



# Lancaster University Carbon Management Plan

2015-2020



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"We make campus an inspiring place to be"

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# 1 Introduction

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Since Lancaster University adopted its Carbon Management Plan (CMP) in 2010 it has successfully reduced its carbon emissions by 28% from 25,899tCO<sub>2</sub>e to 18,793tCO<sub>2</sub>e. This decrease is a result of the implementation of an extensive range of carbon reduction projects including: a wind turbine, combined heat and power engine, biomass boiler and many energy efficiency projects.

The CMP provides a strategic route map, detailing how the University proposes to reduce its carbon emissions by using a range of policies, education initiatives and projects.

This updated version incorporates the progress made in implementing CMP projects and the significant reduction in carbon emissions achieved since the adoption of the plan.

This CMP details emissions targets, proposed carbon reduction projects, projected carbon emissions and incorporates carbon reduction projects and projected carbon emission.

## 2 Background and Context

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Human influence on the world climate is clear, with anthropogenic related carbon emissions the highest in history and warming of the climate system unequivocal. Recent changes in climate have had widespread impacts on human and natural systems and continued emissions will cause further warming and long-lasting changes. This increases the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.

Lancaster University is a leading environmental research and teaching institution, in addition to being a major contributor to research, projects and strategies on global warming, climate change, adaptation and mitigation.

The CMP recognises this position, incorporating a range of projects from the conventional to the cutting edge. Given the institutional understanding of this issue it is essential for Lancaster University to be ambitious with its carbon emission targets and in the projects it implements in order to achieve them. All energy saving opportunities and types of technology will have to be considered in order to meet the carbon emission reduction targets for 2020 and 2050 and contribute to avoiding dangerous climate change.

As well as being a self-contained document, The Carbon management Plan forms part of the overarching Facilities Sustainability Strategy. The Facilities Sustainability Strategy draws together, and puts into context all Facilities environmental sustainability strategies and plans including the Travel Plan, Ecology Plan, Behaviour Change Plan, Energy and Utilities Plan, Carbon Management Plan, and Waste Plan. In addition, the Facilities Sustainability Strategy establishes the context and contribution of specific plans and strategies to the Facilities ISO 14001 Environmental Management System and broader Facilities and University Strategies, such as the Estates Masterplan. The Facilities Sustainability Strategy comprises Facilities contribution to The University Environmental Sustainability Strategy, which establishes University wide strategic environmental sustainability aims and objectives and addresses the environmental commitments made in the University Strategy.

This revised version of the CMP sets out our plans for managing and reducing University carbon emissions until 2020.

### 3 Carbon Emissions Baseline and Targets (Scope 1&2)

With the introduction of the Climate Change Act 2008 the UK Government set legally binding carbon reduction targets of 34% by 2020 and 80% by 2050 for the UK, with 1990 as the baseline year.

In January 2010 the Higher Education Funding Council for England (HEFCE) adopted these targets on behalf of the higher education sector.

HEFCE recalculated the UK national targets using the baseline year of 2005 to generate carbon reduction targets for the Higher Education sector of 43% by 2020, 83% by 2050 and intermediate carbon reduction targets of 12% by 2012 and 29% by 2017.

In accordance with the UK Government and HEFCE Guidance, Lancaster University's CMP sets institution specific carbon reduction targets for 2012, 2017, 2020 and 2050. For the baseline year of 2005 Lancaster University's Scope 1 & 2 carbon emissions (carbon emissions resulting primarily from gas and electricity consumption) were 25,899tCO<sub>2</sub>e\*.

Lancaster University's carbon reduction targets for 2020 and 2050 are challenging; meeting them will require the implementation of the carbon reduction projects in this CMP plus additional, as yet undefined, projects.

CARBON REDUCTION TARGETS FOR 2020 AND 2050						
		Baseline Emissions	Target Year			
		2005	2012	2017	2020	2050
Higher Education Sector Target for carbon reduction	(%)	n/a	12	29	43	83
Lancaster University Target for carbon reduction	(%) (tCO <sub>2</sub> e)	n/a 26,043	34.9 16,953	35.6 16,771	43 14,844	83 4,427
Lancaster University carbon emissions (tCO <sub>2</sub> e)	(%) (tCO <sub>2</sub> e)	- 26,043	12 22,658	29 18,163		

Notes on table 1:

- 1 The baseline year for carbon reductions is 2005.
2. The Higher Education sector targets are derived from national targets for 1990 converted to equivalent targets for 2005.
3. Target years refer to academic years. For example the 2012 Target Year relates to emissions during the year 2012-13 and so would not be reported until a month after the end of that academic year in September 2013.
4. Carbon emission factors published by the UK Government were amended in 2014. These changes have been applied to emission calculations for all baseline and target years to ensure consistency.
5. The standard unit for measuring carbon footprints is tCO<sub>2</sub>e or carbon dioxide 'equivalent'.

## 4 2010-2015 Progress Review

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A range of carbon reduction projects have already been implemented as part of the CMP, including Energy Supply Projects and Energy Demand Reduction Projects.

### Energy Centre Gas Boilers

Three 4.8MW gas thermal boilers were installed in the Energy Centre in April 2011. The boilers supply heat to the University district heating system and are over 90% efficient whereas the old boilers were less than 70 % efficient.

### Combined Heat and Power (CHP) Engine

The CHP engine was operational by February 2012. Running on gas, it generates 2.2MW of heat which is fed into the district heating system and 1.9MW of electricity supplied to the University's electricity network. The CHP supplied 28% of the University's annual electricity demand in 2013-14, reducing carbon emissions by approximately 2,000tCO<sub>2</sub>e per annum. Electricity from the CHP has half the carbon emissions of grid electricity.

### Energy and Utility Efficiency Projects

The energy team has implemented an extensive programme of small-medium electricity, gas and water efficiency projects relating to lighting, small appliance use, Building Management System(BMS) controls and local boiler efficiency. The projects focussed on short-medium payback projects across campus, examples include the Phase 1 re-insulation of the district heating system and retrofitting of LED lighting in the Lancaster Environment Centre (LEC) glasshouses, both funded from a HEFCE grant.

### Wind Turbine Project

Lancaster University's 2.3MW wind turbine commenced operation in November 2012. In its first full year of operation (2013-14), the wind turbine generated over 5,000MWh of electricity, significantly higher than projected. The turbine produced more than 15% of the University's annual electricity requirements and has reduced carbon emissions by over 2,000tCO<sub>2</sub>e per annum.

### Biomass Boiler

The University won £500k grant funding from HEFCE to install a biomass boiler in the Energy Centre. The 0.95MW boiler was in operation by December 2012 and can reduce carbon emissions by 950tCO<sub>2</sub>e during a normal heating season.

### Voltage Change

The voltage of the University's internal electricity distribution network has been reduced by 7% in two phases in 2009 and 2010. The reduction in voltage is calculated to have reduced electricity consumption by more than 1%.

### Utility Metering Project

Comprehensive internal sub-metering of utilities (gas, electricity, water and hot water) was installed in all major buildings between May and December 2009. The metering system enables the identification and assessment of utility consumption in order to identify potential reduction and savings.

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## **Thermal Store**

Installed and operational by November 2014, the thermal store was funded by a £350k HEFCE grant. The thermal store is an insulated tank that stores hot water destined for the district heating system. This storage allows the CHP to generate low carbon electricity for extended hours (when the heat generated is not required immediately), thereby reducing carbon emissions.

## **Building Energy Surveys**

A comprehensive survey of all buildings across campus was completed in August 2012 in order to identify energy and utility efficiency projects.

## **Carbon Competitions and Carbon Awareness**

Awareness and behaviour change campaigns for staff and students began in 2008 and take place annually. These include student carbon competitions in halls of residence and major awareness campaigns for staff and students .

# 5 Impact of Carbon Reduction Projects

The projects implemented as part of the CMP have successfully reduced Lancaster University Scope 1&2 carbon emissions by 30%, from 26,043tCO<sub>2</sub>e of 2005-06 to 18,163CO<sub>2</sub>e in 2017-18.

Following a gradual increase since 1990, especially since the completion of new UPP residences between 2004 and 2006, total Scope 1 & 2 carbon emissions peaked in 2005-06 and remained at approximately 25,000tCO<sub>2</sub>e until 2010.

Following the adoption of the CMP, significant reductions in carbon emissions have been recorded as the aforementioned projects have been implemented and become fully operational.

The reduction in carbon emissions is primarily related to the on-site generation of low carbon electricity from the wind turbine and CHP, and the consequent reduction in electricity purchased from the grid.

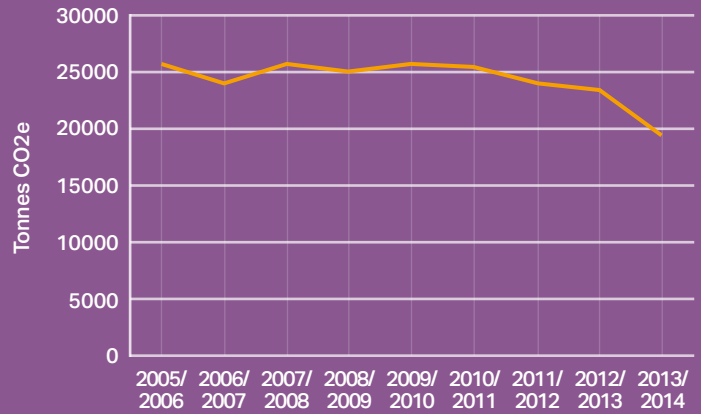


Figure 1: Lancaster University Emissions Emissions





# 6 New Projects

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A range of new carbon reduction projects have been identified and prioritised. These projects include those in the revised Lancaster University Infrastructure Masterplan (2013-2020). In addition; energy efficiency, optimisation and behaviour change projects have been developed by the energy and environment team in Facilities. Each project is subject to appraisal via a business case prior to approval and implementation.

The projects identified for this period are detailed below:

## Second Wind Turbine

The feasibility of developing a second turbine on the University site has been considered, following the successful installation of the first wind turbine and the major contribution it has made to reducing carbon emissions. A second turbine on a similar scale could reduce carbon emissions by more than 2,000tCO<sub>2</sub>e/per annum. However planning constraints are a restricting factor.

## Large Scale Photovoltaics (PV)

The installation of a large scale solar PV farm 1-5MWe in size has been identified as a major potential project. A 5-hectare project could generate approximately 4,250MWh per annum reducing carbon emissions by a further 2,000tCO<sub>2</sub>e, with the advantage that the highest generation would be in the summer when wind generation is normally lower.

## District Heating Optimisation

The efficiency of the district heating system can be improved significantly. Planning is underway to change the system from variable temperature to variable flow and install automated local building circuit controls. These changes are estimated to reduce gas and electricity consumption and cut annual carbon emissions by over 500tCO<sub>2</sub>e.

## Biomass Boiler Operation

There are significant opportunities to increase the operation of the biomass boiler, in order to displace gas consumption. Improvements in linking the boiler to the district heating system, and the potential for summer operation, could increase annual boiler output by 50% and reduce carbon emissions by approximately 300tCO<sub>2</sub>e.

## CHP Engine Summer Operation

The CHP is currently shut down over the summer period. However operation over the summer would allow generation of low carbon and cheaper electricity. It would also enable the limited demand for heating during this period to be met by the CHP rather than electric heaters. It is estimated that this project could reduce annual carbon emissions by approximately 80tCO<sub>2</sub>e.

## Cavity Wall Insulation

The majority of buildings at the University were constructed without cavity wall insulation. Installation of cavity wall insulation is a key project to reduce energy consumption and smooth energy consumption profiles. An initial phase of installation could reduce carbon emissions by 50tCO<sub>2</sub>e per annum.

## Green Lancaster Action Plan (Behaviour Change Plan)

This plan was developed and approved in 2013-14, with the purpose of encouraging, normalising and embedding a wide range of sustainable living behaviours throughout the University community, thereby linking teaching, research and practice. Major elements of the programme focus on reducing carbon emissions and energy consumption; it is estimated that this aspect of the project could initially result in carbon savings of 35tCO<sub>2</sub>e per annum.

## District Heating Insulation

Installation of a second phase of pipework insulation on the district heating system will see the pipework fully re-insulated.

## 7 Projected Emissions

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The new projects identified in the CMP will potentially reduce carbon emissions by approximately 5,000tCO<sub>2</sub>e per annum if fully implemented. However, the feasibility of many of these projects needs to be assessed in detail and funding sources identified, before the projects can be implemented.

Lancaster University annual carbon emissions for 2017-18 were 18,163tCO<sub>2</sub>e and the University's key carbon reduction target for the year 2020-21 is 14,844tCO<sub>2</sub>e, a difference of 3,319tCO<sub>2</sub>e.

As the newly identified projects have the capability to reduce carbon emissions by approximately 5,000tCO<sub>2</sub>e, the 2020 carbon reduction target is within reach. However, refurbishments and new developments on site will increase electricity and gas consumption and hence carbon emissions over the same period. Therefore we need to constantly review projects for effectiveness and, where necessary, implement new ones in order to continue to meet our challenging carbon reduction targets.

## 8 CMP Governance, Reporting and Review

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Under the delegated authority of the University's Vice Chancellor, responsibility for the implementation and review of the CMP rests with the Sustainability Management Group (SMG). SMG review the progress in implementing the CMP and can make recommendations to the University Management Advisory Group (UMAG) to ensure targets can be met.

The CMP is reviewed on a regular basis in respect of performance, projects and scope. Reports on carbon emissions are produced on an annual basis.



# 9 Conclusions

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The impact of carbon emissions on the atmosphere and the resultant changes in global climate have become increasingly clear since Lancaster University's CMP was initially published. Lancaster University's carbon reduction targets are challenging but this CMP updated demonstrates the success of the CMP. Through the successful implementation of a range of projects Scope 1&2 carbon emissions have reduced by 30% compared to the baseline year.

The complexity and time involved in implementing the range of projects in the CMP has been significant and demonstrates the wide-ranging approach that needs to be adopted in order to achieve the required carbon savings.

With the initial phase of major carbon reduction infrastructure projects now operational, effort has turned to optimising existing projects, and identifying and assessing the feasibility of new carbon reduction projects prior to their implementation.

Newly identified projects have the ability to reduce carbon emission by up to 5,000tCO<sub>2</sub>e, sufficient to enable Lancaster to meet its 2020 carbon reduction target of 43%, or 14,844tCO<sub>2</sub>e. Campus growth will result in increases in utility consumption, and hence increases in emissions, which will negate a proportion of the potential carbon emissions reduction.

In order to continue to meet our challenging carbon reduction targets new projects will need to be identified and implemented in the future.





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