential properties is estimated for much of our reporting period due to a lack of collecting trucks with weighing equipment. We use the non-estimated weights to apply a correction to the previously estimated weights. Data for Waste Electrical and Electronic Equipment (WEEE) was collected from receipts from waste collections. Waste data from our academic campus was provided by our waste contractors for the years 2017-2020. This data included general waste, non-hazardous waste, animal bedding and food waste. Weight in metric tonnes for each category was multiplied by the appropriate Defra emission factor to calculate the CO_2 equivalent emissions (kgCO_2e).

Before 2017, Cardiff University's general, non-recyclable waste was sent to landfill, however since 2017 all non-recyclable waste is sent to Viridor, an Energy Recovery Facility (ERF) in Cardiff Bay, whereby waste is incinerated and the heat recovered used within the local area. The only waste remaining that still goes to landfill is animal bedding. The University set a KPI in 2019 committing to reduce our waste sent to ERF/RDF to no more than 30% by 2025 in line with Welsh Government targets. Total emissions produced by each waste stream are presented in Table 4. Despite the low percentage of the total waste which is taken to landfill, due to the high volumes of greenhouse gases emitted by this waste disposal stream it accounts for over a third of the total waste emissions.

Table 4 Emissions resulting from waste disposal streams

Waste stream	**Tonnes CO_2e**	
	Academic	**Residential**
Landfill	19.2	0
Incineration	10.9	11.6
Recycling	6.8	7.1
Anaerobic digestion	0	0.01
Total	**36.9**	**18.7**

Travel

Data for staff and student travel were provided through a combination of travel surveys, insurance data and international student data. Total travel baseline emissions were 47,587 tCO_2e per year, 35.6% of the carbon budget. Travel emissions are split by category in the table below.

Table 5 Emissions resulting from travel.

Travel category	**Tonnes CO_2e**
Student commute	6,993
Student field trips/exchange	5,044
International student home travel	23,699
Staff commute	5,257
Staff business travel	6,594
Total	**47,587**

Staff and student commute

Data for student and staff commutes were provided by travel surveys conducted within the University in 2008, 2012/13 and 2018/19. The 2012/13 survey has the best response rate (Table 6) and thus is used as a basis for this study. The mode and length of travel of the commute is collected and used to produce annual totals of emissions per transport (Table 7). We assume full time staff work 228 days and part time staff work 228 days to calculate these annual commute lengths. These total lengths are scaled up to the total number of staff and students in 2018/19 (Equation 1).

$$Total\ GHG\ emissions = \frac{GHG\ sample}{Sample\ number} \times Total\ population$$ (Equation 1)

The scaled-up distance for each mode of transport was converted into emissions via their appropriate DEFRA emission factors.

Table 6 Response rates for the travel surveys through time.

	Survey response rate %		
	2008/9	2012/13	2018/19
Staff	Unknown	28.3	13.0
Student	Unknown	8.9	1.0

Table 7 Emissions related to staff commuting through time. All emissions are estimated from University conducted travel surveys.

Staff Daily Commuting Trips by Mode	Total Carbon Emissions (tCO_2 per year)		
	2008	2012/13	2018/19
Walk	0.00	0.00	0.00
Cycle	0.00	0.00	0.00
Car	3,843.32	3,473.14	3,201.3
Bus	220.83	57.56	357.35
Train	577.11	533.76	727.75
Other motorised	32.33	93.18	20.9
ALL MODES	**4,674**	**4,158 *(0.72 / staff)***	**4,307 *(0.59 / staff)***

Staff commute emissions remained similar across all three years. However total student commute emissions increased by 58.7% since 2012/13 (Table 8). Emissions per student increased by 47.2% since 2012/13. We believe this is skewed due to the small sample number of the 2018/19 survey and a small number of anomalous commute lengths.

Table 8 Emissions related to student commutes.

Student Daily Commuting Trips by Mode	Total Carbon Emissions (tCO_2e per year)		
	2008	2012/13	2018/19
Walk	0.00	0.00	0.00
Cycle	0.00	0.00	0.00
Car	4,243.29	3,508.86	9,177
Bus	240.79	800.02	429.8
Train	694.56	840.78	2,799
Other motorised	10.26	388.95	80.2
ALL MODES	**5,189**	**5,539** *(0.19 /student)*	**12,486** *(0.36 / student)*

Staff and student international business and study travel

Staff and student international travel produce significant emissions, particularly if the travel involves flying. To calculate the emissions related to flying we collected the number of flights undertaken and the location of the journey from travel insurance data from 2017 – 2020. Using the MyClimate.org online tool we converted the location and cabin class of the flights undertaken into emissions per person. The MyClimate tool calculates the distance between the departure and arrival locations and uses assumptions on the type of aircraft, number of passengers (by class if applicable) and cargo load to estimate the likely emissions emitted per person on the plane.

For this study we assume all travel that is reported via the University travel insurance company is undertaken by aeroplane in economy class (mode of travel is not stated). Staff are assumed to fly from Cardiff and take a connecting flight from Amsterdam while all students fly from London with connecting flights in Doha if they are flying to South East Asia or Australasia, otherwise a direct flight is assumed. As our emission estimates are based purely on travel insurance data, we have included a 20% uncertainty due to not compliance on staff travel and used the standard deviation between 2017 and 2019 on student flights for students. The University has recently appointed a single travel management company and approved a new Travel and Expenses Policy and new expense management system. As a result, more detailed staff travel data will be available from early 2021. The baseline emissions for staff and postgraduate business travel were 6,594 (±1318) tCO_2e. The three schools with the highest carbon emissions were Medicine (941.8 tCO_2e) followed by Engineering (805.86 tCO_2e) and Biosciences (419.64 tCO_2e). The baseline emissions for student field trip/exchange travel were 5,044 (±204) tCO_2e. The three schools with the highest emissions were Medicine (948.87 tCO_2e) followed by Earth Sciences (680.55 tCO_2e) and Geography and planning (609.08 tCO_2e). The Global Opportunities programme was responsible for the highest emissions (1787.1 tCO_2e) accounting for 35.4% of the total emissions for student field trip/exchange travel.

In 2018 a total of 26% students at Cardiff University were not UK nationals and subsequently needed to travel from their home country to Cardiff in order to study on campus. For our baseline period these emissions come to 23,699 (± 2700) tonnes CO_2e. These emissions are calculated using the MyClimate tool with some extra assumptions. As we did not know the exact departure airports for the trips, we assume all flights arrive at London and depart from the largest central airport in the country of origin. The uncertainty of this assumption is estimated for the largest countries included in this study. For a large country with a high number of students, such as China this uncertainty can be up to 2571 tCO_2e.

Goods, works and services procured

Goods, works and services procured account for 47.9% of the total baseline carbon assessment . Sustainability forms one of the four strategic pillars in the Procurement Strategy that was approved by UEB in July 2020 and a more detailed action plan exists to develop Responsible Procurement Policy and Supplier Code of Conduct to include commitment to Welsh Government's Code of Practice: Ethical Employment in Supply Chains; Well Being of Future Generations (Wales) Action 2015 and Modern Slavery Action 2015, Living Wages, IR35 Off-Payroll working, Government Prompt Payment Policy. As the university procures goods, works and services it also inherits the carbon emissions embedded in those products and because the university is typically the final consumer of the products it purchases, these inherited emissions can be a significant proportion of its total carbon budget. The university purchases many thousands of products and services through the year and therefore estimating the related emissions is not a simple task. In order to produce an initial estimate for this report we used the Higher Education Supply-Chain Emission Tool (HESCET), a tool which has been used by other universities allowing for comparison. Using HESCET we estimate the university is accountable for 64,041 (± 2867) tCO_2e.

HESCET is provided free of charge to universities by EAUC and uses annual spend data to produce an estimate of the carbon emissions from procurement. The tool is underpinned by an Extended Input-Output Analysis (EEIOA) which provides average carbon intensities (kgCO2e/£) for categorised spend data. An EEIOA traces the value added to a product through the entire supply chain and combines this with a measure of environmental impact, typically greenhouse gas emissions, to map out the inherited emissions of the procured services. HESCET is provided in the form of an Excel spreadsheet which we disassemble to enable automation and to understand its methodology. This automated version of the tool replicates the methodology of the Excel tool with minimal changes.

Our automated version of HESCET takes financial reports, which present spend categorised into Proc-HE codes, and produces estimates of kgCO2e by these categories. The HESCET script takes the raw financial report and produces total spend of each Proc-HE category. The Proc-HE categories are then grouped into 75 industry categories derived by DEFRA (Department of Environment, Food and Rural Affairs). These industry groupings are the outcome of the EEIOA conducted in the UK in 2011 (based on data collated in 2004). The Proc-HE categories are grouped into these industries based upon the expert knowledge of the authors of the original HESCET tool. Our automated tool then calculates the total spend of each industry category and uses the estimated emission intensity (kgCO2e/£) to produce the total emissions released, including embodied CO2. However, the financial reports contain several Proc-HE categories which are included in other parts of the total carbon budget, such as utilities and business travel, these industry totals are further grouped into categories derived by the HESCET authors to avoid double counting (Table 9).

Table 9 The emissions resulting from HESCET derived procurement categories

DEFRA category	Tonnes CO_2e	Percentage %
Business services	11,525	18.0
Paper products	2,092	3.3
Other manufactured products	7,189	11.2
Fuels, chemicals and glasses	6,740	10.5
Food and catering	5,004	7.8
Construction	12,728	19.9
ICT	7,033	11.0
Medical and precision instruments	6,966	10.9
Other procurement	3,363	5.3
Unclassified	1,401	2.2
Total	**64,041**	**100%**

The procurement category with the largest CO_2 emissions is Construction producing 12,728 tCO_2e (19.9%) followed by Business services which produce 11,525 tCO_2e (18%). Business services includes legal, marketing and financial services. A significant increase in the construction category is seen through time, driving the overall increase in emissions resulting from goods, works and services procured (Figure 4).

This method of calculating emissions from goods, works and services procured has limitations because it uses total spend for each category. In some circumstances spend might not be an accurate predictor of Carbon emissions for example a more energy efficient or sustainably sourced product may be more expensive. In addition, the quality of Proc-HE codes allocated to the University's suppliers is mixed and will impact the accuracy of emission estimates. The HESCET tool uses Defra categories from 2011 and whilst the tool is currently being updated with the most recent DEFRA data, this will not be available for public use until November 2020. Another limitation is that the 10 DEFRA categories are very broad which makes it difficult to target certain areas within the categories for the scenario modelling.

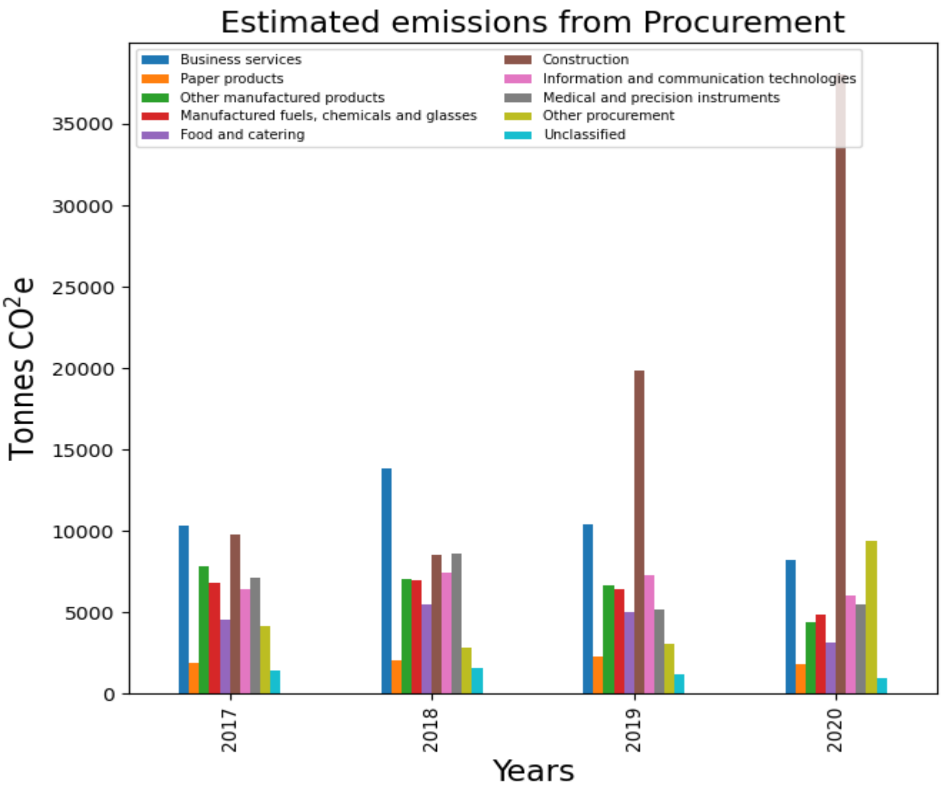

Figure 4 Emissions by procurement category by each year in the reporting period

Part 2: Scenario Modelling

3.1 Scope 1 and 2 - Gas and electricity modelling

The annual emissions for gas and electricity are estimated at 8,210 and 13,700 tonnes CO_2e respectively. This total includes scope 3 emissions related to the transmission from supply to the university buildings. These totals are derived from annual consumption figures from 226 and 178 metered buildings. The uncertainty of the values is derived from the standard deviation and error of area averaged consumption of the buildings. Estimates of gas and electricity emissions in 2019 range from 8174 – 8246 and 13202 – 14198 tonnes CO_2e respectively. The consumption of natural gas will continue to produce emissions as heat decarbonising solutions are unlikely to be available prior to 2030.

Achieving the net zero emissions target on campus will require significant reductions in natural gas used for heat supply in buildings. Decarbonising heat is a significant challenge facing the UK's energy sector over the next few decades and there is no consensus on national policy on how to best decarbonise heating. Therefore, we adopt a "keep-all-options open" and "no-regret approach" to initially focus on improving building controls and thermal insulation to improve energy efficiency and to simultaneously investigate all options for heat decarbonisation as they evolve in the coming years. The no-regret action will be to improve heat insulation of buildings and to improve the control of building heating, ventilation and air-conditioning systems. We estimate that better control of building heating systems can produce a reduction in the consumption of natural gas of 10%. If achieved, we can expect emissions to be between 7420 and 7350 tonnes CO_2e. We also propose Scheduled operating times for building use and space conditioning and dedicated workspaces for weekend/holiday periods for staff and students and only space condition these spaces

However, deep decarbonisation of heating would require a move away from using natural gas for heating our buildings and adopting low carbon alternatives. The heat decarbonisation pathways considered are in alignment with Future Energy Scenarios published by National Grid[1] and the Committee of Climate Change NetZero 2050 Pathways[2]. These scenarios were developed in discussion with the NetZero 2050 South Wales project[3] led by National Grid in collaboration with Western Power Distribution (our local electricity DNO) and WWU (our local gas network DNO) who owns and operates the electricity and gas network infrastructure in Cardiff region. Hence all reductions in natural gas use must come as a result of usage change. Here we estimate that better control of building heating systems can produce a reduction in the consumption of natural gas of 10%. If achieved, we can expect emissions to be between 7420 and 7350 tonnes CO_2e.

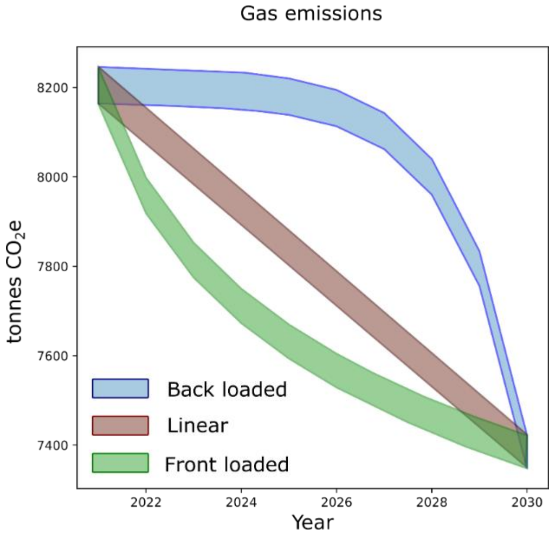

Figure 5 Modelling results of the 3 different scenarios of gas emissions. Uncertainty for each scenario is provided by the standard deviation of gas efficiency of the buildings

Over the next 10 years the National Grid is expected to continue to decarbonise in line with its aims of achieving carbon neutrality by 2050. As a result, the university's emissions from electricity usage will reduce to between 4,300 and 4,060 tonnes CO_2e by 2030 without any change in overall consumption (67% reduction from 2017-19 levels). Along with modelling the decarbonisation of the grid we also consider the reductions in emissions that can be achieved through altering the usage of electricity in university buildings. Better control of electricity usage has been shown to reduce consumption by up to 40%, and for gas by around 10%. This is based on work carried out where we have achieved up to 40% reductions in electricity use in some buildings where we'd used detailed data to inform control and investment (McKenzie House is the main example for Cardiff from a baseline year of 2006). Whilst a 40% reduction in electricity usage may not be achievable in all buildings from what we know, a 5-10% saving in both electricity and gas should be possible through better control of what we have, informed by data. For these savings to be achieved, the metering and use of sensors needs to be appropriate and able to identify when and where action should be taken. This degree of insight is available in many of the newer buildings. The data recorded from these meters and sensors must then be properly allocated to a detailed description of each building and its services. Again, some buildings in the campus have this detail already available.

[1] https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents
[2] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[3] https://www.zero2050.co.uk/

The one-off cost for checking and allocating all the existing metering within the University to its correct buildings and services is estimated at about 10% of the annual utility spend and the recurring annual costs to maintain and use this data would be around 3% of the annual utility spend. Assuming conservative energy savings of 3 – 5% per annum then these costs would be recovered each year. With larger savings expected, then the University would reduce both its emissions and its costs. When combined with the decarbonisation of the electricity supply, we estimate that emissions can be reduced to 1,340 - 1,634 tonnes CO_2e in 2030 - a reduction of 90% (https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents). CO2 from electricity could be net zero by early 2030's but emissions, from our heating systems are still very uncertain. It is unclear if hydrogen will have become that widespread by then so we may still be on gas at that point. A CO2 reduction figure of 50 – 60% should be achievable by that stage, and it could be a lot more.

We model 3 different paths to this reduction a linear, a backloaded, and a frontloaded pathway which provide some uncertainty for the intervening years.

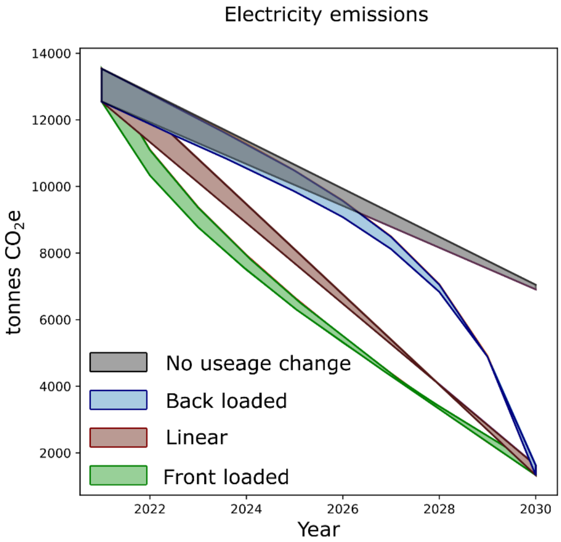

Figure 6 Modelled results of 4 electricity emissions scenarios. Uncertainty for each is provided by the standard deviation of building electrical efficiency & 2 decarbonisation estimates .

Cardiff University currently owns and operates 279 kWp of renewable power generation capacity onsite. This provides 200,000 kWh/year (0.44% of total consumption) Further expansion of the on-site renewable power generation capacity to 1,000 kWp could occur, primarily by investing on roof-top solar PV installations.

We suggest a target of reducing scope 1 (Gas) & 2 (Electricity) emissions by 15% by 2023 through investments in:

- Behaviour change programme to enable staff and students to reflect on their behaviours and implement change.
- Programme for energy efficiency improvement in lighting:
  - An LED replacement programme
  - Estate wide advanced automated lighting controls programme
- Intelligent heating/cooling controls; ultra-high efficiency pumps and compressors; rationalisation of specimen freezers; rationalisation of open access spaces.
- Continuing to implement IT efficiency enhancements.
- Programme to improve controls in building HVAC systems.

A key omission in this modelling exercise is the lack of consideration for buildings currently being constructed which do not currently consume energy. These buildings will use both gas and electricity and therefore will limit the reduction of usage which can be produced therefore, our estimates of 2030 usage represent a maximum reduction. The impact of these buildings on the baseline Scope 1 & 2 carbon emissions is likely to be an increase of at least 8%. However, it is important to note that this presents very rough and limited estimations. The full impact of the evolution of the campus will be fully understood and reported as part of the University's annual carbon audit as new buildings are occupied, old ones vacated and retrofitted. The calculations do not allow for the change in operating procedures for our mechanical ventilation systems as well as increases in heat loss in non-mechanically ventilated areas, due to the requirement to have windows open to provide enhanced ventilation in, leading to increased heating costs. It is also possible the predicted rate of national grid decarbonisation could be an over or underestimate. We have included the two latest projections of grid decarbonisation to try an account for this uncertainty. We have also assumed this decarbonisation is a linear process when it is driven by the addition of less carbon intensive power supply and the removal of carbon intensive plants. This will produce a more step like reduction of carbon emissions.

Scope 3 - Student and staff travel

We have modelled a number of scenarios to investigate ways to cut emissions resulting from flights taken by students and staff on university business. These scenarios include introducing a cap on the number of flights an individual can take per year and encouraging travel by train within Europe wherever feasible.

European travel by train

First, we explore the reductions that can be achieved via replacing flights with train travel across Europe. For this exercise we compared the emissions between flights and train travel to major cities within 16 hours of Cardiff. The countries that were included in this study, based on locations travelled to in the past 3 years, can be found in Table 10.

Table 20 European cities within a 16-hr train journey of Cardiff

Destination	Total Journey Time (Hours)
Geneva	14
Berlin	16
Luxembourg	9
Amsterdam	7
Brussels	5
Paris	5
Edinburgh	7
Bordeaux	12
Cologne	7

A total of 165.04 tCO_2e is saved by students taking trains to European destinations, a reduction of 22.7% and a reduction of 3% in total student study travel emissions. Using a carbon offset model (such as the Regrow Borneo programme or similar), offsetting European flights would cost £6,110.00 per year while the same travel using trains would cost £166.04. As it may be more cost effective for students on field trips to travel together by coach, we also calculated the emissions saved by coach travel to all European countries within 16hrs of Cardiff. A total of 151.29 tCO2e is saved by students taking coaches to European destinations, a reduction of 20.8% and a reduction of 2.7% in total student study travel emissions. A total of 566.52 tCO_2e is saved by staff taking trains to European destinations which is a 33% reduction in staff European travel emissions and an 8.5% reduction in total staff business travel emissions. The cost of offsetting all European flights would be around £11,010.00 per year using a carbon offset model (the Regrow Borneo programme (or similar), whereas offsetting train travel would cost £352.30 per year. A mixed model could be applied here whilst changes in behaviour are being embedded.

3.2.2 Flight caps

Secondly, we modelled the effect of limiting the number of intercontinental and European flights a student or staff member can take a year. These caps vary from 2 intercontinental and 2 European flights to just one European flight. The emissions from these caps were derived from the average emissions of flights from 3 years of flight data, the average emissions for an intercontinental flight was calculated from the weighted average of 5 continents (Tables 11 and 12). These caps are also combined with European train travel. For each cap we calculated the likely reduction in emissions and the percentage of people affected.

Table 11 – Average number of staff flights from 2017 to 2019 to different continents and their respective carbon emissions including average emissions for one return flight to each continent.

	Av. No flights	Av. No flights %	Av. Emissions (tCO2e)	Av. emissions for 1 flight (tCO2e)
Africa	179.7	4.3	524.3	2.9
America	825.7	19.8	2082.4	2.5
Asia	560.3	13.4	1668.6	3.0
Australasia	80.3	1.9	509.9	6.3
MENA	59.7	1.4	103.6	1.7
Europe	2460.3	59.1	1704.6	0.7
	4166	**100**	**6593.4**	

Weighted average for Intercontinental flights = 2.86

Table 12 - Average number of student flights from 2017 to 2019 to different continents and their respective carbon emissions including average emissions for one return flight to each continent.

	Av. No flights	Av. No flights %	Av. Emissions (tCO2e)	Av. emissions for 1 flight (tCO2e)
Africa	173.7	6.2	430.2	2.5
America	313.3	11.2	721.7	2.3
Asia	457.3	16.4	1555.3	3.4
Australasia	242	8.7	1567.5	6.5
MENA	7.3	0.3	10.3	1.4
Europe	1593	57.2	759.2	0.5
	2786.6	**100**	**5044.2**	

Weighted average for Intercontinental flights = 3.58

Capping staff travel could see a maximum reduction of 65% if just one flight to a European destination is expected, however this would reduce the activity of 60% of staff (Table 13). As intercontinental flights produce significantly more emissions than European flights capping these flights produces the greatest reductions in emissions. We also find that capping flights by the average emissions of the previous 3 years reduces emissions by 43% with only 29% of staff affected, highlighting that most emissions are produced by a minority of frequent fliers. The data shows that most emissions are produced by a minority of frequent fliers – with analysis showing these are overwhelmingly senior and male; this situation and its resolution has clear implications for the university's responsibility in terms of EDI as well as for reduction in emissions. Preventing all Intercontinental flights and replacing European flights with trains where feasible can reduce emissions by up to 74% (Table 14).

Table 13 Reductions & % staff impacted by flight caps. IC = intercontinental, EU = European.

	Do nothing	2x IC & 2x EU	1x IC & 2x EU	1x IC & 1x EU	1x IC or 4x EU	3x EU	1x EU	Current av.
Emissions (tCO2e)	6593.6	6132.7	5566.1	5314.6	4973.5	4410.6	2339.8	3782.0
Percent reduction	0%	7%	16%	20%	25%	33%	65%	43%
No staff affected	0	128	326	431	604	890	2618	1274
% staff affected	0	3%	7%	10%	14%	20%	60%	29%

Table 14 Reductions if trains used for European travel whenever possible. (IC / EU as Table 14)

	Do nothing	2x IC & 2x EU	1x IC & 2x EU	1x IC & 1x EU	1x IC or 4x EU	3x EU	1x EU	Current av.
Emissions tCO2e)	6593.6	6072.0	5439.8	5212.9	4973.5	3624.7	1707.4	3782.0
% reduction	0	8%	18%	21%	25%	45%	74%	43%

Capping student flights provides smaller reductions for each cap due to the differing nature of traveling compared to staff. Students travel infrequently, potentially once or twice a year and significantly less than most of the proposed caps. Significant reductions in emissions only occur when only a single European flight is allowed however almost half of the traveling student body is affected. Further reductions can be made (up to 63.3%) if European flights are replaced by train travel (Tables 15 and 16).

Table 15 Results of emissions caps for students. (IC / EU as Table 14)

	Do nothing	1x IC & 2x EU	1x IC & 1x EU	1x IC or 7x EU	5x EU	3x EU	2x EU	1x EU
Emissions (tCO2e)	5044.1	5039.9	5034.4	5023.7	4930.7	4288.8	3592.9	2227.8
% reduction	0	0.1%	0.2%	0.4%	2.3%	15.0%	28.8%	55.8%
No students affected	0	7	15	32	170	883	1998	3377
% students affected	0	0.1%	0.2%	0.5%	2.4%	12.4%	28.1%	47.6%

Table 16 Results of emission caps for students with European trains. (IC / EU as Table 14)

	Do nothing	1x IC & 2x EU	1x IC & 1x EU	1x IC or 10x EU	5x EU	3x EU	2x EU	1x EU
Emissions (tCO2e)	5044.1	5037.6	5032.4	5023.7	4598.8	3825.5	3013.7	1852.1
% reduction	0	0.1%	0.2%	0.4%	8.9%	24.2%	40.3%	63.3%

Post pandemic virtual conferences

The global lockdown resulting from the COVID-19 pandemic has not only prevented people flying to conferences and workshops but has changed our thinking on how these events could be run more sustainably in the future. As many conferences successfully switched to a virtual platform during the lockdown, it is likely that this will become a part of the new normal. We modelled the effects that this may have on future emissions from University staff and postgraduate business flights. It was not possible to determine from our data the percentage of staff flights used for conferences or field trips, however a recent study by Wyne *et al.* (2019) looking at staff flights at the University of British Columbia found that the purpose of 60% of staff travel was for conferences and 15% was for field trips. The remaining 15% was for general business and lectures. We used this information to model reduction scenarios in conference attendance, assuming that more conferences will become virtual due to the current pandemic. The first scenario assumed that just conference attendance would be reduced by 25%, 50%, 75% and 100%. The second scenario assumed that the 15% of travel for field trips would not be able to be reduced as is a vital part of most research. Therefore, only conferences and other business trips (accounting for 85% of flights) were reduced by 25%, 50%, 75% and 100%. The third scenario modelled a reduction in total staff flight emissions including conferences, business and field work by 25%, 50% and 75%. The results of this modelling can be seen in Table 17.

Table 17 Scenarios for various reductions in staff travel

	Emissions (tCO_2e)	Do nothing	25% REDUCTION	50% REDUCTION	75% REDUCTION	100% REDUCTION
CONFERENCES (60% OF TOTAL)	Total	6594	5604.9	4615.8	3626.7	2637.6
	saved	0	989.1	1978.2	2967.3	3956.4
CONFERENCE & BUSINESS (85% OF TOTAL)	Total	6594	5192.8	3791.6	2390.3	989.1
	Saved	0	1401.2	2802.5	4203.7	5604.9
ALL STAFF TRAVEL (100%)	Total	6594	4945.5	3297	1648.5	
	Saved	0	1648.5	3297	4945.5	

Table 18 Summary of % reduction in flights related to percentage % CO_2e reduction

Reduction in flights	Travel Related CO_2e reduction
25%	21%
50%	43%
75%	64%

3.2.4 Commuting

We modelled a combination of 3 scenarios, shifting from private vehicles to public transport, shifting from private vehicles to cycling and working from home. We model a likely maximum shift from private vehicles to public transport or cycling based upon the survey question, "What would encourage you to take public transport/cycle?". ~20% of travel survey respondents said they would not take public transport, primarily due to it being inconvenient or incompatible with their childcare or other needs. ~30% said they would never cycle, of these the majority said they lived too far away from the university to cycle. As a result, we model the impact of 80% of private vehicle journeys being undertaken by public transport (distance divided equally between buses and trains) and 70% undertaken by cycling.

In order to estimate the emission reductions from staff being encouraged to work from home we used the current Covid19 restrictions and the enforced working from home conditions as a base. For the next year it is expected that 30.4% will work completely from home, 34.6% will work 3 or 4 days from home, 21.7% will work 1 or 2 days from home and 11.7% will work exclusively from the campus. As we do not know how these staff would normally travel to work, we spread the commuting emissions evenly across the working from home categories. It is possible that many people will alter their working patterns so that they continue after the Covid19 restrictions are loosened. To capture this we model 2 scenarios, first where 80% return to full time work at the campus and secondly where only 20% do. These scenarios are then combined with our modelling of the shift from private vehicles to public transport or cycling. An important caveat in our modelling is that we assume student numbers on the campus remains constant as we have no data on how restrictions will affect classroom learning and whether any changes will be made permanent.

These models highlight the importance of shifting from private transport to cycling as much as possible. Increasing commuting by cycling can decrease emissions by 53.9% when combined with the current work from home regime emissions could be reduced by up to 64.2%. Encouraging cycling can be done through improving road infrastructure for cycling, showering and changing rooms and more secure bicycle parking. Further, the last 6 months has resulted in a significant proportion of University staff working at home, and predictions for the next academic year suggest that up to 65% of staff will remain working at home for the majority of their working week. Maintaining elements of this practice would significantly reduce emissions from commuting, although consequent increase in scope 3 emissions from staff household emissions should be monitored to avoid unintended consequences**.** We calculated that if staff who drove a car within 3 miles to the University switched to cycling or walking due to the 3-mile exclusion zone a total of 245.4 tCO2e would be saved reducing staff commute emissions by 6%.

3.2.5 International student travel

10.5 tCO_2e can be saved if all European students within a day's train journey from Cardiff took the train to and from Cardiff. This would reduce emissions from European students by 10% and total emissions from international students by 0.4%. The large number of intercontinental flights by international students produce most emissions in this category. We modelled reductions of international student emissions by different percentages. This could be done by introducing an international teaching hub or by encouraging distance learning. This includes two scenarios. Firstly, reducing the total number of EU and overseas students flight emissions by 25%, 50% and 75% and secondly reducing only the Overseas student emissions by 25%, 50% and 75% but also encouraging train journeys for EU students within 16hrs from Cardiff by train.

Table 19 - Scenarios for a reduction in emissions from international student home flights

	EMISSIONS (TCO2E)	DO NOTHING	25% REDUCTION	50% REDUCTION	75% REDUCTION
TOTAL OVERSEAS	Total	23699.1	17774.3	11849.6	5924.8
& EU REDUCTION	Saved	0	5924.8	11849.6	17774.3
OVERSEAS REDUCTION	Total	23688.5	17789.1	11889.7	5990.2
+ EU TRAINS	Saved	10.6	5910.0	11809.4	17708.9

In 2018 a total of 26% of students at Cardiff University were not UK nationals and subsequently needed to travel from their home country to Cardiff in order to study on campus resulting in 26.7%

of the total CO2e emissions. Strategies for reduction of the resulting absolute emissions figure must be identified.

3.3 Waste

Waste does not contribute a significant proportion of the carbon emissions of the university. However, recycling is an important activity as part of building an environmentally conscious staff and student body. We analysed the results of the recent food waste collection trial of Cartwright Court hall of residence and estimated the likely CO_2e emission reductions if rolled out across all halls of residence. By collecting food waste from all halls and ensuring it is composted or anaerobically digested 1.2tCO_2e could be cut from the university's carbon budget. This would reduce the total emissions due to residential waste by 13%. When applied to waste from the Academic buildings (assuming a similar proportion of general waste is food waste) 0.56tCO_2e could be cut from the total emissions equating 5% of the academic campus waste.

Possible best-case reductions in tCO2e that could be achieved for scope 1, 2 and 3 (without procurement). Emissions without procurement are currently **67,760** tCO2e, with the proposed reduction in Table 20 a **73%** reduction could be achieved.

Table 22 Best-case non procurement reductions in tCO2e

	tCO2e
Gas	7350
Fleet vehicles	47
Electricity	1340
Water	121
Staff business travel	989
Student study travel	1852
Student commute	3548.2
Staff commute	843.5
International student travel	5924.8
Academic waste	33.13
Residential waste	17.19
Total	**18,517.6**

Goods, works and services procured

The tool we used, HESCET, allows for quick and easy estimation of the emissions resulting from procurement of goods, works and services, but is very inflexible. The Environmentally and socially extended input-output analysis (EEIOA) which underpins the emission estimates produces single average values from across the UK which prevents in depth analysis from taking place. The single industry emission intensities produced by HESCET does not allow us to investigate the impact of varying suppliers or procurement strategy on the university's emissions. These data are also extremely out of date, from 2004, which suggests many of the emission estimates will likely be incorrect. The reliance on spend data will further distort the emission estimates as spend is unlikely to be directly correlated with emissions. Further it prevents us from proposing emission reduction strategies as emissions can only be reduced by a decrease in spending. To constrain the uncertainty of HESCET we can compare emission estimates with some of our other estimates (Table 23). The difference between our independent estimates and that of the HESCET tool can be ±100%. The large level of uncertainty on the emissions estimated by HESCET indicates a better tool will need to be identified or developed and used moving forward from this report.

Table 21 Comparison of HESCET estimations of emissions and actual.

Proc-HE	Description	HESCET emissions (tCO_2e)	Actual recorded emissions (tCO_2e)
JA	Electricity Supply & Services	37449.77219	13725
JB	Gas Supply & Services	4742.458149	8205
TB	Air Travel	3291.61815	11637.7
JE	Water & Sewerage Services	892.7196594	124

It is important to investigate other methods of assessing carbon footprint for certain products and any tools which are available to help with this. There are two main methods commonly used, the EEIO approached which was used in this report and the Life Cycle assessment approach, these two methods can also be combined in what is known as the hybrid approach. There are also several pre-existing tools for main spend categories including Catering, IT and construction which can aid in the calculation of supply chain emissions once the data is available.

There is a significant issue with assessing some elements of Scope 3 emissions for higher education establishments, not least in the important area of goods, works and services procured. The HESCET tool appears unfit for purpose for baselining emissions, let alone tracking the impact of any ameliorative actions. In this case we recommend that Cardiff University builds on existing (and longstanding) work by staff at the Welsh Economy Research Unit (WERU) at Cardiff Business School which estimates the GHG impacts of various types of economic activity.

WERU staff have, for over 20 years used input-output modelling to analyse how economic activity in Wales ripples along supply chains and through households to provide holistic estimates of economic impact. Since 2010, an environmental module has enabled an assessment of the GHG impacts of activities in Wales – including that arising along supply chains and due to wage spending, both in Wales and elsewhere. Most notably the model has been used to assess in partnership with the Welsh Government to examine the GHG impact of tourism, and of sports events. In 2020/21 following a commission from Welsh Government, ENVIOW will be used to estimate the GHG impacts of Welsh Government budget spending. The current state of the data underlying the Welsh Input-Output Tables and hence ENVIOW is poor. There has not been a full recalculation of the economic account since base-year 2007, although data for some sectors, not least energy, tourism and HE, are later and better. Whilst the Welsh Government project will help update some elements of the model, it is at this stage experimental and illustrative and will only go so far. We recommend an ENVIOW project be scoped and costed to assess the baseline GHG emissions of Cardiff University from goods, works and services procured, staff and other spend, help develop strategic options to reduce emissions from relevant activities in line with the climate emergency declaration and develop a management tool that can help guide decision making in an iterative and interactive way over the relevant period.

Part 3: What happens next

We recognise the current restrictions faced due to the continuing pandemic and propose a phased approach, with a series of recommendations proposed in the following section which we believe must be implemented by the end of academic year 2021/2022. Annual reports on progress will be reported publicly, while Phase 2 actions and associated business plans will be developed in line with the new University Strategy throughout Phase 1.

Phase 1 - Strategic actions by the end of academic year 2021-2022

Governance and Structure

The Climate Emergency working group was set up to report into the Environmental Management Systems (EMS) Steering group and provide a white paper for UEB and Council. Currently environmental sustainability is reported on through the EMS Steering group which is a sub-group of the Health, Safety and Environment (HSE) Committee which meets 6-monthly. This is no longer appropriate due to the urgent need for more frequent decision-making opportunities if we are to meet our 2030 target.

The last six months have demonstrated that a huge cultural and behavioural shift has been possible related to travel and working habits, particularly for those working in the wider knowledge economy. Thus, the COVID crisis could provide a once-only kickstart to our climate transition – but only if we ensure we continue with strategies to optimise the much-reduced travel, at least until alternative energy sources can be developed and embedded. In parallel, the University must develop governance structures to effectively guide a just and inclusive transition to ecologically and climate responsible models of teaching and research. Alongside our commitment to the SDG Accord it is recommended that the Welsh Government's Future Generation Act's, seven Wellbeing Goals and five ways of working should be considered for formal adoption in the near future, as a first order of priority. This would both enable us to think about the long-term impact of our decisions and to work better with our staff, students and wider community, support our civic mission, and prevent problems such as poverty, health inequalities and climate change. Such alignment would also enable effective and strategic partnership working with the Cardiff City's one planet Cardiff vision as well as the Welsh Government themselves.

The current Carbon Management Plan (CMP) runs out in 2020 and its reframing is an integral element of the necessary climate emergency work. Plans are in place for the next version of the CMP to be completed over the next 12 months to address scope 1, 2 and 3 activities as part of the Estates Masterplan. In the interim, a statement will be prepared for 2020/21 detailing ongoing Carbon Management activities. It is recognised that the new CMP for 2021-2030 must cover all aspects three scopes of carbon emissions, however, with many elements of scope 3 emissions falling outside of the remit of the estates department. It is therefore recommended that the new CMP is developed and owned through the proposed new committee.

Strategy

The recast of 'The Way Forward' enabled the rewording of the KPI relating to the environmental sustainability enabling strategy to: 'We promote sustainability education and enable students and staff to make positive changes to our environmental impact, in particular our aim to become carbon neutral by 2030'. To ensure that this commitment is truly embedded across the institution, this needs to be embedded/reflected in all University Strategies.

UK, Regional and Public engagement

Following a meeting in July 2019 with the Minister for Environment, Energy and Rural Affairs to discuss the University's actions towards the climate emergency, the Minister specifically requested that the University worked alongside the Welsh Government's decarbonisation team. This led to discussions with Welsh Government and Future Generations Commissioner and the signing of an MOU (17/9/20) to scope strategic decarbonisation partnership. We will also continue to enhance our partnership with Cardiff Council and their One Planet Cardiff Strategy.

Behaviour and Culture change

The University is entering its 8th year of participating in the NUS behavioural change programme 'Green Impact'. For the academic year 2019/20 Green Impact building teams were re-organised to function by University buildings to enable schools co-located within buildings to work together and for more meaningful data on usage to be established. Green Impact is an integral part of the plans to engage with staff and students to embed changes in working process and change behaviours to enable the University to adapt to climate change. The programme will be minimised during 2020/21 due to the challenges faced with staff being split between home working and campus based. We aim to maintain the good work and momentum achieved so far and ensure we continue to embed the key climate action messages throughout all buildings.

Monitoring and Reporting progress

Resources were provided in the form of two funded PhD internships for the development of the baseline carbon emissions and the development of the scenarios. It is critical that to continue to monitor and track our progress to carbon neutrality that resources are identified to improve the accuracy and granularity of data gathering processes and deliver ongoing analysis of annual performance trajectories across all scopes. These reports will be received by the Carbon Net Zero Board prior to being presented to UEB.

Scope 1 and 2 Infrastructure

The consumption of natural gas will continue to produce emissions as heat decarbonising solutions are unlikely to be available at scale prior to 2030. Instead, all Scope 1 associated GHG reductions must come as a result of reduction in use. We propose a reduction in scope 1 and 2 emissions by 15% by 2023. Whilst we will continue to benefit from the decarbonisation of the National Grid, we need to better understanding of the usage of electricity within our buildings. Better control of our buildings could result in us being able to achieve up to a 40% reduction through targeted behavioural change, as discussed earlier in this paper. Some of our newer buildings already have this degree of insight and to be able to provide detailed targets for spend, we need to invest in enhanced monitoring and metering across the estate. Whilst we recognise finances will be restricted for the next academic year, we need to plan for implementation of monitoring and targeting in identified areas of the campus, it is recommended that monitoring and targeting for the Queen's buildings will form the basis for the first business case, as this will enable living lab activities to be enabled for embedding in Engineering teaching activities. When combined with the decarbonisation of the electricity supply, we estimate that emissions can be reduced to 1,340 - 1,634 tonnes CO_2e in 2030 - a reduction of 90% savings could be identified by reduction in usage by introducing Scheduled (and building-bespoke) operating times for building use and space conditioning, inc. dedicated workspaces for weekend/holiday periods for staff and students. In addition, we will continue to develop and implement IT efficiency enhancements.

Further expansion of the on-site renewable power generation capacity to 1,000 kWp can be achieved, primarily by investing on roof-top solar PV installations. In addition, marketing and communications can be implemented to promote carbon saving behavioural change including the adoption of scheduled (and building-bespoke) operating times for building use and space conditioning. This is likely to include dedicated workspaces for weekend/holiday periods for staff and students. In addition, the proposed Carbon Net Zero Board will continue to work with it to promote the continued development and implementation of ongoing IT efficiency enhancements, such as those likely to be achieved through the transition to provision of laptops as standard for most staff.

Scope 3

During the carbon modelling exercise, it became clear that the tools available for estimating Scope 3 emissions are less well developed and applied across the HEI sector. This is especially important as when currently estimated, 85% of the total emissions fall under Scope 3. In general, most universities that have declared a climate emergency have been much less ambitious in the timescale invoked for net zero of Scope 3 emissions it is proposed that Scope 3 emissions are not included in the 2030 target. Rather than put a target date for this Scope, it is proposed that modelling changes in Scope 3 emissions is carried out in more detail, using a variety of industry standard and bespoke tools currently being developed, for example by Prof Calvin Jones with Welsh Government, before setting a target deadline some time up to, but preferably before, 2050. This will enable us to set realistic targets for the next decade.

Travel

The last 6 months has resulted in a significant proportion of University staff working at home, and predictions for the next academic year suggest that up to 65% of staff will remain working at home for the majority of their working week. Maintaining elements of this practice would significantly reduce emissions from commuting, although consequent increase in scope 3 emissions from staff household emissions should be monitored to avoid unintended consequences. In order to enable us to capitalise on the reduction in emissions experienced over the last 6 months and maintain the current reduction in air travel <u>we must ensure that virtual attendance at conferences becomes the new norm</u>, with conference and business travel requiring justification at College level, a presumption of lowest feasible carbon overland travel option for domestic and European journeys, and climate adaptation built into the consideration process going forward.

A number of scenarios were modelled, including a switch to rail for European destinations. this would result in an 8.5% reduction in total staff business travel emissions. However, as intercontinental flights produce significantly more emissions than European flights (by a factor of 4 to 5 on average), reducing these flights produces the greatest reductions in emissions. The data shows that most emissions are produced by a minority of frequent fliers – with analysis of the CARBS case showing these are overwhelmingly senior and male; this situation and its resolution has clear implications for the university's responsibility in terms of EDI as well as for reduction in emissions.

In 2018 a total of 26% of students at Cardiff University were not UK nationals and subsequently needed to travel from their home country to Cardiff in order to study on campus resulting in 26.7% of the total CO2e emissions. Strategies for reduction of the resulting absolute emissions figure must be identified.

The University has recently adopted a travel management system and a new Travel and Expenses Policy. The new policy provides clear and consistent information, for colleagues and students, a includes a robust approval and risk assessment process for all travel. The Management system will also allow greater monitoring and better control and approval of travel arrangements.

The University has a Travel Plan in place which historically has concentrated on commuting, incentives for public transport and bicycle parking. The University approved a proposal to conduct a review of parking provision in March 2020. Recruitment was also underway for a Transport, Travel and Parking Services Manager at that time, with the onset of COVID unfortunately this role was frozen. To enable the significant amount of work needed in this area, recruitment to this post is essential.

Goods, works and services procured

Procurement of goods and services underpins everything the University does. Scope 3 calculations have identified that activities that fall within the Procurement remit contribute a significant amount to the carbon emissions of the University. A new Procurement Strategy was approved in July 2020 including a 'pillar' dedicated to responsible and sustainable procurement' and committing to 'increasing the knowledge and understanding of the benefits of sustainable procurement of all University staff who participate in the procurement process and make better use of the expertise within the University to ensure sustainable outcomes are achieved'.

As detailed elsewhere, further analysis is required of spend categories to ensure more accurate meaningful data to enable us to develop suitable targets. It is recommended in the short term that work is undertaken to ensure that the tendering process is reviewed to identify where environmental sustainability can be weighted in the scoring process.

Waste and Recycling

Domestic waste and recycling have formed 'The Way Forward' KPI up until the recast in July 2020, with our commitment to increasing our recycling and reducing our domestic waste sent to ERF (see KPI's page 1). Welsh Government were due to publish their guidelines on source segregation during Spring 2020, this would have informed our waste tender and plans for source segregation across the University. Delays to the announcement have resulted in our current waste contract being extended to September 2021.

Longer term

We have addressed actions that we recommend should be taken by the end of academic year 2021-22. More fundamental changes will need to be considered from 2022 onwards including:

- Energy security – undertake a review of our energy sources to ensure we can maintain a sustainable energy supply going forward.
- International travel – undertake a review of how the wider University business model can be transitioned to one based upon climate responsibility.

With current available technologies, our scenarios recognise that it is not possible to reach carbon neutrality without climate mitigation. To enable us to reach our target, we will consider carbon offset models, in keeping with sector and industry best practice.