LSE Carbon Reduction Strategy

Achieving a Net Zero Carbon Estate by 2030

May 2021

QA

Review and Approval

Action	Name & Role	Signature	Date
Prepared By	Helen Fake Sustainability Assistant Ali Ashpitel Sustainability Manager		12/05/2021
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Approved By	Isabel McAllister Director Responsible Business		13/05/2021

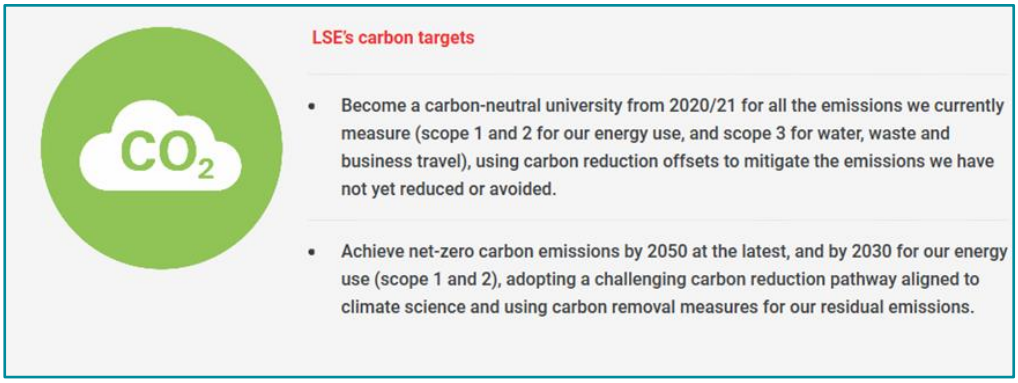
Revision History

Revision	Description	Date
1	First draft issued to LSE for comments	24th March 2021
2	Final draft for approval	13th May 2021
3		
4		

Contents

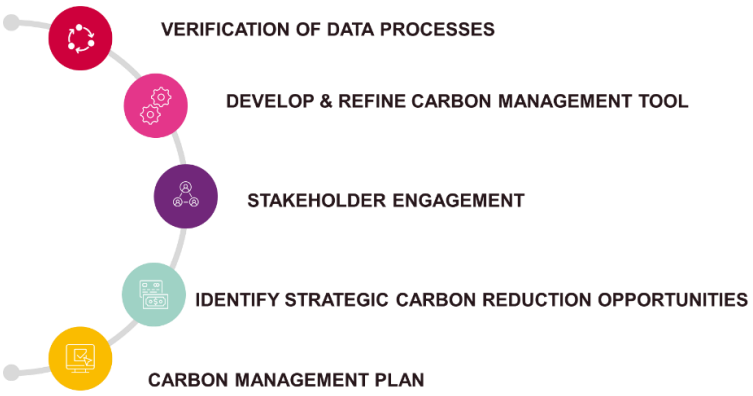
Executive Summary

As a global leader in higher education, the London School of Economics is driving sustainability with the launch of their new Sustainability Strategic Plan in October 2020, which sets ambitious net zero carbon targets for both 2030 and 2050 and requires a clear roadmap for delivery in the form of a new and accessible Carbon Reduction Strategy.

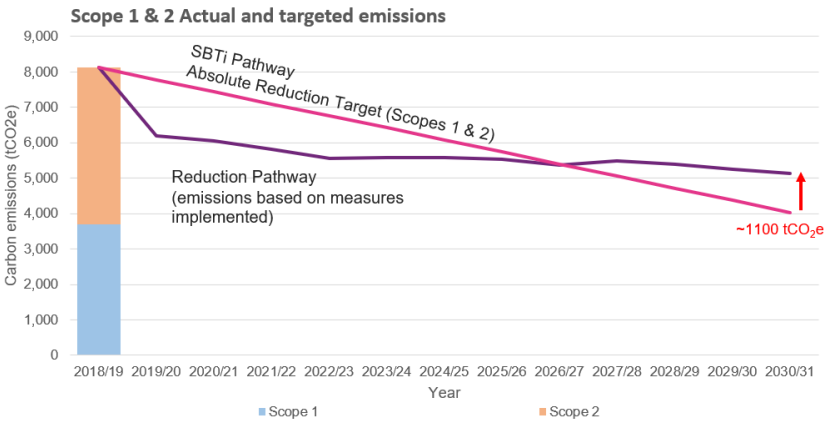


Mace was appointed to develop a strategy that sets out LSE's current baseline carbon position and mapped the required pathway to an absolute carbon reduction aligned to Science Based Targets (SBTi).

Through the process illustrated, we developed an Excel-based Carbon Reduction Tool which is a live document used to show the impact of potential carbon reduction measures on the overall pathway to Net Zero Carbon (NZC), with the intention that LSE will use this in defining and evaluating a preferred route to achieve its carbon targets.



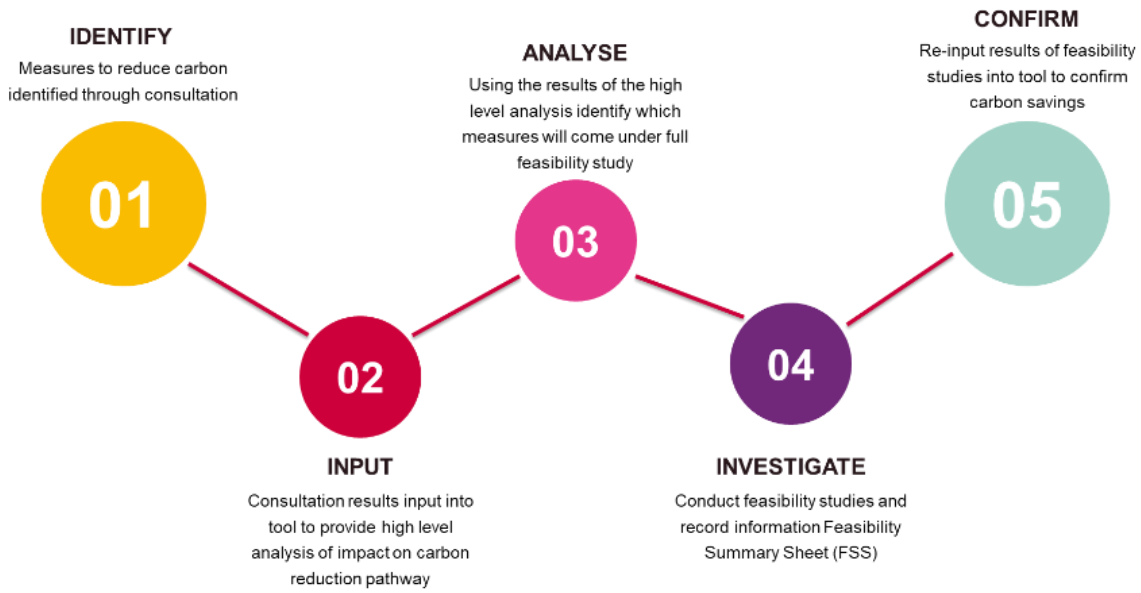
The baseline position mapped in the Tool shows that a Business-As-Usual scenario will not meet the 2030 target. Without intervention, the carbon emissions resulting from the current strategy will exceed the SBTi limits during the academic year 2026/27.



To continue to meet the SBTi pathway beyond 2027, LSE must take action now and adapt the existing plan for the estate to promote carbon saving measures. Through collaborative engagement with relevant LSE stakeholders, we have identified a series of options that align with the existing aspirations for the estate, while saving enough carbon to meet the SBTi absolute reduction pathway.

Options for LSE Estate to meet NZC 2030 target
Option 1 60% electrification of the estate's heating + disposal of leased properties.
Option 2 30% electrification of the estate's heating + deep refurbishment of Towers Building; disposal of leased properties.
Option 3 Deep refurbishment of Towers Building + refurbishment of key properties to Paris Proof Targets + disposal of leased properties.
Option 4 Central energy centre using Air Source Heat Pumps

Having identified four potential options for LSE to meet the 2030 carbon targets, further feasibility work will be required to determine the way forward. This analysis will be supported by use of the Carbon Reduction Tool to quantify the effects of each option on LSE's overall carbon profile.



The ability to quantify the impacts of changes in the estate on the overall carbon footprint will drive scenario planning and support LSE in decision-making about which additional measures to implement in the short to medium term.

1

Introduction

1.1 Introduction

The launch in October 2020 of LSE's new Sustainability Strategic Plan saw a public commitment for the university to become carbon neutral in 2020, and fully Net Zero Carbon by 2050 at the latest, and by 2030 for its Scope 1 & 2 emissions.

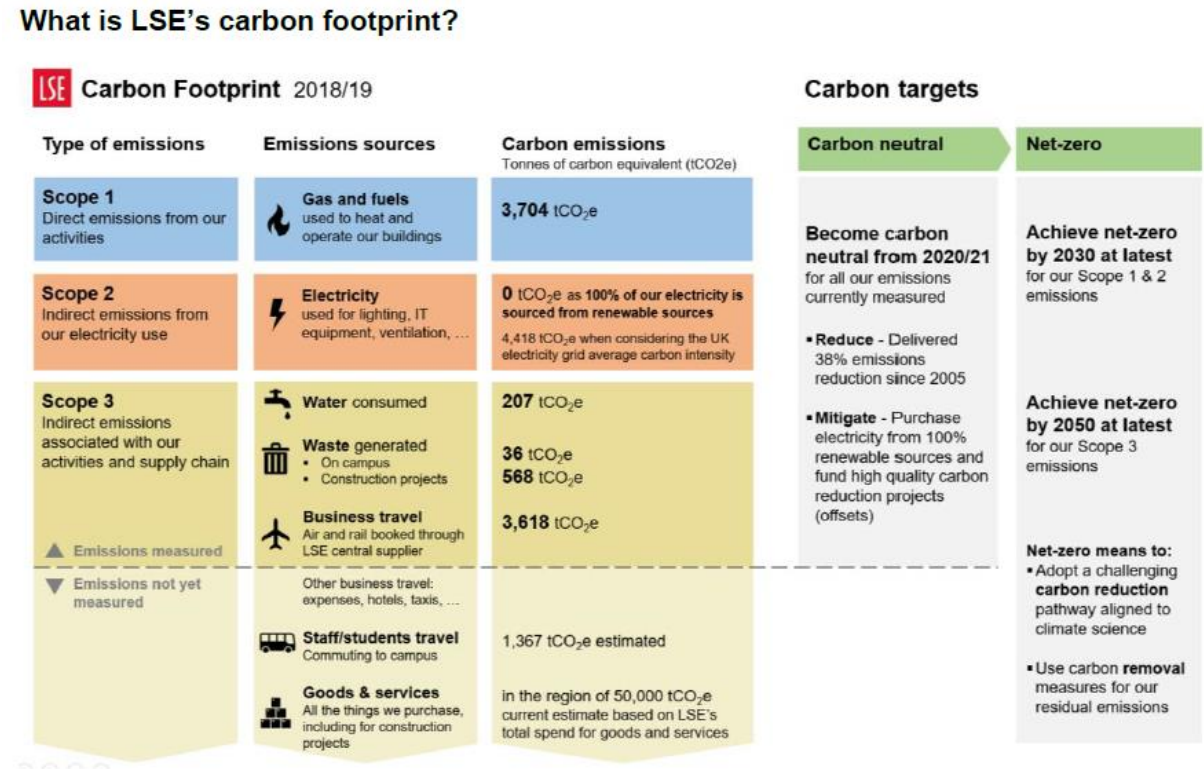


Figure 1. LSE's carbon footprint

Carbon Neutral vs Net Zero Carbon

Carbon neutrality will be achieved by LSE in 2020/21 for its measured emissions through the purchase of high quality carbon credits equal to the amount of carbon emitted. This process balances the overall amount of carbon in the atmosphere, mitigating LSE's carbon impact.

LSE's Net Zero Carbon (NZC) target goes further than this. Priority is given to further reducing carbon emissions through improvements to efficiency and use of alternative technologies. Remaining emissions are mitigated through initiatives which will remove or sequester existing carbon.

Mace was appointed in 2020 to support the LSE Sustainability Team to develop a Carbon Reduction Strategy which sets out an estate-wide approach to achieve the new 2030 carbon target. This strategy provides the detail of a range of strategic options to **measure, reduce and mitigate** carbon emissions from the estate to deliver the headline targets.

The Carbon Reduction Strategy is supported by an Excel-based Carbon Reduction Tool which is used to map the impacts of changes to the LSE estate and/or relevant external factors, and to track these impacts against progress towards the carbon reduction target.

While the Carbon Reduction Strategy is a static outline of options and next steps to achieve the required carbon savings, the Carbon Reduction Tool is a live document that will be updated and used to drive future scenario planning and decision-making.

1.1.1 Drivers

Driver	Details
Maintaining LSE's status as a leader in sustainability	LSE's carbon targets have been widely publicly communicated, and as such there is a reputational risk for the School should it fail to deliver these. In the latest HEDQF Sustainable Campuses Report, results showed: "students are not only well informed about the necessity for sustainability in design, but also that they are willing to take a 'hands-on' approach in the pathway towards more sustainable living." When compared to HEDQF's previous research an unprecedented number of additional written comments were received around sustainability. A defined plan to achieve NZC will enable LSE to maintain its leading sustainability status amongst peers and with students.
Ensuring cost and supply certainty	Planning for delivery of 2030 carbon targets will support better certainty for its energy needs into the medium to long term. This opens to LSE a number of options to protect itself from market variations in energy costs, including Power Purchase Agreements (PPAs) and direct investment in generation.
Increasing energy costs	LSE is currently budgeting for a 4% year-on-year increase in energy costs. An active energy management plan that reduces emissions via energy efficiency and the use of new technologies can therefore protect LSE against these increasing cost pressures.
Decarbonisation of the electricity grid	The UK electricity grid is projected to decarbonise rapidly over the next 10 years whilst innovations to decarbonise the gas network (through e.g. use of hydrogen) are not expected to become mainstream before 2030. Much of the LSE estate is served by gas and a direct switch from gas to electric heating would allow LSE to take advantage of decarbonisation of the grid. However, this transition will increase operating costs due to the higher price of electricity as compared to gas. To mitigate this cost differential, measures to reduce energy demands should be prioritised in strategic planning for the estate.

1.1.2 Content & Structure of the Carbon Reduction Strategy

While the LSE targets cover all emissions categories, the Carbon Reduction Strategy focuses on Scopes 1 and 2, which relate to operation of the estate and delivery of capital works. Mace Scope 3 emissions recommendations to meet the 2050 target are covered in the accompanying "Scope 3 Emissions Review" report.

The Carbon Reduction Strategy covers:

- **Measure:** LSE's current Scope 1 and 2 position and quantification of the required reduction pathway to 2030
- **Reduce:** A series of strategic options to reduce estate-wide carbon emissions, compiled through discussion with LSE key stakeholders
- **Mitigate:** Quantification of the requirements to offset residual carbon emissions

The strategy provides a summary of LSE's baseline carbon position and the SBTi pathway to Net Zero Carbon, and presents the identified options with potential to achieve the targets.

The strategy is supported by our bespoke Excel-based Carbon Reduction Tool. The Tool is a live document used to map carbon emissions from LSE's estate against a reduction pathway aligned with Science Based Targets. It enables LSE to model changes across its Scope 1 & 2 footprint, for example:

- Yearly changes in carbon factors
- Yearly changes to LSE estate, e.g. new builds, estate rationalisation and changing energy consumption patterns
- Energy efficiency implementation, e.g. changing heating strategies or retrofitting existing buildings

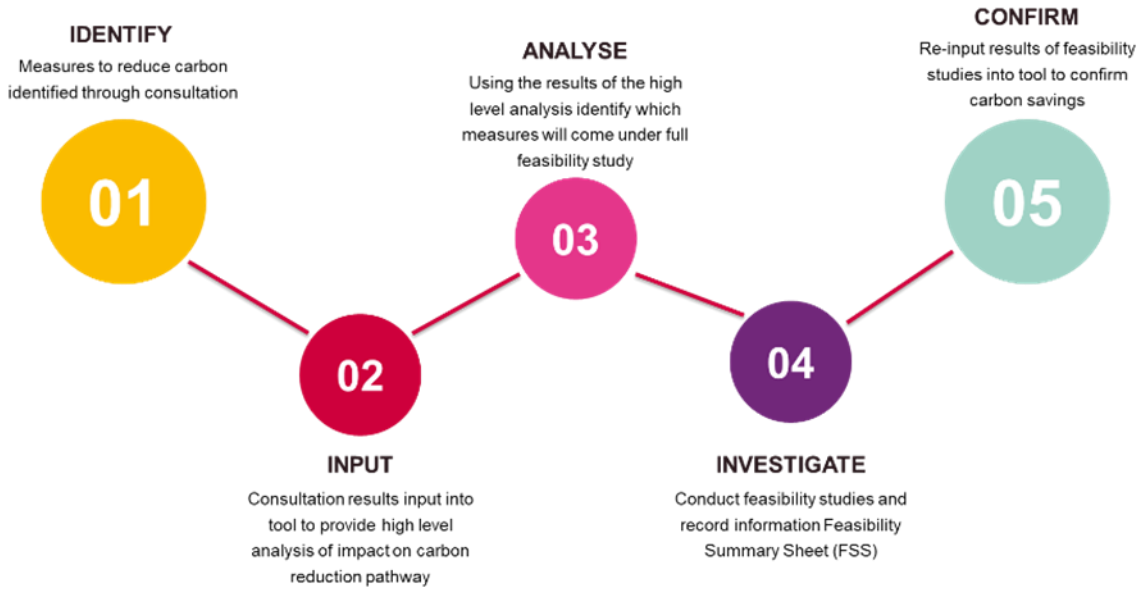


Figure 2. Carbon Reduction Strategy and Carbon Reduction Tool Process

To support LSE's assessment of proposed options, Mace has developed a process for use of the Carbon Reduction Tool, as shown in Figure 2. The Tool is a working document, that can be updated to reflect changes in estate strategy and progression towards the carbon target.

2

Carbon Reduction Strategy

2.1. Measure: Scope 1 & 2

Viable carbon reduction options were identified through consultation with LSE stakeholders. The feasibility of these options has to date been evaluated at high level. This section of the Carbon Reduction Strategy summarises the three options identified, with further details of individual measures provided in Appendix 3.

To achieve the 2030 Net Zero Carbon target, LSE will need to commit to one of the options (or equivalent, to be evaluated using the Carbon Reduction Tool).

2.1.1. Current position of the LSE Estate

The 2030 and 2050 targets build on the success of LSE's previous carbon-saving initiatives, including the Re:Fit programme, which delivered a 38% saving by 2018/19 against a 2005/06 baseline. Figure 3 shows how the 2030 target for Scopes 1 & 2 compares to the earlier baseline year of 2005/06 and new baseline year of 2018/19.

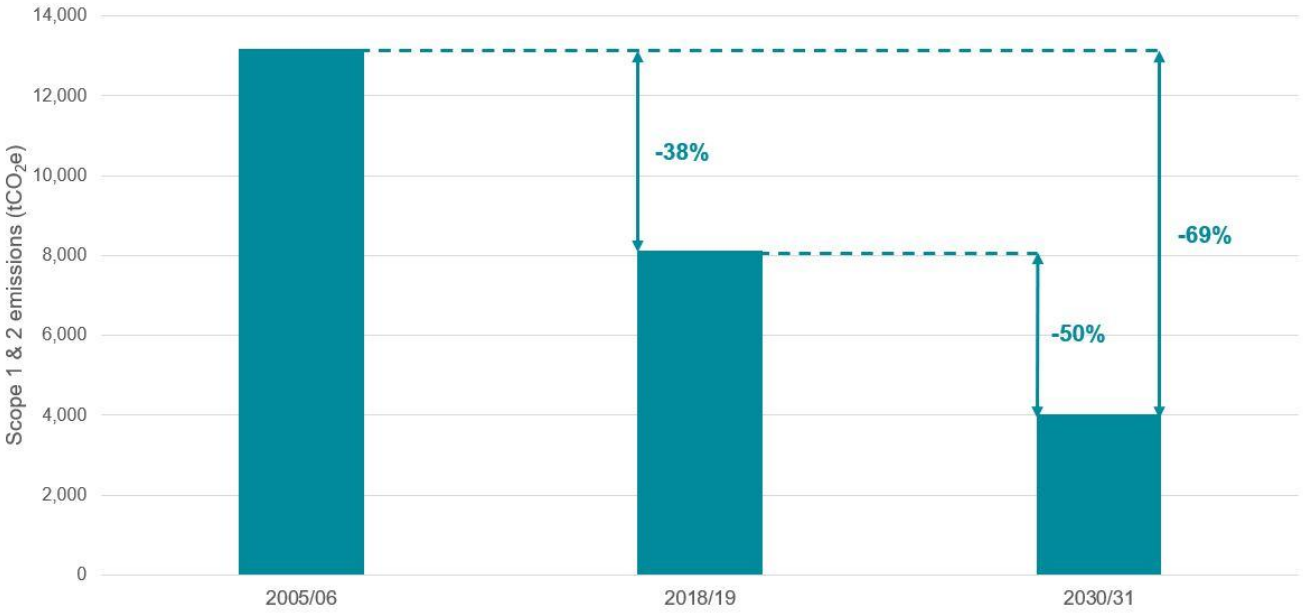


Figure 3: LSE's 2005/06 scope 1 & 2 baseline emissions, the emissions reduction achieved to date in 2018/19 and the targeted reduction to 2030/31.

The 2030 Net Zero Carbon target will be primarily achieved through a reduction in carbon emissions. The reduction pathway has been determined in accordance with the guidance for Science Based Targets (1.5-degree model) and represents a 50% reduction in absolute carbon emissions by 2030, against a 2018/19 baseline.

What is a Science Based Target?

Science Based Targets *are developed using independent models that calculate the level of carbon reduction a particular organisation needs to achieve in order to do its 'fair share' in reducing global emissions and keep global warming below 2 or 1.5°C from pre-industrial levels.*

What is an Absolute Carbon Reduction target?

An ***Absolute Carbon Reduction target*** *measures an actual reduction in total emissions. Importantly carbon offsets are not accounted towards an absolute target but used to mitigate any remaining residual emissions.*

A normalisation factor may be used to translate that target into an ***Intensity based target****, measuring emissions against metrics (number of employees and internal floor area for LSE).*

Figure 4 shows the verified emissions during year 2018/19, and the SBTi reduction pathway through to 2030. The resulting emissions pathway is based on a Business As Usual scenario and indicates that without changes, the estate will emit more carbon than permitted by the target reduction pathway by 2026/27.

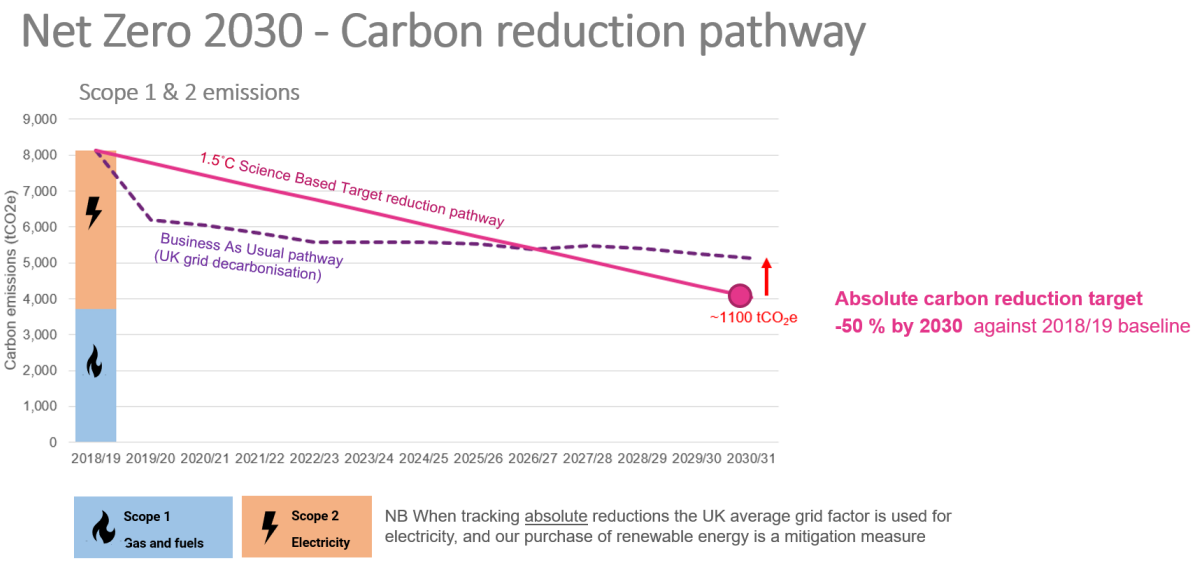


Figure 4: LSE estate predicted emissions pathway in a Business As Usual scenario. In 2026/27 the SBTi reduction pathway would be exceeded and the LSE net zero target missed by ~1100 tCO_2e in 2030.

The baseline position, when mapped against the SBTi Absolute Reduction pathway, indicates that without amendment to the current estates strategy it will not be possible for LSE to meet its carbon targets.

2.2. Reduce: Scope 1 & 2

The first step in the development of the Carbon Reduction Strategy was to engage with LSE stakeholders to understand the previous carbon targets and reduction measures adopted. Details of the consultation process are provided in Section 3, and a summary is presented here.

There is limited scope for building-level mechanical, electrical and plumbing upgrades (e.g. LED replacement and smart Building Management Systems) because these have largely already been implemented during LSE's Re:Fit programme. These upgrades contributed to the 38% decrease in absolute carbon emissions between 2005/06 and 2018/19. Re:Fit-style upgrades will still have a place in the LSE estate strategy, however, these alone will not deliver the required carbon savings.

A series of strategic options need to be considered to deliver the required near 50% reduction in absolute emissions to comply with SBTi by 2030. Through consultation with LSE stakeholders the following opportunities have been identified:

1) Heat decarbonisation
    a) All-electric new build projects and asset replacement projects.
    b) Rosebery Avenue heat network connection.
    c) Replace gas heating with electric heating across the estate.
    d) Build an estate heat network & energy centre.
2) Agile working
    a) Agile 'light' – disposal of leased properties (excluding the Peacock Theatre and student accommodation).
    b) Agile 'plus' – more extensive disposal of properties and rationalisation of working spaces beyond leased assets.
3) Deep retrofit of the estate to improve energy efficiency
    a) Begin to consider energy performance drivers as part of on-going/planned refurbishment works.
    b) Deep retrofit of the Towers Building to meet Paris Proof fabric & energy targets (see appendix for more information).
    c) Deep retrofit programme deployed across key buildings to meet Paris Proof fabric & energy targets.
4) Energy sourcing and procurement to provide longer term energy security for LSE
    a) LSE owned renewable technologies (eg wind farm)
    b) Renewable energy PPA (Power Purchase Agreement)
5) Additional options
    a) Internal Carbon Pricing
    b) Behaviour change

2.2.1. Feasibility of Carbon Reduction Options

A summary of carbon reduction options evaluated to date is presented below with feasibility indicators: carbon saving, cost, implementation, risks & benefits and space management. These indicators have been reviewed with LSE key stakeholders. Full detail of each option and its feasibility is presented in Appendix 3.3.

Each identified measure can be applied on its own, or in combination with other options to achieve the required magnitude of carbon reduction. The subsequent sections illustrate combinations of measures which will meet the carbon targets and align with aspirations for the estate.

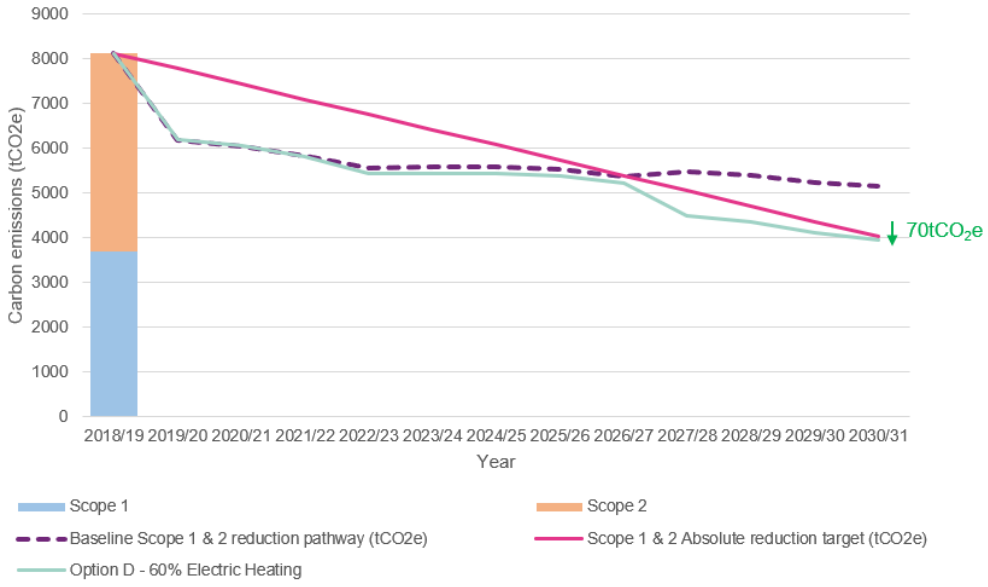
Measure	Carbon saving in 2030 relative to LSE 2030 baseline (tCO_2e)	% Required carbon reduction delivered*	Cost	Implementation	Risk & benefits	Space Management
Rosebery Avenue heat network connection	265	24%	🟢	🟢	🟢	🟢
30% electrification of heating by 2027/28	658	59%	🟡	🟡	🟢	🟡
60% electrification of heating by 2027/28	1179	106%	🔴	🔴	🟢	🟡
Energy centre powering 80% of estate heating by 2026/27	2037	183%	🔴	🔴	🟢	🟡
Disposal of leased properties (estate rationalisation)	171	15%	🟢	🟢	🟡	🟢
New Build energy efficiency targets	TBC	N/A	🟡	🟢	🟡	🟢
Deep retrofit of Towers building to Paris Proof targets by 2025/26	588	53%	🟡	🟡	🟢	🔴
Deep retrofit of key buildings to Paris proof targets between 2024-2029	614	55%	🟡	🟡	🟢	🔴
Internal carbon pricing	TBC		🟢	🔴	🟢	🟢
Behaviour change	TBC		🟢	🟡	🟢	🟢

**Percentage of the required 1100tonne CO2 deficit in meeting the required SBTi pathway at 2030*

2.2.2. Proposed Combined routes to NZC

Only two of the measures above will alone deliver required carbon savings: an energy centre supplying 80% of the estate; or a switch to 60% electric heating (by consumption). Therefore, we denote below how options can be grouped to achieve the 2030 target.

2.2.2.1. 60% Electrification of heating and removal of leased properties

<table>
<tr><th colspan="2">Measures implemented</th></tr>
<tr><th>Electrification of heating</th><th>Disposal of leased properties</th></tr>
<tr><td>60% of heating load (by consumption) is switched from gas to electric systems by 2027/28</td><td>Disposal of all leasehold properties (other than the Peacock Theatre and residential properties) by 2023/24</td></tr>
<tr><th colspan="2">Overall qualitative statements</th></tr>
<tr><td>• The removal of gas plant and transition to renewably-powered electric heating across the estate will improve air quality by reducing local emissions.
• Installation of 60% electric heating across the estate is expected to take several years to complete and will require buildings to be at least partially unoccupied during the install, however post installation maintenance requirements compared to gas heating are expected to fall.
• On its own this measure delivers effective carbon savings on the scale needed to achieve LSE targets.</td><td>• A full review of LSE's Space Management Strategy will be required to ensure that the estate strategy can accommodate the loss of leased properties. Disposal offers the opportunity to rationalise the estate, particularly considering the expected changes to more flexible working driven by Covid-19.
• Disposal of properties leased by LSE will remove emissions from LSE's portfolio but will not demonstrate leadership to drive down emissions.</td></tr>
<tr><td>Costs
🟢 Capex | 🟡 Opex savings | 🟡 ROI</td><td>Costs
🟢 Capex | 🟢 Opex savings | 🟢 ROI</td></tr>
<tr><td colspan="2">Indicative capex for combined measure: £6.8 million</td></tr>
<tr><td>Carbon reductions
🟢🟢🟢 1180 $tCOe_2$ in 2030 (~100% of 2030 carbon reduction target)</td><td>Carbon reductions
🟡⚪⚪ 171 $tCOe_2$ in 2030 (~15% of 2030 carbon reduction target)</td></tr>
<tr><td colspan="2">Resulting emissions pathway:
 
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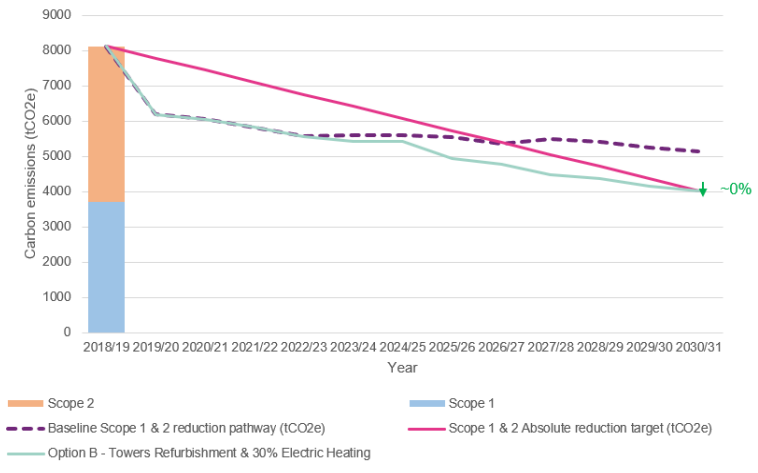
30% Electrification of heating, deep refurbishment of Towers Building and disposal of leased properties

Measures implemented		
Electrification of heating	**Deep Refurbishment of Towers**	**Disposal of leased properties**
30% of heating load (by consumption) is switched from gas to electric systems by 2027/28	Full refurbishment of Towers Building (by 2025/26) to meet Paris-Proof target of 55kWh/m^2 energy demand would include: • Fabric upgrades • Replacement of heating with ASHP / electric systems • Replacement & upgrade of chillers	Disposal of all leasehold properties (other than the Peacock Theatre and residential properties) by 2023/24
Overall qualitative statements		
• The removal of gas plant and transition to renewably powered electric heating across the estate will improve air quality by reducing local emissions. • Installation of 30% electric heating across the estate is expected to take several years to complete and will require buildings to be at least partially unoccupied during the install, however post installation maintenance requirements compared to gas heating are expected to fall.	• Deep refurbishment of the building fabric and installation of new plant is expected to take several years to complete and will create significant disruption across one of the largest buildings in the estate. This will require careful space planning to minimise disruption to students and staff. • Post refurbishment maintenance requirements are expected to fall. • Investment in the deep refurbishment of poorly performing buildings will extend the useful life of Towers and set the standard for future refurbishments to help improve LSE's climate resilience.	• A full review of LSE's Space Management Strategy will be required to ensure that the estate strategy can accommodate the loss of leased properties. Disposal offers the opportunity to rationalise the estate, particularly considering the expected changes to more flexible working driven by Covid-19. • Disposal of properties leased by LSE will remove emissions from LSE's portfolio but will not demonstrate leadership to drive down emissions.
Costs ● Capex | ● **Opex** savings | ● **ROI**	**Costs** ● Capex | ● **Opex** savings | ● **ROI**	**Costs** ● Capex | ● **Opex** savings | ● **ROI**
Indicative capex for combined measure: £7.8 million		
Carbon reductions ●●● 650 tCOe$_2$ in 2030 (~60% of 2030 carbon reduction target)	**Carbon reductions** ●●● 588 tCOe$_2$ in 2030 (~53% of 2030 carbon reduction target)	**Carbon reductions** ●○○ 171 tCOe$_2$ in 2030 (~15% of 2030 carbon reduction target)

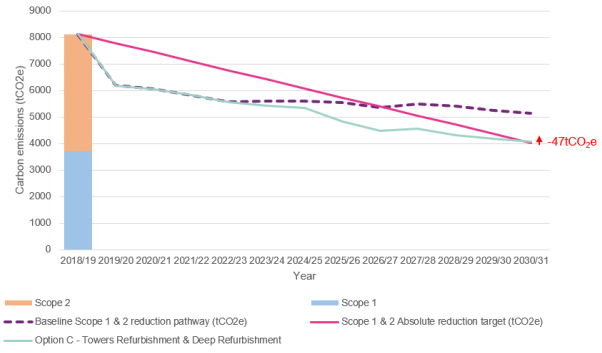
Resulting emissions pathway:



Deep refurbishment of Towers Building, refurbishment of key properties to Paris Proof Targets and removal of leased properties

Measures implemented		
Strategic Deep Retrofits	**Deep Refurbishment of Towers**	**Disposal of leased properties**
Full refurbishment of buildings with highest energy consumption to meet Paris-Proof target of 55kWh/m^2 energy demand. This would include: • Fabric upgrades • MEP replacements and upgrades To include the following buildings: • Lionel Robbins Building • High Holborn • Rosebery Avenue • Butler's Wharf • Bankside House	Full refurbishment of Towers Building (by 2025/26) to meet Paris-Proof target of 55kWh/m^2 energy demand would include: • Fabric upgrades • Replacement of heating with ASHP / electric systems • Replacement & upgrade of chillers	Disposal of all leasehold properties (other than the Peacock Theatre and residential properties) by 2023/24
Overall qualitative statements		
• Long refurbishment time required – extensive refurbishments would be happening across the estate for a 10-year period and would significantly impact the current LSE Space Management Plan. • Post refurbishment maintenance requirements are expected to be reduced. • Opportunity to enhance student/staff wellbeing through a refurbishment strategy focussing on comfort upgrades and incorporating Well criteria into the project briefs.	• Deep refurbishment of the building fabric and installation of new plant is expected to take several years to complete and will create significant disruption across one of the largest buildings in the estate. This will require careful space planning to minimise disruption to students and staff. • Post refurbishment maintenance requirements are expected to reduce. • Investment in the deep refurbishment of poorly performing buildings will extend the useful life of Towers and set the standard for future refurbishments to help improve LSE's climate resilience.	• A full review of LSE's Space Management Strategy will be required to ensure that the estate strategy can accommodate the loss of leased properties. Disposal offers the opportunity to rationalise the estate, particularly considering the expected changes to more flexible working driven by Covid-19. • Disposal of properties leased by LSE will remove emissions from LSE's portfolio but will not demonstrate leadership to drive down emissions.
Costs 🔴 Capex | 🟡 **Opex** savings | 🟡 **ROI**	**Costs** 🔴 Capex | 🟡 **Opex** savings | 🟢 **ROI**	**Costs** 🟢 Capex | 🟢 **Opex** savings | 🟢 **ROI**
Indicative capex for combined measure: £24.7 million		
Carbon reductions 🟢🟢⚪ 614 tCOe$_2$ in 2030 (~55% of 2030 carbon reduction target)	**Carbon reductions** 🟢🟢⚪ 588 tCOe$_2$ in 2030 (~53% of 2030 carbon reduction target)	**Carbon reductions** 🟡⚪⚪ 171 tCOe$_2$ in 2030 (~15% of 2030 carbon reduction target)

Resulting emissions pathway:



2.2.2.2. An Alternative Approach

Stakeholders highlighted that LSE has been considering the potential benefits of an energy centre for a number of years. Construction of, and connection of existing buildings to an energy centre would be challenging, however our modelling confirms that potential carbon savings are significant through to 2030 and beyond.

The option presented below is based on an energy centre using Air Source Heat Pumps as the primary heat source, although alternative technologies such as use of waste heat or hydrogen combustion may deliver the same results. The assumption is that an intervention of this scale would serve as much of the campus as practicable. We have therefore allowed for 80% of existing heat demand to be met via the energy centre.

Energy Centre with ASHP

Scope of works

Construct an energy centre, with a zero carbon heat source (for this modelling we have assumed air source heat pumps), and connect to ~80% of the existing estate.

To effectively contribute to the 2030 carbon target, the energy centre needs to be operational by 2026/27.

Why this project?

The feasibility of this option requires further analysis.

The modelling suggests this project would deliver LSE's 2030 carbon target and set the estate on the pathway to an even greater emissions reduction beyond 2030.

Overall qualitative statement

- An extensive review will be required of the current LSE Space Management Plan to locate a suitable site in the central London campus and to plan for the decant of staff and students.
- Extensive physical disruption would be caused across the campus during the multi-year construction of an energy centre which is expected to include a large portion of external works and internal works to key buildings.
- On its own, this measure delivers effective carbon savings on the scale needed to achieve LSE targets.
- Installation of an energy centre will help improve local air quality through the removal of gas heating across much of the estate

Costs

Capex | Opex | ROI

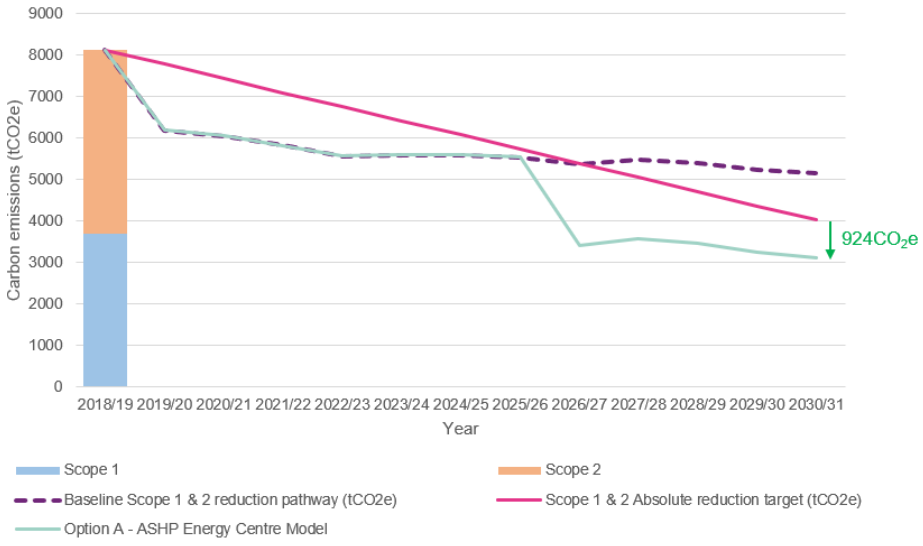
Indicative capex for combined measure: £8.6million

(note significant exclusions around complexities of connections from Energy Centre to existing buildings)

Carbon reductions

2037 $tCOe_2$ in 2030 (180% of 2030 carbon reduction target)

Resulting emissions pathway:



2.3. Mitigate: Scope 1 &2 emissions offset

Alignment with the SBTi absolute emissions reduction pathway will result in LSE reducing its carbon emissions by approximately half by 2030. The residual ~4000 tonnes of CO_2e emissions will need to be mitigated using carbon credits to achieve Net Zero Carbon.

What is Carbon Offsetting?

A carbon offset is an investment to compensate for emissions made elsewhere. Offsets result in a reduction in emissions of carbon dioxide (CO_2) or other greenhouse gases (measured in carbon dioxide equivalent, CO_2e).

Two types of carbon offsets are available: reduction and removal offsets. Reduction offsets are offsetting schemes which replace a carbon-producing process with a clean energy technology, for example investing in renewable technologies. Removal offsets are offsets which sequester carbon, for example via afforestation.

The Excel-based Carbon Reduction Tool enables the user to model the offset strategy for the estate and has been used to generate an illustrative offset scenario below, based on:

- Baseline carbon position of the LSE estate, i.e. before application of carbon reduction measures
- Transition from the current purchase of renewable electricity from the grid to an increase in onsite renewable energy generation
- Offsite carbon reduction offsets to remove all residual Scope 1 emissions (gas) which will transition to offsite carbon removal offsets by 2030 to meet the LSE's net zero carbon target requirements

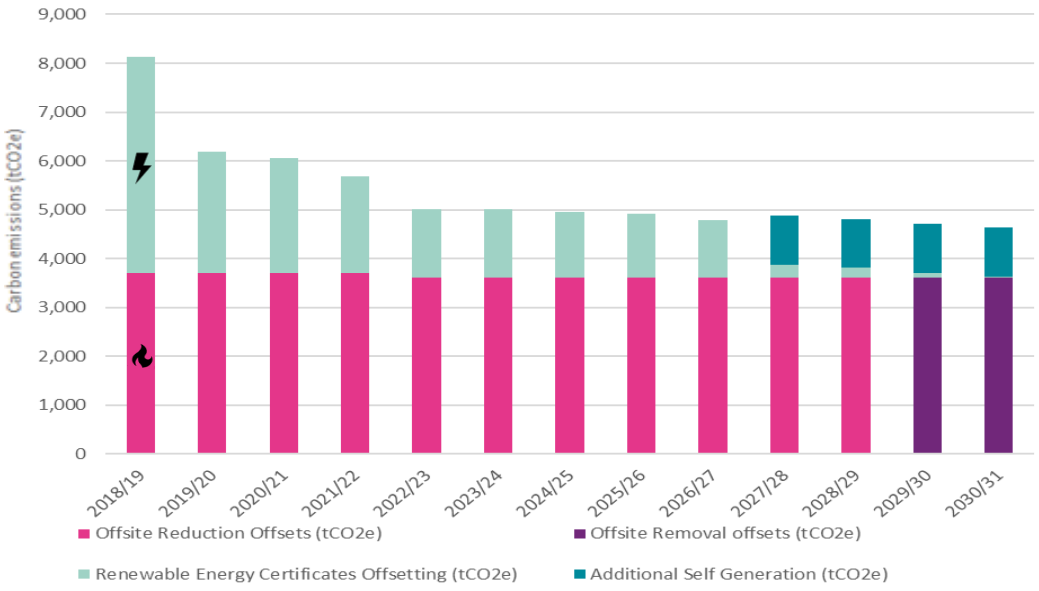


Figure 5: Possible route to offsetting residual carbon emissions in line with LSE's net zero carbon target.

In 2020, LSE achieved carbon neutrality through purchase of Gold Standard offsets. Through discussion with stakeholders, another two possible offset scenarios were raised. The influence of these two scenarios on the LSE carbon profile is summarised below.

LSE Wind Farm	
Scope of works Direct investment by LSE (and partners) to fund and operate a wind farm.	**Why this project?** Secured offset for the whole LSE estate for a fixed term.
Building impacted: The renewable electricity generated by the wind farm would offset the electricity emissions for the whole estate. This is particularly relevant where heating is switched from gas to electric technologies.	
Carbon reductions ⬤⬤⬤ 0 tCO_2e / year **T**his will not deliver additional carbon savings for LSE as the estate already procures 100% renewable electricity as part of their Scope 2 offset strategy. Use of a wind farm contributes to LSE's carbon neutral status, but is not a "removal" offset, as required to comply with LSE's definition of Net Zero Carbon.	
Costs 🔴 **Capex** | 🟢 **Opex** | 🟡 **ROI**	
Implementation • Via a third party	
Risk & Benefits • Long term security of reduction offsets	
Space management implications No space management implications as the chosen site will not be within the current estate.	
Next steps to progress ➢ **Capital Development** – Develop feasibility study for wind farm ➢ **Space Management** – N/A ➢ **Finance –** Plan for costs implications ➢ **Estates Director –** N/A	

Power Purchase Agreement (PPA)

Scope of works

Investment into a zero-carbon energy asset owned/operated by a third party; LSE signs a contract for fixed-price zero carbon electricity supply for a fixed term.

Why this project?

No upfront investment required.

Signing up to a PPA would secure a zero-carbon source of electricity for a fixed term, and at a fixed price. This will reduce risk associated with fluctuations in energy prices in the coming years.

Building impacted:

The renewable electricity generated by the wind farm would offset the electricity emissions for the whole estate. This is particularly relevant where heating is switched from gas to electric technologies.

Carbon reductions

●●● 0 tCO_2e / year

This will not deliver any additional carbon savings for the LSE as the estate already procures 100% renewable electricity as part of their Scope 2 offsetting strategy. A PPA would contribute to LSE's carbon neutral status, but is not a "removal" offset, as required to comply with LSE's definition of Net Zero Carbon.

Costs

● **Capex** | ● **Opex** | ● **ROI**

Implementation

- Procurement route for a PPA is more complex than purchase of a green tariff via an energy supplier

Risk & Benefits

- Long term price security of zero carbon electricity

Space management implications

No space management implications.

Next steps to progress

- **Capital Development** – N/A
- **Space Management** – N/A
- **Finance** – Plan for costs implications
- **Estates Director –** N/A

3

Appendices

3.1 Definitions

Absolute carbon emissions reduction
Reducing total CO_2e emissions at source in line with a Science Based Target. For the LSE this is a reduction of approximately ~50% by 2030.

Carbon
In this report we use 'carbon' to refer to CO_2e (carbon dioxide equivalent). This is the standard unit for expressing different greenhouse gas impacts in terms of the amount of CO_2 that would generate the same amount of warming.

Carbon neutral
In this plan we use LSE's definition of carbon neutral. This is, 'the action of mitigating the emissions an organisation currently produces, usually by purchasing carbon offsets.

Greenhouse Gases (GHGs)
GHGs are the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6). In this report we refer to 'carbon' for simplicity which covers the emissions of all six GHGs.

Net zero carbon
Absolute carbon emissions reduction in alignment with climate science, combined with carbon removal offset methods for residual emissions.

Paris Proof Energy Intensity targets
In-use energy targets set by the UKGBC in line with the 'Paris Proof' concept developed by the Dutch Green Building Council. These energy intensity targets ensure energy demand meets available renewable energy supplies to achieve a 2050 net zero carbon economy.

Removal offset
Carbon offsets which remove existing carbon from the atmosphere (eg carbon capture and storage, tree planting).

Reduction offset
Carbon offsets which reduce future carbon emissions (eg renewable energy generation)

Science Based target (SBTI) 1.5 degree methodology
Reduction pathway to ensure absolute carbon emissions are reduced in line with the guidance released by the IPCC to keep global temperature rises below 1.5 degrees.

Scope 1 emissions
Direct GHG emissions associated with the reporting organisation's activities. Direct GHG emissions are GHG emissions from sources owned/controlled by the reporting company, such as gas boilers and diesel generators.

Scope 2 emissions
Indirect GHG emissions associated with power generation, heating/cooling or steam purchased by the reporting organisation. Indirect GHG emissions arise from the operations of the reporting company but are produced at sources owned or controlled by other companies.

Scope 3 emissions
Indirect GHG emissions associated with the reporting organisation, excluding those covered in scope 2 such as emissions associated with, business travel, procurement and water consumption.

3.2 Assumptions

Datasets and resources used:

- BEIS 2018 Updated Energy and Emissions Projects v1.0 (3rd April 2019)
- DEFRA Greenhouse gas reporting: conversion factors 2020 (updated 17th July 2020)
- LSE Carbon Management Plan 2018-19
- Science-Based Target Setting Tool (version 1.2.1) – using the absolute contraction methodology
- UKGBC Net Zero Carbon; Energy Performance Targets for Offices (https://www.ukgbc.org/wp-content/uploads/2020/01/UKGBC-Net-Zero-Carbon-Energy-Performance-Targets-for-Offices.pdf0

Key assumptions made in the modelling:

- We have assumed based on the BEIS information that there will be negligible UK gas decarbonisation between 2020 and 2030.
- To develop the Carbon Reduction Tool, we averaged the energy (gas/fuel and electricity) and water consumption for each LSE building over the past three years to generate an average annual consumption which was used to model the impact of reduction measures.
- For the purposes of this Carbon Reduction Strategy, opex values used for baseline 2018/19 values include energy purchasing expenditure. Maintenance and FM costs are not included.
- Capex values include the costs of purchasing or constructing a new building or the cost of renting a new space.
- The Scope 3 pathway assumes a reduction aligned to an SBTi 1.5-degree approach.

3.3 Feasibility Summaries

Heat Decarbonisation

Rosebery Avenue: Connection to GreenSCIES Low Carbon Heat Source	
Scope of works Connection to GreenSCIES network to access ambient temperature heat loop to share heat between buildings, and use waste heat from data centres and London Underground. Low grade heat is converted to usable temperatures via heat pumps, replacing the existing gas heating system in Rosebury Avenue	**Why this project?** Use of waste heat from local sources is a source of zero carbon heat for LSE. The works required are minimal.
Building impacted: Rosebery Hall (Leasehold 7,148m^2 GIA)	
Carbon reductions 🟢⚪⚪ 265 tCO_2e in 2030 (~24% of 2030 carbon reduction target)	
Costs 🟢 **Capex** | 🟡 **Opex** | 🟢 **ROI**	
Implementation • Minimal works to swap out existing heating system to connect new • Disruption during installation limited to plant room	
Risk & Benefits • Source of zero carbon heating for LSE • Minimal capex required • Straightforward switch of building heat source • Heat network not in LSE's direct control	
Space management implications • Nil, no impact for space management	
Next steps to progress ➢ **Capital Dev** – Approval to proceed ➢ **Space Mngt** – N/A ➢ **Finance** – Approve budget for any works required at point of connection ➢ **Estates Director -** Integration into Estates Strategy	

Electrification of Heating

Scope of works	Why this project?
30 - 60% of heating load (by consumption) is switched from gas to electric systems by 2027/28	By switching from gas to electric heating, LSE can take advantage of the projected decarbonisation of the grid.

Building impacted:
Feasibility studies required to identify suitable buildings.

Carbon reductions
🟢🟢⚪ Between 650-1180 $tCOe_2$ in 2030 (60-100% of 2030 carbon reduction target)

Costs
🔴 **Capex** | 🟡 **Opex** | 🟡 **ROI**

Implementation

- Moderate disruption: installation of 30% electric heating across the estate is expected to take several years to complete and will require buildings to be at least partially unoccupied during installs.
- Internal works will be required and Space Management team will need to review plans to enable the partial decant of buildings undergoing work.
- Post installation maintenance requirements of electric heating compared to gas are expected to reduce.

Risk & Benefits

- The removal of gas plant and transition to renewably powered electrical heating across the estate will improve air quality by reducing local emissions.
- This measure delivers effective carbon savings on the scale needed to achieve LSE targets

Space management implications
Feasibility studies will be required to identify the most suitable buildings for conversion to electric heating these will include developed decant strategies for buildings where internal works are required.

Next steps to progress

- **Capital Dev** – Assess feasibility for individual buildings
- **Space Mngt** – Review availability for partial decant across the estate
- **Finance** – Plan for cost implications, based on feasibility study outcomes
- **Estates Director -** Integrate in Estates strategy

Energy Centre with ASHP

Scope of works

Construct an energy centre, with a zero carbon heat source (for this modelling we have assumed air source heat pumps), and connect to ~80% of the existing estate.

To effectively contribute to the 2030 carbon target, the energy centre would have to be operational by 2026/27.

Why this project?

The feasibility of this option requires further analysis.

The modelling suggests this project would deliver LSE's 2030 carbon target and set the estate on the pathway to an even greater emissions reduction beyond 2030.

Building impacted:
Feasibility studies required to identify most suitable buildings. The aim is to connect >80% of estate (by consumption) to maximise the benefit of the Energy Centre.

Carbon reductions
🟢🟢🟢 2037 $tCOe_2$ in 2030 (180% of 2030 carbon reduction target)

Costs
🔴 **Capex** | 🔴 **Opex** | 🟡 **ROI**

Implementation

- Extensive physical disruption would be caused across the campus during the multi-year construction of an energy centre which is expected to include extensive external works and internal works to key buildings.
- Long installation time and complex construction requiring an full review of the current LSE Space Management Plan to locate a suitable site in the central London campus
- Plan for the decant of staff and students will be required

Risk & Benefits

- Full feasibility analysis will be required to determine whether this option can be progressed
- Complex installation
- On its own, this measure has the potential to deliver effective carbon savings on the scale needed to achieve LSE targets.
- Installation of an energy centre may help improve local air quality through the removal of gas heating across much of the estate

Space management implications
This will require the identification of a central location in the LSE estate to build the energy centre and will likely have space management implications (depending on the site chosen).

Next steps to progress

- **Capital Dev** – Develop feasibility study for energy centre
- **Space Mngt** – Review strategy as it develops and ensure a plan is in place for any decant
- **Finance** – Plan for cost implications, based on feasibility study outcomes
- **Estates Director -** Integrate in Estates strategy

Modelling assumptions:

Energy centre distribution losses calculated based on a Government paper which indicates a range of 6-28% (assumed 15%)

Assumed heat pump Coefficient of Performance (CoP) for heating of 2.5

Connection of 80% of the buildings (by consumption) to energy centre will reduce Scope 1 emissions by 80%

Alternative options for heat sources (other than the air source heat pumps used for illustration in this model) could be considered such as waste heat from the London Underground network or hydrogen.

Agile working

Disposal of Leased (and Owned) Properties	
Scope of works Disposal of all leasehold properties (other than the Peacock Theatre and residential properties) by 2023/24. Longer term the disposal of some owned properties can be used to respond to a shift to agile working and reduce emissions.	**Why this project?** This approach would allow LSE to make better use of its owned estate, over which it has direct control. This offers greater opportunity for capital works to improve energy performance and reduce associated carbon emissions.
Building impacted: All leased properties. Owned properties to be identified via review by Space Management team.	
Carbon reductions 171 $tCOe_2$ in 2030 (15% of 2030 carbon reduction target) *Note the carbon saving as shown is only for leased properties*	
Costs **Capex** | **Opex** | **ROI**	
Implementation • A full review of LSE's Space Management Strategy will be required to ensure that the estate strategy can accommodate the loss of leased properties • Timescales to achieve disposal will be variable, depending on lease agreements in place • Maintenance requirements will decrease following disposal because of fewer properties	
Risk & Benefits • Disposal of properties leased by LSE will remove emissions from LSE's portfolio but will not demonstrate leadership to drive down emissions. • Opportunity to improve space utilisation in owned building stock. Disposal offers the opportunity to rationalise the estate, particularly considering the expected changes to more flexible working driven by Covid-19.	
Space management implications Disposal of leased properties is not currently allowed for in the space management plan. A review of estate-wide planning would be required.	
Next steps to progress ➢ **Capital Dev** – N/A ➢ **Space Mngt** – Re-sequence Space Management Plan to allow for withdrawal from leased properties and identify any under-utilised owned properties ➢ **Finance** – Plan for cost implications, based on feasibility study outcomes ➢ **Estates Director -** Integrate in Estates strategy	

Capital Works

New Build Efficiency Targets

Scope of works

Develop a sustainability brief for all new projects, setting out requirements for net zero carbon construction and operation.

Detailed targets would cover energy intensity, performance of MEP equipment, building fabric performance, etc.

Ensure specification includes requirement for no gas in new builds.

Why this project?

To meet the targets, LSE needs to continue to deliver an absolute carbon reduction, even if the estate size increases. It is critical that any new buildings do not impact on the ability of LSE to reduce its carbon footprint, and requirements must be set from project inception stages.

Building impacted:
All new projects up to 2050.

Carbon reductions
TBC based on feasibility studies

Costs
Capex | **Opex** | **ROI**

Implementation

- LSE Capital Developments team will need to allocate resources to quantifying and agreeing new building and refurbishment targets in line with the overall net zero strategy.

Risk & Benefits

- No expected disruption as all measures will be incorporated into main building works.
- Maintenance, likely to be no or minimal impact to maintenance as compared to a standard new build

Space management implications
Nil

Next steps to progress

- **Capital Dev** – Ensure net zero sustainability brief is developed used for any new projects
- **Space Mngt** – N/A
- **Finance** – Plan for cost implications on all new builds and refurbishments, based on new briefing outcomes
- **Estates Director -** Integrate sustainability brief for new projects in Estates strategy

Towers Full Energy Retrofit

Scope of works

Full refurbishment of Towers Building to meet Paris-Proof target of 55kWh/m^2 energy demand would include:

- Fabric upgrades
- Replacement of heating with ASHP / electric systems
- Replacement & upgrade of chillers

Why this project?

Towers make up 13% of LSE's carbon footprint. This is due to size but also its poor energy efficiency of 318 kWh/m^2.

While capital outlay may be significant, it is likely to deliver a return on investment for the School due to associated energy/cost savings.

Building impacted:

Towers (Freehold, 14,615m^2 GIA)

Carbon reductions

588 tCOe$_2$ in 2030 (53% of 2030 carbon reduction target)

Costs

Capex | **Opex** | **ROI**

Implementation

- Deep refurbishment of the building fabric and installation of new plant is expected to take several years to complete and will create significant disruption in one of the largest LSE buildings. This will require careful space planning to minimise disruption to students and staff.
- Post refurbishment maintenance requirements are expected to fall.

Risk & Benefits

- Major disruption (localised) will present a space management challenge.
- Improved air quality through the removal of inefficient gas plant.
- Project is likely to deliver costs savings and reputational benefits to the School by demonstrating the significant carbon reductions through investment.

Space management implications

A feasibility study would need to be carried out, and these works are not currently in Space Management Plan to 2030. Towers refurbishment will require a significant review of the Space Management Plan and a full decant strategy will be needed. It is likely that temporary leased space would be required during the refurbishment period.

Next steps to progress

- **Capital Dev** – Ensure 55kWh/m^2 energy target is part of feasibility study brief
- **Space Mngt** – Re-sequence Space Management Plan to allow for Towers decant
- **Finance** – Plan for costs implications, based on feasibility study outcomes
- **Estates Director -** Integrate in Estates strategy

Strategic Deep Retrofits

Scope of works

Full refurbishment of buildings with highest energy consumption across the estate to meet Paris-Proof target of 55kWh/m^2 energy demand. This would include:

- Fabric upgrades
- MEP replacements and upgrades

Why this project?

Existing buildings form most of the LSE estate, and therefore the majority of the carbon emissions. It will not be possible to deliver the LSE carbon targets without addressing the performance of the existing buildings.

Buildings impacted:

Buildings proposed for consideration are those with the highest energy consumption across the estate:

- Lionel Robbins Building – 2024/25 – 55kwh/m2 Paris proof Target
- High Holborn – 2026/27 – 35kwh/m2 Paris proof Target
- Rosebery Avenue – 2026/27 - 35kwh/m2 Paris proof Target
- Butler's Wharf – 2027/28 - 35kwh/m2 Paris proof Target
- Bankside House – 2028/29 - 35kwh/m2 Paris proof Target

The number and combination of buildings to have low carbon retrofits should be determined using the Carbon Reduction Tool.

Carbon reductions

614 tCOe$_2$ in 2030 (55% of 2030 carbon reduction target)

Costs

Capex | **Opex** | **ROI**

Implementation

- Major disruption: Long extensive refurbishments would be happening across the estate for a 10-year period and would significantly impact the current LSE Space Management Plan. Potential for multiple projects to be delivered simultaneously
- Post refurbishment maintenance requirements are expected to fall.

Risk & Benefits

- Opportunity to enhance student/staff wellbeing through a refurbishment strategy focussing on comfort upgrades and incorporating WELL criteria into the project briefs.
- Project is likely to deliver costs savings and reputational benefits to the School by demonstrating the significant carbon reductions through investment.

Space management implications

Not currently included in Space Management Plan. Extensive review of the current Space Management Plan will be required to deliver projects early enough to meet carbon targets, whilst minimising disruption to campus and planning for appropriate decant. It is likely that temporary leased spaces would be required during the refurbishment period.

Next steps to progress

- **Capital Dev** – Ensure energy targets form part of each feasibility study brief
- **Space Mngt** – Re-sequence Space Plan to allow for refurbishment of buildings identified
- **Finance** – Plan for costs implications, based on feasibility study outcomes
- **Estates Director -** Integrate in Estates strategy

Additional Options

Internal Carbon Pricing	
Scope of works Set an internal carbon price to drive savings. Reinvest profits into capital works to deliver further carbon savings.	**Why this project?** Internal carbon pricing can be a driver for the scale of changes required to meet the agreed carbon targets and has considerable potential for external messaging.
Building impacted: NA this will cover the whole LSE estate.	
Carbon reductions 🟡⚪⚪ estimate 0 - 5% of 2030 carbon reduction target	
Costs 🟢 **Capex** | 🟢 **Opex** | 🟢 **ROI**	
Implementation • Requires administration in set up and operation.	
Risk & Benefits • Potential for resistance to implementation, but could be mitigated through engagement, setting reasonable rules and corresponding incentives • Self-funding opportunity, revenue raised is used to fund additional carbon projects. • This is a bold course of action that says LSE is committed to meeting their carbon commitments.	
Space management implications Nil.	
Next steps to progress ➢ **Capital Dev** – Retain involvement to identify potential projects for funding ➢ **Space Mngt** – N/A ➢ **Finance** – Resources for management of funds ➢ **Estates Director –** Retain involvement to identify potential projects and track estate-wide impact	

Behaviour Changes

Scope of works

Engage with staff and students to promote carbon-saving behaviours, including awareness raising of contributing factors, i.e. energy, water, waste, space utilisation, etc.

Why this project?

Behaviour change campaigns will engage the LSE community in delivery of the carbon goals, leading to increased visibility and reputational benefits.

Although overall impact in carbon terms is likely to be relatively low, the benefits in terms of engagement, recognition, low cost and low risk make it a worthwhile option.

Building impacted: Whole estate

Carbon reductions

🟡⚪⚪ estimate 0 - 2% of 2030 carbon reduction target

Costs

🟢 **Capex** | 🟢 **Opex** | 🟢 **ROI**

Implementation

- Requires administration in set up and operation.

Risk & Benefits

- Risk of low engagement from staff and students, could be mitigated through promotion and targeted comms / events.
- Promotion of LSE carbon goals; involvement from LSE community
- Difficult to quantify direct carbon savings.

Space management implications

Nil

Next steps to progress

- **Capital Dev** – N/A
- **Space Mngt** – N/A
- **Finance** – Plan for costs implications (minor – comms, events)
- **Estates Director –** N/A

3.4 List of Stakeholders Consulted

During the development of the Carbon Reduction Strategy the following LSE stakeholders/teams were consulted to identify strategic opportunities for carbon reduction.

- Maintenance team
- Capital development team
- Sustainability team
- Procurement team
- Space management team
- Directors of Estates

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Not Confidential - Internal