The University of Nottingham

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Carbon Management Plan Annual Report 2011/2012

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University of Nottingham

Annual Report 2011/12 Carbon Management

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Executive Summary

This is the University's 2011/12 Carbon Management Plan (CMP) annual report. It is the second annual report and provides details on progress achieved and performance improvements made in reducing emissions of carbon dioxide (CO_2) against University targets.

The University's CMP was approved in December 2010 and can be found at www.nottingham.ac.uk/about/values/environment/carbonmanagement.aspx. The CMP includes targets for reductions in emissions of CO_2 from energy usage. It identifies the principal areas of energy use and investment programmes required to improve energy efficiency, reduce usage and generate energy from renewable energy sources.

In its second year the CMP developed 55 projects requiring a total investment of £1.48 million. The overall benefits identified equate to 2,028 tonnes of CO_2 and £350k per annum. In 2010/11 we saw a 1.7 % decrease in CO_2 and we have continued this trend in 2011/12 with a 2.3% reduction from 67,454 to 65,901 tonnes CO_2 a saving of 1,553 tonnes.

The 2010-2015 new building programme results in c. 3000 tonnes additional CO_2, an annual average of 600 tonnes. The commissioning of new buildings at University Park and Sutton Bonington in 2011/12 increased the overall Gross Internal Area by 8,920 m^2 with additional predicted increases in CO_2 emissions of 490 tonnes. For the first two years the total predicted emissions equate to 1,795 tonnes for buildings completed in 2010/11 and 2011/12 compared to a predicted growth of 1,200 tonnes.

University on Nottingham Innovation Park and East Midlands Conference Centre ltd. assets are excluded from the reported figures.

In July 2011 the University registered with the Environment Agency for the Carbon Reduction Commitment Energy, Efficiency Scheme. The CRC calculation methodology uses a different baseline and annual calculations to that required for the Carbon Management Plan. The initial assessment of our carbon footprint for the period April 2010 – March 2011 was 54,751 tonnes CO_2 and a cost of £657k. Costs will be incurred from 2012 onwards. The actual cost for the period April 2011 – March 2012 was £615k, based on emissions of 51,276 tonnes CO_2. This is an absolute reduction of 3,475 tonnes CO_2 and £42k from the 2010/2011 CRC baseline totals.

Planning applications were made for the construction of a wind farm at Grove Farm. This included details of environmental effects of the project and benefits of c. 6,200 tonnes CO_2 per annum. Decisions are now expected late 2012.

A programme of building and high energy plant audits and strategic heating feasibility studies continues, providing specific projects for approval and investment opportunities at University Park and Sutton Bonington for new and replacement high efficiency plant to be made. The programme findings and recommendations are presented to Environment Committee for approval.

In order to identify and accelerate further projects in the CMP, approval has been obtained for the new post of Carbon Reduction Manager, with the post anticipated to be filled before the end of 2012.

1 Introduction

This is the University's second Carbon Management Plan (CMP) annual report 2011/12. It provides details on progress achieved and performance improvements made against targets.

The CMP was approved in December 2010, with target CO_2 reductions to be delivered against timescales. The second year's programme has invested £1.48 m in projects across all areas of the CMP, with predicted annual savings totalling £350k and 2,028 tonnes of CO_2.

The report provides an update on energy and carbon dioxide (CO_2) emissions arising from Scope 1 and 2 sources, CO_2 reduction projects approved and installed, CO_2 savings, financial performance and the programmes of work planned for the next 12 months.

The UK's Carbon Reduction Commitment energy efficiency scheme commenced in 2010. Details of the University's participation, performance and reporting requirements are summarised in section 5 of this report.

The report includes information on engagement with staff and students to raise awareness of the CMP's objectives and provide knowledge to identify and implement energy saving initiatives.

2 Carbon Management Plan – objectives and targets

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

1. improvements in energy efficiency of buildings, including insulation, heating & lighting
2. more efficient use of existing equipment including switching off when not in use
3. generation of energy from small/medium scale renewable energy systems
4. provision of information and training to staff and students to engage them with the objectives of the Plan

The programme includes a number of specific investment projects and more generic programmes to deliver CO_2 reductions but require further detailed design to ensure maximum value for money is obtained. These focus on the areas of energy saving and energy efficiency for Scope 1 (predominantly gas combustion in boilers) and Scope 2 (electricity use) emissions. CO_2 reductions from travel, procurement and waste (Scope 3) are not included but will be assessed separately and reported in 2012/13.

The CMP provides a baseline of CO_2 emissions, sets emission reduction targets and maps out a new 5 year investment programme to be implemented to deliver environmental performance improvements and carbon & financial savings[1]. The CMP targets and objectives included in the University Plan 2010-15 are as follows:

	Baseline 2009/10	Objective 2014/15
Total energy consumption p.a.	198 GWh	168 GWh
Total CO_2 emissions p.a.	68,000 tonnes	54,000 tonnes

These represent reductions from the 2009/10 usage of 15% on energy and 20% on CO_2 emissions by 2014/15. The targets require average annual reductions in energy consumption of 6GWh and CO_2 emissions of 2,800 tonnes; these are fundamental departures from historic rises seen in energy usage. The CMP will be used as the blueprint to develop carbon baselines for our overseas campuses by 2012, a requirement of the University Plan, and subsequent carbon reduction strategies for all campuses for the period 2015-20.

Assets of commercial subsidiary companies of the University at Innovation Park and East Midlands Conference Centre ltd. are excluded from reported figures.

3 UK's Carbon Reduction Commitment Energy Efficiency scheme

The Carbon Reduction Commitment Energy Efficiency Scheme (CRC) is a mandatory carbon emissions reporting and pricing scheme to cover all organisations using more than 6,000MWh per year of electricity (equivalent to an annual electricity bill of about £500,000). The CRC came into force in April 2010 to significantly reduce UK carbon emissions in non-energy intensive sectors in the UK. The sectors targeted by the CRC generate over 10% of UK

[1] www.nottingham.ac.uk/about/documents/carbonmanagementplan2011.pdf

CO_2 emissions, around 55 $MtCO_2$, and the scheme aims to reduce emissions from these organisations by at least 4 million tonnes CO_2 per year by 2020.

The University registered as a participant in the CRC in August 2010. There are three main differences in the requirements compared to the University's EMS reports:

- The CRC reporting periods use data from 1 April to 31 March
- CRC's definitions of building ownership result in the Medical School being excluded in the CRC carbon footprint
- Different emission factors, particularly of gas, are used by Defra to calculate CO_2 totals

The CRC Footprint report and first Annual report were submitted to the Environment Agency in July 2011 and the second in July 2012. Annual University emissions for the period April 2011 – March 2012 are given below (2010/11 totals in brackets for comparison).

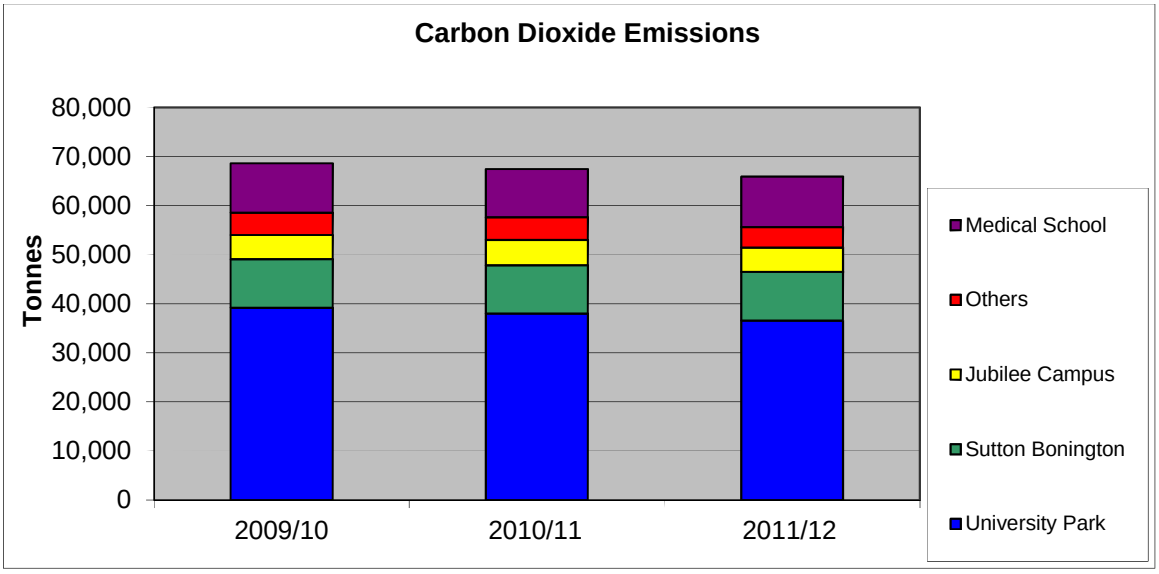
Core supplies (this excludes core supplies of gas to an EU ETS installation and CCA facility and core supplies of electricity to a CCA facility)				
Fuel source	Actual supply	Estimated supply	Measurement unit	Calculated emissions (tonnes CO_2)
Core electricity not covered by a CCA	66,601,971 (67,436,269)	0	kWh	36,031 (36,483)
Core gas not covered by EU ETS or by a CCA	85,826,105 (100,509,167)	0	kWh	15,757 (18,453)
Electricity Generating Credits				
		kilowatt hours	Tonnes of CO_2	
Electricity Generating Credits		948,233 (343,332)	512 (185)	
Emissions for annual reporting years 2010/2011, 2011/12				
Total CRC Emissions (tonnes of CO_2):		51,276 (54,751)		

The annual cost to the University of CRC participation for the period April 2011 – March 2012 was £615k, based on emissions of 51,276 tonnes CO_2. This is a reduction of 3,475 tonnes CO_2 and £42k from the 2010/2011 CRC baseline totals.

4 Performance achieved

4.1 Carbon dioxide emissions (Scope 1 and 2)

In 2011/12 carbon dioxide emissions fell by 1,553 tonnes (2.3%) despite an increase in floor area of 3.5%, and a 3.3% increase in student numbers.



CO_2 Emission Factors	2009/10	2010/11	2011/12
Electricity kg/kWh	0.542	0.541	0.541
Gas kg/kWh	0.205	0.204	0.204

CO_2 emissions	Tonnes 2009/10	Tonnes 2010/11	Tonnes 2011/12	Change '10/11 to '11/12
University Park[2]	39,194	38,007	36,545	-3.8%
Sutton Bonington	9,854	9,804	9,964	1.6%
Jubilee Campus	4,949	5,192	4,942	-4.8%
Others	4,568	4,587	4,161	-9.3%
Medical School	10,061	9,865	10,289	4.3%
Totals	68,626	67,454	65,901	-2.3%

4.2 Electricity

Consumption savings of 2%-3% month on month at University Park were achieved from August to December 2011. These were reversed from January 2012 by a combination of the cold spring and new buildings reaching full occupancy, resulting in an overall increase in consumption of 1.3% for the year. Electricity consumption at Sutton Bonington increased by 9% as the new Gateway and Bioenergy buildings plus new greenhouses added to the load.

A noticeable reduction in consumption of 16.9% in the 'Others' category was down to a 31% decrease in imported electricity at King's Meadow Campus. This was due to the first full year of operation of the CHP plant; this has led to savings from electricity of 703 tonnes CO_2.

4.3 Fossil Fuels

Overall the statistics from fossil fuel usage fell by 2.2%. Jubilee Campus consumption increased by 9% mainly attributed to the impact of new buildings.

Fossil fuel consumption also increased in the 'others' category due to the operation of the 300kW CHP Unit at King's Meadow Campus, but the electricity generated results in net carbon dioxide savings of 295 tonnes per annum.

Examples of localised growth in gas usage include Portland kitchen redevelopments (33 tonnes CO_2); future crop glasshouses at Sutton Bonington (45 tonnes CO_2) and new buildings at Jubilee Campus (82 tonnes CO_2).

Further details and a full breakdown of electricity and fossil fuel usage campus by campus and major buildings can be found in the University's 2011/12 Energy Report. A schedule of main University buildings with fossil fuel and electricity data and associated emissions can be found in Appendix 2 of this report.

4.4 Targets

The targets set in the CMP require annual CO_2 emissions to fall from 68,000 tonnes in 2009/10 to 54,000 tonnes by 2015, a reduction of 14,000 tonnes. The programme includes a reduction in emissions from the proposed Grove Farm wind farm of 6,200 tonnes per year by 2015. The remaining programmes would need to deliver savings of 7,800 tonnes – this would equate to providing savings on average of 1,560 tonnes each year throughout the five year period plus pro rata saving of 600 tonnes each year to support projected new build additions.

Summary of 2 year results on CMP carbon emissions (tonnes) excluding wind farm contributions:

2009/10	2011/12	2011/12	Variance	2011/12	2011/12	Variance	Net Variance
Baseline	Target	Actual		New build assumption	New build actual		
68,000	64,980	65,901	(921)	1,200	1,795	595	(326)

Actual reductions in carbon emission after 2 years are 921 tonnes less than a straight extrapolation projection over 5 years to 2014/15. New build additions have contributed an additional 595 tonnes to the CMP consumptions resulting in a net shortfall of 326 tonnes. The funded CMP projects to date provide an estimated annual reduction

[2] The 2011/12 carbon totals exclude assets of commercial subsidiary companies of the University.

in CO2 emissions of 6,124 tonnes, which is in excess of the target reduction of 4,320 tonnes excluding any contribution from wind turbines. The measured carbon emissions to date do not incorporate the full contribution of these projects due to the natural lag from delivery to measured benefit over a full year.

5 Carbon projects

5.1 Carbon Management Plan projects

A summary of carbon saving projects installed in 2011/12 together with totals for investment in 2010/11 is given below. Projects are grouped into the main CMP themes together with their financial and carbon performances.

Project theme	Project description	Investment cost £	Estimated annual savings	
			Financial £	CO_2 tonnes
Improvements to building fabric, glazing and insulation	Roof insulation installed and cavity wall insulations completed for a number of buildings Major glazing improvement projects	866,561	53,908	367
Laboratories: Continuation of Fume Cupboard works	Reduce air volume and face velocity supplied to fume cupboards by 25%. Install night setback control systems on heating to laboratories.		226,840	1,258
Major equipment upgrades	Replacement of three large chillers and improvements to heating systems	434,345	36,691	206
Building Management Systems	Install new and refurbished heating control systems	130,500	13,875	68
Behaviour change & awareness	Staff induction and champions seminars Student hall competition			
Heating energy strategies	Completed for University Park and Sutton Bonington			
Lighting upgrades	Lighting controls (motion and daylight sensors) installed in a number of buildings	56,879	23,145	129
Total for 2011/12		1,489,937	350,467	2,028
Total for 2010/11		1,509,361	686,424	4,096
Total for 2 year period		2,999,568	1,036,891	6,124

5.2 Project summary

A full schedule of projects is included in appendix 1 and provides details of type, location, capital spend and calculated annual energy, financial and carbon savings.

As in 2011/12 the building insulation and control system projects continue to deliver significant carbon savings with short payback periods and improve the working environments of staff and students. Several buildings have had windows replaced with new double glazing. Insulation of plantroom pipework and valves has also been found to give good paybacks.

The fume cupboard efficiency programme has been completed to deliver reduced electricity from lower fan power and reduced gas from space heating.

The CHP system at King's Meadow has operated throughout the year and has proven to be reliable and effective in reducing emissions (295 tonnes CO_2).

The lighting improvement programme has installed new controls to ensure lights switch on only when necessary. These are based on motion and, where appropriate, daylight sensors. Installations have been carried out in corridors and public areas of large academic buildings and student residences.

Data Centre electrical metering to measure improvements was installed late summer 2011 and more energy efficient servers installed are being evaluated for performance gains.

PowerMAN/WakeMyPC was launched across the University in 2011 and the original design to hibernate inactive PCs at 10 pm has been reduced to 8pm across all staff PCs following a trial across IS and student PCs in computer rooms.

A chiller replacement programme has commenced, replacing old inefficient units with high efficiency systems and better controls.

5.3 Renewable energy projects

Low and medium scale renewables are financially supported by UK legislation – the Feed in Tariffs (FITs) and Renewable Heat Incentive (RHI). These programmes promote widespread uptake and provide income from generation to accredited technologies including photovoltaics (PV), wind, biomass, solar thermal and ground source heat pumps (GSHP). The University has installed further insitu projects as part of energy requirements for new buildings – details are given below.

Renewable energy technologies	Location	Size (kW)
Air source heat pump	University Park: Centre for Advanced Studies	129.9
ASHP	University Park: University Park Hotel	563.3
GSHP Heating/Cooling		45/156.6
Solar PV		4.7
PV	Jubilee Campus: Aerospace Technology Centre	15.2
GSHP Heating/Cooling		33.3/44.8
ASHP	Jubilee Campus: Institute of Mental Health Building (IMH)	73
Biofuel CHP energy imported from ETB		
Biofuel CHP	Jubilee Campus: Energy Technologies Building (ETB)	
Electricity		209
Thermal		210

Income from Lincoln and Derby halls PV systems has totalled c. £32k for the year and this will continue year on year as part of the Feed in Tariff benefits.

5.4 Grove Farm wind farm

The University has applied for planning permission to construct three wind turbines at Grove Farm, adjacent to the River Trent near Clifton Bridge. The turbines would be up to 125m high, with a hub height of approximately 80 m and supply electricity directly to the University Park campus. This would meet a third of the campus electricity needs and reduce our CO_2 emissions by c. 6,200 tonnes per year equating to 40% of the target reductions required by 2015.

Planning applications were made in July 2011 to both Nottingham City Council (2 wind turbines) and Broxtowe Borough Council (1 wind turbine), as the site crosses the boundary between the two authorities. Additional information has been provided to both Councils following requests from consultees and planning decisions are anticipated late 2012.

5.5 Audits and feasibility studies

The CMP includes a schedule of buildings with high usage of electricity and gas, both in total quantity and per unit area. Energy audits have been carried out in the Computer Sciences, Sir Clive Granger and Food Sciences buildings to identify opportunities to reduce energy use and provide investment cases. Examples of findings are given below:

At Sir Clive Granger, the recommendations included draughtproofing, additional air handling controls, and a replacement chiller saving 74 tonnes for a cost of £40,000 and paying back in around 4 years.

At Food Sciences building, there was considerable scope with potential savings of up to 200 tonnes of CO_2 for an investment of £76,000 and a payback of under 3 years. Projects include new inverter drives, improvements to the compressed air system, and better integrating the BMS with air handling services.

The survey at Computer Sciences building, Jubilee Campus, did not provide any large scale projects with a payback period of under five years, although small savings could be made from fitting variable speed drives to pumps (paybacks 7 to 8 years for a cost of £40,000, with CO_2 savings of 30 tonnes).

Schedules of high energy usage plant including heating systems and chillers have been drawn up to develop replacement programmes based on efficiency improvements, energy savings and financial payback. Costs of these are being obtained for each individual location.

Two large scale strategic heating/CHP studies have been completed for Sutton Bonington and University Park They have provided options for:

— more efficient use of energy
— reduced demand due to building fabric improvements
— use of renewable energy fuels to provide proportions of the fuel requirements

The audits examined historic electricity and gas usage in buildings, and also the condition of the existing heating pipework and power cabling infrastructure. The main findings of the studies are summarised below:

Sutton Bonington

An extensive site survey was undertaken to determine the detail and evaluate the condition of the existing heating infrastructure. The site was originally served by a central coal fired boiler plant, and ducted low pressure hot water (LPHW) distribution mains.

The coal fired plant in the main boiler house was replaced circa 1995 with dual gas/oil fired plant, and a gas fired waste incinerator, together with new dual gas/oil fired plant to service the farm area and animal houses. The central boiler plant and site distribution mains are generally in good condition, apart from isolated sections of the distribution, which will require replacement in the medium term.

Subsequent site development has included buildings that have been served from the existing site distribution plus several others with independent high efficiency gas fired boiler plant. Over 50% of the existing building stock is still served from central plant that has a total installed heating capacity of 5,900kW. Current annual demand and associated CO_2 emissions are estimated as follows:-

- Gas consumption by central boiler plant 12,664 MWh (2,596 tonnes CO_2) per annum
- Site electricity consumption 10,649 MWh (5,772 tonnes CO_2) per annum

A number of options have been identified that warrant detailed evaluation together with associated costs, and data on energy consumption and CO_2 emissions.

University Park

A new report was commissioned into options for provision of heating at most of the major buildings at University Park. Presently there is a medium-pressure district heating system using three gas boilers. Options were considered to cover the western part of the system, affecting Trent, Portland, Law and Social Sciences, Hallward Library, and the Sir Clive Granger buildings. The study concluded that the most cost-effective option, with the largest annual carbon reduction, would be to renew the existing system and to add a gas-fired CHP engine. This would generate electricity, with the waste heat providing much of the heat required by the buildings. New plate heat exchangers and additional insulation would allow the system to operate more efficiently at lower temperatures that present. Current annual demand and associated CO_2 emissions are estimated as follows:-

- Gas consumption by central boiler plant 30,278 MWh (6,207 tonnes CO_2) per annum
- Site electricity consumption 45,775 MWh (24,810 tonnes CO_2) per annum

A number of options have been identified that warrant detailed evaluation together with associated costs, and data on energy consumption and CO_2 emissions.

6 Future carbon management and investment programmes

The projects identified from the building audits and surveys will form part of the 2012/13 CMP overall programme. The programme continues the focus on investment in the CMP's main areas based on:

— energy plant audit recommendations

- building audits and building fabric improvements
- lighting controls and LED demonstration projects
- heating controls and additional sensors
- renewable energy installations

A new IT carbon savings programme is to be developed based on findings from an IT carbon footprint study.

Preferred options from the University Park and Sutton Bonington strategic audits will be developed further. These will include financial and carbon savings to enable final proposals to be submitted for approval.

A new post of Carbon Reduction Manager has been approved and an appointment is to be made autumn 2012. The role will have responsibility to identify, develop and implement carbon saving projects and programmes.

7 Staff and student engagement and awareness

Engagement with the University population on environmental issues is an important component of the University's CMP. By encouraging the adoption of greener living and working behaviours, we aim to reduce the University's carbon footprint further to complement the main investment programmes. Aside from increasing general awareness through improvements to our services, like new recycling bins and posters etc, during 2011/2012 there has been a strong push in this area to realise our CMP objectives.

The main engagement tool for students is the inter-halls energy and recycling competition – the Go Greener Halls Competition. Although there was an overall trend of recycling rate improvement and decreasing electricity consumption for halls during 2011/2012, there was limited active engagement with students in the halls. For this reason, the competition has undergone a review, with student feedback, and subsequent changes have been implemented for 2012/2013, including monthly prizes to provide ongoing encouragement to halls to improve their performance throughout the year.

Further examples of engagement with University staff and students include:

- Nottingham Advantage Award module: 2 groups of students from a variety of backgrounds created films to engage their peers in greener behaviour specifically related to local services at the University. These films will be used throughout 2012/2013 to engage students and are currently publically available online.
- Collaborations with student environmental groups:
- Environment Question Time with Project Nottingham,
- Green Week 2012 with the Students' Union and associated societies,
- Working with the JCR Environment Representatives to improve student engagement in halls, via assistance with local environmental event organisation and operational changes.
- Stall at Freshers' Fair
- Stalls and presentations at staff welcome events
- Presentation to School Board committees
- UoN Sustainability facebook page,
- Sustainable Nottingham e-bulletin and blog,
- New Sustainability website.

8 Financial requirements

The University's projected additional capital investment in CMP is summarised below.

	Capital spend 2012/13	Capital spend 2013/14	Capital spend 2014/15	Capital spend 2014/15
Carbon Management Plan 2012/15	7.5	8.4	5.6	4.0

CMP projects continue to be assessed for financial and carbon performance and submitted for approval. The above figures include £12m provision for wind turbines. Funding for CMP projects is provided from CMP capital, revenue expenditure, Salix finance and grant contributions and loans.

8.1 Salix Finance

The University continues to utilise its Salix Finance revolving green fund and has used it to invest more than £525K in carbon saving projects to date and will continue to invest these ring fenced savings into further carbon

saving projects. Investments this year have included the installation of cavity and roof insulation and lighting controls.

9 New construction projects

New buildings – University Park: Highfield House, Jubilee Campus: Aerospace Technology Centre, Energy Technologies Building – have been completed in 2012 and the projected effects of CO_2 emissions from their building services, occupants and equipment are summarised below.

		Anticipated annual carbon dioxide emissions		
Building	Gross internal area	Gas - building services	Electricity - total	Carbon emissions
	m^2	tonnes CO_2 yr^{-1}	tonnes CO_2 yr^{-1}	CO_2 kg m^{-2}
University Park: Highfield House	1,744	6.1	89.3	54.7
Jubilee Campus: Aerospace Technology Centre	1,977	32.9	74.2	54.2
Jubilee Campus: Energy Technologies Building	2,499	Negligible, gas boiler for back up only	48.5	-12.9
Si Yuan Chinese Studies	2,700	9.4	230	88.67
Totals	8,920	48.4	442	

The Carbon Management Plan included the provision of 30,000m^2 of new buildings constructed since 2010 equivalent to increases in emissions of c. 3,000 tonnes CO_2. Prorata the increased emissions would be c. 1,200 tonnes CO_2 by end 2011/12.

The actual CO_2 emissions from these buildings are given below.

Building	Date completed	Gross internal area	Carbon emissions
		m^2	tonnes CO_2 yr^{-1}
Engineering Science Learning Centre	2011	3,511	296
Humanities	2011	4,303	157
Mathematical Sciences	2011	4,674	307
Bioenergy and Brewing Sciences	2011	3,493	418
Gateway Building	2011	3253	518
Future Crop Glasshouses	2011	312	99
Totals		19,546	1,795

Appendix 1 – Carbon Management Plan projects 2011/12

Project	Location	Technology description	Investment cost (incl VAT)	Estimated Annual Savings			£/tCO₂	Payback period
				Financial	CO_2	Energy		
			£	£	tonnes	kWh	£	(years)
Insulation	Nightingale	Roof insulation	6,899	6,372	43.9	215,129	157	1.1
	Medical School	Roof insulation	175,000	4,353	27.0	146,988	6,471	40.2
	Nightingale Hall	Cavity wall insulation	46,451	8,421	58.0	284,333	801	5.5
	Hugh Stewart	Cavity wall insulation	12,748	5,766	39.7	194,697	321	2.2
	Chemistry	Cavity wall insulation	7,587	2,442	16.8	82,454	451	3.1
	Physics	Cavity wall insulation	7,339	2,381	16.4	80,392	448	3.1
	Pope	Cavity wall insulation	4,102	1,383	9.5	46,679	431	3.0
	Coates	Cavity wall insulation	3,281	1,231	8.5	41,559	387	2.7
	Abbey house	Roof insulation	1,625	343	1.0	11,571	1,625	4.7
	Redcourt	Roof insulation	846	584	4.0	19,729	210	1.4
	UNSSC	Roof insulation	1,437	992	6.8	33,510	210	1.4
	Ancaster Bungalow	Cavity wall insulation	274	64	0.4	2,171	619	4.3
	Flats 1/5 St Michaels	Roof insulation	625	661	4.6	22,324	137	0.9
	Flats 6/7 St Michaels	Roof insulation	410	47	0.3	1,593	1,261	8.7
	Flats 8/9 St Michaels	Cavity wall insulation	868	407	2.8	13,739	310	2.1
	Eviton House	Roof insulation	2,045	99	0.7	3,345	2,996	20.6
	Flats 8/9 St Michaels	Roof insulation	368	48	0.3	1,632	1,104	7.6
	Flats 10/15 St Michaels	Roof insulation	518	68	0.5	2,301	1,104	7.6
	18, 20, 40 College Road	Roof insulation	558	135	0.9	4,544	601	4.1
	50 College Road	Cavity wall insulation	410	192	1.3	6,488	310	2.1
	24,38,43,45 College Road	Roof insulation	529	79	0.5	2,662	974	6.7
	50 College Road	Roof insulation	180	37	0.3	1,263	697	4.8
	42 College Road	Roof insulation	198	41	0.3	1,396	697	4.8
	17,19,21,37 Greenfield St	Roof insulation	559	100	0.7	3,377	811	5.6
	6 Highfields	Roof insulation	217	7	0.1	250	4,252	29.3
	68 Highfields	Roof insulation	208	29	0.2	984	1,036	7.1
	Lenton & Wortley Hall	Cavity wall insulation	14,534	6,559	45.2	221,464	322	2.2
	Willoughby Bungalow	Roof insulation	273	25	0.2	840	1,596	11.0
	Paton Cottages 1 & 2	Roof insulation	584	89	0.6	3,009	951	6.6
	Lenton Firs Lodge East	Roof insulation	656	540	3.7	18,223	177	1.2
	Lenton Firs Lodge west	Roof insulation	188	22	0.1	731	1,262	8.7
	38 Highfields	Roof insulation	217	29	0.2	963	1,104	7.6
Double glazing	Sir Clive Grainger	Window replacement	236,976	3,915	27.0	132,171	8,789	60.5
	South Lab	Window replacement	335,552	5,868	40.4	198,141	8,301	57.2
Fume cupboards								
Funding was assigned in last year	University labs	Reduced face velocity		128,476	672.9	2,668,846	86	0.4
	Funded Last Year	Night setback		98,364	585	3,505,829	17	0.1
Lighting upgrades	Cripps Computing Data centre	Lighting controls	3,920	7,389	41.2	76,161	95	0.5
	Biology Corridor	Lighting controls	10,988	3,111	17.3	32,062	633	3.5
	Pharmacy Corridor	Lighting controls	6,621	2,983	16.6	30,748	398	2.2
	Cavendish Hall Corridor	Lighting controls	6,608	2,201	12.3	22,688	538	3.0
	Willoughby Hall Corridor	Lighting controls	9,456	3,272	18.2	33,728	518	2.9
	Ancaster Hall Corridors	Lighting controls	6,161	2,082	11.6	21,462	531	3.0
	Eresby Court Corridors	Lighting controls	1,866	714	4.0	7,358	469	2.6
	Biology B 44	Lighting controls	794	174	1.0	1,797	817	4.6
	Psychology C15	Lighting controls	1,432	300	1.7	3,095	855	4.8
	Trent LG	LED Lighting	8,424	849	4.7	8,752	1,779	9.9
	Biology B 57	Lighting controls	609	68	0.4	706	1,594	8.9
Chiller replacement	Boots Science	Chiller replacement	130,000	16,324	91.0	168,249	1,428	8.0
	Hallward Library 2 x 380 kW	Chiller replacement	205,000	19,206	107.1	197,960	1,914	10.7
Heating upgrades	Coates	Heating upgrade	58,947	653	4.5	22,059	13,099	90.2
	Med School C floor	Heating upgrade	40,398	508	3.5	17,157	11,542	79.5
BMS & metering	Flo Boot	Additional sensors	10,100	1,078	7.4	36,400	1,360	9.4
	Lincoln	Additional sensors	10,100	1,244	8.6	42,000	1,179	8.1
	Sherwood	Additional sensors	10,100	1,244	8.6	42,000	1,179	8.1
	Ancaster	Additional sensors	10,100	829	5.7	28,000	1,768	12.2
	Willoughby	Additional sensors	10,100	1,327	9.1	44,800	1,105	7.6
	Boots	FCU Control Upgrade	80,000	4,161	28.7	140,488	2,791	19.2
Plantroom insulation	L3	Covers - HPHW plant room pipework	2,300	578	4.0	19,500	578	4.0
Sub totals - CO2 savings			**1,488,285**	**350,467**	**2,028**	**8,972,497**		**5.9**

Appendix 2 – University buildings: fossil fuel and electricity use and associated carbon emissions

Building Name	Building Number	Floor area m^2	2009/10 Elec $kgCO_2/m^2$	2009/10 Gas $kgCO_2/m^2$	2009/10 Total $kgCO_2/m^2$	2011/12 Elec $kgCO_2/m^2$	2011/12 Gas $kgCO_2/m^2$	2011/12 Total $kgCO_2/m^2$	% Change 09/10 to 11/12 $kgCO_2/m^2$	Actual carbon emissions 2011/12
Medical School	3101	75,536	55	52	107	54	56	110	3%	8,309
Bio-Molecular Sciences	1353	8,631	203	89	293	219	89	307	5%	2,650
King's Meadow Campus	6901	22,536	81	30	111	49	49	99	-11%	2,231
Rutland Hall & Sherwood Hall	2191	15,957	29	46	75	27	38	66	-12%	1,053
Derby Medical School	3561	8,912	54	28	82	69	32	101	23%	900
Boots Science Building	1581	3,879	162	58	219	163	47	210	-4%	815
Hugh Stewart Hall	2181	11,383	28	51	79	27	45	71	-10%	808
Clinical Sciences (City Hospital) Ph.1	3325	5,568	99	35	134	106	26	132	-1%	735
Veterinary School	5721	8,529	57	46	102	42	43	85	-17%	725
Computer Sciences (DCS) & The Atrium	7040	5,980	80	27	107	91	26	118	10%	706
Cripps Hall	2171	10,452	25	51	75	24	42	66	-12%	690
Wolfson Building	1421	3,220	165	38	203	168	38	206	2%	663
Derby Hall	2121	8,958	32	48	80	31	43	74	-7%	663
Swimming Pool	1571	1,428	157	233	390	172	253	426	9%	608
Lenton & Wortley Hall	2141	6,440	44	57	100	40	53	93	-7%	599
Willoughby Hall	2211	6,963	43	46	89	42	41	83	-7%	578
Institute of Hearing Research	1401	1,224	351	126	477	347	115	462	-3%	565
Newark Hall	7130	8,106	34	31	65	32	31	64	-2%	519
Gateway Building (Bio-Sciences)	5771	3,253	0	0	0	128	31	159		517
Business School South (New)	7080	5,360	57	17	74	64	31	96	29%	515
Lincoln Hall	2150	7,398	26	43	69	22	46	68	-2%	503
Nightingale Hall	2161	6,267	29	50	80	29	46	75	-6%	470
Florence Boot Hall	2131	5,994	37	44	81	34	40	73	-9%	438
Cavendish Hall	2111	4,795	38	52	90	41	47	88	-3%	422
Ancaster Hall	2101	4,922	36	52	88	36	47	83	-6%	409
Sports Centre, Main Campus	1221	6,018	44	23	67	43	21	64	-5%	385
Sir Colin Campbell Building	7340	4,534	64	0	64	72	4	76	18%	345
International House	7320	3,400	91	0	91	91	8	99	8%	337
Dearing Building (FOE)	7050	5,990	23	17	41	32	20	53	30%	317
Melton Hall	7110	3,510	37	35	72	38	38	76	6%	267
Jubilee Sports Centre	7301	2,467	47	28	74	72	36	108	45%	266
D.H.Lawrence Lakeside Pavilion	1631	1,790	76	48	125	85	59	144	16%	258
Southwell Hall	7120	4,035	30	31	61	27	34	62	2%	250
The Amenities Building	7330	2,365	133	0	133	92	11	103	-22%	244
Innovative Technology Research Centre	1641	2,434	66	22	88	72	28	100	13%	243
MMMEM (Production Engineering)	1371	1,456	147	30	177	134	32	166	-6%	242
Lenton Firs - Built Environment	1431	1,244	126	84	210	117	71	188	-11%	234
The Nottingham Geospatial Building	7350	2,944	62	35	97	67	7	74	-24%	218
Staff Club Lenton Mount, Hemsley	1181	1,306	56	82	138	58	70	128	-7%	167
Sports Centre SB (New)	5951	2,450	38	27	65	43	21	63	-2%	154
Cripps Health Centre	1231	1,464	42	33	74	37	37	75	1%	110
Ancaster Hall Eresby Court	2103	1,098	107	0	107	95	0	95	-12%	104
Abbey House	2401	1,078	91	0	91	90	0	90	-1%	97
Lenton Hurst	2411	1,052	24	60	84	24	63	88	5%	93
Lenton & Wortley Hall Wortley House	2149	1,096	78	0	78	76	0	76	-3%	83
Env. Education Centre (New Studio)	1439	1,424	30	26	56	25	26	52	-7%	74
Sustainable Research Building	1436	1,762	32	10	42	30	10	39	-7%	69
Redcourt	2221	677	21	70	91	24	72	97	7%	66
Clinical Sciences (City Hospital) Ph.2	3325	2,000	0	0	0	24	8	32		64
Sports Ground - Highfields	6311	463	57	84	141	72	65	137	-3%	63
Lenton Grove (History)	1211	1,602	10	23	33	15	23	38	17%	61
Vaughan Parry Williams Pavilion	6314	823	0	0	0	41	28	70		58
Cavendish Hall Hardwick Court	2115	1,105	56	0	56	51	0	51	-7%	56
Lenton Eaves (UNSSC)	1461	857	41	31	72	35	30	65	-9%	56
Paton House (Built Env.)	1441	700	39	49	88	28	42	70	-20%	49
Cavendish Hall Chatsworth Court	2116	980	53	0	53	47	0	47	-12%	46
Ancaster Hall Foston Court	2104	986	46	0	46	42	0	42	-9%	41
Orchards	1161	414	26	48	74	34	42	76	2%	31
Lenton Close Annexe (Cripps Hall)	2175	373	22	61	83	23	54	78	-7%	29
Lenton Fields (China House)	2163	519	25	39	64	21	32	53	-17%	28
Lenton Lodge	2251	342	36	27	63	41	30	71	12%	24

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