# Carbon Management Plan 2015/16– 2019/20

## Contents

# Executive Summary

This Carbon Management Plan (CMP) builds upon the foundations laid within the University's 2009 Plan and confirms the University's commitment towards strong action on climate change. The CMP sets out the University's strategy and ambitions toward reducing greenhouse gas emissions associated with the UK campuses in the period to 2019/20, identifying the 2014/15 baseline emissions against which progress will be measured and describing the main initiatives via which reductions in emissions will be achieved.

The continued growth in the University's estate presents a challenge to absolute reductions in greenhouse gas emissions, but the planned implementation of projects described within the CMP allows the University to set targets for a **15% absolute reduction** in greenhouse gas emissions between 2014/15 and 2019/2020 and a 10% relative energy efficiency target (measured in relation to internal area) over the same period. The CMP summarises individual carbon reduction projects which will contribute to attainment of the University's targets, including well-defined projects that are imminently planned, projects in development and less well-defined pipeline projects which are likely to contribute later in the implementation of the Plan.

Arrangements surrounding management and delivery of the programme are described in detail within the CMP and will involve formal annual reporting of performance and the provision of regular updates to Campus Services Management Board and Campus Committee. The University will submit annual external Climate Change Reports to the Scottish Government in accordance with mandatory requirements applying to major players in the public sector in Scotland from 2015-16.

Carbon reduction opportunities associated with the University's built estate form the main focus of the Plan. Implementation of the University's Environmental Policy and the operation of further action plans and policies relating to green travel, waste, water and sustainable procurement will support the CMP and the attainment of the University's carbon reduction targets.

The CMP has been developed as a "live" document and will be reviewed on an annual basis by Campus Committee. This will allow changing investment priorities and opportunities to be accommodated – energy efficiency technologies are evolving rapidly and as a result investment strategy is likely to change during the period of the Plan.

# Foreword from the Principal of the University

The scale of the risks and challenges presented by climate change was laid bare in discussions at the Paris Climate Conference (COP21) in December 2015. While the University has already done much to reduce its climate change impact there remains a great deal of opportunity for further action. The University's status as a leading centre of expertise on climate change mitigation and adaptation leaves us ideally positioned to respond and contribute meaningfully to the development of best practice and the attainment of Scottish and UK greenhouse gas emission reduction targets.

In addition to continuing to provide leading research and teaching addressing all aspects of society's response to climate change, the nature of the climate change challenge dictates that we must act swiftly to reduce our own emissions, with a renewed focus on our estate and operations. The University is committed to taking strong action on climate change and this Carbon Management Plan identifies the short to medium term actions that will allow this commitment to be realised and that will ultimately assist transition towards the University's long term vision for a low to zero carbon estate.

**Professor Richard A. Williams, Principal and Vice-Chancellor of the University**

**17th October 2016**

*Solar powered ventilation units and solar PV array, the Lyell Building, Edinburgh Campus*

# Introduction

The University reduced energy use emissions per student full time equivalent (FTE) between 2007/8 and 2014/15 by more than 27.9%, or by 6.7% in unadjusted (absolute) terms. This Carbon Management Plan (CMP) seeks to build on these improvements and achieve significant further reductions in emissions, allowing the University to support the attainment of Scottish and UK emission reduction targets while realising substantial energy cost savings.

The CMP outlines an emissions baseline relating to 2014/15 and the main carbon reduction measures that the University plans to implement during 2015/16 to 2019/20. These can be summarised under the following strategic themes:

- Developing a low carbon heat strategy, potentially including the development of campus wide or localised district heating systems.
- Improving building fabric to enhance the energy performance of the existing estate.
- Minimising energy use in the existing estate by installing energy efficient technologies (notably LED lighting) and by making ongoing improvements to control systems and their configuration.
- Ensuring that new buildings and refurbishments deliver outcomes with the highest achievable levels of energy performance.
- Engaging effectively with students, staff and all users of the University's facilities in relation to energy efficiency and broader sustainability issues, to raise the profile of environmental sustainability within the University community and help to minimise unnecessary energy and resource use.

# Context & Drivers

**National targets and duties**

The reduction of greenhouse gas emissions to mitigate climate change is one of the foremost challenges of the 21st century, reflected in the Paris Agreement resulting from the Paris Climate Conference (COP21) in December 2015. Governments agreed a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels, with an aim to limit the increase to 1.5°C if possible.

The UK and Scottish Governments have established legislation, targets and a broad array of mechanisms to enable reductions in emissions to occur, with both governments placing an emphasis on the public sector setting a leading example.

The University, in common with all Scottish public bodies, is placed under legal duties by the Climate Change (Scotland) Act 2009 to:

- act in a way best calculated to contribute to the delivery of targets under the Act including a 42% reduction in greenhouse gas emissions by 2020 and an 80% reduction by 2050 (in the case of $CO_2$ these reductions are against a 1990 base year)
- act in a way best calculated to support climate change adaptation programmes
- act in a way that it considers is most sustainable

The Scottish Government have announced plans to increase the 2020 emission reduction target from 42% to 50%. Further duties under the Climate Change (Scotland) Act include, from 2016, requirements to assess and improve the energy performance of large non-domestic buildings prior to their sale or lease. The operation of a CMP is an important step towards allowing the University to comply with all of these requirements.

**Other drivers for carbon management**

The Scottish Further and Higher Education Funding Council (SFC) works to support the attainment of national emission reduction targets and aims to drive carbon reduction across the sector; for example SFC aims to ensure that universities "contribute to the delivery of Scotland's targets for significantly reduced greenhouse gas emissions."

The case for carbon reduction is further strengthened by the substantial operating cost savings that can be achieved as a result of making efficiencies in the University's consumption of utilities, in particular electricity and natural gas, the combined expenditure for which exceeds £3.4M per annum.

## Governance and Embedding of Carbon Management

**Embedding and Strategic Alignment**

In 2015 the University's long term commitment towards climate change action was demonstrated by the re-signing of the Universities & Colleges Climate Commitment for Scotland by the Principal and the Chair of the University Court. The statement includes commitments to reduce greenhouse gas emissions in support of national programmes and to maintain a five year climate action plan: this Carbon Management Plan represents the University's climate action plan.

UCCCS
Universities and Colleges
Climate Commitment for Scotland

The Heriot-Watt Environmental Policy outlines the University's high level environmental ambitions, while other key plans, policies and strategies operated by the University support sustainability and climate change action and therefore ultimately support the implementation of this Plan:

- The Edinburgh Campus Strategic Masterplan
- The Edinburgh Campus Estates Strategy
- The Edinburgh Campus Design Guide
- The University Capital Projects Programme 2015-2020
- The University Sustainable Procurement Policy

Review processes surrounding the University's other main strategic planning documents will formally consider opportunities to improve alignment with the University's sustainability and carbon reduction objectives, further embedding carbon management within the University's decision-making processes.

**Partnerships and collaboration**

Working collaboratively with other bodies and institutions provides opportunities to discover and exploit carbon reduction synergies, and the University will continue to work closely with peer and partner institutions in relation to climate change action. Examples of current collaboration include extensive engagement with the Environmental Association for Universities and Colleges (EAUC) and project work with Zero Waste Scotland / Resource Efficient Scotland. In addition the University is an active member of the Edinburgh Sustainable Development Partnership, a group involving City of Edinburgh Council and partner institutions which provides strategic leadership on the sustainable development of Edinburgh. The University has also pledged support to the City of Edinburgh's 'Sustainable Energy Action Plan' (SEAP), which establishes a city-wide 42% emission reduction target for 2020 (against a 2005 baseline) and acts to realise the City's commitment as a signatory to the Covenant of Mayors.

**Communication**

Effective action against climate change will require action from all members of the University community, and will be a core focus within a new sustainability engagement strategy under development in 2016. The strategy will address messaging on the practical measures everyone can apply to reduce their environmental impact, in addition to information on the processes, systems and resources operated and made available by the University to support sustainability. The Individual, Social, Material (ISM) behavioural model, promoted by the Scottish Government, will be used to guide development of the strategy as a means of promoting low carbon behaviours.

**Roles and responsibilities**

Responsibility for implementation of this Plan rests with relevant project owners while programme co-ordination, monitoring and reporting of performance are the responsibility of Estates Services.

Implementation will therefore occur under the control of the University Executive via the Director of Campus Services, Campus Services Management Board and Campus Committee, which is a Committee of the University Court.

**Reporting**

Progress in the implementation of this Plan and towards achievement of the University's emission reduction target will be reported on a regular basis via Estates Services and the Director of Campus Services to Campus Services Management Board and Campus Committee.

The University reports energy and emissions performance externally under mechanisms including the Estates Management Record (EMR) submitted to the Higher Education Statistics Agency (HESA) and reporting under the CRC (Carbon Reduction Commitment) Energy Efficiency Scheme.

In 2015 the Scottish Government introduced new climate change reporting requirements for large institutions within the public sector under the Climate Change (Duties of Public Bodies: Reporting Requirements) (Scotland) Order 2015. The new arrangements involve the submission of an annual report detailing energy and emissions performance data along with information regarding carbon management governance arrangements, detail of carbon reduction planning (including projects implemented during the relevant year and projects planned for the following year) and information regarding steps taken by the institution to adapt to the effects of climate change. The new reporting framework introduces a universal reporting template and provides an additional focus on climate change performance within the sector. From 2016 the University will be required to submit an annual Climate Change Report in compliance with the requirements of the 2015 Order; a voluntary submission was submitted during a pilot reporting process in 2015. Information submitted within climate change reports will be published via the Sustainable Scotland Network (SSN) website.

**Review and update**

In order to maintain this Carbon Management Plan as a relevant and "live" framework for climate change action, a review of the Plan will be completed by Estates Services each year, to coincide with the preparation of the University's external Climate Change Report. Should significant changes occur to climate change investment priorities or should the University's carbon reduction targets be achieved in advance of 2019/20, the Plan will be formally reissued. An additional stretch target will be established for the remainder of the Plan period in the case of early achievement of the University's carbon reduction target.

## Strategic Vision and Themes

An effective response to climate change requires action to be taken in the short and medium term, but also requires that action taken should be consistent with (and ultimately lead toward) a long term low to zero carbon vision. The University's long term vision for a low to zero carbon estate, relating to the period 2030 to 2050, is one where:

- Buildings are designed to minimise operational energy use by incorporating passive rather than active environmental control strategies wherever possible, for example prioritising natural lighting, ventilation and cooling over electrical / mechanical equivalents. Optimal whole building design fully considers use of relevant internal spaces alongside building form, location, orientation, thermal mass, envelope (insulation / air tightness), daylight and solar control.

- The embodied energy and carbon associated with new build and refurbishment project options is effectively minimised through the application of lifecycle analysis – as operational energy demand is reduced, embodied energy becomes a more critical element within building whole lifecycle energy and carbon balances.

- The energy performance of legacy buildings is substantially enhanced by improvements to building fabric including the installation of high performance glazing, additional insulation and improvements to air tightness.

- Electricity from the grid is largely decarbonised and is used as efficiently as possible, for example in the provision of electrical and mechanical services. Use of grid electricity is reduced by renewable generation from building integrated and retro-fit installations.

- Low carbon heat technologies have substantially displaced the conventional use of fossil fuel (natural gas) for space and hot water heating. Low carbon heat options are likely to continue to evolve but candidate technologies include biomass, heat pumps (air-source, water/wastewater-source and ground-source), geothermal and solar thermal heating.

In alignment with the long term vision, this Carbon Management Plan for 2015/16 to 2019/20 outlines initiatives that can be summarised under the following strategic themes:

- Developing a low carbon heat strategy, potentially including the development of campus wide or localised district heating systems.

- Improving building fabric to enhance the energy performance of the existing estate.

- Minimising energy use in the existing estate by installing energy efficient technologies (notably LED lighting) and by making ongoing improvements to control systems and their configuration.

- Ensuring that new buildings and refurbishments deliver outcomes with the highest achievable levels of energy performance.
- Engaging effectively with students, staff and all users of the University's facilities in relation to energy efficiency and broader sustainability issues, to raise the profile of environmental sustainability within the University community and help to minimise unnecessary energy and resource use.

# Baseline & Projections

**Baseline (2014/15)**

In preparation for the University's initial climate change report under the Climate Change (Duties of Public Bodies: Reporting Requirements) (Scotland) Order 2015, a new emission baseline was established for 2014/15 that reflected boundary changes and the University's status at the Scottish Borders Campus in Galashiels, where the University is co-located with Borders College. The baseline is described in terms of emissions scopes as defined within scopes 1, 2 and 3, where:

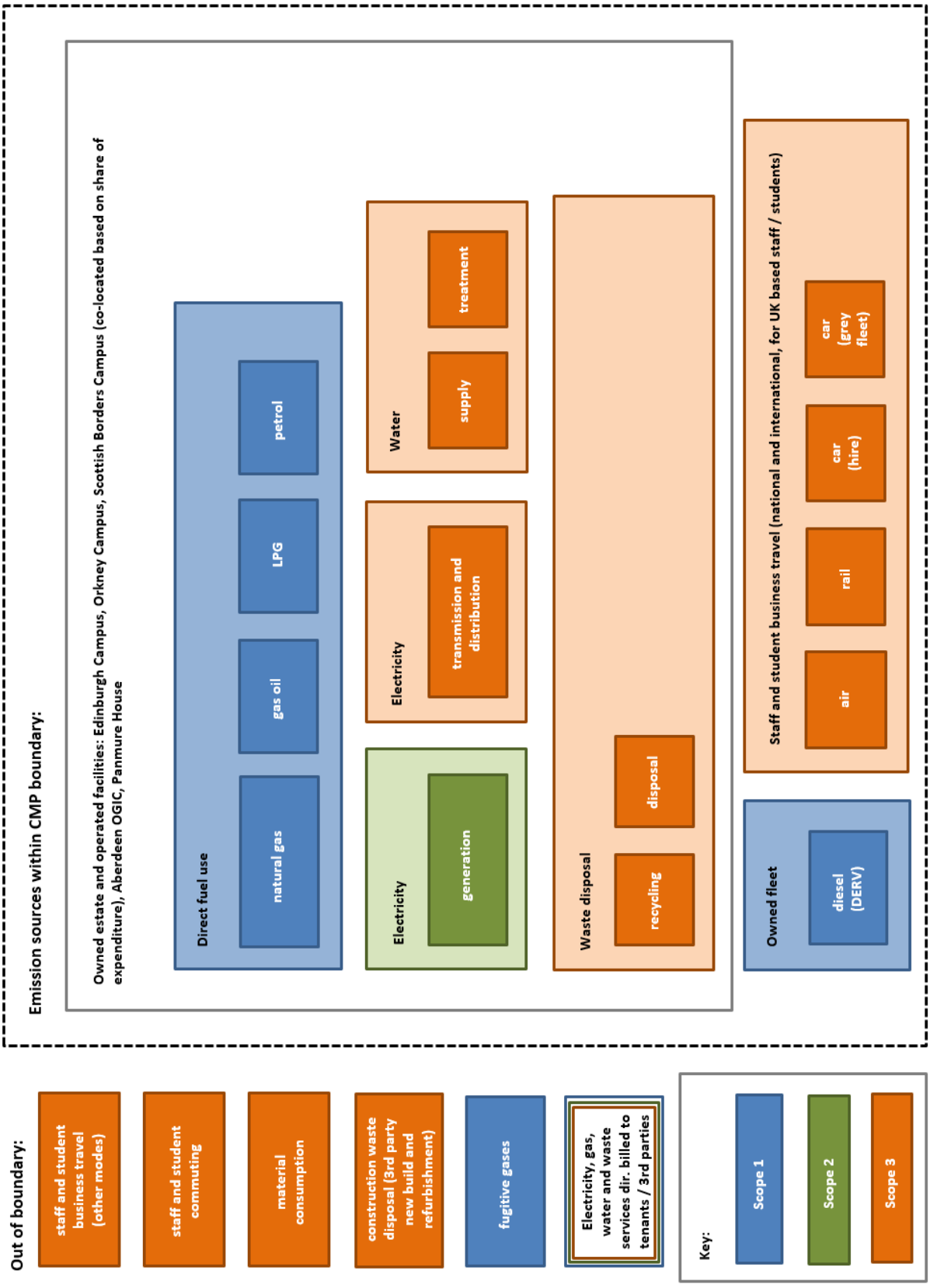
- Scope 1 relates to direct emissions associated with sources owned or controlled by the University, including for example boilers and owned vehicles.
- Scope 2 relates to indirect emissions associated with the generation of purchased electricity a heat.
- Scope 3 relates to other indirect emissions, for example those associated with purchased goods and services including waste management, water and business travel.

| Source | Emissions Scopes | $tCO_2e$ (2014/15) | % |
|---|---|---|---|
| Grid Electricity | 2, 3 | 10,493.7 | 48.6 |
| Natural Gas | 1 | 7,110.0 | 32.9 |
| Other Fuels | 1 | 214.4 | 1.0 |
| Waste | 3 | 261.3 | 1.2 |
| Water | 3 | 339.5 | 1.6 |
| Business Travel | 3 | 3,165.1 | 14.7 |
| Total | 1, 2, 3 | 21,584.0 | 100 |

While data confidence surrounding energy and water related emissions is high, data relating to travel was derived partly from estimation techniques: the University is working to improve the quality of travel related emissions data in future climate change reports.

The following figure identifies the emissions boundary that defined 'included' and 'excluded' emissions sources during the calculation of the University's 2014/15 emission baseline. The boundary will be used to provide a consistent approach to future reporting of emissions.

**Heriot-Watt University - Emission Reporting Boundary**



**Growth and emissions projections**

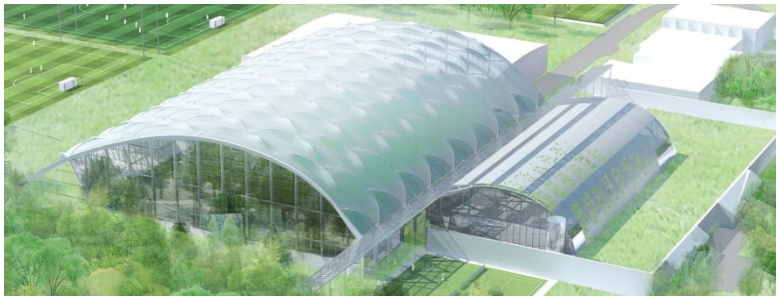
Several significant new developments at the Edinburgh Campus are scheduled for completion during 2015/16 and 2016/17, and the University's underlying growth means that further developments are likely during the period of the Plan. Recent and current developments include:

- The Charles Lyell Centre, comprising the Lyell Building and the Lyell Support Building; a collaboration between the University and British Geological Survey (BGS) which opened in February 2016.
- Oriam - Scotland's Sports Performance Centre, opening late summer 2016.
- New Residences - halls of residence including 450 bedrooms, opening for the 2016/17 session.

The new developments are designed to substantially higher energy and sustainability standards than much of the University's existing estate (to BREEAM "Excellent" standard in the case of the Charles Lyell Centre and the New Residences) but the significant growth in the total size of the estate is nonetheless predicted to increase the University's greenhouse gas emissions by approximately 5%.

**Decarbonisation of grid electricity**

A counteracting effect is likely to be presented by decarbonisation of grid electricity under the effect of increased renewable electricity generation and policies and legislation including the Large Combustion Plants Directive, the Carbon Price Floor and Government plans to close all UK coal-fired power stations by 2025. The combined effect of these changes will be a reduction in the carbon intensity of grid electricity from the value of approximately 500gCO2e/kWh in 2015, although considerable uncertainty remains regarding the future trajectory of decarbonisation.



# Targets

Recognising both the University's growth during the period of the plan and the potential impact of moderate simultaneous decarbonisation of grid electricity, the planned implementation of projects described within this CMP allows the University to establish the following absolute emission reduction target for 2019/20:

| Sources | Emissions Scopes | Baseline $tCO_2e$ (2014/15) | Target $tCO_2e$ (2019/20) | Target Reduction $tCO_2e$ | Target Reduction % |
|---|---|---|---|---|---|
| Electricity, Gas, Other Fuels, Waste, Water, Business Travel | 1,2 and 3 | 21,584 | **18,346** | **2,590** | **15%** |

The 15% target reduction in absolute emissions between 2014/15 and 2019/20 represents the equivalent of an annual 3.2% reduction in absolute emissions.

As described in the "Governance and Embedding" section of this Plan, carbon reduction performance will be reported annually, both internally and externally via public sector reports. If the University's absolute carbon reduction target is achieved in advance of 2019/20 the University will set an additional stretch target for the remainder of the Plan period.

A sustainability reporting project by the Association of University Directors of Estates (AUDE) has led to the development of a new set of green metrics and a "Green Scorecard" for the sector. One of the main energy metrics concerns annual changes in total building energy consumption across the estate (residential and non-residential) normalised according to the total net internal area, i.e. annual changes in kWh/m2(NIA) across the estate. The metric will be calculated according to data submitted in each institution's HESA Estates Management Record return. The University will use the metric as the basis for a normalised energy performance target that is independent of emission factors, as described in the table below.

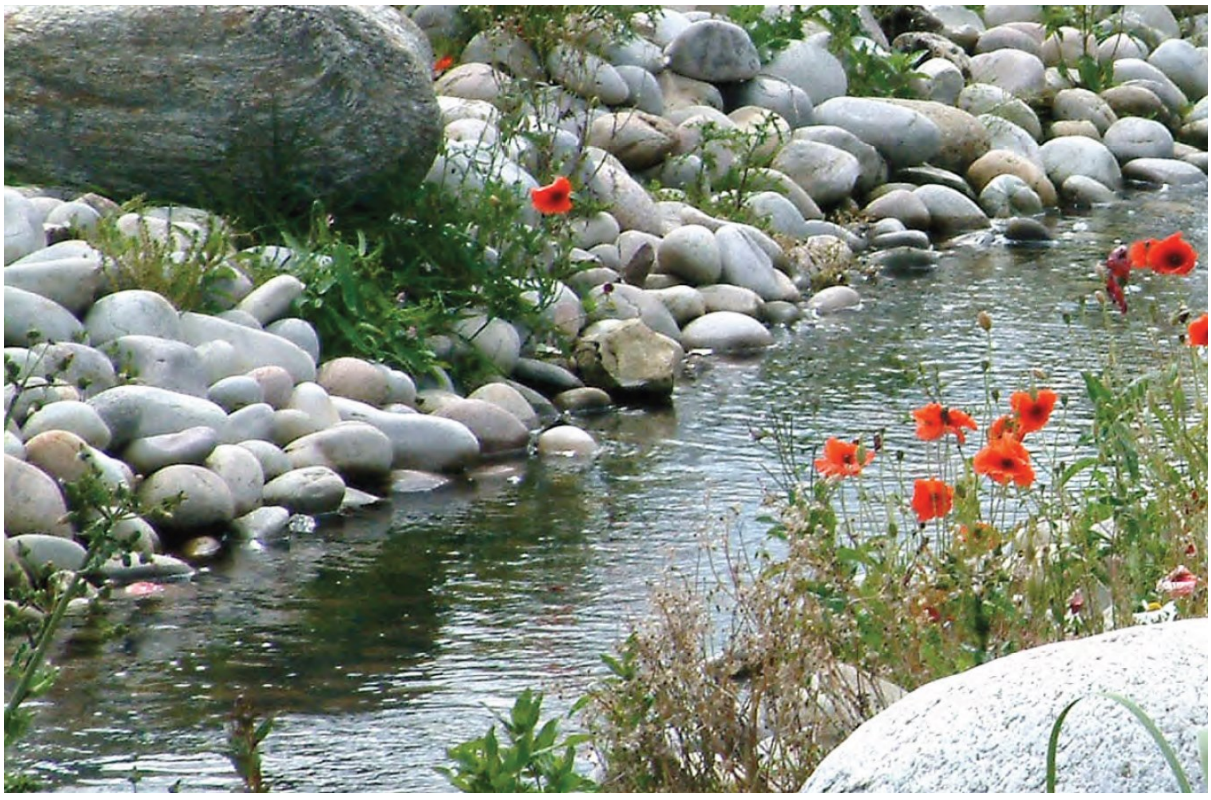
| Baseline Energy Consumption Total (kWh, 2014/15 HESA EMR) | Baseline Total Net Internal Area (m2, 2014/15 HESA EMR) | Baseline Total kWh/m2 Net Internal Area (2014/15) | Target kWh/m2 Net Internal Area (2019/20) | Target improvement kWh/m2 | Target improvement % |
|---|---|---|---|---|---|
| 58,031,644 | 122,113 | 475.2 | **427.7** | **47.5** | **10.0** |

The achievement of the CMP emission reduction target will be supported, in relation to reported Scope 3 emissions, by the development of sustainability action plans and associated targets relating to water, waste, and green travel in 2016/17. Management of the embodied energy and carbon impacts associated with new developments and the sustainability impacts associated with procured goods and services will be addressed during revision of the University's policy and planning surrounding sustainable procurement.

## Climate Change Adaptation

Climate change adaptation involves responding to the risks associated with the changing climate and is an increasingly important element of climate change action, reflected in the Climate Change (Scotland) Act duty on public sector bodies to act in a way "best calculated to deliver any statutory adaptation programme". The University has initiated a process to complete a formalised assessment of climate related risks, the outcomes of which will inform the development of a Climate Change Adaptation Plan. Key risks are likely to include those associated with increased frequency of extreme weather events, for example intense rainfall leading to flooding and summer temperature increases leading to the potential for buildings to overheat. Development of the risk assessment and the plan will utilise tools and resources available via the UK Climate Impacts Programme (UKCIP) and Adaptation Scotland.

Annual review of this Carbon Management Plan will provide an opportunity to formally link or integrate the outcomes of the University's climate change risk assessment and Climate Change Adaptation Plan.



## Finance

The carbon reduction projects described within this CMP will be funded from a variety of sources including:

- The University's Salix Energy Efficiency Recycling Fund, a revolving fund established in 2015/16 with contributions from the University's Long Term Maintenance budget and a zero interest loan from Salix Finance Ltd. It is planned that the Fund will initially be applied to projects with some of the shortest payback periods (often LED lighting projects), allowing for short financial recycling periods and for the Fund to be "worked" hard.
- Long term maintenance (LTM) and capital funding. Funding from LTM and capital budgets will be applied as appropriate to support the objectives of this CMP, with LTM funding being applied to projects including insulation upgrades and window replacements. Implementation of the University's Capital Projects Programme 2015-2020 provides a major opportunity to improve energy efficiency during refurbishment of existing facilities.
- External commercial funding (if considered appropriate). The University may elect to apply for commercial funding for large projects, which could potentially be developed within the context of an Energy Performance Contract (EPC) or alternative framework.

## Carbon Reduction Projects

The implementation of this CMP will allow the University to build upon the successes of recent carbon reduction projects (completed prior to the 2015/16-2019/20 term of the Plan) including:

- Installation of LED lighting on roadways and paths across the Edinburgh Campus, saving approximately 130 $tCO_2e$ per year and reducing street lighting electricity demand by 75%.
- Roof replacement and insulation enhancement projects across many of the original buildings at the Edinburgh Campus.
- Numerous internal lighting and lighting control projects, latterly involving upgrade from fluorescent to LED lighting.
- Server rationalisation and virtualisation to reduce ICT services electricity consumption.
- Boiler and hot water system replacements to replace many of the legacy systems that dated to the first development of the Edinburgh Campus.
- Upgrades to heating, ventilation and air conditioning control via the Building Management System, complemented by the installation of variable speed drives (inverters) on many of the major pump sets and fans across the estate.

The following tables summarise projects for implementation within the term of the Plan.

**Projects targeted for completion during 2015/16 and 2016/17**

| Project Details | | Project Summary |
|---|---|---|
| **LED Lighting - Cameron Smail Library** | | More than 900 fluorescent tubes were replaced with LED equivalents, reducing the lighting electrical load in the Library by approximately 40kW. Significant energy savings achieved with 24/7 operation of the Library. |
| Investment | Approx £12K + labour | |
| Payback period (yrs) | 1 | |
| Annual $tCO_2e$ saving | 120 | |
| Scheduling | **Complete** Summer 2015 | |
| **LPG Boiler Installation - Hermiston House** | | The old oil-fired boiler plant was dated and presenting service difficulties. An LPG system was installed to reduce maintenance / operating costs and emissions. |
| Investment | £72K | |
| Payback period (yrs) | 30 (less incl. maintenance savings) | |
| Annual $tCO_2e$ saving | 7 | |
| Scheduling | **Complete** Summer 2015 | |
| **Roof Replacement – Hugh Nisbet Building (High Level)** | | The roof was replaced to maintain building fabric and enhance insulation levels. |
| Investment | £60K | |
| Payback period (yrs) | 50+ | |
| Annual $tCO_2e$ saving | 5 | |
| Scheduling | **Complete** Summer 2015 | |
| **Roof Replacement – Allen McTernan Building** | | The roof was replaced to maintain building fabric and enhance insulation levels. |
| Investment | £114K | |
| Payback period (yrs) | 50+ | |
| Annual $tCO_2e$ saving | 7 | |
| Scheduling | **Complete** Autumn 2015 | |
| **Boiler Replacement - Edinburgh Business School** | | The boilers at Edinburgh Business School were operating inefficiently and had developed a mechanical fault. They were replaced with modern high efficiency units. |
| Investment | £104K | |
| Payback period (yrs) | 15-20 | |
| Annual $tCO_2e$ saving | 30-35 | |
| Scheduling | **Complete** Autumn 2015 | |
| **Revised HVAC Control – James Watt Centre** | | A new control regime was introduced to improve the matching of heating, ventilation and air-conditioning (HVAC) plant operation with building occupancy. |
| Investment | £3K | |
| Payback period (yrs) | <1 | |
| Annual $tCO_2e$ saving | 170 | |
| Scheduling | **Complete** Winter 2015 | |
| **Library HV Transformer Replacement** | | Replacement of a 1000 kVA high voltage transformer serving the Library with a modern low-loss equivalent. |
| Investment | £30K | |
| Payback period (yrs) | 15-20 | |
| Annual $tCO_2e$ saving | 8 | |
| Scheduling | **Complete** Winter 2015 | |

| Project Details | | Project Summary |
|---|---|---|
| **Borders Campus - Wastewater Heat Recovery** | | The University is co-located with Borders College at the Borders Campus. The installation at the Campus of a SHARC sewage heat recovery system (the first of its type in the UK) provides low carbon heat sourced from the town sewer, which runs adjacent to the site. Low grade heat from the sewer is converted into useful heat by an electric heat-pump, which will result in even lower carbon emissions as the carbon intensity of grid electricity is reduced. |
| Investment | £0 (heat purchase) | |
| Payback period (yrs) | N/A | |
| Annual $tCO_2e$ saving | 87 | |
| Scheduling | **Complete** Winter 2015 | |
| **First Phase of Salix Funded LED Lighting Projects** | | The first round of LED lighting projects funded via the Salix Recycling Fund, targeted at academic buildings at the Edinburgh Campus including William Arrol, James Nasmyth, John Coulson, Earl Mountbatten, Edwin Chadwick and John Muir. The projects will involve the replacement of fluorescent tubes with LED tubes (largely using existing fittings) and replacement of multi-tube modular panels with LED panel equivalents, reducing lighting electricity consumption in upgraded areas by approximately 60%. Lighting can represent more than 40% of electricity consumption in some buildings and retrofit of LED lighting therefore presents an excellent opportunity to significantly reduce electricity consumption at low cost. |
| Investment | £172K (Salix) | |
| Payback period (yrs) | 2-3 | |
| Annual $tCO_2e$ saving | 252 | |
| Scheduling | Summer/Autumn 2016 | |
| **Second Phase of Salix Funded LED Lighting Projects** | | The second round of LED lighting projects funded via the Salix Recycling Fund. Detailed surveys of buildings are required to establish project business cases, but substantial scope for further upgrading of fluorescent to LED lighting will remain across the estate following completion of the first phase projects. |
| Investment | £213K (Salix) | |
| Payback period (yrs) | 3 | |
| Annual $tCO_2e$ saving | 296 | |
| Scheduling | Spring 2017 | |

| Project Details | | Project Summary |
|---|---|---|
| **Monitoring & Targeting / Automatic Meter Reading** | | Roll-out of further automatic metering across the estate, coupled with automatic analysis of energy consumption data via automatic monitoring and targeting (AM&T) software, provides a powerful enabling mechanism to identify areas of energy wastage and improve control of electricity and gas consumption. Live or recent energy consumption data from building sub-meters may be used to provide energy displays in high footfall areas to aid building occupant engagement and improve energy housekeeping. |
| Investment | £25K (first phase, CAPEX/Salix) | |
| Payback period (yrs) | 1 | |
| Annual $tCO_2e$ saving | Up to 335 | |
| Scheduling | 2016/17 | |
| **Low Carbon Heating Strategy for Edinburgh Campus** | | The installation of large scale gas-fired combined heat and power and an associated district heating / cooling network had previously been considered as a reduced carbon energy solution for the Edinburgh Campus, however decarbonisation of grid electricity is likely to significantly erode the carbon benefits of gas-fired CHP within a relatively short period. Low carbon heat options that are likely to maintain or improve their carbon benefits over the medium to long term include heat pumps (air-source, water/wastewater-source and ground-source), geothermal, biomass and solar thermal. Feasibilities surrounding implementation of these technologies at varying scales across the Campus are being developed, with funding potentially being available for project development work via the Low Carbon Infrastructure Transition Programme (LCITP). Projects with value in excess of £1M may be developed via the new Scottish Non-Domestic Energy Efficiency (NDEE) framework. |
| Investment | Potential grant funding for part of feasibility development. Funding for implementation to be determined (TBD). | |
| Payback period (yrs) | TBD | |
| Annual $tCO_2e$ saving | TBD | |
| Scheduling | Scoping and initial consultancy to be completed in 2016 | |

| Project Details | | Project Summary |
|---|---|---|
| **Sustainability & Energy Awareness Campaign** | | A new sustainability campaign is needed to communicate the University's sustainability objectives and enhance student and staff engagement in sustainability. Energy efficiency and carbon reduction messaging will form a central theme in the campaign. This project links with the delivery plan for Transition Heriot-Watt in 2016/17, which includes the development of student and staff energy awareness / efficiency projects and the production of an online sustainability hub which will draw together sustainability information and resources that have previously been made available separately by Estates Services and Transition Heriot-Watt. |
| Investment | £5K (LTM/Salix) | |
| Payback period (yrs) | <1 | |
| Annual $tCO_2e$ saving | 84 | |
| Scheduling | 2016/17 | |
| **Plantroom Insulation Upgrades** | | Fitting of insulation to LTHW pipework and fittings where missing in areas including Christina Miller Energy Centre, David Brewster boiler house, William Arrol Building AHU plant room, David Brewster spur DHW calorifier room, Earl Mountbatten boiler house, James Nasmyth VT pipework and valves, AHU's 3, 4 and 5 in Hugh Nisbet Building, James Watt 1 plant room, and AHU's in the Centre for Sport & Exercise (CSE). |
| Investment | £5-10K (Salix) | |
| Payback period (yrs) | 2-3 | |
| Annual $tCO_2e$ saving | 10-15 | |
| Scheduling | 2016/17 | |
| **Lord Balerno Building Boiler Replacement** | | The boiler plant is nearing the end of its working life and needs to be replaced with modern high efficiency equivalent plant. |
| Investment | £100K (Capex) | |
| Payback period (yrs) | 50+ | |
| Annual $tCO_2e$ saving | 6 | |
| Scheduling | 2016/17 | |
| **Variable Speed Drives** | | Further opportunities exist to implement variable speed drive (VSD) control on some of the University's large fans and pump sets and to re-commission existing installations to modulate motor power. Examples include AHU's 2 and 5 in Hugh Nisbet Building and major pump sets in James Watt Centre. |
| Investment | £19K (Salix) | |
| Payback period (yrs) | Approx. 3 | |
| Annual $tCO_2e$ saving | 32 | |
| Scheduling | 2016/17 | |

**Pipeline projects, projects throughout term of Plan and projects in 2017 - 2020**

| Project Details | | Project Summary |
|---|---|---|
| **Domestic Hot Water Service Upgrades** | | Domestic hot water services for several of the older buildings at the Edinburgh Campus are based on hot water calorifier systems that are relatively inefficient and maintain large storage volumes of hot water. In many cases these can be replaced with modern plate heat exchangers which facilitate reduced hot water storage volumes. In some buildings the installation of direct fired water heaters may provide an optimal solution by fully separating domestic hot water requirements from space heating provision. Candidate buildings include James Nasmyth Building, John Coulson Building, Hugh Nisbet Building, David Brewster Building, William Perkin Building and Scott Russell Building. |
| Investment | Approx. £200K (Capex – potential) | |
| Payback period (yrs) | Approx. 5-10 | |
| Annual $tCO_2e$ saving | Approx. 90 | |
| Scheduling | 2017-2019 | |
| **Solar Photovoltaic (PV) Installation** | | The Edinburgh Campus includes many areas of flat roof and trapezoidal section pitched roof that are suitable for the installation of solar photovoltaic panels, although ground mounting is also an option. This project is essentially scalable; larger or smaller installations can be accommodated relatively simply. The cost listed here relates to a notional 250kW system. The value of the Feed-in Tariff incentive for renewable generation has reduced significantly in recent years but the cost of solar PV installations has also reduced, with financial returns now deriving mainly from avoided costs associated with electricity imported from the grid. Salix funding cannot be applied to renewable energy projects where financial incentives (e.g. Feed-in Tariff payments) are available, preventing the Energy Efficiency Recycling Fund from being applied to projects of this type. |
| Investment | £250K (Capex – potential) | |
| Payback period (yrs) | Approx. 8-10 | |
| Annual $tCO_2e$ saving | Approx. 105-110 | |
| Scheduling | 2017/18 | |

| Project Details | | Project Summary |
|---|---|---|
| **Boiler Replacements** | | While contingent on the outcome of work on a low carbon heating strategy for the Edinburgh Campus, replacement of old inefficient gas boilers with high efficiency modern plant continues to represent a significant carbon reduction opportunity at the Edinburgh Campus. Several buildings operate with their original gas fired boilers, which in many cases had a maximum efficiency of around 75% when new - replacement with condensing boilers can reduce gas consumption by around 20%. Priority buildings include Leonard Horner Hall, John Coulson Building, Robert Bryson Hall, Robin Smith & George Burnett Halls (shared system) and Esmee Fairbairn Building. The costs and carbon savings listed here relate to replacement of boiler plant (and associated works) in these buildings. |
| Investment | Approx. potential Capex (priority buildings):<br>£250K: Leonard Horner Hall<br>£120K: John Coulson<br>£250K: Robert Bryson<br>£150K: Robin Smith / George Burnett<br>£90K Esmee Fairbairn | |
| Payback period (yrs) | 20+ | |
| Annual $tCO_2e$ saving | Approx. 230 | |
| Scheduling | 2017-2020 | |
| **Window Replacements** | | Many of the original buildings at the Edinburgh Campus are fitted with single glazed metal-framed windows with high U-values (high thermal transmittance) that are also associated with significant air ingress / draughts. Replacement with high performance double glazing units, particularly where combined with works to improve insulation and reduce draughts in the building fabric around the windows, will significantly improve thermal comfort for building users while reducing heat loss. Project costs listed here are indicative - detailed project proposals will be developed in relation to the relevant buildings, with priority given to buildings where window structural issues are the most severe and energy consumption is highest. Consideration can be given to building overcladding, including glazing replacement, as an alternative approach. |
| Investment | Approx. potential Capex (priority buildings):<br>£400K: Cameron Smail Library<br>£500: David Brewster (part)<br>£630K: James Nasmyth<br>£800K: William Arrol | |
| Payback period (yrs) | 35+ | |
| Annual $tCO_2e$ saving | Approx. 60-80 per building, 270 total | |
| Scheduling | 2018-2020 | |

| Project Details | | Project Summary |
|---|---|---|
| **HV Transformer Replacement** | | The Edinburgh Campus is served by a private 11kV distribution network, which includes more than 15 sub-stations housing more than 20 high voltage transformers. Many of the transformers date to the origin of the Campus and are therefore now approximately 45 years old. Transformers of this age are associated with significantly larger no load and load losses than modern equivalents, and replacement provides an opportunity to reduce these electricity losses while modernising the electrical infrastructure of the Campus. |
| Investment | £625K | |
| Payback period (yrs) | 10-14 | |
| Annual $tCO_2e$ saving | 185-250 | |
| Scheduling | TBD | |
| **Green ICT Projects** | | Opportunities to reduce electricity consumption associated with information and communications technology include the extension of network PC power management rules across further groups of users (allowing computers to switch themselves off out of hours or after extended inactivity, unless completing critical functions) and further server virtualisation to reduce the numbers and total power of servers in use. Associated projects will aim to improve information regarding ICT energy efficiency, by establishing processes to monitor data centre energy performance under established metrics (possibly including Power Usage Effectiveness, PUE). Detailed monitoring of efficiency will help to identify subsequent round projects. |
| Investment | TBD | |
| Payback period (yrs) | TBD | |
| Annual $tCO_2e$ saving | 30+ (network PC power management) | |
| Scheduling | TBD | |
| **Carbon Reduction Projects with Borders College** | | The University will engage proactively with Borders College to facilitate the implementation of further carbon reduction projects at Borders Campus, Galashiels. |
| Investment | TBC | |
| Payback period (yrs) | TBC | |
| Annual $tCO_2e$ saving | TBC | |
| Scheduling | Ongoing | |

| Project Details | | Project Summary |
|---|---|---|
| **Further Roof and Building Fabric Insulation Projects** | | Despite the completion of numerous projects to upgrade building fabric insulation, many of the buildings at the Edinburgh Campus dating from the 1970's, 1980's and 1990's would achieve significant improvements to energy performance via upgrades to wall and or roof insulation and via improvements to air-tightness. Project opportunities exist in relation to enhancing roof insulation in some halls of residence and several other buildings with pitched roofs (many flat roofs have been fitted with additional insulation during refurbishment works), with other opportunities including upgrading building fabric around link bridges and the reduction of air-ingress at building entrances. |
| Investment | (Salix / LTM) | |
| Payback period (yrs) | Approx 3-20+ years. Priority to short payback projects. | |
| Annual $tCO_2e$ saving | TBD | |
| Scheduling | Throughout period of Plan, further detailed business cases to be established. | |
| **Capital Programme Refurbishments** | | Refurbishment of teaching spaces, offices and other areas under the Capital Programme will in many cases be associated with upgrade of lighting to LED, and accompanied in some cases by improvements to building fabric (double glazing / additional wall insulation / improvements to air-tightness). Development of relevant projects is ongoing, the carbon saving figure here is a conservative estimate. |
| Investment | | |
| Payback period (yrs) | On lighting, approx 2-3 years | |
| Annual $tCO_2e$ saving | 64 | |
| Scheduling | 2016-2020 | |
| **Building Overcladding** | | Building overcladding (the refurbishment of building envelope by the application of a facade system to the existing elevation) can provide significant energy savings while extending the life of a building and providing an opportunity to update building aesthetics. As the overcladding process includes the installation of high performance double glazing this might be considered as an alternative approach to the installation of double glazing as a standalone project. |
| Investment | Approx. £2-3M per building for large academic buildings. | |
| Payback period (yrs) | TBD | |
| Annual $tCO_2e$ saving | TBD | |
| Scheduling | TBD | |