University of Bristol Carbon Management Plan

Summary

In the HEFCE publication "Carbon Reduction Target and Strategy for Higher Education in England"[1], a target is set for the sector to reduce Scope 1 and 2 emissions by 34% by 2020 against a 1990 baseline, which translates to a 48% reduction on a 2005/6 baseline.

The University of Bristol's carbon emissions in 1990 are reported[2] to be 25,513tCO_2 and we calculate that our emissions in 2005/6 were 47,587 tonnes from consumption in buildings and electricity, plus an estimated 358 tonnes from University-owned vehicles. The basis for the preparation of the 1990 figure has been lost, so we have a much higher level of confidence in the 2005 figure.

The growth is ascribable to an increase in student numbers and an increase in the quantity and energy-intensity of the research now undertaken. The period 1990-2005 saw the building of Synthetic Chemistry, the Dorothy Hodgkin Building, Merchant Venturers' Building, and Barn One, which are all energy-intensive sites. We have also seen the amount of IT in use increase dramatically to saturation – a computer on every desktop – a situation often bringing with it a concomitant demand for cooling.

The increase we have seen is similar to that of some of our Russell Group peers: for example, Cambridge, Oxford, Imperial, LSE and Leeds have all seen a near doubling of their emissions over this period. However, there are differences across the sector as a whole, with some institutions showing modest reductions. These differences are an indication of the wide spread of activities undertaken across the sector, and the differences between the buildings that support them.

We aim to play as complete a role as we can in contributing to reaching the sector-wide targets. Our updated Carbon Management Plan shows how University of Bristol aims to reduce its Scope 1 and 2 carbon dioxide emissions[3] in the period from 2005/6 to 2020/21 by 35% and how we intend to extend carbon management to Scope 3 over the next three years.

The plan is an updated and extrapolated version of the Carbon Management Plan adopted by UPARC in November 2009 which described a path for the reduction of emissions of 15% in the period 2007/8 to 2015/16.

It has been produced to ensure:

- That there is sonority of approach with the rest of the University's policy framework, particularly the University Vision & Strategy and the Estate Strategy[4].
- That we have a response to the requirements of HEFCE's Capital Investment Framework
- We are seen to fulfill our moral obligation to act on Climate Change and Peak Oil
- That the University plays its part in achieving HEFCE's national sector targets
- That the University has a strategic tool to reduces its exposure to volatile energy markets and to carbon trading schemes such as the Carbon Reduction Commitment
- That carbon is considered at the earliest planning stages of new buildings, refurbishment and procurement, when mitigation can be implemented most cost effectively.
- That we have a framework for considering carbon emissions outside our direct control

[1] HEFCE – January 2010/01 section 23
[2] SQW Energy "Carbon baselines for Individual Higher Education Institutions in England" Draft January 2010.
[3] Scope 1 & 2 emissions are from owned transport, boilers and the generation of purchased electricity. Scope 3 emissions are those indirect emissions that occur as a consequence of the activities of our organisation, but which are not owned or controlled by us. The staff and student commute is an example of Scope 3 emissions.
[4] in preparation in Summer 2010

For the purposes of the exercise we have assumed that:

- The types and balance of research does not alter dramatically
- The number of staff and students remains constant
- The gross internal area of the University remains constant, with additional area in new buildings being balanced by the disposal of some properties outside the Precinct
- National Composite Centre, the new Bioscience building and new accommodation for Maths all go ahead and all achieve BREEAM excellent.
- Our current High Performance Computing facility is filled, and energy demand doubles over the following ten years.
- The residential stock retains the same number of bedspaces but is refurbished to Part-L of the building regulations and BREEAM Very Good.

Against this background, we propose an energy investment programme of costing £21m over ten years, which should deliver:

- Carbon savings of 17,000 tonnes
- Reductions in gas and electricity consumption, and thus spend on these utilities, of one third each
- A simple payback period of all works taken together of 7 years.

Some of the money for this will come out of previously-agreed budgets, such as the £1.5m spend on voltage optimisation, the awareness budget within UTIL and the capital maintenance budget. Other savings will come from budgets agreed for refurbishments and buildings such as Bioscience and the Queens Rd refurbishment. Where individual projects need to be funded, business cases will be made to the Capital Infrastructure Programme Board.

1. The University of Bristol's Carbon Management Plan

The Carbon Management Plan aims to set short and medium term carbon abatement measures and put them in the context of the University's strategic aims and the local, national and global legislative tropes.

It looks at the relative costs of action and inaction from financial and legislative viewpoints, and describes a best value way to achieve reductions.

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The growth is ascribable to an increase in student numbers and an increase in the quantity and energy-intensity of the research now undertaken. The period 1990-2005 saw the building of Synthetic Chemistry, the Dorothy Hodgkin Building, Merchant Venturers' Building, and Barn One, which are all energy-intensive sites. We have also seen the amount of IT in use increase dramatically to saturation – a computer on every desktop – a situation often bringing with it a concomitant demand for cooling.

The increase we have seen is similar to that of some of our Russell Group peers: for example, Cambridge, Oxford, Imperial, LSE and Leeds have all seen a near doubling of their emissions over

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this period. However, there are differences across the sector as a whole, with some institutions showing modest reductions. These differences are an indication of the wide spread of activities undertaken across the sector, and the differences between the buildings that support them.

We aim to play as complete a role as we can in contributing to reaching the sector-wide targets. However, a 34% reduction on our 1990 carbon emissions to 16,800 tonnes from our current emissions of 47,000 tonnes would require investment beyond our current scope or require us to reduce drastically some of our key research areas. Therefore, our Carbon Management Plan shows how University of Bristol aims to reduce its Scope 1 and 2 carbon dioxide emissions[7] in the period from 2005/6 to 2020/21 by 35% and how we intend to extend carbon management to Scope 3 over the next three years.

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It has been produced to ensure:

- That there is sonority of approach with the rest of the University's policy framework, particularly the University Vision & Strategy and the Estate Strategy[8].
- That we have a response to the requirements of HEFCE's Capital Investment Framework
- We are seen to fulfill our moral obligation to act on Climate Change and Peak Oil
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- That the University has a strategic tool to reduces its exposure to volatile energy markets and to carbon trading schemes such as the Carbon Reduction Commitment
- That carbon is considered at the earliest planning stages of new buildings, refurbishment and procurement, when mitigation can be implemented most cost effectively.
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1.1 Context and drivers for Carbon Management

It must be stressed that carbon management is not only an environmental activity, but one that, under this plan, will yield substantial financial savings.

New technologies, or replacing old infrastructure, can often produce savings elsewhere in the budget, not just the energy lines. For example, reductions in time spent on maintenance have been shown to accrue from replacing boilers. Likewise, chandeliers in the Victoria Rooms are soon to be lit with long-life LED lamps, improving their appearance and reducing the time spent in replacing bulbs.

Carbon management is best effected by reducing our consumption of fossil fuels. This has a welcome side effect for the University. As North Sea oil and gas resources become depleted (the UK became a net importer of natural gas for the first time in a generation in 2005), we have become increasingly dependent on the world oil and gas markets, in which demand from emerging economies is increasing. This, and the early indications that production in some oil-producing areas is declining, is driving prices higher. Thus, reduction in our demand for fossil fuels, using what we need more efficiently and increasing our consumption from non-fossil sources are all good ways to insulate ourselves as a university and as part of the UK from higher fuels prices.

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[8] in preparation in Summer 2010

We believe that measures aimed at mitigating the potential for dangerous Climate Change are desirable in their own right, and the University of Bristol can act as a leader for stakeholders, especially students, staff, alumni and colleague institutions, in delivering carbon emission reductions. We also understand that financial benefits will accrue from judicious action and that the organisation will enjoy reputational benefits from being seen to act well and act early. The converse need hardly be stated: late, ineffectual action will be costly for the University and may damage its hard-won reputation of leadership in the sustainability field.

1.2 Our low carbon vision

As previously stated, the University of Bristol's carbon emissions in 1990 are reported[9] to be 25,513tCO_2 and we calculate that our emissions in 2005/6 were 47,587 tonnes from consumption in buildings and electricity, plus an estimated 358 tonnes from University-owned vehicles.

We aim to play as complete a role as we can in contributing to reaching the sector-wide targets. However, a 34% reduction on our 1990 carbon emissions to 16,800 tonnes from our current emissions of 47,000 tonnes would require investment beyond our current scope or require us to reduce drastically some of our key research areas. Therefore, our Carbon Management Plan shows how University of Bristol aims to reduce its Scope 1 and 2 carbon dioxide emissions[10] in the period from 2005/6 to 2020/21 by 35% and how we intend to extend carbon management to Scope 3 over the next three years.

The University of Bristol's vision is to follow a path to an 80% reduction in Scope 1 & 2 CO_2 emissions from 2005/6 levels by engaging in measures which actively support the quality of learning, research and enterprise and staff and student accommodation at the University. This will require a 35% cut by 2020, with a milestone of 15% by 2015/16. We will also seek to assess and reduce our Scope 3 emissions.[11]

1.3 The situation since 2005/6

The following tables describe the way the University's emissions have changed over the last four academic years.

tCO_2 emitted by source	05/06	06/07	07/08	08/09
Electricity	32,230	29,668	30,520	31,042
Gas	14,784	14,313	15,735	15,976
Steam	268	165	99	0
Oil	305	151	288	171
Total	47,587	44,298	46,624	47,176

"Fugitive emissions" from non-energy sources are estimated to add another 455 tonnes of equivalent CO_2 a year, and emissions from University-owned transport another 360 tonnes.

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[10] Scope 1 & 2 emissions are from owned transport, boilers and the generation of purchased electricity. Scope 3 emissions are those indirect emissions that occur as a consequence of the activities of our organisation, but which are not owned or controlled by us. The staff and student commute is an example of Scope 3 emissions.
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Carbon production thus fell by about 1% between academic year 2005/6 and 2008/9.

The key factors at play during this period divided into actions which reduced carbon and those that increased it. The commissioning of new, energy-intensive buildings such as High Performance Computing (HPC) and Medical School's H-Floor added to our burden, whereas the implementation of the University's first combined heat and power plants (CHP) reduced it. Sharp rises in energy prices, beginning in 2006 and increasing awareness of the desirability of climate change mitigation, and the need to comply with incoming legislation, brought carbon management issues firmly onto the University's strategic agenda.

2.0 Implementation

This plan proposes that the following measures will be implemented over the ten years to 2020. For each element of our implementation plan, there will be some irreducible uncertainty as to the amount of energy that will actually be saved. However, taken as a whole, we believe that these measures will enable us to meet our vision of a 35% cut in carbon emissions from a 2005/6 baseline by 2020.

For the purposes of the exercise we have assumed that:

- The types and balance of research does not alter dramatically
- The number of staff and students remains constant
- The gross internal area of the University remains constant, with additional area in new buildings being balanced by the disposal of some properties outside the Precinct
- National Composite Centre, the new Bioscience building and new accommodation for Maths all go ahead and all achieve BREEAM excellent.
- Our current High Performance Computing facility is filled, and energy demand doubles over the following ten years.
- The residential stock retains the same number of bedspaces but is refurbished to Part-L of the building regulations and BREEAM Very Good.
- The amount of carbon emitted for each unit of electricity generated remains the same. If it does change greatly, it will affect the absolute targets for the whole sector equally. We have taken this matter up with HEFCE.
- Energy prices remain stable. In fact we expect them to rise by 60% over the decade.

Against this background, we propose an energy investment programme of costing £21m over ten years, which should deliver:

- Carbon savings of 17,000 tonnes
- Reductions in gas and electricity consumption, and thus spend on these utilities, of one third each
- A simple payback period of all works taken together of 7 years.

The programme would be delivered as follows, over ten years. It must be borne in mind that the earlier projects are implemented, the earlier savings can be delivered, though implementing everything early will incur project management costs which will extend payback times.

2.1 Energy Efficiency and Conservation Measures

We will invest in an energy investment programme to address specific energy issues as they arise. This will have a value of £300k/year and be largely funded using the Salix revolving loan fund, with new projects being funded from savings. We have conservatively estimated that these projects will have a mean payback time of 5 years, saving a 440 tonnes a year, which will accumulate. Projects

could include better insulation; lighting improvements; improvements to heating plant; better control of air-conditioning; the incorporation of variable speed drives into ventilation systems.

The Energy Manager and BMS Manager will operate and continue to innovate a housekeeping programme to ensure heating, ventilation and air conditioning systems are working optimally, and that the CHP units on the Precinct and at Langford are always running when it is carbon- and cost-effective to do so.

Total cost over ten years: £3m

Annual carbon reduction: 4,800tCO_2

Simple payback time: 5 years

2.2 Voltage Reduction

The voltages measured at the University's electrical outlets are higher than those for which modern equipment is designed to run at. The University has embarked on a programme of voltage reduction at our major sites which will reduce the power drawn by many pieces of equipment, without affecting performance.

The necessary equipment has been tendered for and ordered. The first half of installations are planned for Summer 2010, with the remainder planned over the following year. The total programme will cost £1.5m and save around £560k a year, resulting in carbon savings of around 3,300tCO_2 a year.

Total cost over ten years: £1.5m – already funded from capital budgets.

Annual carbon reduction: 2,500tCO_2

Simple payback time: 3 years

2.3 Behavioural Changes

We have gained a great deal of experience of running successful awareness campaigns over the last five years, and have found that schemes tied to rewards and/or celebration of success for participants work best. The high churn rate of University students and, to a lesser extent, staff, mean that awareness work will need to be supported throughout the period to 2020.

We envisage two strands of awareness activity at the Halls, building on the success of the Student Switch-Off campaign and amongst staff, following on from the first two years of implementation of the Green Impact Awards. The effect of these will be a one-off reduction in halls' electricity consumption by 5% and academic and administrative electricity consumption by 2%, costing £200k over 10 years, and delivering savings of 900tCO_2 per year. These programmes will go further and address use of domestic hot water (a major expense) in halls, and raise awareness of energy-efficient behaviours amongst users of kitchens and fume cupboard – both areas with high costs and carbon associated with them.

Total cost over ten years: £200k – ten equal annual spends, currently spent out of the UTIL budget

Annual carbon reduction: 900tCO_2

Simple payback time: 4 years

2.4 Re-appraisal of Building Energy Management in Highly-Serviced Areas

Analysis suggests that highly serviced Type 3 Space – typically environments, such as laboratories and server rooms, in which there may be a need for a large throughput of conditioned air – is responsible for the emission of nearly 15,000 tonnes of CO_2.

We are confident that the adoption of recently-available control techniques, improvements to the efficiency of system elements, collocating Type 3 space, and reducing the amount of Type 3 Space by a modest 10% will reduce the University's emissions by 5,500tCO_2. This could produce cash savings of £1m a year by 2020 against a notional business-as-usual case. The case for collocation and any reduction in the amount of Type 3 space needed will have to be made in consultation with the Head of Space and Asset Management and service users, though we envisage that reductions of the scale suggested here can be made without a loss in the level of service offered.

Total cost over ten years: £600k – over the next three years> Projects, when identified will be bid for from capital funding.

Annual carbon reduction: 7,200tCO_2

Simple payback time: typically 1 year

2.5 Green ICT

One of the main drivers for growth in the University's electricity consumption over the last five years has been the implementation of the University's High Performance Computers, and over the previous fifteen, we've gradually reached saturation with desktop IT and peripherals, such as printers.

Desktop IT has a double effect: it uses electricity and dumps heat into rooms which then often need to be cooled electrically. We are therefore supporting efforts to virtualise desktops, removing quite large loads from offices into server rooms where they can be better managed, and leaving only low-power thin-client devices in offices. This solution will take a number of years to roll out, and may not be suitable everywhere. We are therefore also supporting technologies which switch conventional desktop computers remotely when they are not in use.

The main HPC is very well managed, and has consumed less electricity than had been expected as new technologies became available between its design and construction. Good housekeeping will maintain the good energy performance of the facility. However, the academic requirement for more installations of this magnitude over the next ten years is unknown, and this is a key variable in our predictions. In the absence of other information, we have allowed for a 25% increase in HPC capacity (0.75GWh of electricity) over each of the following two years, followed by a 10% a year growth.

We envisage a spend of £400k on Green ICT enabling works in the initial 4 years of the programme, to manage desktop IT currently being bought.

Total cost over ten years: £400k – spent over first four years, in addition to ongoing churn of IT stock, to fund capital measures where necessary. Will be bid for from capital funds.

Annual carbon reduction: 600tCO_2

Simple payback time: 4 years

2.6 University-owned vehicles

In the last five years, we have formulated new Staff and Student Travel Plans with low carbon outcomes.

University-owned transport currently accounts for only 390 tonnes (<1%) of our Scope 1 & 2 carbon, but we need to improve the capture of carbon information. This is most easily facilitated by the adoption of the Fuel Card for all fuel purchases – we currently estimate we have 80% coverage. We

expect the owned fleet to remain at roughly this size and for efficiency to increase as vehicles are replaced, leading to a 10% reduction in CO2 from this source by 2020.

Total cost over ten years: Embedded within current projects

Annual carbon reduction: 40tCO_2

2.7 Monitoring and Targeting

The University employs a full time Sustainability Analysis Manager to track Utility spend and the attendant carbon emissions, to make recommendations for change based on the performance of each building and to forecast changes to costs and carbon based on a variety of parameters including weather, fuel prices and estate disposals and acquisitions. This work has formed the basis for the University's Carbon Descent Plan.

The Precinct and Langford are served by large electrical incomers, and individual buildings need more metering for us to understand their contribution to our consumption properly. The University will therefore continue its roll-out of half-hourly metering on the Precinct and Langford to better understand the time profile of their buildings. This helps us to ascertain, for example, when equipment has been left on unnecessarily out of hours, and is also useful for providing information for Display Energy Certificates and gauging the effectiveness of energy saving measures. We will work with energy providers to provide half-hourly data at fiscal metering points.

We will ensure that halls are adequately metered, so that we can identify and eradicate spurious loads. Eventually we will be able to use these as awareness tools amongst the residents, too. There will be no savings per se from these measures, but they will support other efficiency actions

Non staff costs over ten years: £100k

2.8 Refurbishment

In the next ten years, the University will be refurbishing a number of buildings, with the Queen's Rd Building and residences both undergoing major changes. Sustainability will work to ensure that any envelope improvements and actions which will increase the efficiency of space heating, lighting and domestic hot water systems, with a pay back time of ten years or less, are considered from the outset of any refurbishment plans. There is a great potential for cost and carbon savings via refurbishment, though some areas may be able to be more densely populated as a result. We predict that savings on buildings brought up to Part L of the building regulations and BREEAM "Very Good" as part of capital refurbishment programmes will save 1,600tCO2 a year.

Total cost over ten years: embedded within refurbishment costs

Annual carbon reduction: 1,600tCO_2

2.9 Reboilering

The previous Carbon Management Plan proposed a re-boilering programme costing £1.05m over three years to save 1,000 tonnes CO2. We believe this will need to continue through the decade as newer boilers eventually become time-expired.

Reboilering has many drivers, with the impending total failure of the equipment the usual trigger for replacement, early reboilering will reduce energy and maintenance spend and reduce the risk of early failure. Reboilering has quite a long payback time if fuel is considered to be the only saving, usually over ten years. However, this reduces to less than ten years if the avoided costs of maintenance and denial of service are factored in.

Total cost over ten years: £6m – divided into ten equal annual spends. Some of this will come from maintenance budgets but we expect to bid from capital budgets for some larger projects to ensure replacements happen fast enough. Accelerating the programme would cost £3m of the quoted £6m budget. However after 10 years twice as many boilers would have been replaced and future liabilities reduced.

Annual carbon reduction: 3,700tCO_2

Simple payback time (energy only): 12 years

Simple payback time (including avoided maintenance costs): 8 years

2.10 Combined Heat and Power (CHP)

With the Queen's Rd Refurbishment, which will use CHP to heat the swimming pool, and the Biosciences building, we believe we are likely to have come to the end of projects for which there is a constant year-round demand for heat, and for which, therefore, CHP is a natural choice.

There may be some limited scope for CHP at the Halls of Residence, but larger scale implementation is likely to be hampered by the cost of installation of district heating pipes between buildings and a reduction in the amount of heat required by better-insulated buildings. Likewise, we may see some medium scale implementation of combined heating and cooling on the Precinct, but we have yet to identify projects with good payback times.

CHP new build – costs and emissions captured within the Queens Rd programme, 400tCO2 a year saved.

There is likely to be scope for optimising the use of CHP already installed on the Precinct

Total cost over ten years: £0.5m – likely to involve a bid from capital funds when identified.

Annual carbon reduction: 300tCO_2

Simple payback time: 10 years

2.11 Renewable Energy

Many of our colleague organisations have identified renewable energy sources as a way of reducing carbon emissions. We will continue to try to identify projects which may be cost effective, but understand that there is an opportunity cost in investing in renewables. Even with Feed-In Tariffs and the proposed Renewable Heat Incentive, paybacks are usually >10 years, and so our funds are better spent on shorter payback projects and ones with greater carbon benefits – Feed-In Tariffs make projects financially attractive that otherwise would have been untenable, but do not improve the carbon performance of the project per capital pound spent.

The University has no good wind sites, and so is likely to be limited to air-source heat pumps, solar electricity (PV), solar thermal and biomass. We hope to see prices drop and efficiencies increase for the first three technologies, but it is likely that Biomass will become scarce locally within five years as Bristol City Council increases its use of woodfuel.

In this Plan, we are proposing that our main drive over the next ten years will be towards greater energy conservation and efficiency, with 2GWh of heat from biomass, solar and heat pumps and 1GWh of solar electricity being put in place by 2020 as part of new builds and refurbishments, and often to comply with planning conditions. This assumes 12,000m2 of PV, and up to 40 hectares of University land used for biomass.

Total cost over ten years: £4m – will be bid for from capital funds

Annual carbon reduction: 1,200tCO_2

Simple payback time: 12 years

2.12 Disposal of Buildings

The Estates Strategy and Space Policy processes are identifying buildings away from the main Precincts with limited value to the University, but which could yield funds to improve assets in our main areas of operations. The Plan assumes that 600tCO2, or about 1% of our carbon, and a similar gross internal area will be shed by disposals.

There will be income from this action.

2.13 New Buildings

We cannot know for certain what new buildings will be in our stock by 2020, but we expect an increase in emissions by 6,500 tonnes from the National Composite Centre, Langford Veterinary School, New Biosciences and new provision for the Maths Department. We will build these buildings to BREEAM excellent.

2.14 Fuel Switching

We will work wherever possible to move away from electric space and water heating to gas, or even oil. Our priority will be to move Stoke Bishop sites from electrical heating to gas or heat pumps, learning from the experience of the first such switch at 115 Queens Road.

These are some of the longest payback times that we envisage, due to the fact that they are essentially infrastructure projects which may require new gas mains etc, but will ensure continuity of service, improve the offering to students, and greatly reduce maintenance. Work on improving water heating infrastructure at Stoke Bishop will have the added benefit of giving an opportunity of reducing the amount of standing water, and bring with it opportunities to reduce water consumption.

Total cost over ten years: £4m – will be bid for from capital funds

Annual carbon reduction: 1,200tCO_2

Simple payback time: 15 years

3.0 Scope 3 Emissions:

Scope 3 emissions are those indirect emissions that occur as a consequence of the activities of our organisation, but which are not owned or controlled by us. These can vary from commuter travel to the carbon consequences of food miles or the carbon footprint for a stationery supply.

3.1 Procurement

There is a role for Procurement in ensuring the purchasing of the most energy efficient equipment, and the Head of Sustainability will be working closely with the Head of Procurement to implement good practice here. ICT is likely to be an early area for investigation with this approach.

We commit to measure our procurement carbon footprint within two years with an aim to set a revised target from a 10% reduction target.

3.2 Transport

Over the next three years we will work with Procurement and Finance to provide firmer data on business travel and travel undertaken by staff members in their own cars. We will also work to provide more robust estimates for the staff and student commute, and travel from home for students. Some work has already been undertaken in these areas, and completing the methodology will be a big step towards quantifying our Scope 3 emissions.

Full details are not available, but Proactis and centralised business mileage claims will enable firm figures to be put on Scope 3 emissions from transport During the University's participation in the Carbon Trust/HEFCE Higher Education Carbon Management Plan, some estimates of our carbon burden in this are were produced, all in tonnes of CO_2:

Business Flights	3,280
Surface business travel	2,892
Student Commute	357
Staff Commute	2,940
Total	9,469, or 20% of our Scope 1 emissions

Tools available to reduce this would be increasing video conferencing and continuing to promote alternatives to single-occupancy cars for commuting. Technology may help here too: the efficiency of the UK car fleet will increase as new cars – even electric cars – are introduced over the next ten years, which would reduce emissions. Homeworking could help, though a staff member homeworking in winter and using central heating all day just for themselves could quite easily produce emissions greater than a single occupancy car journey. An alternative may be to provide hot desks for staff at Langford and Stoke Bishop, so that not all staff have to commute to the Precinct every day, but would still enjoy good IT facilities and support, including video conferencing with the main precinct, and the social benefits of a communal atmosphere for work. We will explore the distribution of where staff live, using data from staff travel surveys, to explore the viability of this. Other factors may overtake us – for example, the housing developments planned for South Bristol and the city fringes may make increase the number of affordable, attractive living environments close to the main Precinct, reducing staff commuting distances.

We also estimated the burden due to the travel by students to and from their homes, using data from the Student travel survey. The carbon burden from this is estimated to be 13,000 tonnes in 2006/7, or 27% of our Scope 1 & 2 total, 70% of which is due to flights originating in East Asia. Some studies suggest that the global warming effect of fossil fuel burning in the air is greater than that it is on the ground[12], though Government does not yet have a settled view on how great this effect is[13] . It was found that students return home more often than we expected, taking 3 return flights on average a year, and students from Singapore and Australasia making up to 5 long haul journeys a year. Again, circumstances may overtake us, and more East Asian students may be educated more locally over the next 10 years, but we could reduce the number of long-haul journeys by using various methods to make staying in Bristol more attractive over break periods, particularly where students will have already paid for accommodation. Relatively simple projects integrating students with families and support groups in the local community could go some way towards facilitating this.

About 75 tonnes CO2 will be incurred by the operation of the Stoke Bishop bus as currently envisaged.

3.3 Waste

[12] http://www.direct.gov.uk/en/Environmentandgreenerliving/Greenertravel/DG_064429
[13] http://www.publications.parliament.uk/pa/cm200607/cmhansrd/cm070502/text/70502w0005.htm

As part of HECM we estimated emissions due to waste as being 311 tonnes. The main elements of these are emissions to putrescible waste going to landfill, and the burden due to waste not recycled. We will continue to improve our methods for measuring waste generation, and will begin, in 2010, to compost food waste at the Hawthorns, greatly reducing the global warming potential of the resulting emissions

3.4 Water

There are small Scope 3 emissions due to our use of water. We estimate these to be in the region of 420 tCO_2 a year. Many of our schemes intended to rationalise and improve domestic hot water systems will also reduce our water consumption, and our infrastructure programmes are being shown to be tackling leaks effectively.

3.5 Fugitive Emissions

Our largest tranche of other emissions comes from our sheep and cattle herds. We will wait to see how the needs of our vet school evolve before making a judgment on this issue, though taking land out of grazing in order to grow biomass would be carbon positive.

4.0 Outcome

- By 2020, we estimate that the measures outlines will have reduced gas and electricity consumption, and carbon emissions, by 35%, worth £2.6m a year at today's prices, and carbon worth £200k at current prices. If, as expected, energy prices increase by 60% in real terms over the decade, these savings could be worth much more.
- Within two years we expect to have a good understanding of where carbon lies within our supply chain, and have a plan for reducing this by 2020.
- Within three years we will have a firm figure for our Scope 3 emissions from transport, and have a plan for reducing them.

John Brenton

Sustainability Manager (Analysis)

24th June 2010.