Annex B

Carbon management strategies and plans: a guide to good practice

Draft guidance by SQW

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Contents

Executive summary

1. In the 2008 Climate Change Act (CCA), the UK Government committed to a long-term carbon reduction target of 80% by 2050 against 1990 levels, with an interim target of a 26% reduction by 2020. The 2009 budget increased this to 34% by 2020. The higher education sector is expected to contribute to meeting these targets.

2. From 2011, capital allocations will be linked to carbon reduction. Higher education institutions in England will be required to develop carbon management plans that include:

- carbon baseline for 2005 which covers at least scope 1 and 2 emissions. These include direct emissions from sources that are owned or controlled by the HEI such as direct fuel and energy use and indirect emissions from purchased electricity
- targets for scope 1 and 2 emissions to 2020 against a 2005 baseline. Institutions may choose to set targets for scope 3 emissions (for example, emissions from water use, waste, business travel and commuting). These targets must be available publicly
- an implementation plan to achieve carbon reductions including timescales and resources
- clear responsibilities for carbon management
- a commitment to monitor progress towards targets regularly and to report publicly annually
- the carbon management plan, including targets, to be signed off by the governing body.

This guidance aims to help institutions to develop a carbon reduction strategy, target and associated carbon management plan. Illustrative examples of current practice from individual Higher Education Institutions (HEIs) have been provided at various points throughout this document, drawing on case study material from background research by SQW Consulting

1: Introduction

1.1 In the 2008 Climate Change Act (CCA), the UK Government committed to a long-term carbon reduction target of 80% by 2050 against 1990 levels, with an interim target of a 26% reduction by 2020. The 2009 budget increased this to 34% by 2020. The Committee on Climate Change (CCC) has recommended that this target be increased to 42% if an international agreement is achieved.[1]

1.2 The Department of Innovation, Universities and Skills' grant letter to the Higher Education Funding Council for England (HEFCE) for 2009-10 requires the higher education (HE) sector in England to implement a carbon reduction target of at least 80% by 2050 against 1990 levels. HEFCE has announced[2] that, from 2011, capital allocations will be linked to carbon reduction. Institutions will be required to develop individual carbon management plans and to report on progress and the results achieved.

1.3 This guidance aims to help institutions to develop a carbon reduction strategy, target and associated carbon management plan. Illustrative examples of current practice from individual Higher Education Institutions (HEIs) have been provided at various points throughout this document, drawing on case study material from background research by SQW Consulting.

Carbon emissions from the HE sector

1.4 The UK carbon emissions baseline for 1990[3] follows the Intergovernmental Panel on Climate Change (IPCC) methodology and definitions, using the broad categories of: *energy; industrial process and product use; land use; and waste*.

1.5 Key sources of carbon emissions from the HE sector are listed in Table 1-1.

1.6 The World Resources Institute (WRI) developed a classification of emission sources into three scopes.[4] This approach has been widely adopted, including by the UK Government. Table 1-2 shows total CO_2 emissions attributable to the HE sector for 1990 and 2006.

[1] The outcome is expected in December 2009.
[2] 'Sustainable Development in Higher Education. 2008 update to strategic statement and action plan (HEFCE 2009/03).' Available at www.hefce.ac.uk under Publications/2009.
[3] As submitted to the United Nations Framework Convention on Climate Change.
[4] Source: The Greenhouse Gas Protocol – A corporate accounting and reporting standard (World Resources Institute 2004).

Table 1-1: Carbon emission sources from the HE sector

Source	Description	
Energy – fossil fuel combustion (gas, coal, oil) and electricity use	Building related: • Non-residential buildings – teaching, research, catering, sports, other • Residential buildings – student and staff accommodation	
	Non-building related: • Campus lighting, sports grounds	
Transport	• Land transport – car, rail, bus, other • Air travel – domestic flights, international flights	• Includes: • Institutions' own vehicle fleet • Business travel – management, research, teaching • Commute – staff and students
Other	Water, waste, procurement (assets, goods and services), land use	

Source: SQW Consulting

Table 1-2: HE sector carbon emissions – scopes 1, 2 and 3 (1990, 2006)

Scope	Description	Examples	HE sector
Scope 1: Direct emissions	Direct emissions occur from sources that are owned or controlled by the HEI	Direct fuel and energy use Transport fuel used in institutions' own vehicle fleets	**1990: total CO_2 equivalent – 1.779 $MtCO_2$** Of which: 1.100 $MtCO_2$ from electricity (62%), 0.451 $MtCO_2$ from gas (26%), 0.171 $MtCO_2$ from burning oil (10%) and 0.039 $MtCO_2$ from coal (2%); and 0.018 $MtCO_2$ from direct transport emissions. **2006: total CO_2 equivalent – 2.079 $MtCO_2$** (*17% increase compared with 1990*)
Scope 2: Electricity indirect emissions	Emissions from the generation of purchased electricity consumed by the HEI	Purchased electricity	

Scope	Description	Examples	HE sector
Scope 3: Other indirect emissions	Scope 3 emissions are a consequence of the activities of the HEI, but occur from sources not owned or controlled by the HEI	Water Waste Land-based business travel Commuting (both to staff and students) Air travel (international students; international student exchange; business	**1990: total CO_2 equivalent – 2.445 $MtCO_2$** **2006: total CO_2 equivalent – 3.2884 $MtCO_2$** (*34% increase compared with 1990*)
		Procurement	Not assessed at sector level

Sources: SQW Consulting, WRI 2004

What does this mean for HEIs?

1.7 Rising energy costs, changes in public perception and awareness of climate change, and the policy context provided in our sustainable development strategy (HEFCE 2009/03) all support the case for carbon reduction investment decisions in institutions.

1.8 The HE sector has an important role to play in addressing carbon emissions, both as an educator and as an employer. There is considerable appetite from within the sector to minimise carbon emissions: almost 70% of respondents to the consultation on our 2008 sustainable development strategy[5] supported the development of a carbon strategy for the sector.

1.9 The sector is hugely diverse:

- in terms of **physical attributes** – size of institution, type (and age) of estate, geographical location (urban or rural; campus-based or dispersed)
- in terms of **focus** – institutions vary widely in area and degree of specialism, and in the relative balance between research and teaching.

1.10 These variations have a significant impact on the scale of institutional carbon emissions and also affect institutions' potential to reduce emissions. Institutions

[5] 'Sustainable development in higher education: Consultation on a 2008 update to strategic statement and action plan' (HEFCE 2008/18). Available at www.hefce.ac.uk under Publications/2008.

must develop their own carbon reduction targets based on their particular circumstances and ambitions.

1.11 Institutional engagement with the carbon reduction agenda varies. Some institutions already have targets for increasing energy efficiency or reducing CO_2 emissions. A small number have targets for reducing waste, water consumption and/or emissions from road vehicles.

1.12 The diversity of HEIs, along with recognition of their autonomy, makes unilateral recommendations for institutions through a sector-wide strategy inappropriate. This guidance provides advice to institutions across the sector. It is expected that individual institutions will implement carbon reduction initiatives in different ways.

1.13 From 2011, capital allocations will be linked to carbon reduction. Higher education institutions in England will be required to develop carbon management plans that include:

- carbon baseline for 2005 which covers at least scope 1 and 2 emissions. These include direct emissions from sources that are owned or controlled by the HEI such as direct fuel and energy use and indirect emissions from purchased electricity
- targets for scope 1 and 2 emissions to 2020 against a 2005 baseline. Institutions may choose to set targets for scope 3 emissions (for example, emissions from water use, waste, business travel and commuting). These targets must be available publicly
- an implementation plan to achieve carbon reductions including timescales and resources
- clear responsibilities for carbon management
- a commitment to monitor progress towards targets regularly and to report publicly annually
- the carbon management plan, including targets, to be signed off by the governing body.

High-level carbon targets and delivery mechanisms

1.14 A large number of institutions are or will be required to participate in national-level schemes – the EU Emissions Trading Scheme (EU ETS) and the UK Carbon Reduction Commitment (CRC).

1.15 The EU ETS[6] is a cap and trade mechanism targeted at large energy intensive sectors and facilities, and covers individual combustion plants of over 20MW thermal capacity. About 20 English institutions meet this criterion and participate in the scheme, which involves detailed carbon baselining, monitoring and reporting for combustion plants (these typically include large boilers and combined heat and power (CHP)).

1.16 The CRC[7] is a new scheme that will be launched in 2010, targeting large (but non-energy intensive) organisations in the private and public sectors. The qualifying criterion will be annual electricity consumption in 2008 of 6,000 MWh of half-hourly metered electricity. Over 80 institutions in England are likely to be included in this group. Participants will be required to baseline, monitor and report on direct carbon emissions from electricity, gas and other fuels. Participants will have to purchase allowances equivalent to their carbon emissions each year, with allowances starting to be capped (i.e. a carbon reduction requirement) from April 2013.

1.17 The HE sector carbon target and strategy will fully credit individual HEIs for their efforts in these schemes. Consistency and compatibility of monitoring and reporting protocols will be ensured to minimise resource implications and administrative burden.

1.18 This guidance has taken these national cross-sector initiatives into account, and has also considered the requirements of the Carbon Trust's Higher Education Carbon Management (HECM) Programme. The latter, in particular, has developed a detailed methodology and range of tools for producing and implementing sound carbon management strategies and plans for HEIs. The guidance presented in this document is compatible with the above initiatives. Further information and support on these and other initiatives is signposted in Chapter 4.

1.19 When setting and reporting against carbon reduction targets, HEIs will only be able to use trading to offset their emissions to the extent that the HEI fulfils its statutory minimum requirements under the ETS and CRC and any future legal requirements.

[6] For more information on the EU ETS, see www.defra.gov.uk under Climate change and energy/ Action in the UK/Business/Emissions trading.
[7] For more information on the CRC, see www.defra.gov.uk under Climate change and energy/Action in the UK/Business.

Self-assessment questions

1.20 The questions below identify areas which institutions should consider when developing a carbon reduction strategy and management plan.

Table 1-3: Self-assessment questions for HEIs

Theme	Questions
Strategic fit	Do the carbon reduction strategy and management plan reflect the institution's type, size and estate? Do they take an optimal approach and allow for change over time? How does the plan support the institution's strategic objectives? How has the carbon reduction strategy been incorporated into wider institutional strategy?
Stakeholder involvement	How are governors, staff, students and external stakeholders involved in the process of developing the strategy and plan, and in implementing their recommendations?
Content and format	Are the strategy and plan clear and easy to understand? Do they contain all necessary information?
Resourcing	Is responsibility for carbon management clear? Are sufficient resources available (staff time and funding)? Are existing resources and data collection methods used appropriately?
Options appraisal	Are the approach and underlying rationale for developing the strategy and plan clearly set out? Has the institution critically examined a wide range of options and identified the most appropriate ones?
Monitoring and communications	Is there a clear process and timetable for monitoring and revising the strategy and plan?
Partnership and sharing good practice	Has the institution worked with other HEIs and partners to inform its strategy and plan?

Source: SQW Consulting

2: Process and key elements of a carbon management strategy and plan

2.1 HE institutions in England will be required to develop a carbon management strategy. This should include a high-level strategic statement, with objectives and targets, as well as a plan providing more detail on how these will be delivered. Institutions will have the autonomy to develop their own individual and unique strategies and plans reflecting their specific circumstances and requirements.

Developing a carbon management strategy

2.2 Institutions should identify a carbon management strategy.[8] A carbon reduction target and management plan will contribute to this strategy. The strategy needs to outline clearly an institution's overall approach and objectives to reducing its carbon footprint.

2.3 There is no one-size-fits-all approach to developing a carbon management strategy. The content and structure will vary by institution as well as reporting structures and responsibility for implementation. In many cases, the institutional carbon management strategy will form part of a wider environmental/sustainability strategy.

2.4 Institutions should consider how a carbon management strategy will fit within and support existing policies and strategies, as well as what its role will be in delivering certain regulatory obligations (including where appropriate the EU Emissions Trading Scheme and the UK Carbon Reduction Commitment). From an internal HEI perspective, the strategy should be in line with the following:

- overall strategic plan
- estates strategy
- environmental or sustainability policy
- travel plan.

2.5 An effective strategy will require serious commitment and support from senior management and the Governing Body. In most cases, it will be appropriate to develop a carbon management strategy which sets out the overall approach and identifies objectives and targets for reducing carbon emissions. The strategy may cover a wider range of areas than those included in the emissions target.

[8] The strategy should be informed by wider environmental and energy policies. It should include a carbon management plan.

Case studies: Senior management buy-in

Case study institutions stressed the need for senior management buy-in to the need for carbon management. At Manchester Metropolitan University, a section of the annual report is devoted to sustainability, and the Deputy Vice-Chancellor chairs a Sustainability Investment Board (a decision-making panel), which reports directly to the Executive Board and Directorate (which then report to the Board of Governors). The sustainability board has identified key performance indicators (KPIs) (including Carbon Footprint, investment in Carbon Reduction Projects and Display Energy Certificate scores for each building) against which to monitor further progress.

At the University of East Anglia (UEA), the sustainability group reports directly to the senior management team, which is supportive of environmental decision-making as it supports the university's external profile (both nationally and internationally). Becoming an exemplar low carbon campus is now a headline objective in the Corporate Plan.

At Leeds Metropolitan University, carbon reduction is covered by the Corporate Social Responsibility (CSR) Steering Group which is chaired by the finance director. Energy reductions are reported to the finance and general purpose committee, which reports to the Board of Governors.

At King's College London, the Principal is highly supportive of the carbon reduction agenda and, as such, was recently made a 'London Leader' for sustainability by the Sustainable Development Commission, which has helped to raise the profile of King's within the community.

At Imperial College there is an Energy Group, which works with the Director of Facilities and Director of Building Projects in implementing carbon efficient design and operational practices. As a response to the findings of an Environmental Task Force Working group, set up by the Rector, the College has appointed a Director of Sustainability and is establishing a Corporate Social Responsibility Committee led by College Academics and reporting to the Rector. This will define policy, strategy and promote best CSR practice across the College.

Source: SQW Consulting fieldwork

2.6 The carbon management strategy may be set within an existing environmental, energy management or procurement policy.

How to develop a carbon management plan

2.7 There are a number of stages to developing a carbon management plan and ensuring buy-in. The Plan should provide detail on how the institution will get from 'A' to 'B' in reducing emissions. Institutions should consult with their internal stakeholders (staff and students) and external stakeholders (sector bodies, peers and local communities) in order to capture and build on existing work.

2.8 Stages include:

- identifying objectives
- establishing a baseline
- setting targets
- identifying options
- costing
- prioritisation
- monitoring and reporting.

These are considered in turn below.

Stage 1: Identifying objectives

2.9 The plan should identify how carbon management will contribute to the institution's strategic aims. For example, one institution may wish to be an early adopter of new technologies to support learning; another may see reducing energy consumption as fundamental to sound financial management. Institutions should consult with staff, students and other stakeholders to identify objectives.

2.10 The plan should clearly set out key objectives. For example:

- *to measure carbon emissions from the institution's estate*
- *to identify ways of reducing carbon emissions.*

2.11 It should also identify how these objectives will be achieved, and what further benefits can be generated and how.

Stage 2: Establishing a carbon boundary and baseline

2.12 The establishment of a carbon baseline is key to developing a carbon management plan, identifying potential actions and informing wider estate strategies.

2.13 The first step is to define the boundary – which sources of emission will be covered by the target. Scope 1 and 2 emissions need to be included. The inclusion of scope 3 emissions is optional and since these are diverse institutions need to decide which of these it is appropriate to address through the strategy and plan.

2.14 Institutions are encouraged to consider including a wide range of activities and their associated emissions. A justification of the choice of the carbon boundary needs to be provided in the plan.

Table 2-1: Defining the boundary: scopes 1, 2 and 3

Scope	Includes	Inclusion in baseline and target
Scope 1: Direct emissions from sources that are owned or controlled by the institution. These include emissions from combustion in institution-owned or controlled boilers, furnaces, vehicles, and so on; and emissions from chemical production in institution-owned or controlled process equipment. Direct CO_2 emissions from the combustion of biomass are not be included.	Emissions from energy use (within the estate) from fossil fuel (gas, coal, oil) combustion (scope 1) and electricity use (scope 2). This includes energy used for conferences, summer schools and so on. It should include building-related energy use (residential buildings including staff and student accommodation, and non-residential buildings including teaching, research, catering, and sports buildings) and non-building related energy use (for example campus lighting, sports grounds maintenance and lighting). Transport emissions from the institutions' own vehicle fleet (scope 1)	Mandatory
Scope 2: emissions from the generation of purchased electricity consumed		Mandatory
Scope 3: Other indirect emissions. Scope 3 emissions are a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution.	*Emissions from other sources – water use, waste, and procurement (assets, goods and services), land use, business travel (for management, research or teaching) and commuting (both staff and students).* *Transport can be further categorised by mode into land transport (car, rail, bus, other) and air travel (split between domestic flights and international flights).*	*Optional*

Source: SQW Consulting, WRI (2004)

2.15 Establishing the carbon baseline is the next key step. This involves choosing a baseline year and sourcing relevant data to cover the selected scopes of emissions.

2.16 In line with the UK-wide baseline, the HE sector baseline year has been set as 1990 and progress against the sector level target will be measured against this. Therefore, progress will be recognised where institutions have reduced carbon emissions since 1990.

2.17 However, relevant energy and carbon data at the HEI level going back to 1990 are patchy. The Estate Management Statistics (EMS)[9] were first introduced in 1996 (although response rates were low for the first couple of years). The 'Hull' statistics (which were produced before the introduction of EMS) only cover a limited subset of all current HEIs, as the statistics were compiled on a voluntary basis and only include those institutions that had university status before 1992.

2.18 Institutions should calculate a carbon baseline for 2005 (this year is currently subject to consultation). This will provide consistency across the sector against which progress can be monitored and reported. 2005 is being used as a baseline as this year is used for reporting against UK targets and the SQW report demonstrated that robust data for scope 1 and 2 is available for this year at the institutional level.

2.19 Additionally, institutions may wish to reference their targets against a 1990 carbon baseline for comparative purposes. It is recognised that estimates will vary in their accuracy. For institutions where relevant 1990 data are available from the 'Hull' statistics, more accurate estimates can be produced. For others, several methods can be employed including back-casting and top-slicing from the sector baseline. Institutional baselines for 1990 and 2005 are available from SQW research, against which to measure progress.

[9] For more information, see www.opdems.ac.uk/.

Calculating the baseline

2.20 There are various toolkits to assist with establishing baseline data and targets. The Carbon Trust provides HE specific guidance through the HE Carbon Management Programme[10] and has an online carbon footprinting tool.[11] Chapter 4 of this guidance identifies additional sources of support and guidance.

2.21 Table 2-2 explains how to calculate the scope 1 and 2 baseline.

Table 2-2: Calculation of baseline: scope 1 and 2 emissions

Step	Task	Data source	If not available
Step 1	Confirm baseline year(s), as advised by HEFCE	Check availability of records with estates team	-
Step 2a	Establish annual energy consumption across estate for each fuel source: gas, electricity, coal (in kWh) Do not include biomass	EMS returns Data must relate to a 12 month period	Obtain information directly from suppliers
Step 2b	Identify fuel use and/or mileage data for all fleet vehicles	Internal records of mileage or fuel consumption Break vehicle use down by fuel type (diesel, petrol, liquefied petroleum gas (LPG)) and by size (large, medium, small)	Assume that direct transport emissions account for 1% of total scope 1 and 2 emissions
Step 3	Apply carbon conversion factors to calculate carbon emissions for Steps 2a and 2b	See Appendix 1 or www.defra.gov.uk/environment/business/reporting/index.htm	
Step 4	**Sum results to provide annual carbon emissions (NB: check these are reported in tonnes CO_2)**		

Source: SQW Consulting

[10] For more information, see www.carbontrust.co.uk under Solutions/Public sector public management/Higher Education.
[11] Available at www.carbontrust.co.uk under Solutions/Carbon Footprinting/Footprint calculators.

2.22 Table 2-3 explains how to calculate scope 3 emissions for the baseline year.

Table 2-3: Calculation of baseline: scope 3 emissions

Step	Task	Data source	If not available
Step 1a	Water (m^3)	EMS – Water consumption figures – water supplied in cubic meters (m^3) – are reported in both the EMS datasets and 'Hull' statistics, which provide the basis for a robust calculation of carbon emissions for those years	Assume water accounts for approximately 1% of scope 1, 2 and 3 carbon emissions
Step 1b	Waste (tonnes)	EMS (available from 2004 only) Use internal record to assess composition of waste	Assume waste accounts for approximately 3% of scope 1, 2 and 3 carbon emissions
Step 1c	Land-based business travel	Travel survey	Emissions from land-based travel for business purposes can be estimated on a top-down basis from the UK National Travel Survey (NTS) (2007), as follows: • Step 1: Calculate total business mileage in the UK (multiply mileage per person by the population size) • Step 2: Attribute business mileage to individuals in employment only (divide total business mileage by the number of people in employment) • Step 3: Estimate business mileage for the institution (multiply individual mileage of people in employment by the number of staff (all staff, FTE)) • Step 4: Apply an average carbon emissions factor for a unit of mileage (km) (see Appendix 1)

Step	Task	Data source	If not available
Step 1d	Commuting (staff and students travelling to and from the institution)	Travel plan or survey If sufficient data for staff and student commutes are available it is possible to break down the use of cars (large, medium, small), bus, motorbike and rail use in miles	Emissions can be calculated from the NTS as follows: Staff commuting • Step 1: Calculate UK mileage in this category (multiply mileage per person by the population size) • Step 2: Divide total mileage by number of people in employment • Step 3: Estimate mileage for the institution (multiplying individual mileage of people in employment by the number of staff (all staff, FTE)) • Step 4: Apply an average carbon emissions factor for a unit of mileage (km) based on split between car, bus and train (see Appendix A) Student commuting is reported as trips for 'Education' purposes • Step 1: Calculate UK mileage in this category (multiply mileage per person by the population size) • Step 2: Divide total mileage by number of people in education • Step 3: Estimate mileage for the institution (multiply individual mileage of people travelling for education purposes by the number of students) • Step 4: Apply an average carbon emissions factor for a unit of mileage (km) based on split between car, bus and train (see Appendix A)

Step	Task	Data source	If not available
Step 1e	Business air travel	Staff survey; internal travel records or expenses claims	Emissions from business air travel (staff flights associated with academic and professional activities) can be estimated from the Civil Aviation Authority's 'Passenger Survey Report' (2006). Institutions should calculate a pro rata share (based on staff numbers) of those travelling for 'Conference/Congress'. It should be assumed that the average domestic flight (one way) is 300 km and the average international flight (one way) is 5,000 km
Step 1f	Air travel – international students	Emissions arising from international students flying to the UK (and back to their home countries) Two round trips per calendar year should be attributed to EU-25 nationals, and one round trip per calendar year for non-EU-25 nationals. Where the country of domicile is known, institutions should calculate the distance between London and the capital city of the country of domicile. For the remaining students, an average flight distance should be applied	If specific mileage data is not available for air travel, assumptions can be made that a long haul flight is 4,000miles and a short haul flight is 400miles (one way)
Step 1g	Air travel – student exchange	Emissions from air travel of students in English institutions travelling overseas in relation to student exchange programmes. Assume one return flight per student, based on a London to capital city route	If specific mileage data is not available for air, assumptions can be made that a long haul flight is 4,000miles and a short haul flight is 400miles (one way)

Step	Task	Data source	If not available
Step 2	Multiply each category of emissions by the relevant carbon conversion factors	See Appendix A or www.defra.gov.uk/environment/business/reporting/index.htm	
Step 3	**Sum results of Step 2 (NB: check these are reported in tonnes CO_2)**		

Source: SQW Consulting

2.23 Institutions may wish to collect additional data, such as proportion of paper recycled, to inform calculations of scope 3 emissions.

Stage 3: Setting targets

2.24 Institutions will be required to set a carbon reduction target for 2020 for scope 1 and 2 emissions against a 2005 baseline. Institutions may set their targets in context by referencing them against an earlier baseline year to recognise where they have reduced carbon emissions before 2005. Targets will vary between institution but should be ambitious, and reflect the ability of each institution to deliver carbon savings. Institutions may choose to also set targets for interim years and for aspects of scope 3. At a sector level it is expected that targets will aggregate to the sector level target (currently subject to consultation and to be agreed by the end of 2009).

2.25 Targets should be SMART – specific, measurable, achievable, realistic and time bound. Institutions should consider benchmarking themselves against others in the sector.

2.26 Carbon off-setting cannot contribute towards meeting the 2020 target.

2.27 Initial discussions should be held within Estates Management to discuss reduction opportunities and the key focus areas within the estate where the majority of scope 1 and 2 emissions arise.

2.28 A comprehensive list of interventions needs to be produced, covering all known solutions that can be implemented – including technical and non-technical (e.g. behavioural change) solutions. Individual interventions need to be quantified in terms of their carbon reduction potential (impact). The cumulative impact by 2020 in absolute terms (tonnes of carbon) will help institutions to identify a realistic reduction target.

2.29 Each intervention then needs to be quantified in terms of its cost. Some interventions are no or low-cost; others could require a considerable investment. One approach to comparing the carbon benefit of intervention is to identify the cost of abating a tonne of carbon (£/tCO_2). Interventions with negative costs (i.e. financial gain, for example, through savings against energy bills) should be implemented as a priority. Their cumulative carbon savings will inform the financially-viable carbon target.

2.30 The two activities above (quantifying the carbon impact and cost) are typically combined to produce what is known as the Marginal Abatement Cost Curve (MACC). The MACC is a tool that informs investment decisions in terms of what carbon savings can be achieved at what cost. The Carbon Trust's HECM Toolkit contains a MACC tool as well as a project cost and carbon saving quantification tool (CD available from Carbon Trust; see Chapter 4).

Stage 4: Identify options

2.31 Identifying and appraising options for carbon reduction is important. The range of options will depend on several factors, including age of estate, type of estate (campus-based/dispersed) and location (urban/rural). Institutions may wish to implement larger-scale estates solutions (CHP or new boilers); to start with smaller-scale changes (e.g. lagging of pipes); or to implement a mix of both. Institutions should take existing activity into account: institutions already using a number of energy-saving measures will have less scope for quick wins.

2.32 The Carbon Trust offer a range of services to assist in identifying carbon saving opportunities, including free carbon surveys to organisations with annual energy bills of more than £50,000.[12]

Case studies: Identifying interventions

The University of Bristol divides potential interventions into two categories: 'vertical' and 'horizontal'. 'Vertical' initiatives include large-scale investment in three CHP heat-led units, providing around 2,000 tonnes of CO_2 savings annually. Alongside this, the university is running an ongoing programme investing in 'horizontal' energy-saving projects (across departments). The programme has an annual budget specifically for capital investment, which is spent on smaller projects such as updated lighting controls. The programme engages existing staff in a number of ways; it tends to use in-house engineers to implement the solutions, and projects are identified in three ways:

- the energy team carry out an audit of energy usage, and identify projects
- estates design team find issues, and ask the energy team to investigate
- building users and managers make recommendations.

Source: SQW Consulting fieldwork

[12] For more information, see www.carbontrust.co.uk.

Stage 5: Costing

2.33 Each option should be costed in terms of the total capital outlay required (CAPEX), as well as the ongoing operating cost (OPEX) involved. It is important to bear in mind that carbon reduction is closely linked to reducing energy consumption so there will be tangible financial savings that will offset some or all of the costs. Some opportunities are low or no-cost, including behavioural change and space management, where net financial gains are to be expected early on. Even the costlier opportunities need to be looked at from a life-cycle perspective where the upfront investment is set against the energy and cost saving over the life of the intervention.

2.34 Where appropriate, established investment appraisal protocols and procedures should be applied to carbon-saving opportunities, thus maintaining consistency and reducing the administrative burden. In any case, opportunities need to be explored from a simple pay-back angle – i.e. the number of years during which savings on the energy bill cover all additional CAPEX and OPEX. Further assessment, particularly for larger capital projects, may be required where inflation and equipment amortisations are taken into account – i.e. looking at the net present value of a project in future years by applying discount rates.[13]

2.35 When appraising opportunities, it is also important to consider the cost of inaction. This involves looking at likely future energy prices, the price of carbon and other aspects that can be valued, such as institutional reputation. If an opportunity or a package of opportunities is not progressed because of high capital cost, this may result in the institution paying more over time in energy bills and other costs.

2.36 When immediate or short-term paybacks are not possible, it may be appropriate to identify sources of external funding for the initial investment. Some examples are provided in Chapter 4.

Stage 6: Prioritisation

2.37 Institutions need to prioritise the identified and costed opportunities. This should be done on the basis of internally agreed criteria, in particular cost (and affordability) and impact (energy and carbon savings). The result will be a prioritised list of interventions that clearly demonstrates the cost and impact of each intervention. Institutions should also consider how the opportunities fit in with their estates strategies, for example taking into account planned new build and major refurbishments.

2.38 A MACC is a pictorial representation of the relative costs (and reduction potential) of different interventions. Appendix B provides some examples of generic MACCs

[13] Choosing a discount rate varies on the basis of level of risk attributed, expected inflation rate and required project profitability. For public sector projects, the Government's Green Book sets the discount rate at 3.5% per annum. Private sector projects often use discount rates of 10%-15%.

for buildings. The 'Opportunities Database', a tool used in the HECM programme (see Chapter 4), contains a facility for HEIs to generate a MACC.

Case studies: Quick wins, big wins

Quick wins are a useful way of maintaining staff and student enthusiasm for reducing carbon emissions. At Leeds Metropolitan University, quick wins included the introduction of air-handling fans with direct variable speed drive; sub-metering; and movement and light sensors – especially in gyms, toilets and lecture theatres. There are also a number of easily-implementable IT solutions – including automatic overnight switch-off of equipment in IT labs.

Identifying big wins is also critical. At UEA, the campus is dominated by a large listed 'teaching wall', constructed in the 1960s, which limits the range of potential cost-effective investments to reduce carbon emissions. The University decided to invest in a whole-site approach as it would be more efficient in the long run, and has installed three 1MW CHP boilers to cover the whole site (e.g. providing heat for the new sports facilities). One runs permanently, with two running for most of the summer, and three in the winter – around two-thirds of electrical energy is now generated on-site. There is now also a District Cooling system – an absorption chiller in the basement, to provide cooling more efficiently for the whole block in the summer, and the University has made the decision to invest in a large-scale biomass boiler.

Source: SQW Consulting fieldwork

Case studies: Behaviour change

Behaviour change can contribute up to a 10% reduction in energy use. However, it is not necessarily easy and the message needs to be reinforced (particularly to new cohorts of students). King's College London provides a 10-point booklet (now in its second year) to all first year students, and is looking at integrating this practice to staff induction.

Harper Adams University College held an energy competition between halls of residence entitled 'Carbon Challenge'. Halls were provided with varying levels of feedback on energy use during the week. The institution was able to identify motivating factors and the types of message which were most effective in encouraging behaviour change.

Leeds Metropolitan University reports on savings through departmental environmental coordinators, energy champions, Health and Safety Advisory Committees and the Corporate Responsibility Steering Group, and works with the City Council's Climate Change Officer as well as the Students' Union ethical and environmental officer. The 'Big Switch Off', a pan-university project, monitored energy use over consecutive weekends during the national Big Switch Off campaign.

The University of Bristol is introducing 'Green Impact Awards', modelled on the Sound Impact Awards programme run by the National Union of Students Services Ltd (NUSSL). The scheme has 130 criteria, all of which are practical to implement. There are four levels ('working towards' level; bronze and silver (both with fixed standards) and gold). Fifty departments are involved, and it now involves around 2,500 staff as well as students, in projects such as carbon auditing.

At UEA there is a current drive to change behaviour; a pilot scheme presented a department with a breakdown of a business-as-usual case (of its energy baseload), and offered to let the department keep the financial equivalent of additional savings (after energy price changes have been taken into account). The pilot saw savings of 13% on electricity use. UEA also coordinates regular 'tours' of its estate for university staff to raise awareness of the interventions which have been put in place, and is preparing staff training modules on energy and climate change.

Source: SQW Consulting fieldwork

Stage 7: Monitoring and reporting

2.39 Monitoring is a key and mandatory element of carbon management. Progress against targets and in relation to the carbon baseline will be monitored in line with HEFCE's requirements. These requirements will focus on scope 1 and 2 emissions, with optional, but recommended, monitoring of scope 3 emissions (in particular where the institution has implemented interventions for reducing scope 3 emissions).

2.40 Monitoring procedures will be compatible with other national policy and regulatory requirements, including the EU Emissions Trading Scheme (EU ETS) and the Carbon Reduction Commitment (CRC).[14]

2.41 All data should be converted into tonnes of carbon dioxide (tCO_2) and additional metrics can also be used – for example, the original energy or fuel metric (kWh, therm, litres, miles). Other greenhouse gases will be reported as carbon dioxide equivalent (tCO_2e).

2.42 Monitoring and reporting should be carried out on an annual basis (by financial year in common with EMS). A good carbon reduction programme will be embedded into the wider estates strategy including sustainability, environmental and facilities management policies. This will minimise the administrative burden and maximise synergies.

2.43 Appropriate monitoring requires key roles and responsibilities to be established internally – both at operational and strategic levels. Institutions may wish to establish a carbon reduction team with responsibility for implementing actions. Members can include staff, student representatives and estate and facilities management. There should be a link to the senior management team and reporting to the Governing Body.

2.44 Regular meetings between the carbon reduction team are important to raise any issues that could hinder the effective delivery of reduction targets. Any decisions undertaken by the carbon reduction team should take existing relevant strategies into account.

[14] Monitoring progress against the sector level target will rely on data from Estates Management Statistics and it is expected that carbon emissions data will be mandatory with effect from 2009-10.

2.45 Institutions need to consider whether there is scope for a designated carbon manager within the institution who will also be responsible for monitoring and reporting (smaller institutions may consider sharing such a post). Each carbon reduction opportunity needs to have a nominated champion (project manager or key contact point) to determine the course of action and to monitor progress.

2.46 The plan should be agreed and signed off by the governing body. Monitoring should take place at least annually, and progress should be reported publicly.

Case studies: Staffing requirements

Staffing requirements will vary depending on institution size, complexity and existing resources. Leeds Metropolitan University has a sustainability team with three members. Within this team, there is a sustainability manager, a trainee environmental manager (with a specific energy efficiency remit) and a transport co-ordinator. The institution is engaging staff in departments through a network of environmental and energy champions, including staff from Campus and Residential Services (CARES) with a specific remit for waste and recycling. It aims to make carbon reduction 'part of everybody's role' – which requires staff buy-in from a number of areas including Estate Services, CARES, purchasing, finance and faculties. The institution focuses on developing staff competencies and training, and enabling staff to swap experience.

Institutions may also consider how to involve existing staff in the carbon reduction agenda. At the University of Reading, involvement of the full range of staff employed in the institution is seen as vital; everyone from cleaners to security staff can be involved in monitoring and reporting energy wastage in buildings outside 'normal' opening hours, which can help staff feel valued. Furthermore, staff members from the construction engineering department have been involved to identify new opportunities for energy generation on the university's estate.

Source: SQW Consulting fieldwork

Joint working and partnership

2.47 HE institutions should make use of the wide variety of funding, financial and reduction opportunity information available. Chapter 4 identifies some key sources of information, and the Carbon Trust can provide advice specifically tailored to the HE sector.[15]

2.48 Institutions should also identify partners (other HEIs, or local bodies) with whom they can share good practice and/or (for local institutions) joint capital investments and sharing of facilities and space. Partners might be institutions with a similar carbon profile, similar age estate and/or similar research profile, or nearby institutions.

[15] For more information, see www.carbontrust.co.uk under Solutions/Public sector public management/Higher Education.

Case studies: Partnerships

The Universities of Bristol and Reading have both worked with Partnership for Renewables (Carbon Trust) to see if they can install various renewables options across their estate (e.g. photovoltaic (PV) technology on roofs; anaerobic digestion; wind turbines on university-owned land). Institutions with significant land resources (including farmland) may consider alternative uses for their resource which involve carbon reduction measures or energy generation. Both institutions are also exploring potential partnerships (e.g. a shared CHP plant) with other large institutions nearby, including hospitals and local authorities.

Small institutions can benefit greatly from developing partnerships around the carbon reduction agenda in terms of sharing resources, particularly if they do not have the immediate budget to employ a specific carbon reduction manager. The Arts University College at Bournemouth has a number of informal environment-focused links to other HE and further education (FE) institutions in the South West, and has set up an Environment Committee which reports to the executive.

Source: SQW Consulting fieldwork

2.49 There is a wide range of expert organisations and representative bodies within the sector, which play helpful roles in developing and disseminating good practice as well as informing policy. These include:

- the National Union of Students (NUS): the role of students in minimising carbon emissions has been, and will continue to be, significant
- the HE representative bodies (Universities UK and GuildHE) and the Higher Education Regional Associations: these facilitate partnership working both across HEIs and with other regional stakeholders
- the Higher Education Environmental Performance Improvement initiative (HEEPI): provides environmental benchmarking tools, and runs networks and events on sharing best practice
- the Association of University Directors of Estates: currently carrying out research on how the HEI estate may evolve over the next 20-30 years, which will help estates teams to visualise what the university of the future could look like
- the Environmental Association of Universities and Colleges: its website and email groups are useful sources of information and facilitate sharing of good practice, experience and skills
- the Association of University Purchasing Officers (AUPO) and the regional and national purchasing consortia: a sustainable procurement centre of excellence, led by the North Eastern Universities Purchasing Consortium in partnership with AUPO and funded by HEFCE, intends to make demonstrable changes to the way HEIs embed sustainable procurement into their standard procedures, practices and policies. This will help develop measurement and monitoring tools for carbon emissions related to procurement.

Carbon reduction strategy format

2.50 An example format for a carbon management strategy could be as follows:

- Executive summary
- Introduction
- Overview of strategy
- Approach to carbon reduction and fit with strategic objectives
- Carbon emissions data
- Assessment against baseline and target
- Financial and carbon options evaluation
- Implementation plan
- Governance and progress monitoring.

3: Measuring carbon performance

3.1 This chapter provides guidance on how to measure performance in reducing emissions. There are three main elements:

- data collection
- monitoring
- strategy development.

Collecting data

3.2 Section 2 identifies ways in which carbon emissions for a baseline year can be calculated. For future years, institutions will need to collect sufficient information to measure progress.

3.3 Institutions already collect data which can be used to calculate carbon emissions. Using such data will minimise the administrative burden on institutions and ensure greater compatibility and consistency of data and information. In some cases, additional data collection and monitoring systems will need to be established.

Scopes 1 and 2 emissions

Estate Management Statistics (EMS)

3.4 Much of the data collected through EMS is of importance in determining CO_2 emissions. Current (December 2008) indicators which are likely to be of use include:

Table 3-1: Relevant EMS indicators

Reference	Indicator	Short description
D38a	Energy consumption	Energy consumption, defined in kilowatt-hours (kWh), including gas, liquefied petroleum gas, oil and electricity. Total and split by oil, gas, electricity, coal, steam/hot water and other
D38c	Energy emissions	The energy consumption figures returned under D38a, converted into carbon dioxide (CO_2) equivalents NB: this may be redundant or calculating it should follow the procedure outlined further below
D72a	Use of renewable energy sources	Renewable energy is constituted by those sources having a zero carbon loading such as sunshine, wind, flowing water, biological processes, and geothermal heat flows
D72b	% of total energy from renewable sources subject to LECs	Percentage contribution to annual energy consumption from renewable sources where a Levy Exemption Certificate (LEC) has been provided
D72e	% of total energy from renewable sources not subject to LECs	Percentage contribution to annual energy consumption from renewable sources where an LEC has not been provided
D72c	Energy generated on-site by CHP	The annual energy (kWh equivalent) generated on-site from CHP. Includes both heat and electricity
D72d	Renewable on-site energy generation	The annual energy (kWh equivalent) generated on-site through 'renewable' sources (NB: CHP is not a renewable source, unless it uses biomass)

Source: www.opdems.ac.uk – adapted from 'EMS data definitions & amendments', December 2008

Case studies: Estates investment

Harper Adams University College pursues a two-fold strategy to improving energy efficiency on its estate. It views the estate as a potential demonstrator for sustainable technologies. The campus has examples of PV tiles, solar thermal, biomass heating and an anaerobic digester is planned which would make the site largely self-sufficient in electricity. For new build, the institution aims for Building Research Establishment Environmental Assessment Method (BREEAM) excellent rating where possible. Thermal modelling is routinely commissioned early in building design to optimise the design and make informed capital investment decisions.

Reducing energy use can, in some cases, conflict with other objectives: for example, external lighting needs to be sufficient for personal safety and building security, but is also a major factor in high energy use, particularly in an open campus. Integrated lighting and air-conditioning controls on timers have been introduced across the estate. Unused student PCs are switched off overnight automatically by the remote network (this led to a big drop in energy consumption). Other work has included water leak detection and balanced electrical phase loading across three phases for energy use.

At UEA, whilst student numbers have increased by 240% since 1990, and building area by 50%, carbon emissions have gone up by just 10%. This is largely because of investment in major capital projects, including energy generation (see 'Quick wins, big wins' case study box), and the installation of six low energy buildings since 1995, with up to 50% reduced heating energy demand.

Source: SQW Consulting fieldwork

Case studies: Efficient use of space

Leeds Metropolitan University has focused on reducing the size of the estate and improved space management – with individual closed or locked buildings to be used as needed. This results in cost savings on maintenance, heating and lighting, and provides associated carbon savings.

The University of Birmingham has adopted the concept of the 'smaller, better estate', which has been endorsed by its Executive and Council (governing body). As a result, it is planning to reduce the current scale of the operational estate. Buildings are being refurbished to provide greater density of occupation.

Source: SQW Consulting fieldwork

Transport fuel emissions

3.5 Transport fuel used in institutions' own vehicle fleets[16] releases carbon emissions which fall within scope 1. These direct transport emissions are not currently monitored and reported under EMS. Institutions should implement a system for

[16] This includes vehicles owned and leased by the institution.

collecting information on volume of fuel used or purchased and, where this is not available, on mileage by vehicle size and type.

Electricity

3.6 Indirect emissions through the use of electricity fall under scope 2. Total electricity consumption should be monitored and reported on. In addition, grid electricity should be reported separately from non-grid (on-site generation) electricity. For grid electricity, the national carbon factor should be applied (see further below). Electricity sourced from renewable sources, often referred to as 'green electricity' (green tariffs) should also be converted into carbon using the same national carbon factor and included in the baseline. This is because most renewable electricity supplied under green tariffs in the UK is generated and supplied through a statutory requirement, the Renewables Obligation (RO). Only where institutions can demonstrate that the green electricity they purchase is additional to the RO (i.e. where the Renewable Obligation Certificates have been retained) can this be counted as zero-carbon and either not included in the baseline or counted towards meeting the carbon reduction target. This is consistent with EMS.

3.7 Electricity from on-site CHP should be monitored but not included in the HEI's carbon baseline – only gas (as kWh, therm or m^3) should be counted. This avoids double-counting of gas and electricity use.

Scope 3 emissions

Water

3.8 Water consumption figures – water supplied in m^3 – are reported as part of EMS. Where possible, water consumption should be broken down by building or use type (residential/non-residential) which could help to identify and prioritise interventions. This will facilitate institutions in identifying appropriate solutions for reductions in use. Institutions should be able to secure data on water consumption from suppliers and/or meter readings.

3.9 Only mains water consumption should be included in the carbon baseline calculation using the appropriate carbon conversion factor. Rainwater and grey water are considered zero-carbon. Carbon from borehole water (on-site) is accounted for through the energy (electricity) used for extraction and supply.

Table 3-2: Relevant EMS indicators on water consumption and supply

Reference	Indicator	Short description
D38b	Water consumption	The annual volume (m^3) of mains, metered fresh water consumed
D77a	Water supply 'grey water' and rain water	The annual volume (m^3) of non-mains water supply for potable and non-potable use from rainwater and 'grey water'
D77b	Water supply borehole extraction	The annual volume (m^3) of non-mains water supply for potable and non-potable use from borehole extraction

Source: www.opdems.ac.uk – adapted from 'EMS data definitions & amendments', December 2008

Waste

3.10 Institutions report waste-related information through the EMS and should use this source.

Table 3-3: Relevant EMS indicators for waste

Reference	Indicator	Short description
D73	Waste – Total	The approximate annual mass of waste generated by the institution
D73	Waste – Recycled	The approximate annual mass of waste recycled by the institution
D73	Waste – Incineration	The approximate annual mass of waste incinerated by the institution
D73	Waste – Other methods	The approximate annual mass of waste to landfill from the institution

Source: www.opdems.ac.uk – adapted from 'EMS data definitions & amendments', December 2008

3.11 It is important to monitor and report on all categories of waste as they have different carbon contents and some, such as recycling and incineration, can be used to demonstrate reductions in the institution's carbon baseline.

Business travel and commuting

3.12 Emissions from travel for business purposes and commuting can be monitored at the HEI level by way of a survey of staff and students. This will provide up-to-date information and can be done as part of an institutional travel plan. Where this is not practical, a top-down approach, as outlined in Chapter 2, can be adopted, using national-level statistics and estimating the institutional share. This

approach, however, is far less accurate, as it is less sensitive to the specific circumstances of HEIs and behavioural change at the HEI level.

3.13 The EMS has recently started to record travel-related data. Indicators reported include total transport costs (residential and non-residential) (D63) and percentage of single occupancy car journeys (D75). The former may help in establishing carbon emissions through the use of conversion factors, whilst the latter may inform behaviour change strategies.

3.14 However, ultimately additional monitoring procedures should be established at institutional level to capture this area of emissions. For all types of business travel and commuting, three key parameters need to be captured – length of trip, frequency and mode of transport.

Case studies: Travel plans

Leeds Metropolitan University has a 10-year transport strategy. Reducing single occupancy of vehicles is one of the key areas. The university has partnered with the University of Leeds, Sustrans and the City Council on a project to hire bikes to students (for a charge of £35 per year). New Halls of Residence, based on campus, will not allow student parking. The university is also working with local bus companies to provide bus services on campus.

The University of Gloucestershire, with campuses in two smaller towns, provides institutional support for local bus routes as part of the green transport strategy (staff and students travel free on buses in the county).

The University of Reading has worked in partnership with the Local Authority to open a new bus route running through the campus connecting it with the town centre; usage of public transport has grown, and the bus route is now a permanent fixture. It has a car-share scheme, and a variety of vehicles for shared usage, including farm vehicles, minibuses and battery-operated vehicles. The system also calculates the financial and CO_2 saving each user is making compared to making that journey by car (as a single occupant).

The Arts University College at Bournemouth has a travel plan which includes subsidised bus passes for students to travel to and from campus. The Institute sends monitoring data on its vehicle usage to the Travel and Transport Steering group, and the governors and planners take an active interest. The travel plan compares private and public transport usage, including single-occupancy car usage, against a baseline and benchmarks.

Source: SQW Consulting fieldwork

Procurement

3.15 Procurement is one of the most difficult areas of carbon emissions to measure. HEIs are advised to work closely with their procurement teams and with any relevant procurement consortia to establish a consistent and comparable method

of measurement. It is important to understand the full scope of procurement, and to break it down further into broad categories such as building procurement and procurement of goods and services. The former relates to the design specification of buildings and material use, whilst examples of the latter include food and drink, information and communications technology (ICT) equipment, stationery and supplies. Procurement of energy will not be included as it is effectively covered in scope 1 and 2 emissions.

Case studies: Procurement

Reducing carbon emissions from procurement can be difficult for individual institutions. Procurement consortia can help to put pressure on suppliers. A number of institutions are beginning to specify environmental issues in procurement.

At Leeds Metropolitan University, sustainability criteria are included in all tenders for capital projects (weighted at 20%), and they aim for BREEAM excellent for all buildings costing over £0.5M (both refurbishment and new build). Buildings must include recycled content (specified in tender process), and the institution makes use of WRAP[17] toolkits on net waste in construction and demolition (two large demolition projects on-site achieved over 95% reuse and reprocessing on-site). They also take an investment appraisal approach to buildings, which resulted in the retention of CHP and rain water harvesting during a value engineering exercise for the Rose Bowl building.

At the University of Gloucestershire, the IT department has changed its procurement strategy to maximise energy efficiency. Multi-functional devices (machines that will photocopy, print and scan) have replaced all photocopiers and these are AAA energy rated.

The University of Reading has moved to an e-procurement system, reducing the need for hundreds of large paper-based tenders being delivered each year. Tenderers are asked to complete a section on environmental policy, and score extra points for having an ISO14001 system in place.

Source: SQW Consulting fieldwork

[17] For more information see www.wrap.org.uk.

Calculating carbon emissions

3.16 The table below explains how to calculate scope 1 and 2 emissions for monitoring purposes.

Table 3-4: Calculating carbon emissions: scopes 1 and 2

Step	Task	Data source	If not available
Step 1a	Establish annual energy consumption across estate for each fuel source: gas, electricity, coal (in kWh) Do not include biomass	EMS returns Data must relate to a 12-month period	Energy bills for the same period and unit price of energy
Step 1b	Identify transport fuel use or mileage data for all fleet vehicles	Internal records of fuel consumption or mileage Break vehicle use down by fuel type (diesel, petrol, LPG) and by size (large, medium, small)	Fleet annual cost and unit cost (fuel or mileage). NB: detailed analysis is required to account for non-fuel costs, such as insurance, tax, service, breakdown, amortisation and profit (leased cars)
Step 2	Apply appropriate carbon conversion factors for each energy/fuel category to calculate carbon emissions	See Appendix A or www.defra.gov.uk/environment/business/reporting/conversion-factors.htm. These conversion factors are used within EMS	
Step 3	**Sum results for all scope 1 and 2 emissions to provide annual carbon emissions (NB: check these are reported in tonnes CO_2)**		

Source: SQW Consulting

3.17 The table below explains how to calculate scope 3 emissions.

Table 3-5: Calculating carbon emissions: scope 3

Step	Task	Data source	If not available
Step 1	Water (m^3)	EMS – Water consumption figures	-
Step 1a	Apply carbon conversion factors to calculate carbon emissions	See Appendix A or www.defra.gov.uk/environment/business/reporting/conversion-factors.htm	
Step 2	Waste (tonnes)	EMS (from 2004 only) Use internal record to assess composition of waste	-
Step 2a	Apply carbon conversion factors to calculate carbon emissions	See Appendix A or www.defra.gov.uk/environment/business/reporting/conversion-factors.htm	
Step 3a	Business air travel	Travel survey Internal travel records or expenses claims	Calculate top-down from national statistics (see as per baseline)
Step 3b	Air travel – international students	Travel survey	Calculate top-down from national statistics (see as per baseline)
Step 3c	Air travel –student exchange	Travel survey	Calculate top-down from national statistics (see as per baseline)
Step 3d	Sum all air travel mileage		
Step 3e	Multiply air travel mileage by carbon conversion factors to calculate carbon emissions	See Appendix A or www.defra.gov.uk/environment/business/reporting/conversion-factors.htm	
Step 4a	Land-based business travel	Travel survey	Calculate as for baseline

Step	Task	Data source	If not available
Step 4b	Commuting (staff and students travelling to and from the institution)	Travel survey	Calculate as for baseline
Step 4c	Sum mileage of land-based travel (business and commuting)		
Step 4d	Multiply land-based mileage by carbon conversion factors to calculate carbon emissions	See Appendix A or www.defra.gov.uk/environment/business/reporting/conversion-factors.htm	
Step 5	**Sum results of Steps 1a, 2a, 3e and 4d to provide annual carbon emissions (NB: check these are reported in tonnes CO_2)**		

Source: SQW Consulting

Monitoring and reporting

3.18 Collecting data on carbon emissions is the first step in identifying progress against the baseline. Where appropriate, institutions may wish to collect data at campus or building level to provide a more detailed picture of energy use and water consumption. An independent qualified professional audit of the university's carbon accounts could assist in ensuring consistency and correctness.

Case studies: Internal data use

The University of Bristol highlighted the importance of identifying and designing appropriate KPIs, which allow comparison year on year, and provide the information the institution needed to know. For example, 40% of their energy use is in 'highly serviced areas' (e.g. intensive labs), so they can identify where intervention may have the greatest impact.

Harper Adams University College and UEA have both installed building management control systems in every building and metering across the whole estate. This is vital in understanding energy use in order to inform the Estates Department on what steps to take. Typically this provides too much data to interpret however, particularly with limited resources in estates departments; at UEA a PhD student has been employed to focus on analysis of energy usage in the university's buildings. This has been highly valuable, although it is recognised that there is a limit to how much student resource can be drawn on in monitoring and data collection, and this also requires a certain amount of planning and training.

The estates department at King's College London has developed strong links with the Facilities department in terms of collecting and sharing information. Through regular engagement with other departments across the whole College, and sharing monitoring data and analysis, the department has built up credibility across the institution.

The Arts University College at Bournemouth found that small institutions can be disproportionately affected by requirements to collect monitoring data. The Institute is currently installing a new software-based finance system, which will help to rationalise and simplify the collection of data as well as analyse the results. Whilst it will take around a year to 'bed in' (training etc.), the investment is expected to pay off many times over in future years.

Source: SQW Consulting fieldwork

3.19 Interim carbon targets should be used to map and monitor progress toward targets. Strategies can then be designed to meet budgets and the results can be evaluated on a yearly basis.

3.20 The more important element is to interpret the data to inform carbon management strategy. Generally carbon emissions are identified for the institution as a whole however, institutions might identify particular areas where emissions are not falling as fast as others, and may decide to prioritise interventions in these areas.

Case studies: Using a carbon reduction target

Institutions with carbon reduction targets, such as the University of Birmingham, have noted the importance of publicising the target and progress towards it in motivating staff and students.

In addition, allocating responsibility for certain elements of energy management to members of staff or groups of students has been useful. At the University of Gloucestershire, the overarching organisational target is drilled down to functional units (campuses) and monthly figures on energy use provided to each campus. This approach shows how campus managers can play a pivotal role in reducing energy consumption. Using this approach effectively would require providing detailed information on energy use and consumption on a monthly basis, and providing tools to managers to implement savings.

Source: SQW Consulting fieldwork

3.21 Institutions should monitor progress against targets and report this publicly on at least an annual basis. Progress against the plan should be regularly communicated internally to the governing body; senior management team; estates and facilities staff; other staff and students.

4: Other sources of guidance and support

4.1 There are a number of existing sources of guidance for institutions wishing to reduce carbon emissions. There is also a very wide range of ongoing activity across the HE sector, including both sector-wide programmes and institutional initiatives.

4.2 The table below identifies sources of support and guidance, and provides a brief overview of some key, sector-wide activities and initiatives.

Table 4-1: Selected sources of support and guidance for HEIs

Resource	Description	Source	Resource type
UK Government			
Department of Energy and Climate Change (DECC)	DECC was established in October 2008, and has responsibility for energy and climate change mitigation policy. The website provides up to date information on Government policies to tackle climate change, including the setting and monitoring of nationwide carbon reduction targets. It is also a useful source on information on policies that might affect individual HEIs as employers and consumers.	www.decc.gov.uk	Organisation
Carbon Reduction Commitment (CRC)	The CRC section of the DECC website provides up-to-date information on the Government's Carbon Reduction Commitment, including a CRC user guide and quarterly updates to stakeholders.	www.decc.gov.uk under What we do/A low-carbon UK/Carbon reduction commitment	Legislation

Resource	Description	Source	Resource type
Climate Change Committee (CCC)	This organisation advises the Government on necessary measures to monitor and mitigate climate change. It identifies means for achieving a low carbon economy (including carbon budgets and carbon markets), some of which may be of interest to HEIs.	www.theccc.org.uk	Organisation
Strategy development			
Carbon Trust – Generic Vision Statements for HEIs	The Carbon Trust has collated a list of vision statements, drawn from institutions participating in Phase 1 of the HECM programme. Although not intended to be a definitive guide to developing strategic objectives, the list may assist HEIs in framing their carbon management strategies.	Carbon Trust, The Higher Education Carbon Management Programme v1.2, available on CD from the Carbon Trust	Guidance document
Low Carbon Economy	This website is run by Low Carbon Economy Ltd, and provides a useful compilation of information related to low carbon strategies, products and services. It may assist HEIs in determining options available to implement their carbon reduction strategy.	www.lowcarboneconomy.co.uk	Organisation
Consultancy			
Design Advice (Carbon Trust)	Design Advice offers professional, independent and objective advice on energy efficient and environmentally sound building design. Clients are offered free initial design consultancy on a building project – further consultancy, with partial funding, may be available. The consultancy recommendations cover energy efficiency, environmental improvements and the potential commercial benefits of ‘green design’.	www.carbontrust.co.uk under Solutions/Apply for a carbon survey/Design advice	Consultancy

Resource	Description	Source	Resource type
Energy Surveys (Carbon Trust)	A range of different survey types are available depending upon the size of the organisation and experience in managing energy.	www.carbontrust.co.uk under Solutions/Apply for a carbon survey	Consultancy
Fleet Health Check (Energy Saving Trust)	If you're a fleet operator, you may qualify for three days of free advice from an independent fleet management expert to help you reduce your fleet costs, cut vehicle emissions, improve your social and environmental reputation and minimise traffic and parking problems where you work	www.energysavingtrust.org.uk under Business & Public Sector/Transport in business/Advice for organisations/Fleets over 50 vehicles	Consultancy
Developing a carbon management plan			
Higher Education Carbon Management Programme (Carbon Trust)	This programme assists HEIs to develop a carbon management strategy and business case, and to get it signed off by the senior management team. Running since 2005, now in its fourth phase and 85 HEIs across the UK have participated.	www.carbontrust.co.uk under Solutions/Public Sector Carbon Management/Higher Education Carbon Management	Programme
Quick wins			
Carbon Trust – 'Further and Higher Education sector overview' guide	This guide provides examples of initiatives which could help institutions reduce carbon emissions. It focuses on low and no-cost measures with quick payback times.	www.carbontrust.co.uk under Solutions/Public sector carbon management/Higher Education	Guidance document

Resource	Description	Source	Resource type
Target setting and management			
EcoCampus	EcoCampus is an Environmental Management System and award scheme for the HE sector. There are four phases to the scheme, and institutions are encouraged to progress towards implementing a full environmental management system (ISO14001 standard).	www.ecocampus.co.uk	Environmental Management System
Carbon Trust – embedding carbon management progress check	The Carbon Management Health Check allows institutions to identify progress in embedding carbon management approaches. The focus is on change management, defined as 'non-technical activities and issues that make the HECM Programme work well'.	Carbon Trust, The Higher Education Carbon Management Programme v1.2, available on CD from the Carbon Trust	Programme
Carbon Trust HE Network	This network encourages communication between HEIs to share knowledge and experience of carbon management in HEIs. Members can post information or links, share experience and arrange knowledge sharing events.	henetwork.carbontrust.co.uk/	Network
Baselining and benchmarking			
Carbon Trust – carbon footprint calculator	An online calculator to help organisations calculate their carbon footprint. It includes benchmark information.	www.carbontrust.co.uk under Solutions/Calculate your carbon footprint/Footprint calculators	Toolkit

Resource	Description	Source	Resource type
NUS Carbon Academy	The Carbon Academy aims to 'reduce the carbon footprint of NUS services'. It offers staff and student training and has developed a toolkit for sharing best practice (requires online registration). The project is funded by the Carbon Trust.	www.nussl.co.uk under Ethical & Environmental	Programme
HEEPI Energy Benchmarking Tool	CEBenchbuild is an Excel tool that allows HEIs and FE colleges to assess the energy performance of their buildings against national benchmarks.	www.heepi.org.uk under Other benchmarking	Toolkit
Universities that Count (Business in the Community)	Universities that Count, a 'benchmarking and reporting programme', based on the Business in the Community Corporate Responsibility Index, and adapted for the HE sector.	www.eauc.org.uk under Projects/Universities that Count	Programme
Green Gown Awards	The Green Gown Awards are now in their fourth year. The awards cover a range of categories including energy and water efficiency and sustainable construction.	www.eauc.org.uk under Green Gown Awards	Award
People and Planet 'Green League'	The Green League ranks universities on the basis of a number of environmental indicators. The majority of the indicators relate to institutions' carbon emission (water use, waste recycling and energy sources as well as carbon emissions per head). Other categories cover environmental management, (environmental policy, staff roles, and environmental audit).	www.peopleandplanet.org under Campaigns/Go Green/Green League	League table

Resource	Description	Source	Resource type
ICT			
Sustainable ICT in Further and Higher Education: SusteIT Final Report	This report considers the environmental impact of ICT use in the FE and HE sectors, and identifies approaches to improve the sustainability of ICT use.	www.jisc.ac.uk under Publications/Green ICT	Guidance document
Destination Green IT	This website provides up to date information and advice on low carbon information technology systems. Resources include reports, case studies and technological developments.	www.destinationgreenit.com	Guidance document
Energy consumption			
Energy Consumption Guide – Energy efficiency in further and higher education	This Guide, produced by the Carbon Trust, is intended to assist estates and energy staff in HEIs to assess energy use across a range of building types. It provides information on how to assess energy performance as well as quantifying the potential for making energy use savings.	Carbon Trust, The Higher Education Carbon Management Programme v1.2, available on CD from the Carbon Trust	Guidance document
Energy Consortium	The Energy Consortium is a not-for-profit organisation, with 160 members from the FE and HE sectors. The consortium procures energy supplies on behalf of its members.	www.energyconsortium.org.uk	Organisation
Energy Saving Trust	The Energy Saving Trust provides advice and information to help organisations, including those in the public sector, reduce carbon dioxide emissions.	www.energysavingtrust.org.uk	Organisation
Carbon Trust	The Carbon Trust website includes a wide range of publications on carbon related policies, actions and case studies.	www.carbontrust.co.uk under Publications	Guidance document

Resource	Description	Source	Resource type
Procurement			
Office of Government Commerce	The Office of Government Commerce looks to encourage sustainable practices across Government, supporting environmental, social and economic sustainability.	www.ogc.gov.uk under Sustainability	Organisation
PAS 2050 – Assessing the life cycle greenhouse gas emissions of goods and services	A Publicly Available Standard (PAS) for a method for measuring the embodied greenhouse gas emissions from goods and services.	www.bsigroup.com under Standard & conferences/How we can help you/BSI shop/PAS 2050	Guidance document
Energy Technology List	The Energy Technology List provides information on products which meet Government-approved low carbon and efficient technology criteria.	www.theccc.org.uk	Guidance document
Waste			
Waste conversion factors	The EMS website provides a list of over 1,300 waste conversion factors to assist in calculating carbon emissions from waste.	www.opdems.ac.uk	Guidance document
Space use and management			
UK Higher Education Space Management Group	The UK Higher Education Space Management Group 'has been set up to assist higher education institutions to identify and implement best practice in the management of space'. The link is to a list of reports and tools, including practice, performance and guidelines as well as case studies.	www.smg.ac.uk	Organisation / Guidance documents

Resource	Description	Source	Resource type
The SMG Model of the Affordable Estate	The SMG model is based on EMS data, and allows HEIs to calculate and benchmark sustainable and total estate provision.	www.smg.ac.uk under Reports/Tools/The Model	Toolkit
Greenbuild initiative (Building Research Establishment): BREEAM for Higher Education (Apr 2008-Apr 2009)	The Greenbuild initiative 'BREEAM higher education' aims to develop a template approach for higher education buildings.	www.heepi.org.uk under BREEAM for HE	Programme
Greenbuild initiative (Building Research Establishment): High Performance Laboratories (July 2008-Apr 2011)	The Greenbuild initiative 'High Performance Laboratories' aims to 'support environmental improvements in the design and management of labs' as well as raise environmental awareness.	www.heepi.org.uk under GreenBuild	Programme
Behavioural change			
Forum for the Future – Higher Education Partnership for Sustainability (HEPS) project (now ended)	The HEPS project, which involved 18 universities and colleges, focused on integrating sustainability considerations into HEIs.	www.forumforthefuture.org	Programme
Student involvement			
NUSSL	Sound Impact is a NUSSL accreditation scheme, whereby Student Unions sign up to implement practical activities linked to reducing their environmental impact.	www.nussl.co.uk under Ethical & Environmental	Programme

Resource	Description	Source	Resource type
Student Switch Off	The Student Switch Off is an energy-saving competition. Students living in different halls of residence compete to reduce energy usage.	www.studentswitchoff.org	Programme
Transport			
Carbon Trust – Organisational Sustainable Transport – Options and Opportunities	Implementing travel plans and changing travel habits of staff and students can be difficult. This briefing note identifies travel plans options for institutions and provides information and advice on implementation.	Carbon Trust, The Higher Education Carbon Management Programme v1.2, available on CD from the Carbon Trust	Guidance document
Carbon Trust – External Funding For Carbon management programs	This briefing note provides information on how to secure external funding for carbon management projects, including sources of European funding and low- or zero-cost support services.	Carbon Trust, The Higher Education Carbon Management Programme v1.2, available on CD from the Carbon Trust	Guidance document
Energy Savings Trust – Transport	This website provides a range of documents and case studies which can help institutions to manage travel fleets effectively.	www.energysavingtrust.org.uk under Business & public sector/Transport in business	Guidance document
Sustainable Transport Awards	The Sustainable Travel Awards recognise achievement across a range of environmental issues, including low carbon transport and sustainable transport awareness campaigns.	www.sustainabletransportshow.com under STS awards	Award

Resource	Description	Source	Resource type
Curriculum			
The Sustainability Curriculum	This document provides information and advice on integrating sustainability and environmental issues into the curriculum.	Blewitt, J and Cullingford, C (2004), 'The sustainability curriculum: the challenge for higher education' (Earthscan, 2004)	Guidance document
Funding			
Intelligent Energy Europe (European Commission)	This programme funds initiatives in the following areas: • SAVE – improvements in energy efficiency and demand management • ALTENER – new and renewable energy sources for centralised and decentralised production • STEER – energy aspects of transport, the diversification of fuels and the promotion of renewable fuels and energy efficiency in transport • COOPENER – promotion of renewable energy sources and energy efficiency in developing countries.	www.ec.europa.eu under Funding/Grants/Energy/"Intelligent Energy Europe" programme	Funding
7th Framework Programme (European Commission)	This programme funds initiatives in the following areas:: • SUSTAINABLE ENERGY SYSTEMS – research and development projects into cleaner energy technologies plus research into the impact of new energy technologies on society, the economy and employment • CIVITAS II –sustainable surface transport • CONCERTO – supports local communities in developing initiatives that are sustainable and highly energy efficient.	www.cordis.europa.eu under 7th Framework Programme	Funding

Resource	Description	Source	Resource type
Bio-energy Capital Grants (AEA)	Open to industrial, commercial and community sectors; provides grants for the installation of biomass fuelled heat and CHP projects.	www.bioenergycapitalgrants.org.uk/	Funding
Revolving Green Fund (Salix/HEFCE)	The Revolving Green Fund provides ring-fenced, interest-free grants to HEIs for energy/carbon saving projects.	www.salixfinance.co.uk under Higher Education	Funding
Low Carbon Building Programme – Phase 2 (BERR)	This programme provides research funding linked to the development and commercialisation of carbon reduction technologies.	www.lowcarbonbuildingsphase2.org.uk	Funding
Applied Research Programme (Carbon Trust)	Grants to supply 50% of cost of installing approved micro generation.	www.carbontrust.co.uk under Innovations/Applied Research	Funding

Appendix A Conversion factors

1. The Department for the Environment, Food and Rural Affairs (DEFRA) has developed conversion factors which can be used to calculate carbon emissions for a given fuel. The figures below are for the year 2008, institutions should check for updates on the DEFRA website (www.defra.gov.uk). These conversion factors are used for the Estates Management Statistics.

2. Different energy fuel mixes result in different levels of CO_2 emissions. The following CO_2 conversion factors should be used to calculate the CO_2 emission per unit of energy.

Table A-1: Conversion factors by fuel type

Type	Units	Kg CO_2 per unit
Fuels		
Natural gas	kWh	0.206
	Therms	6.023
Gas oil	Tonnes	3.190
	kWh	0.265
	Litres	2.674
Diesel	Tonnes	3.164
	kWh	0.263
	Litres	2.630
Petrol	Tonnes	3.135
	kWh	0.252
	Litres	2.315

Source: DEFRA,, Guidelines to Defra's GHG conversion factors, 2008[18]

3. Conversion figures for electricity use reflect the fuel mix for each year.

Table A-2: Electricity conversion factors by year

Year	Kg CO_2 per unit
1990	0.77000
1991	0.75000
1992	0.70000
1993	0.62000

[18] For more information see www.defra.gov.uk under Environmental protection/Business & sustainability/Environmental reporting/Greenhouse gas conversion factors.

Year	Kg CO_2 per unit
1994	0.61000
1995	0.58000
1996	0.56487
1997	0.52102
1998	0.52276
1999	0.49064
2000	0.51946
2001	0.53524
2002	0.51879
2003	0.53481
2004	0.53478
2005	0.53485
2006	0.56185

Source: DEFRA,, Guidelines to Defra's GHG conversion factors, 2008

4. Conversion figures for road transport reflect the fuel type.

Table A-4: Conversion factors for road transport

Fuel	Kg CO_2 per litre
Petrol	2.3154
Diesel	2.6304

Source: DEFRA,, Guidelines to Defra's GHG conversion factors, 2008

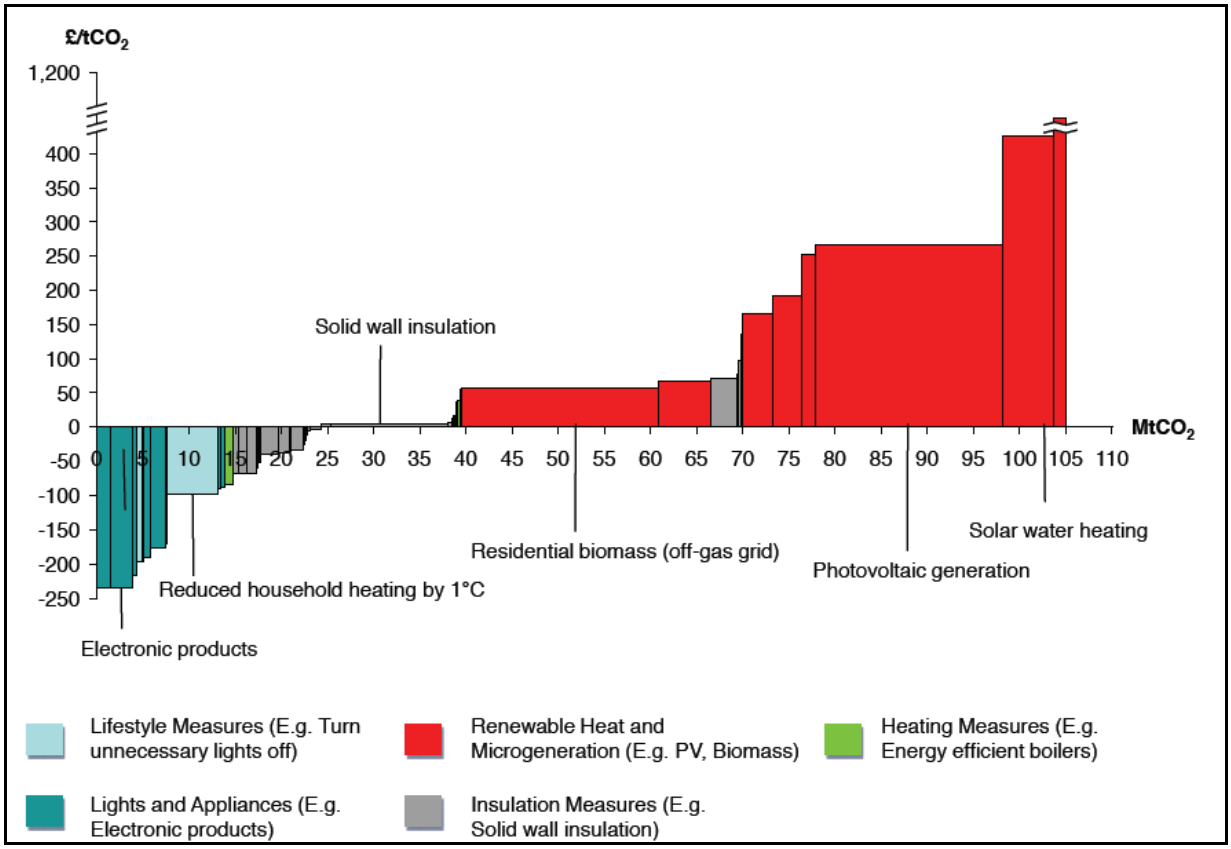
Appendix B: Examples of Marginal Abatement Cost Curves (MACC)

1. The MACC is a commonly used assessment and decision-making tool regarding carbon-reduction interventions that captures several key parameters. Firstly, on the vertical axis, it shows the absolute cost-effectiveness of each intervention as cost (£) of saving a unit of carbon (tCO_2). This is calculated on a lifecycle basis, i.e. capturing all costs (capital and operational) and revenues (income and/or cost savings) and also factoring in inflation and amortisation (discount rate, as %). These are then set against the total carbon saved over an intervention's entire life. Interventions that appear below the line will generate net cost savings/revenues over their life and those above the line will not pay off for themselves. Interventions are plotted in order of their cost-effectiveness, from low to high cost.

2. Secondly, on the horizontal axis, the MACC shows how much carbon each intervention will save over its life (the width of each bar) and the cumulative impact of interventions if they are all implemented.

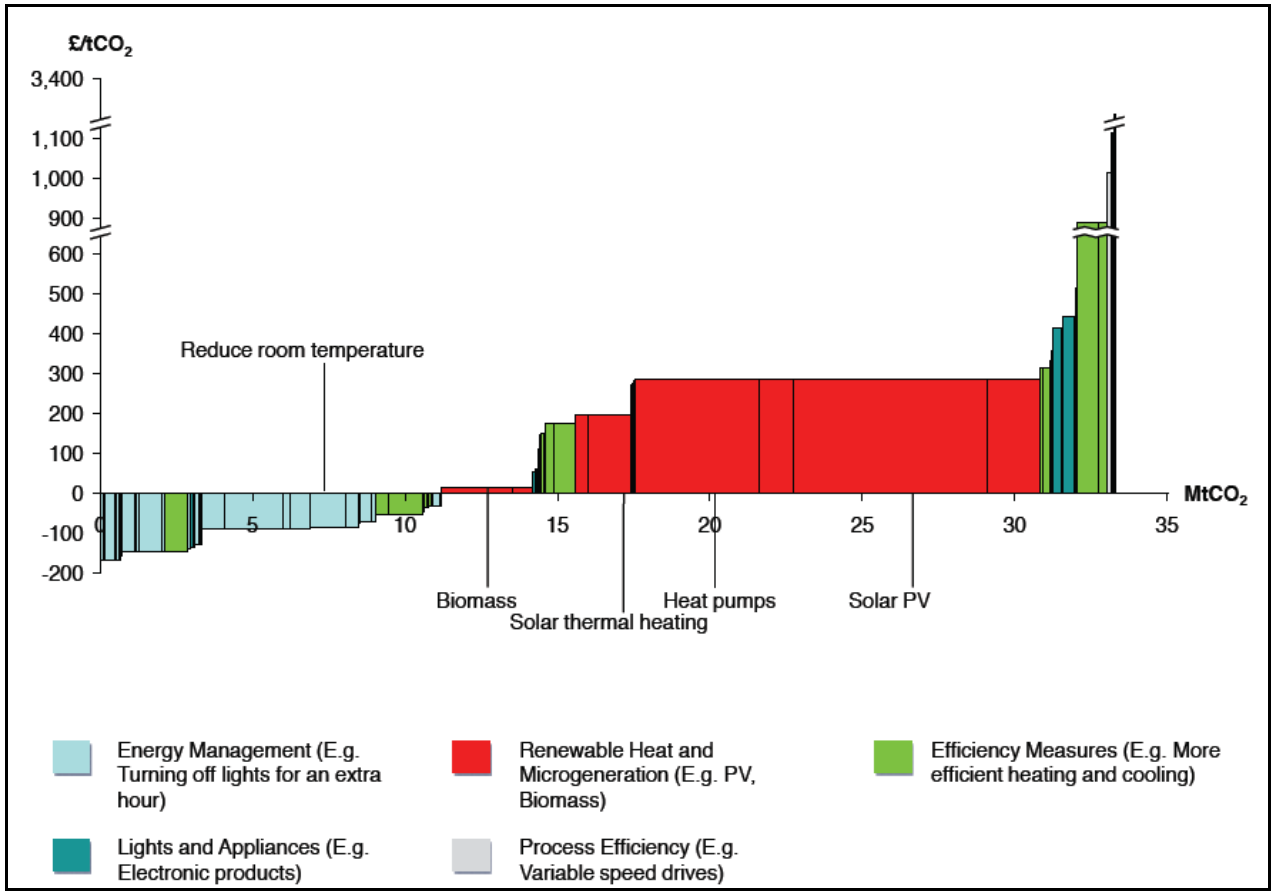
3. The first report of the Committee on Climate Change (December 2008) introduces some generic MAC curves for the UK as a whole, which provide a good indication of some of the typical costs and abatement potential of different types of intervention. Two of the most useful MAC curves, for residential and non-residential buildings, are reproduced here.

Figure A-1: Marginal abatement cost curve in 2020 for residential buildings at the UK level, 2008



Source: Committee on Climate Change, 2008

Figure A-2: Marginal abatement cost curve in 2020 for non-residential buildings at the UK level, 2008



Source: Committee on Climate Change, 2008