CARBON MANAGEMENT STRATEGY

AND

IMPLEMENTATION PLAN

2011 - 2020

Recommended by Estates Committee:	March 2011
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Contents

Executive Summary

In response to Government requirements, HEFCE has announced that, from 2011, capital allocations will be linked to carbon reductions. All HEIs in England must confirm by 31 March 2011 that they have developed Carbon Management Plans. This document is an updated and improved version of Roehampton University's first Carbon Management Plan (March 2008), in line with HEFCE's requirements.

The purpose of this plan is to set an ambitious, but achievable, 40% carbon reduction target for 2020 against our 2005/06 baseline for scope 1 and 2 emissions. This target means that, Roehampton University's scope 1 and 2 annual carbon footprint, calculated to be 6718 tonnes of CO_2 in 2005/06 and 7963 tonnes of CO_2 in 2009/10, needs to be reduced to 4031 tonnes of CO_2 by 2020. This is in effect a 50% reduction against 2009/10.

Roehampton University has made a good start achieving its 2020 target: in the last two years, nearly £750,000 has been invested in a range of projects providing energy savings in excess of 2000 MWh. This is equivalent to c. £200,000 or c. 900 TCO_2 being saved every year and represents 23% of our target for CO_2 reduction.

Since 81% of our 2009/10 carbon footprint was due to our use of energy, this plan focuses on reducing our energy usage. It also indicates how we intend to achieve this target, by implementing a range of carbon savings projects. These include extension of our energy monitoring and building management system, replacement of inefficient equipment such as boilers and lighting, insulation and draught-proofing of buildings, space management and awareness raising for staff and students.

There are many reasons why the University should have a long-term strategy for carbon management: environmental, financial, legislative and moral. Whilst our approach to carbon management will primarily be about carbon reduction, we will also keep in mind the financial risks associated with a 'Business As Usual' scenario.

The University's current utilities bills total around £1.4 million a year and even reached nearly £1.7 million in 2008/09. Some experts predict that energy prices will rise by 10% per year between now and 2015. If these predictions are correct, in 2020 the University would have to 'survive' with a utilities bill of c. £3.5 million, in a 'Business As Usual' scenario, compared to a 'limited' utilities bill of c. £2.7 million if the actions and investments outlined in this Carbon Management Plan were to be implemented.

One of the roles of this plan is to give us an idea of the level of investment needed to reach our carbon emission target, thus allowing us to plan ahead our budgeting and funding. Implementing the carbon reduction measures in this plan is estimated to require a capital investment over a 10 year period of £1.7million. However, savings generated could reach £282,000 per year, at our current energy prices, if all the identified projects are implemented.

At Roehampton University, we strongly believe that reducing carbon emissions is fundamental to the environmental and financial sustainability of the University.

1 Introduction

1.1 Context for the plan

March 2008 saw the launch of Roehampton University's first Carbon Management Plan (CMP) as Roehampton being just one of 15 universities included in Phase 3 of the Carbon Trust's Higher Education Carbon Management Programme. This document is an updated version of the first Carbon Management Plan.

HEFCE (Higher Education Funding Council for England) has announced that, from 2011, capital allocations will be linked to carbon reductions. As part of the second Capital Investment Framework (CIF2), Higher education institutions (HEIs) in England are required to confirm by March 2011 that they have developed individual carbon management plans which meet HEFCE's requirements[1] in including:

a. A carbon management policy or strategy
b. A carbon baseline for 2005[2] that covers all scope 1 and 2 emissions[3]. Institutions are encouraged to measure a baseline for scope 3 emissions and are expected to include these in the longer term.
c. Carbon reduction targets which must: cover scope 1 and 2 emissions; be set against a 2005 baseline; be set to 2020; be publicly available.
d. An implementation plan to achieve absolute carbon emissions reductions across scope 1, 2 and 3 including timescales and resources.
e. Clear responsibilities for carbon management.
f. A commitment to monitor progress towards targets regularly and to report publicly annually.
g. The carbon management plan and targets must be signed off by the governing body.

Roehampton University aims to improve its environmental performance and become a 'greener' university, becoming an exemplar of good practice. One key performance target of the University's Strategic Plan for 2006-2011 is to achieve a 15% energy efficiency gain by the end of 2011 (compared with a 2005 base level).

1.2 Outcomes sought

Introducing measures from this plan should lead to a number of benefits for the University:

- A significant reduction in energy consumption and carbon emissions, with consequent financial savings.
- Improved energy and utilities management and related financial planning to respond more effectively to likely increases in energy costs.
- Better understanding and monitoring of energy consumption and hence more effective identification of energy saving measures.
- Increased staff and student awareness of the importance of environmental issues to enable them to reduce the University's carbon footprint as well as their individual carbon footprints.
- Reputation for being a more sustainable University, enhancing the University's position in the 'Green League Tables' published annually by People and Planet in the THE.
- Compliance with existing and future government requirements to reduce energy consumption and to meet other appropriate guidance and standards.

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[1] See also document HEFCE 2010/01 and HEFCE 2010/02 which can be found on the HEFCE website under publications.
[2] All baselines are measured on an academic year. A 2005 baseline measures emissions from August 2005 to July 2006.
[3] The World Resource Institute developed a classification of emission sources around three 'scopes': 'scope 1' emissions are direct emissions that occur from sources owned or controlled by the organisation (for example emissions from combustion in owned or controlled boilers / vehicles) ; 'scope 2' accounts for emissions from the generation of purchased electricity consumed by the organisation; 'scope 3' covers all other indirect emissions which are a consequence of the activities of the organisation, but occur from sources not owned or controlled by the organisation (for example, staff and students commuting, air and land-based business travel, water, waste and procurement). This approach has been widely adopted, including by the UK government.

1.3 Drivers

There are many reasons, including environmental, financial, legislative and moral, why the University should have a long-term strategy for carbon management.

Driver	Risks and opportunities
Economic	
Energy prices	The University's current utilities (electricity, gas and water) bill is around £1.4 million a year and has even reached nearly £1.7 million in 2008/09 when the University had to renew its energy contracts while energy prices were at a peak. Experts expect energy prices to rise by 10% per year between now and 2015. Introducing energy efficiency measures and reducing carbon emissions will provide cost saving opportunities.
Political	
UK Central Government	The Climate Change Act 2008 commits the UK to reducing its CO2 emissions by at least 34% by 2020 and 80% by 2050, against a 1990 baseline. The UK is the first country to put legally binding carbon emission reduction targets in place. The Higher Education sector has already been asked by the government via HEFCE to play its part in meeting targets for carbon emissions reductions in line with UK targets. Aligning the University to this commitment could also help to attract collaborative opportunities and third stream funding. The UK Government has chosen to raise duty on fuels in response to the UK Budget Deficit, and it is likely that there is significant potential for further increases.
HEFCE	In the 2008 and 2009 grant letters from the Secretary of State for Innovation, Universities and Skills to HEFCE it states that, from 2011, capital allocations will be linked to carbon reductions. As part of CIF2, HEIs in England are required to confirm by March 2011 that they have developed individual carbon management plans which meet HEFCE's requirements. The education sector level target, against a 2005 baseline, is set at a reduction in scope 1 and 2 carbon emissions of 43% by 2020.
Legislative	
Carbon Reduction Commitment Energy Efficiency Scheme (CRC EES or "CRC")	In April 2012, the University, as every UK organisations using more than 6,000MWh of electricity in 2008 from Half-Hourly meters, will be required to purchase CO2 allowances at a starting price of £12/TCO2. The University is expected to pay around £100,000 to surrender carbon emissions in April 2012 and will be ranked on its performance in a league table. Since the start of the scheme in April 2010, the University has already to monitor accurately its carbon emissions to notably produce an annual carbon footprint report. The CRC has been introduced by the government as a strong incentive to reduce emissions and a key strategy to meet challenging targets. However, changes have been made since the Government's Spending Review in October 2010 and this is currently under consultation. More information can be found on the Environment Agency website and the DECC website.
The EU Energy Performance of Buildings Directives	This Directive requires all buildings to have an energy rating certificate since 2009. The poor performance of buildings is now made public. On 18 May 2010 a recast of the 2002 Directive (updated in 2006) was adopted.
Part J (Ventilation), F (Heat producing appliances) and L (Conservation of fuel and power) of the Building Regulations	These Regulations, in particular part L (October 2010), are designed to reduce energy consumption in new and existing buildings. To achieve this, good building design focussing on thermal properties is needed. This requires forward thinking for long term energy saving as opposed to short term initial capital cost saving. These Regulations can be found on the Planning Portal.

Press and Publicity	
	Carbon dioxide emissions and global warming are now frequently making headline news. Young people are increasingly concerned about environmental issues and hence may partly base their selection of university on the perceived relative environmental performance of institutions. For example, national 'Green University League Tables', published annually in the THES, and local press articles may influence student choices.
University Commitments	
Campus Strategy	Management have committed to reducing the University's energy consumption and to assessing the carbon footprint to benchmark future actions.
Strategic Plan	Sets a key performance target to achieve a 15% energy efficiency gain by the end of 2011 compared with 2005 levels.
Operational	Provision of a more comfortable and healthy learning environment by optimising heating, lighting and ventilation.

In November 2007, the WWF (Worldwide Fund for Nature), RSPB (Royal Society for the Protection of Birds) and IPPR (Institute for Public Policy Research) published 'The 80% Challenge – Delivering a low-carbon UK' which concludes that it is feasible to reduce the UK's emissions by 80% by 2050, and at costs that are not prohibitive.

Lord Stern's review of climate change in 2006 concluded that the benefits of strong and early action will far outweigh the economic costs of not acting.

2 Carbon Management Strategy

2.1 Vision and Objectives

We strongly believe that reducing carbon emissions is fundamental to the financial and environmental sustainability of the University.

Our aim is to actively manage the University's energy use and to reduce carbon emissions through greater staff and student awareness, more efficient infrastructure and operations and the use of renewable energies in the years to come.

This will be facilitated by the implementation of a number of projects and policies including this Carbon Management Plan, the University Energy Policy as well as our first Travel Plan.

2.2 Target

Our target is to **reduce scope 1 and 2 CO_2 emissions of 40% by 2020**, compared with our **2005/06 baseline**.

At Roehampton University (RU), **Scope 1 emissions** correspond to emissions resulting from our use of **natural gas** (heating, hot water, catering), diesel and petrol (vehicles owned by Roehampton such as post room vans, security and maintenance vehicles, inter-campus mini-bus).

Scope 2 emissions correspond to emissions resulting from our use of **purchased grid-electricity**. We do not produce yet electricity on-site (CHP, solar photovoltaic, wind turbine...).
However, as per our current electricity contract for Half-Hourly meters with Southern Electric (SE) (01/11/09 to 01/11/11) we have a 'green tariff' which guarantees that 50% of the electricity we purchase to SE is coming from renewable sources.

Since Scope 1 and 2 carbon emissions are likely to represent the vast majority of our total carbon footprint, and since it has not yet been possible to determine 'accurately' and all Scope 3 baselines, it has been decided that our 2020 target will be set against Scope 1 and 2. Our Action Plan will however identify opportunities for reduction that fall in Scope 3.

Setting targets is essential to identify the size of the challenge, coordinate efforts and demonstrate commitment to meaningful change. However, targets alone do not achieve results. They need to be supported by a strategy so that the methods by which the targets are to be achieved can be agreed and the necessary actions and investment put in place.

2.3 Strategy

The intention of our strategy is to focus efforts in areas that offer the greatest carbon reduction return and identify issues that need further action.

The following priorities and principles will be adopted to help Roehampton University achieve the aforementioned vision and targets:

- To develop and implement this University Carbon Management Plan ;
- To continue to seek funding or interest-free loans, such as the Salix loans, to help with the upfront cost to enable energy-saving projects to be implemented ;
- To continue to allocate specific budget for projects that will lead to more efficient energy consumption and reduce carbon emissions ;
- To continue to invest money saved by implementing energy saving projects in new carbon reduction projects, as we already do via our Salix Revolving Green Fund ;

- To continue to focus on emissions from buildings that are associated with space heating, domestic hot water (DHW), lighting and ICT, which account for the vast majority of the University's carbon footprint ;
- Our primary focus will be on reducing our electricity usage due to the higher associated carbon emissions and costs, which will be advantageous in terms of the Carbon Reduction Commitment.
- To continue to facilitate carbon emissions reduction by developing clear energy / project / financial management responsibilities and systems within the Property and Facilities Management Department (P&FM) ;
- To continue our programme to install new electricity and gas sub-meters which will enable more accurate measurement and monitoring of our energy use, and hence facilitate the assessment of the effectiveness of introduced energy saving projects ;
- To enhance the effectiveness of our existing Building Management Systems (BMS) in term of energy management, and to introduce new BMS systems as appropriate ;
- To continue to improve space management and encourage new ways of working (such as videoconferencing) ;
- To report annually on our progress against energy and carbon management targets with a view to brief reporting alongside other significant environmental issues in the University's Annual Report ;
- To continue to raise staff and student awareness of the need to conserve energy and reduce carbon dioxide emissions and to encourage their participation in carbon reduction projects, such as Student Switch-Off, RU Unplugged, and via our network of 'Environmental Champions' and offer for environmental training for staff[4].

[4] More information regarding the projects and initiatives conducted by the Environmental team, in partnership with other departments, can be found on our new Environmental Webpages.

3 Usage, expenditure and emissions baselines and progress

Most of these data is derived from nationally published Estates Management Statistics (EMS), submitted to HEFCE via HESA. The University is now investing in Utilities Billing Validation and CRC Software, which will improve the quality, detail and the speed of reporting energy data.[5]

For financial reporting, the University is using its Central Accounting system, Agresso.

The University has now got since December 2010, Automatic Meter Reader (AMR) installed on most of its fiscal gas and electricity meters, reducing a lot the risk of errors in billing and meter reads, and improving the quality of the reporting we can produce regarding energy use, for various periods.

All the carbon emissions factors used are coming from the latest update from the DEFRA's website.

3.1 Scope 1 – Natural Gas

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 1 - Natural Gas						
RU's Natural Gas usage (kWh) (1)	13,837,962	13,946,688	13,930,343	14,359,208	17,515,992	**14,718,039**
Variation compare to 2005/06 baseline		1%	1%	4%	27%	
RU's Natural Gas costs (£) (2)	195,407	271,330	349,175	541,552	443,528	**360,199**
Variation compare to 2005/06 baseline		39%	79%	177%	127%	
Average Natural Gas price calculated (£/kWh)	0.01412	0.01945	0.02507	0.03771	0.02532	**0.02447**
Variation compare to 2005/06 baseline		38%	78%	167%	79%	
CO2 emission factor (kg CO2e per kWh) (3)	0.18523	0.18523	0.18523	0.18523	0.18523	
RU's Natural Gas CO2 footprint (tonnes of CO2e)	**2,563**	**2,583**	**2,580**	**2,660**	**3,244**	**2,726**
Variation compare to 2005/06 baseline		1%	1%	4%	27%	

(1) Source: Estates Management Statistic as per version submitted in Feb. 2010. D38A Energy consumption C1 Total - gas, except 2005/06 where data have been amended as we didn't received any gas bill (but we have been using gas) for the new Whitelands site until November 2006 when the gas meter was finally registered on the market. Data have been amended as follow: 10,336,453 kWh (as originally submitted to HEFCE) + 3,501,509 kWh (as gas usage between actual reads of 03/07/2007 and 02/07/2008 at the Whitelands site) = 13,837,962 kWh.

(2) Source: Estates Management Statistic as per version submitted in Feb. 2010. D31 Energy costs C1 Total - gas, except 2005/06 where data have been amended as we didn't received any gas bill (but we have been using gas) for the new Whitelands site until November 2006 when the gas meter was finally registered on the market. Data have been amended as follow: £145,962 (as originally submitted to HEFCE) + 0.0141211 (as the Average Natural Gas price calculated using consumption and cost data originally submitted to HEFCE) x 3,501,509 kWh (as gas usage between actual reads of 03/07/2007 and 02/07/2008 at the Whitelands site) = £195,407.

(3) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Table 1c Gross CV basis - Total Direct GHG. The Uk greenhouse gas (GHG) emissions factors follows the Intergovernmental Panel on Climate Change (IPCC) methodology and definitions, where, for baselining purposes, all GHGs are converted into carbon dioxide equivalent (CO2e) on the basis of their greenhouse effect potential.

If these statistics are correct, the following observations can be made regarding Roehampton University's (RU) Natural Gas usage (kWh), expenditure (£) and associated carbons emissions (TCO2):

3.1.1 Natural Gas usage

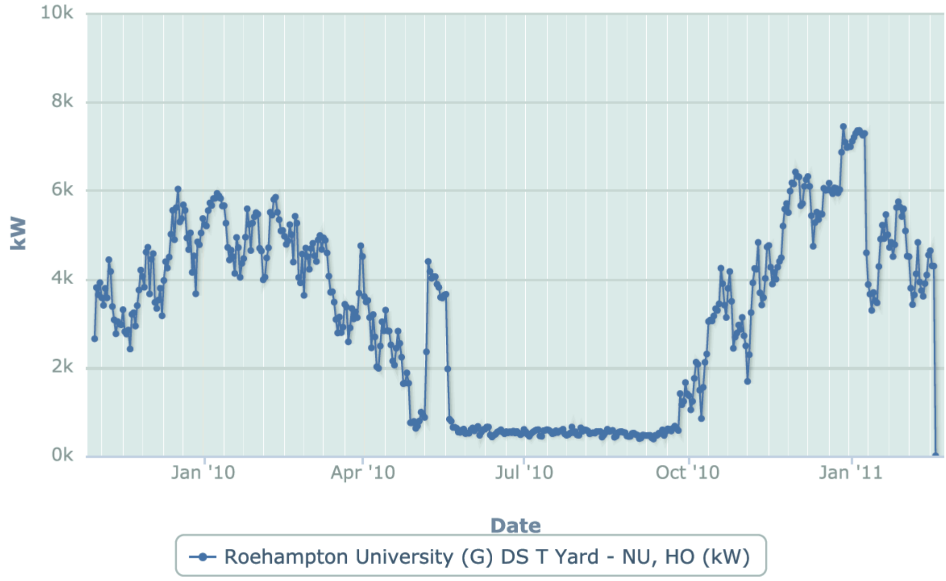
- **RU's annual gas usage** has increased by 27% compared to our 2005/06 baseline to reach circa **17,500 MWh[6] in 2009/10.**
- The **22% increase in our gas usage in 2009/10** was primarily caused by a severe winter, which included significant snow falls.
- The University has in 2009-10 also rented a new residential site, Arton Wilson, which wasn't part of the University previously. Our Duchesne building was built in 2007.
- Some buildings have inadequate insulation, draught proofing, double glazing, especially our historic buildings in the Froebel and Digby Stuart sites. Also, natural ventilation can only be controlled by users therefore it is unsurprising that severe winter weather will contribute greatly to such an increase.

[5] Currently data quality is hampered by the complexity and medium of utilities bills (credits, missing invoices, estimated meters read etc.). Therefore errors or double-accounting in utilities statistics must be born in mind when analysing these statistics.

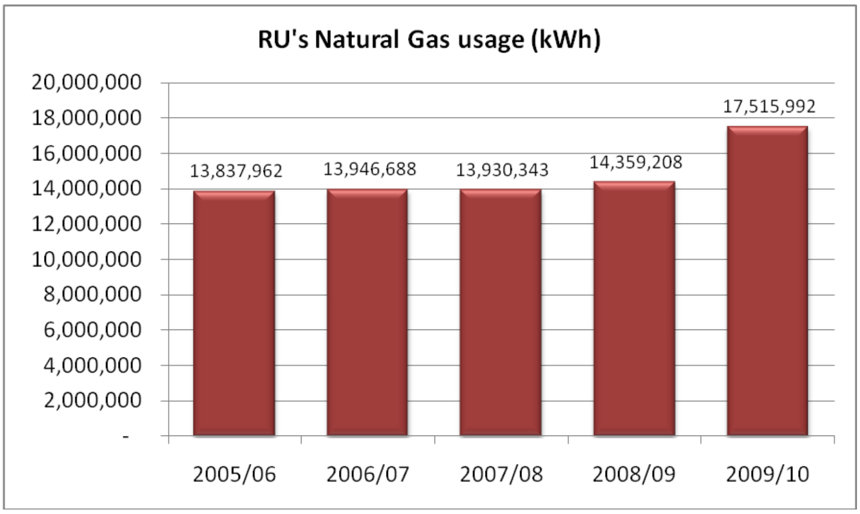
[6] 1 MWh = 1000 kWh.

- RU gas usage is largely due to space heating (probably more than 70% - see chart below). We mainly have 6 residential blocks which are using electrical heaters as the main source to provide space heating. Therefore, any increase in gas usage can largely be attributed to an increase in our space heating usage (severe winter, high internal temperature, lack of heating controls).
- The University has since 2008 replaced 19 ageing boilers in 12 boiler rooms and is continuing its replacement programme with more efficient gas condensing boilers.
- The University has also, thanks to its successful October 2009 application in the Salix Energy Efficiency Loan Scheme 1 (SEELS 1), invested nearly £35,000 to draught proof over 600 windows and doors on a number of selected buildings (Fincham, Howard, Jubilee, Romero Court, Richardson, Grove House). The annual savings have been estimated at 225,000 kWh, which is equivalent to around £7000 per year of savings.

Chart showing our gas usage from one of our 19 gas fiscal meter, since we had our own Smart Metering system installed (November 2009):



We can clearly see that the boilers providing space heating have been turned off on 20 May 2010 and were back on the 27 September 2010. The lower usage during the summer probably corresponds to gas being used by our catering department and for domestic hot water.



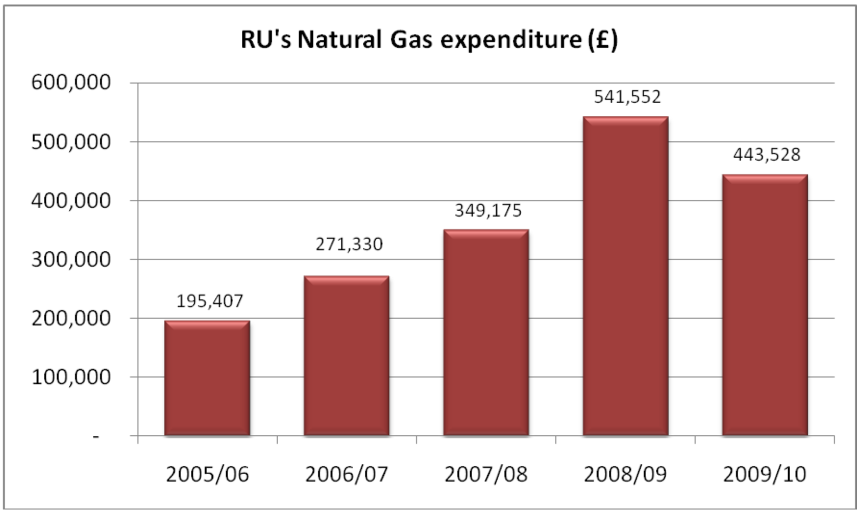
3.1.2 Natural Gas expenditure

- Since 2005, our gas expenditure has increased by 127%. In 2005/06, we were spending annually around £200,000; **'today' we are spending between £450,000 and £550,000**.
- This has been caused by the University taking on the residential costs of Froebel, Digby Stuart and Southlands Colleges following the signing of leases with their providing bodies; in addition to the increase in the price of gas since 2005. The University do not necessary have one price for all its supply points (especially when the University was composed of 4 colleges), but as an example, this is how gas prices have been varying at 'Digby Stuart':

	01/02/03	01/02/05	01/08/05	01/08/07	01/08/08	01/08/09	01/08/11
Gas price (p/kWh)	1.0	1.2	2.6	1.9	4.1	2.5	

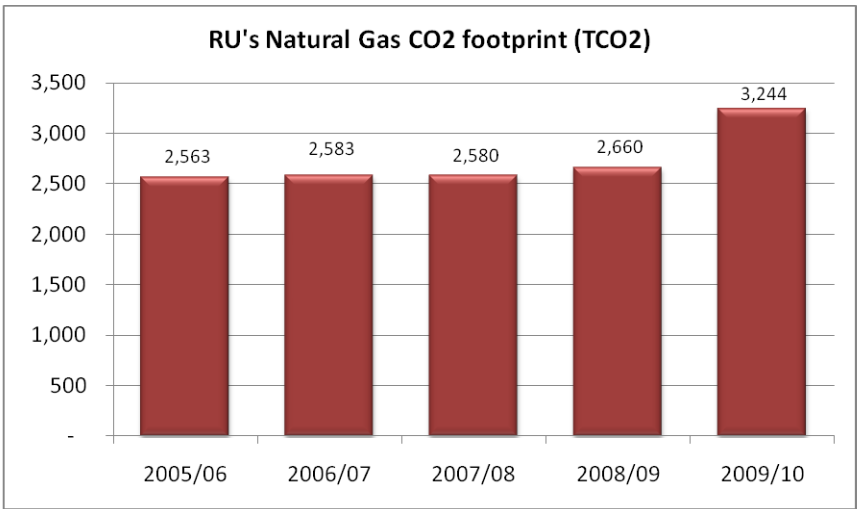
These prices exclude any other charges such as CCL, VAT, standing charges, etc.

- The University was badly affected in 2008, when it had to renew its fixed price fixed term energy contracts (FPFT) at a time when energy prices were at a peak. Along with investments (staff time, capital) in energy savings, the University *must* make budget provision and expect gas prices to steadily increase (up to 10% per year) to reach again 2008 level, between now and 2015. It is interesting to see that, despite our gas usage increasing in 2009/10 compare to 2008/09, this is largely compensated by the unit of gas being cheaper.



3.1.3 Natural Gas carbon emissions

- Due to the increase in our gas usage statistics, carbon emissions related have increased from around 2,500 tonnes of CO2 in 2005/06 to **3,200 tonnes of CO2 in 2009/10**; a 27% increase.



3.2 Scope 1 – Fuel used in RU's own vehicle fleets

UKFuel, our long-term fuel provider, hold a database of our fuel usage (in litres) but it is not currently possible to link consumption to cost centre and cost. In addition, the change to the chart-of-accounts in 2007 makes trend analysis across historical data difficult.

		2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 1 - Fuel used in institutions' own vehicle fleets							
RU's fuel usage (litres) (4)	Diesel	10,666	8,602	6,887	8,894	9,146	**8,839**
	Super Unleaded / Unleaded	365	414	854	339	1,593	**713**
	TOTAL	**11,032**	**9,016**	**7,741**	**9,233**	**10,739**	**9,552**
Variation compare to 2005/06 baseline			-18%	-30%	-16%	-3%	
CO2 emission factor (kg CO2e per litre) (6)	Diesel	2.672	2.672	2.672	2.672	2.672	
	Petrol	2.322	2.322	2.322	2.322	2.322	
RU's vehicle fleet CO2 footprint (tonnes of CO2e)	Diesel	28.5	23.0	18.4	23.8	24.4	**24**
	Petrol	0.8	1.0	2.0	0.8	3.7	**2**
RU's vehicle fleet CO2 footprint (tonnes of CO2e)		**29**	**24**	**20**	**25**	**28**	**25**
Variation compare to 2005/06 baseline			-18%	-31%	-16%	-4%	

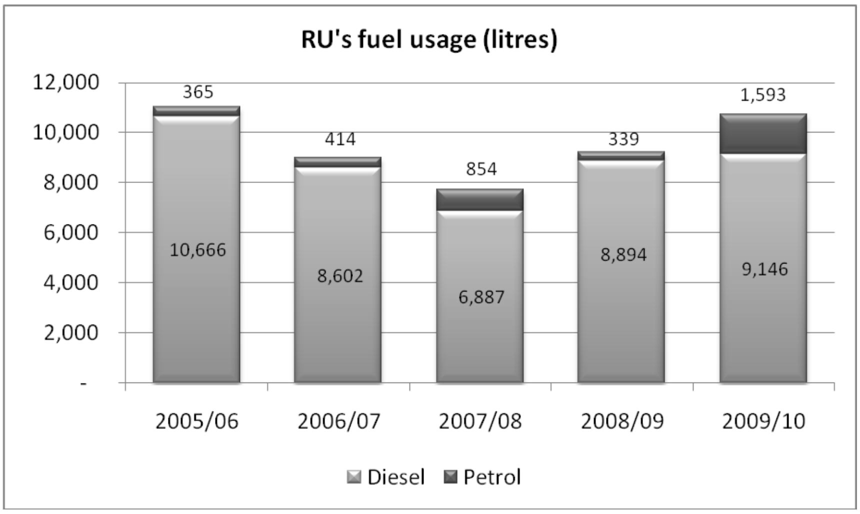
(4) Source: UK Fuel transaction report run by Manon Morel on 26/07/10 via http://www.webfuels.com. Report covers all "Diesel", "Super Unleaded", "Unleaded" transaction under Roehampton University account number 44036 made between 01/08/2005 and 26/07/2010. Vehicle registration numbers have not been verified and are assumed to be part of Roehampton University's vehicle fleet at the time.

(6) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Table 1b - Total Direct GHG

The following observations can be made regarding Roehampton University's (RU) Fuel used in its vehicle fleet (litres) and the associated carbons emissions (TCO2):

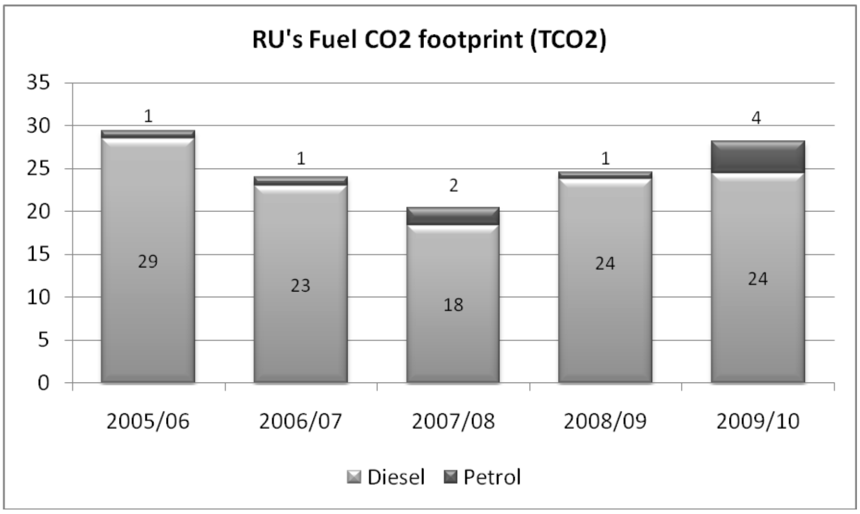
3.2.1 Fuel used in our vehicle fleet usage

- RU's fuel usage (petrol and diesel) has decreased by 3% compared to our 2005/06 baseline.
- Our **fuel consumption fluctuates between 7,700 and 11,000 litres per year**.
- Diesel represents now 85% of our fuel usage and it seems that we have recently started to use more petrol and fewer diesel. CO2 emissions associated to the use of diesel are higher.
- The mid-long term future is to reduce our oil-based fuel usage through changing our fleet to hydrogen or electric powered cars (mixed fuel cars). Our Catering department is already using one electric powered car, and the Maintenance and Portering teams have an electric buggy each.
- Our fuel usage is however quite insignificant, compare to our gas or electricity usage, and limited to 13 vehicles for our post, porters, maintenance, security department and our mini-bus service.



3.2.2 Fuel used in our vehicle fleet carbon emissions

- RU's carbon emissions related to our fuel usage (petrol and diesel) for our vehicle fleet has decreased by 4% compared to our 2005/06 baseline.
- Our **fuel carbon footprint fluctuates between 20 and 29 tonnes of CO2 per year**.
- This decrease is due to a decrease in our fuel usage, as well as, slightly influenced by a bigger proportion of petrol used; petrol having a carbon conversion factor per litre slightly lower than diesel.



3.3 Scope 2 – Electricity purchased

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 2 - Electricity						
RU's Electricity usage (kWh) (7)	7,652,768	7,591,720	8,171,547	9,147,795	8,601,806	**8,233,127**
Variation compare to 2005/06 baseline		-1%	7%	20%	12%	
RU's Electricity costs (£) (8)	400,371	354,501	594,033	996,838	864,265	**642,002**
Variation compare to 2005/06 baseline		-11%	48%	149%	116%	
Average Electricity price calculated (£/kWh)	0.05232	0.04670	0.07270	0.10897	0.10047	**0.07798**
Variation compare to 2005/06 baseline		-11%	39%	108%	92%	
CO2 emission factor (kg CO2e per kWh) (9)	0.53909	0.54291	0.54516	0.54522	0.54522	
RU's Electricity CO2 footprint (tonnes of CO2e)	**4,125**	**4,122**	**4,455**	**4,988**	**4,690**	**4,476**
Variation compare to 2005/06 baseline		-0.1%	8%	21%	14%	

(7) Source: Estates Management Statistic as per version submitted in Feb. 2010. D38A Energy consumption C1 Total - electricity.

(8) Source: Estates Management Statistic as per version submitted in Feb. 2010. D31 Energy costs C1 Total - electricity.

(9) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Table 3c - Grid Rolling Average - Total Direct GHG. An average between 2005 and 2006 factor; 2006 and 2007 factor; 2007 and 2008 factor has been applied for respectively 2005/06; 2006/07; 2007/08, as per "Carbon baselines for individual Higher Education Institutions in England, Report to HEFCE by SQW, August 2010". 2008 factor has been used for 2008/09 and 2009/10 since this is the latest factor to have been published by DEFRA to date.

If these statistics are correct, the following observations can be made regarding Roehampton University's (RU) Electricity usage (kWh), expenditure (£) and associated carbons emissions (TCO2):

3.3.1 Electricity usage

- **RU's electricity usage** has increased by 12% compared to our 2005/06 baseline to reach circa **8,600MWh in 2009/10**.
- Until **2008/09**, our electricity usage kept increasing to reach **9,100MWh**, potentially due to a number of factors:
  - increase in the number of display screens all around the campus to facilitate communication,
  - changes in teaching modes (projectors being now largely used rather than black boards),
  - installation of a new server room in 2008,
  - construction of two new buildings and increase in opening hours.
- Actions were taken between August 2009 and April 2010, with the installation of 6 Voltage Optimisation units on our main supply points. They probably largely contribute to the **6% reduction in our electricity usage in 2009/10**. £265,000 were invested in these units thanks to our successful 2009 application in the Salix Revolving Green loan (50% Salix 50% HEFCE), with an additional contribution from Roehampton University. Following analysing of our Half Hourly data, it has been established that were these units have been installed it has reduced our electricity usage by around 10%, saving in average 280,000 kWh or nearly £90,000 a year.
- The University has in 2009-10 also rented a new residential site, Arton Wilson, which wasn't part of the University previously. Our Duchesne building was built in 2007.

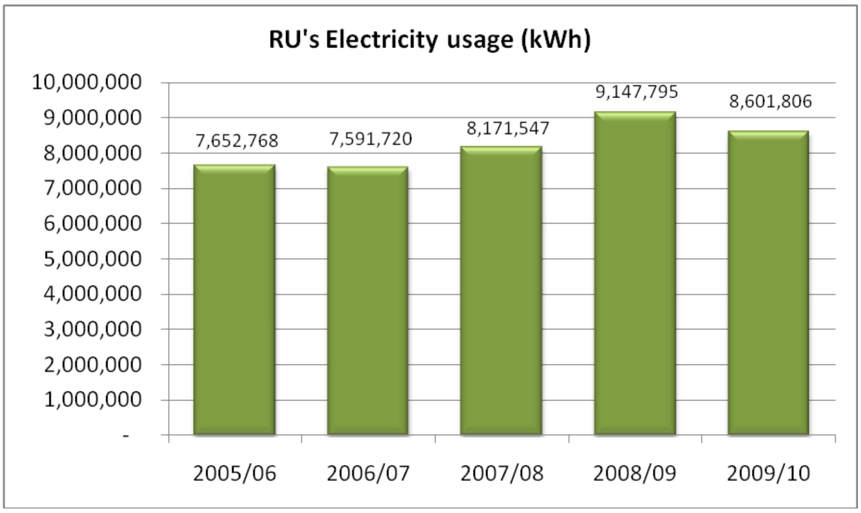
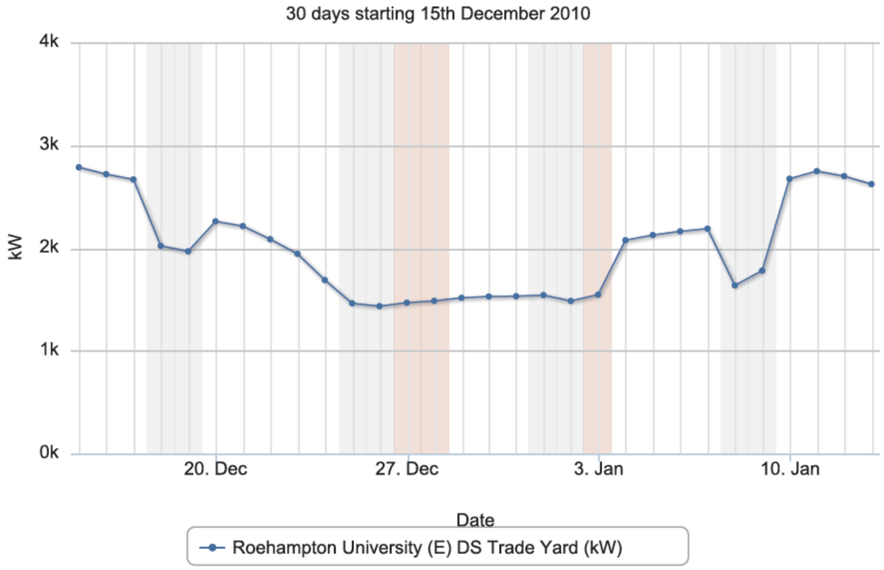
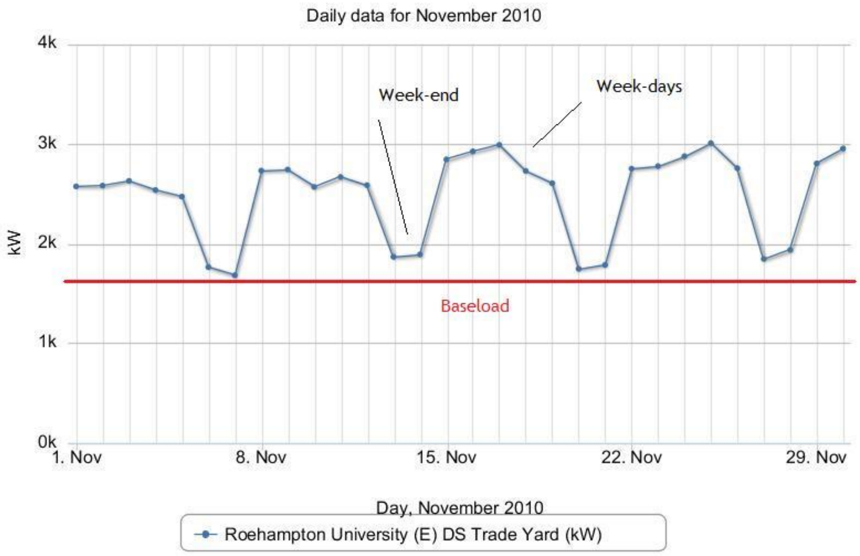


Chart showing our electricity usage from one of our 11 electricity fiscal meter, in November 2010 and around 2010 Christmas period:



We can clearly see that during Christmas 2010, a period of low activity, our daily electricity usage was around 1500 kWh a day, against around 3000 kWh a day for a period of normal activity.



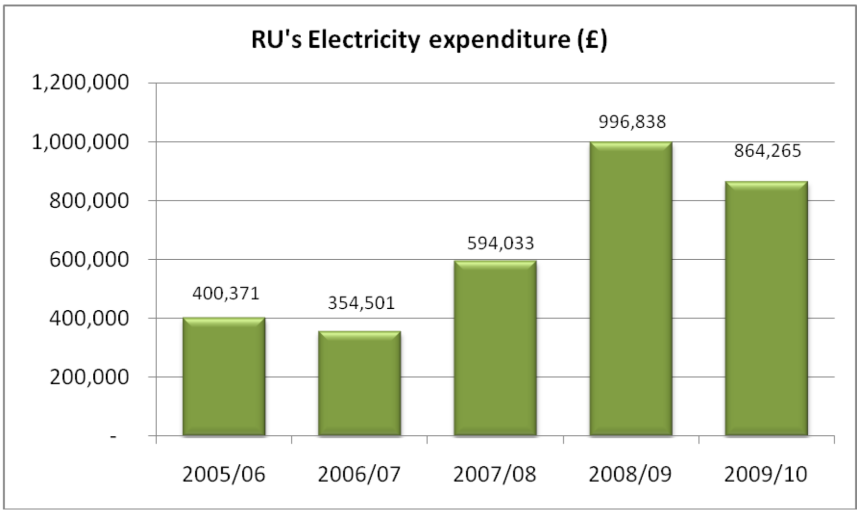
This analysis suggest that our baseload is quite significant (appliances running all the time such as fridges, lights left on and devices on stand-by, IT equipment, etc.), and that maybe we must focus our efforts on this type of equipment.

3.3.2 Electricity expenditure

- Since 2005, our electricity expenditure has increased by 116%. In 2005/06, we were spending annually around £400,000; **'today' we are spending between £870,000 and £1,000,000**.
- As previously stated in 3.1.2, the signing of the leases with Froebel, Digby Stuart and Southlands has meant that the University has increased its expenditure on electricity. This is due to the increase in electricity usage (until 2008/09) discussed above, but also due to an increase in the price of electricity since 2005. The University have different prices for each of its supply points (with currently two different suppliers for half-hourly and non-half hourly meters), but as an example, this is how electricity prices have been varying at 'Digby Stuart Lower Substation':

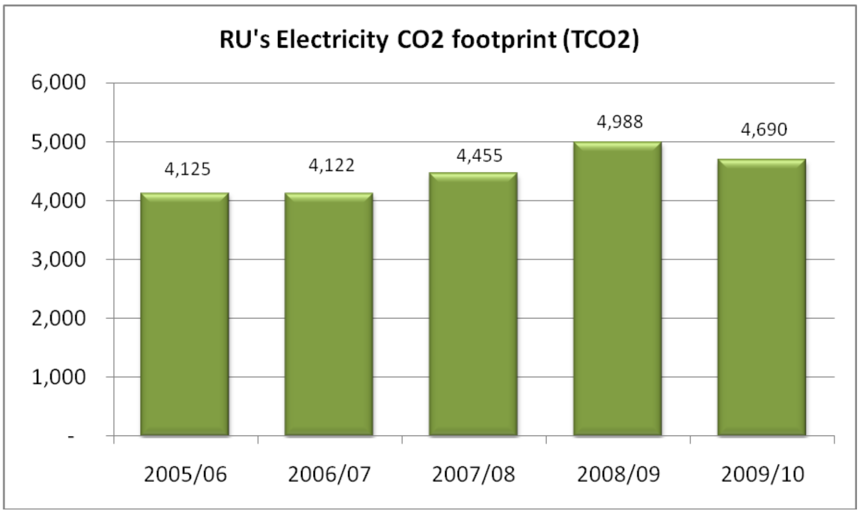
	01/11/02	01/11/05	01/11/06	01/11/07	01/11/08	01/11/09	01/11/11
Day rate (p/kWh)	3.6	7.1	7.5	6.1	11.4	7.6	
Night rate (p/kWh)	1.8	4.0	3.6	3.5	7.3	4.6	

- Along with continuing investments (staff time, capital) in energy savings, the University *must* make budget provision and expect electricity prices to steadily increase (at least 10% per year) to reach again 2008 level, between now and 2015.
- It has been separately calculated that in 2009/10, 77% of our electricity usage was used during 'day time' (7am to midnight), when prices are higher, influencing the average price.
- In 2009/10, an average price of electricity, all sites and all charges included, has been calculated at 0.10£/kWh. This shows the importance of taking into account our consumption pattern (night/day) and all charges rather than just the energy component, when using electricity prices (e.g. to calculate savings). This is reinforced in 2010/11, as the VAT is gone up to 20%, since the 04 January 2011. For more information see Appendix A: 2005-2010 Energy prices in the UK



3.3.3 Electricity carbon emissions

- Due to the increase in our electricity usage statistics, carbon emissions related have increased from around 4,100 tonnes of CO2 in 2005/06 to **4,700 tonnes of CO2 in 2009/10**; a 14% increase.
- It must also be noted that the carbon conversion factor, reflecting how electricity is produced in the UK (gas and coal fired plant, nuclear plant and hydropower), has also increased.



3.4 Scope 3 – Water and Wastewater

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 3 - Water (W) **and Wastewater** (WW)						
RU's Water (W) **usage (m3)** (10)	90,000	101,481	94,686	110,730	116,578	**102,695**
RU's Wastewater (WW) **usage (m3)** (11)	90,000	101,481	94,686	110,730	116,578	**102,695**
Variation compare to 2005/06 baseline		13%	5%	23%	30%	
RU's W and WW costs (£) (12)			143,116	118,821	98,714	**120,217**
Average W and WW price calculated (£/m3)			1.51	1.07	0.85	**1.14**
CO2 emission factor W (kg CO2e per m3) (13)	0.276	0.276	0.276	0.300	0.300	
CO2 emission factor WW (kg CO2e per m3) (14)	0.693	0.693	0.693	0.750	0.750	
RU's W CO2 footprint (tonnes of CO2e)	25	28	26	33	35	29
RU's WW CO2 footprint (tonnes of CO2e)	62	70	66	83	87	74
RU's W and WW CO2 footprint (tonnes of CO2e)	**87**	**98**	**92**	**116**	**122**	**103**
Variation compare to 2005/06 baseline		13%	5%	33%	40%	

(10) Source: Estates Management Statistic as per version submitted in Feb. 2010. D38B Water consumption C1 Total.

(11) Source: Estates Management Statistic as per version submitted in Feb. 2010. D38B Water consumption C1 Total. Basically at Roehampton, wastewater = water consumption so the same figure reported for water has been used for wastewater.

(12) Source: Estates Management Statistic as per version submitted in Feb. 2010. D32 Water costs C1 Total. There has been confusion in our Central Finance accounting system in 2005/06 and 2006/07 regarding water and wastewater costs. We think that only one of the two has been reported in 2005/06 and 2006/07 in EMS as these years are very differents from following years. Therefore we haven't used the costs data submitted in EMS for this year.

(13) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Table 9a - Life cycle Conversion Factors for water - Total Indirect GHG - Water supply. These factors have been provided only for 2007/08 and 2008/09. For baselining purposes we have therefore used the 2007/08 factor for precedent years (2005/06 and 2006/07) and the 2008/09 factor for following years (2009/10).

(14) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Table 9a - Life cycle Conversion Factors for water - Total Indirect GHG - Water treatment. These factors have been provided only for 2007/08 and 2008/09. For baselining purposes we have therefore used the 2007/08 factor for precedent years (2005/06 and 2006/07) and the 2008/09 factor for following years (2009/10).

Notwithstanding potential data errors (described previously) the following observations can be made regarding Roehampton University's (RU) Water usage (m3), expenditure (£) and associated carbons emissions (TCO2):

3.4.1 Water and Wastewater usage

- **RU's water usage** has increased by 30% compared to our 2005/06 baseline to reach circa **117,000m3 in 2009/10.**
- Since three important water leakages (superior to 1m3/h in total) have been discovered and repaired in 2010, the increase in our water usage is likely to be due to these leakages, or others leakages, still undiscovered.
- RU offers 1702 rooms in on-site students' residences and, since it is not yet possible to charge each room for its water usage, variations can also be due to students' behaviour and students' numbers (Arton Wilson, e.g. wasn't part of the University previously).
- Water reduction devices have been installed, albeit not consistently or systematically, on toilets. Since 2008, 28 waterless urinals have been also tested and installed around the University.

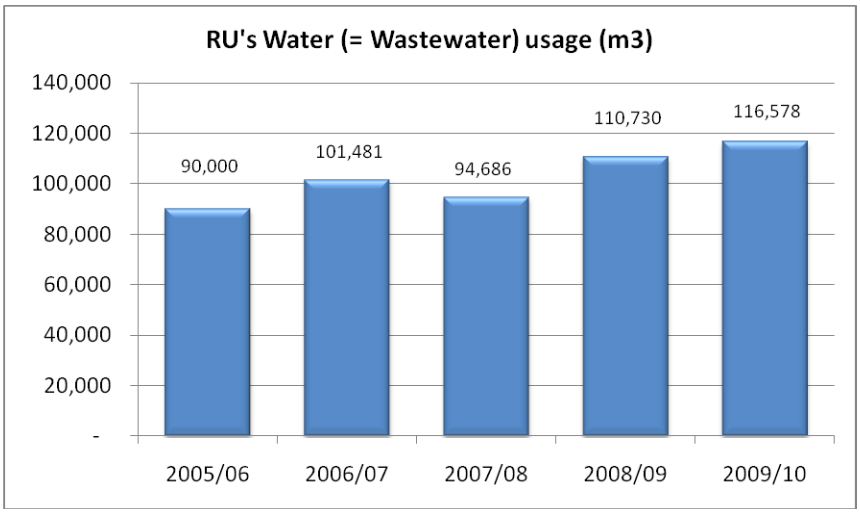
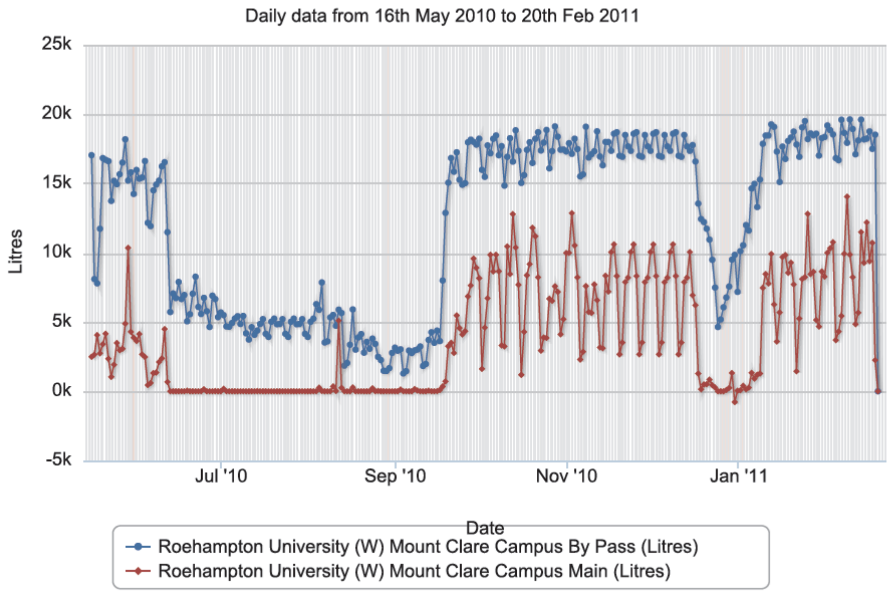


Chart showing our water usage from two (main and bypass) of our 26 water fiscal meter, since 16 May 2010:



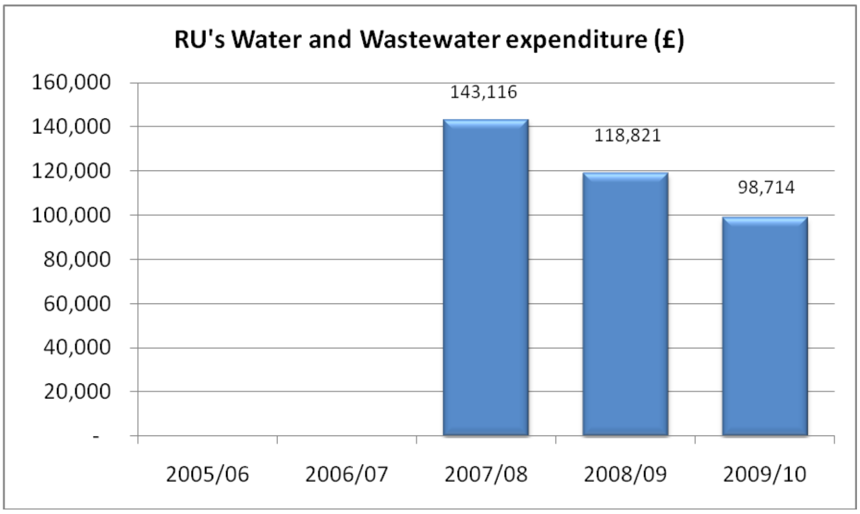
We can clearly see that during a period of normal activity, e.g. September-Christmas 2010, our daily water usage is around 17m3 (or 17,000 litres) a day, against around 5m3 (or 5,000 litres) a day for a period of low activity, like the summer or the Christmas period.

Mount Clare site is comprised of 192 rooms and two buildings are used by our P&FM Department.

During the summer a lot of the residences are used by our Conferencing Department, for external events, so a proportion of water used by the P&FM department cannot be directly deducted.

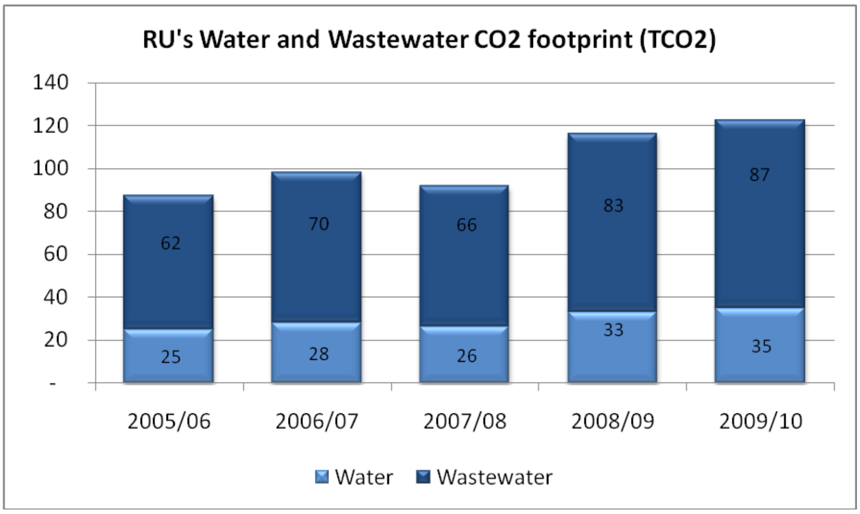
3.4.2 Water and Wastewater expenditure

- Since 2007, our water expenditure has decreased by 31%. In 2007/08, we were spending annually around £143,000; **'today' we are spending between £119,000 and £99,000**.
- We can see that despite our water usage having increased in 2008/09, compare to 2007/08, the cost have been reduced, mainly due to aggregation under one Thames Water account number of all our water meters on the main site. This action allowed us to benefit from the large volume tariff which is now at 0.8738 £/m3 for water and 0.5335 £/m3 for wastewater, compare to 1.1583£/m3 for water and 0.5335 £/m3 for wastewater for the other 'individual' sites.
- Thames Water prices have respectively increased by 2.03p/m3 for water and decreased by 2.41p/m3 for wastewater on the 1st April 2010. This does not include any other fixed charges.



3.4.3 Water and Wastewater carbon emissions

- Due to the increase in our water usage statistics, carbon emissions related have increased from around 87 tonnes of CO2 in 2005/06 to **122 tonnes of CO2 in 2009/10**; a 40% increase.
- It must also be noted that the carbon conversion factor, reflecting how water is transported and treated in the UK, has also increased since 2008/09.
- The volume of water use and waste water disposal are roughly equivalent. However, due to the energy and chemicals needed to treat waste water, its carbon footprint is approximately 70% of the aggregated total.



3.5 Scope 3 – Staff commuting

The first ever Staff Travel Survey was conducted in April/May 2010, by the Environmental Manager and the consultancy Itrace, funded by TFL, who produced our first Travel Plan, launch in December 2010.

The following data comes from this source.

It should be noted that only half of staff members responded to the survey, therefore results have been extrapolated to circa 800 staff FTE.

Surprisingly, the carbon footprint was not calculated and has been derived by the Energy Manager following the below methodology:

	Survey results (4)		Extrapolated to 800 staff FTE and 224 working days (one year)					
	Mileage per commute home/work (two ways) **main travel mode** (miles per working day)	Mileage per commute home/work (two ways) **second travel mode** (miles per working day)	Mileage per commute home/work (two ways) **main travel mode** (miles per working day)	Mileage per commute home/work (two ways) **second travel mode** (miles per working day)	**Kilometers** per commute home/work (two ways) **main and second travel mode (km per year)**	CO2 emission factor (kg CO2e per km) (5)	**RU's staff commuting footprint (tonnes of CO2e)**	% of total staff commuting carbon footprint
Bus	541	193	1,133	435	565,030	0.10609	**60**	**8%**
Car share (as driver or passenger) (1)	340	52	712	116	298,519	0.24579	**73**	**9%**
Cycle	471	42	987	94	389,685	0.00000	**0**	0%
Cycle and train (combined) (2)	90	110	188	247	157,057	0.06510	**10**	1%
Drive alone	2,999	194	6,280	436	2,421,131	0.24579	**595**	**77%**
Motorcycle (over 125cc)	90		188	0	67,946	0.12509	**8**	1%
Other (3)	129	36	269	81	126,251	0.00000	**0**	0%
Scooter/Motorcycle (under 125cc)	60		126	0	45,298	0.10307	**5**	1%
Train	36	36	75	80	56,018	0.06510	**4**	0%
Tube	260	69	545	155	252,186	0.08457	**21**	**3%**
Walk	104	569	218	1,279	539,774	0.00000	**0**	0%
TOTAL	**5,120**	**1,301**	**10,722**	**2,923**	**4,918,896**		**777**	**100%**
Number of answers	*390*	*390*						
Number of usable answers	*382*	*356*	*Extr. to 800*	*Extr. to 800*				

(1) For CO2 accounting purposes, the total mileage has been divided by two to take into account that the car is shared by (probably) two workers, every day.

(2) For CO2 accounting purposes, the total mileage has been attributed to train only, as the mileage cycled is unknown and could be minimal (to get to the station).

(3) For CO2 accounting purposes, this mileage has not been accounted for as responses varies.

(4) Source: First staff Travel Survey conducted in April-May 2010 by Jonathan Horner and the consultancy Itrace, funded by TFL. Note: mileage were provided by the respondant.

(5) Source: DEFRA "101006-guidelines-ghg-conversion-factors" - Annex 6 - Passenger Transport Conversion Tables - Grand Total GHG - Car: Table 6e Average car (unknown fuel) ; Motorcycles: Table 6j Small and Medium petrol motorbike ; Bus, Train and Tube: Table 6k Local London bus, National rail, London Underground.

Therefore, the **Staff commuting footprint is estimated to be 777 TCO2 in 2009/10** and will be used as **our '2005/06' baseline**:

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 3 - Staff commuting						
RU's Staff Commuting CO2 footprint (TCO2e) (20)	*777*	*777*	*777*	*777*	**777**	**777**

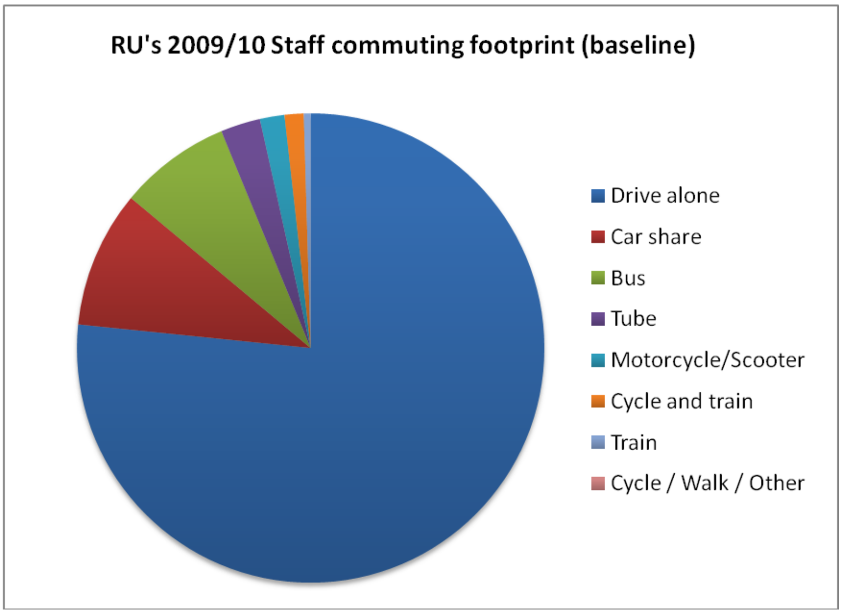
(20) See Staff commuting table for more details. Our first staff travel survey has been conducted in April-May 2010. Therefore this will be used as our baseline. Also, to corretly calculate totals, this value has been taken for all others years.

It must be noted that, **'if' all staff members were to 'drive alone' in their car, our staff commuting footprint would reach an estimated 1200 TCO2 per year**.

While more work can be undertaken to encourage staff to: car share, commute using public transport, or cycle/walk to work (if possible), it is encouraging to see that about 500 TCO2 are already 'saved' by those members of staff who have / can make another choice than 'driving alone'.

Our first Travel Plan and our recent success in a TFL match-funded grant will help considerably to increase the number of cycle shelters and various facilities for greener commuting modes.

Breakdown of RU Staff commuting footprint:



3.6 Scope 3 – Waste

While some preliminary work has been done to determine our carbon footprint relating to our usage, composition and treatment of waste, it has not yet been possible to derive these baselines which will be part of the next update.

Therefore, as suggested in HEFCE 2010/02 guidance document regarding Carbon Management Plan, it has been estimated that our waste footprint account for 3% of the total of Scope 1, 2 and 3.

This methodology gives us the following results:

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 3 - Waste						
RU's Waste CO2 footprint (tonnes of CO2e) (19)	244	245	254	274	283	**260**
Variation compare to 2005/06 baseline		0.3%	4%	12%	16%	

(19) Source: As per the recommendation of 'HEFCE 2010/02' regarding Carbon Management Plan, an estimate of 3% of scope 1, 2 and 3 has been taken.

3.7 Scope 3 - Business travel

While some preliminary work has been done to determine these, it has not yet been possible to access sufficient data to determine more accurately this baseline than in our 2008 Carbon Management Plan.

Therefore, it has been decided to use this result as our 2005/06 baseline:

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 3 - Business travel (inc. air travel)						
RU's Business Travel CO2 footprint (TCO2e)	*556*	**556**	*556*	*556*	*556*	**556**

Business travel can be broken down into the following categories:

	Annual Emissions (TCO2e)	% Business Travel Emissions
Plane	545.5	98.0 %
Rail	7.7	1.4 %
Car	3.0	0.6 %

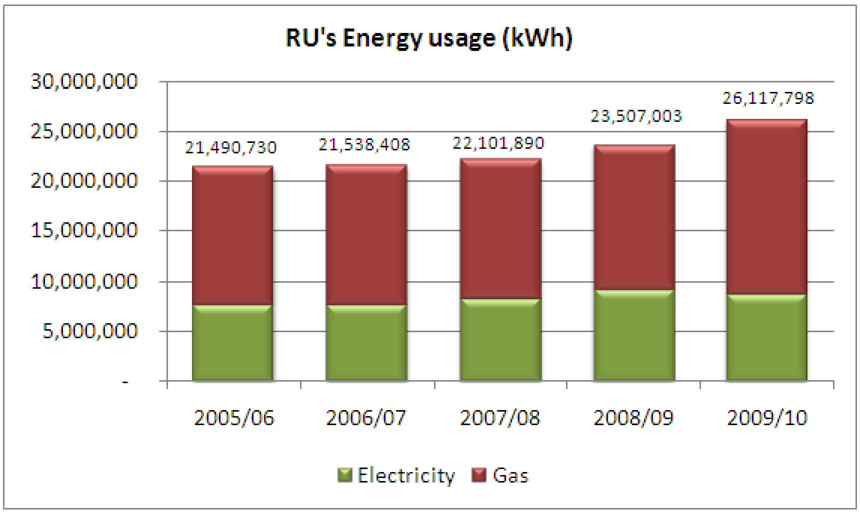
The vast majority of business travel emissions relate to plane travel, flights being taken by staff from all academic schools, often in relation to research, and several departments, mainly in relation to student recruitment.

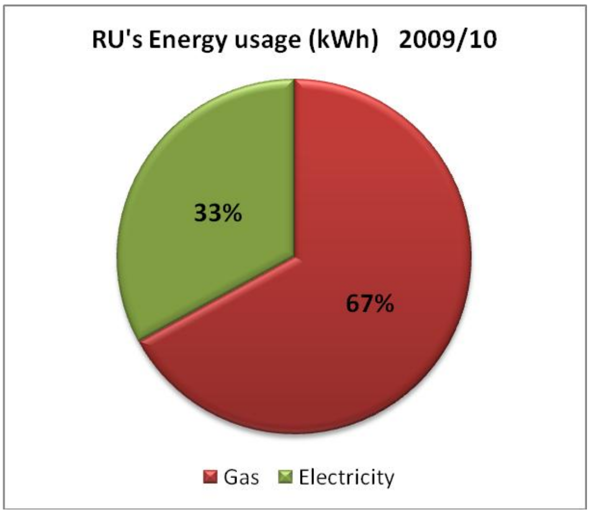
3.8 Scope 3 - Students commuting, Air travel (international students)

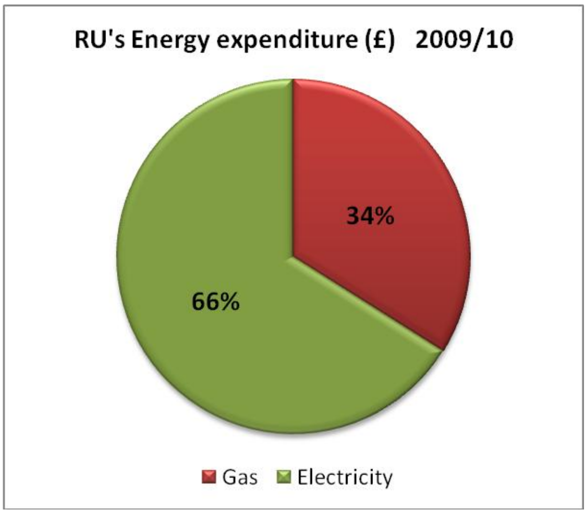
While some preliminary work has been done to determine these, it has not yet been possible to derive these baselines which will be part of the next update.

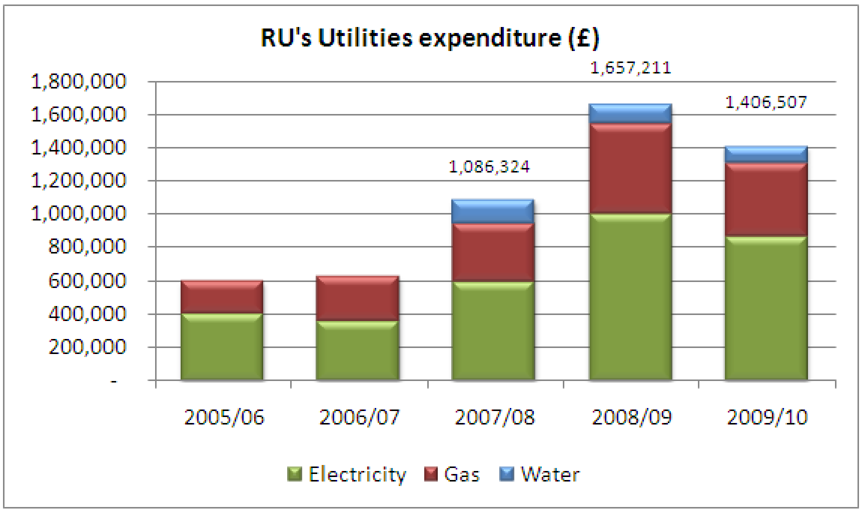
3.9 Scope 1, 2 and 3 – Summary, absolute and relative progression

3.9.1 Utilities usage and expenditure overview





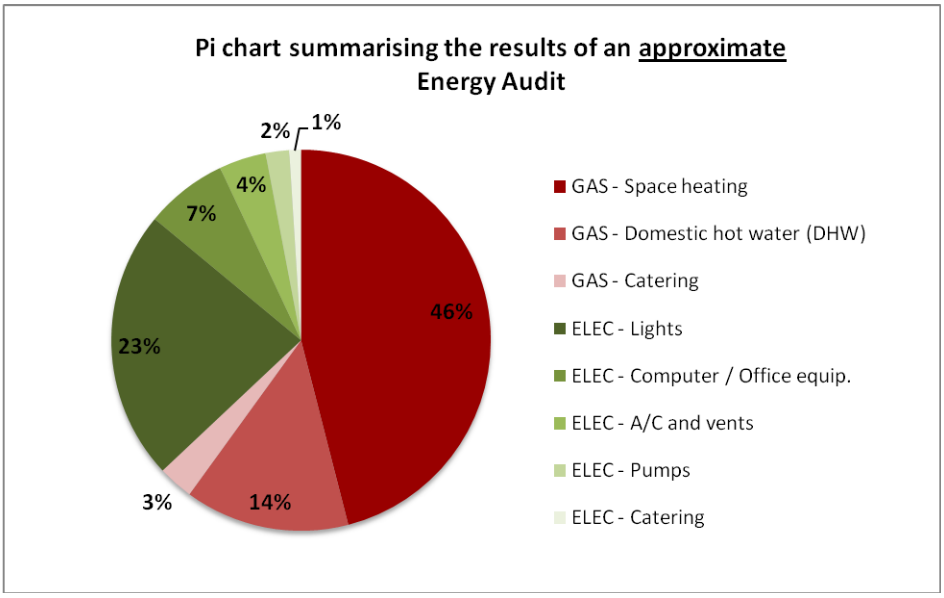




- Roehampton University's energy usage has reached **26,118 MWh in 2009/10**.
- 2/3 of our energy usage is for GAS, but, 2/3 of our energy expenditure is for ELECTRICITY.
- Roehampton University's utilities expenditure has reached nearly **£1.7 million in 2008/09 and is now down to £1.4 million.**
- Our utilities expenditure has more than doubled in the last 5 years.

3.9.2 Approximate audit of energy consumption

For our 2008 Carbon Management Plan, an attempt was made to conduct an approximate audit of energy consumption based on different types of equipment. This is summarised in the following diagram.



As can be seen from the diagram, just 4 types of equipment are thought to be responsible for approximately 90% of energy consumption at Roehampton, namely:

- Gas space heating (46%)
- Lighting (23%)
- Gas Domestic Hot Water (DHW) (14%)
- PC's and other office equipment (7%)

Of the remainder, approximately 4% of energy consumption are thought to relates to catering (3% gas and 1% electricity) and 4% relates to cooling and ventilation ('A/C and Vent').

It would be valuable to the University to conduct a proper survey of this type, so more accurate space heating savings can be calculated (e.g. wall heating losses only compare to windows heating losses, etc.).

Indeed, the quality of the usage pre-project data becomes crucial when theses type of projects payback for themselves using interest-free loans like the Salix loans.

The University would also benefit from a better understanding of space heating (generally gas) usage year-on-year variation, as our mean space heating usage can then be calculated, regardless of the weather conditions, in using degree-days.

Unfortunately, staff and financial investments would be needed as the quality of this type of survey would depend on the University having at least the below information:

1) **Maps of elevation of all buildings** to be surveyed (with a priority for old buildings);
2) **Structure details of all buildings** to be surveyed, e.g. materials composing walls, size of the cavity, etc. (with a priority for old buildings). This information may be collected in drilling small holes in olds and non-listed buildings. This information would benefit other projects such as extensions involving knocking down walls.
3) **Energy usage monitored on a building basis** for at least one year, and, if technically possible, with sub-meters separating gas usage related to:
   - space heating,
   - domestic hot water
   - catering.

3.9.3 Scope 1, 2, 3 totals and absolute variation

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Scope 1 - Natural Gas						
RU's Natural Gas CO2 footprint (tonnes of CO2e)	**2,563**	**2,583**	**2,580**	**2,660**	**3,244**	**2,726**
Proportion of Scope 1, 2 and 3 (%)	31%	31%	30%	28%	33%	31%
Scope 1 - Fuel used in institutions' own vehicle fleets						
RU's vehicle fleet CO2 footprint (tonnes of CO2e)	**29**	**24**	**20**	**25**	**28**	**25**
Proportion of Scope 1, 2 and 3 (%)	0.4%	0.3%	0.2%	0.3%	0.3%	0.3%
Scope 2 - Electricity						
RU's Electricity CO2 footprint (tonnes of CO2e)	**4,125**	**4,122**	**4,455**	**4,988**	**4,690**	**4,476**
Proportion of Scope 1, 2 and 3 (%)	49%	49%	51%	53%	48%	50%
Scope 3 - Water (W) **and Wastewater** (WW)						
RU's W and WW CO2 footprint (tonnes of CO2e)	**87**	**98**	**92**	**116**	**122**	**103**
Proportion of Scope 1, 2 and 3 (%)	1%	1%	1%	1%	1%	1%
Scope 3 - Waste						
RU's Waste CO2 footprint (tonnes of CO2e) (19)	244	245	254	274	283	**260**
Proportion of Scope 1, 2 and 3 (%)	3%	3%	3%	3%	3%	3%
Scope 3 - Staff commuting						
RU's Staff Commuting CO2 footprint (TCO2e) (20)	*777*	*777*	*777*	*777*	**777**	**777**
Proportion of Scope 1, 2 and 3 (%)	9%	9%	9%	8%	8%	9%
Scope 3 - Students commuting						
RU's Students Commuting CO2 footprint (TCO2e)						
Scope 3 - Business travel (inc. air travel)						
RU's Business Travel CO2 footprint (TCO2e)	*556*	**556**	*556*	*556*	*556*	**556**
Proportion of Scope 1, 2 and 3 (%)	7%	7%	6%	6%	6%	6%
Scope 3 - Air travel - International students						
RU's Air Travel International Students CO2 footprint (TCO2e)						

Scope 1 and 2 (tonnes of CO2e)	**6,718**	**6,729**	**7,055**	**7,672**	**7,963**	**7,227**
Variation compare to 2005/06 baseline		0.2%	5%	14%	19%	
Proportion of Scope 1, 2 and 3 (%)	80%	80%	81%	82%	82%	81%
Scope 3 (tonnes of CO2e)	**1,665**	**1,676**	**1,679**	**1,723**	**1,738**	**1,696**
Variation compare to 2005/06 baseline		0.7%	0.9%	4%	4%	
Proportion of Scope 1, 2 and 3 (%)	20%	20%	19%	18%	18%	19%
Scope 1, 2 and 3 (tonnes of CO2e)	**8,383**	**8,405**	**8,735**	**9,395**	**9,701**	**8,924**
Variation compare to 2005/06 baseline		0.3%	4%	12%	16%	
Proportion of Scope 1, 2 and 3 (%)	100%	100%	100%	100%	100%	100%

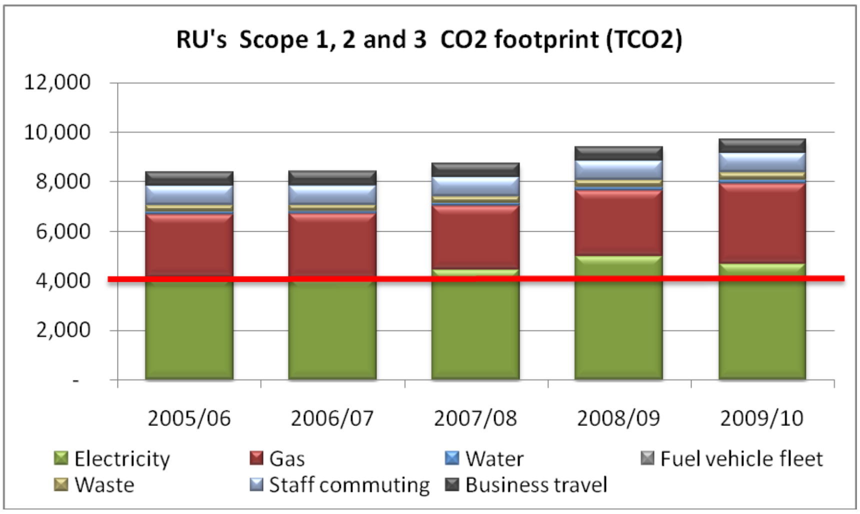
Bearing in mind previous comments, the following observations can be made regarding Roehampton University's carbon footprint:

- In **2005/06 our carbon footprint** **all scopes** **was 8,383 TCO2** and has increased globally by 16% in **2009/10** to reach **9,701 TCO2**.
- Indeed, while **important investments have been made** to improve our understanding of our utilities usage and to reduce it (see section 3.10), **these are still quite recent** and may be compensated by others decisions such as the 'large increase in the use of ICT and other electrical equipment' from staff and students (living on-site or not).
- Thanks to these efforts and further projects planned, we are confident that we are containing the upward trend.

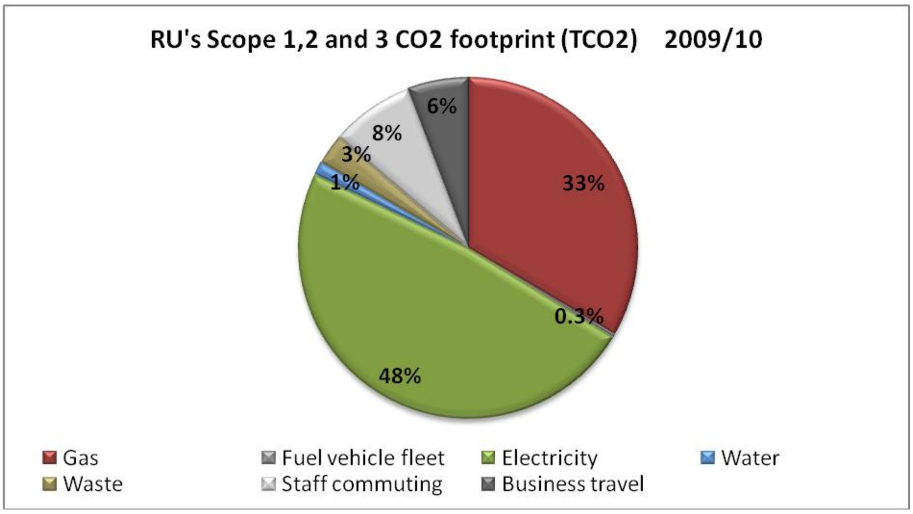
Target 2020 against 2005/06 : -40%	2005/06	2006/07	2007/08	2008/09	2009/10
Scope 1 and 2 (TCO2) footprint	4,031				
Scope 1 and 2 (TCO2) need to be saved	2,687				3,932

A -40% target against our 2005/06 baseline for scope 1 and 2 means that, our **scope 1 and 2 annual carbon footprint** needs to be **reduced by 2020** to nearly **4,000 TCO2.**

Since our 2009/10 scope 1 and 2 carbon footprint has reached nearly 8,000 TCO2, we need to **save nearly 4,000 TCO2** (a 50% reduction) **from 2009/10**.



As mentioned before, efforts should be focussed on reducing our electricity usage, expenditure and carbon footprint: **electricity represents half of our carbon footprint!**



Our **gas** and **transport related** (staff commuting and business travel) carbon footprint is quite significant with respectively **33% and 14% of the total in 2009/10.**

It seems therefore logical to focus on these areas when introducing projects to reduce emissions.

3.9.4 Scope 1 and 2 relative variation (adjusted income, students numbers)

	2005/06	2006/07	2007/08	2008/09	2009/10	AVERAGE
Staff and student FTE (21)	8,322	8,708	8,594	8,587		
Scope 1 and 2 KgCO2eq per staff and student FTE	**807**	**773**	**821**	**893**		
Variation compare to 2005/06 baseline		-4%	2%	11%		
Total income (£) (22)	47,074,000	54,563,000	58,794,000	67,204,000		
GDP deflator adjusted total income (£) (23)	47,074,000	49,200,003	53,015,138	60,598,519		
Scope 1 and 2 KgCO2eq per £ of adjusted income	**0.143**	**0.137**	**0.133**	**0.127**		
Variation compare to 2005/06 baseline		-4%	-7%	-11%		

(21) Source: Estates Management Statistic as per version submitted in Feb. 2010. D4 Student FTE C1 Total and D4 FTE Staff C1 Total, except for 2008/09 w here Student FTE has been given in an email from Richard Bates on 24/08/10. Note: For unknow n reasons HESA statistics providing total students numbers (not FTE) (http://w w w .hesa.ac.uk/index.php?option=com_content&task=view &id=1197&Itemid=266) for precedent years doesn't correspond to data in EMS D3 Student headcount C1 total (also not FTE).

(22) Source: Estates Management Statistic as per version submitted in Feb. 2010. D1 HEI income C1 Total, except for 2008/09 w here data come from HESA w ebsite http://w w w .hesa.ac.uk/index.php?option=com_content&task=view &id=1197&Itemid=266. 06/07 and 07/08 data from HESA correspond exactly to EMS data.

(23) Source: calculated by Richard Bates using GDP deflator and total income.

Scope 1 and 2 carbon footprint has increased by 11% compared to the number of staff and students FTE but it has decreased by 11% as a percentage of total adjusted income.

3.10 Past actions and achievements

The following, typically *ad hoc* measures, especially before our first Carbon Management Plan in 2008, have been introduced in various parts of the University albeit not consistently or systematically:

- Replacement of existing light bulbs with low energy bulbs.
- Fitting radiator thermostatic control valves when new radiators are installed or when refurbishments take place.
- Fitting PIR systems to new builds.
- Introduction of daylight sensors on external lighting.
- Additional insulation of roof spaces.
- New boilers fitted are condensing boilers.
- Building Management Systems are fitted as standard to new buildings.
- In conjunction with Wandsworth Borough Council, mixed waste recycling bins have been introduced.
- An Environmental Forum was established in 2006 to bring staff and students together to promote a more environmentally aware university, helping to embed sound environmental policies and practices within the university.

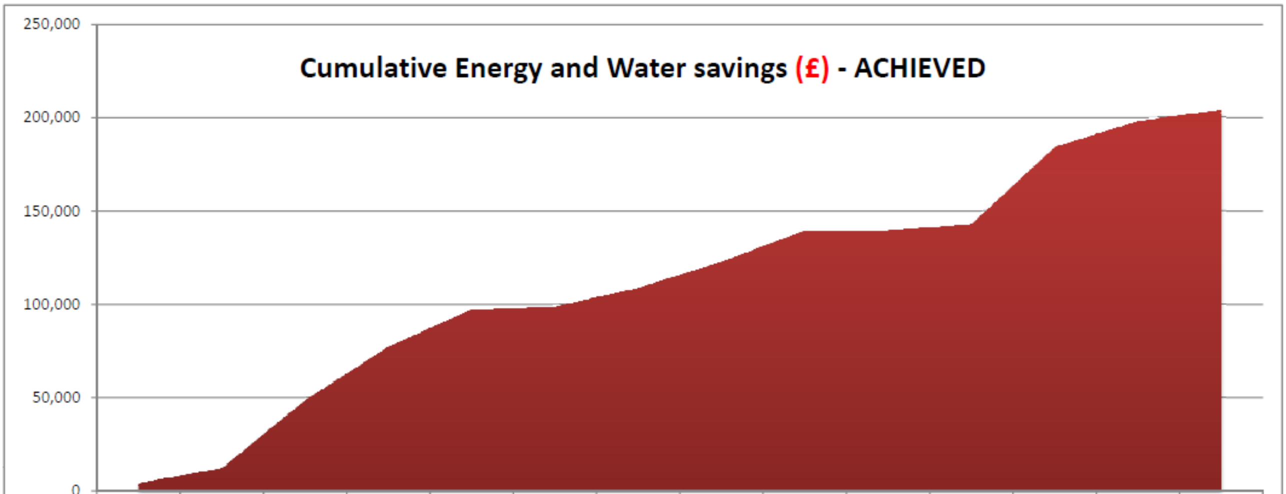
Since our first Carbon Management Plan in March 2008, the following actions for better Energy, Environmental and Space Management were taken:

Apr-08	Operation Kilo audit was carried out to benchmark waste and recycling opportunities
Aug-08	A part-time Energy Coordinator[7] was appointed.
Sep-08	Our first University Energy Policy was approved by Council on 6 October 2008.
Oct-08	A team of Environmental Champions, whose role include encouraging energy efficiency in their area, was created and is continually developed.
Oct-08	Environmental Awareness training for staff and students is offered annually by our full-time Environmental Manager.
Jan-09	A recycling waste competition was organised.
Mar-09	The Environmental Manager position was made full-time.
Sep-09 -date	Food waste is now recycled via a third party to anaerobic digesters where it is turned into gas to generate electricity and create compost as an end product.
Nov-09 to Sept-10	We had a space management programme organised since November 2009, including appointment of a specific project manager, to organise 420 moves during the summer 2010. This programme, motivated by academic restructuring, led to bring staff members who work together closer and increase the number of shared offices (e.g. part-time staff). Thanks to these moves a total of 1510m2 (Bede and Duchesne) are not heated at the moment.
Nov-09 to date	Our Smart Metering system 'phase 1' (120 monitored points) was installed, to start to facilitate a breakdown of energy and water consumption across the University on a building by building basis.
Jan-10	A full-time Energy Manager, replacing the part-time Energy Coordinator, was appointed to strengthen energy management in the University.
Feb-10	A 2 month electricity reduction competition between colleges *'RU Unplugged'*, was organised. The winning college won a prize.
Feb-10 (since)	A two year Green Impact competition, targeting staff, supported by the NUS and two 6 months Green Impact coordinators, is organised.

[7] It is generally recognised that it is financially beneficial for an organisation with an annual energy bill exceeding £1million to appoint a full time Energy Manager.

Feb-10	Our University Environmental Policy was updated and approved by Council on 8 March 2010.
Apr-10	Roehampton University moved up the University Green League Tables from a position of 80 in 2009 to a position of 41 in 2010.
Sept-10 (since)	A one year electricity reduction competition, targeting students living in residences, Student-Switch-Off, is organised in association with the NUS. The competition has already delivered circa 4% worth of savings.
Oct-10	Our first Space Management Policy was approved by Council on 22 November 2010.
Dec-10	Most of gas and electricity fiscal meters have now been fitted with AMR (Automatic Meter Reading), at no cost to the University, improving billing accuracy and work efficiency. This means that the University will only ever pay for energy that has been used (estimated billing, for example, will become obsolete).
Dec-10	Our first University wide Travel Plan was launched. This plan covers more thoroughly projects to put in place to reduce transport carbon related emissions.
	Progresses against targets are now included in our Annual Reports and Financial Statements.
	Progress reports and update on environmental and energy management is provided at quarterly meetings of the University Environmental Forum.

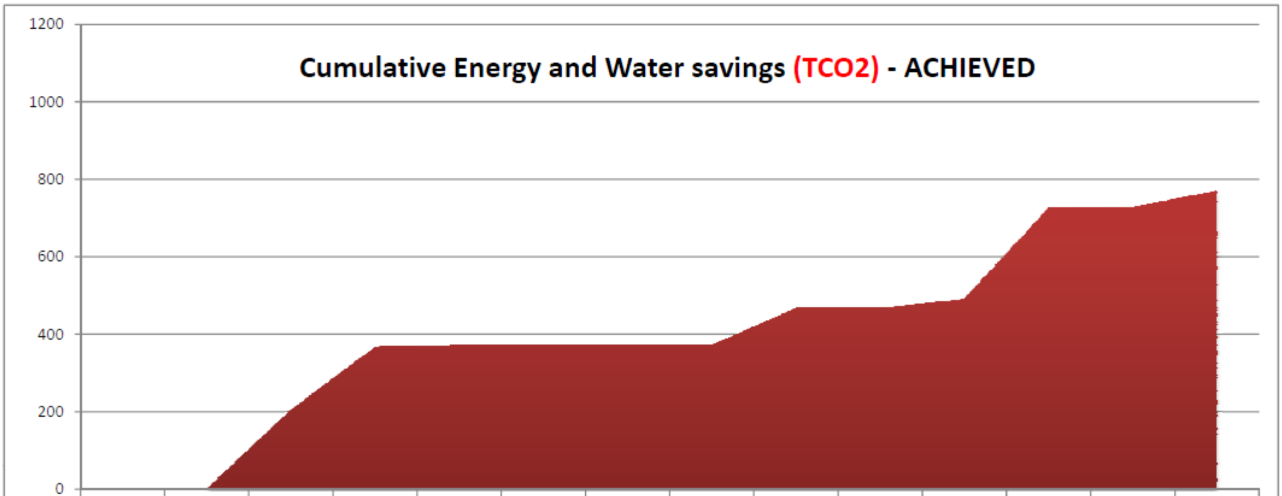
Since our first Carbon Management Plan in March 2008, the following actions and projects realising directly savings (£, TCO2) were achieved:



Savings 'in':	Jul-10	Jul-10	Aug-10	Dec-10	Jan-11	Jan-11	Feb-11	Mar-11	Apr-11	Aug-11	Sep-11	Oct-11	Oct-11	Nov-11
	Erroneous Gas bill - Wrong gas meter read at Digby	Overcharge capacity (kVA) elec. bills 2005-2009 - EON	Voltage Optimisation at Whitelands, Fr Sub, Fr Courts	Voltage Optimisation at DS Trade Yard, DS Sub	Water leakage since Sept 09 Whitelands repaired	Erroneous Water bill since Sept 09 - VAT at Arton Wilson	Overcharge capacity (kVA) elec. bills 2005-2009 - EDF	Overcharge capacity (kVA) elec. bills 2005-2009 - BRITISH ENERGY	Voltage Optimisation at Southlands	Lighting at parts of Lulham, Richardson and Queen	Replaced inefficient boilers at Courts, Erasmus, Jubilee and Hurst	Lighting at LRC	Water leakage near Grove House and Convent	Draught proofing at Finch, How, Jubilee, Romero, Rich, Grove
	MR	MR	JH/VA/DS	JH/VA/DS	MR/AG	MR	MR	MR	JH/VA/DS	DE/AG	AG/DS	MR/DS	MR	MR/DS
Indiv.	4,000	8,000	36,434	28,722	20,000	1,500	10,000	14,000	16,746		3,450	41,280	14,000	5,850
Cum.	4,000	12,000	48,434	77,156	97,156	98,656	108,656	122,656	139,402	139,402	142,852	184,132	198,132	203,982

- Even if **a number of projects are achieving annual savings, on an on-going basis**, they have been counted just once.
- The date in this chart corresponds to when the savings are achieved, i.e. 1 year after the completion of the project for energy/water savings projects.

- A number of projects are paying back for themselves first (Salix loans).
- A couple of projects, realised by the P&FM projects team haven't been accounted for due to a lack of data collection before the project took place.
- **Financial savings in excess of £200,000 have been secured.**



Savings 'in':	Jul-10	Jul-10	Aug-10	Dec-10	Jan-11	Jan-11	Feb-11	Mar-11	Apr-11	Aug-11	Sep-11	Oct-11	Oct-11	Nov-11
	Erroneous Gas bill - Wrong gas meter read at Digby	Overcharge capacity (kVA) elec. bills 2005-2009 - EON	Voltage Optimisation at Whitelands, Fr Sub, Fr Courts	Voltage Optimisation at DS Trade Yard, DS Sub	Water leakage since Sept 09 Whitelands repaired	Erroneous Water bill since Sept 09 - VAT at Arton Wilson	Overcharge capacity (kVA) elec. bills 2005-2009 - EDF	Overcharge capacity (kVA) elec. bills 2005-2009 - BRITISH ENERGY	Voltage Optimisation at Southlands	Lighting at parts of Lulham, Richarsdon and Queen	Replaced inefficient boilers at Courts, Erasmus, Jubilee and Hurst	Lighting at LRC	Water leakage near Grove House and Convent	Draught proofing at Finch, How, Jubilee, Romero, Rich, Grove
	MR	MR	JH/VA/DS	JH/VA/DS	MR/AG	MR	MR	MR	JH/VA/DS	DE/AG	AG/DS	MR/DS	MR	MR/DS
Indiv.			204	163	5				95		24	234	3	42
Cum.	0	0	204	367	372	372	372	372	467	467	491	725	728	770

- The above two charts are a graphical representation of the table 'Existing Projects' in the next section (see 4.1 for more details).
- **Carbon emissions savings of 770 TCO2 have been secured.**
- It must be noted that the University have by law to participate in the **Carbon Reduction Commitment (CRC)** government's scheme and as a result have to surrender its annual carbon emissions, from April 2012, at a starting price of **12 £ per tonne of CO2**.

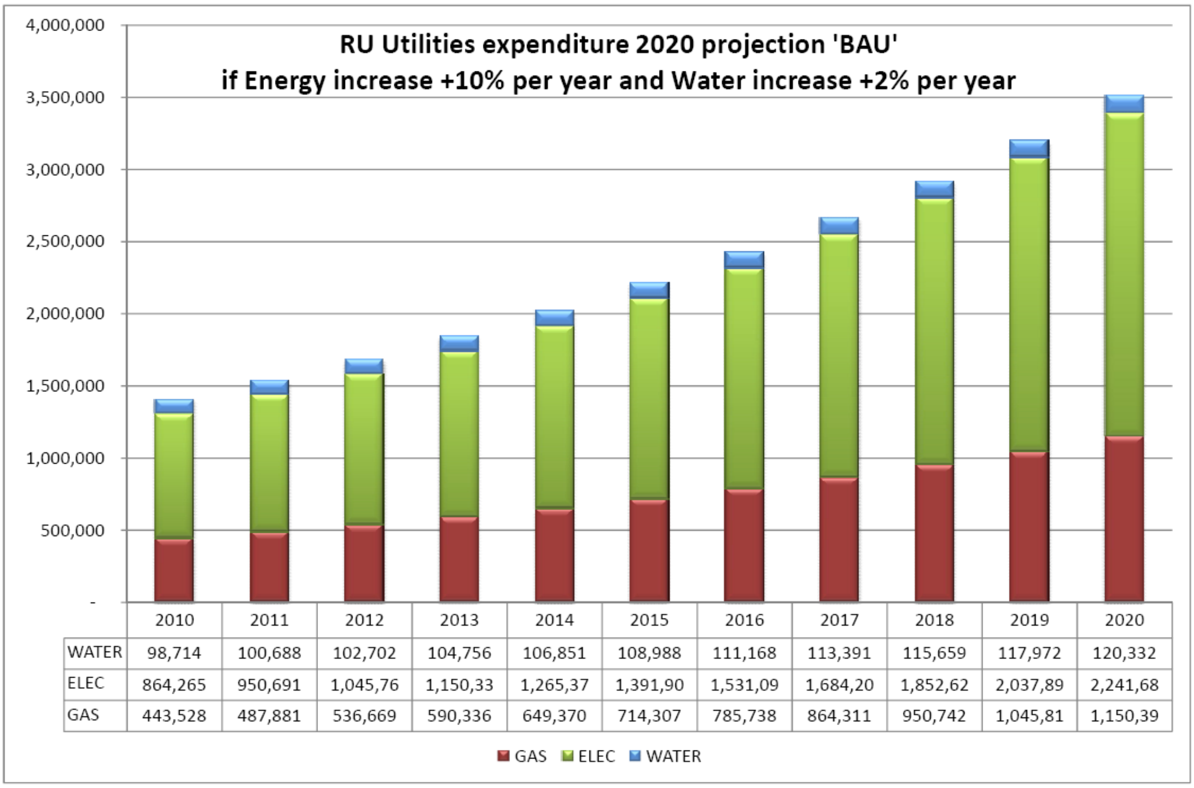
  Therefore, any energy and water savings, not only reduces our utilities bills, but also reduces charges that the University will have to incur under the CRC scheme.
- The current cost implication of the CRC can be viewed as **an added cost to the price of each unit of energy** as follow:
  - Electricity[8] = + 0.65p/kWh
  - Gas[9] = + 0.22p/kWh

[8] Worked out by: 1000 kg (1tonne CO2) / 0.544 kgCO2/kWh (electricity emission factor) = 1,838 kWh. £12 per TCO2 / 1838 kWh = 0.65 p/kWh.

[9] Worked out by: 1000 kg (1tonne CO2) / 0.18523 kgCO2/kWh (gas emission factor) = 5,399 kWh. £12 per TCO2 / 5399 kWh = 0.22 p/kWh.

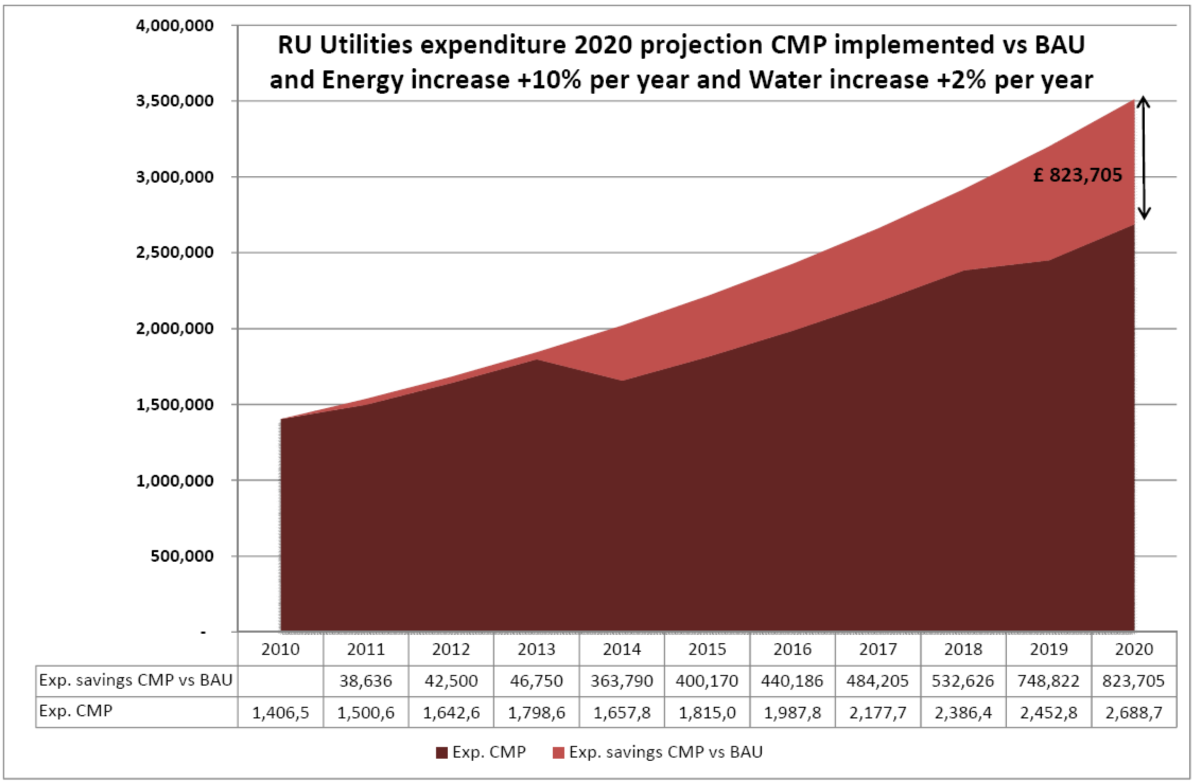
3.11 Projections

3.11.1 Utilities expenditure progression - Business As Usual (BAU)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
WATER	98,714	100,688	102,702	104,756	106,851	108,988	111,168	113,391	115,659	117,972	120,332
ELEC	864,265	950,691	1,045,76	1,150,33	1,265,37	1,391,90	1,531,09	1,684,20	1,852,62	2,037,89	2,241,68
GAS	443,528	487,881	536,669	590,336	649,370	714,307	785,738	864,311	950,742	1,045,81	1,150,39

3.11.2 Utilities expenditure progression – Carbon Management Plan (CMP) implemented



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Exp. savings CMP vs BAU		38,636	42,500	46,750	363,790	400,170	440,186	484,205	532,626	748,822	823,705
Exp. CMP	1,406,5	1,500,6	1,642,6	1,798,6	1,657,8	1,815,0	1,987,8	2,177,7	2,386,4	2,452,8	2,688,7

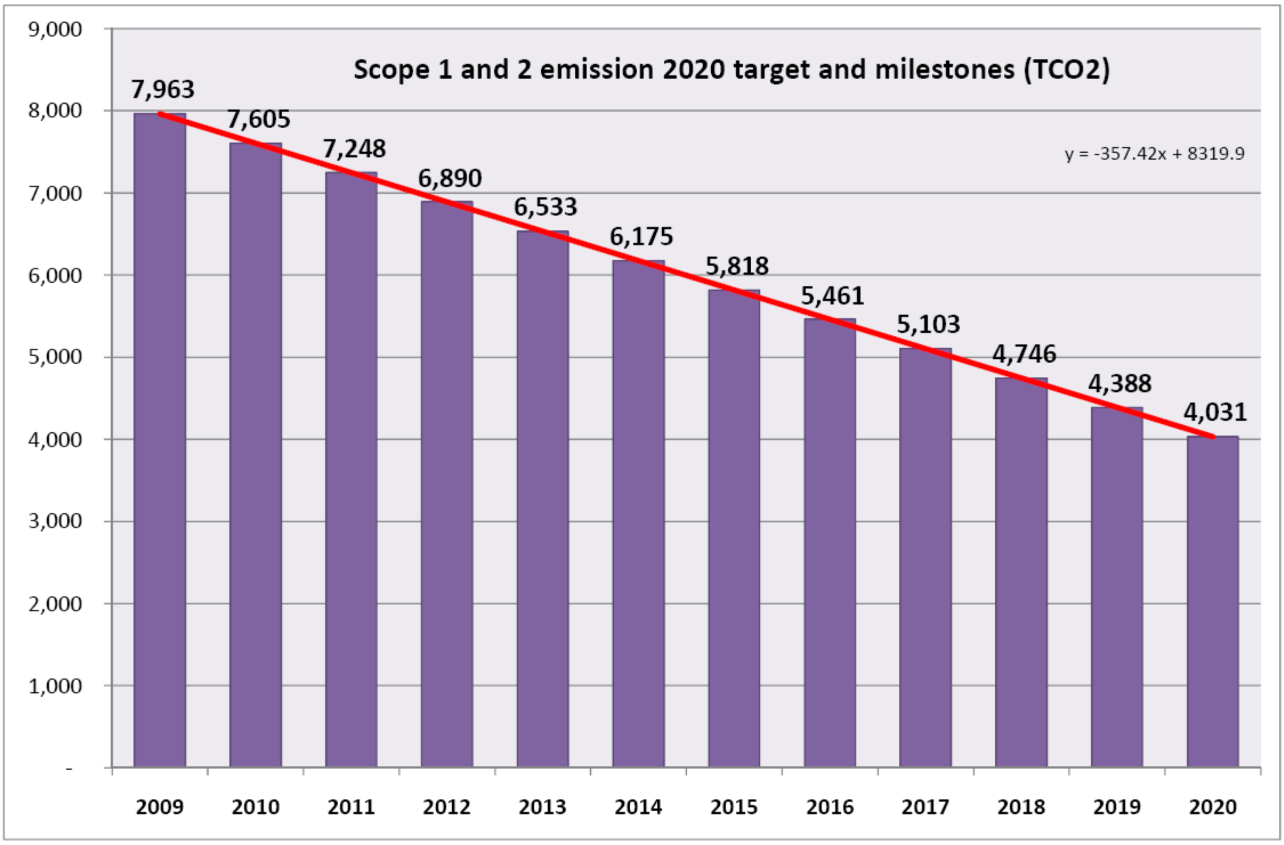
As illustrated in the two charts above, the following assumptions have been made:

- Energy prices will increase by up to +10% year-on-year, which would mean a 159% increase in 2020 compare to today.
- While this assumption could be 'hard to believe', we must remind ourselves that:
  - Our utilities expenditure has already increased by 120% in only 5 years (2005 – 2010).
  - Gas prices have already reached £4.1 p/kWh. This assumption would mean that this level would be reached again in 2015.
  - This assumption would mean that Electricity prices in 2020 would reach 26p/kWh, a price already applied by some suppliers today in the domestic sector.
- It has been assumed that Water prices would increase by +2% year-on-year, which corresponds to a 2 or 3p/m3 increase every year, already the case today.
- Utilities usage in the 'Business As Usual' projection, do not assume any increase in the usage, which has been the case between 2005 and 2008.

As illustrated in the two charts above, if the following assumptions were to take place:

- In 2020 the University would have to 'survive' with a staggering **utilities bill of £3.5 million, in the 'Business As Usual' (BAU) scenario compare to £1.4 million today**.
- In 2020 the University would have a 'reduced' **utilities bill of £2.7 million, in the 'Carbon Management Plan' (CMP) scenario** (see projects details in section 4).

3.11.3 Scope 1 and 2 carbon emissions target and milestones



4 Carbon Management Implementation Plan

The proposed actions and projects detailed in this section are recommended to management for consideration.

They have been drawn up with great assistance of an engineering consultant, from Briar Associates, appointed in mid January 2011, working very closely with the Energy Manager. Briar Associates have 20 years of experience in this field and already had two previous experiences[10] of Roehampton University's infrastructure conditions.

It is important to emphasise that while the survey has been thorough and of good quality, due to the lack of written / accurate records and the timescale of the survey, some of the following actions should be viewed as best estimates for reducing carbon emissions, and that inevitably, projects will be modified, refined added or removed. A much finer level of detail (such as elevations of buildings, detailed structure of buildings, accurate energy monitoring of the area), will be needed to go-ahead and manage each individual project.

The opportunities have been divided into 4 categories:

- Existing projects – i.e. projects which have been realised in the last two years.
- Funded / Planned projects in 2011
- Near term projects – i.e. under a 5 year payback
- Mid-long term projects

4.1 Existing projects

Ref	Project	Lead	Cost	Annual Saving			Payback (years)	% of Target	Completed
			Capital (£'s)	Energy (kWh)	Financial (£'s)	CO_2 (tonnes)			
	Replaced inefficient boilers at Courts, Erasmus, Jubilee and Hurst	AG/DS	145,000	132,206	3,450	24	42.0	0.6%	2008/10
	Developed an automated monitoring and targeting system (aM&T) - 120 smart-metered points	VA/MR	65,000	429,815	21,889	134	3.0	3.4%	Nov-09/11
	Voltage Optimisation at Whitelands, Fr Sub, Fr Courts	JH/VA/DS	132,645	379,524	36,434	204	3.6	5.2%	Aug-09
	Voltage Optimisation at DS Trade Yard, DS Sub	JH/VA/DS	84,203	299,188	28,722	163	2.9	4.1%	Dec-09
	Water leakage since Sept 09 Whitelands repaired	MR/AG	NC	18000 m3	20,000	5		0.1%	Jan-10
	Voltage Optimisation at Southlands	JH/VA/DS	47,507	174,438	16,746	95	2.8	2.4%	Apr-10
	Erroneous Gas bill - Wrong gas meter read given by RU at Digby	MR	Staff time	NA	4,000	NA			Jul-10
	Overcharge capacity (kVA) elec. bills 2005-2009 - EON	MR	Staff time	NA	8,000	NA			Jul-10
	T5 energy efficient lighting with daylight and movement sensors at parts of Lulham, Richardson and Queen (~50 fittings)	DE/AG	NC	NC	NC	NC			Aug-10

[10] Briar Associates was one of the Carbon Trust's preferred engineering consultancies appointed and entirely funded by the Carbon Trust in 2007 and 2009 to help with the realisation of our first Carbon Management Plan and our application for our Salix SEELS 1 loan.
A grant application to the Carbon Trust was made in June 2010, but unfortunately, the Carbon Trust has now cancelled their support for organisations with an annual energy expenditure above £0.5 million.

	T5 energy efficient lighting with daylight and movement sensors at LRC (900 fittings)	MR/DS	237,053	430,000	41,280	234	5.7	5.9%	Oct-10
	Water leakage near Grove House and Convent	MR	2,446	11000 m3	14,000	3	0.2	0.1%	Oct-10
	Draught proofing at Fincham, Howard, Jubilee, Romero Ct, Richardson, Grove House (615 windows and doors)	MR/DS	34,743	225,000	5,850	42	5.9	1.1%	Nov-10
	Erroneous Water bill since Sept 09 - VAT at Arton Wilson	MR	Staff time	NA	1,500	NA			Jan-11
	Overcharge capacity (kVA) elec. bills 2005-2009 - EDF	MR	Staff time	NA	10,000	NA			Feb-11
	Overcharge capacity (kVA) elec. bills 2005-2009 - BRITISH ENERGY	MR	Staff time	NA	14,000	NA			Mar-11
TOTAL			**748,596**	**2,070,171**	**225,871**	**904**	**3.3**	**23.0%**	

MR = Manon Ray (Energy Manager since 2010) ; VA = Vikki Anderson (Energy Coordinator Aug 2008-09) ; DS = Dan Smith (Project Manager) ; JH = Jonathan Horner (Environmental Manager) ; AG = Alan Green (Assistant Director Buildings, Projects and Maintenance) ; DE = Dorothea Exeler (Project Manager)

- **Nearly £750,000 have been invested in the last two years** to realise the above projects, some of which have only been possible thanks to our Salix loans and strong commitment from our P&FM department and the University in general, for reversing the tendency from the last 4 years.
- **Energy savings (kWh) in excess of 2000 MWh have been realised**, which represents, to give an idea, more than half of the annual gas consumption of our Whiteland's site.
- **Financial savings (£) in excess of £200,000 have been achieved**, most of which falls in the 2010 calendar year alone. It must be noted that some of these savings are not 'annual savings' (credits obtained from overcharges from suppliers) but a 'one-off', and that some others are paying back for themselves first (Salix loans).
- More than **900 TCO2 have been saved**, which represents **23% of our 3932 TCO2 target for reduction**, as explained in section 3.9.3.
- While there is still a long way to go and 'easy savings' may exhaust soon; while the University may take others decisions which may not impact favourably our carbon footprint (extended hours, increase in the number of international students, e.g.); while we are more and more dependent on the energy resource (use of ICT); **this result is a positive sign that Roehampton University's has made a good start to reach its 2020 target.**

4.2 Funded / planned projects in 2011

Ref	Project	Lead	Cost	Annual Saving			Payback (years)	% of Target	Year
			Capital (£'s)	Energy (kWh)	Financial (£'s)	CO_2 (tonnes)			
	Voltage Optimisation at Mount Clare	MR/DS	22,300	28,800	2,293	15	9.7	0.4%	2011
	T5 energy efficient lighting with daylight and movement sensors at Bede, Shaw, Lee, Queen, Hirst common areas	MR/DS	98,977	164,849	15,826	90	6.3	2.3%	2011
	External LED lighting and controls - 114 lamppost	DS/DE	200,000	32,412	17,005	17	12	0.4%	2011
Total			**321,277**	**226,061**	**35,124**	**122**	**9.1**	**3.1%**	

- **£320,000 is already due to be invested** (confirmed projects) **in 2011** to realise the above projects, some of which will be funded thanks to the savings from our Voltage Optimisation project (6 units), funded by our Salix Revolving Green Loan.
- Around **226 MWh**, or **£35,000**, or **122 TCO2 are expected to be saved**, which represents **3.1% of our target** for reduction.

4.3 Near term projects

The below projects have been identified and quantified by Sean Gibson, engineer-consultant at Briar Associates, working closely with Roehampton University's Energy Manager.

All projects under a 5 year payback are included in this section.

Wherever possible projects have been aggregated on a per building basis to simplify project and financial management. They have been given a reference which corresponds to the name of the building (or GEN for measures that are common to the site e.g. BMS, loft insulation and space management), so we can refer easily to each specific measure in the detailed energy survey.

Ref	Project	Cost	Annual Saving		Payback (years)	% of Target
		Capital (£'s)	Financial (£'s)	CO_2 (tonnes)		
GEN1	Staff and student energy awareness campaign	30,000	32,250	201	0.9	5.1%
GEN2	Review BMS settings and adopt energy efficient strategies	50,000	76,900	512	0.7	13.0%
GEN3	Replace halogen spotlights & tungsten lamps with low energy equivalents	5,000	3,250	18	1.5	0.5%
GEN4	Insulate exposed pipework and fittings	6,800	3,050	22	2.2	0.5%
GEN5	Install loft insulation	18,000	5,050	36	3.6	0.9%
GEN10	Space management	30,000	42,000	277	0.7	7.0%
DAV1	Davies Building - install lighting controls in sports hall and dance studios	4,000	1,850	10	2.2	0.3%
DAV2	Davies Building Underfloor heating - adopt BMS high temperature override strategy	1,500	450	3	3.3	0.1%
DU1	Duchesne lecture theatre- install presence & CO2 control	4,000	5,250	31	0.8	0.8%
DU2	Duchesne - install lighting controls in lecture theatre	600	400	2	1.5	0.1%
DU3	Duchesne - TRVs - recommission and install tamperproof covers	1,500	350	3	4.3	0.1%
H1	Hirst - replace hall high level lighting with energy efficient light fittings	6,000	1,300	7	4.6	0.2%
LAW1	Lawrence Building heating circulation pumps - control via BMS	2,500	600	3	4.2	0.1%
LAW2	Lawrence Building TRVs - recommission and install tamperproof covers	1,700	350	2	4.9	0.1%
LRC1	LRC Block A heat pumps - resolve control issues	3,000	2,100	12	1.4	0.3%
LRC2	LRC install BMS controls for heating zone control and entrance heaters	17,200	3,400	22	5.1	0.6%
N1	Newman heating circulation pumps - install VSD	3,000	1,250	7	2.4	0.2%
N2	Newman - install heating control improvements	2,000	400	3	5.0	0.1%
SL1	Southlands - install lighting controls in Queens House Building	11,000	6,400	36	1.7	0.9%
SL2	Southlands - Queens House Conference Room AHU - install presence and CO2 control	2,000	1,050	6	1.9	0.2%
SL3	Southlands - replace inefficient lamps with low energy equivalents	8,400	2,200	12	3.8	0.3%

SL4	Southlands residences - install boost/setback controls to communal electric panel heaters	18,000	3,900	21	4.6	0.5%
SL5	Southlands - Extend BMS to control Kitchen plant and air conditioning plant	9,800	2,050	12	4.8	0.3%
SL6	Southlands TRVs - recommission and install tamperproof covers	3,200	650	5	4.9	0.1%
MC1	Mount Clare heating circulation pumps - install VSDs	3,000	650	4	4.6	0.1%
WL1	Whitelands - Lecture Theatre AHU - install presence & CO2 control	4,000	3,800	22	1.1	0.5%
WL2	Whitelands - Dining and social AHU - install presence & CO2 control	4,000	3,800	22	1.1	0.5%
WL3	Parkstead main entrance heating controls	1,200	800	5	1.5	0.1%
WL4	Whitelands - replace spots and halogen uplights	4,800	1,350	8	3.6	0.2%
WL5	Parkstead House TRVs - recommission and install tamperproof covers	7,500	1,650	12	4.5	0.3%
WL6	Parkstead House - Lab AHU replace electric	22,200	4,850	28	4.6	0.7%
Total		**285,900**	**213,350**	**1,362**	**1.3**	**34.6%**

In summary:

- Approximately **£286,000** of capital investment is required over a two to three year period.
- As a consequence, approximately **1,300 TCO2 and £213,000 will be saved on utilities bills,** at our current electricity and gas prices[11]. This represents nearly **35% of our target** for reduction.

While the University has been primarily focussed on electricity saving opportunities, for the reasons explained in section 2.3 and 3.9.3, **the key issue** which arises from this survey **is management of the Building Management System (BMS) and local control systems**.
Buildings are being serviced beyond their hours of use and often are overheated; which is evident when observing the number of windows open when the ambient temperature was low, often with adjacent radiators on, where the thermostatic radiator valve (TRV) was set high, missing or simply not installed.

While this requires prompt attention, space heating issues are not ‘new’ and have been / will be hindered by a number of factors:

- Ageing heating systems with single pipes, preventing installation of TRV;
- Important investments needed to bring some entire systems up to date, not only boilers;
- Draughty and non-insulated buildings means that the internal temperature need to be set high to avoid excessive complains and staff and students bringing in individual electric heaters;
- Lack of boilers and distribution schematics means more planning and staff time is needed when looking at installing and upgrading controls;
- The Energy Policy need to be updated and implemented, with an emphasis on a proper management system to ‘book’ an electric heater only until work is done to repair broken windows, radiators, etc., and an emphasis on an internal temperature policy of 20-21°C during winter time.
- The BMS need to be used as a tool for better Energy Management, not a tool to satisfy requirements of the coldest person in the building. Use of the BMS need to be shared by a person with an interest in Energy Management, as well as a Maintenance person.

It is critical that the University urgently addresses this issue to in view of the increasing cost of energy and in order to meet the CO2 emission target.

[11] Taken as an average of all charges across all sites, at £0.096£/kWh for electricity and £0.026£/kWh for gas.

4.4 Mid-long term projects

As illustrated in section 3.9.3, the vast majority of the University's carbon emissions arise from our energy usage, or relate to travel. As travel related projects are covered in our Travel Plan, this Carbon Management Plan continues to be focussed on Energy savings projects.

Ref	Project	Cost	Annual Saving		Payback (years)	% of Target
		Capital (£'s)	Financial (£'s)	CO_2 (tonnes)		
GEN6	Extend BMS to all main buildings	78,000	12,100	82	6.4	2.1%
GEN7	Replace external SON & metal halide lamps	20,000	3,050	17	6.6	0.4%
GEN8	Lighting upgrades across site for corridors and kitchens	126,000	13,050	74	9.7	1.9%
GEN9	Install cavity wall insulation	39,600	2,950	21	13.4	0.5%
B1	Bede - install energy efficient lighting and lighting controls	31,200	3,950	23	7.9	0.6%
B2	Bede - replace boilers	75,000	950	7	78.9	0.2%
DU4	Duchesne -Replace 2D and twin CFL fittings with low energy equivalents	22,800	2,150	12	10.6	0.3%
J1	Jubilee - TRVs and fan convectors - recommission and install tamperproof covers	2,500	400	3	6.3	0.1%
J2	Jubilee - 1st floor corridor - replace 2D lamps with LED equivalents and install lighting controls	3,200	300	2	10.7	0.0%
J3	Install double/secondary glazing	30,000	400	3	75.0	0.1%
LRC3	LRC - replace 2D fittings with LED equivalents	3,000	500	3	6.0	0.1%
LRC4	Upgrade lighting on ground and mezzanine floors	60,000	6,500	34	9.2	0.9%
LRC5	Replace boilers	100,000	2,150	15	46.5	0.4%
LRC6	Install double glazing	500,000	2,150	15	232.6	0.4%
SL7	Southlands residences - bedroom strip lamps and 2D lamps with LED equivalents and lighting controls	102,500	8,400	47	12.2	1.2%
SL8	Queens House - replace 2D fittings and twin CFL fittings with LED equivalents	7,000	500	3	14.0	0.1%
MC2	Mount Clare - replace the centralised boiler system by individual boiler units	100,000	3,750	27	26.7	0.7%
WL7	Whitelands Lab AHU - replace electric frost coil with LTHW coil	10,000	1,950	10	5.1	0.2%
WL8	Parkstead - replace 2D lamps with LED equivalents and lighting controls	3,600	300	2	12.0	0.0%
WL9	Parkstead - replace twin CFL fittings with LED equivalents	12,000	800	4	15.0	0.1%
WL10	Parkstead - install double/secondary glazing	100,000	2,800	20	35.7	0.5%
Total		**1,426,400**	**69,100**	**422**	**20.6**	**10.7%**

In summary:

- Approximately **£1.5million** of capital investment is required between 2013-14 and 2019.
- Approximately **422 TCO2 and £70,000 can be expected to be saved on utilities bills,** at our current electricity and gas prices[12]. This **represents nearly 11% of the target** for reduction.

[12] Taken as an average of all charges across all sites, at £0.096£/kWh for electricity and £0.026£/kWh for gas.

4.5 Overview of carbon saving opportunities

The list is not exhaustive and this part of the document will be revised in the next update to take account of new opportunities and challenges; in particular renewable energy production with the recent introduction of Feed-In-Tariff.

The table below attempt to give an overview of the above opportunities, with some others included:

Type	Saving	Action
ENABLEMENT ACTION		
Enablement action	Elec, Gas, Water	Extend Smart-Metering system to: 1) Monitor individually each building, if possible, for its Electricity, Gas and Water usage. 2) Monitor separately, if possible, gas and electricity used for space heating vs gas and electricity used for DHW vs gas and electricity used for catering. 3) Monitor, possibly temporarily, for at least 1 month energy and water savings before and after energy saving project implementation.
Enablement action	Gas	Maps of elevation of all buildings to have a Space Heating Survey. Structure details of all buildings to have a Space Heating Survey.
Enablement action	Gas	Conduct a Space Heating Survey using thermal modeling software to determine more accurately space heating losses through loft, wall, windows/doors, draught and ventilation losses.
Enablement action	Gas	Extend and/or upgrade Building Management System (BMS) as appropriate. Train and allow person with interest in Energy Management to draw up a strategy and control the BMS with a Maintenance person.
Enablement action	Elec, Gas, Water	Consider commissioning a company or any other solutions to complete our Utilities Distribution Map from the supply to the end-user, along with updating labels on fuseboards. For cost reduction, consider this when tendering for our next Fixed Wired testing (2014 - every 5 years).
Enablement action	Elec, Gas, Water	Consider installation of sub-metering, if possible, in conjunction with Utilities Billing Validation Software just purchased, for students living in residences to have their utilities bills separated from the accommodation fee and pay according to their use of utilities from 2013/14. Objective being to eliminate extreme / high users, e.g. students having electric heater on in June, halogen and computers always on and 1hour long showers.
BUILDINGS		
Buildings	Gas, Elec	Improve thermal insulation of building fabrics (roof spaces, cavity and solid walls). A major survey in France, involving 1500 thermal modeling simulation on real buildings, has concluded that: A - When insulating buildings, these must be insulated 'once for all' to reach energy-efficient levels of 50 kWh/m2/year and avoid 'killing the potential' and global higher costs of 'insulating in different stages'. B -There is no need of 'complex technologies' to reach 50kWh/m2/year: 1) Loft must be insulated to reach Uvalue = 0.13 W/m2.°C (equivalent of an <u>additional</u> 30cm of mineral wool); 2) Wall and Floor must be insulated to reach Uvalue = 0.22 W/m2.°C (equivalent of an <u>additional</u> 17cm of mineral wool);

		3) Windows must be wooden frame with low emissivity triple or double glazing argon filled (Uw= 1.3 W/m2.°C) ; 4) Heat Recovery Ventilation System (HRVC) with min. 70% efficiency is essential 5) Gas condensing / wood boiler with minimal seasonal efficiency of 70% must be installed to produce space heating.
Buildings	Gas	Draught strip doors and windows, or repair, or replace.
Buildings	Gas	Replace metal frame single glazing with wooden or PVC frame windows with low emissivity double glazing argon filled (Uw= 1.3 W/m2.°C).
Buildings	Gas	Consider secondary glazing in listed buildings single glazed.
Buildings	Gas	Continue Space Management Programme.
Buildings	Gas	Consider creating entrance lobby, with automatic doors correctly timed and draught proofed.
Buildings ventilation	Gas	Extractor fan review, especially settings (manual, on motion sensor and/or on timer) to be considered in conjunction with air-quality complaints and energy-efficient ventilation modes (HRVC, Natural max 15 minutes a day).
SPACE HEATING CONTROLS, PRODUCTION and DISTRIBUTION		
Space Heating controls	Gas	Consider reducing building temperatures in the winter at 20-21°C or lower (sports halls). Every time we turn down thermostats by 1°C it saves at least 7% on the space heating bills: a 'quick win', providing this is done in conjunction with building fabric insulation, double-glazing (to reduce unpleasant sensation due to cold facade), draught and 'uncontrolled' ventilation reduction and sufficient heating controls.
Space Heating controls	Gas	Review if space heating temperature zoning is possible. If heating distribution allows, reduce appropriately space heating temperature in corridors, store rooms and other rooms that are not occupied, compare to offices.
Space Heating controls	Gas	Review heating 'on-times' in conjunction with BMS, local controls and Timetabling with a view to lowering heating by -4°C at times when buildings are not being used (night). Install controls and sensors in right place if not present.
Space Heating controls	Gas	Ensure that wherever practicable individual room (and/or radiator) thermostats are fitted.
Space heating and ventilation	Elec	Air Handling Unit (AHU) inspection.
Space Heating production	Gas	Continue to replace old inefficient boilers with gas condensing boilers.
Space Heating production	Gas	Consider replacement of central boilers feeding academic and residential buildings with local boilers for better controls of 'heating on' times.
Space Heating production	Gas	Consideration of individual CHP, wood boilers and if low temperature radiators can be installed (i.e. on most energy efficient buildings), consider eventually Heat Pumps.
Space Heating production	Gas	Consider 'Burner Management Unit' to optimise firing pattern to demand.
Space heating production	Elec	Review and control the numbers of portable electric heaters being used.
Space Heating distribution	Gas	DHW tank, boilers, pipes (external and internal) and valves lagging.

Space Heating distribution	Gas	Flush heating pipes. Consider replacement of cast iron radiators.
Space Heating and A/C production	Gas, Elec	Ensure heating maintenance is regularly done. Make sure that boilers are tested annually in summer and Air-Conditioning (A/C) unit tested annually in winter to allow planned maintenance.
Space heating and A/C	Gas, Elec	Check that no areas with simultaneous heating and cooling (server room, labs).
Space heating and A/C	Elec	Continue work started on Variable Speed Drives (VSD).
Space Heating and DHW	Gas	Consider boilers modifications such as separating DHW production from space heating to allow better management and monitoring.
DOMESTIC HOT WATER CONTROLS, PRODUCTION and DISTRIBUTION		
DHW production	if Elec	Review calorifier sizing vs needs and if appropriate, consider installation of timer to switch them on at night, when electricity tariff are lower.
DHW production	Gas, Elec	Investigate development of installation of water softener in conjunction with scaling, maintenance cost and loss of efficiency.
DHW distribution	Gas, Elec	Install mixing valves where appropriate for better temperature control and to avoid risk of burning.
AIR CONDITIONING (cooling) CONTROLS and PRODUCTION		
A/C production	Elec	Review and control the numbers of portable air conditioning units (cooling) being used.
A/C controls	Elec	Display simple user controls near Air Conditioning units (A/C).
LIGHTING ENERGY-EFFICIENCY		
Lighting	Elec	Continue standardisation and replacement of inefficient internal and external T12/T8/incandescent/halogen lighting by the appropriate energy-efficient standard: T5/CFL/LED with electronic ballast and daylight and motion sensors.
INFORMATION TECHNOLOGY AND MEDIA (ITM) ENERGY-EFFICIENCY		
ITM equipment	Elec	Continue to investigate financial feasibility of having PC Power management Software to centrally control all ITM equipment with IP addresses in the future (projectors, display screen, computers, printers and photocopiers, wireless connection, etc.). It must be noted that RU is 'Virtualised' at 95%, that computers in open-access suites now automatically goes on stand-by if logged-off for more than 15min. and that a survey is currently being conducted to have a better idea of energy usage due to our IT equipment and target appropriately specific type of equipment.
ITM equipment	Elec	Continue to investigate with ITM department what can be done to improve energy-efficiency of our Server and switch rooms, including evaporative cooling (existing server room), natural ventilation (new server room) and cloud-computing (server not on-site).
ITM equipment	Elec	Timer switches on appropriate electronic equipment, for example vending machines for non-consumables?
WATER EFFICIENCY		
Water distribution	Water	Continue to investigate water leakage and repair. Try to obtain credits for wastewater costs to Thames Water if leakage can be proved.
Water distribution	Water	Investigate suitable provider of water saving showerhead and taps. Compare water savings vs elec. cost increase if bigger pump need to be installed to compensate loss of pressure in upper floors in blocks.

EQUIPMENT		
Procurement	Elec	Develop and implement a minimum energy-efficiency specification, notably requiring that all electrical equipment purchased has an ‘A’ energy rating.
Procurement and Equipment	Elec	Feasibility of replacing all electric washing-machines and dishwashers with dual energy models (i.e. gas to heat the water; 80% of the elec. usage in ‘all elec.’ types!).
Electric equipment	Elec	Continue to consider centralisation and reducing numbers of 'personal' fridges and printers. Encourage equipment running 'all the time' to be shared.
TRAVEL		
Travel		Consider introduction of low carbon emitting university vehicles such as electric or dual fuel.
Travel		Enhance existing provision for cyclists and encourage the use of low carbon emitting modes of transport. Implement Travel Plan.
Travel		Implement Travel Plan.
WASTE		
Waste		Increase recycling results and enhance provision and instructions.
Waste		Set double sided and ‘black and white’ printing as a default setting on all printers. Consider printing quotas for staff and students using ID card.
Waste		Discourage the use of disposable catering related items.
Waste and Cleaning		Replace hand dryers by Dyson 10 second cold air and remove paper to dry hand in toilets.
Waste		Feasibility study for composting food waste.

Higher management input and decisions will be necessary in order to determine the funding for, and sequencing and timing of, the various actions and projects outlined in the previous section. Also, successful implementation of this plan, will be very much a ‘team’s effort’ (see section 6.1 and 6.2).

To facilitate successful introduction and to enhance effectiveness, many carbon reduction emission projects will benefit from support at all levels within the University. For this to take place, it is important to embed energy and carbon management in the organisation and to have good management and processes in place. It requires changed thinking at all levels and one of the key to this is good communication (see section 6.3).

5 Implementation Plan Financing

Some of the actions and projects which have been identified can be implemented without significant investment utilising existing infrastructure and budgets in the course of normal activities. Others require significant investment for which specific budgets will need to be established.

While the current economic situation will slow down drastically capital investments, it is important to:

- **Continue to re-use**, for the appropriate projects, **savings generated from our Voltage Optimisation project, funded by our Salix Revolving Green Fund**. Circa £90,000 a year have to be re-used for projects which can demonstrate a return on investment within 5 years, with costs not exceeding £100 per TCO2 saved. 'Use it or lose it' – savings *must* be reinvested, on annual basis, or it will be concluded that no further 'compliant' projects can be found and the loan need then to be paid back. Roehampton University's Energy Manager and Deputy of Finance are working closely with Salix on an on-going basis.

- Apply for more Salix interest-free loans, as they are made available.

- Consider, with the necessary technical knowledge and careful legal consideration, renewable scheme where the upfront costs are supported by the company installing the technology. If renewable technologies installation were considered in the future, consider support from Partnerships for Renewables.

- **Seek further external support of all forms**, especially for longer term payback, such as the RE:FIT programme, from the London Development Agency (LDA). Consider scheme such as the Low Carbon Zones (LCZ) programme. Keep an eye on projects like the London Thames Gateway Heat Network and the Pimlico and Whitehall Decentralised Energy, in case they are 'extended'.

- Apply for support, as appropriate, from the Department of Energy and Climate Change (DECC) or for larger projects to Intelligent Energy Europe (European Commission).

- Apply for support, as appropriate, from the Carbon Trust. If retrofitting of a building or new energy-efficient buildings were considered, apply for Design advice from the Carbon Trust.

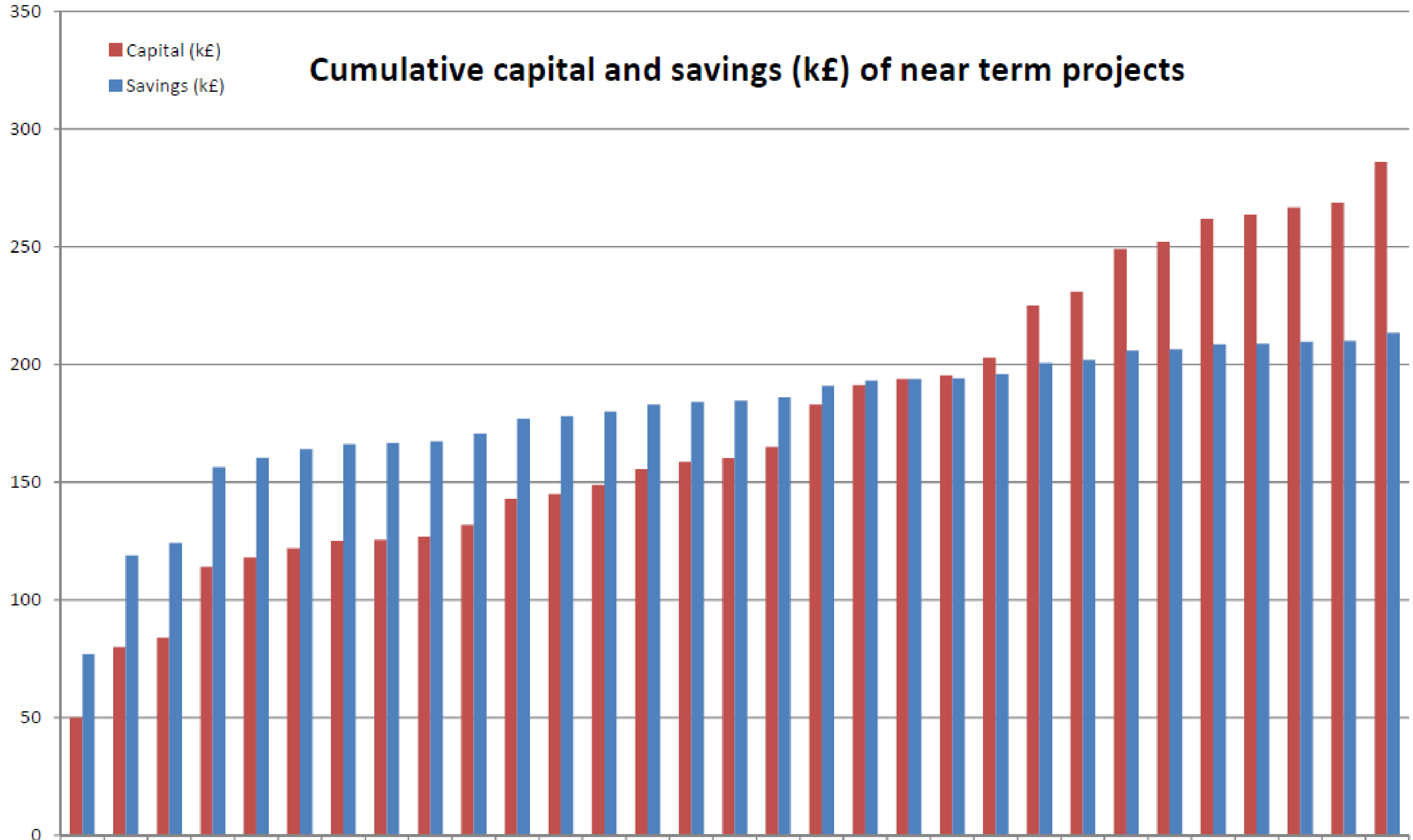
- Finally, it is important to **allocate sufficient staff time** to allow good planning, funding and project management, to make successful carbon saving projects a reality.

One of the roles of this plan is to give us an idea of the level of investment needed to reach our carbon emission target; thus allowing Roehampton University's to plan-ahead budget and funding:

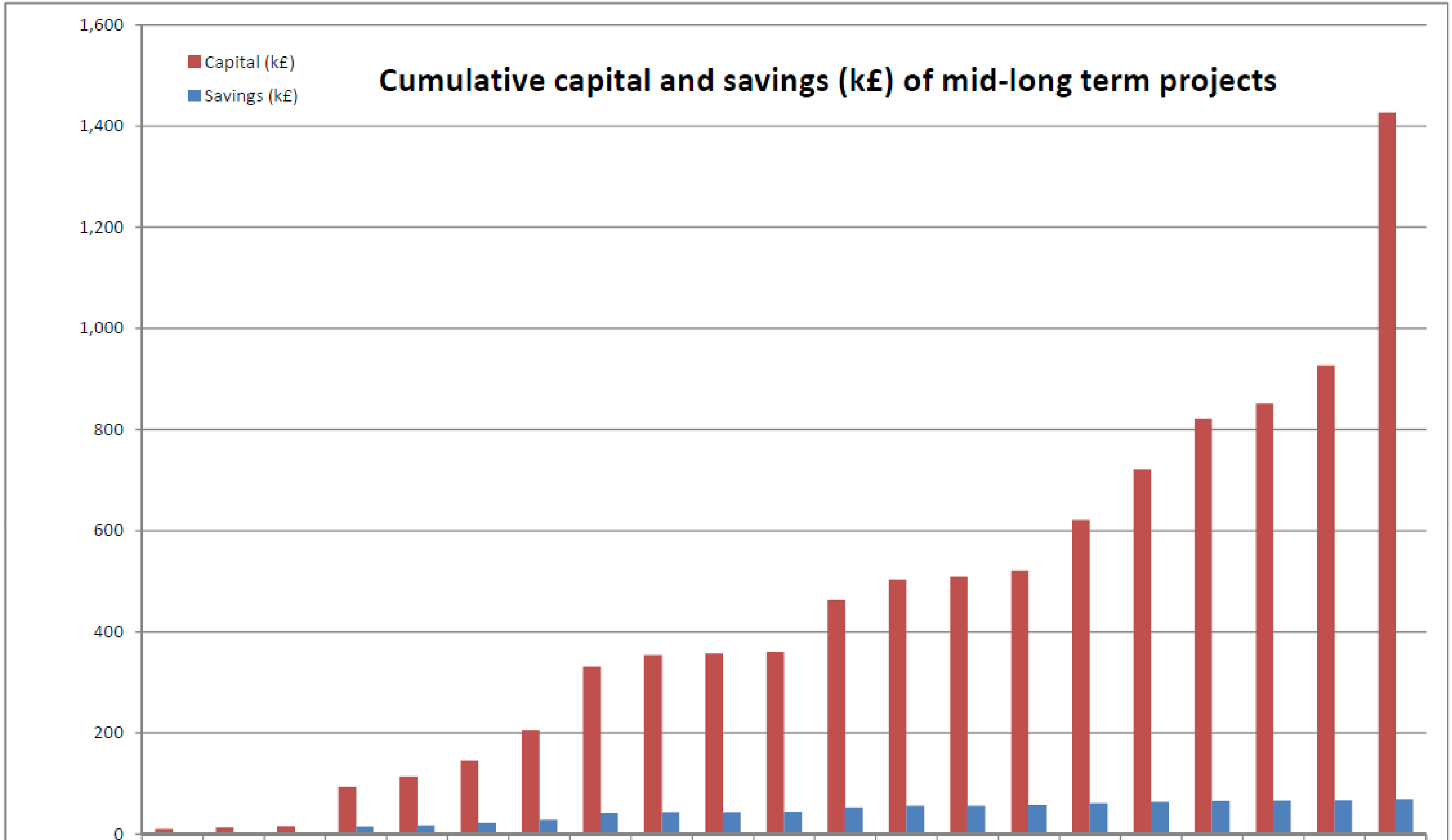
- Implementing the carbon reduction energy saving measures which offer a simple payback of less than 5 years (near term projects) is estimated to require a **capital investment** over a 3 to 5 year period **of £286,000. Savings generated** could reach a staggering **£213,000**, again, without considering any energy prices increase.

- Implementing the carbon reduction energy saving measures which offer a simple payback greater than 5 years (mid-long term projects) is estimated to require a **capital investment** over a 5 to 10 year period **of £1,426,000. Savings generated** could reach **£69,000**, again, without considering any energy prices increase.

The two charts below represent the cumulative capital investment and savings generated, if we were to consider only one criteria when prioritising projects: individual simple paybacks. In other words, the projects with lower payback would get done first, regardless of any other logic of cost reduction or technical issues, until we reach the highest individual paybacks.



	GEN 2	GEN 10	DU1	GEN 1	WL1	WL2	LRC1	DU2	WL3	GEN 3	SL1	SL2	DAV 1	GEN 4	N1	DAV 2	WL4	GEN 5	SL3	LAW 1	DU3	WL5	WL6	H1	SL4	MC1	SL5	LAW 2	SL6	N2	LRC2
Capital (k£)	50	80	84	114	118	122	125	126	127	132	143	145	149	156	159	160	165	183	191	194	195	203	225	231	249	252	262	264	267	269	286
Savings (k£)	77	119	124	156	160	164	166	167	167	171	177	178	180	183	184	185	186	191	193	194	194	196	201	202	206	207	209	209	210	210	213



	WL7	LRC3	J1	GEN6	GEN7	B1	LRC4	GEN8	DU4	J2	WL8	SL7	GEN9	SL8	WL9	MC2	WL10	LRC5	J3	B2	LRC6
Capital (k£)	10	13	16	94	114	145	205	331	354	357	360	463	502	509	521	621	721	821	851	926	1,426
Savings (k£)	2	2	3	15	18	22	28	42	44	44	44	53	56	56	57	61	63	66	66	67	69

6 Governance and Monitoring

6.1 Stakeholder engagement

Engagement with project stakeholders started in October 2007, with an opportunities workshop designed to gather carbon saving ideas and simultaneously raise awareness amongst stakeholders. This was attended by 6 key stakeholders, several of whom hold senior positions at the University.

Since this workshop and our 2008 plan, University stakeholders have been identified as follow:

- Vice Chancellor
- Director of Property and Facilities Management
- Director and Deputy of Finance
- Director of Information Technology and Media Services (ITM)
- Director of Procurement
- Chair of the University Environmental Forum
- Assistant Director of Buildings, Projects and Maintenance
- Maintenance Manager
- Electrical Supervisor
- Accommodation Manager
- Catering Manager
- Cleaning Manager
- Ground and Waste Manager
- Assistant Director Security Fire and Transport
- Assistant Director of Management Services
- Press and Public Relations Manager
- Student Union Environmental Officer
- Editor of the Students Union newspaper
- Environmental Manager
- Energy Manager
- Projects Manager(s)

All of these staff members, most of which are part of the Property and Facilities Management Department, will be, at different levels, involved in the Implementation of this 2011-2020 Carbon Management Strategy.

The implementation of the programme will continue to promote coherent communication on the aims of carbon management to key departments and individuals.

6.2 Main roles and responsibilities

The University Estates Committee will direct the ongoing monitoring and commitment of this 2011-2020 Carbon Management Plan. This Committee is composed of representatives of both academic and central departments.

With the present scope of the proposed programme primarily based on the reduction of carbon emissions from energy efficiency, the co-ordination of the implementation of the programme will be undertaken by the Director of Property and Facilities Management.

It is recommended that **at least two key Project Managers** within this Department are identified **to work closely with the Energy Manager** and Environmental Manager, to assist in establishing business cases and obtaining approval, tendering and implementing the proposed projects, **if we are to achieve our goals**.

Good management (distribution of responsibilities) and effective processes for decision-making is key to the success of this achievable, but nevertheless, ambitious, programme.

Activity	Responsible Person
Responsible of Carbon Management Strategy	Vice-Chancellor and Chair of Estates Committee
Carbon Management Strategy	
1. Set or review objectives	Director of Property and Facilities Management, approved by Council
2. Prioritise and decide order of projects implementation	Director of Property and Facilities Management, after consideration of technical and cost savings recommendations from Energy Manager and AD Buildings, Projects and Maintenance ; and in conjunction with Director of Finance for budget phasing.
3. Manage Implementation Plan	Energy Manager and Environmental Manager, with at least two Projects Managers
4. Monitor and review progress	Energy Manager, Environmental Manager, Assistant Director Management Services and Business Analyst in conjunction with Eco-Campus our Environmental Management System and our Travel Plan
5. Review and update plan (every 3 years)	Energy and Environmental Manager, after consideration of recommendations of Director of Property and Facilities Management
Budgeting and financing of Carbon Management Activities	Director of Finance, Director of Property and Facilities Management, AD Management Services and AD Buildings, Projects and Maintenance
Seek funding as appropriate	AD Management Services, assisted by Energy and Environmental Manager
Management of Salix loans	Deputy of Finance (financial side), Energy Manager (technical side - oversee projects - first point of contact for Salix) and Projects Managers (projects implemented)
Carbon Management in Buildings	Energy Manager, AD Buildings, Projects and Maintenance and Maintenance Manager/Electrical Supervisor
Carbon Management and BMS	Energy Manager and Maintenance Manager, working with Timetabling
Reporting energy related issues	Every member of staff or students to log a job on our Footprint system. Customer Services to answer taking into consideration good carbon/energy management practices.
Carbon Management in ITM	Energy Manager and Director of Information Technology and Media Services (ITM) or Head of IT User Services , Head of Media Services, Head of Infrastructure Services
Carbon Management in Utilities	Energy Manager, Business Analyst and AD Management Services
Carbon Management and Students Accommodation, Conferencing, Security, Cleaning, Catering and Procurement department	Environmental Manager and/or Energy Manager (in their respective fields) with Head of the Department
Carbon Management in Waste	Environmental Manager and Ground / Waste Manager
Carbon Management in Transport	Environmental Manager and AD Security Fire and Transport
Communication about Carbon Management	Environmental Manager and Energy Manager in their respective fields, with Environmental Forum, Marketing Department and Students Union.

6.3 Communication and decision-making about Carbon Management

Roehampton Environmental and Project Teams (P&FM), will continue to deliver carbon savings and successful projects, as long as:

- Carbon Management will be embedded in the institution at all levels
- Clear management and processes are in place to deliver them effectively and on budget
- It will be acknowledged that sufficient staff time and training need to be allocated to deliver successful projects
- Despite the current financial climate, it is acknowledged and possible to 'invest to save', and not only on 'quick wins': some interventions will *need* a step change in the way we *invest*.

  Indeed, as global energy demand increase faster than its 'production' (fossil fuels are a finite resource) energy prices are only set to rise. Delaying important 'longer-term' investment will only put the University, like any other institutions, in greater financial risks. More than half of our building stock is 'old' and not energy-efficient, but, most of these buildings will be there in 2020 or 2030. As it is not financially and technically possible to rebuild every old building, those buildings will need at some point to be retrofitted to energy-efficient standards, if the University need them. The positive sign for this generation is that we still have the choice: 'investing for the future', now, or 'facing the huge bill', later.

It is therefore recognised that an effective communication will be essential for, decision makers, staff and students to understand the issues and make the right decision drawing our environmental and financial future. Communication will be maintained, pending on staff time and resource, by:

- Scheduling presentation and meetings with key stakeholder groups.
- Providing regular e-mail updates to the relevant stakeholders.
- Posting news items on University online notice boards.
- Updating regularly the Environmental Webpages.
- Providing regular updates to existing committees and groups, such as, the University Environmental Forum, Finance Committee and Estates Committee.

6.4 Reporting and evaluation

In order to deliver actual energy reductions it is essential that effective energy data collection, analysis and reporting processes are in place. A Smart Metering system was identified as a key enablement action in our first Carbon Management Plan in order to do this, and the University has made a good start with the installation of 120 smart-metered electricity, gas and water supply points in November 2009. While the University unfortunately had had a lot of technical issues with the current system, an upgrade to a better version has been promised by the company.

Based on this information when made entirely available and accurate, and on any other statistics the University produce, the Energy and Environmental Manager will issue an annual progress report to the Director of Property and Facilities Management, who will report to the University Estates Committee.

6.5 Risks and Benefits

While implementation of this Carbon Management Plan will be mainly driven by the Department of Property and Facilities Management, control of this plan *must* become an integral part of the University's 2025 Strategy.

The main risk of failure of this plan is the financial (and so staff) constraints under which the University has been recently put, due to the Government Spending Review.

If the minimum resources for this plan to succeed are maintained, the first benefit for the University is a better long-term financial stability, at least regarding utilities, waste, transport and 'compliance' costs.

Appendix A: 2005-2010 Energy prices in the UK

These charts have been provided to illustrate the last 5 years evolution of energy prices, as well as their composition. Please refer to the entire OFGEM November 2010 report for analysis, context and methodology explaining how these figures have been derived.

Figure 3.1: Electricity forward prices vs. 18 month hedge

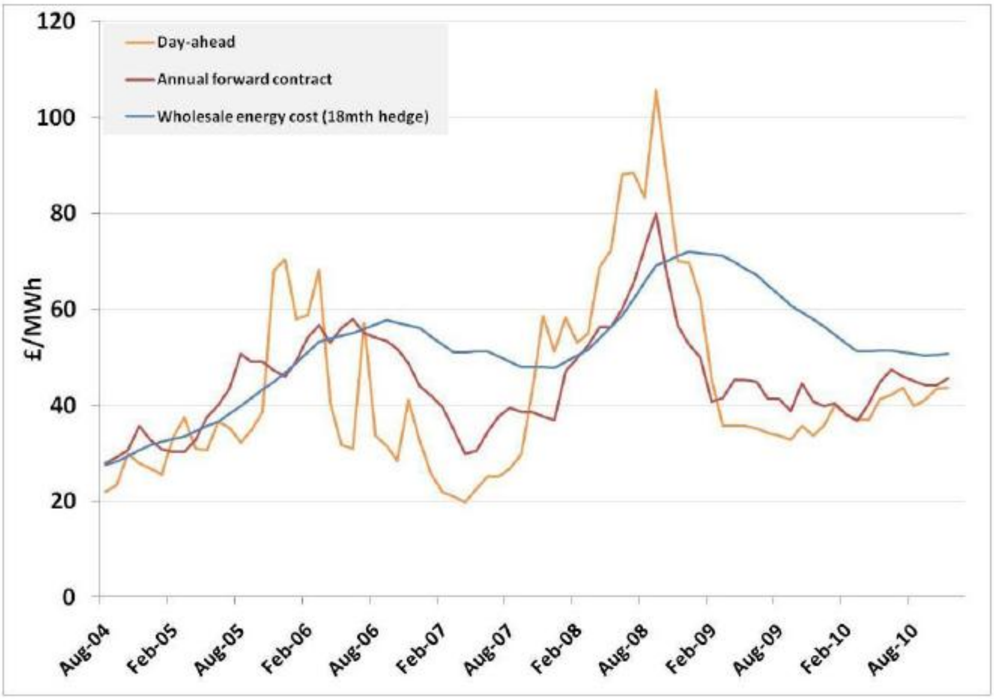


Figure 3.2: Gas forward prices vs. 18 month hedge

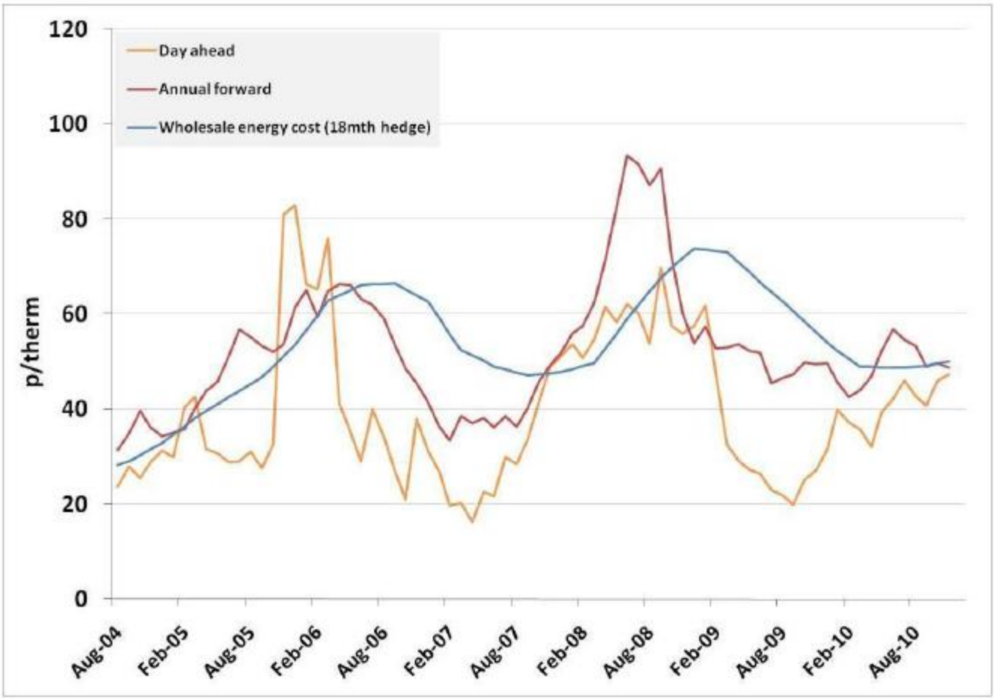


Figure 1.1: Typical dual fuel customer bill, costs and net margin

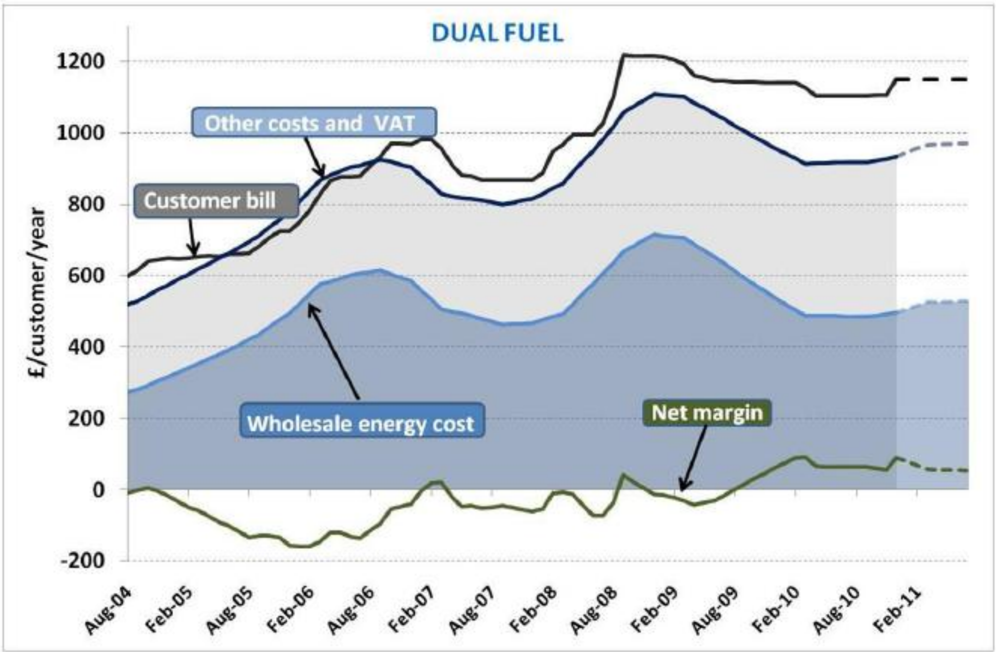
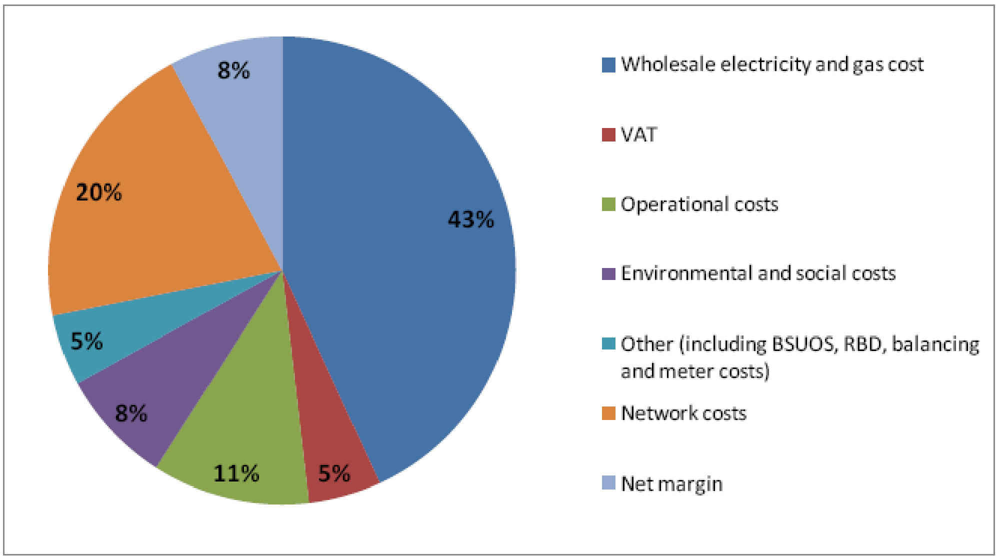
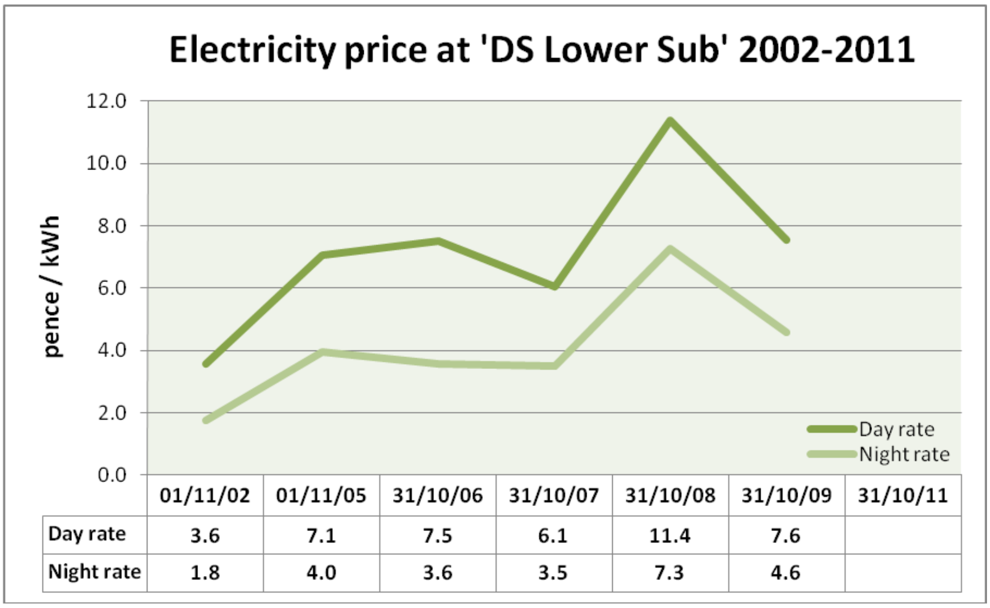


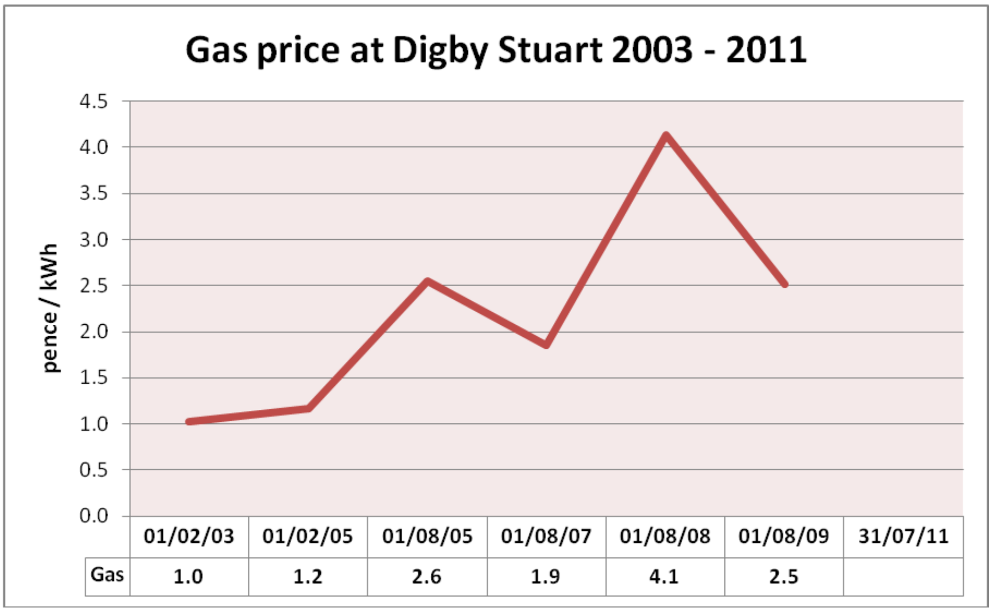
Figure 4.1: Illustrative breakdown of a typical dual fuel customer bill



Appendix B: 2003-2010 Energy prices at Roehampton

As explained in 3.1.2 and 3.3.2, Roehampton University has different prices for nearly each supply points, and would have had in the past some contracts renewed at different dates.
As an example, this is how energy prices have been varying at 'Digby Stuart Lower SubStation' (Electricity) and 'Digby Stuart' (Gas):





These prices do not include any other charges such as fixed charges, CCL, VAT, etc.