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Carbon Report 2019/20

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Executive Summary

This annual report provides an update on our investments and performance across our UK campuses in reducing emissions of carbon dioxide (CO_2) against the University's targets in 2019/20.

The University's Carbon Management Plan (CMP) was refreshed in 2015/16 and includes targets for reductions in emissions of CO_2 from energy consumption with a target for **2020 of 41,000t CO2.** It identifies the principal areas of energy use and our investment programmes to improve energy efficiency, reduce consumption and generate energy from lower carbon and renewable energy sources.

In 2019/20 our Scope 1 and 2 carbon dioxide emissions have shown an absolute reduction of 10% or 4,386t from 2018/19 and down 28,782t from our 2009/10 baseline of 67,998t CO2 exceeding our 2020 target.

Throughout this year we have seen a general reduction in our carbon emissions and this was accelerated as a result of the Covid-19 pandemic. The national lockdown in March 2020 had a significant impact on the energy and carbon performance of our estate and there is much to learn from this. We saw our campuses move into a state of hibernation and a displacement of on-site scope 1 and 2 carbon emissions.

During this last year the University has made further significant commitments to environmental sustainability. These are set out in the Strategy 2020 that was published in December 2019. That strategy states:

We will make an outstanding contribution to supporting the United Nations Sustainable Development Goals (SDGs) through our research and education, our engagement with partners and our behaviour on campus and in our communities. We will place a special emphasis on environmental sustainability, supporting the City of Nottingham's desire to be a net zero carbon city by 2028 and working with partners in China and Malaysia to improve sustainability within their regions.

To support the delivery of the University Strategy, in June of this year we published our Estate Development Framework. This provides the framework for how we will invest in and develop our estate over the next years to meet the needs of the University Strategy. Carbon reduction and energy resilience are key principles of this.

Through 2019/20, there has been continued investment in boiler replacement and chilled water systems through the capital backlog replacement program. Improvements in efficiency in these investments have contributed to reduced Scope 1 and 2 emissions.

We have continued to benefit from the decarbonisation of electricity delivered over the National Grid and the major challenge for us now is to decarbonise how we heat our buildings. We will be adopting a 'fabric first' approach where we will reduce demand through improving the energy efficiency of building envelopes (walls, ceilings, windows) and also applying zero carbon renewable energy technologies.

The current Carbon Management Plan expires this year and we are in the process of establishing new targets using a Science Based approach and a new carbon reduction road map will be needed to deliver those ambitious targets.

University of Nottingham
Carbon Management Plan Annual Report 2019/20

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1 Introduction

This is the tenth annual report on our Carbon Management Plan (CMP) and covers the financial year 2019/20. It provides details on progress achieved and performance improvements made against targets.

The CMP was originally approved in December 2010 and was updated in 2016. So far the CMP has resulted in investments in excess of £20m, with estimated annual savings of 14,223 tonnes of CO_2. Over this last year we have seen significant investment through our capital replacement programme across the estate including continued investment in boiler replacement and chilled water systems. The report provides an update on energy and carbon dioxide (CO_2) emissions arising from Scope 1 and 2 sources, CO_2 reduction projects approved and installed, CO_2 savings, financial performance and the programmes of work planned for the next 12 months.

2 Carbon Management Plan – objectives and targets

The CMP was approved by the University in December 2010 and updated in July 2016 with the main areas of investment to be centred on:

1. Improvements in energy efficiency of buildings, including insulation, heating & lighting.
2. More efficient use of existing equipment.
3. Generation of energy from small/medium scale renewable energy systems.
4. Major infrastructure upgrades to replace existing plant to reduce energy cost, carbon emissions while at the same time improving system resilience.

The programme includes several specific investment projects and more generic programmes to deliver CO_2 reductions. These focus on the areas of energy saving and energy efficiency for Scope 1 (predominantly gas combustion in boilers) and Scope 2 (electricity use) emissions.

The CMP provided a baseline of CO_2 emissions; sets emission reduction targets; and mapped out a five-year investment programme implemented to deliver environmental performance improvements and carbon & financial savings. The CMP targets and objectives set in the 2010 CMP were:

	Baseline 2009/10	Target 2014/15	**Target 2020**
Total CO_2 emissions p.a.	68,000 tonnes	54,000 tonnes	**41,000 tonnes**

These represented reductions from the 2009/10 of 20% on CO_2 emissions by 2014/15 and 40% by 2020.

The current carbon management plan expires in 2020 and we are in the process of establishing new carbon reduction targets using a Science Based approach which will be supported with a new carbon reduction road map.

We will continue to prioritise the most energy and carbon intensive buildings and achieve a better understanding of what contributes to our significant 'out of hours'

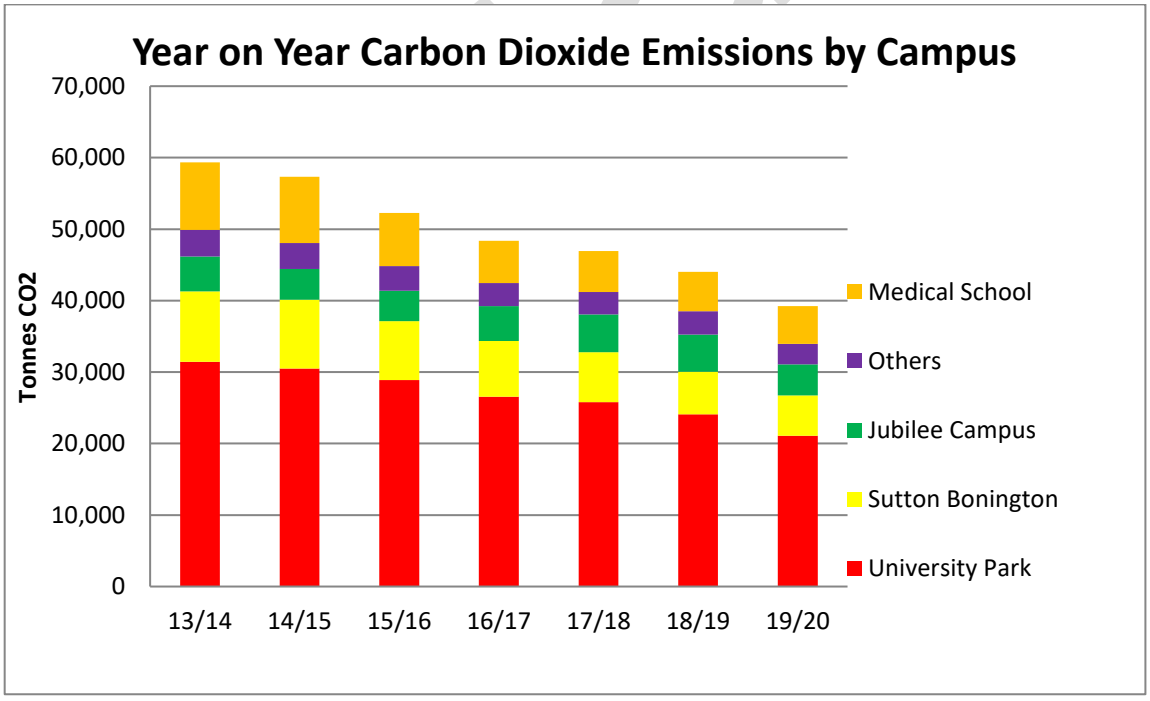
baseload. The further development of energy strategies for each campus will be required with the overall aim of reducing carbon emissions, improving financial sustainability, system resilience and student experience and where possible, deliver income generation.

3 Performance achieved

3.1 Carbon dioxide emissions (Scope 1 and 2)

Over the last decade we have seen year on year reductions in our scope 1 and 2 carbon emission and this trend has continued into this year. We have seen a further reduction in our carbon emissions of **4,386 tonnes** taking our overall carbon emissions for this last year to **39,216 tonnes** almost 2,000 tonnes below our 2019/20 target of **41,000 tonnes.**

After a full year of operation, we have seen the results of investment made in the summer of 2019 delivering some of the carbon savings reported here. There has also been a significant reduction in electrical demand for reporting months March to July as much of the University went into a state of hibernation as a result of Covid-19.



CO2 Emissions (tonnes)								Change
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2018/19 to 2019/20**
University Park	31,424	30,490	28,898	26,573	25,780	24,109	21,109	-12.4
Sutton Bonington	9,876	9,637	8,244	7,791	6,999	5,949	5,641	-5.2
Jubilee Campus	4,855	4,295	4,247	4,877	5,294	5,170	4,334	-16.2
Others	3,731	3,612	3,425	3,199	3,114	3,296	2,865	-13.1
Medical School	9,446	9,285	7,470	5,930	5,760	5,487	5,267	-4.0
Total	**59,332**	**57,319**	**52,284**	**48,370**	**46,947**	**43,602**	**39,216**	**-10.0**

The National Grid has continued to reduce its CO_2 emissions associated with power generation through the increasing proportion of renewable energy and gas fired power stations supplying the grid with a corresponding reduction in the use of coal fired plant. As UK wide demand for power reduced during 'lockdown', the proportion of renewable generation increased further than it would otherwise.

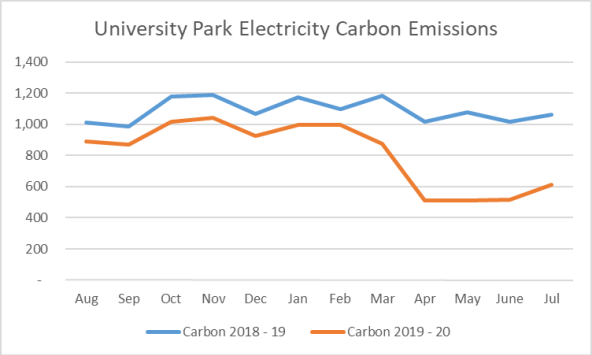
CO2 Emission factor 4	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**
Electricity Kg/kWh	0.494	0.462	0.412	0.352	0.311	0.278	0.243
Natural Gas Kg/kWh	0.185	0.184	0.184	0.184	0.184	0.184	0.184

Our emission factor for grid consumed electricity includes Scope 1 and 2 emissions associated with power generation but does not include scope 3, i.e. those associated with transmission and distribution losses and are obtained from DEFRA / BEIS.

3.1.1 Emissions by energy source

Co2 Emissions (t)				Change
	2017/18	**2018/19**	**2019/20**	18/19 to 19/20
Electricity	25,777	23,084	17,583	-24%
Other Fuel	21,170	21,168	21,633	2.2%
Total	46,947	43,602	39,216	-10%

3.2 The Impact of Covid-19 on Scope 2 (electricity) emissions

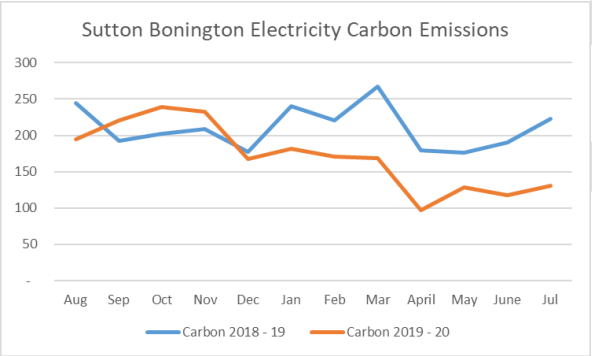


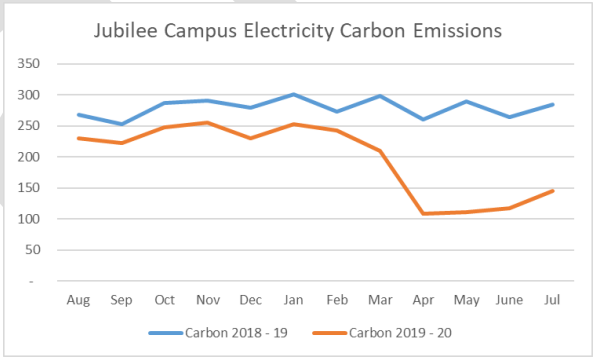
For the first seven months of the reporting year, carbon emissions from our electricity use were down an average of 12% compared to the same period last year.

As the campus moved into hibernation as a result of Covid-19, we saw this reduction increase to 44%.

Overall carbon dioxide emissions fell by 3,639 t in 2019/20 on University Park.

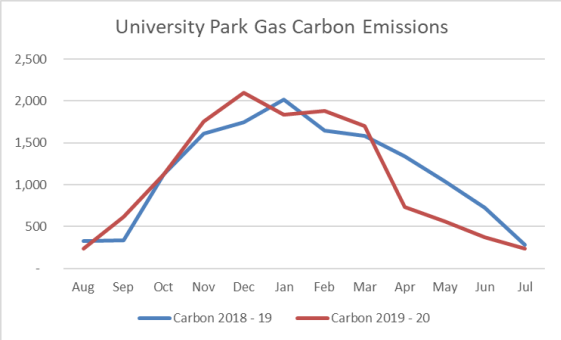
We have seen similar patterns at both Jubilee Campus and Sutton Bonington with a reduction in electricity emissions of 14% and 5% during the first seven months of the year, with a step change as a result of campus hibernation. Resulting in a reduction of over 1,300 tonnes when compared to the previous reporting year.





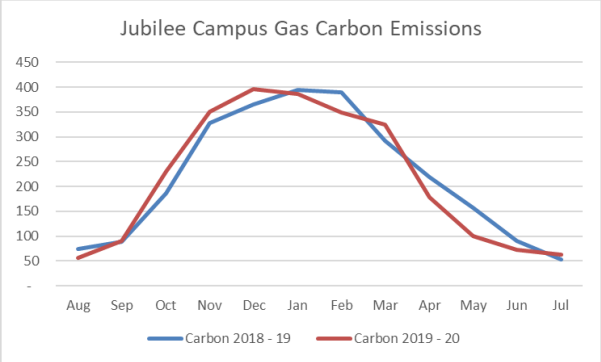
3.3 The Impact of Covid-19 on Scope 1 (Gas) emissions

Overall our use of natural gas increased by 2.2% despite significant reduction in gas consumption at Sutton Bonington due to reduced run hours of the CHP Plant. Much of the increase in gas consumption can be attributed to the fact that last winter was much colder than previous.



During the period of hibernation we saw emissions at **University Park** fall by 30% when compared to previous years.

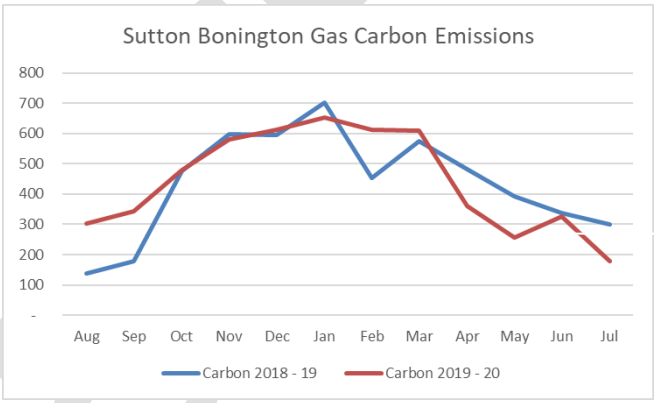
Overall we have seen a 620t CO_2 increase of gas-based emissions on University Park during this last year.



At **Jubilee Campus** we saw an 8% reduction of emissions during campus lockdown and an overall reduction of 44t CO2.

Gas consumption at **Sutton Bonington** was variable and doesn't follow the typical seasonal curve due to the operation of the gas-powered CHP system, which provides both heat and power to the campus.

But overall there was a noted drop in consumption during campus hibernation of 19%. Further details and a full breakdown of electricity and fossil fuel consumption by campus can be found in the University's 2019/20 Energy Report.



3.4 The ongoing impact of Covid-19

As we have brought our campuses back to life through the building reopening programme, we have needed to change our operating parameters to ensure that our buildings continue to be Covid-19 secure. This has included significantly increasing ventilation rates to our buildings and turning off, or bypassing, any heat recovery systems. The net result of this is that our heating and ventilation systems are having to work harder, using more energy and producing more carbon dioxide emissions. Initial estimates suggest gas consumption could increase between 15% and 20% which could equate to up to 4,400 t CO_2.

4 Carbon projects

4.1 Carbon Management Plan projects investment to date

A summary of carbon and cost saving to date is given below.

Year	Investment cost £	Estimated annual savings	
		Financial £	CO_2 tonnes
Total for 2019/20	1,460,600	11,986	13
Total for 2018/19	186,000	40,018	176
Total for 2017/18	572,240	114,682	433
Total for 2016/17	3,042,923	179,623	928
Total for 2015/16	4,388,205	399,792	1616
Total for 2014/15	2,863,391	433,325	2,021
Total for 2013/14	2,136,070	339,793	1,390
Total for 2012/13	2,806,613	219,481	1,522
Total for 2011/12	1,489,937	350,467	2,028
Total for 2010/11	1,509,361	666,424	4,096
		2,322,248	**14,223**

4.2 2019 -2020 Project overview and other initiatives

This year's investment has largely been delivered through our capital backlog replacement programme works, which has included replacement boiler plant at Willoughby, Nightingale, Southwell and Newark halls of residence along with Computer Science, The Dearing building and The Exchange building. Other work includes central chiller replacements at Computer Science, Dearing building and The Exchange. This programme of works will continue over coming years and will involve the installation of more efficient plant.

Work has continued over the last year on developing feasibility studies and business cases for large scale capital investments that will deliver significant carbon and financial savings.

University Park – District heating system replacement

Over the last year, significant work has been done to repair the district heating system on University Park. The central boiler plant and distribution pipework that serves many of the central University main buildings is nearing the end of its useful life and is due for replacement.

Whilst at initial glance it appears that like-for-like gas replacement is the only viable option, further work was commissioned to assess whether we ought to move to a decentralised system or stick with a centralised district system. At the same time, recognising that the decarbonisation of heat is going to be a major challenge in the future, further appraisal work has been done to establish whether or not a dual solution with gas as a primary source could be installed from day one to reduce associated carbon emissions. Investment proposals are being developed for consideration in early 2021.

Large scale Renewable energy schemes

Feasibility projects continue to look into the installation of large-scale renewable energy schemes across the University, including both photo voltaic (PV) systems at Sutton Bonington and revisiting wind generation opportunities at our Riverside complex. The University is also working with the City and Nottingham Trent University to identify collaborative opportunities through the Universities for Nottingham initiative.

Policy and People

We have published a heating and cooling policy that standardises controls and ensures systems are continually operated at the optimum settings via our BMS system.

Recognising the importance of behaviour, we have established a technical energy group that includes representatives from those faculties where energy consumption is highest (Engineering, Science and Medicine/ Health) has also been formed. The aim of this group is to share best practice and generate ideas on how we can reduce electricity consumption associated with the operation of specialist research equipment.

At the same time we are working with a specialist agency, Diva Creative, to develop a behaviour change campaign and rewards platform to encourage and reward sustainability and low carbon activity. Part of the focus of this will be on energy reduction in the work place.

4.3 Renewable Energy

Over the last year we have seen fluctuations and challenges with the operation and productivity of our renewable energy technologies. We have also seen a number of systems go into fault resulting in down time. System improvements and modifications have been put in place to minimise this moving forward.

Building	Type	Annual Generation (kWh) 19/20	Annual Generation (kWh) 18/19	
BioEnergy	Biomass	111,750	90,980	22.83%
Geospatial	Biomass	54,870	53,290	2.96%
Sustainable Chemistry (GSK)	Bio Oil	16,480	25,140	-34.45%
Total		166,620	144,270	15.49%
Humanities	GSHP	151,600	85,800	76.69%
Si Yuan	GSHP	49,171	46,058	6.76%
Cripps Health Centre (New 2019)	GSHP	61,688	43,600	41.49%
ATC	GSHP	29,710	38,850	-23.53%
Maths Building	GSHP	11,276	9,660	16.73%
Total		303,445	223,968	35.49%
Sherwood & Rutland	Solar Thermal	9,227	9,486	-2.73%
Si Yuan Chinese Studies	Solar Thermal	472	780	-39.49%
Total		9,699	10,266	-5.52%
Sustainable Chemistry (GSK)	PV	137,883	215,973	-36.16%
Veterinary School	PV	125,144	123,909	1.00%
Derby Hall	PV	53,416	48,985	9.05%
Lincoln Hall	PV	31,552	37,639	-16.17%
George Green Library	PV	34,067	32,684	4.23%
Business Sch North	PV	14,901	14,245	4.61%
Energy Technologies Building	PV	11,734	13,511	-13.15%
Aerospace Technology	PV	11,711	11,212	4.45%
Orchard Hotel	PV	8,538	8,621	-0.96%
Dearing	PV	2,926	7,310	-59.97%
Computer Sciences	PV	7,029	6,706	4.82%
Advanced Manufacturing (New 2018)	PV	5,002	4,877	2.56%
Ingenuity Centre (TEC)	PV	4,520	4,511	0.20%
Si Yuan Chinese Studies	PV	3,900	4,122	-5.39%
Total		452,323	534,305	-15.34%
IMH	ASHP	4,535	5,110	-11.25%
Total		4,535	5,110	-11.25%
Total Renewable		936,622	917,919	2.04%

We continue to monitor the performance of our renewables and the proposed metering strategy will encompass an increase in the metering of our renewable installations to enable a more proactive approach to the management and maintenance of our systems.

Moving forwards, investment in on-site renewable generation will need to be a major part of our energy strategy, to both limit our financial risk in what is likely to be volatile energy markets, but also to support our future carbon emission reduction targets.

5 Future carbon management and investment programmes

The University of Nottingham has made significant commitments to promoting environmental sustainability. These are set out in the Strategy 2020 that was published in December 2019. That strategy states:

We will make an outstanding contribution to supporting the United Nations Sustainable Development Goals (SDGs) through our research and education, our

engagement with partners and our behaviour on campus and in our communities. We will place a special emphasis on environmental sustainability, supporting the City of Nottingham's desire to be a net zero carbon city by 2028 and working with partners in China and Malaysia to improve sustainability within their regions.

As we progress with developing our science based carbon reduction targets, we will need to build upon, and accelerate, investment in scope 1 and 2 carbon reduction as well as work across Scope 3 emissions. Our new CMP will be an evolution of the existing plan, but will need to respond to the targets we will set in 20/21 and also consider any operational changes brought about by Covid-19 directly or indirectly.

Investment in our capital backlog replacement programme and investments in onsite generation will continue to contribute to future reduction. However, the major challenge will be to decarbonise the way in which we deliver space and water heating to our buildings and activity. We must improve the thermal performance of our buildings to enable the delivery of heat via low or no carbon technologies.

Specifically, over the next year we will see plant replacement covered by £2m backlog maintenance work on the Chemistry Building ventilation plant, large chillers, small AC units and BMS upgrades. At the same time we will continue with major investments such as University Park low carbon heat clusters and the Sutton Bonington large scale PV array. The University is currently investing over £1m in upgrading the high voltage network at Sutton Bonington, which will create opportunities for investment and connection of renewable energy schemes. We will continue to take an evidence-based and targeted approach and further investments in energy and carbon intensive buildings.

6 Financial requirements

All projects are required to follow established governance routes for financial approval following prioritisation assessment. CMP projects continue to be assessed for financial and carbon performance and submitted for approval, having initially gone through an energy/carbon working group. Funding for CMP projects is provided from estates capital as part of a wider investment portfolio, revenue budgets, Salix finance and grant contributions and loans where available. We continue to identify opportunities for external funding where it is available.