JANUARY 2021

Carbon Management Plan Annual Report

For Information and Approval

1. Background

In January 2010 the Board approved the University's first Carbon Management Plan (CMP). This included a challenging target to reduce the Greenhouse Gas (GHG) footprint of the University by 30% (in absolute terms) by the end of the 2015/16 academic year and an aspirational reduction target of 40% by 2020/21, against a baseline year of 2005/6. In 2015 it was recognised, as a result of the growth in the estate/our workforce and our student numbers, the 30% reduction target would not be met and the 40% target 2020/21 was endorsed by ULT and the Board. The Board has now endorsed the new Climate and Ecological Crisis Action Plan (CECAP) with a net zero GHG emissions target by 2030/31 and which includes all activities.

The report is set out in four sections:
Part 1 – Progress against the CMP 40% reduction target and metrics
Part 2 – Progress against the CECAP Science Based Targets
Part 3 – Detailed analysis of the utility data
Part 4 – Progress and conclusions

2. Part 1 - CMP progress

The calculated 2005/06 GHG emissions included those associated with gas, electricity, and water use, fleet transport, BU buses (on designated routes), and waste sent to landfill. The breakdown of BU's GHG emissions is shown in Appendix 1. These emission sources are classified as Scope 1, 2 or 3, as defined in **Table 1**. Energy use (Scopes 1 & 2) accounted for 93% of the 2005/06 emissions, with transport accounting for 5% and the remainder 2%. This paper reports progress against the 2005/06 GHG emissions and also focuses on progress with reducing GHG emissions associated with energy use.

Table 1 Carbon Scope

Scope	Direct/Indirect emissions	Source of emissions
Scope 1	Direct	Emissions associated with sources that are owned or controlled by BU. Examples include gas consumption and fleet vehicle fuel use.
Scope 2	Indirect	Emissions from the generation of purchased electricity
Scope 3	Indirect	Emissions from BU activities that occur from sources not owned or controlled by BU, such as procurement and water supply and disposal

2.1 GHG Reduction Target and Current Projections

The challenging nature of the GHG target should not be under-estimated; an absolute reduction of 40% from a baseline of 8,275 tCO_2e (tonnes of carbon dioxide equivalent) in 2005/06 to 4,965 tCO_2e in 2020/21.

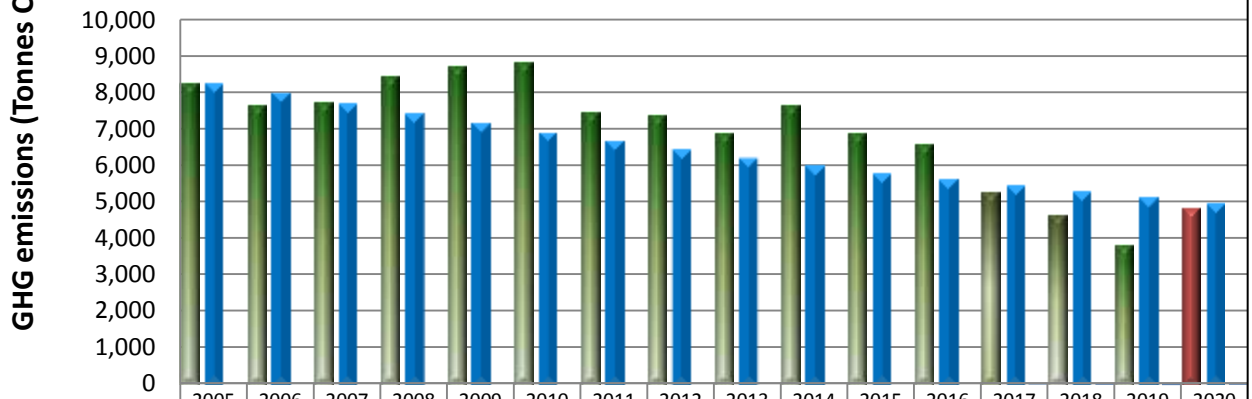
Table 2 shows the 2019/20 carbon emissions compared to the 2005/06 baseline and 40% emission reduction target:

2005/06 Carbon emissions (tCO_2e)	2020/21 40% Reduction target emissions (tCO_2e)	2019/20 Actual emissions (tCO_2e)	Difference between 2019/20 and 2005/06 emissions (tCO_2e)	Percentage reduction comparing emissions in 2019/20 to 2005/06 (%)	Difference between 2018/19 emissions and 2020/21 target (tCO_2e)
8,275	4,965	3,822	-4,453	-53.8	-1,143

Figure 1 shows the progress to date with reducing GHG emissions. In 2019/20 emissions reduced by 21% from 2018/19 and from the 2005/6 baseline by 53.8%. The reasons for the reductions during this period are due to continued energy saving measures and on site renewable energy generation, but mainly because of the impact of the global pandemic. Campus usage has significantly reduced since the first lockdown on 23rd March 2020, with some (very limited) critical activities continuing in accordance with the various lockdown restrictions, resulting in reductions in energy and water consumption. During 2019/20, there has also been a continued decline of the national grid electricity carbon factors (11%), reflecting the de-carbonisation of the grid (See **Appendix 2** for annual DEFRA conversion factors for UK purchased electricity (including transmission and distribution and natural gas). It should be noted the estate Gross Internal Area (GIA) increased by 7% over the same period (See Table 3).

During 2019/20 GHG emissions have been estimated for the life of the current plan (2020/21) to provide some indication of whether the 40% carbon reduction target can still be achieved. These estimates for the remaining life of the CMP take account Energy Conservation Measure (ECM) projects, the University's planned changes to the estate and the DEFRA carbon conversation factors (See Appendix 2).Changes to the estate, such as the operation of the MRI scanner and addition of the Bournemouth Gateway Building, retention of the Yeovil site and the sales of Royal London House (RLH) and Bournemouth House (BH) and the planned exit of Melbury House (MH) have been accounted for in this reduction figure. These changes are expected to have a marked impact on energy consumption and GHG emissions.

Figure 1 - Actual vs Predicted GHG Emissions from 2005/06 to 2020/21

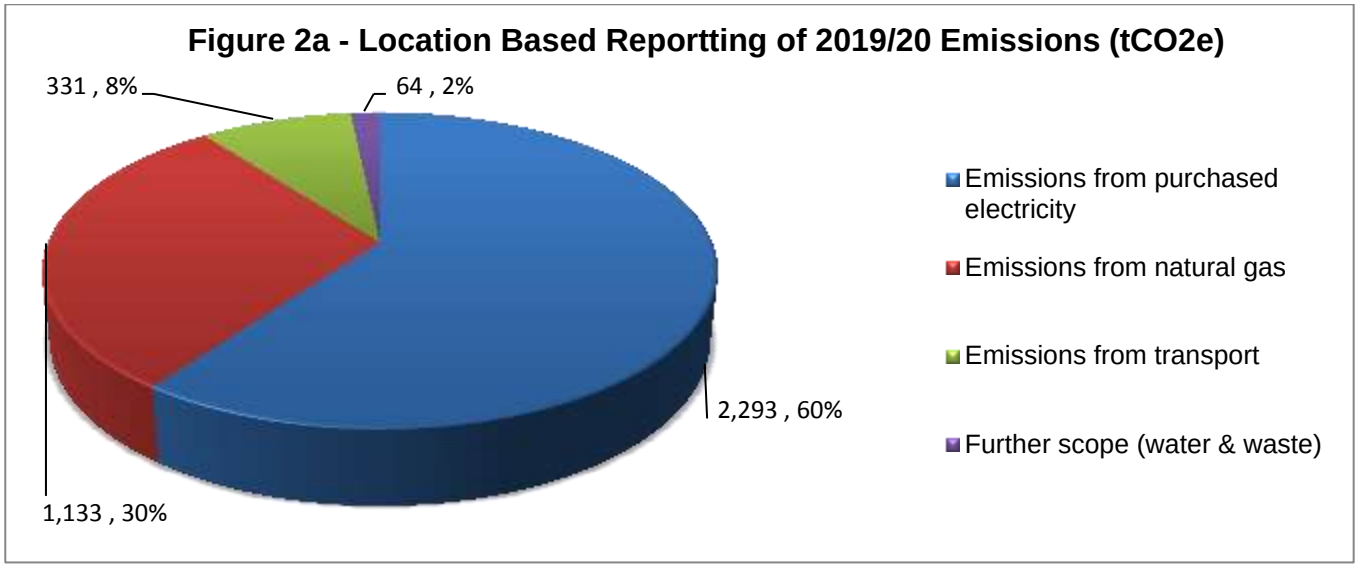


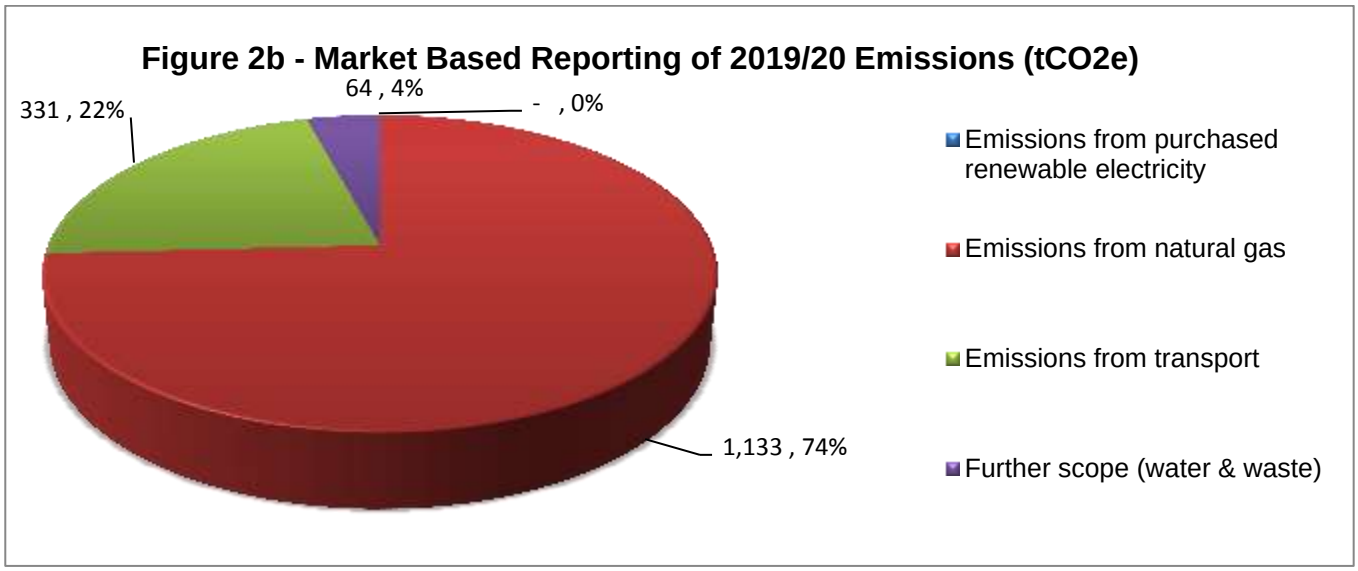
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total CO2 Emissions	8,275	7,689	7,768	8,470	8,755	8,849	7,483	7,402	6,907	7,690	6,900	6,597	5,274	4,644	3,822	4,849
Target Emissions	8275	7983	7701	7431	7170	6918	6677	6444	6219	6003	5795	5629	5463	5297	5131	4965
% change from base year	0	-7.1	-6.1	2.4	5.8	6.9	-9.6	-10.6	-16.5	-7.1	-16.6	-20.3	-36.3	-43.9	-53.8	-41.4

Figure 2a & 2b details the breakdown of emissions for 2019/20 in tonnes of $CO_{2e.}$

GHG emissions can be reported by two different methods; Market Based and Location Based Emissions, where:

- Location Based reporting continues to report grid electricity using the published DEFRA carbon conversion factors. This shows that grid electricity and natural gas GHG emissions account for 60% and 30% of the total GHG emissions (3,821 tCO2e), respectively (See Figure 2a); and
- Market Based reporting allows BU to report grid electricity emissions as zero as BU purchases 100% certified renewable electricity from our supplier. Total emissions reduce to just 1,528 tCO2e with natural gas accounting for 74% of GHG emissions (See Figure 2b).





2.2 GHG metrics

The following figures show GHG emissions (Scope 1 & 2) expressed as metrics using staff and student numbers (FTE), gross internal floor area (m^2) and turnover (£) to demonstrate progress in tackling energy and GHG emissions against a back drop of an increasing University population, estate size and activity (as measured by University turnover) since 2005/6 (See **Table 3**).

Table 3 GHG Metrics Data

Metric	Data Source	Dates when data used or provided	2005/06	2019/20	% change between 2005/06 and 2019/20
Student and Staff FTE	PRIME	January 2021	11,643	15,868	36.3
University Space GIA (m^2)	Estates (EMR)	January 2021	85,313	94,663	7.0
Total Income £M	PRIME	January 2021	£81.2	£164.42	102.5

Figure 3 shows that in 2019/20 GHG emissions per FTE have decreased by 19.3% from 2018/19, demonstrating continued efficiency of running the University estate and operations. Emissions per FTE have reduced by 69.7% since 2005/06, from 670 kgCO2 per FTE to 203 kgCo2 per FTE, despite the increase in University population by 4,225 over this period.

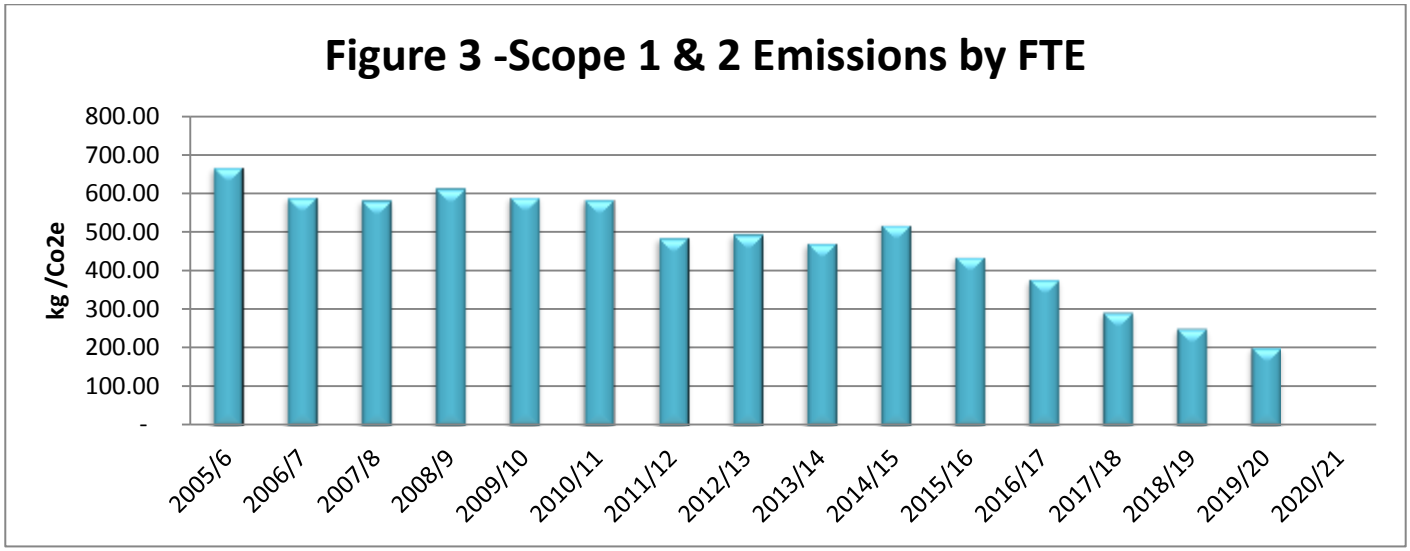


Figure 4 shows that carbon emissions per gross internal area (GIA) in 2019/20 decreased from 2018/19 by 5.8%. Since 2005/06 there has been a decline in emissions per GIA of 63.8% (down from 91 kgCO2/GIA to 33 kg Co2/GIA), indicating a much lower energy intensive use of the estate. Since 2005 the estate has increased by 12,079m^2, from 85,313m^2 in 2005/6 to 97,392m^2 in 2019/20, representing a 7% increase.

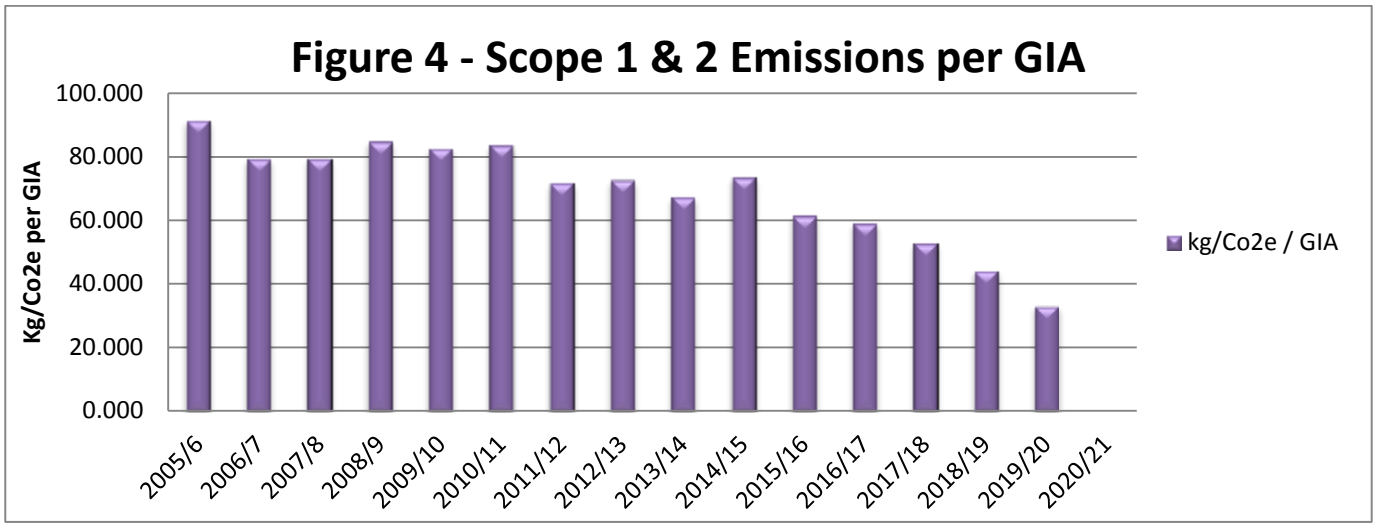
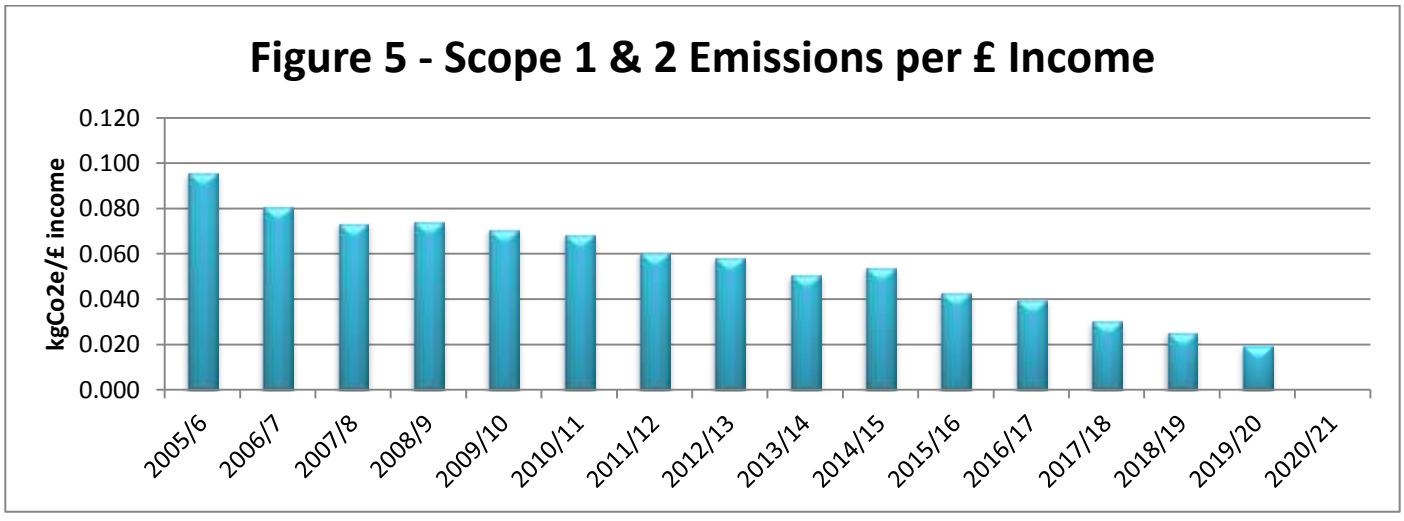
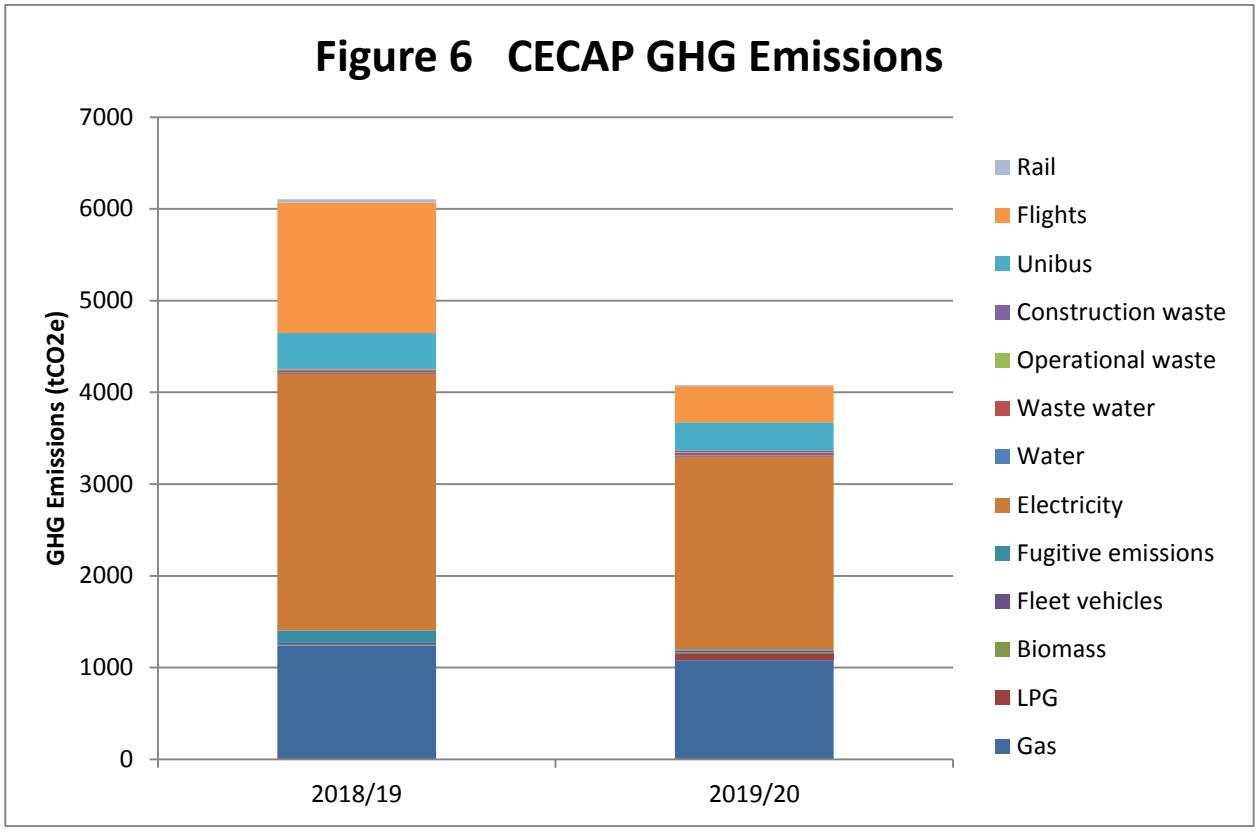


Figure 5 shows carbon emissions per £ turnover declined by 79% between 2005/06 and 2019/20 (0.096 to 0.020 kgCO2/£), reflecting BU's increased income and activity (an increase of 102.5%) over this period.



3. Part 2 – Progress with CECAP

In 2019/20, GHG emissions reduced by 33% compared to 2018/19, mainly due to the lock down (See Figure 6). This reduction is seen for all three scopes; scope 1 (mainly natural gas): 14.5%; scope 2 (grid electricity): 25% and scope 3 (mainly business travel): 59%.



The CECAP used a science based target (SBT) methodology to calculate GHG emissions to 2030/31 (See Figure 7). The SBT reductions for 2024/25 and 2030/31 are 26% and 50% against the 2018/19 baseline, respectively

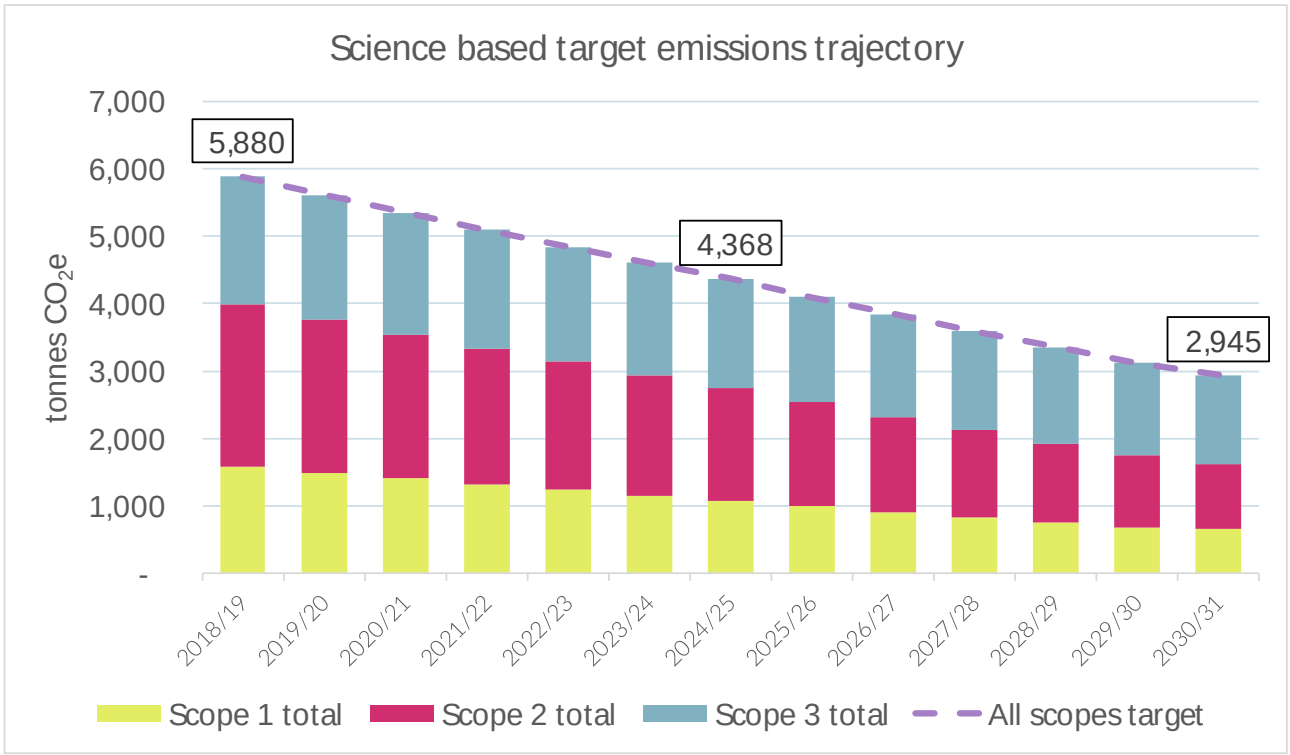
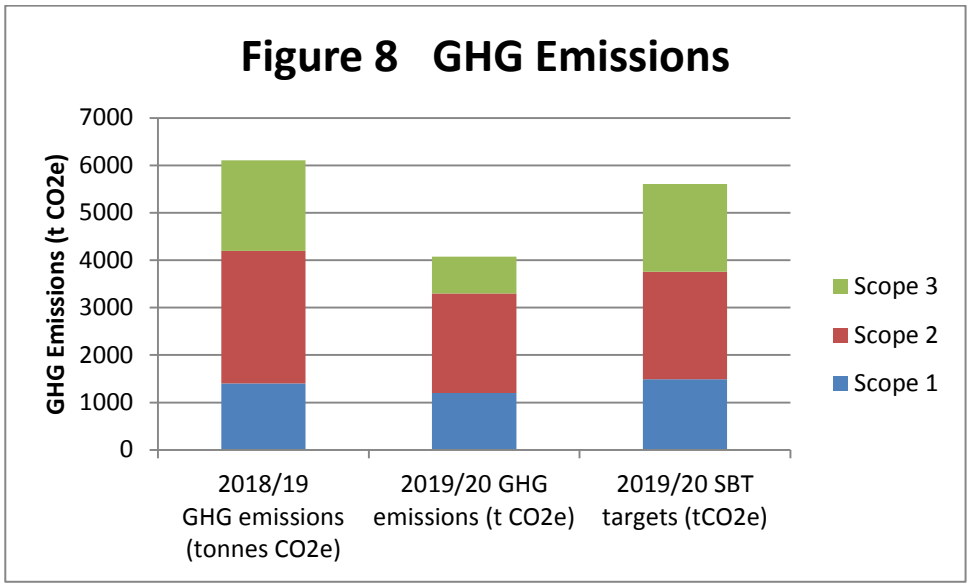


Figure 7: Science based target emissions reduction trajectory to target year

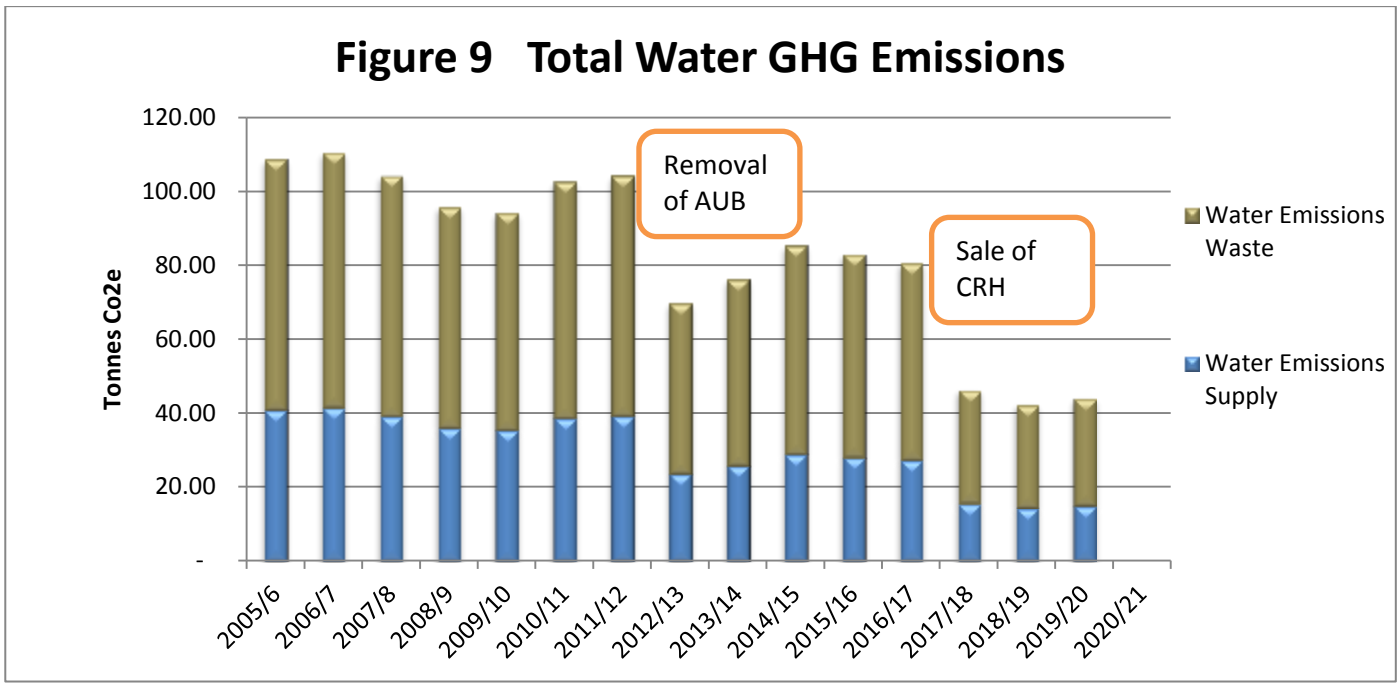
It appears BU is well on track to achieve its SBT targets, as the 2019/20 GHG emissions are well below the 8% SBT reduction target (See Figure 8). However, as stated above, the pandemic has been largely responsible for these reductions and so it is too soon to assess progress. This is also going to be the case for 2020/21.



3.1 Scope 3 GHG emissions

These indirect emissions are for water, waste, procurement and transport and the available data is shown in Appendix 1.

Water



Note: Wastewater volume to sewer calculated as 95% of water consumption figures.

Total water GHG emissions have increased in 2019/20 compared to 2018/19 by 4% but have fallen by over 60% since 2005/06 (See Figure 13). This increase reflects the increase in water consumption, due to the addition of Chapel Gate and PGB together with the COVID 19 pandemic requirement to increase water hygiene flushing for all buildings due to low occupancy. The Energy Team continue to identify leaks using the university's metering system and BU continues to invest in low flow taps and sanitary ware to reduce water use.

The main points to note for the remaining Scope 3 GHG emissions are:

- Unibus – reduction in emissions reflecting the reduced service during lockdown. This will also be the case for 2020/21.

- Operational waste – very low emissions as no waste sent to landfill and the amount of waste has reduced due to the lock down. Waste volumes continue to be markedly low in 2020/21;
- C&D waste – increase due to more waste being sent for recovery rather than being recycled. The completion of the two Gateway buildings will see a marked reduction in C&D waste produced in 2020/21;
- Business Travel – significant reduction (72%) due to the pandemic; with all travel stopping in March 2020. This will also be the case for 2020/21 with reductions for business travel likely to continue whilst adhering to travel restrictions and guidelines.

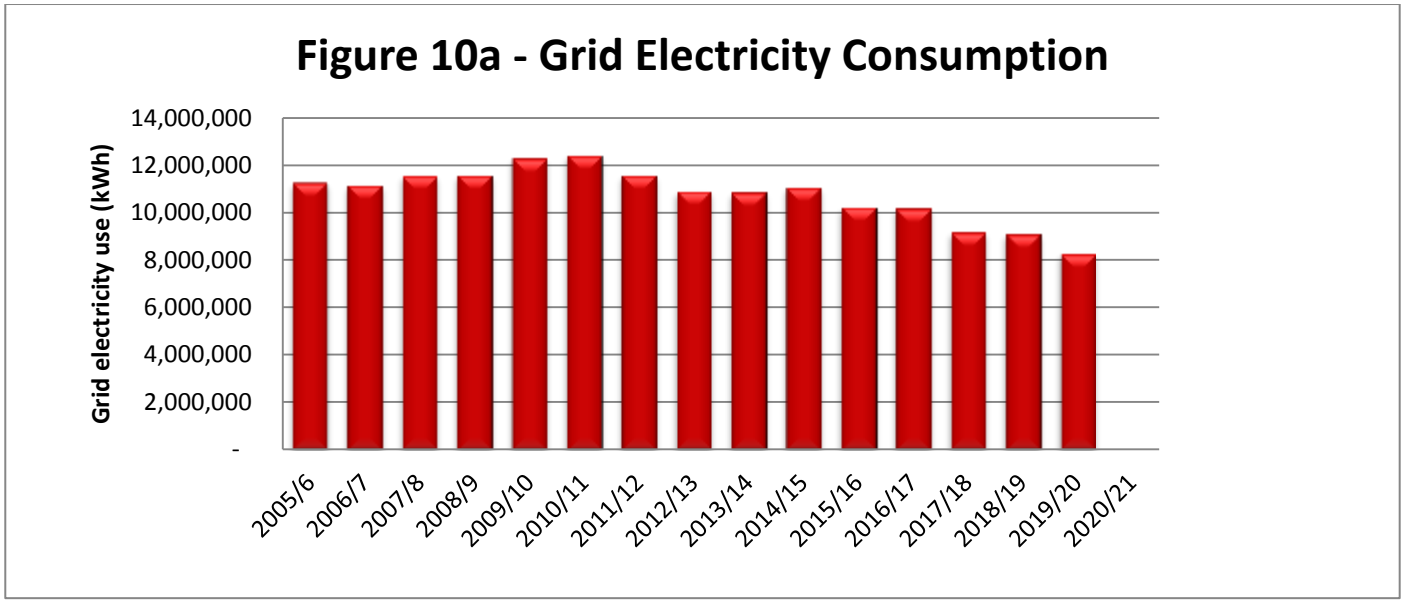
Progress with other Scope 3 data sources:

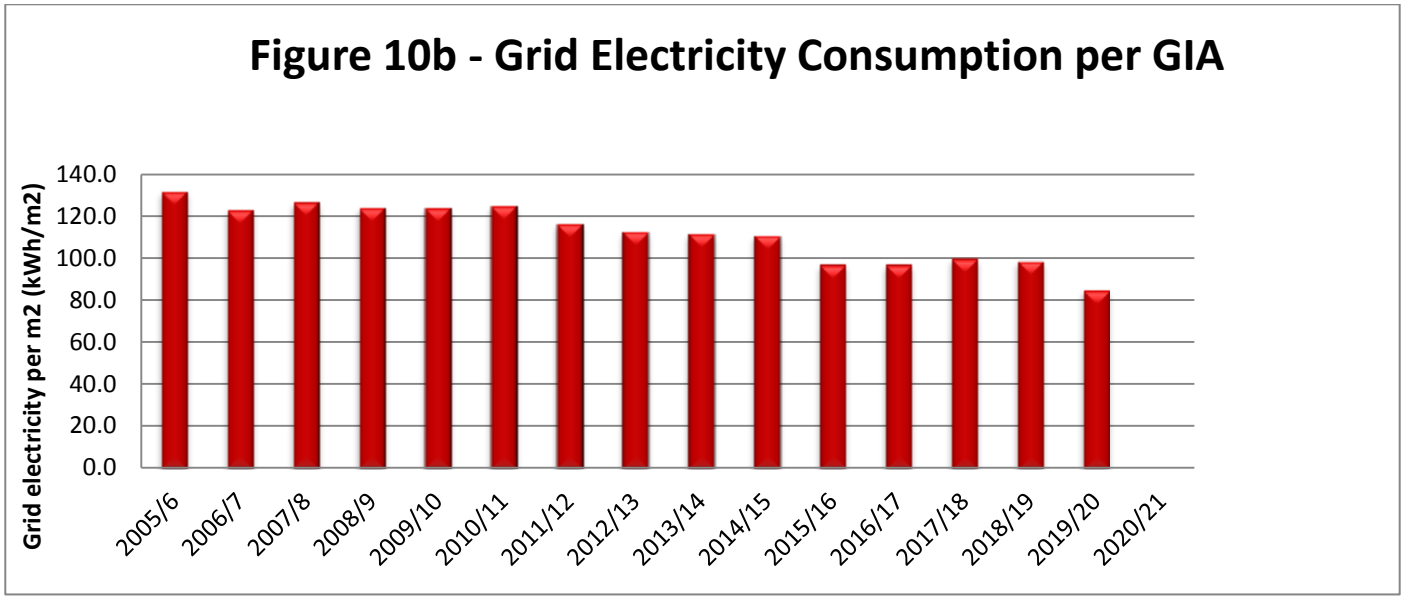
- Procurement – data not reported as the method to calculate emissions is not robust and provides inaccurate and meaningless data. The sustainability Team is seeking solutions to improve this data. The embedded carbon emissions for the next new build, Arne House, have been calculated (3,383 tCO2e).
- Transport – The Travel Plan includes measures to improve the provision of GHG data. Work has started with Enterprise to provide staff 'Grey Fleet' business travel GHG data. Staff and student travel surveys will be updated to more accurately capture commuting GHG emissions data. The pandemic has seen commuting levels markedly decline and it is estimated this change in commuting patterns would reduce GHG emissions by 22 tCO2e each week during Semester 1, compared to pre-COVID emissions.

4. Part 3: Energy and water consumption

4.1 National Grid Electricity consumption

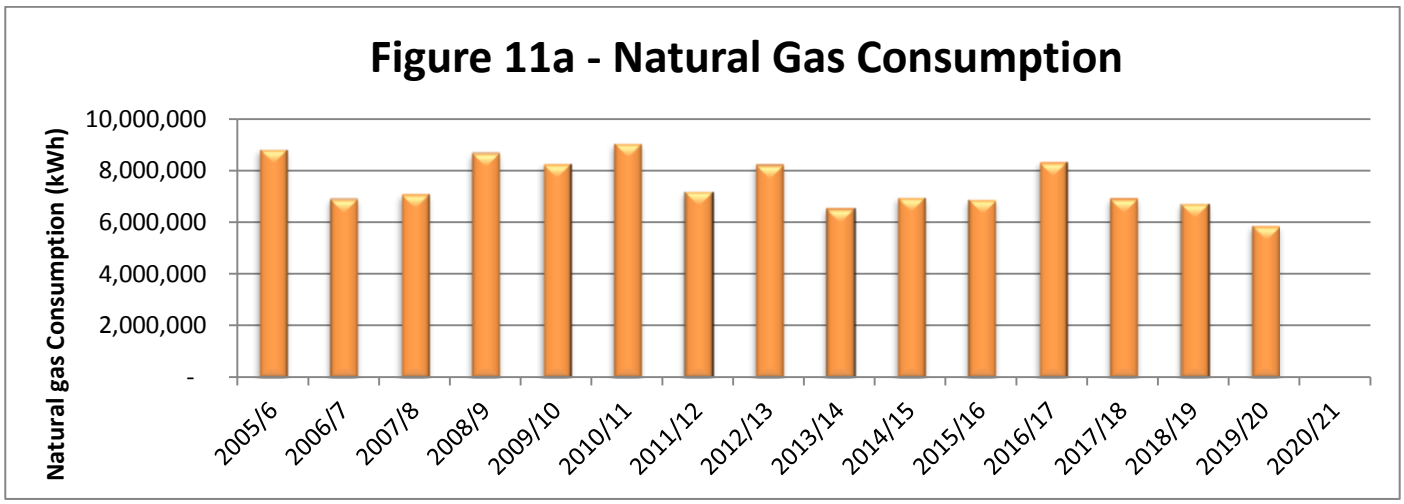
Figure 10a shows that Grid Electricity consumption decreased by 9% in 2019/20 compared to 2018/19. Overall electricity consumption from the national grid has reduced by 26.5% between 2005/06 and 2019/20 and continues to be below 10 million kWh. The reasons for the decline in grid electricity are as described for the decline in GHG emissions together with the increase in on-campus electricity generation from photovoltaics, which have increased by nearly 50% compared to the previous year. This has also resulted in a decrease (14%) in the grid electricity per GIA compared to the previous year (Figure 10b) reflecting the reduction in grid electricity consumption and increase in estate size.

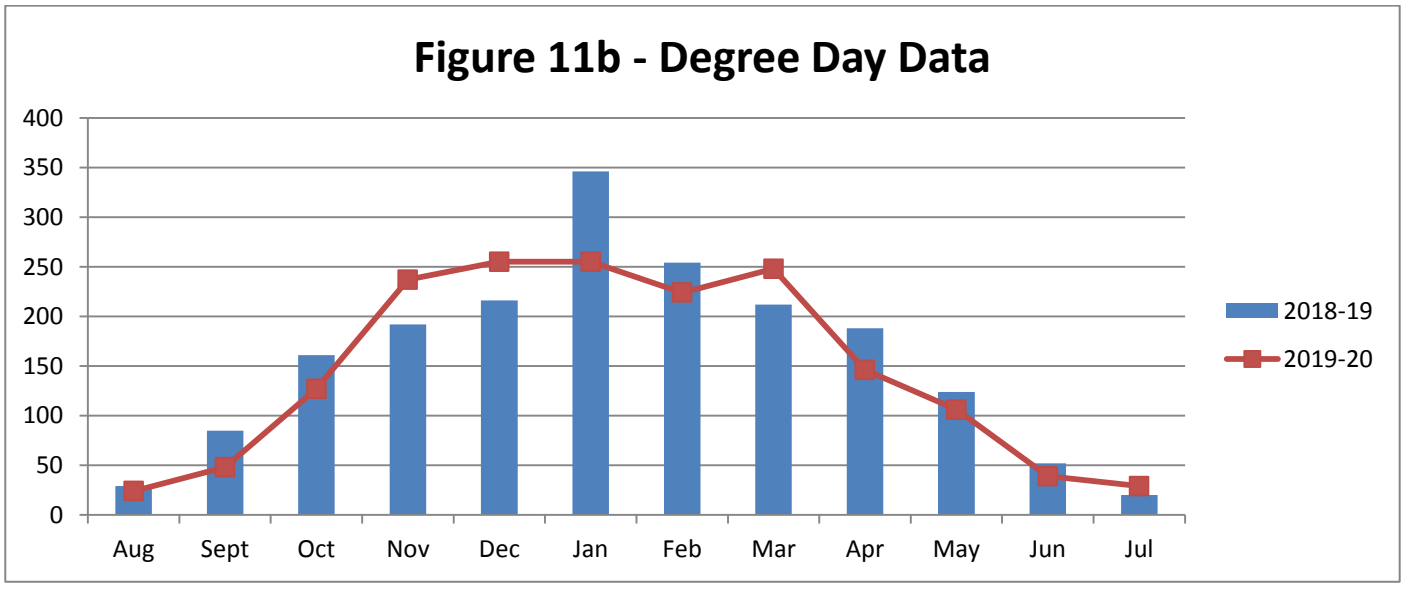




4.2 Natural Gas consumption

Figure 11a shows natural gas consumption decreased by 12.8% in 2019/20 compared to 2018/19 consumption. This decrease was a combination of a warmer winter period, as shown by the degree day data for Bournemouth being 141 degree day's warmer (1,879 – 1,738) compared to 2018/19 (See Figure 11b) and higher heat output from the biomass boiler, which generated over 884Mwh; a 67% increase on the previous year. New efficient boilers have also been installed in Studland House and Poole House. A Direct Hot Water System (DHWS) has been added to the Biomass boiler on the Poole House system to provide both heating and hot water. Overall natural gas consumption declined by 33.5% between 2005/06 and 2019/20.

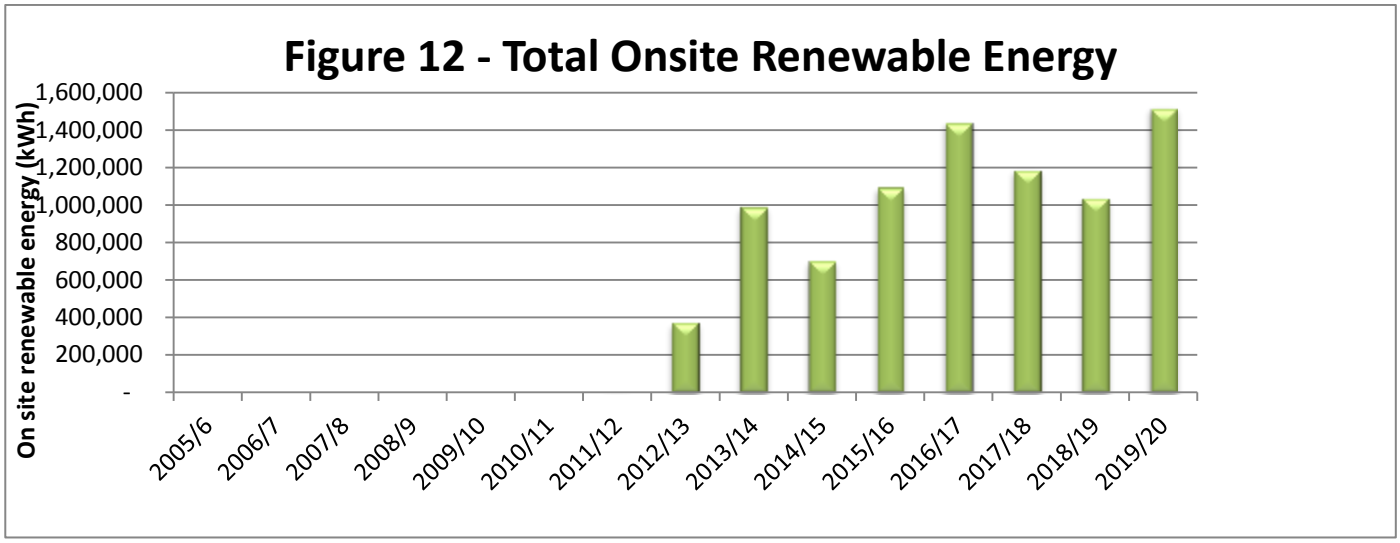


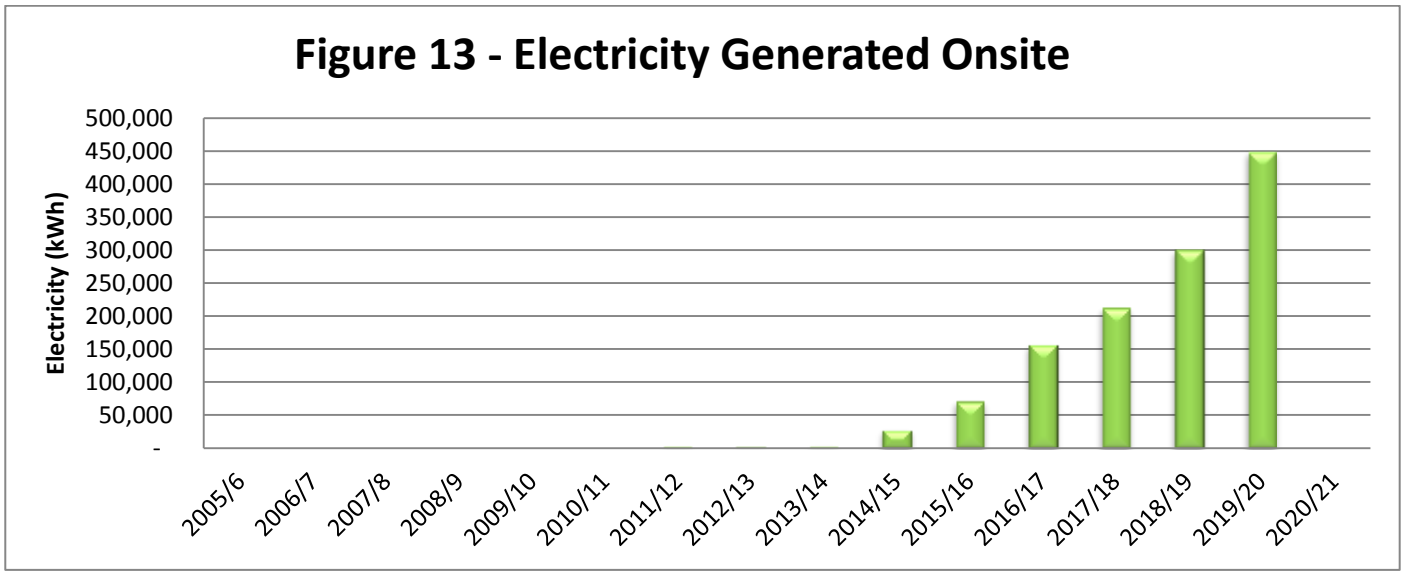


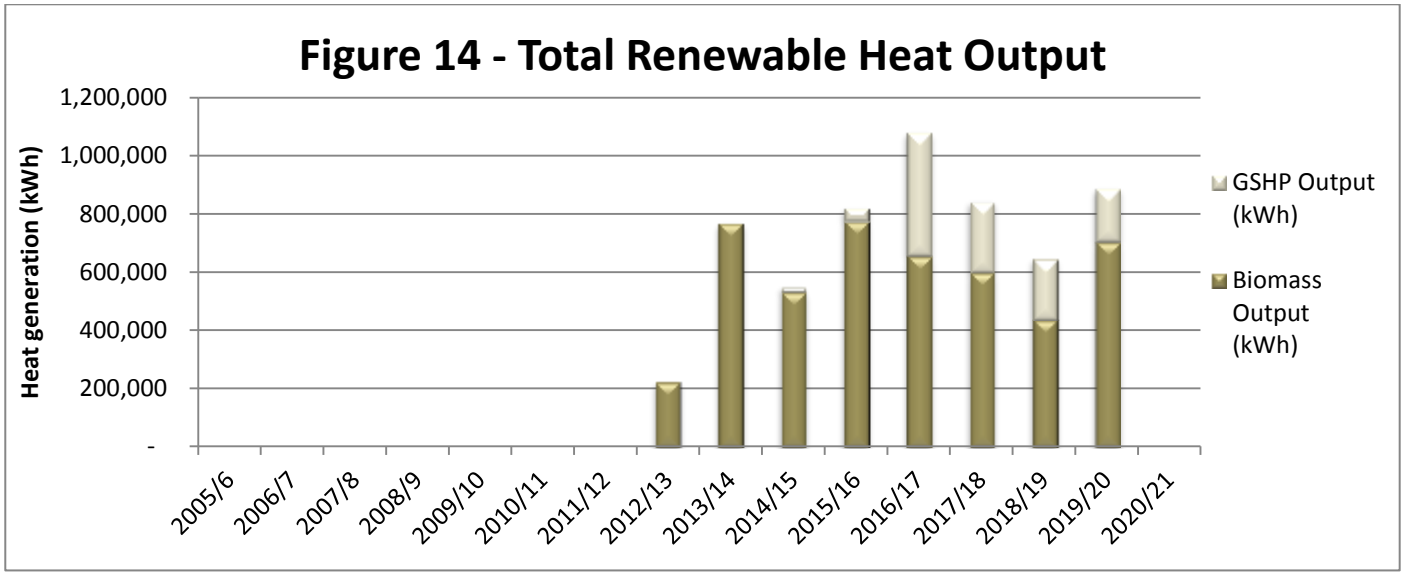
4.3 On-site Low and Zero Carbon (LZC) Technologies

Onsite renewable energy production increased by 46% to 1,518,328 kWh from 2018/19 (See Figure 12). This was due to both an increase in on site electricity and heat generation. Onsite electricity generation increased by 49% during 2019/20 compared to 2018/19 mainly due to generation from the new PV arrays on Poole Gateway Building and Studland House (See Figure 13).

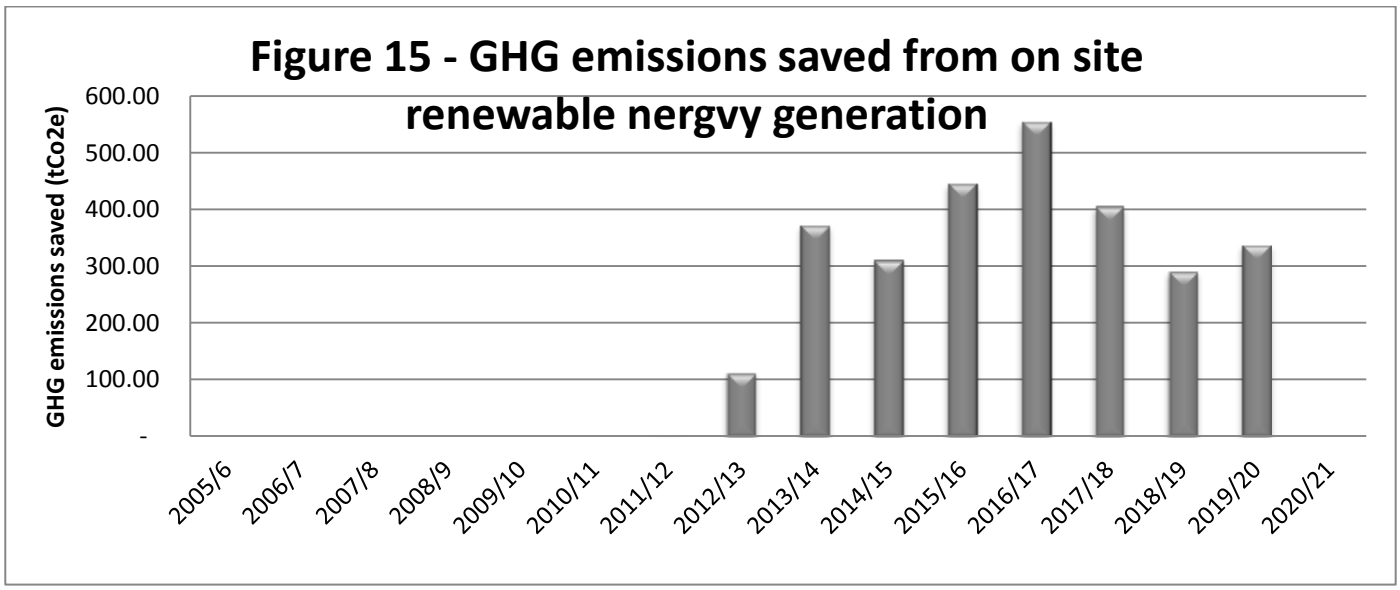
In 2019/20, heat generation increased by 240,000 kWh (37%) compared to 2018/19 (See Figure 14). Heat generation from the Ground Source Heat Pumps (GSHP) declined by 12%, due to a warmer heating season with the Biomass Boiler increasing output by 60.7% mainly due to operational improvements and the additional loading of the hot water demand from Poole House.







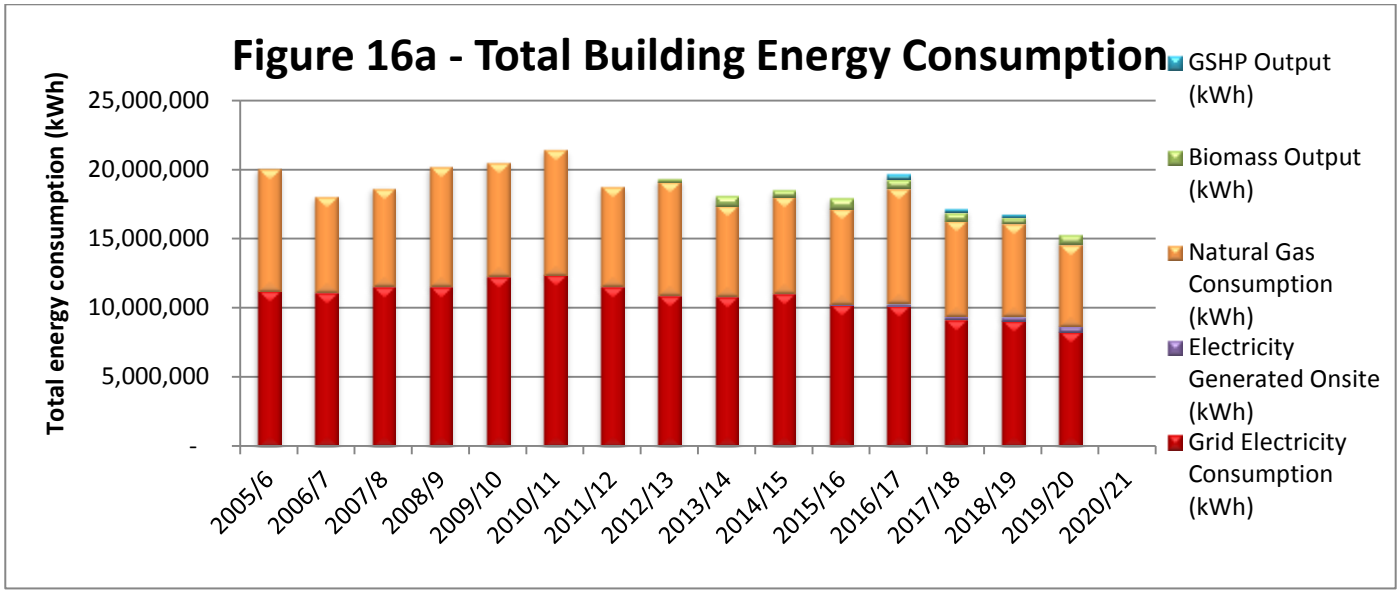
LZC technologies saved 338.8 tCo2e during 2019/20, an increase from the previous year of 47 tCo2e (See Figure 15). This was due to the reduction in the grid electricity carbon factors and increased outputs from the Biomass Boiler and Photovoltaic Panels.

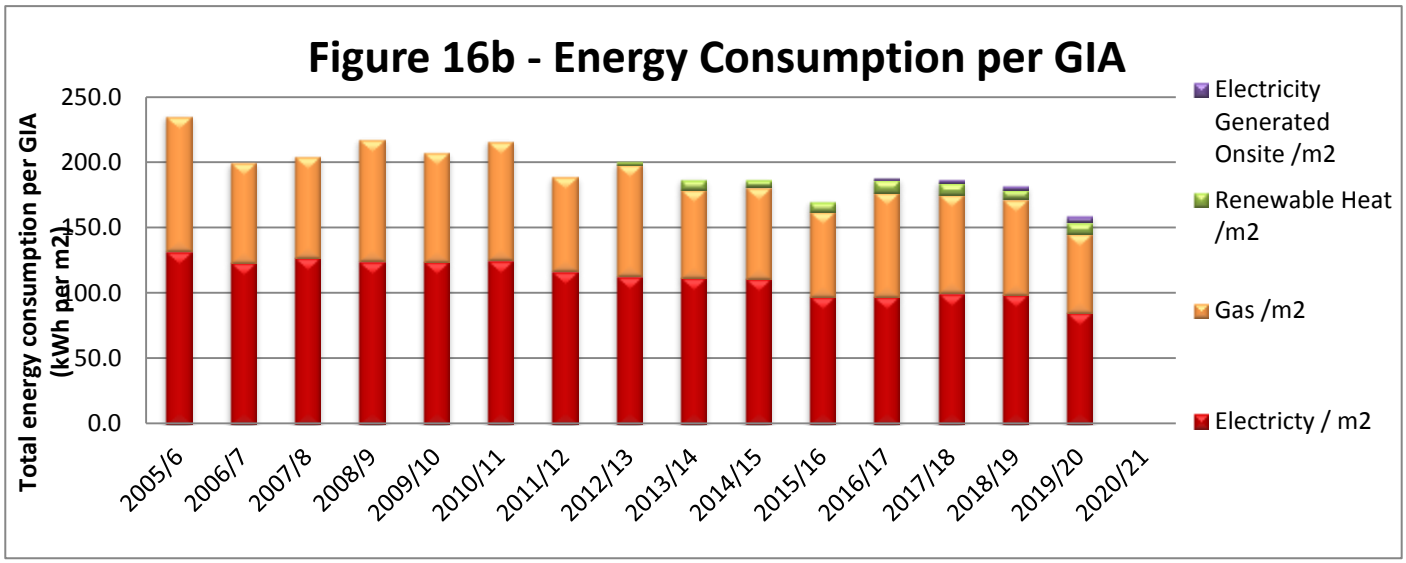


4.4 Total energy consumption

Total energy (grid & LZC sources) used across BU in 2019/20 was 15.829 million kWh where on-site and LZC sources accounted for nearly 10% of the total energy (See Figure 16a). It is the first time since 2005/06 that BU has been below 16 million kWh for total energy consumption, although the lock down clearly played its part in achieving this outcome. This equates to a reduction of total energy consumption of 6% from 2018/19 and 21% from the 2005/06 baseline year.

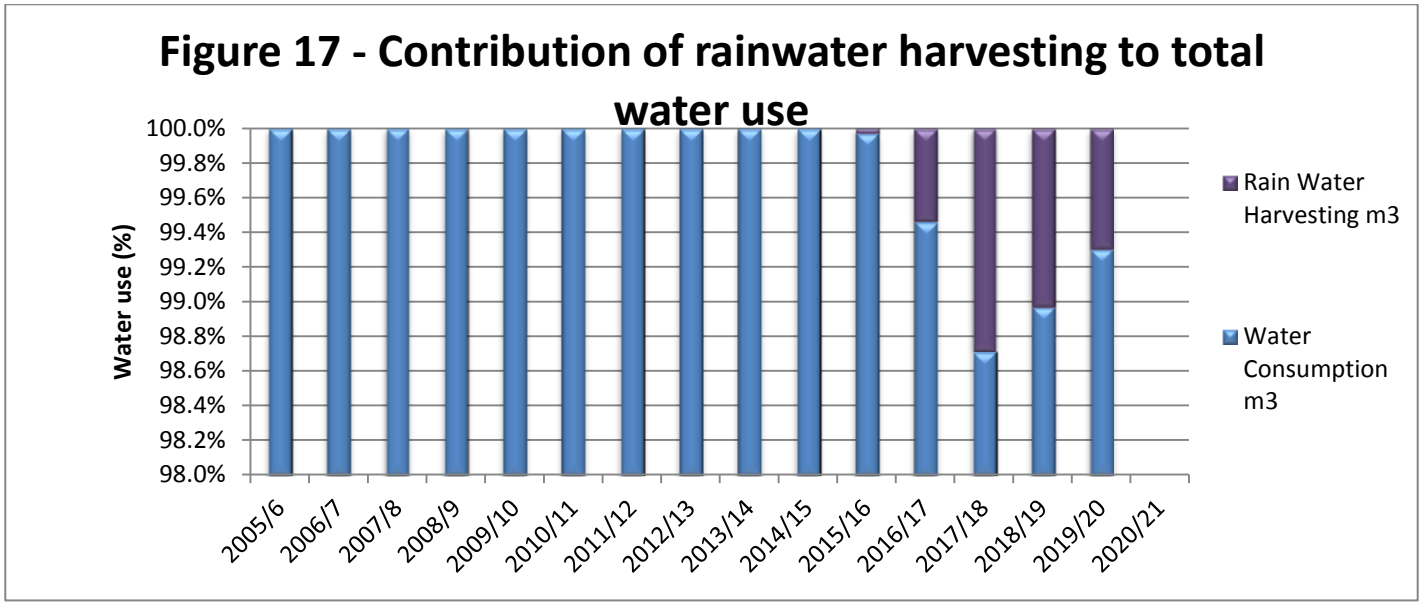
Total energy consumption per GIA decreased by 12.8% in 2019/20 compared to 2018/19 and by 32.5% compared to 2005/06 (See Figure 16b), again demonstrating the impact of COVID-19.





4.5 Water

Rainwater harvesting systems in Fusion and PGB only contribute about 1 % of the total water consumed across the estate (See Figure 17).



5. Progress to Date

i) Estate Development

The University continues to ensure the principles of sustainable development are incorporated into the design of new developments and refurbishments. Both new buildings PGB and BGB include a range of low and zero carbon technologies and rainwater harvesting and both are on track to achieve EPC As and BREEAM Excellent scores. The Sustainable Construction Policy includes commitments to help achieve the UN Sustainable Development Goals and sets out BU's requirements for all construction projects.

ii) Energy Conservation Measures (ECMs)

Now into its 12th year the University continues to operate the HEFCE/Salix Revolving Green Fund (RGF) for energy efficiency projects. Investment of £786,171 to date has identified forecast savings of 1,111 tonnes of carbon and £218,384 per annum. In 2019, RGF funded projects have included installation of LED lighting to various internal spaces including, but not limited to Chapel Gate and Poole House.

BU's Building Management System (BMS) software is being upgraded to a new version, called IQ Vision. The new platform will ensure optimum control for new buildings and bring our existing building stock up to the latest standards. The work has been set in 2 phases with Phase 1 now complete and phase 2 expected to be completed by early February 2021.

A Solar Thermal Hot Water system is currently being installed in Poole House. This is the first time this type of renewable heat system has been used at BU and will further add to our range of onsite renewable energy generation. This will be connected to heat the hot water during the summer periods with the Biomass Boiler providing the hot water and heating during the winter. As a result renewable energy may provide all the hot water used in Poole House throughout the year.

A recent national survey by energy comparison site uSwitch, found that, out of the universities compared, BU has the most onsite installations of renewable energy (https://www.uswitch.com/gas-electricity/guides/eco-friendly-universities/).

iii) IT Efficiencies

Work has started on replacing the Uninterruptible Power Supplies (UPS) within BU's IT comms rooms. This work will provide significant reductions in electricity consumption due to the increased efficiencies and correct sizing of units to meet the required specifications for each comms room. The project is funded as part of the RGF programme. Each UPS replacement is expected to save approximately 3.5 tonnes of CO2e.

iv) Solar Photovoltaic (PV) Projects

PV Generation Comparison (Kwh)		
	2018-19	2019/20
Studland House	3,224	20,420
Poole House	149,668	197,073
Student Centre	28,343	24,499
Fusion Building	98,118	101,460
PGB	97,544	106,035
Total	**376,897**	**449,487**

The existing PV system located on the roof of Studland House was replaced with a new larger array with the work being completed in October 2019 as part of the 2nd floor refurbishment project. The new array has helped to reduce the carbon emissions by 5.6 tonnes. BGB has a new PV array installed and is expected to produce in excess of 100,000 kWh of renewable energy per year. With the current trend of generation, and with the addition of the Bournemouth Gateway Building PV array, BU will be producing over 500,000 kWh of renewable electricity onsite.

6. Impact of COVID 19

Covid-19 has had a major impact on our operations during 2020 to date. Between August 2019 and February 2020, when we were running business as usual, GHG emissions were 4% lower than the same period for 2018/19. These reductions occurred despite the addition of Chapel Gate in May 2019 and Poole Gateway

Building, which opened in January 2020 and reflected the increase in onsite energy generation and the grid decarbonisation.

Energy use across BU's campuses decreased by 5.7% year on year, due to the closure of most of BU's buildings during the first lockdown. During this lockdown period, natural gas and electricity use reduced by 46% and 31%, respectively compared to the previous year. Prior to the lockdown there was a small increase in total energy use for the period of August 2019 to March 2020 compared to the same period in 2018/19, reflecting the addition of Chapel Gate and PGB.

The COVID-19 pandemic has provided a unique opportunity to compare the carbon intensity of working/studying at home and on campus. Showcasing an example of Living Labs, Dr Viachaslau Filimonau from the Business School and members of the Sustainability Team studied the carbon footprint of BU during the COVID-19 lockdown. The paper, peer-reviewed and published in Science of the Total Environment, a leading international journal in the field of sustainability and environmental management, is the first investigation of its kind and only the third attempt to assess the carbon emissions of UK higher education institutions.

The study has found that working/studying from home may be less beneficial from the carbon perspective than originally thought. The carbon emissions produced by staff, but particularly students, at home are almost equal to the carbon footprint of their commute. Overall, there was a decrease in GHG emissions due to the shutdown of the university campuses.
This research has important implications for higher education and the environmental benefit or dis-benefit of a blended teaching and learning approach, which may have low carbon efficiency.

The team aims to advance this project by assessing the carbon intensity of BU on- and off-campus over the winter period. Read the full paper here: https://www.sciencedirect.com/science/article/pii/S0048969720374957

Although lockdown and reduced operations has helped to significantly reduce energy consumption and GHG emissions of BU's estate the reality is that it is becoming difficult to predict and understand the expected profiles of how energy will be used across the BU estate. Determining the annual profile for the year and the coming year has become challenging to forecast due to this uncertainty. In addition, the new PGB is not operating as it was designed and so we are unable to determine if energy and GHG emissions are as predicted.

7. Forward Plans

Low and zero carbon projects will continue to be implemented throughout 2020/21, focusing on ECM, IT and building projects. Additional smaller scale projects will continue to be undertaken through the RGF programme, including continued LED lighting replacement to internal and external spaces.

In 2020/21 the completed installation of the upgraded BMS system will enable BU to monitor and improve energy consumption at a building level across the estate due to improved controls and more data being recorded.

A new PV array is planned to be installed on Jurassic House increasing the onsite electrical generation at BU.

The Energy Team will continue validating the data sent to the Automatic Metering and Reporting (AMR) and Systems Link (Bill verification) systems to determine where potential energy reductions can be achieved. System Link will quickly help identify areas of increased consumption, thus enabling a rapid response to identify and correct the cause(s). This will help BU reduce GHG emissions, save on energy costs and improve energy efficiency.

Proactive analysis and management of energy data is also a central component of BU's Environmental and Energy Management System (EEMS). In 2019/20, BU's EEMS retained certification to ISO14001 and for the first time achieved certification to ISO50001. The Sustainability Team will continue to manage these risk management systems to retain certifications for 2020/21.

The cooling system for the Studland House Data Centre is to be replaced in 2020/21 and should deliver improved efficiencies and GHG savings, whilst increasing resilience to the IT infrastructure.

The Sustainability Team will manage the implementation of the new Climate and Ecological Crisis Action Plan (CECAP) and this will include investigating a new data management software solution to help report against the CECAP.

8. Conclusions

The CMP continues to be a live document, although it has now been replaced by the new CECAP. This shows the continued commitment by BU to reduce its environmental impacts. The net zero emissions for all scopes is an extremely challenging target and will require all staff and students to play their part in helping BU continue to drive down GHG emissions as much as possible to help avert the crisis facing the world. It should be noted that inclusion of additional scope 3 emissions will increase BU's GHG footprint. BU is developing an offsetting strategy to ensure the net zero target is met.

The CECAP requires rapid cuts in GHG emissions across all scopes to make progress against the net zero target. ECMs and renewable energy projects and efforts to reduce indirect scope 3 emissions continue to be a priority. The implementation of the CECAP also requires a shift in focus to tackle all scope 3 emissions.

Key to the next 12 months will be delivery of IT efficiencies and onsite power/heat generation such as the operation of the new PV array on Jurassic House and continued operation of the GSHPs.

Work is in progress to develop the business cases for larger scale infrastructure projects, such as upgrading the cooling system in the Studland House Data Centre and replacing three of the existing Talbot Campus high voltage transformers. Optimising the performance of buildings, using the upgraded BMS, will continue ensuring the estate is operating efficiently whilst also providing a comfortable working environment.

The impact of COVID 19 over the period has been very challenging, even though it has helped reduce GHG emissions of BU's estate operations. However, it is unclear at the moment what impact the required increase in heating and ventilation of buildings is having on winter 2020/21 GHG emissions, particularly as most buildings are now closed again. It is hoped some form of consistency for running the estate will return for 2021/22.

Overall, it is a significant achievement to exceed the 40% carbon reduction target for the second year running. However, the significant changes to the Estate over this year and beyond may result in an increase in energy use and GHG emissions.

BU is also proud to have achieved the ISO50001 standard and is one of only a handful of HEI's to gain the two ISO standards of 140001 and 50001. Being recognised by uSwitch as the leading university for the most onsite renewable energy generation technologies is a great acknowledgement of BU's commitment to reduce its environmental impacts.

Dave Archer
Energy Manager
January 2021

Appendix 1: Break down of BU Carbon emissions

Scope	Source	GHG emissions 2005/06 (tonnes CO2e)	GHG emissions 2018/19 (tonnes CO2e)	GHG emissions 2019/20 (tonnes CO2e)	Accurate/ Estimate	Comment
1	Buildings (Gas)	1,633.9	1,239.9	1,080.5	A	Natural gas used in buildings
1	Buildings (LPG)	0	0	71.2	A	LPG used at Chapel Gate
1	Biomass	0	8.3	13.7	A	Biomass used in Poole House
1	Fugitive emissions	0	135.7	14	A	Losses from air conditioning units
1	Fleet vehicles	11.3	19.5	21.7	A	Diesel vans
2	Buildings (Electricity)	6,048.6	2796.5	2097.3	A	Grid electricity used in buildings
1 & 2	Sub-total	7,693.8	4,199.8	3,297.7		
3	Water & wastewater	40.8	42.5	43.7	A	2005/06 data is for water supplied only. 2018/19 & 2019/20 data includes waste water emissions.
3	Waste	111.3	8.9	5.2	A	2005/06 baseline is for waste sent to landfill only. 2018/19 & 2019/20 figures are for total waste. Based on operational waste production & does not include C&D waste
3	Waste (C&D)	0	3.3	16.1	A	Waste from construction projects

Scope	Source	GHG emissions 2005/06 (tonnes CO2e)	GHG emissions 2018/19 (tonnes CO2e)	GHG emissions 2019/20 (tonnes CO2e)	Accurate/ Estimate	Comment
3	Unibus	430	391	310.3	A	Based on Unibus fleet mileage
3	Staff Business travel	-	1,458.2	404	A	Based on BU Travel Management Company (TMC) flight (includes Radiative forcing - a measure of the additional environmental impact of aviation. These include emissions of nitrous oxides and water vapour when emitted at high altitude) and rail travel.
3	Sub-total	582.1	5,487.6	779		
1,2 & 3	Total	8,276	9,687.1	4,076.8		

Appendix 2: DEFRA Carbon Emissions Conversation Factors for UK Purchased Electricity (including transmission and distribution) and natural gas from 2005/6 to 2020/21