Bath Spa University

Carbon Reduction Management Plan

2010 – 2020

DRAFT

Executive Summary

- In publication of the Climate Change Act 2008, the Government has set legally binding targets for the UK to reduce carbon emissions by 80% by 2050, against a 1990 baseline with an interim target of 34% reduction by 2020.

- The Secretary of State for Innovation, Universities and Skills has made clear that the HE sector is expected to play a leading role in achieving these targets and that capital funding to HE institutions is to be linked to performance against these targets.

- Under the Capital Investment Framework 2, HEFCE have announced that, from 2011, 40% of capital funding is to be dependent upon HE institutions developing a carbon management plan and demonstrating progress towards published targets.

- In Jan 2010, HEFCE, Universities UK and Guild HE have jointly published a Carbon Reduction Target and Strategy document for the period to 2020, which sets sector wide targets broadly matching those of the Government. Detailed guidance on developing and implementing a carbon management programme is also provided, together with a list of compulsory requirements for target setting.
  These are, that carbon emission targets must be:
  - set against a 2005 baseline;
  - absolute targets, not relative to business metrics such as student numbers etc;
  - include all Scope 1 & 2 emissions (resulting from gas and electricity consumption and from BSU owned vehicles) as a minimum and;
  - not include carbon offsetting.

- Sector wide targets have been translated by HEFCE to a 2005 baseline and are to be limited, in the short term, to Scope 1 & 2 emissions.

Sector Target:

48% reduction in Scope 1 & 2 emissions by 2020, against 2005 baseline

- This document recommends that BSU adopt a target of 50% reduction in Scope 1 & 2 carbon emissions by 2020, against a 2005 baseline. This means reducing emissions from approximately 4,000 tonnes p.a. to 2,000 tonnes p.a. over 10 years.

- Achieving this target will require a systematic, policy driven, programme management approach. A management framework, together with roles and responsibilities is described.

- A ball park analysis of large scale opportunities for building upgrade, refurbishment and replacement, together with a cultural change in attitudes towards energy efficiency, indicates that this target is achievable. However, this will require investment on a scale never before undertaken at BSU and will be dependent on the proposed development of the Newton Park Campus to deliver energy efficient buildings, which are fit for the future.

- All new student accommodation built after 2016 and all non-domestic new build and major refurbishment built after 2018 will have to achieve “Zero Carbon” rating under Part L of the Building Regulations.

- The largest single opportunity for reducing carbon emissions on the Newton Park campus, lies in replacing the student accommodation with 2016 compliant, zero carbon accommodation.

Contents

1 Context and drivers

1.1 Context

The impact of anthropogenic greenhouse gas (GHG) emissions, primarily from energy production, industrial processes and transport, on climate behaviour is now well established science. It is also widely accepted that the burning of fossil fuels is leading to dangerous levels of global warming, which is likely to have serious worldwide economic and social consequences.

In 2008 the Department of Energy and Climate Change (DECC) published The Climate Change Act (2008)[1], which now commits the UK to achieve an 80% reduction in CO_2 emissions by 2050, based on a 1990 baseline, with an interim target of 34% reduction by 2020.

The Secretary of State for Innovation, Universities and Skills, in the Grant Letter to HEFCE of January 2009[2], made clear that the HE sector is expected to play a leading role in achieving these targets and that capital funding to HE institutions is to be linked to performance against these targets.

A joint consultation process, carried out by HEFCE, Guild HE and Universities UK, together with extensive research by SQW consulting (HEFCE appointed research partners), has resulted in the publication of a clear strategy for the HE sector and extensive guidance for institutions in setting and achieving their own carbon reduction targets[3,4].

The Bath Spa University community has an acute recognition that all our activities have an impact on the environment, particularly in terms of carbon emissions and that we have our role to play in achieving the targets set. This awareness is matched by a strong desire to improve performance and reduce our emissions wherever possible.

This desire was demonstrated in 2007 by a collaboration with the Carbon Trust, which resulted in the development of a Carbon Reduction Strategic Implementation Plan (SIP). The SIP included what were thought at the time to be stretching but achievable targets and described a range of energy saving opportunities for implementation or further investigation to make progress towards these. However, in the light of current scientific development and the HEFCE publications introduced above[3,4], it is now clear that the aspirations of the SIP were too modest to achieve the reductions which will be necessary. Hence, the purpose of this document is to build on the foundations of the SIP, guide BSU along a path of energy efficiency and carbon reduction over the next decade and meet the requirements of HEFCE.

1.2 Drivers

As well as BSU's own desire to reduce carbon emissions, there are also several external drivers which function to constrain carbon inefficient development and to reward engagement and penalise disengagement in the transition to a low carbon future. BSU's approach to managing and reducing carbon emissions will integrate these drivers with our own targets and managerial processes. Current drivers can be broadly categorised into legislative, economic and reputational.

1.2.1 Legislative

Legislation aimed specifically at reducing energy consumption and carbon emissions is in its infancy and there are currently (during 2010) only three pieces of legislation which currently impact directly upon BSU's activities. These are the Energy Performance of Buildings Regulations 2007[5], the Carbon Reduction Commitment Energy Efficiency Scheme (CRC)[6] and Part L (conservation of Fuel and Power) of the Building Regulations[7]. However, our legislative obligations, with respect to energy and carbon emissions, are likely to increase over time. It is widely expected that all businesses will have to begin reporting on all greenhouse gases (in terms of a "corporate carbon footprint") by April 2012[8].

The Energy Performance of Buildings Regulations 2007 (EPBR) were developed following the recognition that approximately 50% of EU carbon emissions resulted from the construction and occupation of buildings. The lion's share of these emissions result from the heating, cooling and lighting of these buildings over their life span. Hence, the principle aim of this legislation is to encourage and promote energy efficiency within the built environment.

There are three key outcomes of this legislation to which BSU are directly subject. These are:

The Carbon Reduction Commitment Energy Efficiency Scheme (CRC)

- The requirement for organisations with half hourly metered electricity below the 6,000 MWh threshold, such as BSU, to make an annual disclosure of energy consumption and carbon emissions to the Environment Agency. This requirement has already been undertaken and BSU is now fully compliant.

Energy Performance of Buildings Regulations (EPBR)

- The requirement for all buildings which are newly built, rented or undergo a major refurbishment to have an Energy Performance Certificate (EPC), together with a current recommendations report for energy efficiency improvements. – We are currently fully compliant with this legislation.
- The requirement for all air conditioning systems over 12 kW to have a certificate of inspection for energy efficiency, carried out by an accredited inspector, together with a recommendations report for improvement. – This will be undertaken in house following the completion of the necessary training and accreditation.
- The requirement for all buildings over 1000 m^2 to display a Display Energy Certificate (DEC) and to possess a current advisory report for further energy efficiency recommendations. – We are currently fully compliant with this legislation and intend to carry out future DEC assessments, in-house.

The building regulations Part L

- All new build and major refurbishment built after the 2010 Part L revision (expected Oct), will have to demonstrate a 25% improvement against previous 2006 levels in order to gain Building Regs approval. Similar step change improvements are planned for 2013 and 2016.

- The requirement for Zero operational carbon emissions will come into force for all residential new build by 2016 and 2019 for all non-domestic buildings. This is likely to be bought forward to 2018 for all public sector buildings, including universities.

1.2.2 Economic

Economic drivers fall broadly into the two categories of expenditure and income, based on where their impact lies.

Expenditure

Expenditure based drivers relate to the management and reduction of energy costs to reduce current expenditure and to protect against future energy price increases. Several factors are likely to combine over the coming years, to significantly increase both the cost and volatility of energy cost. Amongst these are:

- Rapidly dwindling economically recoverable fossil fuel resources
- Increasing demand as the global economy expands
- Increased speculation in investment markets as dwindling reserves increase the value of fossil fuels
- Large scale investment required to de-carbonise national energy supply (expansion of renewables and nuclear, implementation of carbon capture and storage (CCS) and redevelopment of the national grid to cope with the fluctuating nature of renewable energy and decentralised generation)

Investing in energy efficiency to reduce immediate costs and to minimise exposure to future energy price increases makes sound business sense.

Income

Failure to act appropriately to reduce consumption will also have a serious impact upon income for BSU. In the latest development of the Capital Investment Framework (CIF)[9] HEFCE have announced that, from 2011, 40% of capital investment allocation to HE institutions will be dependent upon the production of a carbon management plan and demonstration of progress towards published targets for carbon reduction. Details of exactly how this will function are in consultation.

All public sector and HE institutions are likely to be facing severe cuts in funding over the next few years. However, in the HE sector, the level of investment which will be required to meet the stretching carbon reduction targets set by HEFCE and DECC is clearly recognised. Funding is available in the form of interest free loans and grants from both HEFCE and the Carbon Trust, via Salix finance. BSU have currently secured £268,000 for five energy conservation projects to be completed during 2010 (Appendix 2).

Other funding sources are also available, particularly for renewable energy installations and the installation of innovative technologies.

1.2.3 Reputational – BSU strategy, status and public image

Environmental sustainability is a key part of BSU's strategy and action to reduce carbon emissions is a central theme. This is demonstrated by BSU's recently updated Environmental Policy[10], which has the backing of the Vice-Chancellor and which states that we will:

"commit to reducing our carbon emissions through our carbon management plan which includes a range of projects and initiatives ensuring we meet and exceed statutory sector targets"

Environmental sustainability is also increasingly seen as a key choice factor for many students when applying to universities. University's efforts to increase sustainability are now published in the Green League[7] which ranks institutions on the basis of a range of sustainability criteria. Awards and accolades such as the Green Gown Awards[11] also enable HE institutions to capitalise upon their achievements in the public domain.

2 Scope, objectives and targets

2.1 Scope

This Carbon Reduction Management Plan (CRMP) covers Scope 1 & 2 emissions as defined by the World Resources Institute (WRI)[4,12], for all University owned buildings, grounds and vehicles. For BSU, this means all natural gas, electricity and vehicle fuel consumption. The geographical breadth of this differs from the Ecocampus scope, in that it must include the entire University estate.

Comprehensive data relating to Scope 3 emissions (waste, water, products, services, non-business transport etc.[4,12]) will be collected to develop a future reduction strategy to cover these aspects. This is not currently a compulsory component of the CRMP and so, will be managed as part of BSU's Ecocampus Environmental Management System.

2.2 Objectives

The twin objectives of this CRMP are to:

- Map out BSU's approach over the period 2010 – 2020, towards an ultimate position of sustainable resource consumption and;
- Comply with HEFCE's carbon reduction requirements under the second Capital Investment Framework (CIF)[4,9].

2.3 Baselines and Targets

2.3.1 Baseline

The baseline year, against which HE institutions are to measure progress is the 2005/6 academic accounting year. This is to synchronise with the Estate Management Statistics (EMS) submissions and may be calculated from this source.

Table 2.1 BSU CO_2 emissions 2005/6 to 2008/9 (tonnes) calculated from EMS returns.

Emissions: tonnes CO_2	**2005/06**	**2006/07**	**2007/08**	**2008/09**
Gas	1,810	1,873	1,687	1,778
Electricity	2,168	2,301	2,197	2,297
Vehicle fuel	25	25**	25**	23
Total	**4,003**	**4,199**	**3,909**	**4,098**

** currently estimated

2.3.2 Target

The sector level target is to reduce emissions by 34%, against a 1990 baseline. This is in line with the UK Government targets, as described in the current Climate Change Act. This translates to a

48% reduction against a 2005 baseline. If the sector as a whole is to achieve such reductions, each institution will have to at least match it, on aggregate.

While it is up to individual HE institutions to set their own targets they must adhere to the following criteria[4]:

- Set against a 2005 baseline;
- Be absolute targets, not relative to business metrics such as student numbers etc;
- Include all Scope 1 & 2 emissions as a minimum and;
- Not include carbon offsetting.

Over the coming decade, a great deal of a university's corporate image will be dependent on leading the way forward. Hence, BSU's target should be at least 50%.

In round terms, this means that by 2020, BSU will need to carry out its business, at all its sites, using energy which emits a maximum of 2,000 tonnes of CO_2 per year.

BSU target for Scope 1 & 2 emissions:- 2000 tonnes by 2020

Is 2,000 tonnes achievable?

The BSU estate is typically complex for HE institutions, with a variety of buildings of different ages and uses, across several sites. Due to the variable nature of each site, different approaches may be required at different locations. These will include improvements to building fabric, such as insulation, air tightness and double glazing, improvements to heating provision and controls, the introduction of renewable energy technologies and changes to behaviour, working practice and attitude towards energy efficiency.

Due to its size and complexity, the Newton Park Campus offers both the largest opportunities for carbon reduction and the widest variety of possible solutions. These may include on site generation of electricity using micro CHP (combined heat and power) and a distributed heat network, on site renewables, such as biomass heat production or solar PV, upgrades to building fabric, services and controls or replacement of existing buildings with new, more efficient buildings, fit for the future. In all probability, a successful approach will include a combination of these.

Plans for a large scale redevelopment of the Newton Park Campus have been unveiled and, it is hoped, are likely to proceed in a form broadly as planned. It would be nonsensical to prepare a strategic plan or to evaluate the potential for reductions without taking this into account and making it an integral part of the plan.

Calculating energy consumption changes from large scale infrastructural changes, such a distributed heating, micro-generation or off site renewables are technically beyond the scope of this document. However, energy and carbon savings can be reasonably estimated for potential significant interventions to individual buildings and for the larger scale redevelopments planned for the Newton Park Campus, using available research and known legislative requirements.

A résumé of such interventions and major developments, with estimates of potential energy and carbon savings are presented in Table 2.2. While not exhaustive, it does suggests that a reduction of 2,000 tonnes of CO_2 might be possible but would require large scale investment and wholesale commitment to the task.

As the Masterplan and wider energy strategy become more fully developed, their implications will be incorporated into the CRMP.

Table 2.2. Potential interventions, estimated energy and carbon savings

Intervention	Electricity reduction	Gas reduction	CO_2 reduction	Current status
	(kWh)	(kWh)	(t)	
Voltage optimisation at NP & SH	350,000	0	189	Completion Sept 2010
Upgrade BEMS and heating controls, Newton Park	0	400,000	80	Completion July 2010
SH heating upgrade, window replacement and cavity wall insulation	0	350,000	70	Summer 2010 & 2011
Renovate Compton and Ashton	44,000	375,000	99	Scoping study 2010
Replace Twiverton chillers with evaporative cooling	200,000	0	108	Not fully scoped
Demolish Newton, Stanton & Doynton	120,000	330,000	131	Planned
Renovate Corston, Twinhoe & Wellow, inc renewable energy provision	70,000	314,000	101	Possibility 2012 -2015
Upgrade heating and lighting, Hiscocks and Harrington	125,000	200,000	108	Possible 2010 - 2012
Demolish Hugerford & Nevill	140,000	490,000	174	2012
Demolish Pope, Langton Temple etc.	185,000	720,000	244	?
Biomass heating, revolving front door and secondary glazing for MH	45,000	300,000	84	Not yet scoped
Biomass heating, draught exclusion, loft insulation and lighting upgrade for CC	25,000	820,000	178	Not yet scoped
Refurbish Library & computer rooms for energy efficiency	70,000	225,000	83	Not yet scoped
Insulate, secondary glazing and upgrade heating system and lighting to Stable, Sofia & Dairy	50,000	75,000	42	Not yet scoped
Upgrade heating, lighting and building fabric, Student's Union	10,000	350,000	75	Not yet scoped
Heat pumps for Castle	20,000	0	11	Not yet scoped
Behaviour change	200,000	250,000	158	Ongoing
New Student accommodation - Zero Carbon build	-250,000	0	-135	Early planning stage
New Teaching space	-200,000*	0	-108	In design
Decarbonisation of electricity supply (reasonable estimation of 0.38 kg CO_2 kWh^{-1} by 2020[15])			289	Ongoing - Govmt dependent

TOTAL	**1,204,000**	**5,070,000**	**1,981**	

Based on EPC A rating 9.18 kg $CO_2/m^2/y$ + 40% unregulated emissions

3 Strategic approach

Carbon management and reduction at BSU will be considered in three basic components (below) and will be driven by the Carbon Reduction Policy (Section 3.1)

1. Management (Section 3.2):
   A systematic, policy driven management approach, including governance structure, roles and responsibilities, reporting and communication mechanisms and an agreed review and improvement process

2. Operational / technological (Section 3.3):
   A process of identification and technical evaluation of potential capital interventions, including cost benefit and lifecycle carbon analyses, together with identification of potential funding streams

3. Behavioural / cultural (Section 3.4):
   A culture change programme, which seeks to raise the level of energy conservation, such that it becomes a priority consideration in all decision making processes, university procedures and policy decisions

3.1 Carbon Reduction Policy

Bath Spa University recognises that the energy, products and services it consumes cause the emission of greenhouse gases to the atmosphere, which contribute to climate change. As part of our overall goal of sustainable development, we are committed to continual improvement in the management and reduction of energy consumption and carbon emissions.

To this end we will:

- Develop a systematic, auditable energy management system
- Ensure continual compliance with energy related legislation, HEFCE requirements and corporate commitments
- Develop a sustainable energy strategy
- Ensure any new development contributes to the sustainable energy strategy
- Implement a programme of improvements to building fabric, services and controls to maximise energy efficiency
- Regularly monitor and review energy consumption against our reduction targets
- Ensure the necessary resources are made available to achieve these goals, cost effectively
- Manage emissions from waste, water, transport products and services, via our Ecocampus, Environmental Management System
- Develop behaviour change programmes to promote an energy aware culture, via our Ecocampus Environmental Management System
- Communicate progress to internal and external stakeholders

This policy will be reviewed annually to ensure it continues to reflect Bath Spa University's commitment to reducing carbon emissions.

3.2 Management

Overall responsibility for continual improvement in the management and reduction of energy consumption and carbon emissions lies with the Board of Governors, the Vice-Chancellor, managers and staff of Bath Spa University.

3.2.1 Process

The carbon reduction management process should remain simple, flexible and un-bureaucratic and will function within the existing management structure. Decisions made and processes followed will be robust, externally auditable and in keeping with BSU's financial protocols.

- Energy reduction activities are driven by the Energy Policy (Section 3.1), which has been sanctioned and supported by the Vice-Chancellor and the Governing Board.

- Energy reduction capital projects are identified, planned and assessed by the Carbon Reduction Manager, who is also responsible for business case development and submission to the Director of Estates.

- Proposed energy saving projects are included in the annual capital investment funding review and those projects for which funding is agreed are carried out within the following year, or as planned.

- Reductions in energy consumption resulting from energy efficiency projects are monitored, calculated and reported annually to the Vice-Chancellor. (Appendix **)

- BSU Estate-wide energy consumption and carbon emissions from scope 1, 2 and 3 activities will be monitored and recorded using Loreus Carbon Manager software and reported to external bodies as required. (Appendix 7)

- Energy consumption in individual buildings will be automatically monitored, via the BEMS. These data will be collated and used to identify future energy saving opportunities and to assess the effectiveness of implemented projects.

3.2.2 Ownership

Ownership of the Carbon Reduction Management Plan will lie with the Estates Department. The project management team will comprise a core of Estates Team members, working in close collaboration with the Environment Team and will draw from a pool of key individuals to direct or assist in particular areas of specialism, such as IT, student housing, academic space planning, H&S, marketing etc.

3.2.3 Responsibility

The responsibility for continual improvement in the management and reduction of energy consumption and carbon emissions lies with the Board of Governors, the Vice-Chancellor, managers and staff of Bath Spa University.

- The Vice-Chancellor has the responsibility for keeping the Board of Governors advised of energy consumption and carbon emission issues (for example, the publication of relevant advice or reports). To help discharge this responsibility the Deputy Vice-Chancellor (Finance and Resources), and Director of Estates will be responsible for providing advice and relevant reports to the Vice-Chancellor.

- The Director of Estates has line management responsibility for formulating appropriate action plans to meet the University's energy consumption and carbon emission objectives which will be resourced through the annual budget approved by the Board of Governors. This officer will be assisted as appropriate by the Carbon Reduction and Energy Manager.

- The Carbon Reduction and Energy Manager will be responsible for liaising as appropriate with the Environment Steering group, with managers and staff responsible for the University's waste and recycling environment objectives, and for ensuring close working relationships with the University's energy and environment champions.

- All members of the Senior Management team are responsible for ensuring that the Objectives and Action plans applicable to their areas of responsibility are followed appropriately.

- Managers have responsibility for maintaining an awareness of good practices in their own area of operation and for ensuring that these are followed appropriately. Managers will be assisted in this by staff reporting to them who are designated Energy Champions.

- All staff should endeavour to support the University's objectives of continual improvement in the management and reduction of energy consumption and carbon emissions.

3.3 Operational / technological interventions

Technological interventions are addressed in three categories, each of which will require a particular approach towards identification and evaluation of energy efficiency opportunities.

1. Campus wide infrastructure, developmental or new build interventions particularly relating to the Newton Park development. This would include integrated energy solutions, such as CHP with distributed heat and renewable energy solutions.

2. Building fabric and service upgrades, such as improvements to insulation and glazing or re-designing heating, cooling and lighting systems and controls.

3. Management of building conditioning, and monitoring of energy consumption, via the Building Energy Management System (BEMS).

3.3.1 Campus wide infrastructure, new build and renewable energy

The Newton Park Development Masterplan, which is currently being developed, has energy efficiency and wider sustainability at its heart. The CRMP is a working document, which will guide development of the Newton Park site to achieve its aims. All new development will be designed to fit within the Masterplan and to contribute towards the targets of the CRMP.

A site wide energy strategy, to assess options for the efficient generation and delivery of energy from centralised energy centres and distribution networks is being developed. Once finalised, it will be integrated into the CRMP.

Construction of all new academic and residential buildings and all major refurbishments will be subject to the increasingly stringent requirements of the EPBRs[5] and Part L[7] of the building regulations. In addition to this, all new developments will be constructed to BREEAM[13] excellent standard. These standards will ensure that the buildings are designed and constructed to be energy efficient.

Renewable energy generation, such as solar thermal and solar PV, will be assessed as part of each development and as separate projects in retro-fit installations. Sensitivities surrounding the visual impact of such installations, given the historic nature of the site and stakeholders involved, will require careful consideration, on a project by project basis.

3.3.2 Building fabric and service upgrades

Information relating to building fabric, such as construction type, U-values etc., necessary for modelling the thermal efficiency of buildings, will be collected as part of a condition survey.

Opportunities for the improvement to thermal elements of buildings, such as insulation, air tightness and glazing, are assessed on a building by building basis, as are the provision and control of heating, cooling and lighting within buildings. Responsibility for this work lies with the Carbon Reduction Manager and Estates team colleagues, with external specialist input where appropriate.

Once identified, potential opportunities are recorded on the opportunities register (Appendix 2) and are assessed and progressed, following the flow chart given in Appendix 3.

3.3.3 Management of building conditioning and energy monitoring

An upgrade of the Newton Park BEMS to current industry standard, including automated gas, electricity and water metering on all buildings, where appropriate, will be complete for the 2010/11 academic year.

During this process, a complete review of heating control for each building will be undertaken to ensure that the most economical fit with occupancy patterns is maintained and that fully functional weather compensation is operational on all systems, where appropriate. Buildings which are not currently controlled by the BEMS, will be connected, where economically feasible.

Currently, none of BSU's air conditioning/comfort cooling systems are controlled by the BEMS, other than that of the MTC performance space. Consequently, these systems commonly function antagonistically to the heating system, using energy to cool previously heated spaces. Where economically feasible, it is the intention that cooling system controls will also be linked to the BEMS. Where cost & carbon / benefit analysis is unfavourable, alternative solutions to this problem will be assessed in the manner described in Appendix 3.

3.3.4 Current Projects

A preliminary assessment of buildings and power distribution on the Newton Park campus was undertaken during 2009, to identify high priority opportunities. Five priority projects were identified, recorded on the 2010 opportunities register (Appendix 1) and assessed according to the protocol given in Appendix 3. These were:

- Lagging of boiler room valves and flanges in NP boiler rooms
- Upgrade of BEMS at NP (including automated monitoring)
- Voltage Optimisation of the three transformers at NP
- Upgrade of heating and domestic hot water supply at Sion Hill
- Voltage optimisation at the Sion Hill transformer

Funding was successfully acquired, via Salix Finance, in the form of interest-free loans and the projects are in various stages of preparation and implementation. The first project, to insulate all flanges and valves in the main boiler rooms on Newton Park Campus, was completed in January. Each of the projects and their estimated carbon savings were independently audited by Atkins International to ensure that the carbon saving forecasts were realistic.

In total, projected carbon savings from these 5 projects are in the region of 450 tonnes of CO_2 per year, which represents approximately 11% of BSU's Scope 1 & 2 emissions and approximately 22% of our target emissions reductions of 2,000 tonnes. Investment will be approximately £300,000 and payback is expected to be less than 5 years in total.

A number of further projects which offer energy savings are being undertaken during the 2010 summer recess. These are part of the normal building maintenance programme but in each case, opportunities to replace existing plant with more efficient alternatives is being taken.

Projects, which are not specifically carbon reduction related, will be assessed on the basis of energy efficiency and fit with the Sustainable Energy Strategy.

3.4 Behaviour and culture change

Behaviour and culture change will be key components of success in achieving carbon reductions at BSU. However, the impact on carbon reductions from changes in behaviour are not simply through direct impacts on Scope 1 and 2 emissions but are commonly linked to overall resource efficiency. Hence, behaviour change strategies and programmes should remain the responsibility of the Environment Team and should be carried out as an integral part of the Ecocampus Environmental System, steered by ESG.

A figure of 10% is commonly used to estimate the potential for energy savings from behaviour change programmes, in office based organisations. However, the energy saving potential of behaviour dependent energy consumption is likely to be considerably greater than this, particularly within the University environment. Traditional behaviour change programmes alone are unlikely to fully realise this potential, as people's behaviour is often fickle and changes constantly need reinforcing. Hence, BSU will need to develop a more structured approach.

While many staff within BSU could be considered to function in an office environment, the picture over the organisation as a whole is far more complex. Academic staff often occupy office space for only a fraction of the working day, utilising teaching or performance space for the majority of time. Students, who may be far more difficult to influence with regard to behaviour change, account for the majority of individuals within BSU, many of whom are also resident within BSU owned accommodation. Added to this is the fact that student cohorts come and go every year and so require continual effort to maintain awareness and appropriate standards of behaviour.

Quite different strategies will be required to influence the behaviour of these groups. However, the most effective way to reduce behaviourally dependent energy consumption is to eliminate the behavioural element as far as possible. Hence, the initial approach should be to engineer out the reliance on individual's behaviour, where ever practicable.

3.4.1 Staff

Methods of achieving staff behaviour change in organisations have traditionally involved Energy or Environmental Champions to raise awareness and influence their colleagues, through awareness raising, incentive schemes and peer pressure. This approach has been effective but unfortunately, often fails to embed changes over the longer term. Hence, the Environment/Energy Champions approach is unlikely to achieve the full potential of energy savings available, unless it is backed up by full management support and carried out within a structured management framework, again, driven by the Energy/Environmental Policy.

Ideally, energy (and resource) efficiency within teams and departments would become a line management responsibility and would be included as a fixed agenda item in team and departmental meetings. Issues such as ensuring that:

- All electrical equipment is switched off at the end of the working day or when not in use for any period of time, such as while the user is in meetings, at lunch or conducting lectures.
- Screen savers are not used
- Printing is minimised to essential documents only
- Windows are not used as a heating control, instead of thermostatic devices
- Lighting is not left on unnecessarily

Targets should be set and metrics/monitoring strategies agreed to measure and demonstrate efficiencies.

3.4.2 Students

The profile of environmental sustainability and energy efficiency should be raised, such that it becomes a central theme for students joining BSU. Students should be engaged in the process at the outset and encouraged to participate, throughout their stay at BSU. This would be challenging and would require expert assistance and constant development. However, the message that we take our environmental responsibility seriously will be an ever stronger marketing point for BSU in the future and should be taken full advantage of.

The behaviour of students within their individual living space is likely to have a significant impact on energy consumption within residences but is probably the most difficult aspect to manage. As an example, a student who leaves their room with a games station and TV on while attending lectures or at the SU, might waste in the region of 3 - 6 kWh a day, depending on type of equipment and duration etc. If just 10% of the proposed accommodated students did this routinely, it might waste between 30,000 and 60,000 kWh per year, equivalent to 16 – 32 tonnes of CO_2 y^{-1}. A small component of the overall target perhaps but behaviour change is all about the accumulation of individually small changes.

New student accommodation will, simply by meeting statutory requirements, have engineered out some of the behavioural elements of energy efficiency, such as smart lighting controls. However, other than these engineered solutions and the behavioural coercion discussed previously, the most effective way to influence energy related behaviour is to make residential students responsible for their own consumption. Separate smart meters are now very cheap, simple to fit, reliable and give an easily understandable consumer display of consumption. Fitting of such meters to the new residential accommodation would give BSU the ability to make students financially responsible for the cost of their own electricity and would make students aware of the consequences of their behaviour. This would also enable students to gain, directly from their efforts to use energy wisely.

4 2010/11 Programme of actions

A résumé of proposed significant actions to take place between Jan 2010 and the end of the 2011 academic year is given in Appendix 1.

Actions are categorised into:

- Strategic development
- Technological interventions and;
- Legislative & obligatory requirements

Behaviour change programmes and actions are excluded, as these are to be progressed by the Environment Team, via Ecocampus, as described.

4.1 Strategic development

The development of an auditable management system will continue throughout the 2010/11 period. The decision whether to fully integrate this into the Ecocampus programme or to run it as a separate process can be reviewed periodically, as part of the management review process.

A monitoring and reporting framework will be developed in draft form, for the January 2011 mid – term management review. Once agreed, annual progress report will be prepared for the July 2011 Annual Management Review.

Following completion of the Newton Park Energy Strategy feasibility study, currently being undertaken as part of the Masterplan development, its findings and recommendations will be incorporated into the CRMP. This will form the Newton Park Sustainable Energy strategy, which will continually develop and will inform the planning of a “road map” to 2020. This should be completed in draft form for the July 2011 Annual Management Review.

4.2 Technological interventions

The first project recorded on the 2010 opportunities register (NP-01-2010, boiler flange insulation, Appendix 2.) has been completed. Upgrading of the Allen Martin BEMS system is expected to be completed by the end of August 2010. Upgrading of the Sion Hill heating system is planned for completion and handover by 16th September. The Voltage optimisation work is now planned to be undertaken during November.

Once automated metering is in place for the major buildings on the NP campus (part of BEMS upgrade) and a condition survey has provided essential building fabric data, detailed energy auditing and modelling can be undertaken. This will enable informed decision making and targeting of resources in the planning of interventions and projects.

Automated monitoring will also improve the ability to forecast and measure energy savings from individual projects. The energy auditing and intervention identification/analysis phases are essentially ongoing processes, which continually seek to improve our knowledge and understanding of energy consumption and possible remedies.

A number of energy saving projects are currently being scoped and evaluated for completion by April 2011.

Identification and initial business case development of proposed projects for the 2011/12 academic year will take place during winter of 2010/11. These will form part of the annual capital investment submission and, once agreed, successful projects will be further developed and prepared for implementation during the summer of 2011.

7.3 Legislative & obligatory requirements

Energy related legal compliance is the responsibility of Carbon Reduction and Energy Manager.

- Carbon Reduction Commitment Energy Efficiency Scheme (CRC) registration has been completed and BSU is now fully compliant.
- Air conditioning surveys will be carried out during the autumn, for completion in January.
- Renewal of Display Energy Certificates will be completed by October 29th.
- Capital Investment Framework (CIF) II returns must be submitted to HEFCE by Oct 30th.
- Estate Management Statistics are due for submission in January 2011

Appendix 1. Timetable of significant elements Jan 2010 – Jul 2011

	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11
Strategic development																			
Develop CRMP																			
Develop an auditable Energy Management System																			
Develop and agree monitoring and reporting strategy																			
Develop draft Sustainable Energy Strategy																			
Management review																			
Technological interventions																			
Install insulation jackets in NP boiler rooms																			
Upgrade BEMS and metering NP				Evaluation & Prep															
Upgrade Sion Hill main heating system				Evaluation & Prep															
Voltage optimisation at NP & SH					Evaluation & Prep														
Detailed building energy surveys (inc condition survey)																			
Spring 2011 Projects									Evaluation & Prep										
Intervention identification and analysis																			
Prepare plan for 2011/12 interventions																			
Agree 2011/12 projects																			
Prepare 2011/12 projects																			
Legislative & obligatory requirements																			
CRC registration & Info Disclosure																			
Display Energy Certificates																			
Air Conditioning certifications																			
HEFCE CIF 2 submission								Prep											
HEFCE EMS returns											Prep								

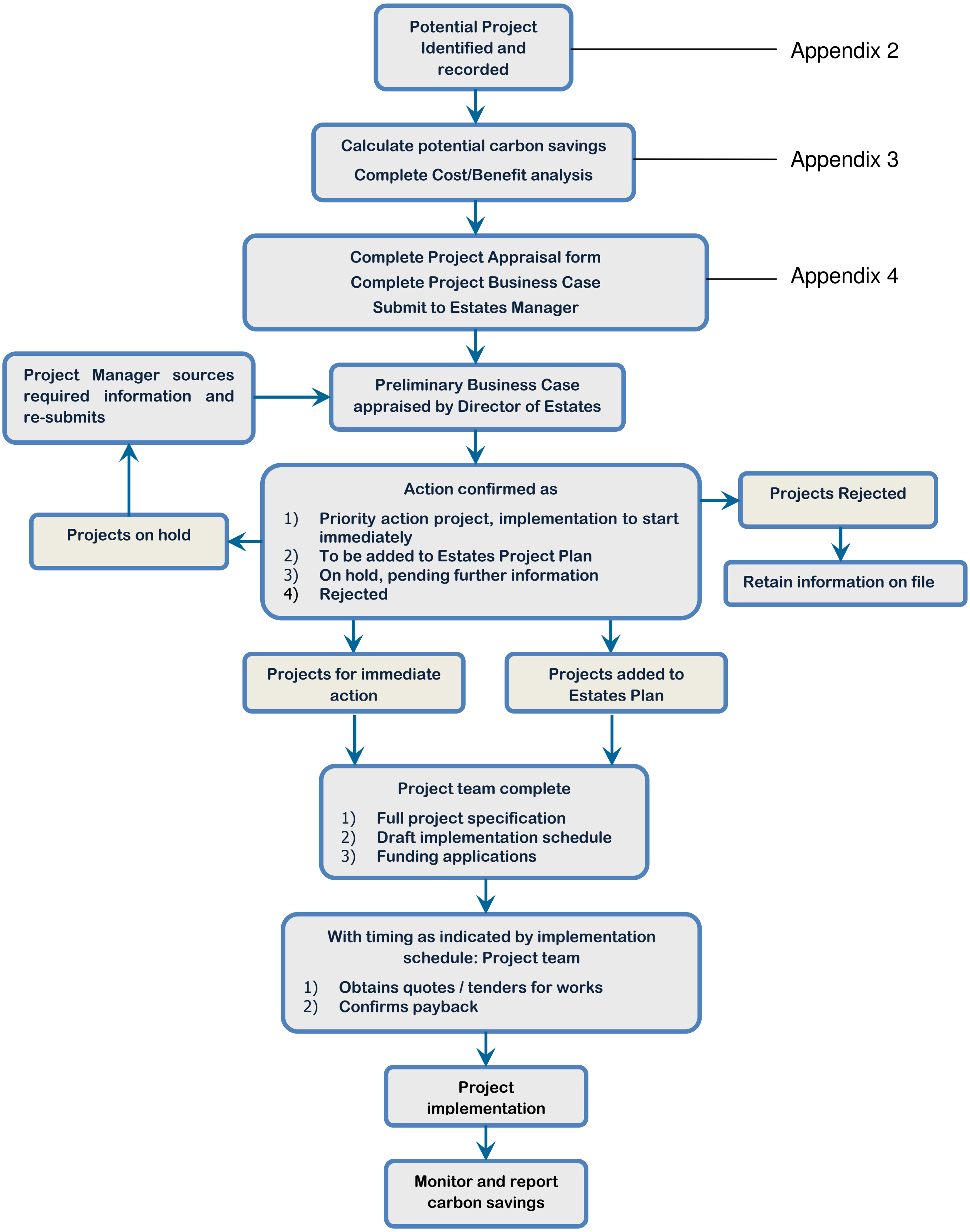
Appendix 2. Opportunities register, including the five main funded projects identified in section 3.3.4

Bath Spa University

Energy Mangement - Opportunities Register 2010

Opportunity						Summary of Indicated cost/benefits				Implementation Date		Completion Date		Status
PBC Ref	Building/ Function	Title	Priority score	Appraisal / Prioritisation reference	Cost Benifit Analysis	Capital investment	Cost Savings	Carbon saving	Energy saving	Planned	Actual	Planned	Actual	
						Totals: £	£/year	Tonnes CO_2/year	kWh/year					
						267,687	61,779	450	1,652,388					
NP-01-2010	NP	Insulation of boiler room flanges & valves	1000	PN-NP-01-2010	CBA-NP-01-2010	£17,115	£4,856	40	210,223	05/01/2010	05/01/2010	08/01/2010	05/01/2010	Completed
NP-02-2010	NP	Upgrade of BEMS (inc automated metering)	920	PN-NP-02-2010	CBA-NP-02-2010	£40,131	£12,705	105	550,000	April 2010		July 2010		Planning Phase
NP-03-2010	NP	Voltage optimisation on three NP transformers	843	PN-NP-03-2010	CBA-NP-03-2010	£110,916	£23,504	152	282,165	Aug 2010		Sept 2010		Planning Phase
SH-01-2010	SH	Upgrade Main Heating system	840	PN-SH-01-2010	CBA-SH-01-2010	£51,066	£11,550	95	500,000	Aug 2010		Sept 2010		Planning Phase
SH-02-2010	SH	Voltage optimisation Sion Hill	861	PN-SH-02-2010	CBA-SH-02-2010	£48,460	£9,163	59	110,000	Aug 2010		Sept 2010		Planning Phase

Appendix 3. Guidance flowchart for the assessment and implementation of carbon reduction projects



Appendix 4. Example cost benefit analysis sheet for boiler room flange insulation, including projected carbon savings and cost per tonne CO_2.

Building	NP boiler rooms			
Opportunity Title	Insulate flanges and valves in boiler rooms			
Opportunity Ref	NP-01-2010			
Costs				
Supply and install insulation jackets	17,115			
Total cost	**£17,115**			
Benefits				
reduction in elec			kWh	
reduction in gas		210,223	kWh	
Total saving		**210,223**	**kWh/y**	
		£4,856		
		39.94	**tonnes CO_2**	
Payback		**3.52**	**years**	
Cost/tonne over payback period CO_2		**£34.50**		

Appendix 5 Example project appraisal form for boiler room flange insulation.

Project Title	Insulate flanges in boiler rooms					
Date of Appraisal	18/12/2009					
Project Reference	NP-01-2010					
Cost/Benefit Calculatio	CB-NP-01-2010					
		Project Aspect	**Response**	**Score**		
1.0	**Financial**		**Section Weighting**	**10**		Error log
		Estimated savings indicated	**£4,856**			
		Estimated Cost	**£17,115**			
		Have all costs for Installation been included	All costs included based on budget quotes	50		0
		Have all costs for connection of services been included	All costs included based on budget quotes	50		0
		Have all costs for project management and training been included	All costs included based on budget quotes	50		0
		Is cost included in capital spend budget	Included in budget for year of anticipated spenc	50		0
		Have all costs for Professional Fees been included	All costs included based on budget quotes	50		0
		Has VAT been included where applicable	All costs included based on budget quotes	50		0
		Payback period	3.52	300		0
						0
2.0	**Technology Proposed**		**Section Weighting**	**5**		
	1.1	Type of technology proposed in project	proven technology already used in BSU	75		0
						0
3.0	**Installation**		**Section Weighting**	**3**		
	2.1	Is there physical space already	Yes	15		0
	2.2	Is creating space part of project cost	Yes	15		0
	2.3	Does installation require builders work	No	15		0
	2.4	Does installation require shutdown of existing services	No shutdown	15		0
	2.5	Is any below ground works required	No ground works required	15		0
	2.6	Can installation be contained within existing plants rooms	Yes	15		0
						6
4.0	**Connection to existing services**		**Section Weighting**	**3**		
	3.1	Do electrical supplies need changing	No - electrical works required	15		0
	3.2	Do gas supplies need changing	No - gas supply works required	15		0
	3.3	Do water supplies need changing	No - water supply works required	15		0
	3.4	Do drainage systems need changing	No - drainage system works required	15		0
	3.5	Is connection to site BMS required	No - BMS works required	15		0
	3.6	Is connection to local piped service required	No - supply works required	15		0
						0
5.0	**Maintenance**		**Section Weighting**	**3**		
	4.1	Does installation require routine intrusive maintenance	No	15		0
	4.2	Will new external service contract be required	No	15		0
						0
6.0	**Training**		**Section Weighting**	**3**		
	5.1	Do site staff require training to support new installation	No	15		0
7.0	**Project Management**		**Section Weighting**	**4**		
	6.1	Is project likely to fall within CDM Regulations	No	20		0
	6.2	Is project likely to fall create hazardous waste	No	20		0
	6.3	Is project in area were asbestos may be present	No	20		0
	6.4	Will project cause disruption to site traffic / pedestrian routes	No	20		0
	6.5	Is planning / listed building / Duchy of Cornwall consent required	No	20		0
						0
	Summary					
	1.0	**Financial**	**600**	**of 600**	**Pass**	**600**
	2.0	**Technology Proposed**	**75**	**of 75**	**Pass**	**75**
	3.0	**Installation**	**90**	**of 90**	**Pass**	**90**
	4.0	**Connection to existing services**	**90**	**of 90**	**Pass**	**90**
	5.0	**Maintenance**	**30**	**of 30**	**Pass**	**30**
	6.0	**Training**	**15**	**of 15**	**Pass**	**15**
	7.0	**Project Management**	**100**	**of 100**	**Pass**	**100**
		Overall Project	**1000**	**of 1000**		

Appendix 6. Project business case.

Bath Spa University

Carbon Management Projects

Project Business Case

Project Reference	NP-01-2010
Project Title	Insulation of boiler room flanges
Date	18/12/09

Anticipated Costs and Benefits

Installation Costs (sum elemental costs to give total)	Equipment Supply and Installation	17,115
	Preparatory works	Nil
	BSU staff training	Nil
	External consultants fees	Nil
	Total installation cost	17,115
Financial savings (annual)		£4,856 pa
Energy Savings		210,223 kWh/yr
Emissions reduction		40 Tonnes CO_2/yr
Cost per tonne CO_2 – over payback period		£34.50
Payback period		3.52 years

Project Outline

Description of Proposal:

Install lagging jackets to flanges and valves in all large boiler rooms on NP campus.

Project to be funded by an interest free loan from Salix Finance, repayable in 8 equal, six monthly instalments, beginning March 2011.

Project Ownership and Management

BSU Project Owner (responsible for project delivery and control)	Julian Greaves	
BSU Project Sponsor (responsible for project approval)	Carolyn Puddicombe	
Milestone Dates	Detailed specification	Nov 2009
	Tender return	Nov 2009
	Project start	05/01/2010
	Project completion	08/01/2010
Principle Risks (Technical, financial, programme)	Ensuring repayment management is in place	
Performance measurement (how will success be measured)	Reduced gas consumption	

Appendix 7 Monitoring and Communication Strategy requirements

Currently, the majority of the buildings on the NP campus and most of the satellites have electricity and gas meters of some description. All meters are read monthly and manual recordings are entered onto an electronic database (Dynamat). These data have been used historically only for bill checking at the campus level and, more recently, to separate residential and non-residential gas consumption in order to take advantage of the lower 5% VAT rate on domestic use. Main incoming supplies of gas and electricity on the NP estate, together with the three transformers, Sydney and Nevill buildings are currently metered automatically but are also read manually each month. Manual meter reading and data entry, currently require approximately 3 - 4 man days per month.

A monitoring strategy will require measurement and data collection to fulfil four basic requirements:

1. Regulatory and obligatory, such as CRC, HEFCE returns (Estate Management Statistics and forthcoming CIF2) and Display Energy Certificates (DECs)
2. Internal BSU energy management, including financial probity (bill checking)
3. Internal reporting to BSU management and wider stakeholders
4. Published data to external stakeholders for PR and marketing purposes (e.g. Green Gown Awards etc.)

These requirements are not necessarily mutually exclusive and data collection should be designed to fulfil as many requirements as possible at once and avoid double handling of data. The Loreus Carbon Manager software is currently being investigated to facilitate this.

Regulatory

- CRC:
  - Electricity consumption at BSU is below the threshold for full participation in the CRC at this time. However, we are obliged to make an annual information disclosure to the Environment Agency. This is a simple on-line process, of largely administrative information and total electricity consumption consumed through half hourly meters, during the 2008 qualifying period.
  - It is expected that, once the scheme is embedded, the threshold will be reduced, at which time, BSU may need to participate fully. Hence, it would be prudent to ensure mechanisms to collect the relevant data are in place beforehand.
- HEFCE:
  - Currently, energy data collection for HEFCE comprises total energy consumption and CO_2 emissions, for scopes 1 & 2, using standard conversion factors, for the BSU Estate as a whole. Collection and submission of energy and carbon data is the responsibility of the Estates department.
  - Energy and carbon related data submission to HEFCE is currently under review and there will be a future requirement to disclose further data pertaining to the CMP and progress towards targets.
- DECs:
  - Currently, all buildings with a total useful floor area (TUFA) of >1000 m^2 must have a valid DEC and recommendations report. DECs must be renewed annually.
  - It is expected that the threshold of 1000 m^2 will be reduced to 250 m^2 later this year (2010)[14]

Internal energy management

Effective energy management of building services requires high resolution, well defined data at a minimum of building level. During the 2010/11 academic year, it is intended that all major buildings will have automated meter reading, providing half hourly data for gas and electricity, at the building level. These will be linked to the upgraded BEMS and data collection and analysis will then become largely automated, as will data returns for all regulatory and obligatory requirements.

It is now a requirement of the building regulations Part L that all new and substantially refurbished non-domestic buildings must be able to monitor **at least 90% of energy consumption by end use**. That is to say, electricity for lighting circuits, cooling, air handling, central heating distribution and consumer socket circuits must be separately metered, as must gas consumption to boilers, calorifiers, space heaters etc.

This level of monitoring makes it possible to produce far more accurate cost savings forecasts for assessing interventions and enables more accurate assessments of real savings. High resolution monitoring is also key to early fault identification in building plant. All new builds and major refurbishments in the BSU estate will incorporate metering at this level.

Internal reporting

The requirements for internal reporting to the Carbon Reduction Programme Steering Group should be agreed in the first Group meeting. This should then form the reporting framework for the subsequent Steering Group meetings and Annual Reviews. Ensuring the provision of the correct information to the Steering Group, would be the responsibility of the Programme Manager.

Reporting should include:

- Total BSU energy consumption and Scope 1 & 2 CO_2 emissions, against targets and milestones
- Site breakdown
- Agreed Scope 3 data
- Programme and project implementation; progress against agreed milestones
- Measured energy reductions from interventions
- Results from internal management system auditing (e.g. energy related agenda items from team / departmental meetings)
- Annual DEC results

Internal reporting criteria and mechanisms for reporting environmental data, including energy, to all BSU stakeholders are currently being developed as part of the Ecocampus Communication Strategy.

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