University of Greenwich

Zeroby30 'Strategy into Action' Recommendations

January 2022

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1. Introduction, Scope & Objectives

The University of Greenwich has a long and proud history of acting as a 'force for good' and driving sustainability throughout the organisation. In 2021, the University's strategy for 2021-2030 was refreshed to reflect the vision of being 'the best modern university in the UK' and a net zero carbon goal for 2030 was set as part of the strategic pillar, 'Connected and Sustainable campuses'. This target is fully supported by the Vice Chancellor and senior leadership team and recognises the increasing concerns of staff and student populations regarding climate change.

To create a strategic plan and roadmap to achieve this net zero carbon goal, The Planet Mark's Zeroby30 programme was initiated in February 2021, working in partnership with Low Carbon Europe. The Zeroby30 programme applies a rigorous and transparent definition of **net zero carbon**, as follows:

- Direct and electricity ('Scope 1 & 2') emissions **have a target of zero.**
- Indirect emissions ('Scope 3') must be reduced **by at least 50% by 2030** against the baseline year and must continue to be reduced after 2030 by at least 90% against the baseline by 2050.
- Residual carbon remaining at the net zero target date must be **balanced by carbon removal schemes** (note that these differs from offsets that avoid or mitigate carbon – see s.4).

This definition is aligned to industry best practice and thought leadership, as defined by the UN Race to Zero and Science Based targets initiative. It is important to note that 'net zero' is a much more ambitious and robust goal than 'carbon neutral', as it requires an organisation to actively reduce its emissions across all Scopes at source by stipulated minimum levels by 2030 and by 2050. In contrast, carbon neutrality allows carbon 'offsets', rather than removals, to be purchased to balance an organisation's footprint to zero without setting a minimum level of targeted emissions reductions. Furthermore, it does not mandate inclusion of indirect Scope 3 emissions, so is much less demanding in its requirements.

For this phase of the University's net zero carbon plan, the boundary of the emissions to be included was specified as direct (Scope 1) and electricity (Scope 2) related emissions driven by Buildings and Fleet, and the following subset of indirect (Scope 3) emissions: utilities consumption in the Estate relating to third parties occupants in shared buildings, Waste, Water, Business Travel (non-fleet) and Laboratory gases. Other Scope 3 emissions, such as those driven by procured goods and services, employee, or student commuting, have been excluded at this stage but must be considered as a future second phase for the University to progress to net zero in its full sense.

The objectives of the Zeroby30 programme are to: identify a suite of recommended 'decarbonisation' solutions for these emissions Scopes; map the solutions into an optimally phased roadmap to 2030 that will enable the University of Greenwich to achieve its net zero carbon goal; and model the resulting cashflow and carbon reduction impacts for each year of the roadmap.

The purpose of this report is to provide a summary of the Zeroby30 recommendations and implementation roadmap, together with supporting rationale and 'enabling' actions to support the successful implementation of the roadmap. It also includes some initial thoughts on influencing the University's wider indirect emissions via Procurement and engagement, ahead of setting formal targets.

The Vice Chancellor has given her full support to the strategy, saying: "The University of Greenwich is determined to do its part to battle the climate crisis. That is why in our new strategy we have committed to net zero carbon by 2030. By working with such wonderful partners as Planet Mark and Low Carbon Europe we are making real and tangible strides towards our goal. It is particularly great that Planet Mark is led by a former University of Greenwich student, CEO Steve Malkin, and has other alumni amidst its staff." The Chair of the Governing Body added "By taking decisive actions, the University of Greenwich is proudly leading the way on sustainability. The aim for the University, as set out in our new strategy, is to be net zero carbon by 2030. This is ambitious, as it needs to be, but with the collaborative work going on with partners, such as Planet Mark and Low Carbon Europe, achievable."

2. Executive Summary

Following the Zeroby30 kick off meeting in late March 2021, the team completed a four-month programme to deliver the Zeroby30 'Strategy into Action' recommendations set out in this paper. This included detailed site surveys of all the Estate to develop building-specific zero carbon solutions, supported by bespoke technical specifications and bottom-up cost/benefit analysis. The recommendations have been reviewed with key stakeholders and iterated to incorporate their feedback. The headline targets, solution recommendations and forecast cashflow impacts and carbon reductions each year to 2029/30 are summarised below, with further detail provided in section 3.

2.1 Carbon Footprint & Targets

The Zeroby30 baseline, covering the emissions Scopes described above, has been calculated based on the University's activity levels in the financial year 2018/19, as this is the most representative recent year that was not skewed by the Covid-19 pandemic. The baseline is calculated using the Greenhouse Gas (GHG) Protocol's 'market-based' assessment, which allows electricity emissions to be based on supplier-specific data rather than the standard UK electricity grid carbon footprint. The University's current electricity tariff is 100% nuclear and has been confirmed by the Planet Mark as zero carbon on the market-based assessment, leading to a carbon footprint from electricity consumption of zero (see s.3.1 for more details on methodology). This gives a baseline carbon footprint and 2030 target as follows:

Zeroby30 Baseline carbon footprint = 6,525.2 tCO_2e; 2030 target = 1,537.5 tCO_2e

- Scope 1 and 2 emissions account for **3,234.9 tCO2e**, driven primarily by the Estate (**3,208.5 tCO2e,** relating to gas consumption and as reported in the CD24 submission for 2018/19), plus a very small Fleet footprint (26.4 tCO_2e).

  The 2030 target for these emissions is **zero.**

- Scope 3 emissions from the Estate from gas consumption account for **214.4 tCO_2e,** of which **208.2 tCO_2e** relates to 3rd party shared buildings services at Medway and 6.2 tCO_2e to the Daniel Defoe and Cutty Sark buildings; the latter have been brought back in-house since 2018/19 and hence must be included in the forward-looking Zeroby30 plan.
  - The 3rd party shared services have been included on the grounds that these buildings will either be brought back in-house before the end of the roadmap, or that the third party incumbents will need to contribute a fair share to the investment in the Zeroby30 decarbonisation solutions, as these will necessarily be implemented for the entire building.

  The 2030 target for these emissions is **zero.**

- Scope 3 emissions account for **3,075.9 tCO_2e,** primarily from Business Travel **(2,888.1 tCO2e)** plus Waste and Water (187.7 tCO2e). Laboratory gases contributed no carbon emissions.
  - Waste and Water emissions are made up of 119.1 tCO2e relating to the University's own operations in 2018/19 and a further 68.6 tCO2e relating to buildings that have subsequently come in house or relate shared service buildings. The rationale for including these is the same as that above, coupled with the fact that emissions from the shared services also come under the University's wider 'downstream' Scope 3 footprint.

  To qualify as net zero, the 2030 target for these Scope 3 emissions is a reduction of at least 50% i.e. a target of **1,537.5 tCO_2e (maximum).**

The solutions to support the University's net zero carbon targets are a combination of technology-based initiatives, primarily relating to the Estate and Fleet, and policy and behavioural levers, particularly for Business Travel. Alignment of Procurement policies to net zero carbon goals, and staff and student engagement, will also be key to underpinning the successful execution of the net zero carbon strategy. The recommended Zeroby30 solutions are described in the following section.

2.2 Zeroby30 recommendations: Estate & Fleet (Scope 1 & 2 + Scope 3 Shared buildings)

Baseline footprint = 3,449.3 tCO_2e; Target = zero by 2030

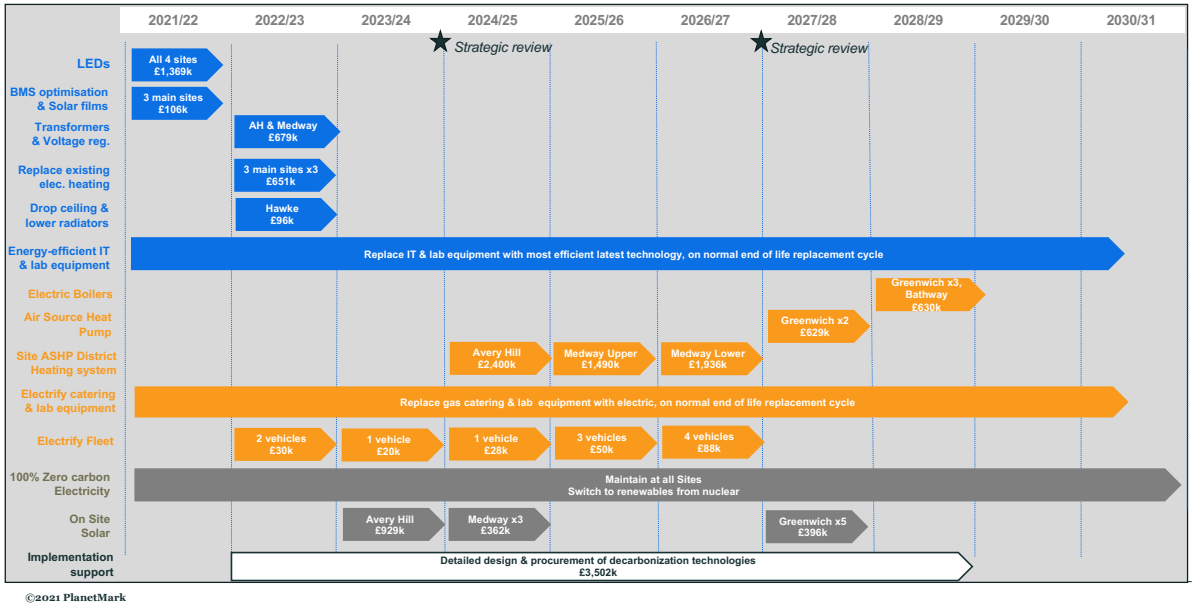
Recommended solutions - primarily relating to the Estate - and a roadmap spanning the period from 2021/22 to 2029/30 have been identified to achieve the zero emissions target. In overview, the solutions are focused on the following four priority areas, with details of solutions recommended per site itemised in s.3.2:

- **Driving energy efficiency via technology**. Recommended technologies included in the roadmap are: LED lighting; solar films; building management system (BMS) optimisation; transformers with voltage regulation; smart controls and replacement electric heating (for buildings that already have electric heating); and, for the Hawke building specifically, a dropped ceiling solution with lowered radiators to replace the current inefficient system of very high, ceiling-mounted radiators.
- **Eliminating gas and oil consumption throughout the Estate**. For all sites, this means switching heating and hot water boilers to air source heat pumps, or electric boilers where heat pumps are not feasible. Catering and lab equipment must also be switched for electrically powered alternatives as they reach end of life. This can be done as part of the 'business as usual' replacement cycle, provided it is completed at the latest by the year 2029/30.
- **Using 100% zero carbon electricity to power the Estate**. Continuing to source from a validated zero carbon electricity supply is a fundamental requirement. Where roof space and planning regulations permit, recommendations to install solar panels to self-generate electricity for use by the University have also been included in the recommendations. This is viewed in the industry as superior to a commercial zero carbon tariff, as it will make a direct contribution to increasing the UK's renewable energy capacity.
- **Eliminating petrol and diesel by switching to a fully electric Fleet** (noting that the impact of Fleet at 26 tCO_2e is very small).

Estate & Fleet Roadmap, Cashflow & Carbon forecast

The recommended phasing of the above solutions, by site, into the Zeroby30 roadmap is set out below.

University of Greenwich Zeroby30 roadmap: Estate & Fleet



In total, the roadmap requires an investment of **£15.4m over an eight-year period** from the year 2021/22 to the year 2028/29, of which **£15.2m relates to the Estate** solutions. This includes an allowance of **£3.5m - 30% of the capital spend - for design, technical consulting, and project management support.** Once complete, the roadmap will drive estimated cash savings of **£0.53m p.a. at today's prices**. The cashflow impact becomes **positive in year in 2029/30** and **breaks even cumulatively in 27.4 years**. However, it is important to note the assumptions that have been made in establishing the cashflow and carbon forecast (see s.3.4 for details), including the fact that all costs for technology solutions are based on today's prices. This represents a worst-case scenario, as costs will reduce as the market matures. Furthermore, no assumption on increased carbon taxes, which are likely to rise to £70-£100/t in the medium term, has been incorporated in the interests of prudence. Hence, the actual costs and business case as the roadmap are executed are expected to be more favourable than these estimates.

The Zeroby30 initiatives are phased for completion by the year 2028/29, allowing a buffer for delays and ensure the zero-carbon target is fully achieved by 2030. Sequencing of the Estate initiatives has been optimised according to the following principles (see s.3.2 for further details of the rationale):

- Energy efficiency solutions front-weighted in years 1 and 2: 'quick win', low disruption solutions that generate both operating cost savings and electricity efficiencies.
- On-site solar from year 3: providing renewable electricity to support the electrification of heating.
- Electrification of heating from year 4 onwards: technologies requiring more investment, with more lead time required for planning and execution. This phasing also allows time for the technology to further evolve and optimise.

The roadmap reflects the current Estate configuration, so needs to be overlaid with the Estate master plan once ready later in 2021/22. Depending on the master plan decisions, some of the Zeroby30 recommendations may be able to be rephased to 'piggy-back' on master plan projects at a lower cost than as standalone projects.

For Fleet, the roadmap follows the existing plans of the Fleet manager to replace the current portfolio of 19 petrol, diesel, and hybrid vehicles with a Fleet of 14 fully electric vehicles, as the current vehicles become due for replacement. This is planned for completion by the financial year 2026/27.

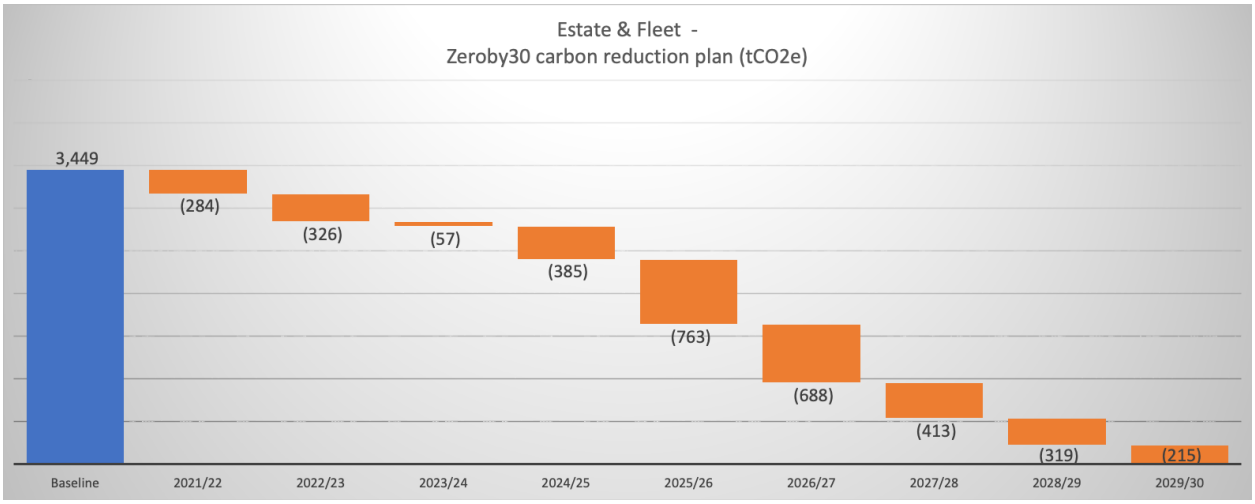
The annual projected impact of this roadmap on cashflow and the University's carbon footprint is given below, with a detailed breakdown by initiative set out in Appendix 2.

Cashflow & Carbon forecast: Estate & Fleet (Scope 1, 2 + Scope 3 shared buildings)

Zeroby30 UoG: Scope 1 & 2 Estate & Fleet + Scope 3 Estate shared buildings

Cashflow & Carbon footprint forecast - Summary by year

		2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	TOTAL
Cashflow summary	Cost (£) - one off	(1,475,185)	(1,955,741)	(1,448,609)	(3,289,975)	(2,039,738)	(2,523,835)	(1,525,303)	(1,130,246)	-	(15,388,634)
	Cost (£) - p.a.	-	-	-	(83,328)	(259,903)	(406,019)	(480,716)	(590,245)	(677,944)	
	Benefits (£)	248,623	619,677	779,276	879,064	985,573	1,063,191	1,131,824	1,187,558	1,208,387	
	Net cashflow in year (£)	(1,226,562)	(1,336,064)	(669,333)	(2,494,239)	(1,314,068)	(1,866,664)	(874,196)	(532,933)	530,442	
										Break-even	27.4
Scope 1, 2 & 3 Carbon footprint: (market based)	Year start (Tonnes)	3,449	3,166	2,840	2,783	2,398	1,635	947	534	214	
	Year on Year Reduction (Tonnes)	284	326	57	385	763	688	413	319	215	3,450
	Year end (Tonnes)	3,166	2,840	2,783	2,398	1,635	947	534	214	(0)	



Once launched, it will be key to treat the roadmap as a living plan that is refreshed on a regular basis to factor in technology innovations, such as the mainstream use of hydrogen, opportunities to access new incentives/grants, and to reflect emerging external plans for District Heating Systems at Greenwich and Medway. An annual progress review is recommended, together with a full strategic review at three-yearly intervals.

2.3 Zeroby30 recommendations: Business Travel, Waste & Water (Scope 3)

Business Travel, Waste & Water Solutions

Baseline footprint 3,075.9 tCO_2e; Target = 1,537.5 tCO_2e (maximum) by 2030

The opportunity to reduce Scope 3 emissions lies primarily in Business Travel, as the Waste and Water footprint is very small (187.7 tCO_2e) and there is a limit to the savings that can physically be made. For this reason, the carbon forecast assumes that all the targeted Scope 3 emissions reductions are driven by Business Travel; however, this should not preclude a focus on continuous improvement in Waste and Water management. Staff and students can be engaged in supporting a Zero Waste to landfill target; for Water, prompt identification and remediation of leaks via targeted metering and implementation of water saving technologies, such as low flush toilets and grey water harvesting, should be included as business as usual.

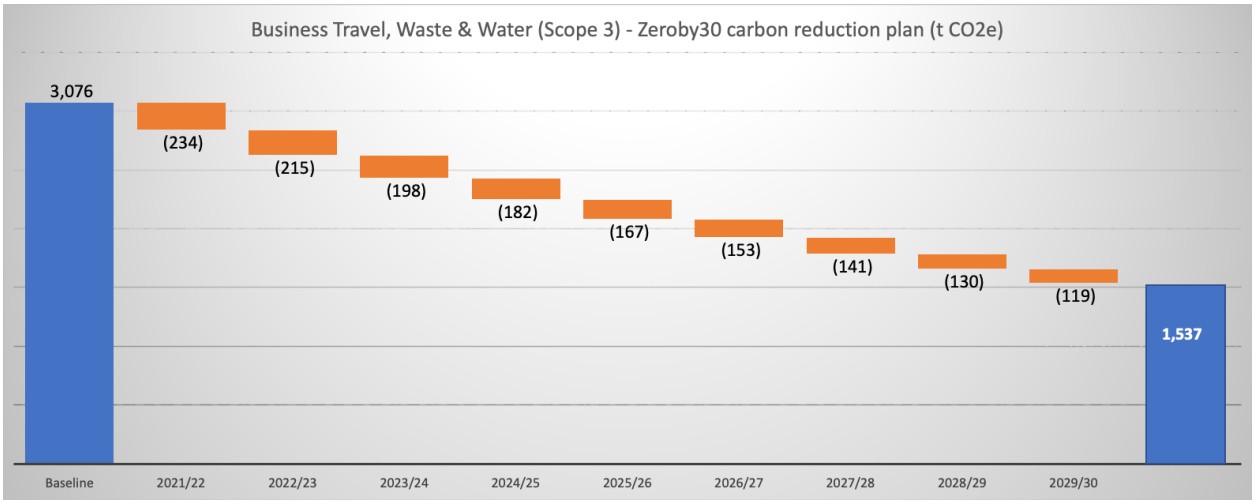
Business Travel (2,888.1 tCO_2e, of which 80% is driven by air travel) requires a minimum 8% reduction in the carbon footprint each year to 2029/30 to achieve the Scope 3 net zero target. This equates to a **maximum of 1,349.7 tCO_2e** for Business Travel emissions by 2029/30. The University's draft green travel plan aims to go significantly further than this so, if adopted, the University will be very well placed to not only achieve but exceed the net zero carbon goal.

The solutions to drive a reduction in Business Travel are a blend of engagement to 'win hearts and minds', policies, tools to support staff in making low-carbon choices, and reporting to give visibility of progress. The University's draft green travel plan has a very well-developed set of policies, decision-hierarchy guidelines, and metrics to influence a reduction in travel. Given the large proportion of the footprint driven by air travel, a reduction in this form of travel will be the main driver in achieving the target, with technology-enabled virtual meetings being the recommended default option wherever feasible. To enhance the success of outcomes from the green travel plan, the following initiatives are also recommended:

- Create a simple Travel Toolkit to help staff to make low carbon decisions, with a travel impact infographic and carbon calculator.
- Set site and/or directorate level carbon budgets for travel, with a mechanism to block 'overspend'.
- Publish a monthly site and/or directorate 'Business Travel league table' of carbon consumed against budget, to encourage awareness and stimulate competition.
- Staff engagement to include Business Travel messaging in Sustainability training, communication, and the remit of 'Eco-team' champions (more details below).

Carbon forecast: Business Travel, Waste & Water (Scope 3)

Zeroby30 University of Greewich: Scope 3 Business Travel, Waste & Water *Carbon footprint forecast - Summary by year*											
		2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	TARGET
Scope 3 Business Travel	Year start (tonnes)	2,888	2,654	2,439	2,241	2,060	1,893	1,739	1,598	1,469	1,350
	Year on Year Reduction (tonnes)	234	215	198	182	167	153	141	130	119	8%
	Year end (tonnes)	2,654	2,439	2,241	2,060	1,893	1,739	1,598	1,469	1,350	
Scope 3 Waste & Water	Year start (tonnes)	188	188	188	188	188	188	188	188	188	
	Year on Year Reduction (tonnes)	0	0	0	0	0	0	0	0	0	0%
	Year end (tonnes)	188	188	188	188	188	188	188	188	188	
Total	Year start (tonnes)	3,076	2,842	2,627	2,429	2,247	2,080	1,927	1,786	1,657	1,538
	Year on Year Reduction (tonnes)	234	215	198	182	167	153	141	130	119	
	Year end (tonnes)	2,842	2,627	2,429	2,247	2,080	1,927	1,786	1,657	1,537	



2.4 Enabling Initiatives

Enabling initiatives are the process, policy and decision-making levers that are key to supporting the embedding and long-term integrity of the net zero action plans. Designed to influence responsible behaviours, these will have an important role in ensuring that the technology-led solutions operate in an optimal way and that the underlying net zero carbon principles and mindset are fully embedded in the organisation's culture to become 'business as usual' in decision-making. The enablers fall into three areas: Procurement; Monitoring and Reporting; and Engagement. Key considerations for each are given below, with further detail in s.3.5. It recommended that these initiatives commence in 2021/22 to align with the start of execution of the net zero carbon roadmap and that they are refreshed annually as part of continuous process improvement.

Procurement Initiatives

- Introduce a 'Red list' of technologies/items that are no longer available, including any fossil-fuel consuming equipment.

- IT & Lab equipment: offer only the most energy-efficient, modern devices, with a regular (minimum annual) refresh of the list available to order.
- Add carbon footprint and energy efficiency criteria, with appropriate weighting, to the Procurement selection process.

Monitoring & Reporting Initiatives

- Promote and cascade the annual Planet Mark footprint certification and Zeroby30 programme results widely throughout the organisation and student body.
- Implement a 'real-time' energy consumption dashboard, supported by area-specific meter readings, to drive transparency and targeted energy-efficiency action plans.
- Set site and/or directorate carbon targets, starting with Business Travel but with the potential to extend to other carbon drivers as the net zero carbon strategy matures.

Engagement Initiatives

- Formal launch of the net zero carbon roadmap, supported by the Planet Mark's Sustainability energiser training for all staff and Sustainability Essentials workshops.
- Upweight the 'green champions' network/Eco-team, supported by an annual sustainability event and regular communications update on roadmap progress, success stories and external insight.
- Provide a carbon literacy toolkit to empower staff and students to make informed choices and consider offering incentives based on evidenced Sustainable behaviours (already underway with the University's 'Behaving Sustainably' campaign).

2.5 Implementation recommendations

The net zero carbon roadmap is a longer-term plan than is typically found in most business strategies and will require strong, sustained leadership for a successful execution over the 9-year period to 2030 and beyond. The roadmap investment detailed above includes an assumption that external support will be required for the design and project management of the Estates initiatives, at a cost of £3.5m (30% of the total capital spend) However, critical as the Estates initiatives are to achieving net zero, the Zeroby30 programme must have a holistic reach and ownership throughout the University and be sufficiently resourced to deliver across all the elements described above. To this end, recommendations to set up the programme for a successful implementation are as follows:

- Establish a clear governance structure from the outset of the roadmap execution, with an Executive leader as sponsor (ideally the VC), a steering group drawn from cross-functional leaders and working with monthly formal updates/operational review and minimum quarterly steering group review.
- Create and budget for a short- and medium-term internal resourcing plan to manage the programme, ideally comprised of a small number of dedicated roles rather than as 'add-ons' to an existing operational role. (Note that any costs for incremental internal resourcing have not been included in the roadmap evaluation as this needs to be assessed by the University's leadership team with regard to existing team capacity).
- The achievement of this plan will in part be done through partnerships with organisations with which the University works, including contractors such as those responsible for FM services, transport, catering, and other services. It will therefore be key for the University to communicate and influence these partners to fully engage with and support this net zero carbon ambition.
- Commit to regular, transparent reporting on progress against the roadmap, both internally and externally. The net zero commitment for the UN Race to Zero requires a minimum annual formal disclosure of progress but interim updates to stakeholders as key milestone are met are also recommended to further drive momentum and credibility.

2.6 Business benefits

There is a growing body of evidence of the business benefits flowing to organisations that are setting bold net zero carbon goals, robustly underpinned by transparent, rigorous action plans to translate ambition into impact. Nowhere is this more relevant than in the higher education sector, where young people are highly sensitised to the challenges and impact on their futures from climate change and, as a result, are becoming increasingly discerning as to where they take their custom. The benefits to the University of setting, publishing, and executing its net zero carbon roadmap are multi-faceted and span both qualitative and quantitative elements, across the following headline areas:

- **Reputational enhancement** from the direct contribution to creating a resilient environment for future generations, with potential to amplify impact via employees and the wider community.
- **Business development opportunities** in attracting more future students to the University by meeting or exceeding their expectations on climate action.
- **Enhanced ability to attract and retain talent**, with engaged and inspired employees, who can clearly see the path the business is taking and their role in achieving the net zero carbon goal.
- **Access to investment, funding, or grants**, with the sustainability criteria as pre-requisites for investors/ funding bodies wishing to support environmentally and socially responsible prospects.

3. Carbon footprint & recommendations in detail

2.7 Baseline carbon footprint & targets

The first step in any carbon reduction strategy is to measure and validate the baseline footprint, which the action plan is then created to address. The international standard for carbon accounting used to calculate the footprint is called the Greenhouse Gas ('GHG') protocol, which allows for two methodologies for calculating the carbon footprint of electricity, as follows:

- The 'location-based' method, which uses the standard carbon footprint of UK grid electricity
- The 'market-based' method, which allows an alternative calculation of the actual carbon footprint of the electricity sourced from the supplier, where supporting data can be provided. The impact of this method is that genuine, validated renewable or nuclear-produced electricity is classed as zero carbon i.e. the Scope 2 emissions relating to this electricity supply drop to zero.

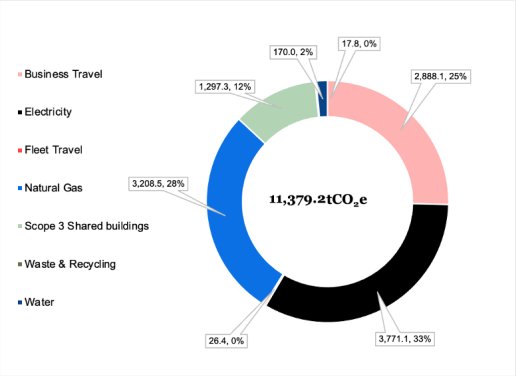
Zeroby30 includes a step to review electricity provision against the criteria for the market basis and applies the zero-carbon classification to the footprint where these are met. The University's current electricity provision meets the criteria and thus qualifies as zero carbon on a market-based evaluation.

Standard practice for creating a net zero carbon plan is to use the most recent year's carbon footprint data as the baseline on which the plan is based. However, as the year ending July 2020 was not representative of normal ongoing operations due to the global pandemic, a decision was made to baseline the Zeroby30 roadmap against a **carbon footprint based on the year ending July 2019.**

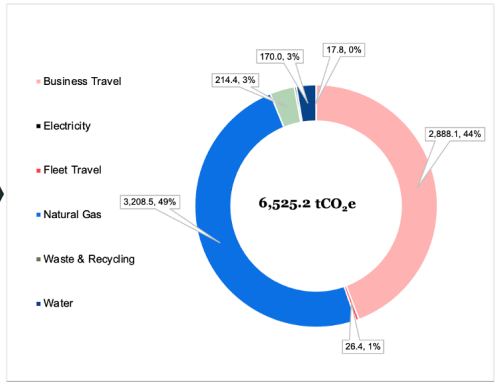
The **Zeroby30 baseline footprint on the market-basis is 6,525.2 tCO_2e*** (location-basis: 11,379.2 tCO_2e). The Zeroby30 recommendations use the market-based footprint as the start point for the roadmap, as the electricity-emissions have already been validated as zero carbon. It is therefore critical that this continues and that only zero carbon electricity, and ideally renewable rather than nuclear sourced, is purchased going forward.

The breakdown of the location and market-based footprints into the emissions sources is shown below:

LOCATION-BASED Carbon Footprint



MARKET-BASED Carbon Footprint



Note: Scope 3 transmission and distribution losses from electricity supply have not been included in the Zeroby30 baseline, on the ground that they make up less than 5% of the total footprint and are largely outside the University's control

2.8 Recommendations in detail: Estate (Scope 1 & 2 + Scope 3 shared buildings)

Baseline footprint = 3,449.3 tCO_2e; Target = zero by 2030.

The Scope 1 & 2 carbon footprint for the Estate, plus the Scope 3 elements for 3rd party gas consumption in shared buildings, is entirely driven by the emissions from burning natural gas in the Estate. From a pure decarbonisation perspective, therefore, it is critical that any technologies that run on fossil fuels - in generating heat and hot water and by gas-powered catering or lab equipment – are replaced with electricity-powered alternatives such as air or ground source heat pumps or electric boilers.

In addition, maintaining the zero-carbon status of the electricity supply is key to avoid any future emissions from electricity. At minimum, this can be done by retaining the current nuclear tariff, but it would be preferable to switch to a 100% renewable energy tariff when prices allow, as nuclear electricity has undesirable side effects for the environment. Even better is to supplement the commercial tariff with self-generated electricity from on-site solar PV, as this creates 'additionality' i.e. contributing directly to an increase in the UK's renewable energy capacity overall.

Finally, even using zero-carbon renewable electricity, driving energy efficiency remains essential as:

- Energy efficiencies generate cost savings, which can help fund capital investment in other solutions.
- Reduced demand on electricity supply capacity is critical to accommodate the increased power consumption from new technologies such as electrification of heating.
- The 'greenest' energy of all is the energy we don't use at all.

The recommended technical Estate solutions therefore include key electricity efficiency drivers; most important from an energy efficiency and savings perspective being LEDs, BMS optimisation, smart controls and replacing existing electric heating. The technical solutions proposed for each site, together with a summary of total cost per solution, estimated payback, and timing are detailed below.

In addition to these technical initiatives, driving energy efficiency will also be optimised by a focus on space utilisation, retaining and using only the spaces needed, at the times they are needed. This rationale will also ensure staff are more amenable to working behaviours that maximise space utility.

Net Zero lever	Solution	One-off cost & payback	Timing	Greenwich	Avery Hill	Medway	Bathway
Use less energy	LEDs	£1,369k; 3-4 years	2021/22	Full site	Full site	Full site	Full site
	Solar films	£39k; 5-8 years	2021/22	King William, Dreadnought	David F, Mary S, Science Module, Wren	Blake, Nelson, Anson, Grenville	N/A
	BMS optimisation	£67k; 0.5-2 years	2021/22	Full site	Full site	Full site	N/A
	Transformers + Voltage regulation	£679k; 6-18 years	2022/23	N/A	Anne B, Catherine of A, Henry T, Catherine P, Jayne S.	Full site	N/A
	Smart controls +/or replace electric heating	£651k; 4-5 years	2022/23	Cutty Sark, Devonport	Student Village		N/A
	Drop ceiling + lower radiators	£96k; 11 years	2022/23	N/A	N/A	Hawke	N/A
	Energy efficient IT & lab equipment	N/A – business as usual budget	Ongoing, by 2029/30	Replace IT/lab equipment on normal end of life cycle			
Re-design for zero carbon	Switch gas boilers to electric boilers	£630k; N/A	2028/29	Queen Anne, Queen Mary, King William			Full site
	Air Source Heat pumps/ Site ASHP District Heating	£6,454k; N/A	2024/25 – 2027/28	Dreadnought, Stockwell St.,Hamilton House, Stephen Lawrence, Cooper	Site wide ASHP District Heating system	Site wide ASHP District Heating: Upper + Lower	N/A
	Electrify catering & lab equipment	N/A – business as usual budget	Ongoing, by 2029/30	Replace gas catering equipment on normal end of life cycle			
Decarbonise electricity supply	On-site solar	£1,688k; 8years (ex. Avery Hill car park - 16 years)	2023/24 – 2027/28	Dreadnought, Devonport, Cooper, Daniel Defoe, Cutty Sark	David F, Mary S, Anne B, Henry T, Catherine H & P, car parks	Drill Hall, Hawke, Wolfson	N/A
	Electricity tariff	N/A	Ongoing	Maintain at zero carbon; switch to renewables from nuclear once practical			

2.9 Recommendations in detail: Fleet (Scope 1 & 2)

Fleet represents a very small proportion of direct emissions but must still be addressed to meet the net zero carbon goal and, ultimately, to comply with UK regulation that will ban sales of new petrol/diesel cars by 2030. Furthermore, providing electric fleet vehicles and on-site charging will also support the reduction of the University's wider Scope 3 footprint from employees or students commuting in either Fleet or their own Electric Vehicles (EVs).

The Fleet roadmap phasing reflects the Fleet manager's plans to shift the current fleet with EVs in the next cycle as they become due for replacement and is scheduled to be fully electric by the year 2026/27. The composition of the fleet each year on this basis is forecast as follows:

2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Fleet: 19 - 4 EVs - 1 hybrid - 14 petrol/ diesel	Fleet: 18 - 6 EVs - 1 hybrid - 11 petrol/ diesel	Fleet: 17 - 7 EVs - 1 hybrid - 9 petrol/ diesel	Fleet: 15 - 8 EVs - 1 hybrid - 6 petrol/ diesel	Fleet: 15 - 11 EVs - 4 petrol/ diesel	Fleet: 14 - 14 EVs

The cashflow assumptions assume that the University purchases the vehicles outright and, as for site solutions, are based on today's costs of EVs compared to petrol or diesel equivalents. This drives a forecast investment of £215k between 2022/23 and 2026/27. However, EV costs will certainly fall over the same period, as the UK approaches the 2030 deadline for the ban on all sales of new petrol and diesel cars and the market for new EVs grows and becomes the dominant sector. The running cost savings of EVs compared to the current petrol/diesel vehicles have also been assessed on a conservative basis of 4p/mile vs. 11p/mile; again, this differential is likely to increase in favour of EVs as technology improves. Therefore, the estimated £215k investment is very likely to be overstated and it is anticipated that the lifetime cost of the EV fleet will reach parity with, or even be lower than, a petrol/diesel fleet over the period of the roadmap.

2.10 Roadmap & cashflow forecast – phasing rationale & key assumptions

Estate Roadmap Phasing Rationale

- Energy efficiency solutions front-weighted in years 1 & 2: 'quick win', low disruption solutions that generate operating cost savings and headroom in the demands on electricity supply capacity, needed to facilitate the energy draw of heating decarbonisation solutions.
- On-site solar from year 3: as this provides further electricity generating capacity ahead of electrification of heating.
- Electrification of heating from year 4: higher impact solutions, with more lead time required for planning and allowing for the technology to further evolve. Site priorities are recommended as follows, driven by specific site situations:
  - First - Avery Hill: as the current District Heating system is nearing end of its life
  - Second – Medway: assuming the current CHP issues continue, replacing the CHP once agreement can be exited (2025). Should the current CHP become fully operational before this time, the option to leave it in situ and run on a zero-carbon fuel may be considered as an alternative. This would have the benefit of avoiding waste of disposal and indirect embodied carbon in the new equipment.
  - Last – Greenwich and Bathway: back-weighted to maximise the lifetime use of recently replaced boilers. This will also allow lead time to secure any approvals needed from Historic England for replacing boilers at Greenwich, although the recommended solutions have been selected to create a 'like for like' replacement to avoid any impact on the buildings' fabric and appearance.

Estate & Fleet Key assumptions

Several assumptions were made in constructing the Estate and Fleet (Scope 1 & 2) cashflow and carbon reduction forecasts:

- No change to current electricity & gas prices has been assumed. However, an increase in gas prices may be required over the roadmap period to support the UK government's net zero legal commitments, which would deliver an improved business case.
- Benefits are based on first year values for scheme, with no inflation or degradation assumed for subsequent years. Similarly, costs for all technologies are based on today's prices but, in reality, costs can be expected to decrease as technologies improve and the market matures. The best fit technologies and related costs should therefore be updated when the strategy is refreshed and at the point of commissioning capital works.
- No allowance for the Renewable Heat Incentive (RHI) replacement scheme has been included. There is a potential upside from the next incarnation of this scheme when announced by the Government (expected later this year), although likely to be small.
- One-off costs & 'go live' on average fall mid-year, therefore 50% of annual operating costs/benefits are achieved in year of solution implementation; 100% from year following implementation. Likewise, 50% of carbon footprint reduction occurs in year of solution implementation and 50% in following year.
- Roadmap initiatives are all funded directly by the University. Where buildings are owned by the University but remain shared with 3rd party incumbents at the times solutions are implemented, the 3rd party be asked to pay for the appropriate share of the investment upfront; alternatively, if the University funds 100% of the initiative's investment, it will recoup the balance attributable to the 3rd party from the ensuing cost savings. However, a packaged service to have the roadmap

funded and implemented by a third-party 'ESCO' provider could be an alternative to avoid the capital investment.

- Greenwich's decarbonised heating solutions for the historic site assume no physical external impact would be allowed by Historic England, hence only 'like for like' solutions proposed.
- Electricity generated by solar PV is consumed on site, hence benefits are based on electricity tariff price that would otherwise have been payable.
- Lab equipment & IT equipment will be replaced at end of life with most efficient new technology as part of business-as-usual budgets. In the interim, it is anticipated that energy efficiencies will be driven by behaviours and Procurement policy but this has not been quantified in the roadmap or cashflow.
- Fleet charging is 100% using renewable energy sources, which are therefore classed as zero carbon. Charging on site will qualify as the University sourced renewable electricity; fleet drivers should also be guided to using renewable energy charging when on the move (networks such as Gridserve, Osprey, BP Pulse) and at home to avoid increasing Scope 2 or 3 emissions from fleet charging.

2.11 Enabling Initiatives in detail

Procurement Initiatives

Procurement policies and processes are important enablers in the execution of the solutions described above and in maintaining the integrity of the roadmap over the medium and long-term. Procurement decisions taken across the organisation by anyone responsible for buying energy-consuming devices must be aligned to the principles of energy efficiency and eliminating fossil fuels, and Procurement selection criteria and controls need to support this. Recommended enhancements to the Procurement process are as follows:

- Establish a 'Red list' of items that are not permitted to be purchased, with immediate effect. This should include any technology that consumes fossil fuel in its operation: gas boilers; gas-fired Bunsen burners; gas catering equipment, petrol/diesel vehicles.
- IT and Lab equipment: ensure options available reflect only the most up-to-date, energy efficient models across the entire set of user needs, with a regular (minimum annual) refresh of the list available to order.
- Expand Procurement criteria to include measurement of carbon impacts and ensure these have sufficient weighting to drive low-carbon decisions. This should begin with efficient operational performance but can be expanded over time to include Scope 3 emissions from supply chain, driven by the product carbon footprint and transport to site. Although not included in this phase of the net zero carbon strategy, any actions that can help reduce the University's wider Scope 3 footprint are worth putting in motion as soon as practicable.
- From an ILS perspective, moving on site data centres to cloud-based services is a strategic aim that would drive overall energy efficiency, as cloud specialist providers are far more efficient than in-house centres. The ILS team has identified that barrier to doing this is the related shift from capex to operational budgets. An adjustment in the Finance decision-making criteria to take into account the energy efficiency benefits of such initiatives and holistic impact on energy costs would unlock these opportunities.

Reporting & Monitoring Initiatives

Reporting and monitoring are recommended to tackle different needs at a number of levels:

- At a high level, the University's carbon footprint development will be monitored by the Planet Mark certification each year and this will independently verify the reduction in carbon driven as the Zeroby30 programme is executed. A Zeroby30 check on the roadmap progress will also be conducted as part of the annual certification cycle.
- At an operational level, one of the biggest energy consumers in the University is the ILS function. While the ILS team has made good progress in driving energy saving projects, they are hampered by a lack of granular, real-time data on energy drivers. Implementing a detailed energy dashboard feeding from area-specific meter readings would allow far greater transparency of energy consumption, focused actions, and the potential to track the effectiveness of actions and team behaviours.
- Setting specific carbon targets by site or directorate can be a very powerful lever in driving decision-making. The opportunity to set a carbon budget for Business Travel has already been mentioned and this could be extended to wider carbon, or sustainability, targets and tracking as the net zero carbon plans are embedded. This will be particularly relevant when the wider Scope 3 emissions are rolled into the strategy, as Scope 3 cover areas where the staff and student population have a much greater direct influence, such as resource procurement, consumption, and employee commuting.

Engagement Initiatives

A critical enabler of any carbon reduction strategy is the engagement and motivation of all the organisation's employees in the execution of the plan, and, in the case of the University, that extends to the students too. Not only do the operational and personal choices made every day impact the carbon emissions that the University is responsible for, being empowered to make a direct contribution to tackling climate change is a source of motivation and inspiration for employees and students. This will, in turn, enhance the University's reputation and attractiveness as a responsible and forward-thinking place to work and study. Recommended activities to drive engagement are as follows:

- Formally launch the Zeroby30 strategy and roadmap at an appropriate forum, with an introduction by the Vice Chancellor.
- Planet Mark 'Sustainability energiser' and 'Sustainability essentials' training: to be run in 2021/22 with all staff encouraged to attend (included as part of the Zeroby30 programme).
- Upweight the profile of the Eco-team among staff and students, and train representatives to communicate net zero carbon and broader sustainability goals, progress, and learnings.
- Promote the University's "Being Sustainable at Work/in Halls/in your House" infographics and carbon calculator widely among all staff and students. The Planet Mark's engagement team has created some additional recommendations on how to maximise the impact of this campaign, in Appendix 3.
- Consider use of a collaboration platform where individuals or teams can make pledges on sustainable behaviour, share results, and earn rewards. 'We are donation' is a good example which has been used by, among others, Innocent Drinks, Network Rail and UCL.

4. Carbon removals guidelines

To achieve a legitimate net zero goal, any residual emissions must be balanced by an equivalent amount of carbon removals, from the point at which net zero is claimed and thereafter. This can be done by investing in verified carbon removal schemes, which today are based on nature-based carbon sequestration such as tree planting. In the future, commercially available mechanical carbon capture and storage schemes may develop, however, The Planet Mark recommends sourcing nature-based solutions as the preferred route.

Note that carbon removals schemes are different from carbon offsets, as offsets allow schemes that avoid or reduce carbon emissions, rather having to actively remove carbon from the atmosphere.

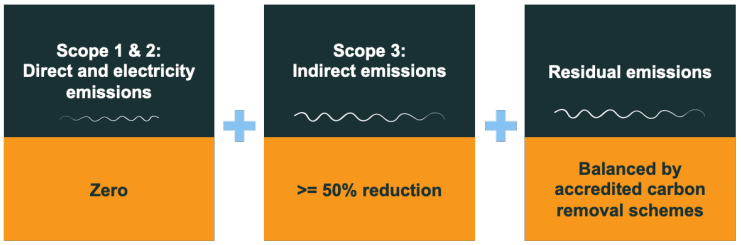
Based on the Zeroby30 targets set out in this strategy, the University will need to remove up to **1,537.5 tCO_2e** in 2030. The final number will depend on by how far the Scope 3 emissions are reduced, so may be lower if the Business Travel reductions exceed these targets. At prices available in today's market of £10/t-£15/t, this would equate to an **annual cost of £15k - £23k p.a.** However, demand for removal – as opposed to offset – schemes is likely to increase in the face of pressure to meet net zero carbon goals and an expected increase in carbon tax. Hence, costs of carbon removal schemes are likely to increase, possibly by as much as 5 to 10 times. Therefore, every ton of carbon saved up to and beyond 2030 has the potential to drive significant benefits in carbon removal costs from 2030 onwards.

The Planet Mark can provide advice at the appropriate time on the best choice of carbon removal schemes for the University. Whatever the scheme chosen, it is key that they are from verified sources of the highest quality such as Gold Standard (non-UK), Verified Carbon Standard (non-UK) or Woodland Carbon Code (UK). Based on schemes available today, options would include:

Forest Carbon https://www.forestcarbon.co.uk/	UK & Ireland afforestation/ reforestation Dedicated, named projects possible for large partners	£10 - £15/t (est.– quote required)	Assured by the UK Woodland Carbon Code
Woodland Trust https://www.woodlandtrust.org.uk/	UK afforestation/reforestation, woodland conservation Dedicated projects for very large partners only	£15/t (Standard)	Assured by the UK Woodland Carbon Code

Appendix 1: What is Net Zero Carbon?

Before setting out to develop a net zero carbon roadmap it is important to clarify the definition of net zero. Unlike the term 'carbon neutral', there is currently no legal international standard to define 'net zero carbon', although the Science Based targets initiative has in November 2021 launched a net zero carbon definition. As part of the Zeroby30 programme we have developed the ambition set out below, which is aligned to the most rigorous industry practice and compatible with the 'near term' targets for net zero defined by the Science Based Targets Initiative. In addition to the 2030 goals set out below, the Zeroby30 targets have now been extended to include the goal of achieving at least a 90% reduction in Scope 3 emissions by 2050 at the very latest, to ensure alignment with Science Based Targets' long-term net zero requirements.



By 2030

+ 90% Scope 3 emissions reduction by 2050

This approach is both highly robust and credible, as it requires tackling of direct (Scope 1) and electricity related (Scope 2) emissions and requires the organisation's full value chain impact (Scope 3 emissions) to be considered. Notably, a 2019 report by CDP estimated that an organisation's Scope 3 'indirect' emissions are on average 5.5 times the size of the direct and electricity related emissions, so these emissions sources cannot be ignored. It is now an industry expectation that organisations making net zero carbon claims are taking responsibility for their entire sphere of impact in this way.

In contrast, the definition 'carbon neutral' allows for offsetting of direct and electricity related emissions and does not mandate the inclusion of indirect emissions. Whilst the current international standard for carbon neutrality does require a reduction target, this does not stipulate it must be ambitious enough to align to the maximum 1.5-degree temperature increase that is now seen as critical by thought leaders. This is clearly a less stringent requirement and risks accusations of 'greenwashing', as it allows the organisation on one hand to continue to emit carbon across its operations while on the other paying for offsets elsewhere. It is very likely that a recognised standard for net zero carbon will be set in the near future that incorporates indirect emissions, hence it is valuable to structure targets and plans now to anticipate this.

Appendix 2: Cashflow & carbon forecast in detail

Zeroby30 UoG: Scope 1 & 2 Estate & Fleet + Scope 3 Estate shared buildings

Cashflow & Carbon footprint forecast - Summary by year

		2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	TOTAL
Use Less Energy	**LEDs**										
	Cost (£) - one off	(1,368,794)	-	-	-	-	-	-	-	-	(1,368,794)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	191,770	383,540	383,540	383,540	383,540	383,540	383,540	383,540	383,540	3,260,090
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	-	-	-
	Solar films										
	Cost (£) - one off	(39,341)	-	-	-	-	-	-	-	-	(39,341)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	2,889	5,778	5,778	5,778	5,778	5,778	5,778	5,778	5,778	49,113
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	-	-	-
	BMS optimisation										
	Cost (£) - one off	(67,050)	-	-	-	-	-	-	-	-	(67,050)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	53,964	107,928	107,928	107,928	107,928	107,928	107,928	107,928	107,928	917,388
	C-reduction YOY (Tonnes)	270	270	-	-	-	-	-	-	-	541
	Transformers with Voltage Regulation										
	Cost (£) - one off	-	(679,000)	-	-	-	-	-	-	-	(679,000)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	-	36,663	73,327	73,327	73,327	73,327	73,327	73,327	73,327	549,950
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	-	-	-
	Smart controls and/or replace electric heating										
	Cost (£) - one off	-	(650,985)	-	-	-	-	-	-	-	(650,985)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	-	80,985	161,971	161,971	161,971	161,971	161,971	161,971	161,971	1,214,782
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	-	-	-
	Hawke Building Drop ceiling & lower radiators										
	Cost (£) - one off	-	(95,510)	-	-	-	-	-	-	-	(95,510)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	-	4,368	8,735	8,735	8,735	8,735	8,735	8,735	8,735	65,513
	C-reduction YOY (Tonnes)	-	40	40.1482438	-	-	-	-	-	-	80
Re-design for zero carbon	**Switch Gas Boilers to Electric Boilers**										
	Cost (£) - one off	-	-	-	-	-	-	-	(630,000)	-	(630,000)
	Cost (£) - p.a.	-	-	-	-	-	-	-	(87,700)	(175,399)	(263,099)
	Benefits (£) - p.a.	-	-	-	-	-	-	-	20,829	41,657	62,486
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	201	201	402
	Air Source Heat Pump										
	Cost (£) - one off	-	-	-	-	-	-	(628,655)	-	-	(628,655)
	Cost (£) - p.a.	-	-	-	-	-	-	(21,829)	(43,657)	(43,657)	(109,143)
	Benefits (£) - p.a.	-	-	-	-	-	-	10,914	21,829	21,829	54,572
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	105	105	-	209
	Site Wide ASHP District Heating System										
	Cost (£) - one off	-	-	-	(2,399,810)	(1,489,992)	(1,935,589)	-	-	-	(5,825,391)
	Cost (£) - p.a.	-	-	-	(83,328)	(259,903)	(406,019)	(458,888)	(458,888)	(458,888)	(2,125,913)
	Benefits (£) - p.a.	-	-	-	40,191	123,074	198,809	231,852	231,852	231,852	1,057,628
	C-reduction YOY (Tonnes)	-	-	-	369	743	665	291	-	-	2,070
	Design, consulting & project support										
	Cost (£) - one off		(500,246)	(500,246)	(500,246)	(500,246)	(500,246)	(500,246)	(500,246)		(3,501,723)
	Cost (£) - p.a.										-
	Benefits (£) - p.a.										-
	C-reduction YOY (Tonnes)										-
	Electrify Catering & Labs										
	Cost (£) - one off										-
	Cost (£) - p.a.										-
	Benefits (£) - p.a.										-
	C-reduction YOY (Tonnes)	13	13	13	13	13	13	13	13	13	121
	Electrify Fleet										
	Cost (£) - one off	-	(30,000)	(19,500)	(27,500)	(49,500)	(88,000)	-	-	-	(214,500)
	Cost (£) - p.a.										-
	Benefits (£) - p.a.	-	415	1,055	1,378	2,675	4,557	5,242	5,242	5,242	25,808
	C-reduction YOY (Tonnes)	-	2	3	2	6	10	4	-	-	26
Decarbonise electricity supply	**On site solar**										
	Cost (£) - one off	-	-	(928,863)	(362,419)	-	-	(396,402)	-	-	(1,687,684)
	Cost (£) - p.a.	-	-	-	-	-	-	-	-	-	-
	Benefits (£) - p.a.	-	-	36,943	96,216	118,546	118,546	142,537	166,528	166,528	845,844
	C-reduction YOY (Tonnes)	-	-	-	-	-	-	-	-	-	-
	Electricity tariff										
	Cost (£) - one off										-
	Cost (£) - p.a.										-
	Benefits (£) - p.a.										-
	C-reduction YOY (Tonnes)										-
Cashflow summary	Cost (£) - one off	(1,475,185)	(1,955,741)	(1,448,609)	(3,289,975)	(2,039,738)	(2,523,835)	(1,525,303)	(1,130,246)	-	(15,388,634)
	Cost (£) - p.a.	-	-	-	(83,328)	(259,903)	(406,019)	(480,716)	(590,245)	(677,944)	
	Benefits (£)	248,623	619,677	779,276	879,064	985,573	1,063,191	1,131,824	1,187,558	1,208,387	
	Net cashflow in year (£)	(1,226,562)	(1,336,064)	(669,333)	(2,494,239)	(1,314,068)	(1,866,664)	(874,196)	(532,933)	530,442	
										Break-even	27.4
Scope 1, 2 & 3 Carbon footprint: (market based)	Year start (Tonnes)	3,449	3,166	2,840	2,783	2,398	1,635	947	534	214	
	Year on Year Reduction (Tonnes)	284	326	57	385	763	688	413	319	215	3,450
	Year end (Tonnes)	3,166	2,840	2,783	2,398	1,635	947	534	214	(0)	