

SUSTAINABLE WAYS – ENERGY AND CARBON



TARGET 2020



University of East Anglia

**SUSTAINABLE
WAYS**

UEA Energy and Carbon Reduction Programme: 2015–2020

Through its Energy and Carbon Reduction Programme, UEA will work to deliver a low carbon campus by 2030, whilst ensuring the University remains a financially, environmentally and socially sustainable institution.

The University of East Anglia has long been a leader in the field of climate science, and much of this research has been included in the reports produced by the International Panel on Climate Change. Climate change is one of the greatest challenges facing humanity at present. UEA recognises the need to act upon the findings of research undertaken within the University and to contribute to the national and international efforts to mitigate the impacts of climate change.

Through its 2030 Vision and resulting corporate strategy, UEA intends to help prepare our students for the challenges they will face in their careers. By developing Global Citizens, we will ensure that our students are ready to work in low carbon environments, whilst still achieving the goals required in their careers.

The Energy and Carbon Reduction Programme, or ECRP, sets out UEA's carbon reduction targets and the work areas aiming to achieve these. The ECRP will be broken down into a series of five-year frameworks, of which this is the first. The below framework sits over a number of supporting reports and programmes of work, updated on an annual basis to provide the ECRP with a responsive and reflexive approach (see Appendix A).

Targets

Carbon: Reduce our campus carbon emissions by 35% by 2020, against a 1990 baseline

Energy: Reduce our energy consumption by 25% by 2020, against a 2013/14 baseline

UEA aims to match the UK's national carbon reduction targets of 35% reduction by 2020 and 80% by 2050 from a 1990 baseline, in line with the ever-changing needs of our students, researchers and funding mechanisms. If it is financially sustainable, UEA hopes to achieve this by 2030.

The ECRP specifically addresses emissions from energy generated and used on the UEA campus. Carbon emissions relating to waste, water, transport and procurement ('scope 3' emissions) are dealt with and reported elsewhere by UEA's Risk and Sustainability team.

Carbon vision statement – David Richardson, Vice-Chancellor

UEA's campus has embodied bold confidence and innovation since our beginnings in the 1960s, growing and changing to reflect the evolution of the UK Higher Education system.

In 2015 we continued to pioneer the future of education and research by opening the Enterprise Centre, Britain's greenest commercial building. I am determined that this aspirational project be an inspiration for our future buildings as well as for the entrepreneurs and low carbon organisations that have found a workspace there.

At UEA we motivate our students and staff to challenge, ask questions and think beyond boundaries and conventions to solve all kinds of problems. Research-embedded teaching is key – how can we embed technical, methodological and critical analysis skills into the teaching at UEA, skills needed in future working lives even for individuals who do not choose to pursue research further? Our Living Laboratory programme is one way that we aim to support students in becoming global citizens and sustainability ambassadors. Connecting our low carbon campus with our research, through new thinking and student-driven projects, we aspire to enable all members of the University to support our carbon reduction and energy efficiency agenda.

Our purpose at UEA is to continue to build and develop our reputation as a leading UK university, delivering excellent research and teaching, and making a positive impact on the wider world. We need to be trailblazers; to innovate, adapt and meet constantly changing needs; to follow new, Sustainable Ways. The energy and carbon reduction programme speaks to our ongoing commitment to reduce the environmental impacts associated with our processes, activities and operations. Through infrastructure improvements and with help from our community of staff, researchers and students, we can look forward to the University of East Anglia continuing to inspire future generations of staff and students to step up to the carbon challenge.



UEA's Energy and Carbon Reduction Programme

The cost of utilities and carbon are expected to rise between 2015 and 2020, particularly the cost of electricity. Chart 1 shows the expected increasing cost of carbon to UEA in the EU Emissions Trading scheme (EU ETS)¹ over the next five years. This is due to the phasing out of free carbon allowances and changes to the scheme to increase the price of allowance.

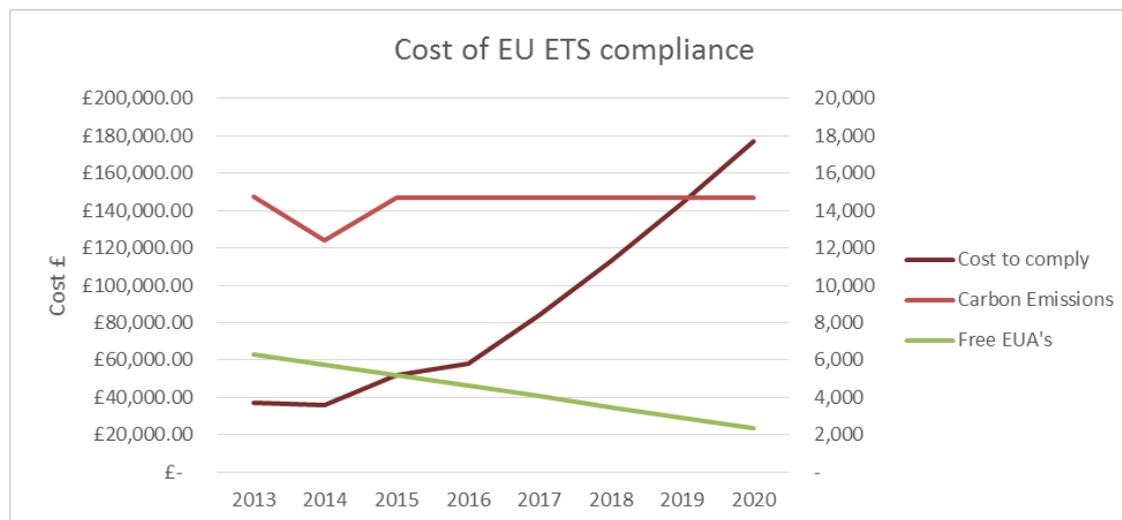


Chart 1: Cost of EU ETS compliance with steady carbon emissions and reducing free allowances

The cost of electricity is also expected to rise, due to an increase in charges to pay for the replacement of ageing national generation and distribution infrastructure. According to the Department for Energy and Climate Change (DECC), the cost of electricity could rise between 20% and 50% by 2020² (Chart 2). This could add £1.3million to UEA's utilities bills by 2030. The impact of these rising costs can be mitigated by reducing our energy consumption, generating electricity on site and by further investment in renewable technologies.

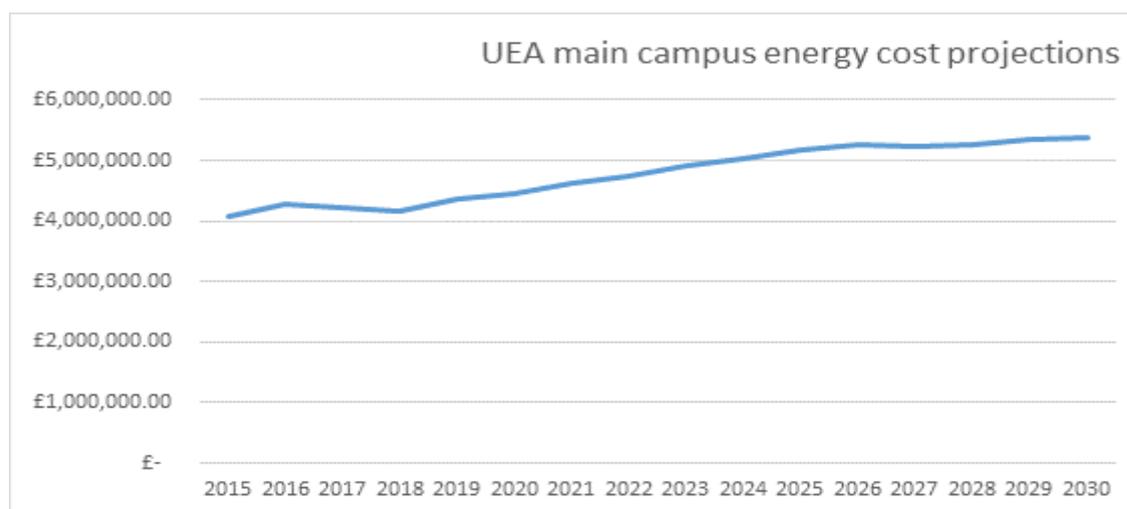


Chart 2: Cost of gas and electricity for the main campus, based on 2013/2014 energy consumption and DECC central energy projections released December 2014

¹ The University is subject to EU ETS due to the collective installed capacity of the boilers on the main campus.

² <https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2014> (Annex M)

UEA's low carbon campus journey

1990 to 2015

Although the need to reduce CO₂ emissions only came to the forefront of activities after 2005, running an efficient and low energy estate has been a long-standing goal of UEA. The challenges of operating a 1960s estate with poor thermal performance led UEA to develop a series of highly thermally efficient buildings, both to counter the original building stock and to ensure the estate as a whole was cost effective to operate. This has resulted in UEA being an early adopter of the low energy/carbon agenda, with the journey beginning in the early 1990s. Chart 3 illustrates how the carbon intensity of UEA's operations have reduced against the background of an expanding campus, and is followed by a snapshot of some of the projects undertaken over the past 25 years on our journey to being a low carbon campus.

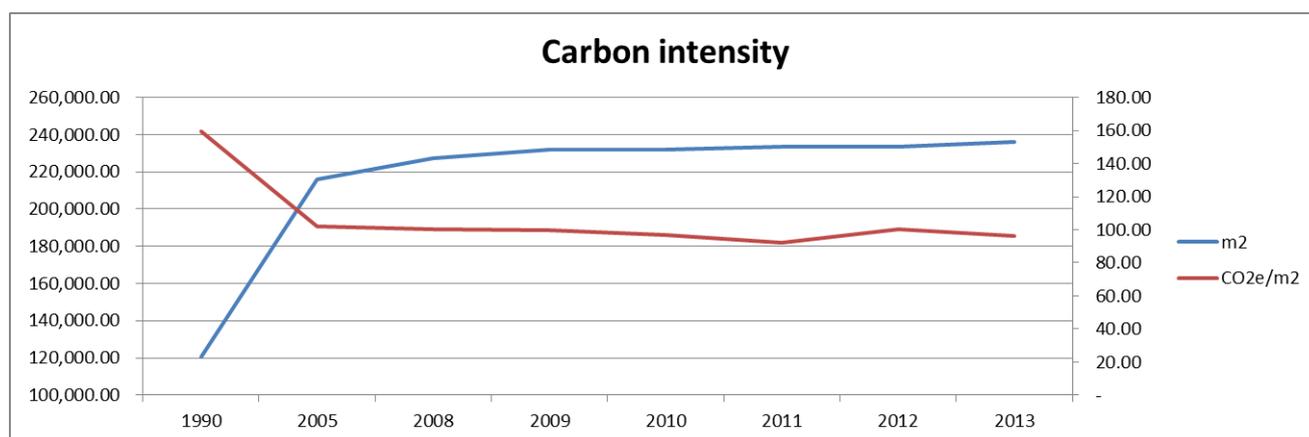


Chart 3: Carbon intensity 1990 to 2013/14

1990 to 1995

The Elizabeth Fry building was completed in 1995 and was named the 'Best building ever' by Building Services Journal in 1998. It is a high thermal mass, highly insulated building using the Termodeck³ heating and cooling system to provide very consistent conditions throughout the year. After 20 years, this building still exceeds current building regulations in terms of thermal performance and is one of our most energy efficient buildings on campus.



1996 to 2000

In 1999 UEA took advantage of its existing district heating scheme to install three 1000kW combined heat and power (CHP⁴) engines, to provide heating and electricity to the campus. Through the CHP system, UEA regularly generates over 60% of its own, low carbon electricity. This reduces our carbon footprint by around 20% compared to the using natural gas boilers and buying electricity from the National Grid. Financially it has also been a great success, regularly reducing costs by over £1million per year compared to the traditional route.

³ The Termodeck system utilises the hollow cores in concrete floor slabs, by passing air through the cores to heat and cool the building and storing the heat in the concrete slab.

⁴ Our CHP engines use natural gas to generate electricity and the engine and exhaust heat is captured and used to heat buildings, making the overall efficiency around 80%.

2000 to 2005



In 2002 UEA opened its second low energy building using the Termodeck system. The ZICER building housed the Zuckerman Institute for Connective Environmental Research. The thermal performance of this building was further improved over that of the Elizabeth Fry Building. This project included UEA's first building-integrated PV system. The 34kW system was used to demonstrate what was possible with building integrated PV and has generated over 240,000kWh of zero-carbon electricity since being installed.

2006 to 2010

In 2006 UEA installed a District Cooling system⁵. This system uses an absorption chiller in the summer and utilises the excess heat from the CHP engines to provide cooling to laboratory equipment and areas prone to overheating.

In 2009 UEA opened the Thomas Paine Study Centre, hosting a 360-seat lecture theatre, seminar rooms and offices. This building also used the Termodeck system and achieves a similar performance to Elizabeth Fry and ZICER. Through our learning in the other buildings we have installed displacement ventilation and more zone controls to improve the comfort of the occupants.

2011 to 2015

Low energy buildings

After 15 years of using concrete to construct low energy buildings, UEA took the next step in building a low carbon campus by using cross-laminated timber (CLT) to construct the Julian Study Centre and Crome Court residential block. The Julian Study Centre, opened in 2013, still uses the Termodeck heating and cooling system with hollow concrete floors, but the CLT structure reduced the amount of concrete used (saving 'embodied carbon') and also sped up construction. This building achieved an air tightness far exceeding current building regulations, meaning that it loses heat much more slowly in the winter. It uses LED lighting throughout the building, has 22kW of PV roof mounted PV and received the highest rated Energy Performance Certificate of A⁶. All of these elements combine to give us a building that used less energy in construction, but is also more efficient during use too.

The University's newest accommodation block is also our most energy efficient and environmentally sound. Crome Court, delivered to the University in August 2014, came in £800,000 under budget and also in a record-breaking timescale. Cross-laminated timber was used for the building's whole superstructure. The wood reduces the embedded carbon of the building compared to a steel or concrete structure. Crome Court has around 20kW of PV, as well as a green wall and greywater recycling system. All the kitchens have energy display screens to help residents understand their energy use and to rank the energy performance of the flats in real time.



⁵ The district cooling system provides chilled water at around 7°C to a number of buildings across the campus.

⁶ EPCs are required to be produced for all new buildings and are on scale of A to G.

In June 2015 the Enterprise Centre opened. Dubbed by the press as the UK's greenest commercial building, it has been designed and is being delivered to achieve the Passivhaus⁷ standard and a BREEAM Outstanding rating. It aspires to be an exemplar of low embodied energy and carbon construction technologies through the use of natural and bio-renewable materials sourced through local supply chains. The building aims to be a world class facility through its design and use of material, demonstrating sustainability by design. As a demonstration of connections between the built estate at UEA and our academic colleagues, UEA researchers generated future climate data for the project. With this information, a range of design scenarios were simulated to identify the most robust solution over an 87-year period. The lifecycle carbon study, including embodied carbon, allowed optimisation of the building mass, glazing ratios, shading and natural ventilation design. Sensitivity analysis was carried out for both a warming and cooling scenario.

Boiler replacement

2015 also saw the replacement of the 50-year-old boilers that had been used to back up the CHP engines and provide extra heat in mid-winter. These have been replaced with three 6MW natural gas Bosch boilers, which have improved the boiler efficiency from 75% to over 90%, saving over £50,000 per year.

2016 to 2020 and beyond

UEA wishes to contribute to the UK's goal of reducing carbon emissions by 80% from 1990 levels by 2050. However, the University needs to continue to adapt to the ever changing needs of our students, researchers and funding mechanisms.

Targets

Carbon: Reduce our campus carbon emissions by 35% by 2020, against a 1990 baseline⁸

Energy: Reduce our energy consumption by 25% by 2020, against a 2013/14 baseline⁹

In line with this, we aim to match the UK's national carbon reduction targets of 35% reduction by 2020 and 80% by 2050 from a 1990 baseline. If it is financially sustainable, UEA hopes to achieve this by 2030. To deliver this, we have established an Energy and Carbon Reduction Programme, broken down into a series of five-year frameworks, of which this is the first. Appendix A lists all the documents that will be produced for this framework and when they will be produced.

It is envisaged that in order to achieve the targeted 35% reduction in carbon emissions by 2020, UEA will need to reduce energy use by 25%, replace our ageing CHP engines with more efficient CHP engines, and install 1MW of PV and a 1MW woodchip boiler.

⁷ The Passivhaus standard ensures very little energy is used for heating, whilst ensuring that internal conditions still meet international standards for warmth and fresh air. BREEAM is a wider measure of a buildings environmental impact. As well as energy it considers issues such as building materials, access to the site and previous use of the land.

⁸ CO₂e scope 1 and 2 emissions and scope 3 emissions for National Grid electricity (1990 baseline), covering all facilities owned and operated by UEA. Scope 3 carbon emissions (e.g. waste, water and procurement) will be reported separately and monitored via the relevant EMS Implementation Team.

⁹ Includes electricity, heat and gas used by UEA buildings and by CHP plant (2013/14 baseline).

UEA's total utilities costs exceed £4million per year, and this would be much higher if UEA had not been proactive over the past 25 years. Therefore a 25% reduction in energy consumption based on 2013/14 energy consumption and prices will deliver an annual saving to UEA of over £1million, allowing further investment in the existing estate.

This is a significant change from business as usual, and the Risk and Sustainability team will be working closely with staff and students across UEA to showcase examples of great practice as well as help people to understand the impact of their practices. However, to make the task more manageable the 25% reduction has been broken down into five work areas (below, Figure 1). At this stage it is envisioned that each work area will produce a 1% saving per annum for the next five years. This will be reviewed annually as part of developing the annual works programme.

In addition we anticipate that the National Grid will continue to decarbonise. This will reduce the carbon emissions (scope 2) associated with the electricity that we buy. This is not something that we can influence and will be significantly affected by political drivers. We will monitor progress of this and factor it into our annual work programmes.

Energy and Carbon Reduction Delivery 2016–2020

Progress against these targets will be monitored by the Sustainability Board on a quarterly basis and reported to the Executive Team by the Chair of the Sustainability Board.

The Energy and Carbon Reduction Implementation Team will deliver this work¹⁰. The working group consists of members of the University with the ability to influence the high energy-using parts of the institution, and aims to ensure that requirements of the ECRP are included in the wider decision making whilst also ensuring that the ECRP assists with the needs of UEA. The delivery will be broken up into five work areas, each with a designated lead, as follows:

Capital Investment: These are existing projects to refurbish or replace end of life equipment and facilities, which will deliver energy savings. This work area will be led by the Head of Engineering and Infrastructure, with support from Head of Projects and Estate Development.

Energy Saving projects: These are new projects that will achieve a five-year payback or less based on energy savings. We are appointing an Energy Saving Company (ESCo) that will guarantee the projects meet the stated energy savings. The funding of these projects will come from the existing Revolving Green Fund¹¹, a new invest-to-save fund or via the ESCo. This work area will be led by the Energy Officer with support from Head of Energy and Utilities.

Building Re-commissioning: Over the last 50 years many of UEA's buildings have been repeatedly modified and it is likely that many of the building services are no longer performing at their optimum or being controlled in the most efficient way. This work area will aim to improve the comfort of occupants and reduce energy, by ensuring building services and controls are as effective as possible. This theme will be led by the Head of Energy and Utilities.

¹⁰ See Appendix B for the membership of this Implementation Team.

¹¹ UEA borrowed £350,000 from HEFCE and Salix Finance and added £100,000 to establish a Revolving Green Fund. This fund is used to invest in energy saving projects and the energy savings are paid back into the fund for future projects. The fund has been fully utilised with repayments of around £110,000 per year available for further projects.

UEA's Sustainability Network: All members of UEA can get involved with this work area. An early pilot campaign held in the Registry building at UEA delivered an 11% saving. If just half of this can be achieved across campus it will be a significant contribution to the overall objectives. This work area will be delivered by the Environmental Officer.

Enhanced Maintenance: UEA is embarking on an exciting new relationship with CBRE, an outsourced Facilities Management company, to deliver planned maintenance across the UEA campus. With experience of working with universities they are confident of being able to deliver significant energy savings through their maintenance practices. This work area will be led by the Head of Maintenance.



Figure 1: UEA's ECRP work areas and managers

The UEA carbon sustainability balance

At UEA we are working to create a university now that will be even better in the future. At a basic level, sustainable development at UEA means that we try to balance the ‘three pillars’ of sustainability; environmental, economic and social impacts. We challenge our environmental impact through reducing our reliance on grid electricity and therefore fossil fuels, as well as promoting recycled and ‘eco’ products such as biological cleaning materials. We champion local suppliers and ethical causes, including Fairtrade and vegan products. Alongside Procurement, the Risk & Sustainability Team seeks to ensure value for money in a holistic, whole-life costing sense, and looks to promote alternatives to international business travel.

In carbon reduction terms, we work to balance the three sustainable development principles alongside three energy-specific themes: Reputation, Capital cost, and Operational cost.

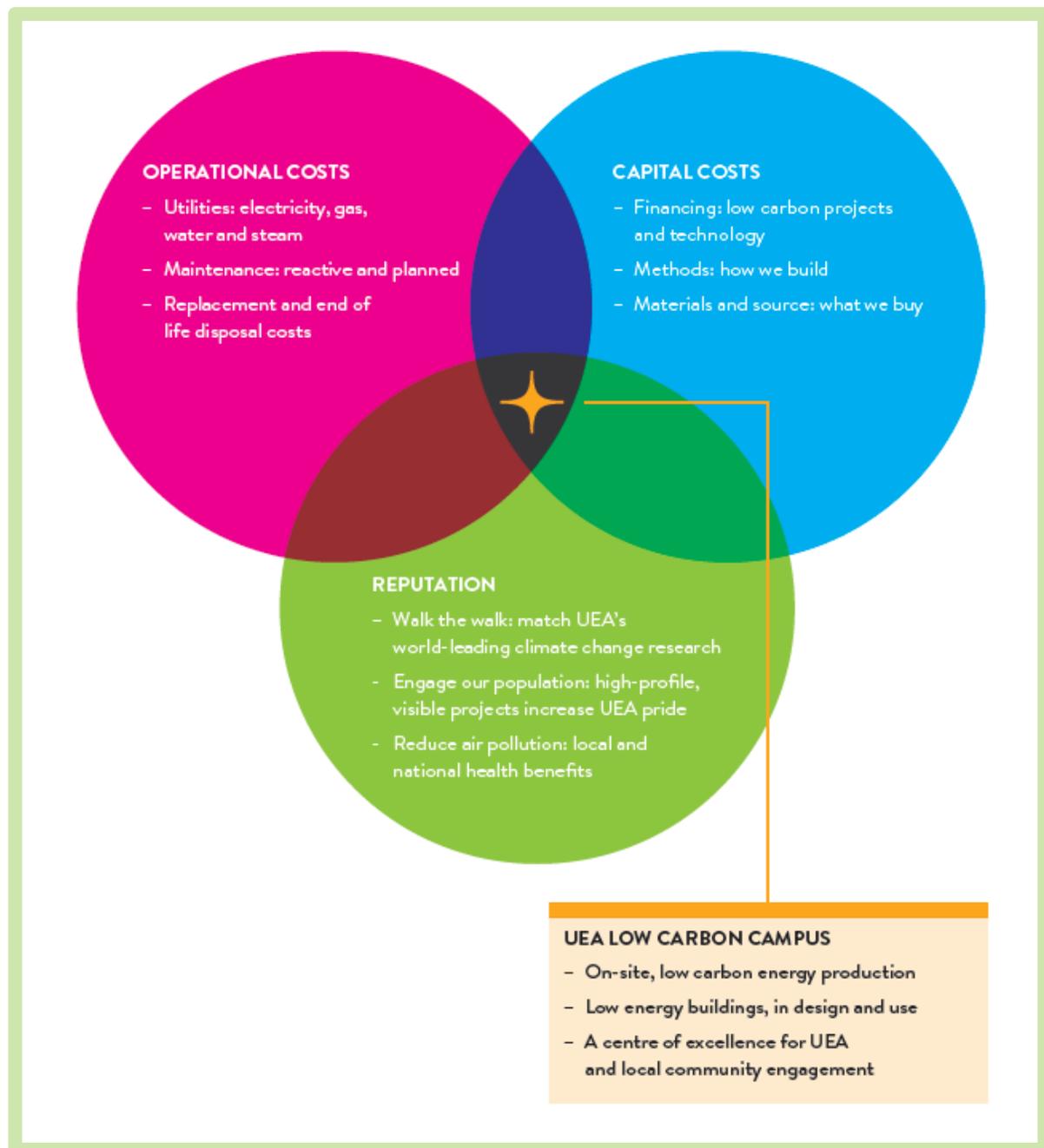


Figure 2: The UEA carbon sustainability balance

UEA Estates Strategy

Future infrastructure changes: the Lasdun Academic Wall

A feasibility study has been undertaken to understand the possibilities for refurbishing the Lasdun Academic Wall (approx. 40,000m²). Whilst preserving the architectural heritage of this listed building, the intention is to reimagine the Wall for the 21st century. It is hoped that this will deliver a better utilised, more comfortable building, with lower energy and environmental impacts. Energy savings projects undertaken within the Lasdun Academic Wall will be aligned with the refurbishment programme. This work is likely to be a major component of the next phase of Energy and Carbon Reduction Programme (2020 to 2025).

Financing

A number of funding routes have been put in place to help deliver the first phase of this Energy and Carbon Reduction Programme, and others will continue to be investigated. For example, Salix Finance offer interest-free loans on an annual basis, which can be applied for once specific projects have been identified. Other funding and technology providers can provide funding and all routes will be considered at all stages of the programme.

The existing internal Revolving Green Fund is now in its recycling phase and the repayments average £110,000 p.a. This fund will be focused on smaller energy-saving projects and opportunities identified through the UEA Sustainability Network.

UEA has taken advantage of a change to the CRC regulations and a drop in utility prices to establish a £500,000 p.a. fund to invest in energy saving projects that achieve a payback of five years or less. This will be invested through an Energy Saving Company who will guarantee the savings. The company will also be able to provide additional funding in various forms, subject to the University's borrowing conditions.

£2.5million has been secured to deliver three replacement CHP engines in 2015/16. These have a payback of four years. Additionally, £580,000 has been secured from Salix Finance in the form of an interest free loan to install thermal stores on the district heating system. This will allow any excess heat produced by the CHP engines to be stored and then used to heat buildings the following morning rather than using boilers. This will reduce the amount of gas used on site saving money and carbon and also prolong the life of the boilers. This is also due to be delivered in 2015/16.

The UEA Capital Plan will deliver a number of projects that are being undertaken for non-energy saving reasons, but have an energy saving element. As part of the Environmental Officer's role in the Risk and Sustainability Team, information on these carbon wins will be shared across the UEA community to help increase awareness of the behind-the-scenes projects being carried out.

It is anticipated that all projects driven by the ECRP will achieve a payback of five years or less in this phase of the Energy and Carbon Reduction Programme¹². Energy-saving initiatives will also be considered in the planning of Capital Projects where financially viable.

¹² Future phases of the Energy and Carbon Reduction Programme may have different payback criteria, as projects with the greatest opportunities are realised.

Appendix A: Document Framework 2015–2020

Ref	Document Title	Publication Date
1.0	UEA Energy and Carbon Reduction Programme	November 2015
1.1	UEA Energy and Carbon Reduction Programme Launch Document	November 2015
2.0	Performance report 2010-2015	December 2015
2.1	Annual performance report 2015-2016	October 2016
2.2	Annual performance report 2016-2017	October 2017
2.3	Annual performance report 2017-2018	October 2018
2.4	Annual performance report 2018-2019	October 2019
2.5	Annual performance report 2019-2020	October 2020
3.0	Works Programme	December 2015
3.1	Works Programme Update 2016	December 2016
3.2	Works Programme Update 2017	December 2017
3.3	Works Programme Update 2018	December 2018
3.4	Works Programme Update 2019	December 2019

Appendix B: Energy and Carbon Reduction Implementation Team

Name	Role
Richard Bettle (Chair)	Head of Energy and Utilities
Ivica Bacic	Lab Manager
Paul Bailey	Accommodation Manager
Andrew Burbidge	Projects and Estate Development
Catrin Darsley	Environmental Officer
Richard Hipperson	Assistant Director of Estates, Built Assets
Iain Reeman	ICT Systems Director
Vikki Rees	Energy Officer
James Taylor	Head of Maintenance
Paul Thacker	Head of Engineering and Infrastructure
Andrew Watts	EMS and Waste Manager
SU Environmental Officer, or representative	Student Union Representative