University of Reading

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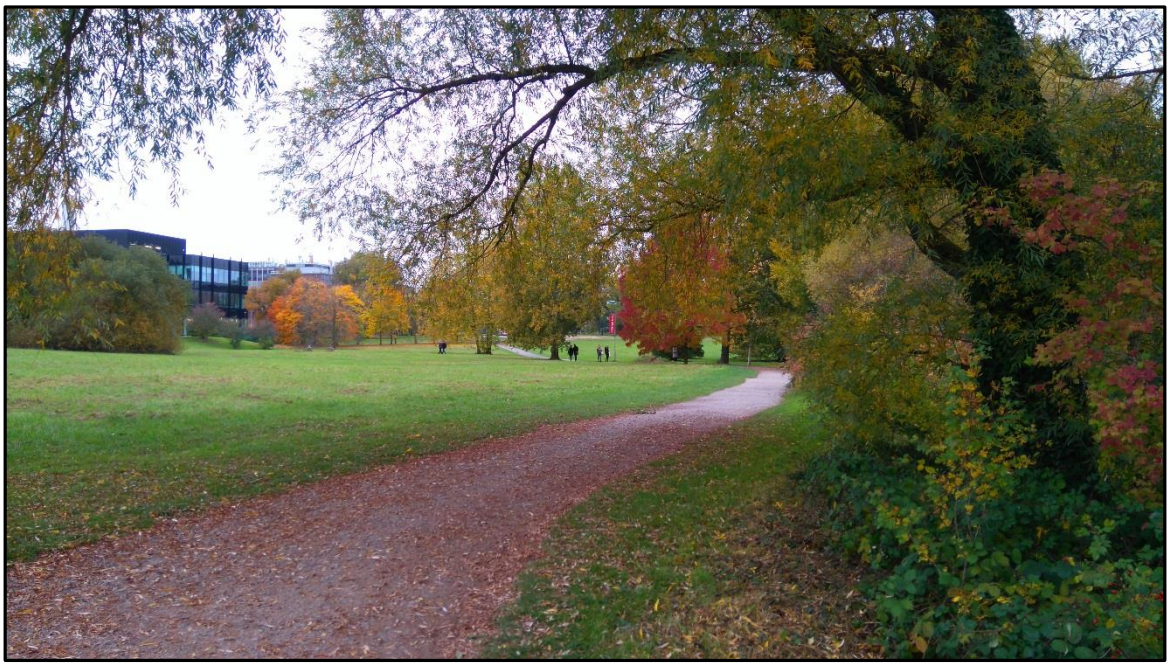

Carbon & Water Management 2016 Progress Report

clean&green

35%

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Related Documents

- Carbon Management Plan (CMP), 2 March 2011
- Carbon Management Plan Update 2012
- Carbon & Water Management Progress Report 2015

Terminology

The standard UK unit for the measurement of greenhouse gas emissions is tCO_2e; tonnes of carbon dioxide equivalent. This converts the various types of greenhouse gas to the equivalent tonnes of carbon dioxide. Throughout this document, tCO_2 is used as shorthand for tCO_2e.

All carbon figures are reported using Defra's 2015 GHG conversion factors.

EXECUTIVE SUMMARY

July 2016 marks the end of our original 5 year carbon reduction target. We have come along way since 2011, delivering an impressive 31% reduction in our carbon emissions compared to a sector average of just 12%[1].

The programme has delivered 58,764 tCO_2 and £14.7 million of cumulative savings for the University, for an investment of £4.1 million.

While a 31% reduction falls a little short of our original 35% target, this was one of the most ambitious targets set through the Carbon Trust's Higher Education Carbon Management Programme, and we already have plans to meet this target during 2016/17.

Our sustainability achievements were recognised with a Highly Commended award for Continuous Improvement in the EAUC's 2015 Green Gown Awards, and we have recently been shortlisted for the 2016 Green Gown Awards 'Facilities & Services' category.

Work in tackling our water consumption is progressing too, but remains a challenging area. We plan to establish new water reduction targets during 2016/17, to compliment the 45% carbon reduction target which has been agreed for our carbon emissions to 2020/21.

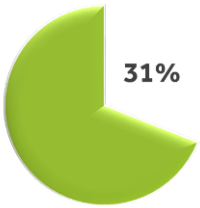
[1] *Source: AUDE 2016 Green Scorecard analysis of 2014/15 HESA Estates Management Records, criteria E12CET. HESA data available at:* *https://www.hesa.ac.uk/index.php?option=com_studrec&task=show_file&mnl=14042&href=Default.html#onward*

INTRODUCTION

Welcome to our annual carbon and water progress report. The following pages describe how we have done against our target of reducing the University's carbon emissions by 35% by July 2016, and reducing water consumption by 10%.

The report also outlines our key plans and targets for 2016/17. We will shortly be publishing our next 5 year carbon management plan for delivery of a 45% carbon emissions reduction by July 2021.

CARBON EMISSIONS UPDATE



We have delivered carbon emission reductions of 31% against our 2008/09 baseline compared to a sector average of just 12%[1]. This sector leading performance is a little short of our ambitious 35% target for July 2016, but we do expect to meet this target during 2016/17. In the meantime, we explore below both some of the key reasons for our success, as well as for falling slightly short of our ambitious target.

Since our carbon management programme began, we have emitted 58,764 tCO_2 less than our business as usual projection. This is equivalent to 12,980 UK households for a year[2].

As with previous years, our performance is weather adjusted to remove the impact of seasonal differences in weather on heating, using weather data from our own Meteorology department's weather station.

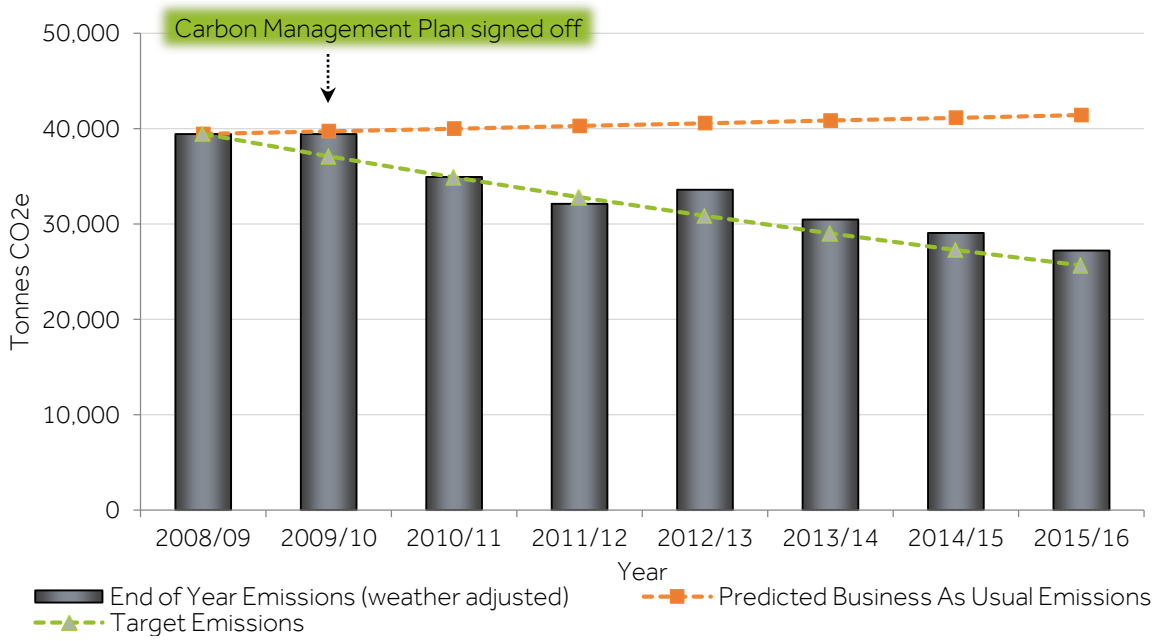


Figure 1: Carbon progress against target to 2015/16

[1] *Source: AUDE 2016 Green Scorecard analysis of 2014/15 HESA Estates Management Records, criteria E12CET. HESA data available at:* https://www.hesa.ac.uk/index.php?option=com_studrec&task=show_file&mnl=14042&href=Default.html#onward

[2] *Source: United Kingdom housing energy fact file 2013: tables, Table 5i – CO2 emissions per HH, available at:* https://www.gov.uk/government/statistics/united-kingdom-housing-energy-fact-file-2013

Emissions from building energy use, waste, and business travel have continued to fall this year, leading to an overall reduction of 6.4% compared with 2014/15. Figure 2 shows the breakdown of emissions by source, and further details about changes over time are shown in Appendix 1.

Consumption of natural gas has increased by 25% compared with last year, offset by a corresponding reduction in electricity from the National Grid. This is due to the gas used in our new Energy Centre's combined heat and power (CHP) engine to generate low carbon electricity. The net carbon impact of gas and electricity together is a reduction of 4.4%.

Water consumption has increased slightly since last year, and this is discussed further in the **Water consumption update** section.

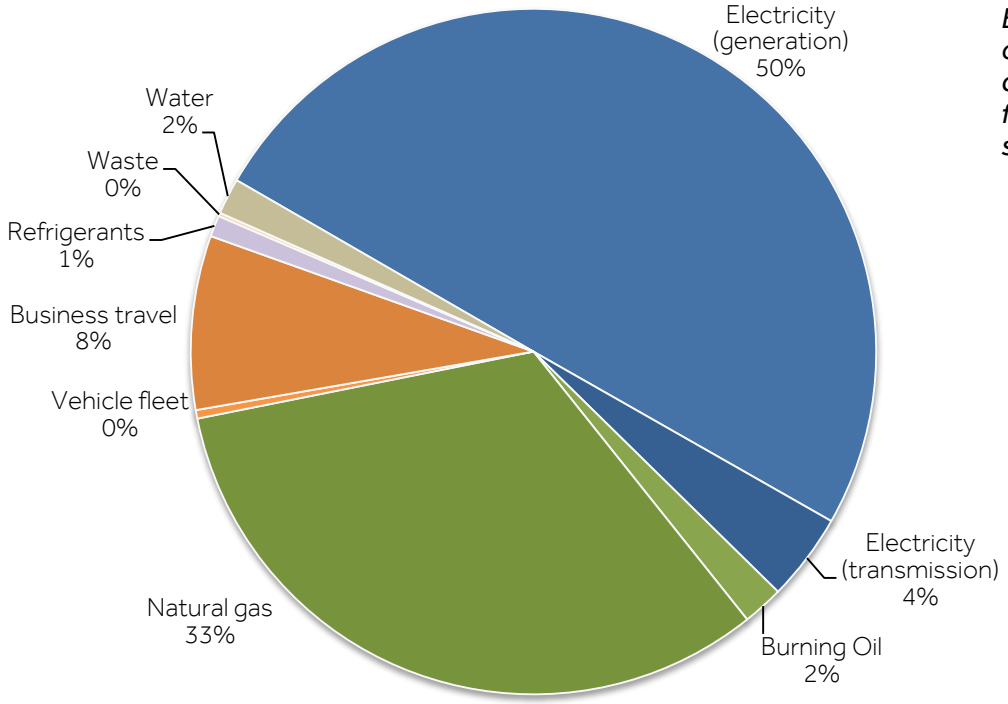


Figure 2: Breakdown of 2015/16 carbon footprint by source

In November 2015, we were proud to receive a Highly Commended award for Continuous Improvement in the EAUC's Green Gown Awards, recognising our sustainability achievements over a prolonged 5 year period.

Key issues for 2015/16 delivery

The following challenges have impacted even further progress during the year:

- Solar panel scheme (1.3% baseline reduction) dropped due to cuts to Government feed-in-tariffs
- Progress with resolving long running gas meter issue with suppliers identified our gas consumption was higher than previously understood (1.3% impact against baseline)
- HVAC recommissioning programme delivered over a longer period than anticipated, meaning in-year savings were reduced
- Funding was reduced by £100,000 (circa 0.2% impact against baseline)

KEY PROGRAMME ACHIEVEMENTS

The later section Carbon & water projects 2015/16 explores the key deliverables in the last year which have contributed to our ongoing carbon reductions.

Looking at the entire carbon management programme since its inception, the following points can be identified as key to our success:

- Consistently committed senior leadership
- Increasing localised as well as centralised action
- Regular progress reporting, including on carbon performance, financial investments and associated returns
- An evolving programme with regular annual reviews rather than a static list of projects
- Close monitoring of and planning for key estate and business strategy changes to anticipate impacts on the programme
- A combination of internal and external funding streams; with 40% coming from external sources
- A strong energy management system, certified to ISO50001
- A committed, enthusiastic and persistent team!

SALIX
SOLVING ENERGY EFFICIENCY FINANCE IN THE PUBLIC SECTOR

CERTIFIED
LUCIDEON
MANAGEMENT SYSTEM
ISO 50001
UKAS
MANAGEMENT
SYSTEMS
0006

HOW WE'VE DONE IT

In 2008/09 the University's carbon footprint was nearly **39,500 tonnes of CO_2**. Over the past five years we have been working to reduce this and have become one of the leading universities in the country for managing our environmental impacts.

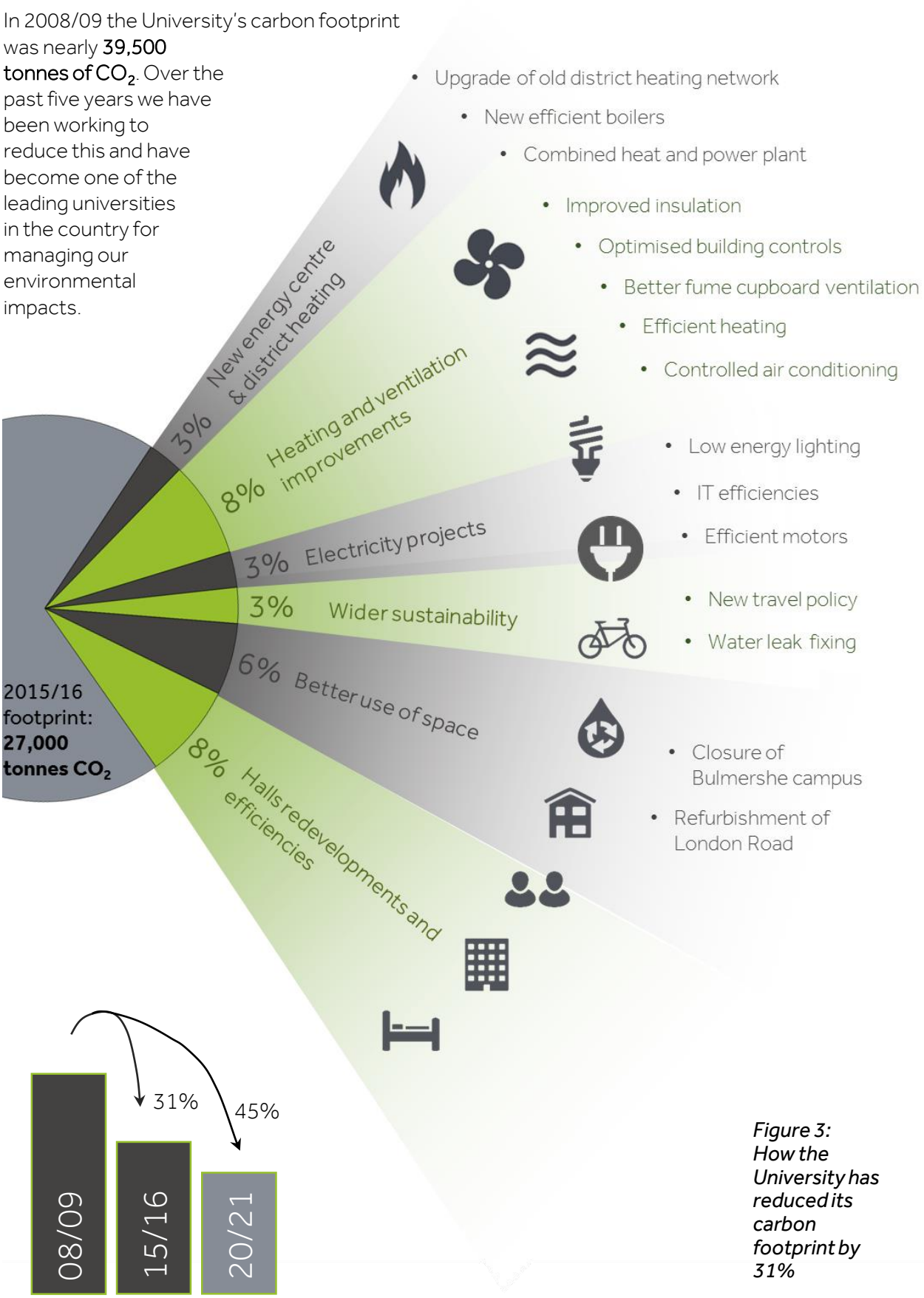


Figure 3: How the University has reduced its carbon footprint by 31%

WATER CONSUMPTION UPDATE

It has been another mixed year for water consumption. Fixing a major underground leak at the Henley Business School Greenlands campus has delivered the targeted savings of 20,000 m^3 and is the main contributor to a 9.3% annual reduction in non-halls water consumption.

Unfortunately this has been offset by an 18.4% year-on-year rise in water consumption at the halls. While some further leaks (now fixed) explain part of this rise, our partners at UPP are working actively to understand the reasons for this and the actions needed to tackle rising consumption.

Water consumption in our non-halls estate is now 26% lower than our 2011/12 baseline, however the rising consumption in our halls means total water consumption has risen by 1.5% from 2014/15, and is 9.1% above our 2011/12 baseline.

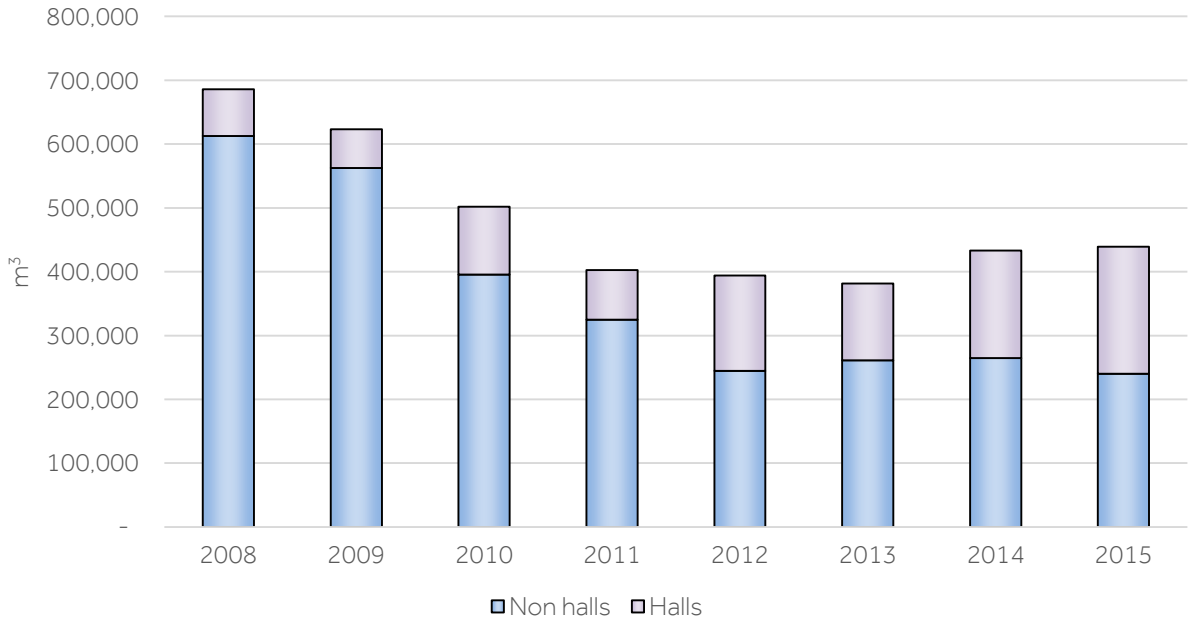


Figure 4: Annual water consumption split by halls and the rest of the estate

Through the year, a major review of water consumption on Whiteknights campus has taken place, looking to identify any unusual water consumption patterns and opportunities for water reduction. This work is ongoing, but once complete, we will be reviewing the current 10% water reduction target. Revised targets will take account of planned changes in the estate and in the student population, and will be backed by a robust action plan for delivery.

INVESTMENTS AND SAVINGS

Our energy and water efficiency investment in 2015/16 totalled £1.04 million, bringing our total since 2011 to £4.1 million. Over the 5 year carbon management programme, direct savings for the University have accumulated to £14.7 million, with a further £4.4 million achieved for and by our partner organisations on the estate. These combined savings of £19.1 million are very close to the original target of £19.6 million of savings from a £4.04 million investment.

Section 7 provides some of the highlights of this year's investments, while Appendix 2 provides a full list of investments in 2015/16.

As with previous years, we have been able to use a combination of internal revenue funds and external funding to finance the projects, with £400,000 of funding from HEFCE's Revolving Green Fund 4[3] making a significant contribution to our fume cupboard ventilation project.

This year's investment is slightly below the anticipated £1.2 million, in large part because the fume cupboard work has come in under budget.

[3] The Revolving Green Fund 4, operated by HEFCE (the Higher Education Funding Council for England), provides interest-free loan funding to higher education institutions for energy efficiency investments

CARBON & WATER PROJECTS 2015/16

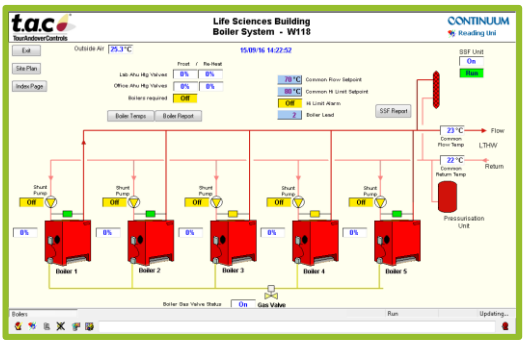
Here is a snapshot of some of the work we've been doing this year. A full list of projects can be seen in Appendix 3.

We reached a major milestone in October 2015 with the completion of our new district heating network, which supplies a total of 16 buildings with heat as well as generating approximately 15% of Whiteknights campus' electricity. In the 9 months to July 2016, the system had delivered 1,152 tCO_2 savings, compared to a target annual saving of 1,200 tCO_2. This performance against target is particularly encouraging as the full system has not yet been operating for 12 months, so we expect these savings to increase.

Our estate-wide fume cupboards energy efficiency upgrade is now almost complete, which by December 2016, is targeted with delivering 600 tCO_2 savings annually. The work has been carried out in tranches, the largest of which took place from April to June in the Chemistry Research Wing. Final works are due to complete in September. In the Chemistry Research Wing we have measured consistent electricity savings since the labs re-opened equivalent to 207 tCO_2 if sustained over a full year, 27% higher than the targeted savings.

Staying with the science buildings, we invested £49,476 in replacing 4 compressors in Chemistry and Food Biosciences with efficient, variable speed equivalents. This is delivering annual savings of 66 tCO_2, a little below the original target savings of 72 tCO_2 but still delivering a payback on investment of just 3.7 years.

Another major project for 2015/16 has been improving the controls of our heating, ventilation and air conditioning (HVAC) systems, installing modern controllers and optimising them for the current building uses. This project has taken longer to implement than originally anticipated, and we are not yet in a position to compare how close the project has got to the targeted annual savings of 898 tCO_2. However, early measurements indicate savings of 12% across eight of the buildings, a strong start. Further measurement of the project's outcomes will be a key focus during the start of the 2016/17 heating season.



We completed a water efficiency review for the Whiteknights campus, analysing the water consumption of each building and identifying a number of areas for potential improvement or further investigation. This will now be turned into an action plan for 2016/17, which will be used to support the setting of a new water reduction target.

Our Carbon Countdown behaviour change ran throughout the year, with a number of high-profile events including the 2 popular 'Blackout' switch off events and a 'How Low Can You Go?' competition rewarding the best energy savings over the Christmas shutdown. Savings from this programme have been hard to measure as it is so wrapped up with the day-to-day operation of the University. It has also partially been superseded by the roll out of PC power management software to a further 864 PCs, delivering 25 tCO_2 and £6,100 annual savings.

HIGHLIGHTS AND TARGETS FOR 2016/17

We will be monitoring some of the key projects completed during 2015/16 to ensure they are delivering the expected large energy savings. In particular, the fume cupboard efficiency project, and the improvements to heating, ventilation and air conditioning controls are targeted to deliver 600 tCO_2 and 898 tCO_2 annual savings respectively.

We will continue to focus on improving the controls of heating, ventilation and air conditioning systems during 2016/17, with a further £400,000 earmarked to deliver savings of 425 tCO_2 annually by July 2018. In a number instances, this includes the connection of air conditioning units to the central building management system (BMS).

We plan to increase the focus on the efficiency of motors and pumps in heating and ventilation systems across the University, as technology improvements in recent years mean efficiency gains can be significant. An initial £40,000 has been earmarked for this work.

Following a review of low carbon heating opportunities across our 3 main campuses, we will be actively exploring opportunities to expand our district heating on the Whiteknights campus. Savings of 200 tCO_2 are targeted from this work, though the timescales need to be carefully considered to fit in with the University's overarching Estates Strategy.

We will be running focussed behaviour change initiatives this year, in particular to better engage building occupants with their energy consumption, as well as looking at energy saving opportunities within science laboratory equipment.

We intend to set a new water reduction target during 2016/17, as well as tackling some priority opportunities which are targeted to save 2,760 m^3 water/annum.

Underpinning this year's programme as a whole will be our overarching aim of meeting our 35% carbon reduction target during the year.

A full list of projects planned for the year can be seen in Appendix 4.

2016 DISPLAY ENERGY CERTIFICATES

B 26-50

JJ Thomson ⇧	Business School Offices ⇧	L004 & L011
Engineering ⇧	Henley Business School	L022
Miller ⇧	Foxhill House	L033

C 51-75

Systems Eng ⇧	Russell	L045 Great Hall
Agriculture ⇧	URS MERL	Whiteknights House
Minghella ⇧	Cedars Hotel	Park Eat
Library ⇧	Carrington	Allen Laboratory ⇩
Palmer	SportsPark	Wager ⇩

D 76-100

Park House ⇧	Estates & Facilities
TOB2 ⇧	River House, Greenlands
AMS	HumSS ⇩
Students' Union	TOB1 ⇩

E 101-125

Hopkins ⇧	Main House, Greenlands
Knight	Paddock House, Greenlands
Harry Pitt, Meteorology & Psychology	L014

F 126-150

Maths & IT ⇧
Food Biosciences ⇧
ICMA ⇧

G Over 150

Chemistry
Eat at the Square
Harborne ⇩
Philip Lyle ⇩

Fourteen buildings DEC ratings have improved since last year, and seven have declined. Figure 5 shows that this is consistent with a general trend of improvement since 2012.

Due to the rollout of building level metering in 2014, the data used to produce our DECs is improving. This year only five buildings on Whiteknights campus use estimated electricity consumption, compared with fourteen last year.

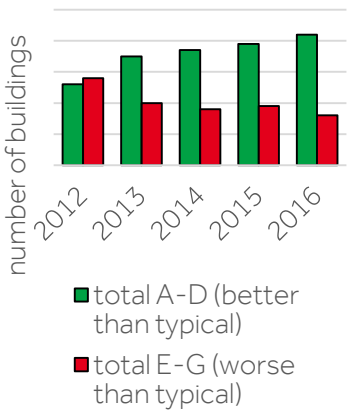


Figure 5: Change in DEC ratings over time

⇧ Rating improved since last year
⇩ Rating declined since last year

APPENDIX 1
Emissions breakdown compared with baseline and last year (tCO_2)

Emissions Source	2008-09	2014-15	2015-16	% change since last year	% change since baseline
Electricity (generation)	19,126	16,146	13,569	16 % ⇩	29 % ⇩
Electricity (transmission)	1,487	1,412	1,120	21 % ⇩	25 % ⇩
Burning Oil*	1,544	514	524	2 % ⇧	66 % ⇩
Natural gas*	12,937	7,073	8,860	25 % ⇧	32 % ⇩
Vehicle fleet	138	363	109	70 % ⇩	21 % ⇩
Business travel	2,855	2,557	2,231	13 % ⇩	22 % ⇩
Refrigerants	207	467	272	42 % ⇩	31 % ⇧
Waste	426	76	44	42 % ⇩	90 % ⇩
Water	713	456	462	1 % ⇧	35 % ⇩
Total	**39,434**	**29,064**	**27,191**	**6.4 % ⇩**	**31.0 % ⇩**

*Emissions for gas and oil have been degree day adjusted to enable comparison across different financial years

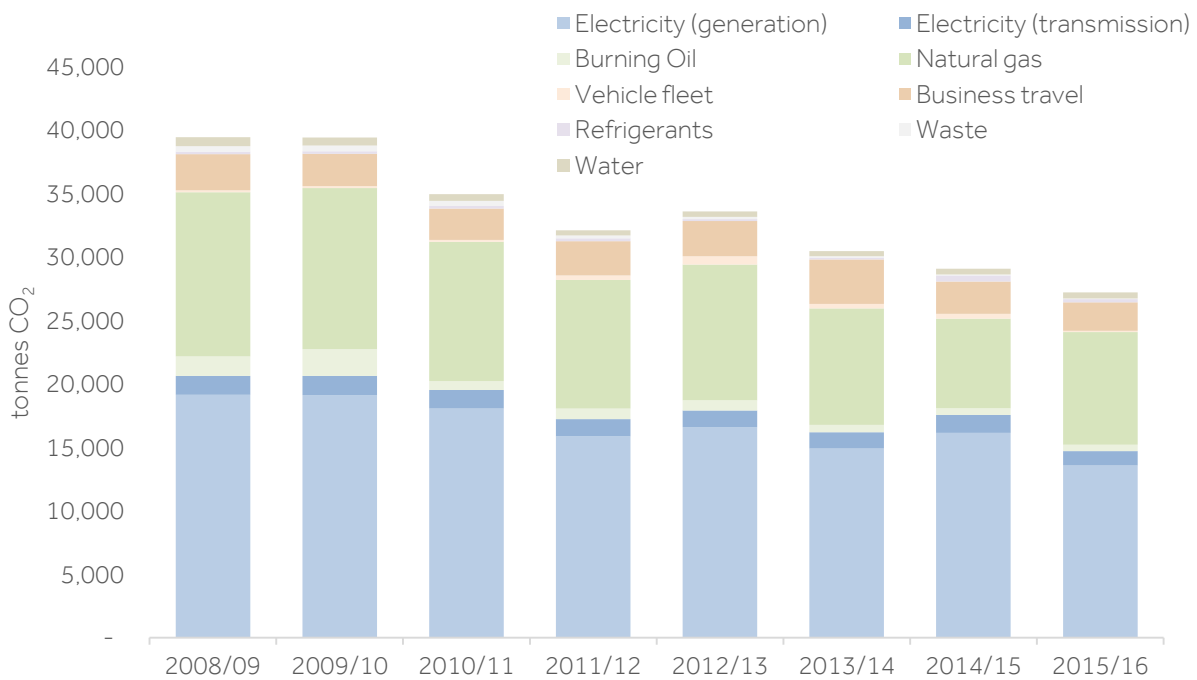


Figure 6: Carbon emissions by source since 2008/09

APPENDIX 2
Additional out of scope emissions (tCO_2)

Emissions Source	2011-12	2012-13	2013-14	2014-15	2015-16	% change since last year
Employee Commuting	2,137	2,098	2,293	2,293	2,194	4% ⇩
Student Commuting	2,202	2,145	2,446	2,446	2,133	13% ⇩
Procurement	26,682	28,765	47,721	57,257	30,654	46% ⇩
Air travel radiative forcing	-	-	2,069	2,059	1,488	28% ⇩
Total:	**31,022**	**33,008**	**54,529**	**64,055**	**36,469**	43% ⇩

Employee and student commuting figures are based on Travel Survey data completed every 2 years.

Defra now recommends that the additional radiative forcing impacts of air travel should be reported upon, however these are not available before 2013 and therefore are not considered in scope.

APPENDIX 3:

Completed carbon and water projects 2015/16

Project Ref	Project description	Building(s)	Est CO_2 savings	Cost inc VAT	Notes
UoR043	**Fume cupboard efficiency improvements**	Multiple Chemistry, Food Bioscience, Hopkins, Russell, Harborne, Lyle, Wager, Allen & AMS	600	£609,966	Continuation of 2014/15 programme
UoR042	**CHP/District Heating Energy Centre phase 2**	Multiple	1200		*Capital programme costs*
n/a	**DHS/CHP efficiency monitoring**	Multiple	n/a		*Monitoring work*
UoR108	**A/C upgrades following investment-grade surveys - Inc** connection of systems to BMS that are not currently centrally monitored/controlled	15 buildings	n/a	£11,760	*Survey work only*
UoR108	**A/C insulation** upgrades	15 buildings	6	£31,472	
UoR109	**Re-commissioning of HVAC systems** Review set up of all systems to ensure appropriate for current use of building	Multiple Review of control settings across 17 prioritised Whiteknights buildings	898	£158,641	*Savings to be realised during 2016/17*
UoR109b	**Re-commissioning of further HVAC systems - Tranche 2** Rollout programme across estate, ensuring controls appropriate for current use of building	Maths, Eat @ the Square, Palmer, Whiteknights House, Henley Business School, Cedars Hotel, Archaeology, Foxhill House, Carrington, Minghella, MERL, STC, Ent Centre, Greenlands, London Rd	n/a	£18,781	*Survey work only*
UoR111	**BMS optimisation & control improvements** Self-optimisation inc occupancy sensors and fine tuning of Hopkins HVAC controls	Chemistry, Food Bio, Hopkins	82	£31,893	
UoR111	**Compressed air inverters & ducting**	Chemistry	66	£49,476	
UoR122	**Estate-wide heating strategy** Study of heating solutions across Whiteknights, London Rd, Greenlands	Whiteknights, London Rd, Greenlands	n/a	£35,994	*Survey work only*
UoR123	**Water efficiency study**		n/a	£	- *Survey work only*
UoR054a	**Electrical Sub-metering** For individual distribution boards	Food Bioscience	0	£19,769	

Project Ref	Project description	Building(s)	Est CO_2 savings	Cost inc VAT	Notes
UoR028a	**Carbon Countdown campaign - yr 2** Campus wide behavioural change campaign plus quick win fixes	Multiple	100	£17,055	
UoR028	**Behaviour change 2015** Inc Green Impact, Green Week, eLearning, Roadshows, Comms	Multiple	50	£12,500	
UoR024	**PC Power Management**	Multiple	25	£	-
TBC	**Low cost/re-active in-year opportunites for efficiency improvements**	Multiple	2	£3,564	
TBC	**RUSU Lighting** Replaced CFLs	Student's Union	5	£5,598	
UoR124	**Room controllers & CO2 sensors**	Minghella	7	£8,602	
UoR101	**-80C freezer replacement**	Food Bioscience	4	£2,000	*Contribution to School purchases*
TBC	**Chiller pumps**	Food Bioscience	-	£8,248	*3,100 m3 water saving/annum*
TBC	**BMS enhancement** enable boiler setpoint reductions as VT circuit temps reduce	Multiple	-	£1,440	
UoR125	**Nursery BMS connections** AC & door heater	RUSU Nursery	2	£4,135	
TBC	**Whiteknights House Hand Dryers**	Whiteknights House	2	£5,809	
TBC	JJ Thomson refenestration	JJ Thomson			*Maintenance project*
			3,049	£1,036,703	

APPENDIX 4:

Planned carbon and water projects 2016/17

Project Ref	Project description	Building(s)	Est CO_2 savings	Approx 2016/17 spend inc VAT	Notes
UoR43b	**Fume Cupboard Estate-wide efficiency upgrade**	Food Biosciences	-	£25,000	Completion of previous works
UoR109	**ICMA window natural ventilation control improvements**	ICMA	50	£50,000	
UoR109	**Re-commissioning of heating, ventilation and Air Con (HVAC) systems - phase 2**	Maths, Eat @ the Square, Whiteknights House, Henley Business School, Cedars Hotel, Archaeology, Foxhill House, Carrington, Minghella, MERL, STC, Ent Centre, Palmer, Greenlands, London Rd	200	£160,000	
UoR109c	**Continuous commissioning system**	Multiple	25	£40,000	Software solution
UoR108	**Air Conditioning control upgrades**	Multiple, based on estate-wide review	150	£150,000	
UoR123	**Water efficiency implementation**	Multiple across Whiteknights, based on estate-wide review	0	£150,000	
TBC	**Energy efficient pumps on heating systems**	Multiple	30	£40,000	
UoR70b	**HumSS Van Emden refurb** - Roof Insulation and double-glazing	HumSS	16	£26,500	Contribution to capital project

Project Ref	Project description	Building(s)	Est CO_2 savings	Approx 2016/17 spend inc VAT	Notes
UoR122	**Low carbon heat** - full feasibilities/enabling works	Chemistry research, Hopkins, RUSU, Park House, Cedars Hotel, Eat @ the Square, Greenlands Main House	0	£50,000	Design work
UoR35d	**Lighting upgrades**	HumSS and others TBC	20	£55,000	
UoR054a	**Sub-metering rollout**	Food Bio, JJ Thomson, Glasshouses and others TBC	0	£100,000	
UoR054b	**Additional Energy Centre meters**	Energy Centre	0	£5,000	
UoR44c	**Solar PV**	Thames Court Windrush	7	£30,000	
UoR127	**Lab equipment upgrades**	Chemistry, Hopkins, Food Bioscience, Knight, Harborne, Lyle, Wager, Russell. JJ Thomson	40	£50,000	
UoR128	**Peak Demand reduction** opportunities study	Whiteknights, London Rd, Greenlands, Cedar Farm	0	£20,000	Market study
TBC	**IT** energy efficiency feasibility study	Whiteknights, London Rd, Greenlands	0	£20,000	Feasibility study
			Total:	**£1,021,500**	