Carbon Reduction Action Plan

October 2018 Update

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1. Introduction

The Carbon Reduction Plan provides a roadmap for how Oxford Brookes University will reduce energy consumption and carbon emissions through 2025. This plan first looks at how we use energy in order identify the greatest areas for potential savings. It then benchmarks our performance to see how we are performing among on universities. Finally, it outlines our priorities and actions for achieving our carbon reduction targets.

2. Energy use and carbon emissions at Oxford Brookes

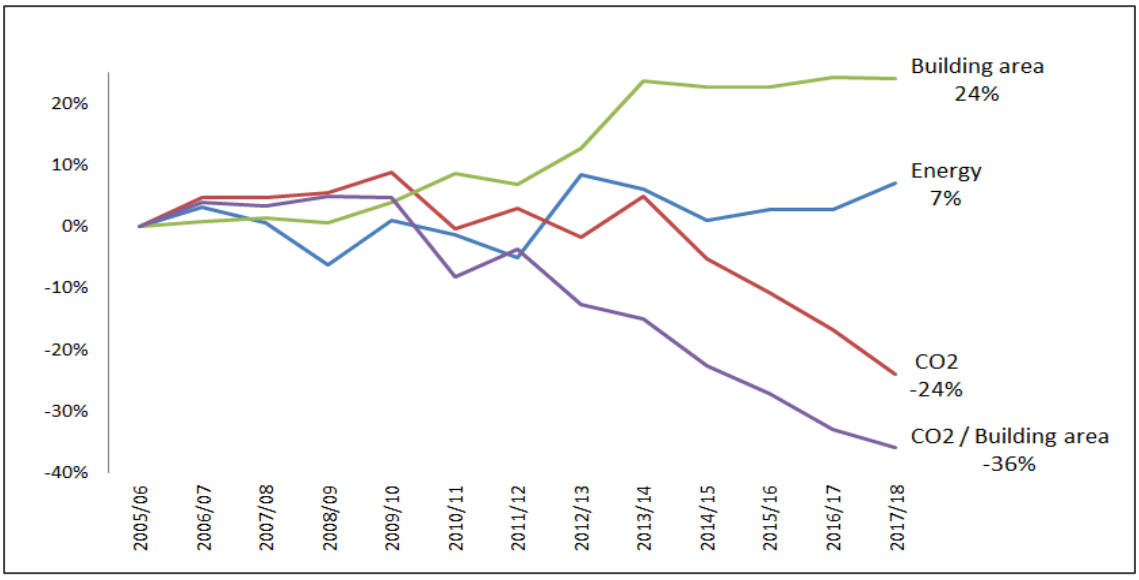
2.1 Annual energy use (2017/18 vs. previous year)

	Energy (kWh)	% change in energy	% change in CO_2 intensity	% change in Heating Degree Days (HDD)
Gas	34,818,202	+1%	0%	+6%
Electricity	14,630,652	+1%	-19%	
Oil	91,872	-14%	0%	
Total	49,540,726	+1%	--	

Our carbon reduction targets are listed in the table below. Based on updated forecasts for energy projects in the pipeline, we are on track to meet our 2020 reduction target of 28%. However, without an increase in funding to support energy efficiency improvements in our HVAC and building energy management system, we will most likely not be able to achieve our 2025 reduction target of 34%.

Year	% change in CO_2 (2005/06 baseline)	Progress	Notes
Previous year	17%	--	
Current year	**24%**	**8% decrease** from previous year	Due to reduction in CO_2 intensity of electric grid
2020 target	28%	On track	
2025 target	34%	Not on track	Due to lack of funding for HVAC and BMS improvements

Oxford Brookes has cut absolute carbon emissions by 24% since 2005/06 despite a 24% increase in building area (GIA). **Carbon emissions per building area have been cut by 36% during this time**. This has been due to energy efficiency improvements and an increase in the use of lower carbon fuel sources.

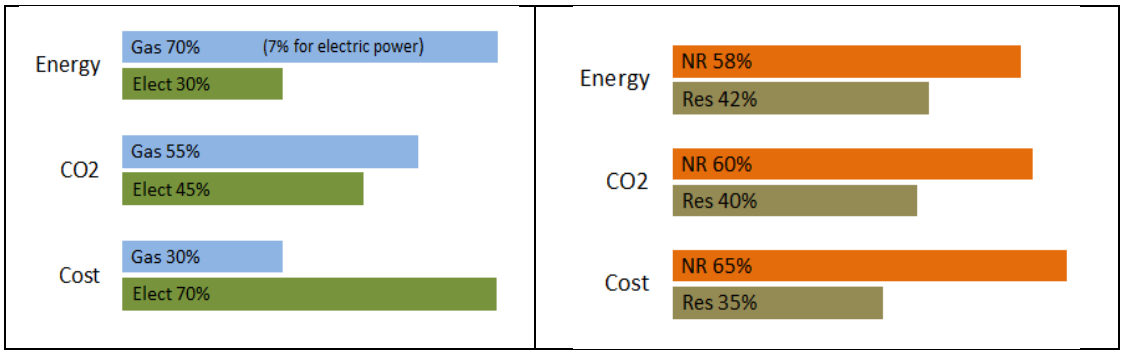


Changes at Oxford Brookes University compared to 2005/06 baseline year

2.2 Energy use by fuel source and building type (2017/18)

Most of our energy consumption comes from natural gas (70%) used mainly for space and water heating (with 7% used to generate on-site electricity). Although electricity represents only 30% of total energy use, its high cost per unit of energy mean that it is responsible for 70% of our total energy costs.

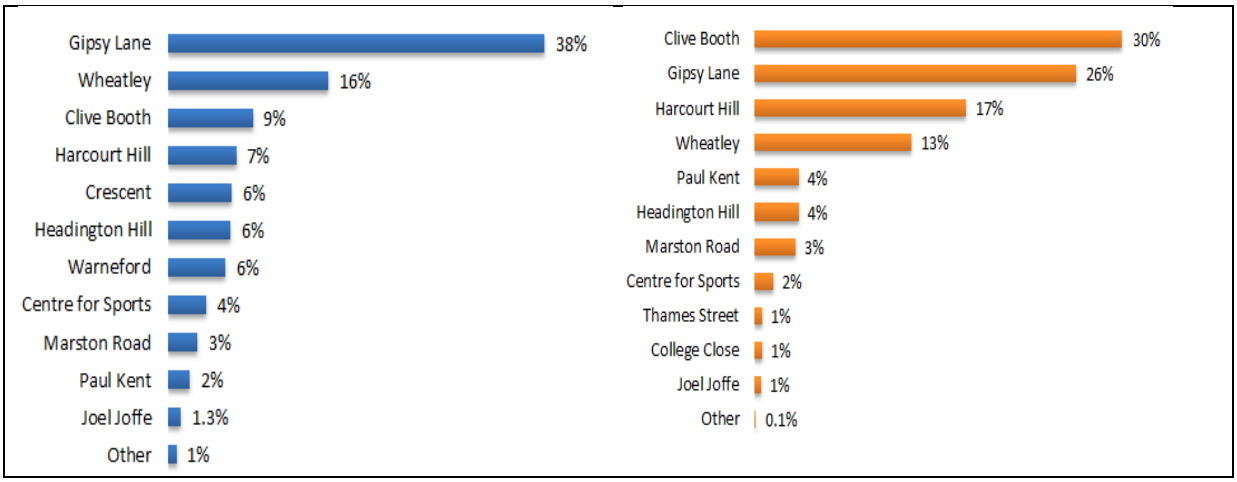
Around 60% of our energy use and carbon emissions are from our Non-residential building. Since these building have a higher density of electrical lighting and IT equipment, they also consumer more electricity than our residential halls. The higher cost of electricity results in non-residential buildings representing 65% of our total energy costs.



Gas vs. Electricity **Non-residential vs. Residential**

2.3 Energy consumption per site location (2017/18)

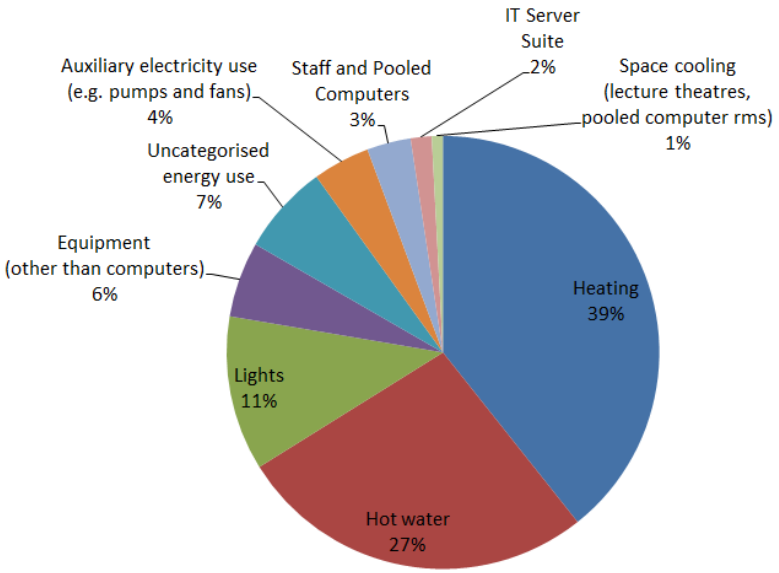
As illustrated in the graphs below, 70% of our total electricity use and 86% of our total gas use is concentrated in four main site locations: Gipsy Lane, Wheatley, Clive Booth, and Harcourt Hill. These sites provide the greatest potential for making significant reductions in energy consumption and resulting carbon emissions.



Electricity Usage as percent of total Gas usage as percent of total

2.3 Energy consumption by end use

The chart below shows relative energy use based on end use (2017/18 based on best data available). Space heating and hot water comprise the majority of energy use (66%), followed by lighting (11%).



3. Benchmarking carbon and energy to the UK University sector (2016/17 data - HESA)

The graphs below compare normalised carbon and energy data for Oxford Brookes comparted to all UK universities for the 2016/16 fiscal year (HESA data). Note that because building size (m2) and number of building occupants (FTE) both influence energy use, it is important to normalise performance to these parameters when data is available. It is also to break out Non-residential and residential energy use separately to assess the performance of each building usage type. Oxford Brookes is performing better than median in all metrics except for residential energy use.

Carbon (tCO_2)	median	OBU	Ranking (top X%)
Total/m2	55	52	37%
Non-Res /m2	59	55	41%
Non-Res/FTE	564	434	30%
Res/m2	47	47	52%
Res/bed	1143	1094	43%

Energy (kWh)	median	OBU	Ranking (top X%)
Total/m2	214	213.6	48%
Non-Res /m2	222	220	48%
Non-Res/FTE	2,178	1,745	36%
Res/m2	194	206	57%
Res/bed	4763	4767	51%

Carbon/Energy Performance vs. UK university sector

4. Carbon Reduction Strategy

Our Carbon Reduction Strategy is signed-off by senior management and reviewed each year. It provides a roadmap for developing and implementing our carbon reduction action plan.

4.1 Vision

Oxford Brookes will be a sector leader in energy efficient, low-carbon operations and behavioural practices.

4.2 Key drivers of energy and carbon

Carbon emissions can be viewed as having three key drivers as summarized below. Our carbon reduction strategy consists of a combination of reduction measures related to each driver.

1. **Energy Demand** – The energy services required for our buildings (thermal comfort, lighting, IT, etc.)
2. **Energy Efficiency** – The energy efficiency of the equipment/kit used to provide energy services
3. **Energy Source** – The amount of carbon in the energy sources we use (carbon intensity).

4.3 Objectives

Each of the key drivers of carbon emissions has a related objective as follows:

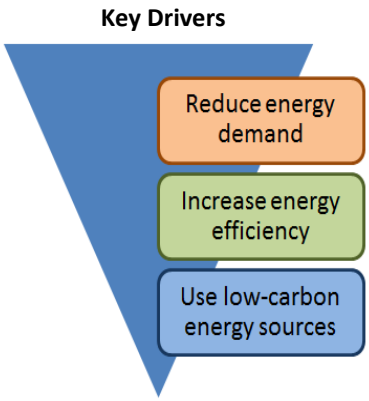
1. **Optimise space use** and refurbish existing buildings and use sustainable design practices for new buildings.

2. **Optimise use of existing energy-consuming kit** (heating, lighting, etc.) and upgrade to more efficient kit.

3. **Switch from electricity to (lower carbon) natural gas and invest in on-site renewable energy**.

The most cost-effective way to cut our carbon emissions is to first consider opportunities to reduce the demand for energy services – for example, making better use of our existing building space before creating new buildings. Once this has been done, we focus on maximising the energy efficiency of the kit used to provide energy services (heating, lighting, etc.). Finally, we consider the use of low carbon energy sources – for example, using (lower carbon) natural gas in place of (higher carbon) grid electricity and the use of solar energy. This approach is summarised in the carbon reduction hierarchy below.

4.4 Carbon Reduction Hierarchy



Objectives

1. Optimise space use and refurbish existing buildings and use sustainable design practices for new buildings.

2. Optimise existing energy-consuming kit (heating, lighting, etc.) and upgrade to more energy efficient kit.

3. Switch from electricity to (lower carbon) natural gas and invest in renewable energy such as solar panels.

5 Carbon Reduction Action Plan: 12% additional reduction required by 2025

Our carbon reduction action plan identifies reduction measures for each of the three main drivers/objectives outlined in our carbon reduction strategy. As of 2017/18 we have already reduced carbon emissions from 13,873 tCO2e to 11,570 tCO2e. This is equal to a **24% reduction** is absolute emissions despite a 24% growth in building area. **We must achieve an additional 12% reduction (of baselie) in order to achieve our 2025 target**.

5.1 REDUCING DEMAND: 4% (of 12% total reduction)

The Oxford Brookes Space Strategy has a 2025 target of reducing non-residential building area by 15% (from 2006 baseline). To achieve this target, we will optimise space at our Headington and Harcourt Hill campuses in order to allow closure of our Wheatley campus. This will result in a 3% reduction in carbon emissions by 2020. We are also refurbishing a number of buildings at our Headington and Harcourt campuses, which will result in an addition carbon savings of 1% by 2025, resulting in a total reduction of 4% due to reduced energy demand. Finally, we are developing new sustainable design guidelines to help mitigate carbon emissions from new building construction.

5.2 INCREASING EFFICIENCY: 5% (of 12% total reduction)

We will continue with our ongoing strategy of upgrading of our existing heating and lighting kit. The majority of these energy efficiency projects will focus on upgrading to LED lighting with improved controls. See table on next page.

Over 60% of our potential carbon reduction from efficiency improvements will depend on updating HVAC controls and the building management system (BMS) - responsible for heating, ventilating, and cooling our buildings. **Without a significant increase in funding to implement HVAC/BMS energy efficiency projects, we will not be able to achieve our 2025 reduction target of 34%.**

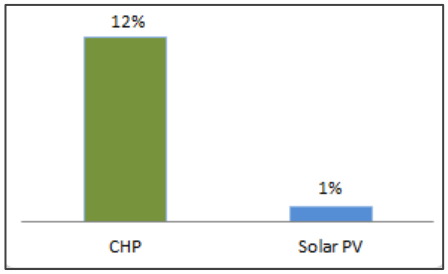
Project	Annual savings (£)	CO2 reduction (tCO2/a)	Payback (years)	Status
CHP expansion (Harcourt Hill)	34,106	39	5.7	*completed*
Valve pipework insulation (various)	8,700	52	2.3	*completed*
Heating circulation pump upgrades	5,239	9	5.8	*In progress*
Rooftop solar PV (Clerici and Wheare)	10,346	19	8.7	*completed*
Air conditioning unit upgrades (R22)	15,099	22	9.6	*In progress*
Gas boiler upgrades (Paul Kent)	22,667	86	12.5	*In progress*
Lighting controls (JHB / Abercrombie)	2,020	3	6.9	*In progress*
LED lighting upgrades (Paul Kent)	11,123	8	10.3	*In progress*
LED lighting upgrades (Clive Booth)	62,382	104	10	*In progress*
HVAC/BMS system improvements	282,427	685	3	*NO BUDGET*
TOTAL (without HVAC/BMS)	**171,683**	**342**		
TOTAL (with HVAC/BMS)	**454,109**	**1027**		

Current list of current and recently completed energy efficiency projects (as of October 2018)

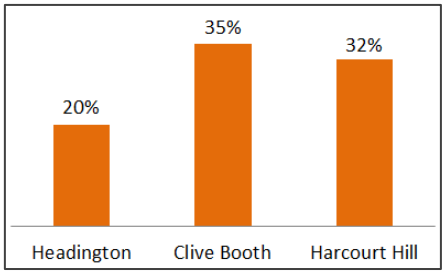
5.3 USING LOW CARBON ENERGY: 3% (of 12% total reduction)

CHP and Solar PV: 1% reduction by 2025

We continue to use gas-powered combined heat and power (CHP) units to generate both heat and electricity. Electricity from CHPs contains less carbon than that purchased from the National Grid. CHP systems at three sites together meet 12% of total current estate electricity demand. The high density of energy use in our buildings compared to available rooftop area, plus UK climate, means that solar PV will be limited in its relative contribution to on-site energy generation (currently at 1%).



On-site electricity generation (2017/18)



CHP electricity contribution per site (2017/18)

National Electrical Grid: 2% reduction required by 2025

Since purchased electricity from the National Grid accounts for almost half of total carbon emissions, changes to the carbon intensity of this electricity has a significant impact to our total carbon emission.

6. Summary of carbon reduction targets: 2020 and 2025

The graph below illustrates how we plan to achieve our carbon reduction targets of 28% by 2020 and 34% by 2025 (based on 2005/06 baseline). **Note that without an increase in funding to support energy efficiency improvements in our HVAC and building energy management system, we will most likely not be able to achieve our 2025 reduction target of 34%.**