Infrastructure Decarbonisation Plan 2025 - 2030

Version - Final
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Executive Summary

The University of York is committed to achieving Net Zero Scope 1 and 2 greenhouse gas emissions by 2030 and a 30% reduction in Scope 3 emissions by the same year, as outlined in its Sustainability Plan. This Decarbonisation Plan details the current state of the university's infrastructure, establishes guiding principles, presents baseline emissions data, and outlines potential pathways towards these ambitious targets.

The university's estate comprises approximately 500 buildings of varying ages and construction, presenting unique challenges for decarbonisation. Currently, the campus relies heavily on a district heating network powered by gas-fired Combined Heat and Power (CHP) plants, which, while efficient, are a significant source of emissions. On campus, renewable energy generation is limited, primarily consisting of solar PV installations.

The plan proposes four decarbonisation pathways:

- **Option 1 (Business As Usual):** Relies solely on external factors like grid decarbonisation, which is projected to have a limited impact due to the university's proportion of on-site electricity generation.
- **Option 2 (Current Budget Options):** Utilises the allocated £10 million budget for projects such as LED lighting upgrades, expansion of solar PV capacity to 1MWp, building fabric improvements, and behavioral change programs.
- **Option 3 (Additional Renewable Electrical Energy Capacity):** Explores currently unfunded projects like large-scale solar PV (1.25MW) or a wind turbine (900kW), requiring careful consideration of their impact on existing CHP operations and heat production.
- **Option 4 (Replacement of Heat Source for District Heating Main):** Considers the replacement of the CHP heat source with a non-gas alternative, representing the most impactful but currently unfunded and technically complex option. Supported by the recent award of a £35m grant from the Public Sector Decarbonisation Scheme for a deep geothermal project.

Achieving Net Zero will require a multi-faceted approach, including reducing energy demand through building improvements, policies and behavioral change, increasing on-site renewable energy generation, and potentially replacing the existing CHP heat source. Even with significant interventions, residual emissions are anticipated, requiring a strategy for offsetting or insetting. The plan estimates that offsetting Scope 1 and 2 emissions under a "business as usual" scenario could cost approximately £3 million annually from 2030.

Key challenges include grid connection limitations for large-scale renewables, operational constraints on CHP usage, the need for significant funding beyond the current budget, and the technical complexities of integrating new technologies with the existing infrastructure.

The Sustainability Steering Group provides strategic leadership for the Sustainability Plan, with the Net Zero Project Board directly responsible for implementing this Decarbonisation Plan. Success will depend on securing necessary funding, overcoming technical challenges, and fostering a culture of sustainability within the university community.

1.0 Introduction

In 2021 the University of York launched an ambitious Sustainability Plan.

The plan sets out goals across six key themes linked to the UN Sustainable Development goals, these themes include:

- Quality Education
- Sustainable Research
- Climate Action
- Responsible Consumption and Production
- Cities and Communities
- Good Health and Wellbeing

The Climate Action section of the plan contains a goal for the University to be Net Zero on Scope 1 and 2 emissions by 2030, an ambitious challenge, but one that the University has committed to achieving. The purpose of this document is to set out the current context of the University infrastructure and the future plans to assist in meeting this ambition.

The University has a further target for Scope 3 emissions, which sets a target for a 30% reduction by 2030. Whilst this document contains reference to Scope 3 emissions, the focus of the content is primarily on the reduction of Scope 1 and 2 emissions.

1.1 University Estate

The University has approximately 500 buildings spread across Campus West, Campus East and Kings Manor sites. These buildings can be broadly placed into 4 categories based on the development of the University, these include:

- Pre-1945/Historic.
- 1960s Campus West Development.
- 1980s Campus West Extension.
- Post-2000 development Campus East and Campus West.

The University has long-term land lease agreements and partnerships with third parties for student accommodation. These arrangements along with the development phases pose a range of challenges associated with decarbonisation, including listed buildings, inefficient legacy buildings and ongoing collaboration with strategic partners.

Figure 1. Campus East and West Aerial Views

1.2 University Infrastructure

Campus East and West are supplied by a district heating network (DHN), supported by two Energy Centres, the existing and upgraded 1960's facility on Campus West and a new facility on Campus East. The infrastructure is owned and operated by the York University Energy Supply Company (YUESCo) a wholly owned subsidiary of the University of York.

The Campus West Energy Centre contains two 1.5 MW gas Combined Heat and Power (CHP) plants and a modulating gas boiler, along with a gas oil boiler. On Campus West the DHN mainly supplies the 1960s and post-2000 buildings, with approximately 340 independent gas boilers supporting the remainder of the buildings. In 2023, a new Energy Centre was brought online on Campus East, incorporating a 2.3MW gas CHP. The CHPs do not currently export electricity to the external electricity network, apart from a small amount as a result of load following.

The University network also has an 850kW biomass boiler, installed to supplement the DHN on Campus East, this facility is currently not operated.

The University has two high voltage incoming mains, a 10 MVA electrical supply at the Energy Centre on Heslington West Campus and a 9.375 MVA incoming main at the Energy Centre on Heslington East Campus. IT data centres and facilities at Biology and Central Hall have backup diesel generators and there are a small number of portable generators to support critical functions.

In terms of renewable production, the University has approximately 1,500 solar panels (March 2025) with an anticipated output of 730 kWp/year. The solar panels are located at the Constantine Nucleus, Environment Building, ISA, WACL and the new Nursery, with the most recent installations on the Harry Fairhurst Building, the Hull/York Medical School and the Church Lane Building.

The University currently purchases additional electricity through a low carbon tariff (nuclear fuel source), which makes up the balance of energy demand on the University campus.

Currently, approximately 80-90% of consumed electricity is generated on site through the CHP units, the remaining electricity is imported from the grid.

Figure 2. Campus West and East Energy Centres

Figure 3. Solar Panel installations at the Institute for Safe Autonomy and the National Centre for Atmospheric Science

1.3 Current Infrastructure Strategy

The current heating plant provides medium temperature hot water via primary pump circuits to three constant temperature circuits which comprise the district heating networks described as:

- Heslington West (South)
- Heslington West (North)
- Heslington East

These provide approximately 65% of the heating demand on campus, with the rest being heated from localised independent gas boilers.

The operational rationale is electricity generation led as follows:

1. To run all three CHPs at an output to maximise electricity generation and minimise electricity import.

2. To run all three CHPs to meet the heating and hot water requirements to circa 70% of campus.

3. If the CHPs are unable to provide the required heat demand, one of the natural gas boilers in the Energy Centre will automatically fire up and support any additional heat demand. As demand for heat drops any natural gas boiler support will automatically turn off.

4. As electricity demand drops the CHP output will automatically reduce via a demand following strategy. As CHP efficiency and longevity is adversely affected by running at less than 50% output, the University's High Voltage network is arranged so that at minimum base load all three CHP's run but none at less than 50%.

The integration of renewable production into the existing network represents a key challenge to normal operation in addition to the constraints described in Section 1.4.

1.4 External Factors and Internal Constraints

The external electricity network has limited capacity for additional connection agreements, constraining the connection of any large-scale renewable production, which will only be resolved by upgrades to the network by the network operator.

Northern PowerGrid has set an export allowance for the University that will not be increased until approximately 2034, pending upgrades to the local network by National Grid. This restriction limits the University's ability to undertake any substantial new generation projects on campus.

Reducing demand on the Heslington East Campus CHP will currently lead to operational inefficiencies as it would have the potential output below the recommended 50% demand, which would affect the reliability and quality of the electrical network. This limits the ability to add significant renewable production on Campus East under current operating arrangements.

To allow for additional renewable generation on Campus West, Northern Power Grid has placed a requirement on the University to install Power Quality Monitoring in the Heslington West main substation, which will allow for additional renewable production on Campus West. This would also need to be included on the Heslington East Campus for any significant renewal production initiatives.

Due to these constraints, the majority of renewable production outlined within this plan will be centred on Campus West, with an anticipated maximum output of 1MWp.

A recent award from the Public Sector Decarbonisation Scheme will support a significant deep geothermal project through a £35m grant.

2.0 Decarbonisation Principles

The University Executive Board has approved a range of principles that will guide the approach to decarbonisation, which are listed below:

- Reduce the size of the estate to reduce demand on heating / power.
- New buildings - Net Zero in operation and construction.
- Increase the energy efficiency of buildings - fabric first improvements.
- Increase the energy efficiency of buildings - optimisation improvements.
- Behavioural change within the University community.
- Move to electrification of the estate - away from gas heating.
- Renewable technology and infrastructure - energy production.
- 'Insetting' the remaining carbon emissions, with external offsetting as a final resort.

These guiding principles will be used to inform future development, maintenance and repair of the Estate to ensure that decarbonisation is built into all potential interventions made.

3.0 Baseline Data

The baseline carbon data for this plan has been taken from a 2017-2019 average, Figure 4 provides the breakdown across Scope 1, 2 and 3 emissions.

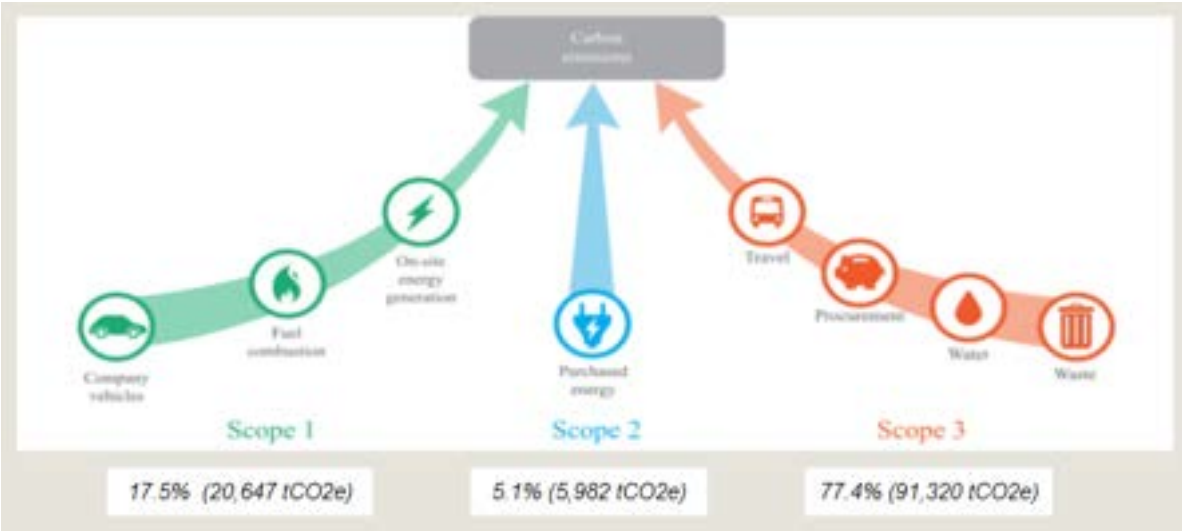

Figure 4. Baseline data for Scope 1, 2 and 3 emissions.

Table 1 provides the carbon reporting data since the commencement of the Sustainability Plan in 2021, with Figure 5 showing current progress against a straight line target.

Year	Scope 1	Scope 2	Scope 3
2020-2021	21,347	3,240	53,775

2021-2022	18,953	4,018	77,637
2022-2023	20,049	3,779	89,356
2023-2024	21,780	2,346	86,328

Table 1. Annual Carbon Figures for Scope 1, 2 and 3 Emissions (tCO_2e) (2021-2024)

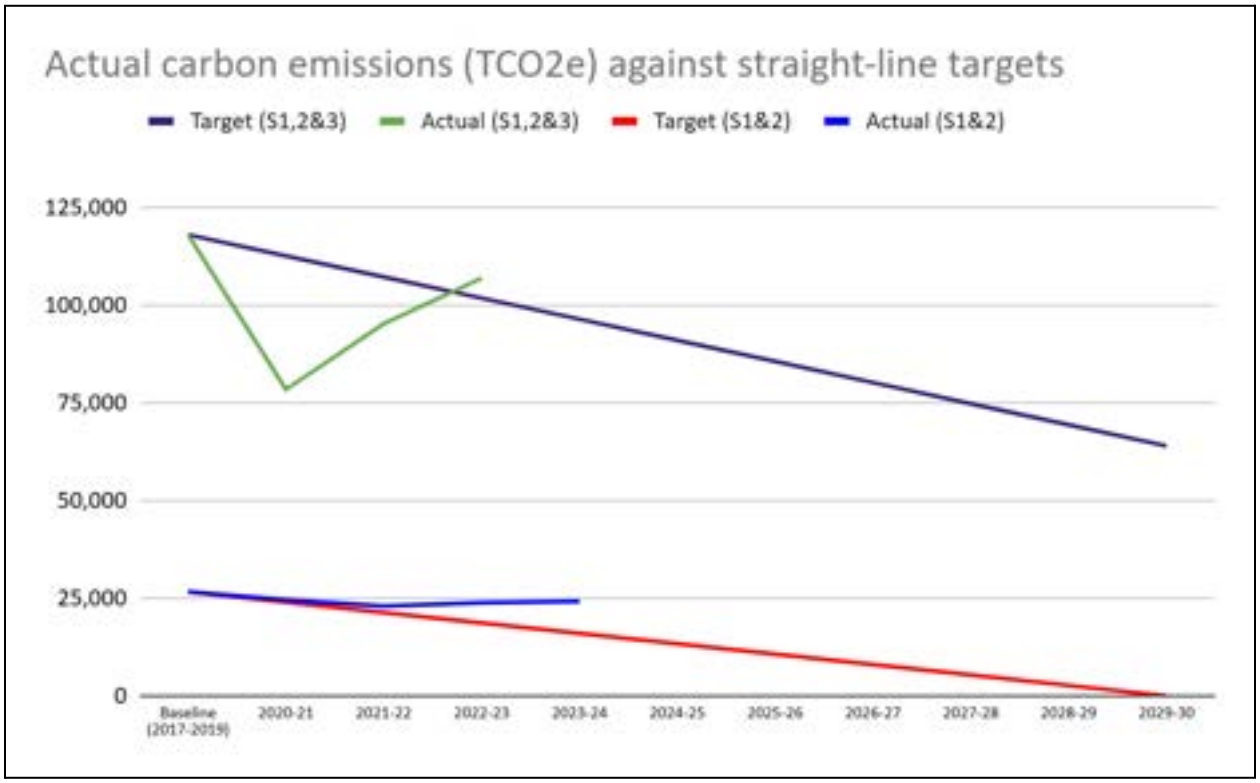

Figure 5. University of York - Actual carbon emissions (tCO_2e) against straight-line targets.

The current operating model means that we are generating more electricity through the CHP engines and importing less from the grid, which has increased our Scope 1 carbon emissions, whilst reducing Scope 2. This model has a financial benefit to the University in terms of electricity production.

The pandemic was the primary reason for the dip in Scope 3 emissions in 2021-22 due to the main sources of emissions within Scope 3 resulting from commuting, business travel and purchased goods and services, which were all reduced due to the pandemic, but are now returning to pre-pandemic levels.

4.0 Decarbonisation Pathway Overview

The decarbonisation schemes within this plan will be assigned against 4 options:

Option 1 - business as usual and wait for external factors to materialise e.g. grid decarbonisation and alternatives to natural gas.

Option 2 - Decarbonisation Pathway based on the current Net Zero budget allocation, plus changes to external factors.

Option 3 - As 2, but also including currently unfunded renewable electricity opportunities, as well as fully resourcing a behavioural change engagement plan.

Option 4 - As 3, but incorporating the Deep Geothermal Project, as well stricter policy and behaviour change participation..

Within these options, interventions for the Scope 1 and 2 decarbonisation can be split into 3 categories outlined below.

- Production - covers the diversification of energy production on campus and will primarily look to address how the University's infrastructure can diversify away from the use of natural gas.

  Options for production within the context of this plan include the installation of additional solar PV, air source heat pumps or electrification of heating and options for replacement for the heat source for the District Heating Main.

- Reduction - focus on improvements to reduce our overall energy demand, examples include behavioural change projects and infrastructure upgrades to reduce overall energy demand.

  Options for reduction within the context of this plan include:

    - Building mothballing
    - Temporary building efficiency periods
    - Behaviour and policy change
    - LED lighting installation
    - Baseload optimisation
    - Building fabric upgrades
    - IT server room upgrades

- Optimisation - ensuring that the existing infrastructure is operating as efficiently as possible.

Options for optimisation in the context of this plan include smart controls, building management system upgrades and building infrastructure optimisation to improve building systems to make them more efficient and effective.

These key elements will form the basis of this decarbonisation plan and associated pathway. To achieve the Net Zero target any generated carbon emissions remaining after these options have been implemented will be subject to an agreed off-setting or in-setting strategy.

4.1 Option 1 - business as usual

This approach relies on developments outside of the control of the University to reduce carbon emissions.

The primary factor for Option 1 is the decarbonisation of the external power grid (see Figure 6). Projections to 2030 show a potential 25% reduction in the carbon intensity of the grid, which will improve the carbon factor associated with imported electricity.

In the context of the University, given that the majority (approximately 80%) of electricity is generated on campus through the CHP units, this will have a diminishing contribution to carbon reduction as the amount of renewable production increases on campus.

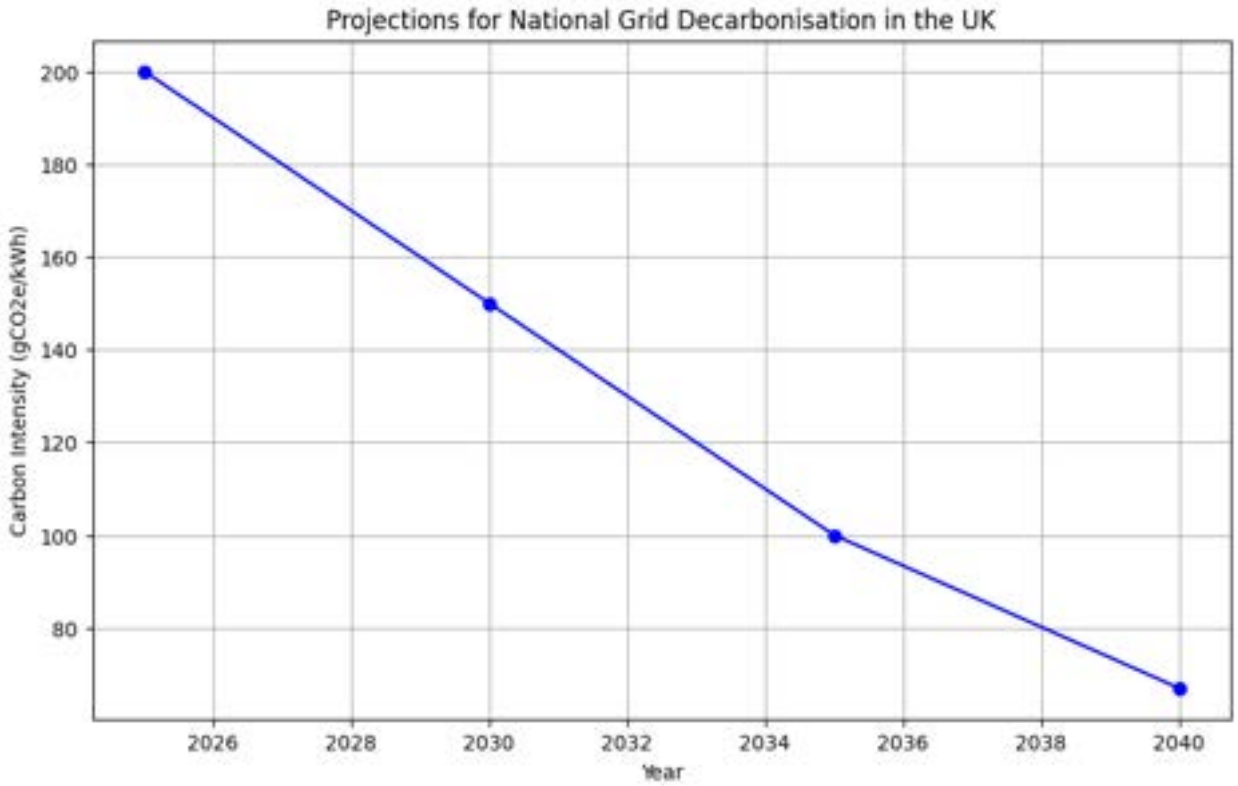

Figure 6. Projections for UK grid decarbonisation.

Source projections from the UK government's Department for Energy Security and Net Zero (DESNZ). These projections are detailed in their annual reports on energy demand and greenhouse gas emissions, specifically the "Energy and Emissions Projections 2022 to 2040"

Further future external developments may include the replacement or mixing of alternative sources of gas within the gas network, such as Hydrogen. It is not anticipated that this will be an option for the University network within the next 15-20 years.

Currently the only factor that will make an impact from Option 1 is the decarbonisation of the grid, this is shown in the ‘business as usual chart in Section 5.2 of this report.

4.2 Option 2 - Current Budget Options

The University has allocated a dedicated £10 million budget over the next five years to support decarbonisation initiatives. The Net Zero budget will be supported through other work on the Estate associated with development and maintenance to improve building performance and associated long term carbon emissions.

Currently the budget is distributed across various projects, including:

- LED lighting upgrades
- Solar PV installation
- Building fabric upgrades
- Infrastructure and heating optimisation
- IT server room upgrades

A proportion of the budget is reserved to support match funding for successful grant applications.

Planned Solar PV projects will increase the campus's total generation capacity to 1 MWp, this will primarily be situated on Campus West due to the demand constraints described on Campus East. This is near the limit of generation capacity allowed under current agreements with Northern Power Grid. The additional solar capacity will help manage peak electricity demand on campus, reducing reliance on imported grid electricity.

Other projects, such as LED lighting upgrades and building fabric improvements, as well as behavioural change programmes will contribute to reducing the overall electricity demand on campus.

Options described within this section will be delivered in full through the delivery of the decarbonisation plan.

4.3 Option 3 - Additional renewable electrical energy capacity

This section will describe options for additional renewable electricity capacity in addition to that be delivered through Option 2.

There is currently no funding allocated to these projects and detailed feasibility work will be required to confirm how these technologies will interface with the existing network, particularly the replacement of heat production through the CHPs.

The options within this section account for large scale Solar PV or additional generation through Wind Turbines.

The current option for solar PV includes the installation of a 1.25 MW ground mounted array, to be located on land adjacent to Campus East, providing an estimated annual production of 1.16GWh and an associated carbon saving of 230 tonnes.

The current option for wind generation includes the installation of a 900kW Wind Turbine on Campus East, providing an estimated annual production of 1.3 GWh and an associated annual carbon saving of 230 tonnes.

As noted within section 1.4, reducing demand on the Heslington East Campus CHP will currently lead to operational inefficiencies, affecting the reliability and quality of the electricity supply. Therefore these options will also need to consider alternatives for heat production due to their impact on CHP demand.

It is also recognised that there will be interventions that will increase the demand on energy on campus, such as the requirement to provide EV charging points and the provision of new facilities, which may reduce some of the demand issues.

4.4 Option 4 - Replacement of Heat Source for District Heating Main

Option 4 includes the replacement of the heat source for the district heating main, moving away from the reliance on natural gas and the use of the CHP units. The replacement of the CHP heat source will reduce the gas demand on campus by approximately 65%. The remainder of heating is made up from individual gas boilers on campus, which will be addressed after the implementation of Option 4.

The replacement of the heat source would reduce Scope 1 emissions by approximately 70%, which will be achieved through the delivery of the Deep Geothermal Project.

4.5 Offsetting / Insetting residual emissions

Even if the most significant interventions across all of the options are implemented there will be some remaining carbon emissions generated. To achieve the target of being carbon Net Zero the University would need to balance these residual emissions.

The most common practice is to purchase verified carbon offsetting credits from external providers to cover the residual emissions. If Option 1 (“business as usual”) was undertaken it is predicted to cost approximately £3 million annually from 2030 to offset the scope 1 and 2 emissions. This is not a single investment cost but would need to be purchased on an ongoing annual basis to retain a carbon Net Zero status for the University. This cost could potentially be reduced if the carbon emissions are reduced.

In 2030 the demand for carbon credits will outpace projected supply by 7 times, due to the large number of other companies that all have similar 2030 carbon targets. Resulting in scarcity of available carbon credits and expected cost increases.

‘Carbon Insetting’ is similar to ‘Carbon Offsetting’ but instead of investing in external projects, insetting would relate to investing in the value / supply chain of the University to provide a more direct impact (including our own scope 3 emissions) and increased collaboration with our stakeholders. Insetting would require more work for the University and potentially not have the same certification and validation processes.

Another option is to invest the money we would otherwise spend on offsetting / insetting the residual carbon emissions directly into operational projects on campus to reduce our direct Scope 1 and 2 emissions.

The University will develop policy relating to off-setting ahead of the 2030 target date.

5.0 Decarbonisation Plan

5.1 Potential Pathway timeline

	Option 1							
	Option 2							
	Option 3							
	Option 4							
Area	**Intervention**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Production	Grid Decarbonisation							
	Solar: Rooftop							
	Solar: Ground							
	Wind Turbine: ground							
	Heat Source Replacement - District Heating							
Optimisation	Ongoing Energy Optimisation							
	Baseload Optimisation							
Reduction	Building retrofit							
	LED replacements							
	Campus rationalisation							
	Behaviour change programmes							
	Campus efficiency periods							

5.2 Potential carbon reduction

The graphs in figures 7-10 show waterfall graphs of the reduction in carbon emissions, from the original baseline total emissions, for each category of intervention currently identified across the various options.

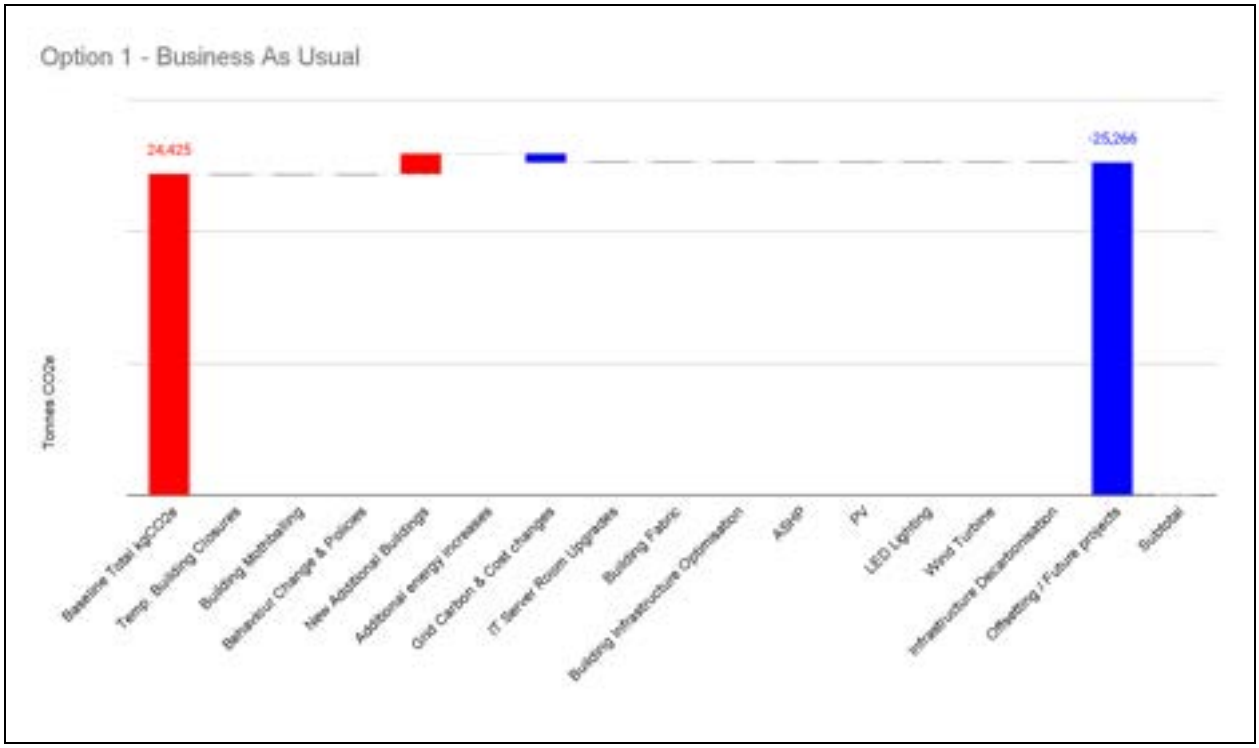

Figure 7. Interventions waterfall graph for Option 1 - business as usual and wait for external factors to materialise e.g. grid decarbonisation and alternatives to natural gas.

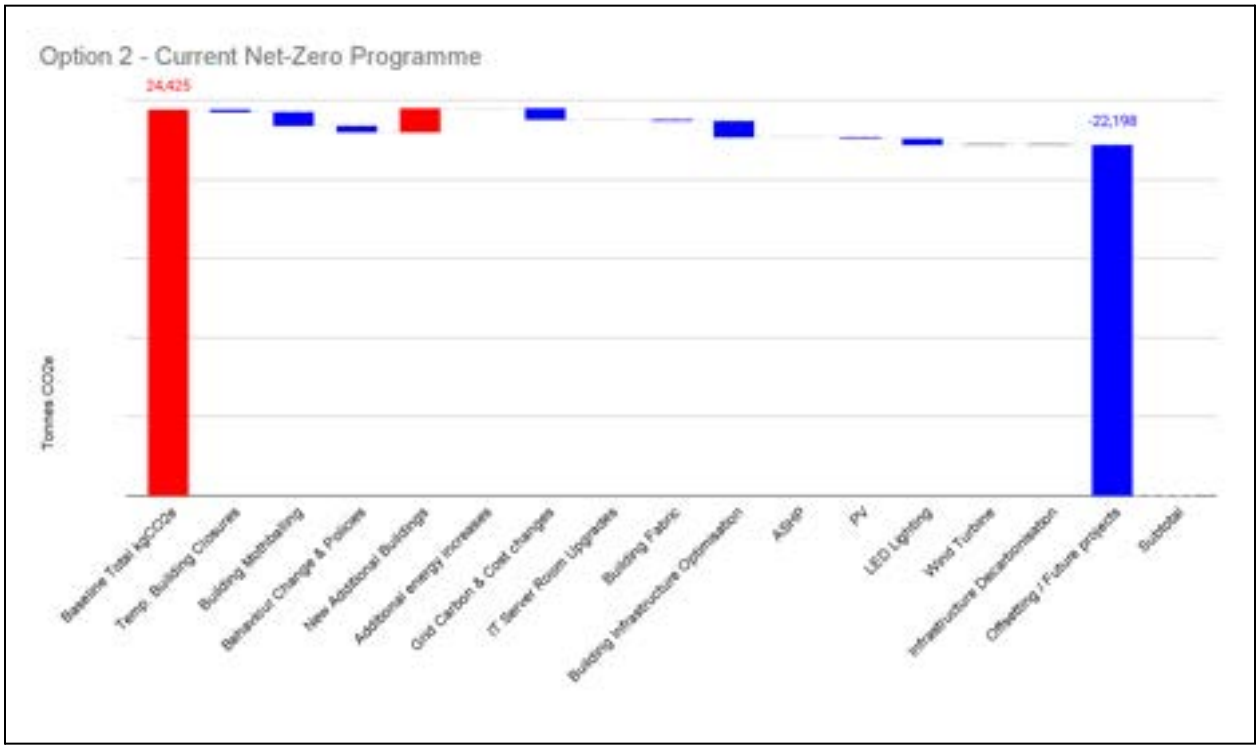

Figure 8. Interventions waterfall graph for Option 2 - Decarbonisation Pathway based on the current Net Zero budget allocation, plus changes to external factors.

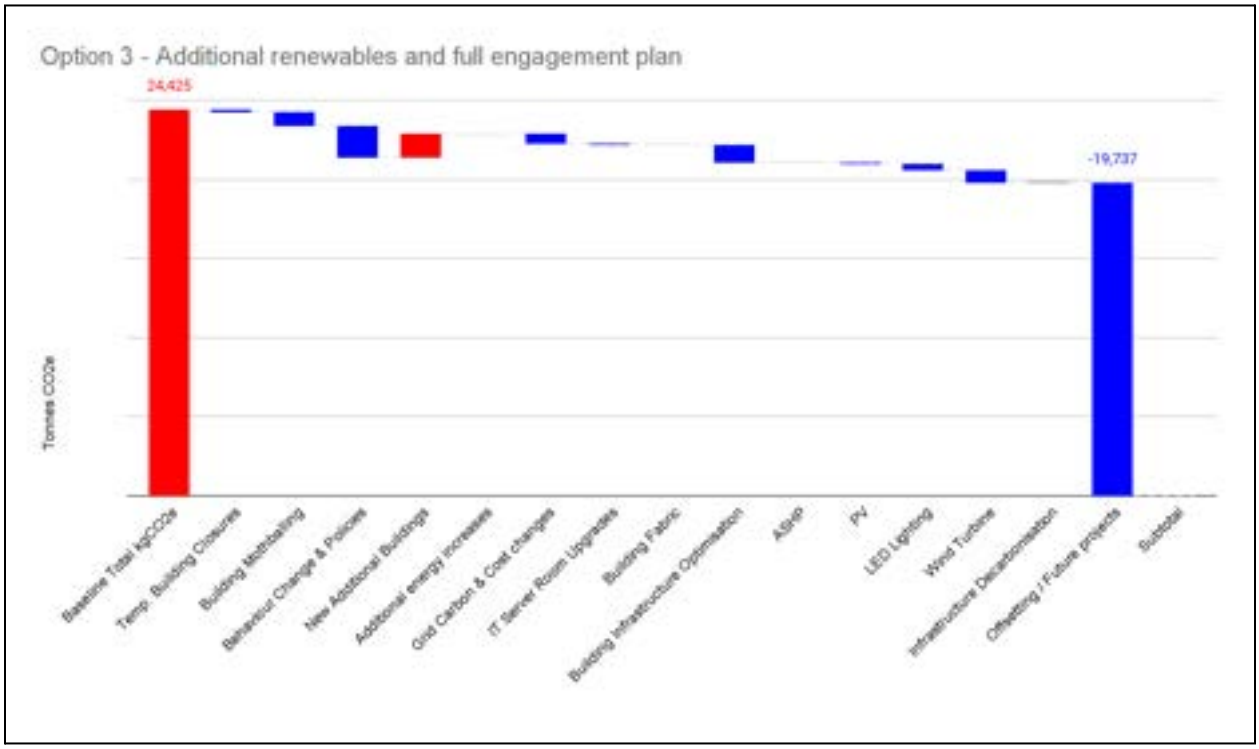

Figure 9. Interventions waterfall graph for Option 3 - As 2, but also including currently unfunded renewable electricity opportunities, as well as fully resourcing a behavioural change engagement plan.

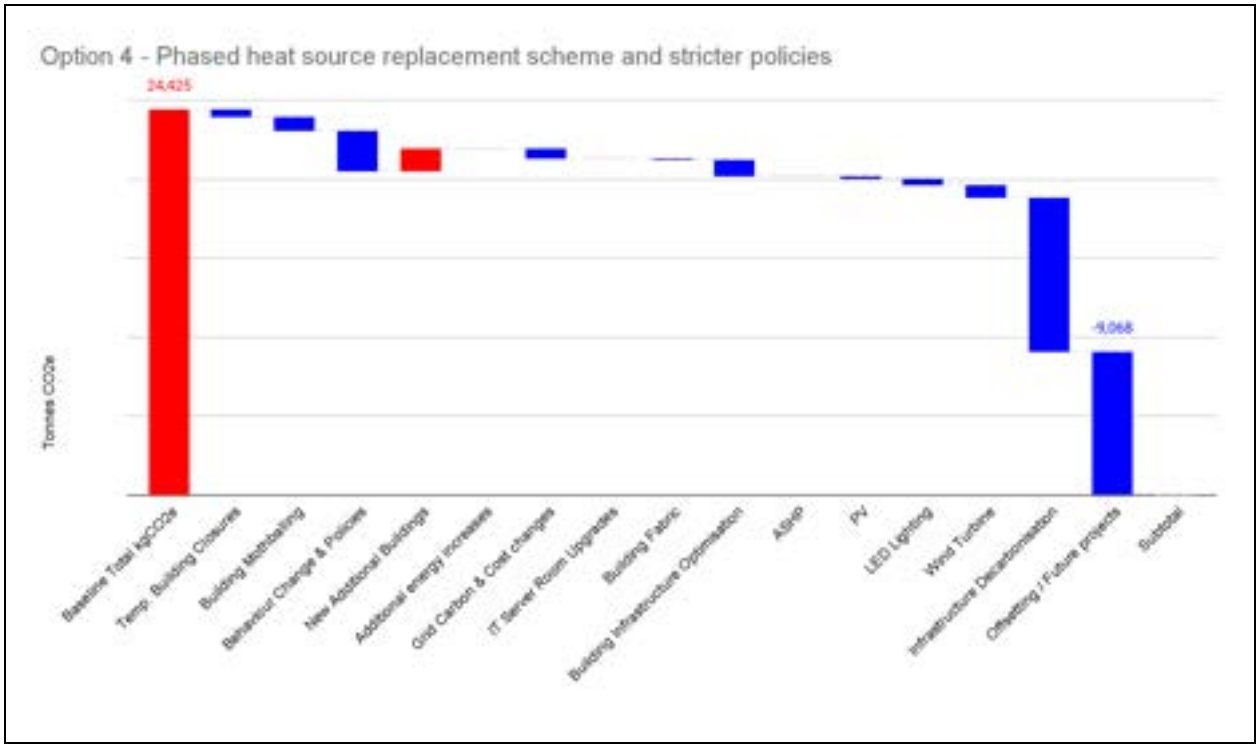

Figure 10. Interventions waterfall graph for Option 4 - As 3, but also including currently unfunded renewable district heating replacement scheme, as well stricter policy and behaviour change participation.

The waterfall graphs highlight that even with the currently proposed interventions and renewable electricity opportunities there is still a significant amount of carbon emissions that will need to be addressed through large scale heating decarbonisation works or offsetting to achieve carbon Net Zero. This is mainly due to the carbon emissions associated with running the gas fired CHP and boilers.

6.0 Challenges and Risks

Decarbonisation of the University of York's infrastructure comes with a range of challenges and risks, some of which have been outlined within this plan, but are summarised within this section.

- The decarbonisation of the grid is dependent on continued private and government investment in renewable energy projects in challenging economic conditions. It is however anticipated that this will have limited impact given the declining reliance on imported electricity.

- The current Net Zero budget will only address approximately 3% of scope 1 and 2 emissions. Grant funding or other sources of external funding will be required to address the shortfall in funding.
- Internal resource constraints could impact the acceleration of decarbonisation projects or the ability to deliver at scale.
- The local network that supplies the University does not have the capacity to accept any large scale renewable generation projects. The upgrade to the network is scheduled to take place in 2034.
- The internal network is configured to prevent the CHP units operating under 50% of capacity. This places constraints on the amount of additional renewable generation that can be introduced, particularly on the Heslington East Campus.
- The CHPs provide a reliable baseload of heat and electricity, there are limited alternative technologies that will deliver this capacity (7MW) at the scale required or that will integrate with the configuration of the existing network.
- There is also a growth risk relating to the University Estate in the event that major capital developments increase the size of the Estate or the associated electrical demand.
- The gas and electricity price differential continues to be favourable for the generation of heat and electricity through the CHP units. It is likely that this differential will decrease over time, requiring alternative plans for the cost effective generation of heat and electricity, but this is unlikely to occur within the next 5 years based on current information.
- The Sustainability performance of the University, including carbon reduction, will become an increasingly important factor for student recruitment and grant funding applications. Continued focus on decarbonisation is required to ensure that the University continues to meet stakeholder expectations.

These represent the main risks to decarbonisation at the publication date of this plan. These risks are likely to shift during the life of this plan and will be updated for any significant changes.

7.0 Governance and Reporting Mechanisms

The Sustainability Steering Group (SSG) provides strategic leadership for the implementation and delivery of the University Sustainability Plan.

The Group has the responsibility for defining the overarching vision for sustainability at the University and makes recommendations to the University Executive Board (UEB) for Council approval. It is the central governing and oversight group for sustainability at the University. The Group develops and oversees the implementation of the University Sustainability Plan ensuring alignment with University Strategy.

SSG has assigned responsibility for the delivery of this Decarbonisation Plan to the Net Zero Project Board. The Net Zero Project Board is responsible for the development and oversight of the Net Zero Programme. The Net Zero Project Board is a sub-group of the Integrated Infrastructure Board (IIB) and will make recommendations on the programme of work for approval on an annual basis and provide updates as required by the IIB schedule of business.

The Board will have overall responsibility for approving initiatives, projects and programmes of work associated with the decarbonisation of University infrastructure. It will also seek to establish the campus as a ‘Living Lab’ harnessing expertise from within the University and through strategic partnerships to accelerate progress with decarbonisation.