Sheffield Hallam University

SHARPENS YOUR THINKING

Sheffield Hallam University Carbon Management Plan 2008/2009 - 2014/2015

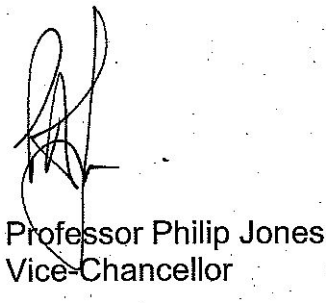
September 2009

Foreword from Vice Chancellor & Project Sponsor

Sheffield Hallam University recognises its responsibility to ensure sound, environmentally and socially responsible, operational practice in all its activities and is committed to continually improve its environmental performance and role within the wider community on a cost-effective basis.

To date the University has introduced a number of successful environmental initiatives, which have won national recognition.

Participation of the University in the Higher Education Carbon Management Programme will act as a catalyst to highlight and bring together this ongoing work, create agreed coordinated plans for future work including raising awareness of the issue with staff, students and stakeholders and by increasing participation in the subject, help the University to reduce carbon from its operations, making a significant contribution to the HEFCE and government reduction targets and be even more effective in its control of major operating costs.



Professor Philip Jones
Vice-Chancellor

Foreword from the Carbon Trust

Cutting carbon emissions as part of the fight against climate change should be a key priority for higher education establishments - it's all about getting your own house in order and leading by example. The UK government has identified the University sector as key to delivering carbon reduction across the UK inline with its Kyoto commitments and the Higher Education Carbon Management programme is designed in response to this. It assists universities in saving money on energy and putting it to good use in other areas, whilst making a positive contribution to the environment by lowering their carbon emissions.

Sheffield Hallam University was selected in 2008, amidst strong competition, to take part in this ambitious programme. Sheffield Hallam University partnered with the Carbon Trust on this programme in order to realise vast carbon and cost savings. This Carbon Management Plan commits the University to a target of reducing CO_2 emissions by 15% by the year 2015 and underpins potential financial savings to the University of at least £2 million.

There are those that can and those that do. Universities can contribute significantly to reducing CO_2 emissions. The Carbon Trust is very proud to support the Sheffield Hallam University in their ongoing implementation of carbon management.

Richard Rugg
Head of Public Sector, Carbon Trust

CARBON TRUST

Executive Summary

The current situation

Sheffield Hallam University is a large sized teaching, research and knowledge transfer higher education institution with over 30, 0000 students, 4,000 staff and an estate of over 160,000 m_2 GIA over two main campuses. We have a history of working towards best practice in environmental management and are constantly investigating ways in which our performance can be enhanced.

In particular the University has engaged for several years in activities to reduce its carbon footprint which resulted in being awarded one of only 7 national climate change champion awards by HRH Prince Charles in 2007 for our achievements in reducing our CO_2 emissions from our operations.

Participating in the Carbon Management Programme provides the framework for the development and implementation of a University wide strategic Carbon Management Plan (CMP) which will consolidate and confirm these past and current carbon reduction activities and help to set the direction of our future activities including the sharing of targets and outputs across the University and by having one visible and forward looking plan enable the University to reduce its carbon footprint and operating costs in these areas further over the next 5 years and into the future.

As the majority of our emissions directly relate to our estates use of energy, the plan has a particular focus in this area. The cost of energy consumption last financial year (2007/08) was over £2.6m representing over 25% of the Facilities Directorate budget, so reducing the use of this resource has potential significant financial savings which will become more important given the expected rise in energy costs and the introduction of the carbon reduction commitment initiative over the next few years.

The plan is expected to be a dynamic document as new opportunities through, for example, the advancement of technologies and knowledge are used to update the plan in order to reach and exceed targets to the benefit of our estate, stakeholders and the environment.

Drivers for Change

Although the University has had some success in carbon management there are several important and undeniable reasons to improve both much faster and much further than we have. The following is a summary of some of these drivers:

National Strategies

The Climate Change Act 2008 confirms the Governments aspiration of legally binding targets to reduce CO_2 emission in the UK by at least 80% by 2050. The Government is to issue guidance next year and use its powers to mandate reporting of organizations' emissions.

The University will be subjected to the Carbon Reduction Commitment (CRC) carbon tariff programme from April 2010 which will have significant financial and reputational penalties if carbon reductions are not made.

National Student bodies and opinion groups concerned with Universities' environmental performances, particularly relating to climate change, are gathering popularity and strength. Benchmarks by such organizations as People and Planet now make headline news in national press such as the Guardian and Times Higher which

can have either a positive or negative effect on the reputation of the institution depending upon its performance.

From January 09, new regulation required the energy efficiency of our larger buildings to be put on display to the general public which may create pressure for reducing our consumption in the future.

Local and regional strategies

The University both supports and relies heavily on the Local Authority and the city in general to carry out its activities and recruit its students and business partners. As such it understands the need to support and have synergy with local and regional strategies especially where these have community, business organizations and political support.

Last year Sheffield City Council signed up the "Nottingham Declaration on Climate Change" pledging Sheffield to systematically address the causes of climate change which will demand businesses and public organizations in the city to reduce carbon emissions from its operations.

The Yorkshire and Humber Regional Assembly are in the final stages of publishing its expectations of, in particular public sector, organizations in embedding sustainable development into the region with the key focus being on reducing climate change and the use of natural resources.

University sector drivers

The HEFCE, in its annual grant letter in January 2009, confirmed its ambition to link capital funding for institutions to performance in reducing carbon emissions and that these links will be in place for 2011-12. Against a baseline of 1990 levels reductions of 80% are expected by 2050 and at least 34% by 2020. This is in line with parliament's decision in passing the Climate Change Act 2008

Sheffield Hallam University has recently carried out a Masterplan exercise to determine its activities, likely demands on space and shape over the next 20 years which has been articulated in an estate strategy to support this. Through this process we have learned that we are likely to face a tension between our CO_2 management and aspirations against a likely growth in our estate, and potentially our energy demands, to accommodate more student numbers and demand for increased space to function increased expectations of staff and students of high quality, available on demand infrastructure, services and equipment.

At both a national and a local level, potential students and business partners are seeking to evaluate (in different ways) the environmental performance of institutions when deciding which institution to use as a place to study or to do business with.

The University has committed to sustainable development with several policies which are already in place which provide direction and commits to target setting and public reporting of this subject each year.

The rising cost of all fuels, including those for travelling as well as servicing buildings, the use of water and disposal of waste are increasing the financial strain on all businesses including the University operations which is experiencing an increase this financial year (2008/09) of over £0.5m in energy bills alone.

All these factors make it even more important for the University to be as efficient and effective as it can be in the use of its resources both in order to save carbon and to reduce operating costs. Many (but not all e.g. commuter travel) of the suggested

opportunities in this plan will eventually be qualified by their potential financial savings as well as CO_2 savings.

In response to the key drivers, the summary of the outcomes from the implementation of this plan will be for Sheffield Hallam University to:

- increase the appetite and commitment to reduce the adverse impact of its operations upon the environment
- through financial investment and sound management practices to make financial savings through reducing energy and water consumption, reducing waste and (where applicable) business travel
- make emissions savings a key factor in the decision making process when purchasing and developing new equipment and buildings
- enable the University to fully understand its current impact on the environment through the emission of carbon by: quantifying these emissions, developing reduction targets and developing further activities to meet (or exceed) the targets.
- pull together information about existing initiatives, assess their impact and develop a coordinated measurable programme of initiatives to ensure progress is made to achieve the targets set
- ensure that future work and actions at the University take carbon emissions and the associated environmental and financial impact into account
- heighten awareness amongst staff, students and stakeholders as to their contribution to the creation of and potential to reduce carbon emissions.
- ensure that the University complies with relevant legislation and European directives.

Business as usual compared to taking action

As discussed earlier, the main purpose of this plan is to provide a framework to deliver operational cost savings and reductions in the carbon emissions generated by our operations between the period of the baseline year of 2006/07 and 2014/15 was correct.

The plan provides detailed tables with various scenarios. The scenarios are necessary in order to examine what might happen in terms of potential consumption changes and the likelihood of rising costs flowing against a tide of management activity to both continue the efforts currently being applied, increasing these activities, as well as introducing new initiatives to reduce consumption.

Where "business as usual" is assumed then consumption of electricity is set to increase by 2.2% each year (E.g. from increased use in technology). This figure is based on our knowledge from past consumption information.

The University energy and water management service have used an indicative figure of 5% increase in the cost of fuels and 7% increase in the cost of water.

In summary, in relation to energy costs and our consumption between 2006/07 and 2014/15 the following table indicates the likely potential (£0,000's):

Business as usual with Increase costs @ 5% Increase consumption @ 2.2%	Costs increase by CO_2 increases by	£2,325,000 343 tonnes
Business as usual with Increase costs @ 5% no increase to consumption	Costs increase by CO_2 **decreases** by	£1,924,000 879 tonnes
Applying reduced emissions scenario from CMP	Costs increase by CO_2 **decreases** by	£1,336,000 2,646 tonnes
The amount of capital and revenue investment required to help achieve this is not reflected in these figures. Details of strategic utilities budget planning indicating levels of investment is demonstrated at section 5 of this plan.		

Annual Value at Stake £,000

Carbon Management vs.	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Steady electricity consumption	102	212	329	454	587	730
Increasing electricity consumption	166	346	543	757	989	1,242

Cumulative Value at Stake £,000

Carbon Management vs.	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Steady electricity consumption	102	314	643	1,097	1,684	2,414
Increasing electricity consumption	166	512	1,054	1,811	2,800	4,041

Looking forward, the tables above show the value at stake and the financial benefit of following the carbon management plan.
The top table shows the saving in each year and the bottom table shows the total saving to date.

Total savings by the end of 2012/13 would be approximately £1 million or £4 million by the end of 2015/16.

(Sheffield Hallam University is working hard to identify its entire carbon footprint. Like most organisations, it is currently able to measure and report with accuracy on energy and water usage and some of its waste disposal with the next phase of measurement being to calculate all waste and some business travel and later, commuter travel).

Objectives

This CMP is the starting point for our journey to make a difference over the next few years. When fully implemented the plan and the ongoing activities within Hallam University we expect to reduce overall CO_2 emissions from University owned buildings by at least 15% (using baseline data starting at 2006/7 financial year) by 2014/15 financial year end which will include the following indicative targets:

- Reducing the kwh/m² energy consumption of the non residential University buildings by a minimum of 15% (Electricity and heating energy consumption will be separated and individual targets set to deliver the overall target)

- Reducing normalised water consumption by 10% in non residential building. Performance to be recorded in terms of cubic metres of water per square metre GIA.

- Reducing waste (refuse) created by the University by 15%

- Measuring CO_2 emissions and then reduce by 5% staff travel on behalf of business, with a plan to extend the saving to travel to and from campus for work and study by staff and students in the future.

- Reducing CO_2 emissions by 30% in future construction and refurbishment of our buildings which will be built to be more energy efficient than our existing buildings (pre Furnival building as baseline).

- Identify where additional carbon and financial savings can be made by investing in technologies, infrastructure, staff and student training and as new advances are made over time, apply these where applicable.

- Bring together existing and future carbon management projects into a consistently managed and coherent programme which will be reported to the estates operation group on a frequent basis and University executive group on an ad hoc basis and via the annual sustainability report to the board of governors on an annual basis.

- To demonstrate where beneficial carbon savings and or financial savings can be made in order to attract financial investment and then to monitor the effect to help inform future approvals.

However, it is important to note that the attention, importance and knowledge in society in general, around carbon management and climate change is increasing at an intense rate at the time of developing this plan and it is extremely likely that these overall % reduction targets will increase in the near future to align with the likely increase in reduction targets (in percentage terms as well as the range and speed) being set by Government and other significant agencies which can affect the University.

Investments

Evidence of actual invest to save actions and opportunities to make energy savings in planned purchases that have taken place to date shows that our current practice is patchy, with confusion existing over what the barriers and criteria for investment is.

This is not unusual in any sector given that much of the technology now being used is relatively new and untried in all the different scenarios.

The plan gives a list of some of the current potential opportunities for "spend to save" activities with some of these calculated to show the potential investment required to make financial and CO_2 savings.

Over the life of the plan, it will also describe in more detail than it currently does, the opportunities and achievements in reducing energy and CO_2 from our scheduled infrastructure replacements and purchases.

The intention is to make the process more transparent for staff (and stakeholders), by providing support and information enabling easier decision making in the University body, especially in the procurement process, estate planning and use of space and equipment.

Examples of potential opportunities which are being explored and/or implemented are:

- Estates "spend to save" investments to reduce energy consumption and waste (Tables giving the detail of the investment values, their potential savings and the timescales involved appear later in this plan).
- Initiatives, including audits; aimed at staff and students to reduce consumption and waste of energy and water and production of refuse.
- The Sustainability Hub - a cross disciplinary working group across University operational, research and academic sections designed to maximise the use of knowledge for a range of opportunities: consulting on new initiatives and investments: capturing expert and leading edge ideas and suggestions: a crucible of different disciplines to develop research bids: using the knowledge that we have in our own people to ensure as best we can that we use the latest technology and best practice in delivering research and teaching of our students.
- Cross departmental working between FD and Central IT Services where pilots that were trialled recently are now being rolled out across the University which have already resulted in significant savings. For example, the use of software on student and most staff computers has reduced the use and waste of paper and reduced energy consumption in the operation of ICT. Further work is being carried out to identify the most energy efficient new ICT (which does not compromise the service at the desk top) to inform the next purchase and replacement schedule. As servers and other pieces of infrastructure come to be replaced, energy efficiency is becoming a key criterion.
- Schemes to reduce the amount of waste we produce, including the development of a new waste strategy, which in most cases will also have financial benefits in reducing purchases as well as disposal costs.

- Transport planning aimed at reduced emissions from our own fleet and reducing single occupancy car use, reducing congestion and car parking whilst creating healthy option alternatives for staff and students.
- Participation in city wide and regional initiatives such as the "Sustainable Travel City" bid, the low carbon working group and development of a city wide climate change adaptation strategy.

1. Introduction

Sheffield Hallam University was accepted as part of phase 4 of the carbon management programme for higher education following the submission of an application and a presentation by the University in late April 2008. The timing of this opportunity could not have come at a better time given impending new regulations; increased awareness of climate change and the subsequent demands from society for, in particular, public organisations to take a lead role: and the likely increases in the cost of fuels, water and management of waste.

Although the plan sets targets and a framework until 2015 it is intended that our activities in this area will continue long after this date.

Following acceptance by the Carbon Trust many activities have taken place to inform this carbon management plan which have included:

- The development of a project plan in order to identify the key features and scope of the plan and the timescales for delivery.

- Stakeholder analysis to identify those with the most influence and authority to help achieve the plan.

- Identification, costing and measurement of some potential opportunities to achieve carbon reductions and help to articulate our targets.

- Awareness raising of the carbon management programme and consultation with various stakeholders across the organisation to identify carbon saving opportunities. These included using vehicles such as:

- The development of the new University masterplan and estate strategy with architects and consultants commissioned by the University who engaged with focus groups from across the whole spectrum of stakeholders internally and externally to inform all aspects of the University estate plan for the next 25 years and which includes for the first time, an environmental framework of which carbon management is now a key part.

- Development of a University sustainability research and academic network which now includes over 100 members of staff across all academic disciplines in discussion about effective ways to engage with the sustainability agenda, enhance knowledge creation and transference with multi disciplinary working on external and internal projects including support of the carbon management plan.

- The existing Energy Action Group which is tasked with seeking out and implementing ways to reduce the University energy and water consumption. The group has academic, service and finance staff representatives and its activities are reported formally.
- Work with Sheffield City Council (and other partners) to identify and understand the city's aspirations and potential introduction of regulation in order to ensure that the University plan supports these external influences as well as not being

compromised by them. These include taking part in the City's development of carbon reduction measures; the development of a new waste strategy for the city; Key member of "Sheffield on the Move": developing a wider range and more suitable suite of car alternatives for movement throughout the city and into the region: informing the city's new strategic response to the weather effects of climate change: supporting the city as it develops its objectives to achieve targets set through the Nottingham declaration.

http://www.energysavingtrust.org.uk/nottingham

- Individual meetings with key staff in the University to explain the carbon management programme and the development of the plan.

- Numerous awareness raising events throughout the University for staff and students about sustainability and within that, the importance and relevance (to them) of carbon management. This included a University wide energy challenge where staff could pledge to save energy in their workplace and which, following spot checks and submission of ideas for opportunities resulted in prizes. More importantly it gave the carbon management team direct access to over 150 engaged staff and their work areas to have a dialogue about carbon management and to learn from each other how they can participate.

- Supporting teaching activities with talks and events and the Students Union to achieve Sound Impact Silver Award (environmental improvements to students union building and activities).

- Our Landlords for Excellence Programme, which won the Green Gown award for best course content in 2007, is a free 10 week course provided by the University for landlords in Sheffield. Information about housing legislation and good housing management is provided in addition to energy saving initiatives, waste management and general environmental performance. The Responsible landlord scheme which was implemented by both universities and the Local Authority over 2 years ago (and is now being updated) gives a framework for housing management including energy, water and waste management. These are important areas of work because of the reliance that the University has on this sector to house over 12,000 of its students and because of the obvious significant environmental impact that this sector has.

1.1. Achievements

Sheffield Hallam University has analysed its influence on the local environment in the widest sense of Corporate Social Responsibility in 2006by being the first University to measure and benchmark using the Business in the Community Index where over 750 other business organisations took part. Information from this exercise has been used to influence our policies, targets and activities in this area.

For the past 8 years the University has also taken part in the Business in Environment Index achieving a gold place in 2008 and 2009.

For the last 3 consecutive years, Hallam has been awarded a Green Gown award (HE sustainability annual awards) for its management of energy and water, continuous improvement in our travel planning and for best course content for the landlords programme.

We work with many partners locally and regionally and through this our student residence "The Trigon" gave the city centre its first green roof which is also a teaching resource for our students, staff and external users such as our city planners and architects. We have now gone on to create a green roof on our new Mews building at Collegiate campus; and our latest new building, the Furnival, was completed in summer 2008 and has many environmental improvements on the existing estate which include: solar panels, photovoltaic's and a ground source heat pump.

We have dedicated energy and sustainability teams which over the last few years has made significant achievements in savings of energy, water and CO_2.

We have now become a partner in the Carbon Action Yorkshire Carbon Reduction Commitment simulation exercise, a 10 month programme to learn with and from the other partners across a range of public, private and voluntary sectors in order to practice carbon trading. This has created an opportunity for the University to be in the best possible position in readiness for this new regulation being implemented across the UK in April 2010.

Energy and Water - Results over last 10 years include:

- Use of heating fuels 20% lower and annual consumption reduced by 13.5 million kilowatt-hours
- Total water use 60% lower and annual consumption reduced by 117 million litres – achieved by pro- active reduction measures
- Electricity use now 12.5% higher - annual consumption risen by 2.17 million kilowatt-hours due to increased use of technology by staff and students, extended opening hours, increase in student numbers etc.
- Reduction measures in place and being extended e.g. automated switch off on ICT and AV equipment, energy efficient lighting, renewable energies

Carbon Dioxide (Extract from 2008 sustainability report)

- Total emissions of carbon dioxide generated through energy fell by 529 tonnes or 4.3% to 11700 tonnes over the last year
- Of which 474 tonnes or 12% was associated with heating our buildings and 54 tonnes or 0.06% was associated with reduction in electricity use.
- A target of a further 2% reduction in carbon dioxide emissions from heating fuels set for next year.
- By diverting general waste from landfill through reduction initiatives - the University also lowered its related CO_2 emissions by a further 42 tonnes last year
- The University intends to establish its carbon baseline (Utilities and waste) during 2008 in order to reduce our impact further

Since 2003 we have had internal University wide policies relating to the governance of sustainability, transport, energy, water and waste management as well as Fairtrade and external relationship management policies.

Whilst these achievements are excellent tools to raise the profile of the subject and of the University and in engaging and motivating stakeholders, the University does not see it as a signal to be complacent and is shrewd enough to understand that in order to meet the challenges which lie ahead of us in the future, both in terms of moral demand borne out of a pressing political and public appetite to improve the environment and out of the financial and regulatory need to perform, we need to have a framework to guide us to achieve this.

1.2. Reporting

As part of the assurance and governance strategy (and in some instances legal obligations), sustainability activities and achievements are reported extensively, including via the following:

- To Board of Governors each year in an annual report which is then made public http://www.shu.ac.uk/services/facilities/sustainability/docstore.html
- As part of the annual published financial statement for the University http://www.shu.ac.uk/services/finance
- HEFCE annual monitoring statement
- Facilities Directorate annual report and at AGMs https://staff.shu.ac.uk/fdr/documents/3194%20FD%20Annual%20Report%20inners%20FINAL.pdf
- On and ad-hoc basis in the Facilities Directorate management reports
- Local Authority against planning application and consent conditions
- HEFCE initiatives e.g. EMS benchmarking, Sustainable Development Plans and Green Gown Awards etc.
- People and Planet Green league and Business in the Environment Index

2. Carbon Management Strategy

2.1. Context and drivers for change

Climate change as a threat to the planet has resulted in raising the profile of carbon management throughout the UK, provoking the implementation of new legislation and regulation; most of which has a direct impact on the Higher Education (HE) establishment. With recent evidence confirming the more imminent depletion of earth's natural resources, the effect of climate change on our weather conditions creating destruction and affecting health and wellbeing of living things it is becoming more important to attack our carbon burdens and to reduce our emissions.

We are also currently in the UN Decade for Education for Sustainable Development, which runs until 2014 and the UK government is setting new targets (and incentives) in relation to sustainability and in particular in relation to carbon reduction measures for all sectors, including the public sector. This will have a huge impact on the way we manage our estate in the future.

The Higher Education Funding Council for England (HEFCE) recognizes the HE sector in this country as a major contributor to society's efforts to achieve sustainability and respond to climate change.

HEFCE believes HE institutions already make an important contribution to the UK's sustainable development strategy and is able to make a greater substantial, sustained and exemplary contribution and has recently published an updated strategic statement and action plan to support their delivery of this national and internationally growing political priority. This is about our positioning to influence society through our educational programmes: our knowledge transfer potential and research activities as well as the effect we create in the operation of our estate. Carbon reduction targets and strategies, potentially linked to capital funding are being consulted on in the sector until October 2009

(http://www.hefce.ac.uk/pubs/hefce/2009/09_03/)

Potential students and other customers, such as agencies who are considering procuring a service from the University, are now comparing the environmental performances of Institutions (see People & Planet by way of example http://peopleandplanet.org/campaigns/#ccc) as part of the decision making process.

The rising cost of energy, fuels, water, transport and waste disposal etc. has stimulated economic drivers to reduce our consumptions, making the subject a much more business focused driver than ever before. The introduction of the Carbon Reduction Commitment regulations in April 2010 will have the potential for new additional costs in the purchase and trading of carbon tariffs relative to the amount we produce which will force the need to reduce the amount of carbon we produce.

In addition the University's public reputation is at stake given that our carbon management performance will be promoted publicly in a league table of all participants.

The achievement of the carbon management plan directly supports the University's corporate plan (2008 - 2013) https://staff.shu.ac.uk//corporateplan.asp and in particular:

- Strategic enabler number 7: Enhancing our estate
- Strategic enabler number 8: Maintaining our financial sustainability

2.2. Our low carbon vision

By committing to and embedding the contents in this plan, during the timescale described, the University has the opportunity to:

- realise a reduction in CO_2 emissions of 15% or more which will have a significant environmental benefit:
- reduce the risk of financial penalties in payments when the carbon reduction commitment initiative is introduced in 2010:
- by investing in infrastructure and staff training and support will also reduce the energy, water, waste and business travel costs of the University:
- ensure that politically this is not a subject which will undermine the University's potential to attract new or retain existing business (especially for those that are starting to use CO_2 criteria in its selection processes):

- use this as an exciting opportunity for further cross disciplinary and subject based internal interactive working that has the potential to create new opportunities within the curriculum and research areas of business as well as enhancing the understanding of our operational staff.

2.3. Scope

The scope of the plan includes all University owned buildings and the operations of the whole organisation.

Initially, the project aims to measure and reduce carbon emissions from the following areas:

- Energy use in non residential buildings*
- Water consumption in non residential buildings*
- Waste management in non residential buildings*
- Emissions from University owned vehicle travel

Subsequently, the project is likely to be extended to encompass the following: although it is recognised that it is more difficult for the University to measure and therefore influence emissions from these sources:

- Transport (business travel)
- Commuting (staff and students)
- Procurement (influencing purchasers and suppliers)

Projects will be prioritised to the most attractive opportunities which are those that are capable of being implemented and/ or which deliver the largest savings (financial and CO_2) and the shortest payback periods.

* The estate strategy identifies residential buildings for disposal/change of use during the life of this plan.

2.4. Strategic themes

Procurement

- policies to ensure purchase of energy efficient equipment, consumables and infrastructure
- create awareness of consumption in general and question if the purchase is necessary
- improve knowledge transfer and information to help staff understand how to reduce carbon impacts, for example, by buying recycled products
- work towards developing criteria for environmental performance of our key suppliers.

Technology solutions

- to help manage energy consumption for example complete programme to automatically turn off computers when not in use: use building management systems and other equipment to reduce wasted energy and water

- think strategically in the use of technology in order to reduce the amount of equipment used in the University, for example: to reduce the number of local printers and copiers
- Improve the provision, understanding and usage of existing and new technology, for example: to reduce the need for travel and the unnecessary use of space by increased telephone and video conferencing where appropriate
- Increasing the use of "joined up projects", for example by using excess heat generated from cooling processes to heat other areas or water.

Stakeholder commitment

- Raising the awareness of staff, students and partners about carbon management and it's relevance and importance both within the University space and in satisfaction of our travel plans
- Work on specific projects with those operational staff who have a particular potential to make a difference in their daily activities, for example: technical staff, maintenance operatives, drivers, cleaners, caterers and security staff
- Work on specific projects in cross disciplinary groups where there is a potential to develop new ideas and opportunities, for example: energy management section and research and development staff in academic areas who are experts in the latest technology and/or are developing carbon management tools for world wide organizations
- Work with external stakeholders where there is potential for joint beneficial outcomes, for example with other large organizations with significant buying power to influence new supplies of renewable energies and markets for recycled products etc.

Estate development and management

- By using knowledge and information from existing initiatives, develop sustainability design standards for new build and refurbishment of buildings through the application of policies and development of new strategies to reduce carbon emissions and save energy, water and waste from our estate and develop low energy impact buildings.
- Deploy into existing buildings, refurbishments and new builds, design features which both enhance the environmental performance and create more pleasant and thermally pleasing locations to work and study in.
- Building layout and landscape design to enhance microclimate within the campus sites.
- Development of on site generation of power.
- Deployment of further water conservation and recycling measures.
- Development of low energy and low environmental impact building.
- Monitoring of design impacts and environmental impact when in use.
- The continued deployment and further development of a range of car alternative measures to reduce transport impacts on the environment whilst ensuring that the development of the estate supports this and vise versa.

Waste management

- Be strategic in our thinking about waste minimisation

- For example, by working with timetabling to avoid unnecessary heating and lighting of buildings with low occupancy activities at certain times of year and times of the day
- Reviewing the waste refuse policy and strategy to increase re-use and recycling where possible for example redundant furniture and composting of waste food
- Ensure that we have maximised any income from our waste, for example in the sale of redundant equipment and waste oil from catering where it is possible to do so and still meet relevant regulations
- Build on the successful "jumble sales" events for students as an enabler for their engagement to reduce disposable waste costs and CO_2 and support the local community where possible.

Civic, regulatory and community stakeholder engagement

- The University has much to gain from and thank the local and regional community for. We play a major part in the life of the local community and economy: in the impact of our operations and sizeable estate: the importation of students into the city as well as the education of local students, the employment we provide, the enhancement of the City's reputation and economy in our research and knowledge transfer activities. This gives us a huge responsibility, draws attention from regulatory and political bodies but also provides great opportunity to influence policy and strategy.
- We already engage with the Local Authority (and several regulatory bodies such as the Environment Agency, Sheffield First for Environment, Sheffield is my Planet etc.) in many different ways within the environmental agenda. We intend to continue or increase this activity where there are mutually beneficial outcomes.
- We will be aware of and help to shape (where appropriate) local strategic initiatives to help the University and the city and region achieve the targets in the Nottingham Declaration, national targets and pressures as well as more locally pressing issues relating to CO_2 management.
- We will continue to seek out other beneficial partnerships, for example with commercial operators such as Waste management companies, to develop initiatives to benefit the University population and the local community an example of which is exploring the expansion of the heat from waste network supply and creating new recycling bring sites.

2.5. Targets and Objectives

The carbon management strategy is expected to set targets which will reduce overall CO_2 emissions from University owned buildings by at least 15% (using baseline data starting at 2006/7 financial year) by the end of the 2015/16 financial year, which may include the following indicative targets: (Please note that the % target and / or the baseline year may change to align with external policies eg HEFCE, which are still being developed).

- Continue to work on understanding, measuring and monitoring the Universities carbon emissions baseline and future carbon management performance within the identified scope.

- Reducing the kwh/m² energy consumption of the non residential University buildings by a minimum of 15% (electricity and heating energy consumption will be separated and individual targets set to deliver the overall target).
- Reducing normalised water consumption by 10% in non residential building. Performance to be recorded in terms of cubic metres of water per square metre GIA.
- Reducing waste (refuse) created by SHU by 15%.
- Measuring CO_2 emissions and reducing by 5% emissions from staff and student travel (from the University owned vehicles, business travel and travel to and from campus for work and study).
- Reducing CO_2 emissions by 30% from our buildings in the future construction and refurbishment of buildings and by ensuring that they are built to be more energy efficient than our existing buildings (Furnival building as benchmark).
- Bringing together existing and future carbon management projects into a consistently managed and coherent programme which will be reported to the estates operation group on a frequent basis and University executive group on an ad hoc basis.
- Identify where additional carbon and financial savings can be made by investing in technologies, infrastructure, staff and student training and apply these where applicable.
- To ensure that financial support is considered by the University where it can be demonstrated that beneficial carbon savings and or financial savings can be made.
- Communicate (in an easy to understand and interesting way) to staff, students and partners the collective progress in our carbon reduction. This will be via a range of media including; face to face in meetings and road shows, the new Sustainability Hub intranet site, newsletters, notice boards and email etc.

However, it must be noted that the HEFCE, Universities UK and GuildHE are currently consulting on a carbon reduction target and strategy for higher education in England. The suggested targets for all HE are currently 34% reduction by 2020 and 80% by 2050 (against a baseline year of 1990), although until the consultation closes in October and targets are agreed amongst the sector, the eventual target figure (and the baseline) will not be known. The HEFCE are suggesting that performance against the targets will influence their decision on capital funding applications from HEI's. In view of this, our target % reductions and the pace of them may be changed accordingly.

3. Emissions baseline and projections

3.1. Scope

The baseline has been calculated from the emissions arising from the energy used by the University in the form of electricity, natural gas, oil and heat from the Sheffield District Energy Network (Veolia Environmental Services).

Emissions from waste, internal transport fleet, University related business travel and water fall within the scope of the Carbon Management Programme (as described elsewhere) but the information required to calculate them is not available in sufficient

detail at the present time. It is intended that these emission sources will be incorporated in the very near future.

3.2. Baseline

Estimation of emissions was carried out using the appropriate conversion factors relating the quantity of carbon dioxide (CO_2) produced in providing for each unit (kWh) of energy consumed. The factors used for electricity, natural gas and oil are those stated in DEFRA's "GHG Conversion Factors annexes updated April 2008" document and supplied by the Carbon Trust and shown in Table 3.1 below. The use of the April 2008 conversion factors ensures that carbon dioxide emissions do not see an increase due to the changes in the electricity factor rather than any changes in carbon management.

Just less than 4% of electricity consumed is sourced from a "renewable energy supplier" and has been considered as grid electricity for this calculation.

The emissions resulting from the use of thermal energy from the District Energy Network are calculated from figures available from Veolia Environmental Services[1].

Table 3.1 Conversion Factors

Energy Source	Kg CO_2/kWh
Electricity	0.537
Natural Gas	0.185
Oil	0.252
District Energy Network	0.1001

Energy and water consumption figures are available for a number of years. The baseline year of 2006/07 financial year has been selected as the baseline year throughout this plan because at the University's commencement of engagement in the carbon management programme (April 2008) this was the most recently available set of full year data figures.

The baseline year (2006/07) figures are shown together with associated costs and carbon dioxide emissions in Table 3.2 below.

Table 3.2 Baseline Energy Consumption Year 2006/07

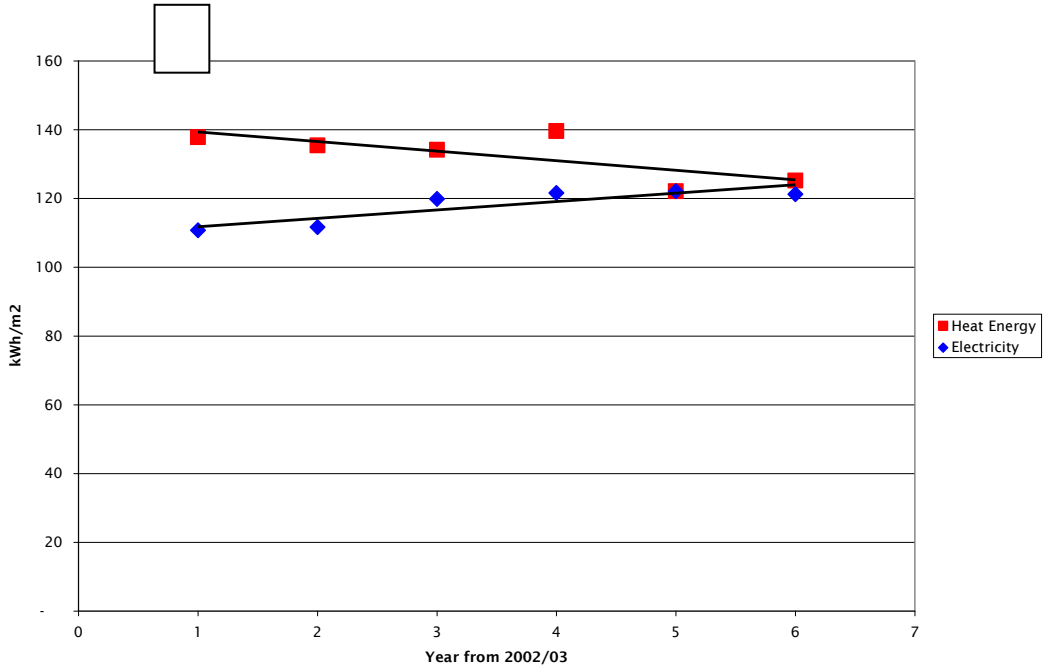
Energy Source	kWh	Tonnes CO_2	£
Electricity	20,394,266	10,952	1,878,784
Natural Gas	11,390,653	2,107	353,098
Oil	2,006,909	506	73,254
District Energy Network	6,992,031	700	243,580
Total	40,783,859	14,265	2,548,716

[1] www.veoliaenvironmentalservices.co.uk/sheffield/pages/district_developer.asp

Our total carbon emissions from energy for the baseline year is just over 14,265 tonnes

When historical energy consumption is analysed in the form of benchmark figures considering energy use per square metre of floor area two simple trends are apparent as shown figure 3.1.

Figure 3.1 Benchmark Figures



It can be seen from this graph that there is an anticipated year-on-year rise in electricity consumption of 2.2% and a reduction in heating energy consumption of 2%. This is due to a number of currently known factors such as;

- Changing nature and size of the estate
- New “highly serviced” buildings
- Increased use of electrical equipment and appliances
- Changing mix of heating energy sources

Business as Usual

In considering a “business as usual” approach a continuing annual increase in electricity consumption of 2.2% has been assumed. Thermal energy use is assumed to remain constant to the 2007/08 value.

For the purposes of projecting future energy costs it has been assumed that costs will rise by 5% each year. Table 3.3 shows how the energy costs and emissions will increase under this scenario. The information is illustrated in Figure 3.2.

Table 3.3 Energy related costs (£1000's) BAU

Energy related costs (£1000's) - Business As Usual with increasing electrical demand

Based on a starting point of actual costs with an anticipated 5% increase in fuel costs each year and electricity consumption increasing by 2.2% each year.

This information is Illustrated in figure 3.2

Source	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Electricity	1,879	1,805	2,425	2,737	2,937	3,152
Thermal	670	725	735	767	806	846
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,743**	**3,998**
CO_2 tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,620**	**13,859**

Table 3.4 Energy related costs (£1000's) BAU

Energy related costs (£1000's) - Business As Usual with steady electrical demand

Based on a starting point of actual costs with an anticipated 5% increase in fuel costs each year and electricity consumption remaining steady each year

This information is illustrated in figure 3.3

Source	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Electricity	1,879	1,805	2,425	2,737	2,874	3,018
Thermal	670	725	735	767	806	846
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,680**	**3,864**
CO_2 tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,386**	**13,386**

Table 3.5 Energy related costs (£1000's) CMP

Energy related costs (£1000's) - Reduced Emissions (Carbon Management Plan)

Based on a starting point of actual costs with an anticipated 5% increase in fuel costs each year and consumption increasing by 2% each year

This information is illustrated in figure 3.4

Source	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Electricity	1,879	1,805	2,425	2,737	2,788	2,840
Thermal	670	725	735	767	789	812
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,577**	**3,652**
CO_2 tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,012**	**12,649**

Please note that:

These tables are repeated at Appendix G providing additional information for each year to 2015.

See table 3.1 for conversion factors relating to carbon calculations.

Where appropriate, for consistency, calculation factors are in line with our reporting to Estates Management Statistics.

These tables do not account for potential additional costs penalties incurred as part of the carbon reduction commitment initiative due to be introduced in 2010.

Figure 3.2 Energy Related Costs BAU

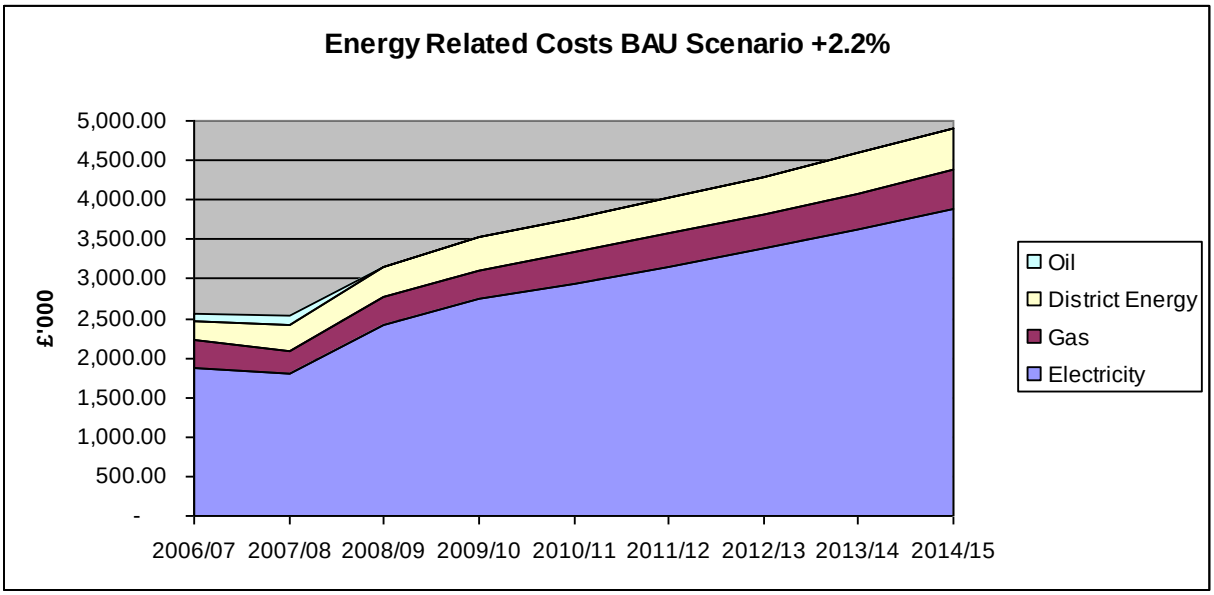
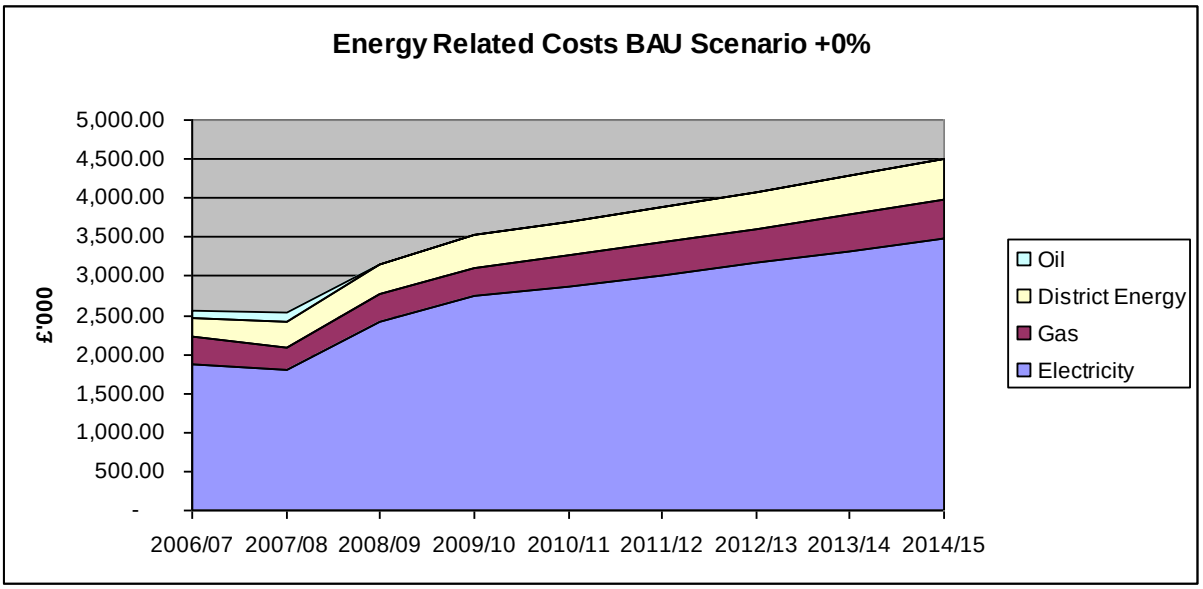


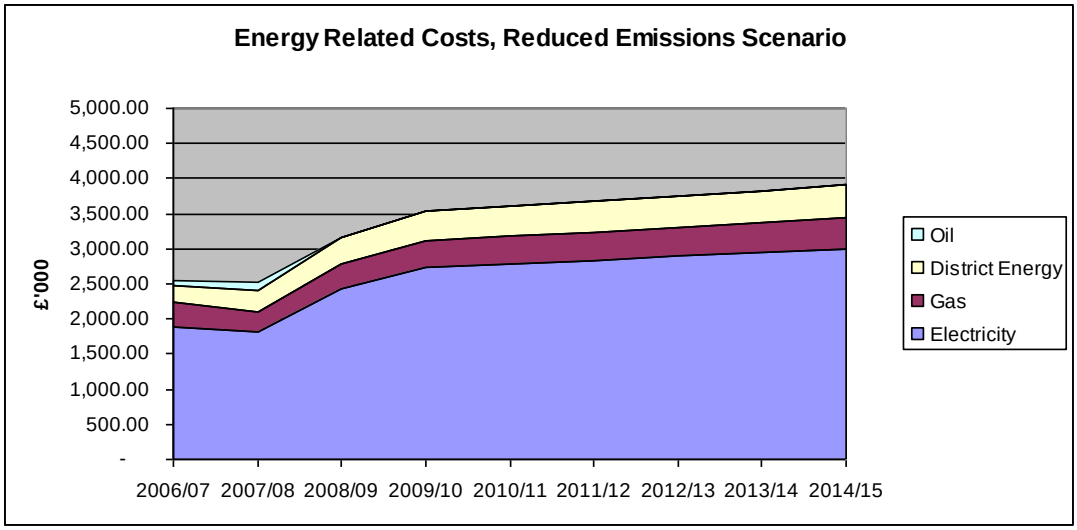
Figure 3.3 Energy Related Costs BAU



Reduced Emissions

For the reduced emissions scenario it is assumed that the target of a 15% reduction in emissions by the financial year 2015/16 will be met through the carbon management programme. This can be allocated for the next five years at a rate of 2% per year as shown in Table 3.5 and graphically in Figure 3.4

Figure 3.4 Energy Related Costs Reduced Emissions



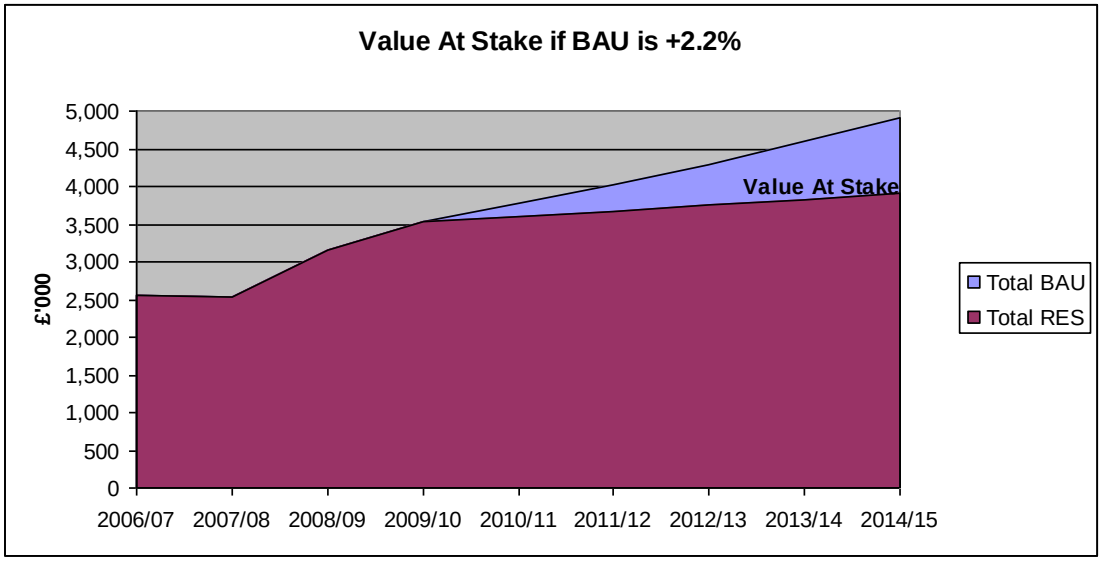
The effect of the carbon management scenario is shown in Figure 3.5 below.

Value at Stake

The Value at Stake is the difference between the BAU and Reduced Emissions scenarios and illustrating the value to be gained by adopting a carbon management approach. Figure 3.4 shows that the savings in costs in 2012/13 are approximately £500,000, rising to almost £1 million in 2014/15.

If it is assumed that energy consumption remains constant under the Business as Usual scenario, the total value at stake is £590,000 in 2014/15.

Figure 3.5 Financial Value at stake



The effect of the carbon management scenario is shown in Figure 3.5 b

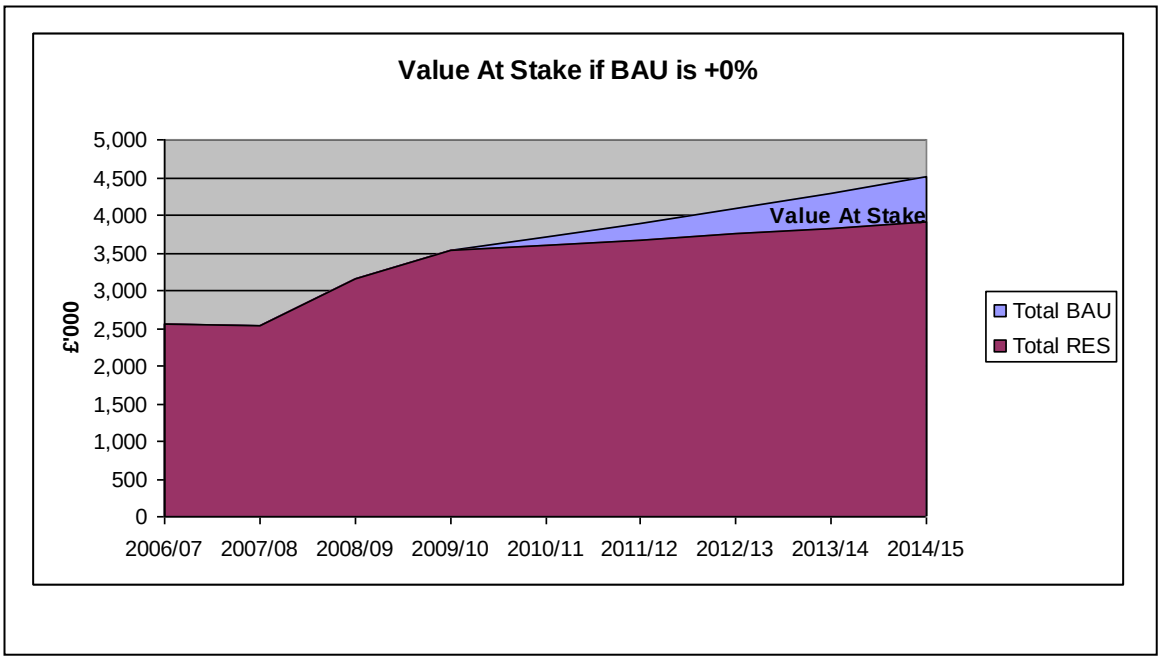
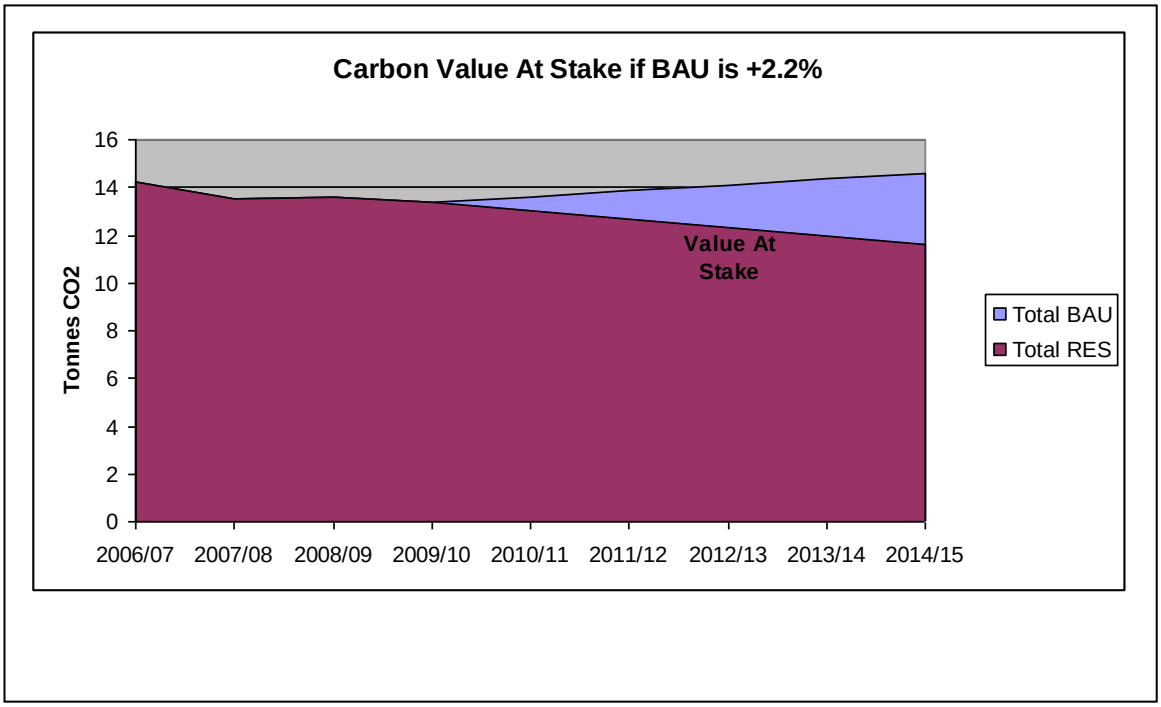


Figure 3.5 Carbon Value at Stake



4. Carbon management projects

4.1. Existing and past projects

There are many examples of improvement activities undertaken in the past. Three of these are summarised below:

1. 'Low cost' and 'no cost' improvements at City Campus. Investment in staff training led to efficiency gains of 20% from existing plant and equipment.
2. Boiler upgrades at Collegiate Crescent Campus as part of the Capital Plan. Energy consumption reduced by 23%, CO_2 emissions reduced by 40%.
3. Boiler replacement at Psalter Lane Campus using 'in house' resources with funding from long term maintenance budget. Payback period of 12 months.

1 'Low Cost' And 'No Cost' Improvements at City Campus

The Sheffield district heating system is the primary heat source for the major buildings at the University's City Campus. In July 1996, five heat exchanger stations served an area of 68,552 m². Before the appointment of a maintenance electrician to the new post of BMS Engineer, University staff were unable to program or adjust the equipment. The development of our BMS Engineer is one of our success stories.
The investment made in staff training has been repaid many times over, and further improvement opportunities are still being identified and implemented such as:

- Heating and ventilation schedules for lecture theatres and teaching rooms matched to timetables and room booking lists.
- Optimum Start programs introduced to delay heating start times but ensure comfortable conditions by the time staff arrive for work.
- To match heating supply with demand, the temperature of water supplied to radiators is reduced as the outside temperature rises.
- Operating strategy of heat recovery pumps is improved, reducing heat demand.

Two additional buildings with a floor area of 14,000 m² were connected to the district heating network between 1996 and 2000 without increasing the total demand for heat.

	Fuel	**1996/97**	**2000/01**	**Change**	**% Chg**
City Campus District Heating	DH	8,260,620	8,072,638	-187,982	-2%
		8,260,620	8,072,638	-187,982	-2%
Area (Gross Internal Area)	m²	68,552	82,525	13,973	+20%
Normalised Heating Fuel Use	kWh/m²	121	98	-23	-19%
Degree Days (E Pennines)		2,292	2,367	75	+3%
Carbon dioxide emissions	kg CO_2	750,890	733,803	-17,088	-2%
Normalised CO_2 emissions		10.95	8.89	-2.06	-19%

Using data from invoicing, a 20% energy saving was validated by the district heating operator, which was publicised in company promotional material. Our calculations valued the 2000/01 savings at £39,000, based on heat meter readings and regression analysis using TEAM Energy Accounting software.
The University has continued to increase its use of the district energy network and in December 2008, nine heat exchanger stations served a floor area of 103,450 m².

2 Boiler Upgrades at Collegiate Crescent Campus as part of the capital plan

Normalised energy performance improved by 23% between 1997/98 and 2005/06

Fuel Consumption (kWh)	**Fuel**	**1997/98**	**2005/06**	**Change**	**% Ch.**
Main Boiler House	Oil	1,912,081	-	- 1,912,081	- 100%
Marshall Hall	Gas	135,518	1,333,880	+1,198,362	+884%
Pearson Sports Centre	Gas	548,489	828,723	+280,234	+51%
Total kWh		2,596,088	2,162,603	- 433,485	- 16.7%
Area (Gross Internal Area)	m²	9,002	9,729	727	+8.1%
Normalised Heating Fuel Use	**kWh/ m²**	**288.39**	**222.28**	**- 66.11**	**- 22.9%**
Degree Days (E. Pennines)		2052	2169	+117	+5.7%

- *Note: no 'weather correction' has been applied, but 2005/06 was colder than 1997/98.*

Normalised emissions of carbon dioxide fell by 40% between 1997/98 and 2005/06

Carbon Dioxide (kg)		**kgCO_2/ kWh**	**1997/98**	**2005/06**	**Change**	**% Ch.**
Main Boiler House	Oil	0.271	518,174	0	-518,174	-100%
Marshall Hall	Gas	0.194	26,290	258,773	232,482	+884%
Pearson Sports Centre	Gas	0.194	106,407	160,772	54,365	+51%
			650,871	419,545	-231,326	-36%
		kg/kWh	0.251	0.194	-0.0567	-23%
Area (GIA)		m²	9,002	9,729	727	+8%
Normalised CO_2 Emissions		kg/m²	72.30	43.12	-29.18	-40%

Fuel cost reductions of more than 50% were achieved during 2005/06

	Fuel	2005/06 if "No Change"	2005/06 Actual	Change
Main Boiler House	Oil	£69,910	0	-£69,910
Marshall Hall	Gas	£2,419	£23,810	£21,391
Sports Centre	Gas	£10,956	£16,554	£5,598
Total		**£83,286**	**£40,363**	**-£42,922**

Efficient operation and favourable gas prices both contributed to a 51.5% reduction in fuel costs during 2005/06.

Based on 2005/06 prices, heating costs were £42,900 lower than if this improvement work had not taken place. Calculations are based on validated supplier invoice data.

The cost of upgrading the heating and infrastructure for the Pearson Sports Centre and Main Building formed part of a £2.6 million refurbishment project undertaken as part of the Estates Strategy. This work was completed for the start of 2005/06.

The cost of the Marshall Hall boiler house was £146,000 in 2000/01. In the first year of operation, 15% less energy was used and fuel costs were reduced by £14,200 yielding a simple payback period of around ten years at that time. Savings made in subsequent years have been affected by relative movement in gas and oil prices, but have continued to generate a good rate of return on the investment made.

3 Boiler Replacement At Psalter Lane Campus Using 'In House' Resources

A targeted long term maintenance programme (LTM) complements the SHU Capital Plan producing benefits across the estate (not just on high profile 'new build' projects).

During the summer of 2004 a gas fired boiler was installed at our Psalter Lane Campus. This replaced one of three existing oil fired boilers and supplied approximately half of the site's heat requirement.

The new gas boiler operated much more efficiently than the old boiler it replaced, with much of the extra heat output used to improve comfort levels. For every kWh of gas used during the year, costs were reduced by 1.49 pence compared with the cost of burning oil at prevailing prices. The saving during the full year was £24,400.

By burning gas instead of oil, carbon dioxide emissions are reduced by 0.077 kg/kWh. During 2005/06, CO_2 emissions from the Psalter Lane Campus were 125 tonnes or 15% lower than if oil had been burned.

The new boiler was installed by in house staff and the project cost of £23,700 was funded by the LTM budget. In this case a simple payback period of less than one year was achieved.

Waste

Following the introduction of recycling initiatives for some waste streams, and more intensively applied, activities to reduce waste at source, the University achieved the following reductions.

Year	total amount of waste to incineration (tonnes)	Reduction /increase on previous year (tonnes)
2004/05	971.23	- 79.841 (8.22%)
2005/06*	1044.574*	+73.344 (7.02%)*
2006/07	960.14	- 84.434 (8.79%)
2007/08	812.43	-147.71 (15.38%)

*Included the closure, decanting and disposal of a 23 acre student village.

The next phase of the plan will be to calculate out CO_2 emissions from waste and to also calculate the weight of all recycled waste (currently have measurement for paper at 23.2 tonnes for 2007/08). This information will be added to our carbon baseline in order to inform how we will achieve the target savings.

4.2. Planned future opportunities and projects

The University has implemented a range of initiatives over the last few years as a result of engagement with stakeholders, and the work of the Energy Action Group and Estates Operations Group. Here are further opportunities that have been identified which we will be exploring within the plan. At the present time these are not costed or assessed for the potential CO_2 savings.

Building technical specific opportunities

*** Indicates those being considered imminently**

	Measure	**Detail**
	Insulation and Draught-proofing	Review and install insulation to walls, roofs and pipe work as well as draught proofing measures across all buildings.
	Evaluate Pilkington K glass	Determine potential energy savings. Incorporate in future Estates specifications if appropriate
	Building Management System improvements and expansion	Continue with the programme of improving the existing BMS network. Link in additional buildings, auditing controls strategies and pick up items of uncontrolled plant that are not currently on the BMS.
*	Install BMS link to The Lodge heating system. **See appendix D for detailed costing.**	A BMS fitted controller has been fitted in The Lodge plant room to enable remote switching of floodlights on the sports pitch. This means that the marginal cost of connecting the heating to the BMS is relatively low.
*	Install BMS to Arundel Gate Court heating systems	A BMS fitted controller has been fitted in Arundel Gate Court as part of an access control scheme. This means that the marginal cost of connecting the heating to the BMS is relatively low.
	Install BMS to Science Park heating systems	A BMS fitted controller has been fitted in the Science Park as part of an access control scheme. This means that the marginal cost of connecting thirteen heating boilers to the BMS is relatively low. This scheme should be considered with a package of improvements to the 'landlord's services.

	Building Services Improvements	All refurbishment projects will contain an appraisal of energy efficiency measures and the incorporation of appropriate items. New buildings will be designed with energy and water efficiency and running costs as a key component of the brief. Performance targets will be established and monitored.
	Low energy humidification	Consider evaporative humidifiers for Air Handling Units. Adiabatic cooling may offer additional benefit for areas with intensive IT equipment use.
	Low Energy Cooling	Consider centralising some of the cooling systems at City Campus and investigating low energy cooling sources alongside reducing the need for cooling. Consider absorption cooling using heat from the District Energy network. Use passive cooling options where appropriate.
*	Eric Mensforth Building AHU inverter controls **See Appendix F for detailed costing**	Fitting inverter controls to supply and extract fans could allow airflow to be reduced during cool weather. This would reduce heating costs and reduce perception of cool draughts. Also extend operating life of air filters and reduce intrusive resonance noise in teaching rooms.
	Modify operation of Adsetts smoke vents to provide stack ventilation during warm weather	Requires additional measures to prevent birds entering when vents are open.
*	Stoddart Building - Assessment of windows in 3 storey block.	Building was designed with mechanical ventilation strategy. One opening window was fitted to the Charles Street elevation as a trial. If other windows are converted, requirement for mechanical ventilation could be reduced.
*	Stoddart Building - Chiller control modification **See Appendix E for detailed costing**	Free cooling could be used in cold weather if control circuits are modified to allow chillers to be switched off although cooling demand exists.
*	Adsetts Centre - L2 file server room. Install local cooling to allow main cooling system to be switched off during cool weather.	File server room relies on main cooling system which must run 24/7. Fitting local system would target cooling to where it is needed - result would be both more efficient and more effective. Proposal to use cooling unit salvaged from Psalter Lane would minimise installation cost and shorten payback period.
*	Modifications to Sheaf Building compressed air system	Assess compressed air demand, eliminate leakage. Install suitably sized variable load compressor to act as primary source of supply. Reduce compressed air pressure to minimum required.
	Survey mains voltages in all buildings larger than 1,000m²	Record mains voltages and rank results. Determine where voltage optimisation may be beneficial. Current operating experience indicates 235 Volts is an appropriate cut-off point.
	Install voltage optimisation equipment in major buildings	Install voltage optimisation equipment where feasible to reduce supply voltage from 240 to 230V to reduce running and maintenance costs. Pilot installed in HUBS Students Union building in July 2008.
	Sub Metering	Continue to develop a sub metering strategy and install new meters for strategic areas such as catering and data centres to allow better accountability, monitoring and targeting, and possible future recharging.
	Collegiate campus boiler and heating improvements	Continue with the programme of improving the operation and control of the existing heating and hot water services and boiler plant at Collegiate Crescent campus.

*	Collegiate Hall heating system	Current high-low modulation is unsatisfactory. Consider fitting small gas burner to one gas boiler Consider linking 'high-low' facility to BMS
	Lighting	Install more lighting controls to suitable areas and adapt existing to improve operation. Replace old and inefficient lighting and look to incorporate new low energy types during refurbishment Consider converting light fittings to take T5 lamps in areas where full replacement is not cost effective.
	Reassess lighting requirements for the Atrium at City Campus	Existing wiring and control arrangements limit our ability to manage lighting levels on the lower landings of the Atrium. A full reassessment of SHU requirements (including corporate events) is recommended. Appropriate 'intelligent' light fittings can then be chosen from current and emergent technology.
*	Stoddart car park lighting	Consider changing existing fittings which are 10 years old, or retrofitting T5 lamps and converters.
*	Fit dimming lighting with presence detection to emergency stairs in Surrey Building	Lighting is maintained 24/7 in case of emergency. Intelligent light fittings would reduce power consumption by up to 80% but still provide light when needed.
	Modify Main Entrance lighting to respond to natural light levels	This a high profile area and visitors have commented that lights are on although natural light levels near the windows are more than sufficient.
	Modify Furnival Cafe lighting to respond to natural light levels and occupancy.	This is the 'gateway' to the University. The perimeter lighting is on continuously while the building is open.
	Modify Heart of the Campus lighting to respond to natural light levels	This a high profile area. Staff and visitors have commented that lights are on although natural light levels are more than sufficient.
	Convert electric space heating system at 39 Broomgrove Road.	Electric space heating is more polluting than alternative options. Conversion would reduce carbon emissions by a large percentage. Options include: Condensing gas boiler Ground source heat pump
	Convert electric space heating system at 38/40 Howard street	Electric space heating is more polluting than alternative options. Conversion would reduce carbon emissions by a large percentage.
	Convert electric space heating system at 48 Howard street	Electric space heating is more polluting than alternative options. Conversion would reduce carbon emissions by a large percentage.
	Hand Dryers	Install new low energy hand dryers across the estate as part of a programme of toilet refurbishment.
	Water Saving	Continue with the installation of various measures to reduce water consumption such as spray taps and aerating nozzles where appropriate.
	Water reduction in toilet areas	Low water urinals - pilot trial started 2008 Fit dual-flush cisterns in gents toilets - this measure is not felt to be appropriate for ladies toilets.
	Explore more capture of rainwater as an alternative to tap water to use on our grounds	Some success already on Howard street. Issues about space for storage.

	Install renewable energies into refurbishments and new buildings	Furnival building includes ground source heat pumps, solar power etc. Assessment mechanism needs putting in place to inform new buildings
	Feasibility study for 'large' ground source heat pump at Robert Winston Building.	Robert Winston Building receives heat from the boilers at Woodville Hall. A feasibility study would determine whether there are benefits in providing RWB with its own heat source.

Equipment specific opportunities

Short term equipment specific (* = are part of scheduled work in revenue budgets)		
Initiative	**Responsible person**	**Progress**
*Install software to double side print as default position to reduce waste paper and energy consumption	MM/NW	Pilots carried out plans to progress to key areas in SHU
*Install software to turn off IT equipment when not in use (perception issue - some people think that PCs do this already but they go into sleep mode still using 40% of total possible power)	MM/NW	Pilots carried out plans to progress to key areas in SHU
*Install software to turn off AV equipment (issues about training and awareness so staff understand how to turn back on)	MM/NW	Pilot began in October 08
*Assess energy consumption and desk top performance of different IT and AV equipment to inform procurement criteria	MM/NW/CM	Pilot to begin March 09
Further work will be added to this table as the Carbon management plan and the University estate strategy is developed.		

Also see initiatives and opportunities at Appendix A1 for small scale technical opportunities

Behaviour and operational opportunities

The plan pays particular attention to reductions in waste, energy and water use, future construction and refurbishment activities and business and commuter travel. However, the plan also recognises the significant beneficial impact that the University can (and is expected to) have by staff at the University from different departments and academic faculties and research centres, actively being encouraged to work together to improve our business as a whole and in particular in achieving our aspiration in relation to sustainability. The following table includes few examples.

Initiative	**Responsible person**	**Progress**
Awareness raising to staff and students in all issues to do with sustainability. Includes engagement meetings and induction training. (e.g. reducing general waste, improve use of existing recycling facilities, increase recycling and use of recycled products. Continue Hallam energy challenge)	MM/Marketing/ Students Union	Equivalent to 107 days activities during last financial year. Plan to improve effectiveness of events from February 2009

Work with timetabling on space usage to identify peaks and troughs of activity aligned to energy use	CM/MM/RN/JL	Pilot carried out which identified that 40% of all energy use is used in Stoddart building when it is closed. (24/7/52 project). Further work needs to be carried out to identify savings that can be made.
City wide energy users group	Instigated by SHU to consider long term use of waste to incineration	Awaiting outcome of consultation exercise carried out by consultants funded by SHU and University of Sheffield.
City wide waste strategy group	Various agencies working together to develop targets and initiatives to reduce, reuse and recycle	Plan to be drafted by Sep 09 with adoption by City Dec 09. Targets set in this CMP have been developed in line with potential targets and support by City.
Develop sustainable procurement policy and strategy	MM/FD procurement /central procurement	A start made in 2008 - needs to be developed alongside CMP
Measure impact, implement further and expand on initiatives in the University green travel plans	MM/Marketing/Central finance/FD IT	Existing travel plan for local business and commuter travel. Expand to include UK and international business travel as well as new car free alternatives
Develop new waste strategy for University based on reduce, re- use and recycle principles	MM/FD procurement/marketing	Started June 09 to be in place by Feb 2010
Reduce production of glass and plastic from catering supplies by refilling and reusing bottles and by using filtered mains water in place of bought bottled water	Richard McGloin, & sustainability coordinator	Glass and plastic from catering waste expensive to recycle. Discussed how catering can reuse bottles by refilling on site. Potential to reduce waste, transport need and CO_2.
Open windows overnight in Owen building to help cool building in Summer (pilot to inform other buildings)	CM/Security staff	Initial audit carried out. Needs further assessment of PIR system.
Assess use of water and energy in our labs and workshops to make sure as much saving is being made as possible.	Energy Manager, Technical staff in Faculties and Departments	Some work already carried out leading to savings. Work done 18 months ago by MM and CM identified that 40% of energy use is when SHU closed which could be lost in plant and lab operations.

Long term abstract opportunities

(Potential to be taken forward as cross disciplinary research / operational projects which may require and/or attract external research funding).

Some of these projects are already being discussed as part of the Sustainability Hub network steering group where FD staff, academics and researchers are exploring ways in which we can work together to benefit the CMP, the University and create knowledge to be used elsewhere and add to the University's potential for further research and product development business.

Initiative	Comment
Assess impact of recently installed renewable energy initiatives to plan for potential installations into refurbishments and new buildings	Furnival building includes ground source heat pumps, solar power etc. Assessment mechanism needed to inform new buildings
Explore replacement of existing energy sources with renewable, cheaper and less damaging fuels in existing buildings	Extensive programme already been completed to reduce reliance on oil. Bio mass partly considered with no firm outcomes presented. Needs further evaluation.
Potential to re-clad existing buildings to generate electricity (e.g. Owen building)	Need to asses viability of idea
Potential to cool and insulate buildings with use of green roofs and walls	Need to assess viability of idea
Assess our hard landscaped areas for water run off to see how we can reduce this	Water rates reduce if we reduce water run off areas and we may be able to use water on estate to reduce our consumption of mains supply.
Partnership working to explore local rivers which may be used for cooling purposes or small scale hydro electricity generation.	Protect SHU for future increases to water costs, may reduce energy costs.
Re explore bore holes	Mild consideration in past - worthy of re considering given increase cost of energy and advancement of technology since last explored.

4.3. Projected achievements towards targets

As identified in section 4.1, projects carried out in recent years have resulted in significant emissions and financial savings. Projects are underway to take place during the remainder of this financial year (2008/09) which will deliver further savings.

5. Implementation plan - financing

As already highlighted in this document many of the identified opportunities have yet to be costed and evaluated to determine their potential to contribute to the financial and CO_2 savings targets. However, the tables and other information in section 3 of the plan demonstrate the potential financial savings and CO_2 emissions reductions to be made.

In summary, adopting the carbon management plan currently provides total savings by the end of 2012/13 of approximately £1 million or £4 million by the end of 2015/16 (1 year pas the current life of this plan with CO_2 emissions of 2,646 tonnes by 2015, representing 18.5% reduction against baseline.

As part of the strategic budget planning for the next 5 years the Facilities Directorate will confirm investments necessary to maximise our potential to make the savings identified in the plan and to possibly improve even further on this performance. A draft investment plan for energy and water is attached at Appendix H of this plan.

5.1. Assumptions

The assumptions applied in the scenarios in the relevant sections of this plan are:

- Energy costs increasing each year by 5%
- Water costs increasing each year by 7%

Where an increase in consumption is assumed in the BAU scenarios this is based on 2.2%

It is also assumed that the estate will remain at its current size. As mentioned in the executive summary, the changing estate over the next 5 years is likely to mean that the estate is temporarily larger than it currently is. However, we are unable to account for this in any of the scenario plans as the detail of the application of the estate strategy is not fully known at the time of drafting this plan. An increase in the size of the estate is likely to increase operational costs.

5.2. Sources of funding

As part of the carbon management programme and assuming that projects meet the criteria, the University is eligible to apply for Salix funding and to the rolling green fund.

Both of these funds provide interest free loans with the loans being repaid out of the savings. It is also possible to ring fence savings made from the loan to re invest to new projects over time. At the time of drafting this plan, the University intends to fund the investment plan from its own capital. However, as we start to apply the plan, this situation may change. This is work that will be carried out in the forthcoming months.

5.3. Funding for resources

It has become apparent in putting this plan together that the success of the plan will depend largely on having the staffing resource to apply, monitor, review and report on the progress against the plan. The tables in section 6 of this plan identify responsibilities and actions associated with individuals and teams. However, it is important for senior management to recognise that this will not be achievable unless

sufficient support is provided to relieve those with identified responsibilities from many of the current duties. The business case for each section will identify additional resources necessary and/or what other work will be displaced in order to prioritise the activities in the plan. The appraisal process will identify training and other resource issues.

6. Actions to embed carbon management into our organisation

6.1. Corporate strategy

The carbon management plan is endorsed at the most senior level demonstrated by the following examples: It has been signed off by the project sponsor, the Director of Estates and Facilities, support from the University executive group and will be reported to the Board of Governors.

The production of the plan and the ongoing initiatives have formed part of the strategic objectives for the next 3 years, of relevant staff tasked with responsibility for delivering initiatives within the plan and which will be monitored within the staff performance and appraisal process.

The performance against targets and revisions to the plan will be reported in the annual formal sustainability report to the Board of Governors which will then be published.

6.2. Programme Management

The project sponsor will oversee the implementation of the plan at the highest level.

The Deputy Director for finance and management services will deputise for the project sponsor and be responsible for championing financial and resources investment at the relevant informal and formal boards and ensuring support for calculating and measuring performance.

The Community, sustainability and residential development manager will be responsible for the monitoring and reporting against the plan in addition to specific areas of responsibility.

The Energy manager and the energy action group will be responsible for the identification, assessment, recommendation and implementation of relevant technical initiatives identified in this plan and subsequent revisions of it.

6.3. Responsibilities

Role in Carbon Management Programme	Name and position in the University	Role
Sponsors	Alex Pettifer Directors of Estates & Facilities	Provides strategic support to the project leader and the core project team. Reviews, approves and endorses the project plan and the CMP. Presents supports and reports on the progress of the programme to the Executive group of the University and other relevant senior level decision makers.

		Unblocks communication channels and champions the project against "sales prevention officers". Helps to embed carbon management into relevant strategies and policies. Chair of core team
Project Co Sponsor	Roger Nunn Deputy Director of Estates and Facilities	Deputises for Alex Pettifer. Removes obstacles and provides support and cohesion across the project. Advises on Financial matters in relation to programme. Ensures that all known and available funding streams and budgets in the University are identified to the core team. Provides support by identifying potential suitable projects. Receives regular progress reports from core team in order to offer advice and unblock obstacles. Part of core team.
Project Leader	Marie May Community Sustainability & Residential Development Manager	Coordination of team, monitors progress against programme. Collates regular reports for Sponsor and Co sponsor. Collation of information from relevant team members to form baseline. Identify opportunities and ideas. Lead on awareness raising and engagement activities, external liasions. Provides expert advice on relevant areas of sustainability transport, waste, new products and legislation). Part of core team.
Core team member	Charles Morse Energy Manager	Responsible for energy and water management including saving initiatives. Coordinates and instigates costed technical options and solutions. Provides expert advice and management information on relevant areas of energy and water management and legislation.
Core Team members	Claire Hamilton Communications manager	Provides advice and support in relation to marketing and communications. Liaises with external (to FD) marketing divisions to ensure that relevant messages are communicated to and from staff and students in the University. Advises on external press activities. To lead on customer/consumer surveys and provide trended data in relation to behaviours and awareness of initiatives in the project.
	Clive Booth Assistant Director Estates Operations	Ensures that all known potential estates opportunities which may have a potential to be positively affected by the project are identified to the core team. Ensures inclusion of sustainability and carbon management in all new buildings, refurbishment projects and general maintenance of buildings. Provides support and expert advice in relation to the University estate.
	Nigel Williamson Learning and IT services	Provides support to core team in relation to projects and initiatives which may be identified to save CO2 and other resources. To bring to the core team existing, ongoing and potential future projects. Provides expert advice on IT and AV and other relevant technologies used (such as cooling systems). Help identify IT solutions to reduce energy usage.

	Environment officer Students union (SU) executive (vacant post) Gail Stephens General Manager SU.	Communication of the project to students. Identification of activities and projects suitable for student involvement. Coordination of Sound impact initiative with carbon management project.
	Steven Ward Senior Building Services engineer	To bring projects to the core team. To provide expert advice in relation to existing systems and new systems that may create potential savings.
	Mark Swales Assistant Director Business Services	To bring to the core team existing, ongoing and potential future projects with CO_2 saving in residences, print unit, space usage, catering and FM operations. Champion the implementation of initiatives agreed by project team. Unblock blockages to existing and new initiatives in relation to service areas of responsibility. Provide expert advice in relation to service areas of responsibility
	Vacant post Sustainability coordinators	Provide support to core team in general knowledge of subjects. Identify new initiatives to the project team. Provide information (including basic research) to support team. Initiates awareness raising and engagement activities with staff, students and stakeholders of SHU.
	Philip Severs Director Finance and Operations (to be delegated when new structure in place)	Works with the core project team to develop an implement sustainability procurement policy and strategy (medium to long term). Short to medium term, provides support to the core team; provides expert advice in relation to strategic procurement.
	Carol Clarke Admin support	Provides clerical support to the core team. Takes minutes of relevant meetings. Formats reports for EOG and University Executive. Coordinates meetings.
Additional Project Support	Members of estate department, F.M.'s, Environmental champions in HR O&M, LITS, D&S and H&W. Security staff, cleaning staff, porters and University drivers. FD and SHU training sections. FD procurement. IT support in FD and SHU FD finance Sheffield City Council, transport, planning, air quality sections.	
Core consultation and liaison groups	Sustainability Hub, Faculty and Departmental environmental groups (e.g. SLS sustainability group, FD and LITS green group etc.) Academic, research and development staff in support of carbon management programme and use of programme projects to enhance curriculum delivery where relevant e.g. student engagement in projects, learning from implementing project to use in product and research development. Enabler for cross disciplinary working.	

6.4. Data Management and forecasting

Energy and Water - owner Charles Morse

The University currently holds its energy and water consumption data on an internal data base with at least 10 years of trended data (see example table below). Data is

available on usage across the estate but in some areas metering is not available to give information about specific buildings or sub meters to give information about divisions or types of usage in buildings.

Waste strategy - owner Marie May

The University currently holds its waste production data on an internal data base with 3 years of trended data provided by its key waste collection agency through a pay by weight contract. However, until recent months, the University recycling contractors have not had the capacity to give data about recycled materials collected and recycled. However, the University does have in place recycling facilities for all main wastes across campuses but not all facilities are available at all campuses.

Transport and travel - owner Marie May

The University has very little data on travel for business and commuter travel. A survey of staff and students was carried out in 2004 to: understand modes of transport used: identify ideas from stakeholders about what alternatives would attract them to change from car usage: provide a starting point to measure modal shift. However, this is has not prevented the University from implementing an effective green travel plan which includes many initiatives for staff and students to use car alternative means of travel.

6.5. Stakeholder analysis

It is important to use our limited resources for the management of this project wisely. The following stakeholder analysis provides some direction to determine the best focus of resources in order to realise the most beneficial, timely outcomes.

Perceived stakeholder interest in CO_2 management	**High**	Potential Students	Environmental champions (Staff, Students and stakeholders) External community (e.g. area panel) Students Union	Director of Finance, Central Finance section (agree budgets/complains about overspend on energy). University executive - high interest & power in financial performance. University contractors e.g. architects, engineers, suppliers for waste reduction. Transport planning, planners etc.
	Med	Students	Some staff including support staff. FD and central marketing Existing working groups e.g. energy action	"Specialist knowledge" staff. e.g. IT, Project managers, procurement specialists, academics, sustainability, energy, health and safety service Academic staff
	Low	Most staff when confronted with actual task in relation own CO_2 footprint.		Estates services and maintenance
		Low	**Medium**	**High**
	Potential to impact on CO_2 emissions management			

6.6. Stakeholder engagement and communication

Following the analysis and identification of stakeholders and projects we can decide what type and level of communication is needed and who is best placed to influence.

Stake holder	Influence	Key Issues	Means of communication	Lead Responsibility
Executive group (inc. Finance Director)	High	Financial investments and savings, staff and student satisfaction rates	Reports, presentations bespoke to specific part of project	AWP/RN
Contractors and external stakeholders	High	Having and increasing business with SHU Climate change Satisfying regulations Improving reputation	Hold stakeholder awareness events to describe desired outcomes of project and seek their input into how they can support it. Understand new regulations which both SHU and stakeholders need to meet	GK/CB/MM
Specialist knowledge staff (including maintenance & academics)	High	Time and finances savings Energy saving Improving staff and student experience (thermal comfort)	Cross disciplinary workshops (opportunities workshops) Reports Impact surveys and studies Staff, student satisfaction surveys Advertise success	MM/CM/RN/CB/ training sections GK
Students	Medium	Climate change Impact on coursework Saving energy and water Recycling	Blackboard email Intranet and internet Students union activities and joint SHU & SU activities	MM/GK/MV/GS
Staff (non specialist - see stakeholder analysis)	Medium	Waste reduction and recycling Energy management and awareness of changes project team make Direct impact on travel	EView, New View and Faculty/Departmental newsletters email Staff intranet Induction	GK/MM/CM/ AWP/training sections

Environmental champions (and "front of house services" e.g. receptionists)	Medium	Climate change Reporting successes to colleagues Reporting faults to maintenance, FM's, raising awareness to their teams Raising ideas	Meetings in groups and one to ones Bespoke web based file share Newsletter	MM/CM/GK
FD and SHU marketing	Medium	Improving communication Raising profile of organisation to potential new customers (e.g. potential new students) Climate change	Meet to explain project Understand issues and lead in timescales Marketing to create communications plan	MM/CM/RN
Students Union	Medium	Climate change Travel of students Waste reduction Raising awareness joint events with SHU Energy and water management in HUBS building	Face-to-face meetings with Matt Vicary / Gail Stephens Awareness raising via SU through Blackboard, email, intranet, events Advertise successes and incentives (e.g. free cycle lessons)	MM/GK/CM/MV/ GS/AWP

6.7. Policy alignment

As mentioned already in this plan, the University has policies in place for the direction and management of the core elements identified as opportunities including an overarching sustainability policy with underpinning energy and water, waste and transport policies - see

http://www.shu.ac.uk/services/facilities/sustainability/policies.html

This carbon management plan will both support these policies and drive the review of the waste and transport policies as well as help to push forward the creation of a sustainable procurement policy and strategy and a " sustainable building handbook" by the end of 2009/10 financial year. The University already has a robust procedure for the review and monitoring of the effectiveness of all our policies and those mentioned above will be subject to that existing rigorous process.

7. Programme Management

In order for the carbon management programme to succeed, there needs to be clear and appropriate management structures in place, including identification of ownership and allocation of responsibilities. The responsibilities of staff are detailed in sections 6.2 and 6.5 of this plan.

7.1. The Board

Strategic direction and support will be provided by the University Executive Group (which includes the Vice Chancellor, the Director of Finance and Executive Deans) who will receive regular updates from the Core Team via the project sponsor, the Director of Estates and Facilities.

This group also reports periodically to the Board of Governors.

7.2. The Core Team

The Core Team is chaired by the project sponsor, the Director of Estates and Facilities. Details of the proposed core team are detailed in 4.2 6.2 and 6.5 of this plan.

7.3. Risks to the programme

- The University fails to make investment or sufficient investment to support the project sufficiently, leading to its failure. (E.g. in staff time and resources, new technologies, installation of new equipment etc.)
- The University's Masterplans change the way space is used which demands the increase of energy, undermining the projects' targets
- The loss of key team members
- Team members becoming overloaded or diverted to other priority activities at key stages in the project
- Failure to engage with and receive the support from key decision makers
- The University fails to secure critical funding to carry forward initiatives even though internally it has been supported
- Unable to establish sufficient detail in the baseline information that targets and monitoring become difficult or meaningless
- Insufficient workable ideas are suitable to implement
- Failure to get buy in from University staff, students and stakeholders
- Failure to plan (and resist pressure to do everything in one go) the project into viable phases which will lead to confusion and fragmentation of the overall project.

7.4. Management of the Risks

Risks will be monitored and managed through regular budgeting and financial reporting of the key elements involved e.g. energy, fuel and waste disposal costs, team meetings of the core project team and with the Project Sponsor, regular reporting to EOG and through contact with the University Senior Management team through the existing line management structure.

The requirement for Display Energy Certificates has helped in providing information on baselines and in focussing on specific geographical areas for improvement to energy

efficiency. This forms one of our tools to manage risks and to manage the priorities in the project.

It will be a priority to make carbon management engagement activities exciting, fun and rewarding for staff and students in order to get and maintain their buy in. Training from staff with expertise in teacher training section of D&S will help overcome this.

7.5. Annual Progress Review

Annually, (in line with the current reporting period to the Board of Governors) a report will be drafted on the progress of the carbon management plan. The report will include information on:

- the cost and benefits from the programme
- sources of funding used and the financial savings made
- CO_2 savings against target
- financial savings against target
- Stakeholder feedback of satisfaction of cause and effect of plan (e.g. students, staff, local community)
- Stakeholder feedback on new opportunities as part of the process of reviewing and updating the plan.

Appendix A (1)

Energy saving suggestions from site survey advisory reports.

Detailed analysis is proceeding and will be added to the CMP at subsequent revision.

Measure	Detail	Application	Impact	Payback
Low Energy Cooling	Consider centralising some of the cooling systems at City Campus and investigating low energy cooling sources alongside reducing the need for cooling. Consider absorption cooling using heat from the District Energy network. Use passive cooling options where appropriate.	Generic	High	Unknown
PC Auto Switch Off Control	Work with LITS staff install software to automatically switch off computers when not required.	Generic	High	Unknown
Low resistance filters	Claimed to reduce energy consumption in air handling units by presenting less resistance to air flow.	Generic	Medium	Unknown
Timers to equipment	Provide and install plug in timers to various items of office and catering equipment to prevent operation out of hours.	Generic - trial in Furnival	Medium	Unknown
Evaluate Pilkington K glass	Determine potential energy savings. Incorporate in future Estates specifications if appropriate.	Generic	Unknown	Unknown
Low energy humidification	Consider evaporative humidifiers for Air Handling Units. Adiabatic cooling may offer additional benefit for areas with intensive IT equipment use.	Generic	Unknown	Unknown
Metering	Continue to develop a sub metering strategy and install new meters for strategic areas such as catering and data centres to allow better accountability, monitoring and targeting, and possible future recharging.	Generic	Unknown	Unknown
Energy Management techniques	It is recommended that energy management techniques are introduced. These could include efforts to gain building users commitment to save energy, allocating responsibility for energy to a specific person (champion), setting targets and monitoring.	Sheaf Building Eric Mensforth Building	High	Short
Lighting controls	Immediate attention should be given to the reduction of lighting energy consumption particularly in the evenings and at weekends.	Sheaf Building Eric Mensforth Building Woodville Hall Robert Winston Building	High	Short
PC Auto Switch Off Control	Enable power save settings and power down management on computers and associated equipment.	Sheaf Building Eric Mensforth Building HUBS Collegiate LC	High	Short

Measure	Detail	Application	Impact	Payback
Planned lighting maintenance	Consider implementing a programme of planned lighting systems maintenance to maintain effectiveness and energy efficiency.	Sheaf Building Eric Mensforth Building Bawtry Rd	High	Short
Specialist advice	Engage experts to survey the condition of the heating systems and propose remedial works.	Collegiate Hall	High	Short
Survey mains voltages in all buildings larger than 1,000m²	Record mains voltages and rank results.Determine where voltage optimisation may be beneficial. Current operating experience indicates that the UK nominal voltage of 230 Volts is an appropriate cut-off point.	Generic	High	Short
User engagement	Consider engaging with building users to economise equipment energy consumption with targets, guidance on their achievement and incentives.	City Main Buildings	High	Short
Voltage optimisation	Install voltage optimisation equipment where feasible to reduce supply voltage from 240 to 230V to reduce running and maintenance costs. Pilot installed in HUBS Students Union building in July 2008.	Generic	High	Short
Voltage optimisation	Install voltage optimisation equipment where feasible to reduce supply voltage to 230V to reduce running and maintenance costs.	Howard Building Harmer Building Sheaf Building Adsetts Centre Owen & Norfolk Collegiate Campus	High	Short
Zoning	Common circulation areas such as the canteen should be closed off at night to reduce lighting energy consumption.	HOTC	High	Short
BMS controls	A BMS fitted controller has been fitted in The Lodge plant room to enable remote switching of floodlights on the sports pitch. This means that the marginal cost of connecting the heating to the BMS is relatively low.	Southbourne	Low	Short
Collegiate Hall heating system	Current high-low modulation is unsatisfactory. Consider fitting small gas burner to one gas boiler Consider linking 'high-low' facility to BMS	Collegiate Hall	Low	Short
Minor modifications	Adsetts Centre - L2 file server room. Install local cooling to allow main cooling system to be switched off during cool weather.	Adsetts Centre	Low	Short
Minor modifications	Clean windows and roof lights to maximise daylight entering building and reduce the need for artificial lighting.	Southbourne	Low	Short

Measure	Detail	Application	Impact	Payback
Catering	Consider with chefs and kitchens managers implementing an energy efficiency plan including maintenance and servicing provisions and operational targets, monitoring and incentives.	HOTC Robert Winston Building	Medium	Short
Controls	Seek to minimise simultaneous operation of heating and cooling systems.	Robert Winston Building	Medium	Short
Energy Management techniques	It is recommended that energy management techniques are introduced. These could include efforts to gain building users commitment to save energy, allocating responsibility for energy to a specific person (champion), setting targets and monitoring.	Adsetts Centre Arundel Building City Main Buildings Stoddart HUBS Broomgrove Hall HOTC	Medium	Short
HVAC checks	Consider introducing a system of regular checks of Heating, Ventilation and Air Conditioning (HVAC) time and temperature settings and provisions to prevent unauthorised adjustment.	Collegiate Hall	Medium	Short
Lighting controls	Immediate attention should be given to the reduction of lighting energy consumption particularly in the evenings and at weekends.	Stoddart	Medium	Short
Metering	Consider a programme of fitting energy meters to kitchen facilities as part of the serving and maintenance regime.	City Main Buildings	Medium	Short
Minor modifications	Clean windows and roof lights to maximise daylight entering building and reduce the need for artificial lighting.	Collegiate Hall	Medium	Short
Minor modifications	If stratification occurs consider re-circulating the air during heating.	Robert Winston Building	Medium	Short
PC Auto Switch Off Control	Enable power save settings and power down management on computers and associated equipment.	Adsetts Centre Collegiate Hall Southbourne	Medium	Short
Planned lighting maintenance	Consider implementing a programme of planned lighting systems maintenance to maintain effectiveness and energy efficiency.	Stoddart Broomgrove Hall Collegiate LC	Medium	Short
Power monitoring	Consider installing automated controls and monitoring systems to electricial equipment and portable appliances to minimise electricity waste.	Broomgrove Hall Collegiate Hall Southbourne Bawtry Rd	Medium	Short

Measure	Detail	Application	Impact	Payback
Procurement regime	Consider with experts the implementation of an energy efficient equipment procurement regime that will upgrade existing equipment and renew in a planned cost-effective programme.	Arundel Building Generic	Medium	Short
Reduce water consumption in Eric Mensforth Building, L3 toilets.	Wash basin taps are using excessive amounts of water. Cisternmiser settings also need checking.	Eric Mensforth Building	Low	Short
Specialist advice	Consider adjusting existing or installing new automatic external door closers or adopting revolving door solutions.	Collegiate LC	Medium	Short
Specialist advice	Consider engaging experts to review the condition of the building fabric and propose measures to improve energy performance. This might include building pressure tests for air tightness and thermography tests for insulation continuity.	Southbourne	Medium	Short
Stoddart Building - Chiller control modification	Free cooling could be used in cold weather if control circuits are modified to allow chillers to be switched off although cooling demand exists.	Stoddart	Medium	Short
User engagement	Consider engaging with building users to economise equipment energy consumption with targets, guidance on their achievement and incentives.	Arundel Building HUBS	Medium	Short
Variable speed drives	Fitting inverter controls to supply and extract fans could allow airflow to be reduced during cool weather. This would reduce heating costs and reduce perception of cool draughts. Also extend operating life of air filters	Stoddart Sheaf Building Harmer Building Eric Mensforth Building	Medium	Short
Voltage optimisation	Install voltage optimisation equipment where feasible to reduce supply voltage to 230V to reduce running and maintenance costs.	HUBS	Medium	Short
Lighting	Install more lighting controls to suitable areas and adapt existing to improve operation. Replace old and inefficient lighting and look to incorporate new low energy types during refurbishment Consider converting light fittings to take T5 lamps in areas where full replacement is not cost effective.	Generic	High	Medium
Solar gain	Consider applying reflective coating to windows and/or fit shading devices to reduce unwanted solar gain.	City Main Buildings	High	Medium

Measure	Detail	Application	Impact	Payback
Building fabric inspections	Consider implementing regular inspections of the building fabric to check on the condition of insulation and sealing measures and removal of accidental ventilation paths.	Arundel Building Collegiate Hall Collegiate LC HOTC Southbourne	Low	
Minor modifications	Improvements to Science Park 'landlord's services. Lighting, hot water, heating, stairwell heating	Science Park	Low	Medium
Modify Furnival Cafe lighting to respond to natural light levels and occupancy.	This is the 'gateway' to the University. The perimeter lighting is on continuously while the building is open.	Furnival Building	Low	Medium
Solar gain	Consider applying reflective coating to windows and/or fit shading devices to reduce unwanted solar gain.	Collegiate LC	Low	Medium
BMS controls	A BMS fitted controller has been fitted in the Science Park as part of an access control scheme. This means that the marginal cost of connecting thirteen heating boilers to the BMS is relatively low. This scheme should be considered with a package of improvements to the 'landlord's services.	Science Park	Medium	Medium
BMS controls	A BMS fitted controller has been fitted in Arundel Gate Court as part of an access control scheme. This means that the marginal cost of connecting the heating to the BMS is relatively low.	City Small	Medium	Medium
Building fabric inspections	Consider implementing regular inspections of the building fabric to check on the condition of insulation and sealing measures and removal of accidental ventilation paths.	Adsetts Centre Sheaf Building Eric Mensforth Building Broomgrove Hall Woodville Hall Bawtry Rd	Medium	Medium
Compressed air	Assess compressed air demand, eliminate leakage. Install suitably sized variable load compressor to act as primary source of supply. Reduce compressed air pressure to minimum required.	Sheaf Building	Medium	Medium
Hand Dryers	Install new low energy hand dryers across the estate as part of a programme of toilet refurbishment.	Generic	Medium	Medium
Lighting controls	Installation of lighting technology such as movement sensors and timers, as well as photocell daylight sensitivity switches would significantly reduce energy waste through lighting.	Stoddart HOTC Southbourne	Medium	Medium

Measure	Detail	Application	Impact	Payback
Modifications to Harmer Building compressed air system	Assess compressed air demand, eliminate leakage. Install suitably sized variable load compressor to act as primary source of supply. Reduce compressed air pressure to minimum required.	Harmer Building	Medium	Medium
Modify operation of Adsetts smoke vents to provide stack ventilation during warm weather	Requires additional measures to prevent birds entering when vents are open.	Adsetts Centre	Medium	Medium
Pipework insulation	Provide removable lagging jackets for valves, strainers and flanges on heating pipework.	Generic	Medium	Medium
Solar gain	Consider applying reflective coating to windows and/or fit shading devices to reduce unwanted solar gain.	Robert Winston Building	Medium	Medium
Stoddart car park lighting	Consider changing existing fittings which are 10 years old, or retrofitting T5 lamps and converters.	Stoddart	Medium	Medium
Voltage optimisation	Install voltage optimisation equipment where feasible to reduce supply voltage to 230V to reduce running and maintenance costs.	Eric Mensforth Building	Medium	Medium
Voltage optimisation	Install voltage optimisation equipment where feasible to reduce supply voltage to 230V to reduce running and maintenance costs.	Stoddart	Medium	Medium
Water Saving	Continue with the installation of various measures to reduce water consumption such as spray taps and aerating nozzles where appropriate.	Generic	Medium	Medium
Glazing	Consider replacing or improving glazing.	City Main Buildings	High	Long
Heating strategy	Engage experts to review overall heating strategy and propose an investment programme for upgrading and/or switching to alternative solutions.	Bawtry Rd	High	Long
Renewable heat pump	Consider installing a ground source heat pump.	Collegiate Hall Collegiate LC HOTC Southbourne Bawtry Rd	High	Long
Renewable PV	Consider installing building mounted photovoltaic electricity generating panels.	Collegiate LC HOTC Southbourne	High	Long
Renewable solar water heating	Consider installing building mounted solar water heating.	HOTC	High	Long
Convert electric space heating system at 38/40 Howard Street and 39 Broomgrove Road	Electric space heating is more polluting than alternative options. Conversion would reduce carbon emissions by a large percentage. Options include: Condensing gas boiler Ground source heat pump	City Small Broomgrove Road	Low	Long

Measure	Detail	Application	Impact	Payback
Explore more capture of rainwater as an alternative to tap water to use on our grounds	Some success already on Howard street. Issues about space for storage.	Generic	Low	Long
Fit dimming lighting with presence detection to emergency stairs in Surrey Building	Lighting is maintained 24/7 in case of emergency. Intelligent light fittings would reduce power consumption by up to 80% but still provide light when needed.	Surrey	Low	Long
Modify Main Entrance lighting to respond to natural light levels	This a high profile area and visitors have commented that lights are on although natural light levels near the windows are more than sufficient.	Owen Building	Low	Long
Water reduction in toilet areas	Low water urinals - pilot trial started 2008 Fit dual-flush cisterns in gents toilets - this measure is not felt to be appropriate for ladies toilets.	Generic	Low	Long
BMS controls	Continue with the programme of improving the existing BMS network. Link in additional buildings, auditing controls strategies and pick up items of uncontrolled plant that are not currently on the BMS.	Generic	Medium	Long
BMS controls	Install BMS to Church House heating system. This scheme would be relatively more expensive as the BMS network has not yet been extended to this building.	City Small	Medium	Long
Collegiate campus boiler and heating improvements	Continue with the programme of improving the operation and control of the existing heating and hot water services and boiler plant at Collegiate Crescent campus.	Generic	Medium	Long
Convert electric space heating system at 48 Howard street	Electric space heating is more polluting than alternative options. Conversion would reduce carbon emissions by a large percentage.	City Small	Medium	Long
Feasibility study for 'large' ground source heat pump at Robert Winston Building.	Robert Winston Building receives heat from the boilers at Woodville Hall. A feasibility study would determine whether there are benefits in providing RWB with its own heat source.	Robert Winston Building	Medium	Long
Glazing	Consider replacing or improving glazing.	Sheaf Building Eric Mensforth Building Broomgrove Hall Collegiate Hall HOTC Southbourne	Medium	Long
Heating strategy	Engage experts to review overall heating strategy and propose an investment programme for upgrading and/or switching to alternative solutions.	Stoddart	Medium	Long

Measure	Detail	Application	Impact	Payback
Howard Building - Pennine Theatre. Optimise performance of heat recovery dampers	Existing equipment is 15 years old and no longer functions at peak efficiency. Minor refurbishment may be cost-effective.	Howard Building	Medium	Long
Install renewable energies into refurbishments and new buildings	Furnival building includes ground source heat pumps, solar power etc. Assessment mechanism needs putting in place to inform new buildings	Generic	Medium	Long
Insulation and Draught-proofing	Review and install insulation to walls, roofs and pipework as well as draught proofing measures across all buildings.	Generic	Medium	Long
Lighting strategy	Engage experts to review the building lighting strategies and propose alterations and/or upgrades to daylighting provisions, luminaires and their control systems and an implementation plan.	Arundel Building Stoddart Broomgrove Hall Collegiate Hall Collegiate LC HOTC Southbourne Robert Winston Building	Medium	Long
Reassess lighting requirements for the Atrium at City Campus	Existing wiring and control arrangements limit our ability to manage lighting levels on the lower landings of the Atrium. A full reassessment of SHU requirements (including corporate events) is recommended. Appropriate 'intelligent' light fittings can then be chosen from current and emergent technology.	Atrium	Medium	Long
Renewable PV	Consider installing building mounted photovoltaic electricity generating panels.	Adsetts Centre Arundel Building Sheaf Building Eric Mensforth Building Stoddart Broomgrove Hall	Medium	Long
Renewable solar water heating	Consider installing building mounted solar water heating.	Adsetts Centre Arundel Building Sheaf Building Eric Mensforth Building	Medium	Long
Review hot water systems	Engage experts to review the HWS systems provisions and propose remedial works, upgrades and/or alternative provisions to improve effectiveness and efficiency and plan for implementation.	Eric Mensforth Building	Medium	Long

Measure	Detail	Application	Impact	Payback
Stoddart Building - Assessment of windows in 3 storey block.	Building was designed with mechanical ventilation strategy. One opening window was fitted to the Charles Street elevation as a trial. If other windows are converted, requirement for mechanical ventilation could be reduced.	Stoddart	Medium	Long
Specialist advice	Consider constructing draught lobbies to reduce unwanted air infiltration.	City Main Buildings	Medium	Long

Appendix A (2)

These projects are currently being implemented into the estate.

Potential Projects	KWh saving	CO2 saving	Cost saving	Project Cost	Payback (Years)	Useful Life (years)	£/tonne CO2
Voltage Optimisation							
HUBS - VO enhanced controls	40,000	21.5	4,680	3,000	0.6	10	14
Variable speed drives							
Eric Mensforth - VSD	73,315	39.4	8,248	16,000	1.9	8	51
Stoddart - VSD	55,000	29.5	6,188	15,000	2.4	8	63
Improved plant room insulation							
Insulate valves and flanges:	133,990	13.4	4,467	11,500	2.6	10	86
Sheaf, EMB, Adsetts, Stoddart, Arundel							
Minor modifications							
Adsetts - L2 server room cooling	13,001	7.0	1,300	2,500	1.9	5	72
Collegiate Hall - new gas burner	32,000	5.9	1,280	2,500	2.0	7	60
Sheaf - new air compressor	19,865	10.7	2,235	7,500	3.4	10	70
Controls projects							
Stoddart - chiller control mods	50,000	26.9	5,000	2,500	0.5	8	12
Install BMS - The Lodge	36,260	6.7	1,450	7,000	4.8	6	174
Stand-alone Energy Saving Projects	**453,430**	**161 t**	**£34,848**	**£ 67,500**	**1.9**		

Appendix B:

Carbon Management Matrix – Embedding As at September 2008

	POLICY	RESPONSIBILITY	DATA MANAGEMENT	COMMUNICATION & TRAINING	FINANCE & INVESTMENT	PROCUREMENT	MONITORING & EVALUATION

5 **BEST**	• SMART Targets signed off
	• Action plan contains clear goals & regular progress reviews
	• Strategy launched internally & to community
		• CM is **full**-time responsibility of a **few** people
		• CM integrated in responsibilities of **senior** managers
		• VC support
		• Part of **all** job descriptions
			• **Quarterly** collation of CO_2 emissions for all sources
			• Data **externally** verified
			• M&T in place for:
			  ○ Buildings
			  ○ Waste
				• All staff & students given formalised CM:
				  ○ Induction
				  ○ Training Plan
				  ○ Communications
				• CM matters **regularly** communicated to:
				  ○ External community
				  ○ Key partners
					• **Granular** & **effective** financing mechanisms for CM projects
					• **Finance representation on CM Team**
					• **Robust** task management mechanism
					• **Ring-fenced fund** for carbon reduction initiatives
						• **Senior** purchasers consult & adhere to ICLEI's **Procura+** manual & principles
						• Sustainability comprehensively integrated in **tendering** criteria
						• Whole life costing
						• Area-wide procurement
							• Senior management review CM process
							• Core team regularly reviews CM progress
							• Published externally on website
							• Visible board level review

4	• SMART Targets **developed but not** implemented	• CM is **full**-time responsibility of an **individual**
		• CM integrated in to responsibilities of department **managers**, not all staff
			• **Annual** collation of CO_2 emissions for:
			  ○ Buildings
			  ○ Transport
			  ○ waste
			• Data **internally** reviewed
				• All staff & students given CM:
				  ○ **Induction**
				  ○ Communications
				• CM communicated to:
				  ○ External community
				  ○ Key partners
					• Regular financing for CM projects
					• **Some** external financing
					• **Sufficient** task management mechanism
						• Environmental demands incorporated in tendering
						• Familiarity with **Procura+**
						• **Joint procuring** between HEIs or with LAs.
							• **Core** team **regularly** reviews CM progress:
							  ○ Actions
							  ○ Profile & Targets
							  ○ New opportunities quantification

3	• **Draft** policy
	• Climate Change **reference**
		• CM is **part**-time responsibility of a **few** people
		• CM responsibility of department champions
			• **Collation** of CO_2 emissions for limited scope i.e. buildings only	• **Environmental / energy** group(s) give ad hoc:
				  ○ Training
				  ○ Communications
					• **Ad hoc** financing for CM projects
					• Limited task management
					• No allocated resource
						• **Whole life** costing occasionally employed
						• Some **pooling** of environmental expertise
							• CM team review aspects including:
							  ○ **Policies / Strategies**
							  ○ Targets
							  ○ Action Plans

2	• No policy • Climate Change **aspiration**	• CM is **part**-time responsibility of an **individual** • No departmental champions	• **No CO_2** emissions data compiled • Energy data compiled on a regular basis	• Regular poster/awareness campaigns • **Staff & students** given ad hoc CM: ○ Communications	• Ad hoc financing for CM **related** projects • Limited task coordination **resources**	• **Green** criteria occasionally considered • Products considered in **isolation**	• Ad hoc reviews of CM actions progress
1 **Worst**	• No policy • **No** Climate Change reference	• No CM responsibility designation	• Not compiled: ○ CO_2 emissions • Estimated billing	• No communication or training	• No internal financing or funding for CM related projects	• No Green consideration • No life cycle costing	• No CM monitoring

Project: **Reference:**	**Appendix C** ***Building Management System extension - The Lodge***
Owner (person)	*Energy Action Group*
Department	*Facilities Directorate*
Description	*Extend the Continuum Building Management System to control the gas fired heating system serving The Lodge at Collegiate Crescent.*
Benefits	• Financial savings: £1,400 per annum • Payback period: 3.6 years on investment of £5,100 • CO_2 Emissions reduction: 7.0 tonnes of CO_2
Funding	• *Project cost estimated at £5,100 for 10 hard-wired points.* • *Source of funding: energy revenue budget* • *Decision on funding status - decision made*
Resources	• *Project to be delivered by specialist subcontractor* • *Supervision by Facilities Directorate staff*
Ensuring Success	• *Requires cost-effective solution that takes advantage of proximity of BMS controller recently installed to manage sports ground lighting.* • *If project is over-engineered, payback period will be extended.*
Measuring Success	• *Annual gas consumption is more than 300 kWh/m²/year.* • *Target is 200 kWh/m²/year - reduction of 35%.* • *Fuel consumption will reduce by 35,200 kWh worth £1,400 at 4.0p/kWh*

Timing	• *Milestones / key dates*
	  ○ *start date: 01/07/2009*
	  ○ *completion date: 31/08/2009*

Notes	

Project: **Reference:**	**Appendix D** ***Controls wiring modifications - Stoddart Building chillers***
Owner (person)	*Energy Action Group*
Department	*Facilities Directorate*
Description	*Modify controls interfacing to allow chillers to be switched off as part of control strategy. This will allow periods of 'free cooling' for much of the year.*
Benefits	• Financial savings: £5,000 per annum • Payback period: 0.5 years on investment of £2,500 • CO_2 Emissions reduction: 26.9 tonnes of CO_2
Funding	• *Project cost estimated at £2,500 for wiring modifications and provision of suitable relays.* • *Source of funding: energy revenue budget*
Resources	• *Project to be delivered by specialist subcontractor* • *Supervision by Facilities Directorate staff*
Ensuring Success	• *Requires cost-effective solution to provide simple On-Off control of pumps and chillers by Building Management system.* • *If project is over-engineered, payback period will be extended.*
Measuring Success	• *Target savings of 2,500 kWh per week for 20 weeks each year.* • *Expected annual saving of 50,000 kWh worth £5,000 at 10.0p/kWh*

Timing	• *Milestones / key dates*
	  ○ *start date: 01/06/2009*
	  ○ *completion date: 31/10/2009*
	  ○ *This will secure savings at the start of the next cooling season.*

Notes	*The plant configuration in Stoddart is unlike any other SHU buildings.* *This solution could not be replicated in our other properties*

Project: **Reference:**	**Appendix E** ***Inverter control of ventilation - Eric Mensforth Building***
Owner (person)	*Energy Action Group*
Department	*Facilities Directorate*
Description	*Fit inverter controls to four air handling units to provide variable-speed control of ventilation. This would result in energy savings and would also reduce ambient noise levels in teaching rooms.*
Benefits	• Financial savings: £8,250 per annum (on all four) • Payback period: 1.9 years on investment of £16,000 • CO_2 Emissions reduction: 39.4 tonnes of CO_2
Funding	• *Project cost of £16,000 based on quotation from BG Controls dated14/07/08.* • *Source of funding: energy revenue budget*
Resources	• *Project to be delivered by specialist subcontractor* • *Supervision by Facilities Directorate staff*
Ensuring Success	• *Requires Building Management System control programs to be rewritten to respond to changes in air quality, space temperatures and external air temperature.* • *If project is over-engineered, payback period will be extended.*
Measuring Success	• *Expected annual saving of 73,300 kWh worth £8,250 at 11.25p/kWh*

Timing	• *Milestones / key dates*
	  ○ *start date: 01/08/2009*
	  ○ *completion date: 31/12/2009.*

Notes	*This project will not reduce internal overheating in hot weather, but may allow more flexible control strategies to be developed e.g. 'free cooling' by running ventilation at low speed overnight.*

Appendix F

Energy related costs (£1000's) - Business As Usual with increasing electrical demand									
Source	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Electricity	1,879	1,805	2,425	2,737	2,937	3,152	3,383	3,630	3,895
Thermal	670	725	735	767	806	846	888	933	979
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,743**	**3,998**	**4,271**	**4,562**	**4,874**
CO_2 Tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,620**	**13,859**	**14,103**	**14,353**	**14,608**

Energy related costs (£1000's) - Business As Usual with steady electrical demand									
Source	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Electricity	1,879	1,805	2,425	2,737	2,874	3,018	3,169	3,327	3,494
Thermal	670	725	735	767	806	846	888	933	979
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,680**	**3,864**	**4,057**	**4,260**	**4,473**
CO_2 Tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,386**	**13,386**	**13,386**	**13,386**	**13,386**

Energy related costs (£1000's) - Reduced Emissions (Carbon Management plan)									
Source	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Electricity	1,879	1,805	2,425	2,737	2,788	2,840	2,892	2,946	3,000
Thermal	670	725	735	767	789	812	836	860	885
Total	**2,549**	**2,530**	**3,160**	**3,505**	**3,577**	**3,652**	**3,728**	**3,806**	**3,885**
CO_2 Tonnes	**14,265**	**13,550**	**13,574**	**13,386**	**13,012**	**12,649**	**12,295**	**11,953**	**11,619**

Appendix G

(NB The figures in these tables reflect a given point in time and will fluctuate as changes are made to budgets, the University estate and costs).

Utilities budget planning document for FD's strategic development plan demonstrating the spend to save scenario

	08/09		08/09 Forecast	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Misc Income	-113,000		-132,440	-135,000	-137,498	-140,041	-142,632	-145,271	-147,958	-150,695	-153,483	-156,323
Energy Projects	15,000		21,550	165,000	189,750	218,213	250,944	288,586	331,874	381,655	438,903	504,739
Heating Oil	5,600		3,600	1,200	1,260	1,323	1,389	1,459	1,532	1,608	1,689	1,773
District Heating	335,700		380,920	390,182	401,498	413,141	425,122	437,451	450,137	463,191	476,623	490,445
Electricity	2,068,900		2,424,750	2,737,350	2,787,991	2,839,569	2,892,101	2,945,605	3,000,098	3,055,600	3,112,129	3,169,703
BMS Maintenance	30,000		29,975	30,000	30,900	31,827	32,782	33,765	34,778	35,822	36,896	38,003
Gas	329,600		353,350	375,809	386,708	397,922	409,462	421,336	433,555	446,128	459,066	472,379
Water	203,700		204,150	206,400	209,806	213,267	216,786	220,363	223,999	227,695	231,452	235,271
	2,875,500		**3,285,855**	**3,770,942**	**3,870,414**	**3,975,221**	**4,085,955**	**4,203,294**	**4,328,015**	**4,461,004**	**4,603,275**	**4,755,991**

Assumes
Water cost +7% p.a.
Energy cost +5% p.a.
Initial investment £150,000
Electricity use -3% p.a. from 2010/11
Heat & gas -2% p.a. from 2010/11
Water use -5% p.a. from 20/11
Escalate @15% p.a.

Tackle 'quick wins' first, then expect slower payback.

Appendix H
Utilities budget planning document - assuming business as usual - electricity consumption @ 2.2% increase p.a.

	08/09		08/09 Forecast	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Misc Income	-113,000		-132,440	-135,000	-144,869	-155,458	-166,822	-179,017	-192,103	-206,146	-221,215	-237,386
Energy Projects	15,000		21,550	15,000	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002
Heating Oil	5,600		3,600	1,200	1,260	1,323	1,389	1,459	1,532	1,608	1,689	1,773
District Heating	335,700		380,920	390,182	409,692	430,176	451,685	474,269	497,983	522,882	549,026	576,477
Electricity	2,068,900		2,424,750	2,737,350	2,937,450	3,152,178	3,382,602	3,629,870	3,895,214	4,179,954	4,485,509	4,813,399
BMS Maintenance	30,000		29,975	30,000	30,900	31,827	32,782	33,765	34,778	35,822	36,896	38,003
Gas	329,600		353,350	375,809	394,600	414,330	435,046	456,798	479,638	503,620	528,801	555,241
Water	203,700		204,150	206,400	220,848	236,307	252,849	270,548	289,487	309,751	331,433	354,634
	2,875,500		**3,285,855**	**3,620,942**	**3,865,331**	**4,126,596**	**4,405,922**	**4,704,576**	**5,023,917**	**5,365,401**	**5,730,587**	**6,121,143**

Assume
Water cost +7% p.a.
Energy cost +5% p.a.

Appendix J

These projects are currently being evaluated in detail. £250,000 has been allocated in the next financial year (2009/10) to implement the projects providing the best financial and CO_2 returns.

Potential Projects	KWh saving	CO2 saving	Cost saving	Project Cost	Payback (Years)	Useful Life (years)	£/tonne CO2
Voltage Optimisation							
Owen/Norfolk/Other - VO	519,000	278.7	60,723	50,000	0.8	10	18
HUBS - VO	40,000	21.5	4,680	3,000	0.6	10	14
Harmer & Atrium - VO	264,450	142.0	30,941	35,000	1.1	10	25
Howard - VO	242,500	130.2	28,373	35,000	1.2	10	27
Adsetts - VO	227,100	122.0	26,571	35,000	1.3	10	29
Sheaf - VO	205,500	110.4	24,044	35,000	1.5	10	32
Collegiate Crescent - VO	181,600	97.5	21,247	35,000	1.6	10	36
Stoddart - VO	66,000	35.4	7,722	30,000	3.9	10	85
Eric Mensforth - VO	59,800	32.1	6,997	35,000	5.0	10	109
Voltage Optimisation Projects	**1,805,950**	**970 t**	**£ 211,296**	**£ 293,000**	**1.4**		
Variable speed drives							
Harmer -VSD	93,110	50.0	10,475	20,000	1.9	8	50
Eric Mensforth - VSD	73,315	39.4	8,248	16,000	1.9	8	51
Sheaf - VSD	90,317	48.5	10,161	20,000	2.0	8	52
Stoddart - VSD	55,000	29.5	6,188	15,000	2.4	8	63
Variable Speed Drive Projects	**311,741**	**167 t**	**£ 35,071**	**£ 71,000**	**2.0**		

Potential Projects	KWh saving	CO2 saving	Cost saving	Project Cost	Payback (Years)	Useful Life (years)	£/tonne CO2
Minor modifications							
Adsetts - L2 server room cooling	13,001	7.0	1,300	2,500	1.9	5	72
Collegiate Hall - new gas burner	32,000	5.9	1,280	2,500	2.0	7	60
Sheaf - new air compressor	19,865	10.7	2,235	7,500	3.4	10	70
Controls projects							
Stoddart - chiller control mods	50,000	26.9	5,000	2,500	0.5	8	12
Install BMS - The Lodge	36,260	6.7	1,450	3,900	2.7	6	97
Ongoing controls tuning							
Gas Heating - Control tuning	166,900	30.9	6,676	5,000	0.7	1	162
Dist Energy - Control tuning	196,000	19.6	6,566	5,000	0.8	1	255
Gas Heating - Uncontrolled	19,400	3.6	776	1,000	1.3	1	279
Electric Heating	3,555	1.9	533	1,000	1.9	1	524
Base load management							
Improved base load efficiency	719,267	386.2	80,918	200,000	2.5	8	65
Improved time control	1,048,931	563.3	83,915	300,000	3.6	4	133
Stand-alone Energy Saving Projects	**4,422,870**	**2200 t**	**£ 437,016**	**£ 894,900**	**2.0**		
Long Term Maintenance							
Chiller replacement							
Sheaf - Replace chillers	97,500	52.4	9,750	400,000	41.0	20	382
Adsetts - Replace chillers	45,420	24.4	4,542	230,000	50.6	20	471

Potential Projects	KWh saving	CO2 saving	Cost saving	Project Cost	Payback (Years)	Useful Life (years)	£/tonne CO2
Stoddart - Replace chillers	44,000	23.6	4,400	225,000	51.1	20	476
Fabric improvements							
Surrey Cladding	123,384	12.4	4,133	1,000,000	241.9	25	3,239
Norfolk Cladding	121,207	12.1	4,060	1,200,000	295.5	25	3,956
Lighting projects							
Atrium lighting	21,400	11.5	2,140	49,000	22.9	8	533
Energy Efficient Lighting	1,170,900	628.8	117,090	3,210,000	27.4	8	638
LTM Project Impact	**1,623,811**	**765 t**	**£ 146,116**				

Appendix K

These projects are currently being implemented into the estate.

Potential Projects	KWh saving	CO2 saving	Cost saving	Project Cost	Payback (Years)	Useful Life (years)	£/tonne CO2
Voltage Optimisation							
HUBS - VO enhanced controls	40,000	21.5	4,680	3,000	0.6	10	14
Variable speed drives							
Eric Mensforth - VSD	73,315	39.4	8,248	16,000	1.9	8	51
Stoddart - VSD	55,000	29.5	6,188	15,000	2.4	8	63
Improved plant room insulation							
Insulate valves and flanges:	133,990	13.4	4,467	11,500	2.6	10	86
Sheaf, EMB, Adsetts, Stoddart, Arundel							
Minor modifications							
Adsetts - L2 server room cooling	13,001	7.0	1,300	2,500	1.9	5	72
Collegiate Hall - new gas burner	32,000	5.9	1,280	2,500	2.0	7	60
Sheaf - new air compressor	19,865	10.7	2,235	7,500	3.4	10	70
Controls projects							
Stoddart - chiller control mods	50,000	26.9	5,000	2,500	0.5	8	12
Install BMS - The Lodge	36,260	6.7	1,450	7,000	4.8	6	174
Stand-alone Energy Saving Projects	**453,430**	**161 t**	**£34,848**	**£ 67,500**	**1.9**		