Glasgow Caledonian University
Estate's Carbon Neutrality Roadmap

Version No.: 1 (Approved)
Version date: 16th January 2025
University Planning & Resources Group Approval Date: 4th February 2025
Author: P. Cruz (Head of Operational Sustainability)

Executive Summary

Glasgow Caledonian University declared a climate emergency in 2019 and in Strategy 2030 committed to carbon neutrality by 2040 with interim targets for 2030, but aligned to deliver the Scottish Government's ambition for Public Sector buildings to be carbon neutral by 2038.

The transition to carbon neutrality requires that the University cuts carbon emissions from all aspects of its operations, including absolute reductions from its Estate by 2038. This means that the University must transition its Estate to renewable heat and power. Whilst this may appear straightforward, it is exceptionally complex and challenging due to the uncertainties and unknowns around technology maturity and suitability to the current and future Estate.

The University's Estates Carbon Neutrality Roadmap (E-CNR) seeks to address these uncertainties and unknowns with five principles that will guide the operation and development of the Estate and deliver the necessary reductions in energy consumption to enable the transition to renewable heat and power by 2038.

The E-CNR will reduce the energy intensity of the University's Estate from the current average range of 270-315 $kWh.m^2.year$ to as close as possible to 25 $kWh.m^2.year$ (aligned to the most demanding standards for net-zero buildings).

The five principles that will achieve this are:

1. Full visibility of energy use.
2. Reducing energy wastage.
3. Zero carbon heat.
4. Strategic improvements to energy.
5. Progress monitoring and reporting.

The most significant challenge is the decarbonisation of heat, which is provided by local gas boilers and a baseload from a district heating network (harnessing waste heat from the University's gas-fired Energy Centre). The merits of various alternative options, such as solar heating, hydrogen and heat pumps were considered (at a scoping workshop with the University's School of Computing, Engineering and the Built Environment) and the prevailing recommendation was that the route with the greatest certainty is to reduce demand for heat whilst pursuing a decarbonisation strategy that offers flexibility to accommodate future technological or local developments.

The roadmap therefore focuses on the phased delivery of localised heat pumps, better insulated buildings (with lower heat demand) and improvements in energy efficiency across the Estate.

The five principles proposed by the E-CNR will guide the operation and management of the University's Estate to reduce demand for energy and enable the switch to renewable heat and power necessary for the transition to carbon neutrality by 2038.

Contents

Introduction

Glasgow Caledonian University declared a climate emergency in 2019 and in Strategy 2030 committed to carbon neutrality by 2040 with interim targets for 2030 (Table 1) that are aligned to deliver the Scottish Government's ambition for Public Sector buildings to be carbon neutral by 2038.

Scope	2014-15 (baseline)	2030-31 (target)
1 (gas)	4,527 tCO$_2$e	3,531 tCO$_2$e (-22%)
2 (purchased electricity)	2,785 tCO$_2$e	57 tCO$_2$e (-98%)

Table 1 Glasgow Caledonian University's baseline (2014-15) Scope 1 and 2 greenhouse gas emissions and Strategy 2030 targets.

Carbon neutrality is defined as the "condition in which, during a specified period of time, the carbon footprint has been reduced as a result of greenhouse gas (GHG) emission reductions or GHG removal enhancements and, if greater than zero, is then counter balanced by offsetting." [1]

The transition to carbon neutrality requires that the University cuts carbon emissions from all aspects of its operations[2], including absolute reductions from its Estate by 2038 without offsetting (as set out by the Scottish Government's guidance to the public sector[3]). This means that University must transition its Estate to renewable heat and power by 2038. Whilst this may appear straightforward, it is exceptionally complex and challenging because of uncertainties and unknowns around technology maturity and suitability to the current and future Estate.

The University's Estates Carbon Neutrality Roadmap (E-CNR) seeks to address these uncertainties and unknowns through a series of principles to guide the management and operation of the Estate to deliver the necessary reductions in energy consumption to enable the transition to renewable heat and power by 2038. The E-CNR includes specific measures that the University will develop to enable this transition (and which are set out in the E-CNR Implementation Document (E-CNR ID), included as Appendix A).

Vision Statement for 2038

By 2038 the University's longstanding commitment to energy efficiency has reduced demand for heat and power to the extent that the Estate is carbon neutral because it can be fully heated and powered by renewable energy.

Aims & Objectives

The aim of the E-CNR is to guide the management and development of the University's Estate to reduce demand for energy and enable the switch to renewable heat and power necessary for the transition to carbon neutrality by 2038.

As a guide, the energy intensity (kWh.m^2) of the University's estate needs to fall from the current Energy Performance Certificate average of 270-315 kWh.m^2.year provided by a mix of gas and electricity to as close as possible to 25 kWh.m^2.year provided by electricity only by 2038 (the level

---

[1] International Standards Organisation - Section 3.1.1 - ISO 14068:2023 ISO 14068-1:2023 Climate change management - Transition to net zero - Part 1: carbon neutrality.

[2] Thematic decarbonisation plans are available from the University's sustainability pages.

[3] Public Sector Leadership on the Global Climate Emergency: Guidance (Oct 2021)

set by the PassivHaus and EnerPHit standards, which are the current best practice in net-zero buildings).

To achieve this, the University will embed the following principles into the operation of its Estate:

1. Full visibility of energy use
2. Reducing energy wastage
3. Zero carbon heat
4. Strategic improvements to energy efficiency
5. Progress monitoring and reporting

The remainder of this document elaborates how these principles will support the transition to carbon neutrality in light of current energy consumption, known unknowns and uncertainties. The E-CNR should be read in conjunction with its Implementation Document (included as Appendix A), which sets out key deliverables under each of the above principles.

Scope of the Roadmap

The scope of the E-CNR is the whole University Estate (owned and rented) where it has operational control over when and where heat and power are used. The principles apply to the existing Estate and any buildings added to it in the future. Whilst the focus is on energy and power, fluorinated (refrigerant) gases are also within scope, but Scope 1 emissions from the University's fleet aren't (because they are included in the University's Sustainable Travel Plan).

Energy Use & Greenhouse Gas Emissions

The University uses around 30,000,000 kWh of gas and electricity per year[4]. Gas is used for space and water heating and to generate electricity at the University's Energy Centre, whilst electricity is used primarily to power the Estate[5].

Although a range of factors influence how much and what type of energy is used (e.g. fluctuations in weather, operating strategy for the University's Energy Centre or the development of the Estate), electricity and gas consumption at University has been stable since 2014-15, at around 270-315 $kWh.m^2.year$.

Although total energy consumption has been stable, associated emissions have been on a downward trend, with combined Scope 1 (gas) and Scope 2 (purchased electricity) falling 40% from 7,382 tCO_2e in 2014-15 (the University's baseline[6]) to 4,428 tCO_2e in 2023-24. This decline is attributed the decarbonisation of electricity in the National Grid and minor improvements in energy efficiency across the University's Estate.

The principles introduced by this E-CNR will decarbonise the University's Estate by reducing demand for electricity and gas to a point where a switch to renewable heat becomes feasible.

---

[4] For comparison, a 1-2 person (1 bedroom flat) in the UK uses 7,500 kWh of gas and 1,800 kWh of electricity per year (source: Ofgem – 23/5/2023).

[5] It is also used to heat water and space in the London Campus and at the University's residencies.

[6] Some stakeholders use 2005 as a baseline for GHG emissions. Whilst the University's total inventory has changed, Scope 1 and 2 emissions in the 2014-15 baseline are 6% lower than in 2004-5, when the University reported 7,796 tCO_2e Scope 1 and 2. The University's annual carbon footprint reports are available from its sustainability webpages.

Decarbonisation Principles

The E-CNR proposes five principles to guide the management and development of the University's Estate to reduce demand for energy and enable the switch to renewable heat and power necessary for the transition to carbon neutrality by 2038. The five principles are detailed below with associated deliverables listed in the accompanying E-CNR Implementation Document (included as Appendix A).

Full Visibility of Energy Use

Understanding where, when and how energy is used is critical for identifying opportunities for improvement and addressing excessive consumption. Historically, the University's ability to achieve this has been constrained by capacity and low-granularity data. The University will implement a series of initiatives to develop and improve its understanding of where, when and how energy is used across the Estate.

The Carbon Management Catalyst Project[7] provides a starting point for addressing this by introducing an analytics platform and building-level sub-meters for all utilities (electricity, gas and water), with the intention of developing building-level profiles and automating notifications of deviations from agreed norms. These profiles will enable the University to identify building-level anomalies and take prompt action to reduce wastage. With time, the intention is to increase the granularity of sub-metering of electricity consumption to include individual distribution boards/high-energy consuming plant.

Significant deviations from agreed norms will be reviewed to identify (and address) any underlying issues that could detrimentally impact the energy efficiency of the Estate.

Building on the success of its' ISO14001 certified Environmental Management System, the University will introduce an Energy Management System, aligned to ISO 50001, to provide a structured, and potentially externally auditable mechanism for ensuring it continues to drive improvements it the energy efficiency of its Estate in structure way.

Progress so far: The University is installing building-level submeters connected to a new energy analytics platform. It has also recruited an Energy Performance Manager to identify opportunities to reduce energy consumption.

Reducing Energy Wastage

The University will use its enhanced insights into energy use to drive a more proactive approach to reducing energy wastage by optimising how ambient comfort levels (and the plant that delivers them) are managed and address the inefficiencies through targeted maintenance interventions.

To further reduce energy wastage, the University will develop a number of awareness campaigns to encourage students and staff to reduce energy use and wastage throughout the University's Estate through (a) a better understanding of how buildings operate, (b) switching equipment/instruments off and (c) reporting faults.

---

[7] Approved by the Finance & General Purposes Committee in January 2024 and due for completion by July 2025.

Progress so far: The University is working with a global engineering specialist to reduce energy wastage from un-insulated valves in the University's district heating system, replacing motors on a number of air-handling units and upgrading its Building Management System[8].

Zero Carbon Heat

For the University, the key challenge is the decarbonisation of heat, which is currently provided by local gas boilers with a low baseload from a district heating network (DHN – harnessing some waste heat from the University's Energy Centre).

A workshop with faculty from the University's School of Computing, Engineering and the Built Environment considered solar heating, hydrogen and heat pumps (centralised and distributed at the University or as part of a city-wide network). The key findings were:

- Solar heat from roof-space available at the University is unlikely to meet the Campus' heat demand. Significant enabling works would be required (including improving the structural integrity of roofs).
- Limited supply of (green) Hydrogen and it is generally earmarked for transport and other hard-to-decarbonise applications (not space/water heating). If supply was not a constraint, the heat exchangers on the University's DHN would need to be upgraded to provide significantly more heat to each building.
- Limited information about the cost and carbon intensity of a prospective city-centre low carbon district heating network. An upgrade to the heat exchangers in each building and the heat distribution systems would be required.
- Potential power capacity issues at the University and in the city-centre grid to support centralised and/or distributed heat pumps for the Campus. For a centralised system upgrades to the heat exchangers would also be required and both (centralised and distributed) would require upgrades to the heat distribution system.

In light of the above, the key proposal from the workshop was that the University reduces demand for heat whilst pursuing a decarbonisation strategy that has sufficient flexibility to accommodate significant developments in any of the above options.

The University will evaluate the potential for deploying heat pumps across its' Estate (as part of the execution of the master plans).

Progress so far: Ongoing work to understand power constraint in the local grid. Enhanced metering and monitoring (through the Carbon Management Catalyst Project) will provide a better understanding of building specific heat demand.

Strategic Improvements to Energy Efficiency

The University will also adopt a longer-term approach to identifying opportunities for strategic improvements in energy efficiency. This will be achieved through the University's Estate's Asset Management Strategy (AMS) and execution of an evolving Campus Master Plan (MP).

To enable this, the University will conduct regular, documented horizon scanning exercises to identify technology opportunities to reduce demand for energy in its Estate. The horizon scanning exercises will include consultation with technical specialists, market consultation and collaborations

---

[8] Also delivered through the Carbon Management Catalyst Project, approved by the Finance & General Purposes Committee in January 2024 (and due for completion in June 2025).

with academics and other experts. Technologies deemed to have significant potential to contribute to the decarbonisation of the University's Estate will be subjected to a more rigorous assessment of their feasibility and, where appropriate, added to a register of potential projects (the Project Register).

The Project Register will be used to develop building-specific decarbonisation plans for execution through the Estate's AMS and Campus MP. To enable this, the University will also keep track of funding opportunities that could be leveraged to expedite the decarbonisation of its Estate.

Progress so far: The University's Estate's Team already engage with a range of stakeholders to understand how different technologies could be used in its Estate and an outline project register is in place that informs the University's planning process. Strategically, energy efficiency is an important element of the University's Estate's AMS and a strong consideration in an emerging MP.

Progress Reporting & Reporting

The University will report on progress decarbonising its Estate annually, as part of existing arrangements to report GHG emissions, and in relation to total energy consumed and the relative energy intensity of the Estate.

Progress so far: The University reports GHG emissions annually.

Management & Monitoring

The University's Planning and Resourcing Group has responsibility for the University's transition to carbon neutrality.

This responsibility will be delegated to the Sustainability Steering Group (SSG)chaired by the Director of Estate and Chief Operating Officer and Deputy Vice-Chancellor. The SSG will include student representation (through GCU Students' Association elected officers or their appointed representatives), Procurement, Finance and members of the Estates and Facilities Management senior management team.

The Director of Estates will be responsible for implementing initiatives identified in E-CRN with support from the University's Head of Asset Management and Head of Operational Sustainability (HOS). The HOS will be responsible for updating all documentation associated with the E-CRN (e.g. List of Projects and Progress Reports).

Students and staff will have an opportunity to contribute to the E-CNR through the GCU Students' Association and Sustainability Forum.

Version Control

Version	Date	Change
0.1b	2/9/2024	First circulation draft
0.1c	9/9/2024	Incorporating initial feedback and alignment with PPUL requirements for Managing Carbon. Circulation draft.
0.1d	25/9/2024	Second circulation draft.
0.2	16/1/2025	Final draft. Incorporated feedback that better aligns document with the refreshed Strategy 2030.

Appendix A – E-CNR Implementation Document

This is the Implementation Document for Glasgow Caledonian University's Estates Carbon Neutrality Roadmap 2024 (approved by GCU's University Planning & Resourcing Group on 4th February 2025). It is a working document and will be updated as and when required.

Ref.:	Objective	Deliverables	Rationale	Lead	Status
01	**Understanding where, when and how energy is used** will help identify opportunities for improvement.	Capacity to _measure and monitor energy consumption_ in real-time across the Estate.	Understanding where and when energy is used is critical to identifying wastage and opportunities for improvement. The proposal is to develop monitoring capacity that will provide detailed insights into energy consumption by distribution board/high energy consuming equipment. This will build on the building-level monitoring being introduced as part of the Building Management System (BMS) upgrade.	H. Op. Sustainability Snr. Maintenance M.	In-progress - CMP Catalyst project (FIM 1) will deliver building-level sub-metering.
02		_Energy profiles_ to benchmark energy consumption in buildings, plant and equipment.	Energy profiles will help identify anomalies in buildings, plant/equipment operation that could result in unnecessary consumption of energy (through wastage and/ or faults). Profiles to be used to trigger actionable alarms that will need to be investigated.	H. Op. Sustainability	Early stages – building concept developed. Require information for plant.
03		Monthly _energy briefings_ with the maintenance teams to explore energy saving opportunities.	Monthly energy briefings (based on 'energy profiles') to identify under-performing equipment and reduce the risk of energy being unnecessarily wasted.	H. Op. Sustainability Snr. Maintenance M.	Not started.
04		ISO 50001 aligned _Energy Management System_ (EnMS).	Build on the experience with ISO14001 (EcoCampus) to develop a structured, potentially externally verifiable mechanism (EnMS) that provides the evidence-base to make informed decisions that drive continuous improvement in heat and energy demand across the Estate.	H. Op. Sustainability Snr. Maintenance M	Early stage research.
05	**Reducing energy wastage** by optimising building controls and maintenance regimes.	_Awareness campaigns_ to promote energy efficiency.	Develop targeted awareness campaigns to encourage students and staff to reduce energy use and wastage on campus through (a) a better understanding of how buildings should operate, (b) switching equipment/instruments off and (c) reporting faults.	H. Op. Sustainability Snr. Maintenance M	Not started.
06		_Optimise operating model_ for space and plant to reduce unnecessary energy consumption.	Enhanced building controls (new Building Management System and associated sensors) will help deliver a better alignment of ambient comfort levels with space occupancy and utilisation.	Snr. Maintenance M.	In-progress - CMP Catalyst project (FIM 2 – BMS) replacing BMS.
07		_Align maintenance regimes_ to ensure plant and equipment are operated efficiently.	The University's maintenance regime will use the 'Enhanced understanding of where, when and how energy is used' (#01-05) to maximise energy efficient by optimising how plant and equipment are operated.	Snr. Maintenance M.	Not started.
08	**Deploying low/zero carbon heat alternatives**	_Feasibility study of heat pumps (HP) in the University Estate_	Evaluate feasibility of HP as a mechanism for delivering renewable heat to buildings in the University's Estate. Understand whether centralised or distributed pumps are most suitable. Linked to Master Plan execution.	H. Asset M. H. Op. Sustainability	In progress.
09		_Monitor city-wide renewable heat developments_	Engage with local stakeholders to understand progress with city-centre district heat network and their potential to contribute to the University's transition to carbon neutrality.	H. Asset M. H. Op. Sustainability	In progress.
10	**Strategic improvements in energy efficiency** through the Asset Management Strategy (AMS) and Campus Master Planning (CMP) process.	Regular _horizon scanning_ exercises to identify new opportunities to reduce demand for energy.	Regular horizon scanning exercises will help identify new/evolving technologies with potential for reducing energy consumption across the Estate. The horizon and technology scanning exercises will amalgamate information from a variety of sources, including: student projects, academic collaboration, sector good-practice, market research and specialist consultants. These exercises will feed into the University's AMS and CMP process.	H. Asset M. H. Op. Sustainability	In progress, but not documented.
11		_Project Register (pipeline of energy saving projects)_	A pipeline of investment grade (technologically and financially feasible) energy saving projects ('shovel-ready' projects) will be developed from the horizon scanning exercises, enabling the University to capitalise on any funding opportunities it identifies (inc. third-party) and inform the AMS and the execution CMP. A summary will be kept in the public domain.	H. Op. Sustainability H. Asset M.	In progress.
12		_Register of funding opportunities._	To leverage the impact of its resources, the University will keep a register of funding opportunities it could potentially draw on to expedite the decarbonisation of its Estate.	H. Op. Sustainability H. Asset M.	In progress.
13		_Building-specific decarbonisation road-maps_	The CMP will set out the intended use for specific buildings. Building-specific decarbonisation road-maps will identify material decarbonisation opportunities that can be	H. Asset M.	Not started.

Ref.:	Objective	Deliverables	Rationale	Lead	Status
			explored through the natural asset replacement cycle or in the lead-up to or execution of CMP. These road-maps will incorporate elements of the horizon scanning exercises.		
14	**Tracking and reporting progress** annually	*Annual progress reports* (kWh savings and carbon emissions).	Reporting will demonstrate the direction of travel and provide an early warning mechanism. Reports will be publicly available.	H. Op. Sustainability	Elements in-place.