CRANFIELD UNIVERSITY
ENVIRONMENTAL TARGETS 2030

2030 environmental targets

Net zero carbon by 2030

Zero avoidable waste by **2030**

50% water reduction against 2010 consumption **by 2030**

Single occupancy car commuting **reduced to 50%** for Cranfield Campus **by 2030**

Net environmental gain including biodiversity to be increased **by 20%** to maximise potential on site

Pollution control monitoring systems in place by **2023**

Develop a **climate change adaptation strategy** **by 2023** to improve the resilience of the campus to climate change

The SDG Accord

The University and College Sectors' Collective response to the Global Goals

SUSTAINABLE DEVELOPMENT GOALS

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Executive Summary

This document sets out the key strategies and principles for delivering the environmental targets the University committed to last year. The focus is on the carbon, waste and water targets where the greatest effort will be required to change the existing systems to a more sustainable way of operating. Strategies for the other targets are commented on and are either in place and being reviewed shortly or are still being developed.

The targets were developed with the following issues in mind:

- Addressing significant aspects and issues identified in the University Environmental and Energy Management Systems (as certified to ISO14001 & ISO50001)
- Taking into account Government Targets and stakeholder expectations such the Zero Carbon target by 2050 and the 25 year Environment Plan
- Aligning with UN Sustainable Development Goals
- Comparison with other Universities/Institutions
- Competitive advantage
- Technical feasibility and alignment with estate management and academic activity
- Forming an integral part of an overall sustainability strategy and corporate plan

The environmental targets are monitored and managed by the Energy & Environment Team in Facilities. This is overseen by the Board for Energy & Environment which meets quarterly to monitor and ensure progress is being made. There is an annual review. The Environmental Management System is externally audited and certified to ISO14001. The Energy Management System is externally audited and certified to ISO50001.

In delivering environmental targets and strategy the university will apply the following principles:

- Align action and relevance with UN sustainable development goals (SDGs)
- Effective Governance monitoring, reporting and evaluation of performance
- Seek synergies and opportunities for collaboration with learning and research (Living Lab, Urban Observatory)
- Ensure cost efficient solutions
- Communication and engagement – maximising opportunities for staff and student involvement.

Scope

The scope includes all activities under the operational control of the University, including teaching and research activities, estates and facilities operations, and support services.

Carbon

The carbon target is to reach Net Zero Carbon emissions by 2030. The target includes Scope 1 and 2 emissions (largely direct emissions resulting from electricity and heating fuel consumption on site) and Scope 3 emissions (in direct emissions associated with procurement of services and products, and travel). Where it is not possible to reduce emissions to zero directly then they will need to be offset by purchasing or investing in carbon saving options elsewhere. Rather than rely on offsetting it is imperative that the University reduce its Scope 1 and 2 emissions as quickly as possible. Some possible scenarios for achieving this are set out. These suggest that a target of an 80% reduction on the 2005 baseline will be possible. This is in line with the trend in reductions required to qualify as a Science Based Target. That is a target which is consistent with a less than 1.5 deg C global temperature rise.

The option to electrify Cranfield Campus is explored. This largely involves replacing gas heating with heat pumps and installing renewables in the form of solar and wind to produce zero carbon electricity. There will need to be an investment in storage technology to balance the heating and electrical demands. But electricity will still need to be imported, particularly as the CHP unit will come to end of life in 2026. The counter option of replacing natural gas with hydrogen is also explored. It is uncertain whether this will be technically possible at scale by 2030. However, it maybe that a combination of the electrify and hydrogen options can be applied.

The cost of this transformation is large, requiring investments more than £20 Million over the next 10 years. However, there are also savings as the reliance on existing energy solutions will become more expensive over time. There is also the possibility of Government grants and support with £5 Million having already been secured to invest improvements this year.

Scope 3 emissions are difficult to measure, and some will be difficult to influence or control. The focus initially will be to gather more accurate data and research the emissions where the University has more influence such as business travel, commuting, waste, water, and other services and products which are procured.

Carbon offsetting also needs more research. This is a difficult topic as it has genuine potential to make a difference, but it also has a poor reputation. To be credible any offsetting will need to be third party certified. The greater the control the University over seeing that it is effective will also be important. The University is a founding member of the Community Forest of Marston Vale (in which the university is located). This provides an excellent opportunity to establish tree planting carbon offsets. These may also have a benefit through being tied into the university's living Lab. Beyond that there may potential for carbon sequestration research, other forms of offset and even the University's Carbon Brainprint". The latter involves quantifying the impact of research and learning and some earlier research suggests it can be very significant. The issue may be how to demonstrate "additionality" and who gets to claim the carbon savings accruing.

The key objectives are:

Objective 1 – Decarbonise Cranfield Campus by replacing natural gas for power and heat

Objective 2 – Continue to improve energy efficiency and reduce consumption

Objective 3 – Electrify the Cranfield vehicle fleet

Objective 4 – Increase heat and electricity storage on Cranfield Campus

Objective 5 – Ensure MKU and other new constructions are truly zero carbon in operation

Objective 6 – Review and improve reporting of Scope 3 emissions

Objective 7 – Review, research and deliver carbon offsets

Resources and Waste

The target is to reach Zero Avoidable Waste by 2030. This means preventing anything which ends up in landfill or being incinerated , from becoming waste which the University could have avoided. Another way of defining Avoidable Waste is in the Government's Resources and Waste Strategy as: Waste that is technically, economically, and environmentally feasible to reuse or recycle, or, where this does not apply, it is (technically, economically and environmentally) feasible to replace with alternatives that are reusable or recyclable.

It is important to note that the university has a responsibility to prevent and avoid waste being created in the first place. Therefore, the key to reducing avoidable waste is to gather information on the materials ending up in the residual waste stream (waste sent for landfill or incineration with or without energy recovery) and use best management practices to apply the waste hierarchy to these materials: prevent, reduce, reuse, and recycle.

The key objectives are:

Objective 1 - Circular Economy principles built into design of new projects, operations, and initiatives.

Objective 2 - Achieve Level 4 DEFRAs sustainable procurement framework (further detail) and establish CE procurement framework

Objective 3 - Resource use and efficiency applied in building design and construction activities.

Objective 4 - Reduce total waste arisings per FTE staff / student

Objective 5 - Reduction of food waste from catering outlets

Objective 6 - Increase amount of items reused

Objective 7 - Identify significant waste streams in residual waste, investigate avoidance and reuse, and increase capture rates for recycling, composting and anaerobic digestion.

Objective 8 - Reduce scope 3 emissions / life cycle impacts from waste management operations

Water

The target is to reduce water consumption by 50% from 2010 levels to 0.5 m3/m2/annum. The priority is to install effective water metering across the campus and particularly in areas of likely high consumption. Without this it will be impossible to identify all except the largest leaks. It will also be difficult to target area of high consumption. At the same time, it will be possible raise awareness and develop behaviour change promotions to engage with staff and students to reduced water use where possible.

The key objectives are:

Objective 1 - Improve water monitoring

Objective 2 - Reduce leaks and waste by monitoring and targeting

Objective 3 – Improve the efficiency of water use.

Objective 4 – Investigate water recycling, rainwater capture and storage

Sustainable Commuting

The target is to reduce single occupancy car commuting to 50% of all journeys by 2030. However, given the experience of working from homes as a result of Covid it may be sensible to reframe that target in terms of number of journeys per population rather than a percentage approach. This would reinforce the benefits of working from home as an option for reducing car commuting.

The current Travel Plan has a target to reduce single occupancy car commuting to 53% of journeys by 2023 from a baseline of 70% in 2012. Current levels (prior to Covid) were at around 59%. A new version of the Travel Plan will be developed in 2023.

Biodiversity

The target is to ensure “net environmental gain including biodiversity gain of 20%” for any developments on the campus. The priority is to maximise the potential for improving biodiversity on site. Having maximised the potential on site then off-site measures will be required.

Since developing a Biodiversity Action Plan in 2016 the Cranfield Campus has seen a transformation in terms of the number of areas set aside for biodiversity to flourish. The Biodiversity Action Plan is five years old, and a new version will be developed over the next 12 months.

Pollution Control

The objective is to have a measurement system in place by 2023 which allows for the ongoing monitoring of key pollutants in ground, water, and air. Whilst some instrumentation is already installed it has yet to be fully commissioned. Once it is providing reliable data targets for reducing levels of key pollutants and emissions will then be developed.

Climate Adaptation

The objective is to develop a climate adaptation plan which increases the resilience of the university against climate impacts. Some preliminary work has taken place as part of an MSc Thesis. This will be developed over the next 12 months.

SDG Accord

The University has now signed up to the SDG Accord and has made a submission to the EAUC (Environmental Association of Universities and Colleges) on Cranfield contribution to the SDGs.

It is becoming clear that Cranfield makes a makes a significant contribution to the SDGs but that this is not sufficiently highlighted nor promoted as much as other Universities or institutions. A plan will be developed to progressthis further.

Conclusions

The Environmental Targets are very challenging, particularly the carbon and waste targets. However, they are necessary if the University wants to prepare itself for resilience, deliver and lead on sustainability in practice in a way that is consistent with our calibre of sustainability teaching and research, and compare positively amongst our peers.

The achievability of the targets will depend on both internal and external factors. The University will need to incorporate the targets into its wider plans. All staff and students will need to be engaged. The University will need to invest in more sustainable technology and systems. At the same time, it is hoped that Government will provide incentives and support to make these investments more viable. There will be opportunities to partner with third parties to develop and trial some of the solution to meeting the targets.

The University has academic expertise which is relevant to all the targets. This needs to be harnessed. The “Living Lab” is an example of the benefits of applying research and learning to the operational aspects of the University.

Many measures to meet the targets are about being more efficient and less wasteful. This will save money. However, in many cases investments in new equipment or processes will need to be made. The Salix revolving fund for energy efficiency is a good example of how investments to make savings can be done. This could be applied to waste and water as well. Other targets such as sustainable commuting, pollution control and biodiversity may need other investment models. It will be important to make sure that funding is sourced to make

the necessary investments. A review of how funding can be sourced internally and externally is needed.

Recommendations

1. Make sure the environmental targets are incorporated into the University's strategies and planning.
2. Expand the opportunities for staff and students to be involved.
3. Develop implementation plans and review progress towards the targets annually.
4. Review funding options and sources so that the necessary investments in new equipment and processes can be made.
5. Develop the Living Lab to harness and apply the University's academic expertise to help meet the targets.
6. Develop strategic partnerships to help develop affordable solutions to meeting the targets.
7. Develop a plan to highlight and promote the Universities contribution to sustainability and the SDGs.
8. Review the current delivery and governance structure. Does the inclusion of social and ethical considerations in reporting on the SDGs require the more formal involvement of other parts of the University?

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Introduction

The environmental targets were adopted by Council last year. This paper sets out some principles and strategies for achieving these targets.

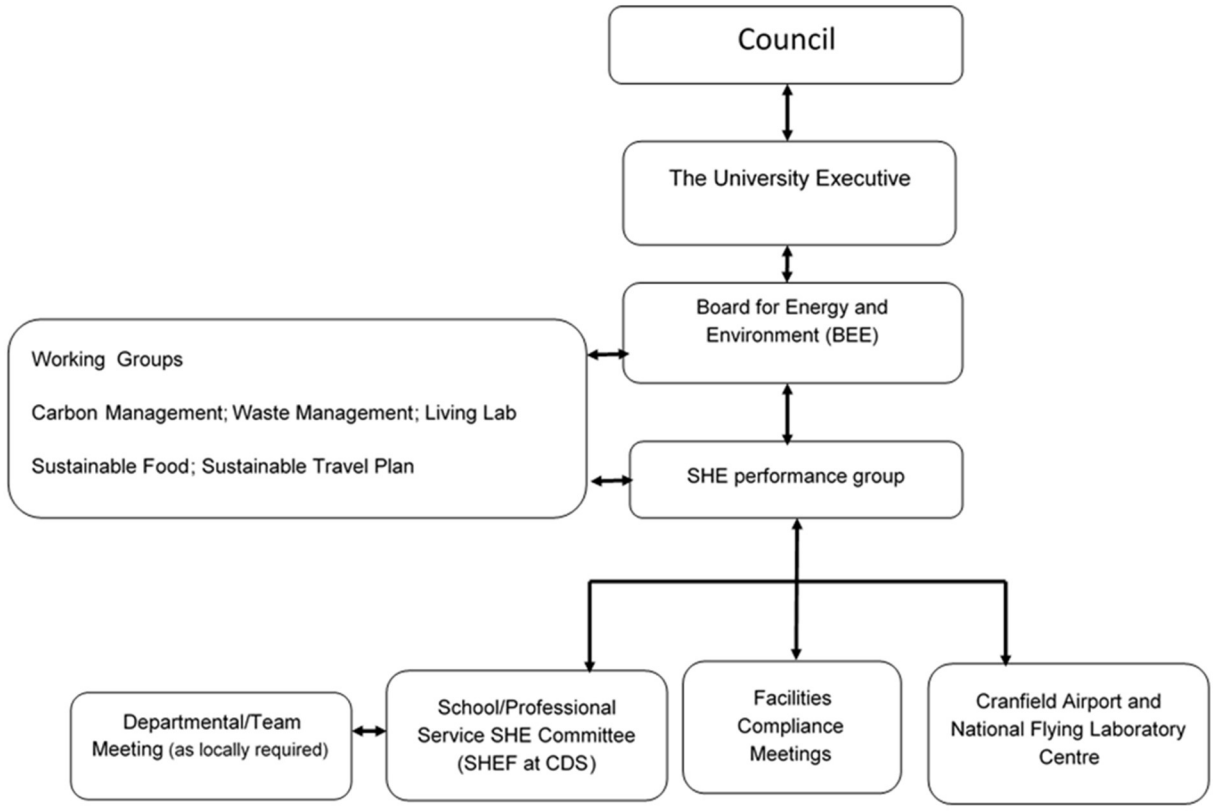
Principles for main strategy

In delivering environmental targets and strategy the university will apply the following principles:

- Align action and relevance with UN sustainable development goals (SDGs)
- Effective Governance monitoring, reporting and evaluation of performance
- Seek synergies and opportunities for collaboration with learning and research (Living Lab, Urban Observatory)
- Ensure cost efficient solutions
- Communication and engagement – maximising opportunities for staff and student involvement.

Governance, monitoring and evaluation

Governance structure diagram



The Energy & Environment Team in Facilities mange many of the operational activities most relevant to the targets. They also monitor and report on progress to the Board for Energy & Environment (BEE). They also report and guided by Working Groups for specific topics. The broadening out of the environmental targets to include the SDGs brings in social and ethical aspects as well as the contribution of the learning and research elements to sustainability. This may require other parts of the University to be more directly involved in delivery and

reporting, widening this responsibility from its current focus in the Energy & Environment Team in Facilities. A review of the delivery and reporting structure would help determine this.

There is an Environmental Management System and an Energy Management System. Each are certified to the relevant ISO standard (ISO14001 and ISO 50001) and externally audited. There is mandatory reporting to external bodies for certain aspects such the reporting to HESA on Estate Management Reporting. Energy and greenhouse gas emissions are reported in the University Annual Report as required by Government under SERC. In order to bid for certain Government Funding a Carbon Reduction Strategy has be presented as required by PPN 06/21.

The strategy will be reviewed by BEE annually to ensure it is having the impact intended. Evaluation will include an assessment of impact, process and cost effectiveness. BEE meets quarterly and progress will be monitored at each meeting and this will reported to Executive and Council.

Scope

The scope includes all activities under the operational control of the University, including teaching and research activities, estates and facilities operations, and support services.

Locations in scope include Cranfield Campus COTEC and MKU. However, at Shrivenham where the University is a tenant a number operations are not within the control of Cranfield University. For example, operational non-hazardous waste is controlled by SERCO and no data is available, the same applies to energy so it is difficult to monitor or influence energy and waste consumption. If this changes in the future and more data becomes available, then this can be incorporated, and baselines adjusted accordingly.

Context & Drivers

When considering future targets there are a number of factors to take into account including:

- Addressing significant aspects and issues identified in the University Environmental and Energy Management Systems (as certified to ISO14001 & ISO50001)
- Taking into account Government Targets and stakeholder expectations such the Zero Carbon target by 2050 and the 25 year Environment Plan
- Aligning with UN Sustainable Development Goals
- Comparison with other Universities/Institutions
- Competitive advantage
- Technical feasibility and alignment with estate management and academic activity
- Forming an integral part of an overall sustainability strategy and corporate plan

Global

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. There are 17 SDGs and they set out a number of targets and objectives to ensure that development must balance social, economic and environmental sustainability

The COP26 conference in November will bring renewed calls for action on greenhouse gas emissions to prevent runaway climate change. This includes ambitious 2030 emissions reduction targets on route to reaching net zero by 2050. The need to protect ecosystems and to build resilience to adapt to climate change will also be on the agenda.

UK

The UK has set a legally binding target of net zero emission by 2050. Many companies and institutions have gone further and set voluntary targets to achieve net zero emissions by 2030 or even sooner. Over 700 Universities and Colleges worldwide (Cranfield included) have signed up to the “Race to Zero” campaign ahead of COP26.

In the UK 25 year Plan to Improve the Environment. There is a goal to minimise waste: “We will minimise waste, reuse materials as much as we can and manage materials at the end of their life to minimise the impact on the environment. We will do this by: working towards our ambition of zero avoidable waste by 2050….’. The 25 year plan also includes targets on biodiversity, pollution control and climate adaptation.

Regulation

There are regulatory and procurement requirements which the University is being asked to meet. The Government’s Streamlined Energy and Carbon Reporting requires annual reporting of Scope 1 and 2 emissions and certain business travel emissions. The Government’s Procurement Policy Note 06/21 requires suppliers for larger contracts to have a Net Zero commitment and a specific type of Carbon Reduction Plan.

Universities

There are several league tables that rank universities according to their sustainability performance , including the Times Higher Education Impact Rankings. These are global

performance tables that assess universities against the United Nations' Sustainable Development Goals (SDGs).

Stakeholders

Customers have their own requirements which often specify certification to an appropriate standard (such as ISO 14001 or ISO 50001) and also queries about environmental performance and incidents.

Cranfield is delivering many education and research activities across the schools, involved with solving the complex issues around responsible and sustainable consumption and production. For example, Cranfield has been leading thinking in the circular economy through research on sustainable design and corporate responsibility for some time. We are one of six circular economy 'Pioneer Universities' in the world, working with the Ellen MacArthur Foundation and have developed an integrated, industry-driven circular economy research and teaching agenda, including the MSc in Technology, Innovation and Management for a Circular Economy. It naturally follows that we also manage university resources sustainably and that our internal processes actively seek to reduce waste and follow Circular Economy Principles.

Increasingly our partners, students and staff expect the university to practice what it preaches (walk the talk) to use resources sustainably and have processes in place to reduce, reuse and recycle.

Policy and Standards

The University's Environmental Policy contains the following commitments:

- Mainstreaming environmental excellence into everything we do, including business planning and decision-making processes
- Minimising resource use and ensuring that any unavoidable waste is correctly handled, stored and disposed of.

The Environmental Management System then follows setting the framework for sound environmental management which is certified to ISO 14001 standard. Equally the University's Energy Policy states we need everyone who works, studies, or lives with us to help achieve the policy aims. The Energy Management System sets out how the aims will be achieved, and this is certified to ISO 50001.

Coronavirus Pandemic

The Coronavirus pandemic has significantly impacted on the operations of the University. Initially energy and water consumption reduced as did waste arising. However, with new measures brought to ventilate buildings at high rates with no recirculation then energy consumption crept back up.

Before the pandemic, the university was making good strides to reduce use of single use items such as coffee cups and other catering waste. However, it must be noted that this trend has reversed for safety reasons. There has also been an increase in new waste streams such as disposable masks. Whilst this may not be significant in weight, they are very visible indication of extra waste and carry reputational risk if not dealt with appropriately. Lifestyle changes due to the pandemic have also meant an increase in packaging waste, especially cardboard. It is too early to say if this change is likely to stay longer term.

Carbon

Progress

The University has already reduced its Scope 1 and 2 Carbon emissions from a 2009 peak of 19,000 tCO2 to less than 11,000 tCO2 in 2020/21. It was lower still in 2019/20 but the Coronavirus virus and a cold spring has increased emission this year. The decrease since 2009 is despite the University growing in size and activity. It has been achieved by investing in energy efficiency and renewable energy which have also provided financial benefits.

Target

The target is to achieve Net Zero Carbon emissions by academic year 2030/2031. Emissions will be reduced where possible and any remaining emissions will be offset.

The target includes direct and indirect emissions. The latter where they can be effectively measured and influenced. Scope 1 (fuel burned on site) and Scope 2 (electricity imported to site) are already monitored closely and targeted. Scope 3 emissions which include travel (business and commuting), procurement of goods and services, waste disposal, leased assets and investments are currently largely estimated. Subsidiary companies will be included in the overall scope.

Objectives

To achieve Net Zero Carbon emissions by 2030 more work will be required to further reduce Scope 1 and 2 emissions. New monitoring systems will need to be set up to track Scope 3 emissions and strategies developed to reduce them. Finally suitable systems of Carbon Offsetting will need to be adopted.

Objective 1 – Decarbonise Cranfield Campus by replacing natural gas for power and heat

This will require the replacement of gas heating and the phasing out of the gas CHP which currently generates two thirds of the campus electricity.

The most likely route to achieving this will be the replacement of gas boilers with electric heat pumps. An alternative solution of using clean hydrogen is likely to be too expensive in the short to medium term.

Grid electricity will become cleaner over the next 10 years but the scope to generate clean electricity on site should be maximised. This is likely to be more cost effective.

Objective 2 – Continue to improve energy efficiency and reduce consumption

This will keep a lid on energy costs, whilst also reducing the renewable energy capacity required and associated costs. Behaviour change campaigns will be an important element.

Objective 3 – Electrify the Cranfield vehicle fleet

The University has some 30 vehicles used largely on campus. These should be replaced with electric vehicles with the capability for V2G (vehicle to grid). This will also help with energy storage for the site.

Objective 4 – Increase heat and electricity storage on Cranfield Campus

This will improve the operation of heating and power systems on site, increase the scope for renewable energy and help deal with grid capacity issues.

Objective 5 – Ensure MKU and other new constructions are truly zero carbon in operation

Zero carbon in planning terms is not the same as zero carbon in operation. New buildings must be built to the highest energy standards possible. The BREEAM standard does not ensure this. Achieving this will be the most cost-effective route to emissions reduction by 2030.

Objective 6 – Review and improve reporting of Scope 3 emissions

Travel is a key scope 3 emission which we already have a regulatory requirement to partially report. Elements of this could be improved by better data capture and more frequent surveys. Procurement related emission are largely estimated using industry averages. This needs a more in-depth study.

Objective 7 – Review, research and deliver carbon offsets

Tree planting is an obvious option given that the University is located in a Community Forest (the University is a founder member of the Forest of Marston Vale Trust). There are alternatives and relevant standards which need to be reviewed. The Carbon Brainprint of the University's research and learning activities also needs to be developed to explore whether this can be used as an offset.

KPIs

i. Energy use (electricity and heating) per m2 of University Estate
ii. Energy use per £ turnover
iii. New & refurbished buildings: EPC ratings
iv. DEC ratings for existing buildings
v. Scope 1 & 2 emissions tracked with reduction in line with Science Based Target approach
vi. Scope 3 emissions

Implementation

To achieve objectives 1 to 5 will require a major capital investment over the next 10 years. This will require funding applications, detailed planning with consultancy support, project management, new operation and maintenance contracts and ongoing engineering and maintenance support. Against that there should be savings in energy costs, reduced overall maintenance costs and improved delivery of energy services providing a better working environment for staff and students.

A successful bid for funding under the PSDS Public Sector Decarbonisation Scheme has just been won for £5 Million. This will fund the replacement of a large gas boiler on the district heating with a 1 MW Air Source Heat Pump, improvements to the heat network with two more buildings added on, new BMS Building Management System, an extension to the solar farm, more LED lighting upgrades and a 900 kW battery for balancing the campus electricity network.

Actions to improve Scope 3 emission will start with reviewing and better understanding the data. The following table shows the results of using the estimating tool used for HESA reporting. It excludes business travel and commuting travel which will also need to be estimated.

Year	2015-16	2016-17	2017-18	2018-19	2019-20
	Tonnes CO2	Tonnes CO2	Tonnes CO2	Tonnes CO2	Tonnes CO2e
Business services	5,543	5,297	3,456	5,918	12,113
Paper products	522	1,630	2,576	645	496
Other manufactured products	2,391	3,594	2,244	2,805	942
Manufactured fuels, chemicals and glasses	626	253	125	488	2,424
Food and catering	2,327	2,657	2,727	3,061	1,225
Construction	12,316	15,051	4,972	7,011	40,142
Information and communication technologies	2,097	1,997	1,359	1,958	1,256
Waste and water	884	801	711	824	416
Medical and precision instruments	1,184	1,039	225	1,192	87
Other procurement	1,776	8,904	1,142	15,347	7,131
Unclassified	205	0	0	15	286
Total	29,870	41,224	19,537	39,264	66,518

However, it is clear that the University Scope 3 footprint is likely to be much larger than the Scopes 1 and 2 footprint. It is also the case that aspects of Scope 3 emissions will be less easy to influence and reduce than Scopes 1 & 2. This leads on to the need to consider carbon offsetting – Objective 7.

Carbon offsetting involves the payment for carbon saving projects by third parties. It is difficult to be sure that those projects are truly additional, i.e. that they would not have happened anyway. There are certification schemes to give confidence but the more involvement the University has in the projects concerned the more assurance there will be that the carbon has really been saved. One of the best know offsets is tree planting. The University is located in and a founding member of the Community Forest of Marston Vale. This provides an excellent opportunity to invest in a carbon offsets where the University already has an ongoing relationship and there would be benefits to the local community.

Carbon sequestration through the development of new technologies may be another way the University could offset emissions.

Certain Scope 3 emissions are easier to measure and influence than others. Scope 1 & 2 emissions are accurately monitored and are very much under the control of the University. But some Scope 1 & 2 emissions may still remain by 2030. It is proposed that investment in carbon offsetting should reflect this. So Scope 1 & 2 emissions and Scope 3 emission where there is a high confidence in the monitoring and control should be offset with high grade offsets where the University can have greatest influence and control such as planting trees on University land or within the local Community Forest. These offsets should also be certified by an external body. For the remaining Scope 3 emissions where there is less certainty about the quantities and less control and ability to reduce, then less expensive third party offsets could be considered. Finally, the University's carbon brainprint should also be explored. That is the contribution the University's research and teaching contributes to products or services which reduce carbon. Whilst the additionality of this may be difficult to claim, nevertheless it will provide important context when judging the Universities carbon impact overall.

Costs

The following scenarios sets out the next large investments required to progress Objectives 1 to 5.

The potential impact of an "Electrify" scenario and a Hydrogen "H_2" scenario versus Business As Usual on Greenhouse Gas Emissions is shown below in terms of tonnes CO2. Both scenarios result in around a 90% reduction from the 2005 baseline (equivalent to 80% reduction from 2018). This should more than satisfy the rate of decarbonisation required for a Science based target.

Electrify scenario

This scenario is very capital intensive with major investments in heat pump technology and renewable electricity generation. The table below outlines potential projects:

2022	1 MW ASHP, DH Heating, BMS, 450 kW PV, 1 MW Battery	£ 5,000,000
2023	Hangar de-steam, 1 MW ASHP, 800 kW PV, 1 MW Battery, Hangar insulation	£ 5,000,000
2024	De-Gas Mitchell, 1 MW ASHP	£ 1,000,000
2025	De-Gas Martell, 300 kW heat pump, 100 kW PV	£ 350,000
2026	De-Gas Lanchester, 1 MW ASHP, 1 MW PV, 1 MW Battery	£ 2,500,000
2027	CHP end of life, 500 kW PV on BY Halls, 3 MW GSHP, 2 MW wind, 2 MW Battery	£ 7,000,000
2028	De-Gas houses, 100 x 10 kW heat pumps	£ 1,000,000
2029	De-Gas CMDC, 700 kW Heat pump	£ 500,000
2030	De-Gas Stringfellow, 400 kW heat pump	£ 300,000

The Electrify scenario assumes at the same time a 2% efficiency gain each year through standard energy efficiency measures and the installation of new more energy efficient buildings.

Hydrogen scenario

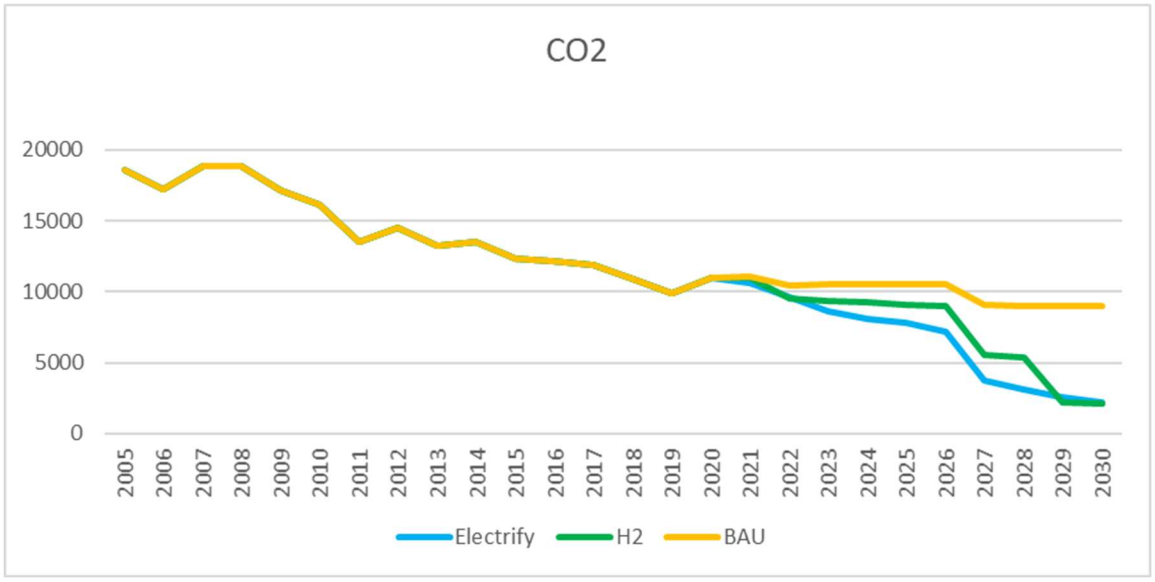
This assumes no large investments until the gas CHP is reaching end of life. Then in 2027 a 1 MW fuel cell is installed to provide power for the campus and heat for the district heating. This is followed in 2029 with the conversion of gas boilers across campus to operate on hydrogen with some allowance for hydrogen storage costs. The big unknown is how easy it will be to purchase blue or green hydrogen in quantity at a reasonable price. It is assumed that the Hydrogen is imported by tanker and not produced on site. Capital costs of £6,600,000 are assumed for the fuel cell with storage and £17,750,000 for the boiler conversion with storage. It is assumed that hydrogen can be sourced for between 10 p/kWh in 2027 and 8 p/kWh in 2030, including transport costs.

The H_2 scenario also assumes a 2% efficiency gain each year through standard energy efficiency measures and the installation of new more energy efficient buildings.

BAU scenario

The BAU scenario assumes no large investments in energy infrastructure (other than for replacement gas boilers) and 0.5% energy efficiency improvements overall coming from new buildings.

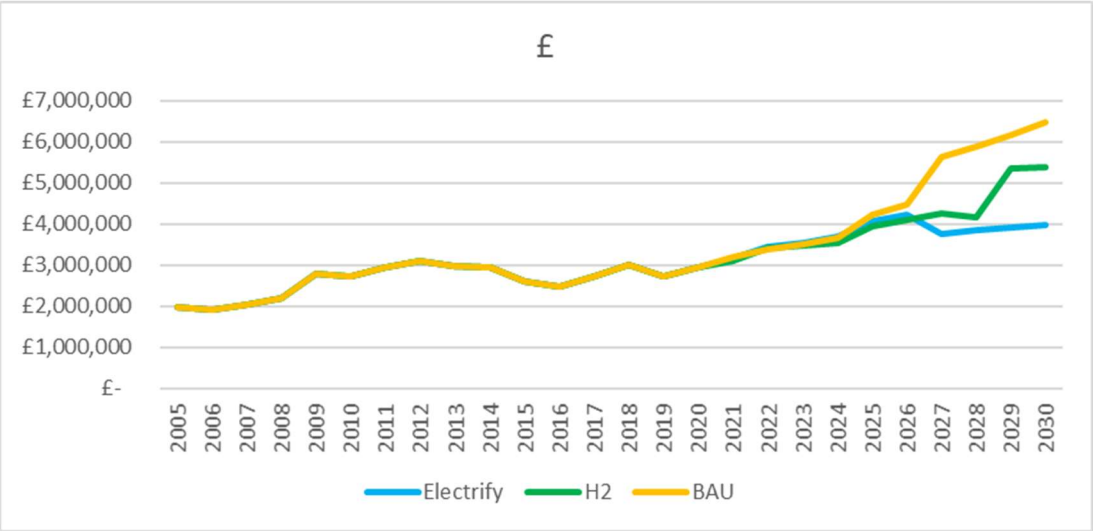
All scenarios assume a growth rate of 1.5% each year in floor area.



The Electrify scenario reduces caron emission more quickly. This because the Hydrogen measures in the H2 scenario are not assumed to be affordable until later in the decade. The Electrify is perfectly doable technically and practicably now, so the main barrier is funding. The H2 scenario is based on Green Hydrogen or high grade very low carbon Blue Hydrogen becoming significantly cheaper and more abundant by 2027. It also assumes that the hydrogen can be imported by tanker with short term storage on site. This may not be practicable or desirable at the scale envisaged.

The financial comparison below estimates the ongoing operational costs of each scenario.

The increased cost of importing electricity after the CHP is removed in 2026 is offset in the Electrify scenario by the increase in solar and also wind generation. The Hydrogen scenario assumes the gas CHP is replaced with a Hydrogen fuel cell.



Overall costs over the period 2021 to 2030

	Capital costs	Energy costs	Total
BAU	£ 2,000,000	£ 46,631,969	£ 48,631,969
Electrify	£ 22,650,000	£ 37,691,185	£ 60,341,185
H2	£ 24,349,412	£ 40,748,527	£ 65,097,938

The BAU scenario looks like the cheaper option however the trend in cost is sharply upwards by 2030 and within a few years it can be anticipated that the other two scenarios will have the lower cumulative costs over time. The capital investments required for the Electrify and H2 scenarios are very significant. Government is currently making grants available through the Public Sector Decarbonisation Scheme. It makes sense to take advantage of this and other opportunities. Depending on the price of gas and electricity some of the investments will see a reasonable payback, justifying investment. There are uncertainties in the costs particularly for the Hydrogen scenario. Green hydrogen is unlikely to be available at reasonable prices, nor easy to source and store until the end of the decade. So, the proposed strategy is to progress early on with an Electrify strategy when funding is available through grants or low cost loans. At the same time a watching brief should be kept on the development of low carbon hydrogen and to switch to incorporating elements of that option if appropriate.

Other possible technologies such as biomass heating or CHP, anaerobic digestion, other alternative fuels and solar thermal have not been included in these scenarios. These have been looked at previously and either deemed too small scale, uneconomic, impractical on

the campus or experience has shown in the case of the woodchip boiler the technology applied on site is unreliable. Nevertheless, a watching brief should be kept on these and other emerging technologies.

Overall costs will need to include for carbon offsets. These are fairly cheap at present, but their cost will undoubtedly rise over time. Whilst Scope 1 and 2 emissions may have reduced to less than 2,000 tonnes CO2, Scope 3 emissions may still be over 30,000 tonnes. If an assumption of price for carbon of £100/tonne CO2 by 2030 is made this could then add up to a cost of over £3 Million/year by 2030. It may not be appropriate to offset all Scope 3 emissions and the University's carbon brainprint needs to taken into account. Nevertheless, there is an imperative to reduce Scope 3 emissions and find cost effective means of offsetting.

Resources & Waste

Progress

Since 2010 the University has achieved 20% reduction in total waste, well beyond the target of 10%. This downward trend started to happen from 2016 - an achievement considering the University has continued to grow. The recent 20% reduction has been boosted as a result of low occupancy levels on campus due to the COVID pandemic. However, in July 2021 there was increase in total waste due not only to the usual process of student changeover but also due to the addition of new student accommodation and the re-structuring of workspaces to align with a more flexible way of working.

The recycling rate saw a steady increase before plateauing at around 50% segregated for recycling at source on campus. Further recycling was extracted off site by the waste contractor raising overall recycling rates to over 60%. However recycling and total waste are not the best measure of waste minimisation. Aiming for zero avoidable waste, delivered through more sustainable resource focussed buying and operational practices and measured through a diverse a range of indicators will be a more appropriate approach for the years up to 2030.

Target

The target is to achieve Zero Avoidable Waste by 2030. This means preventing anything ending up as waste entering landfill or being incinerated when the University could have avoided this happening.

The purpose of this Strategy is to provide the framework for understanding and managing the University's resource use and waste management to 2030, but it will be reviewed and updated as necessary.

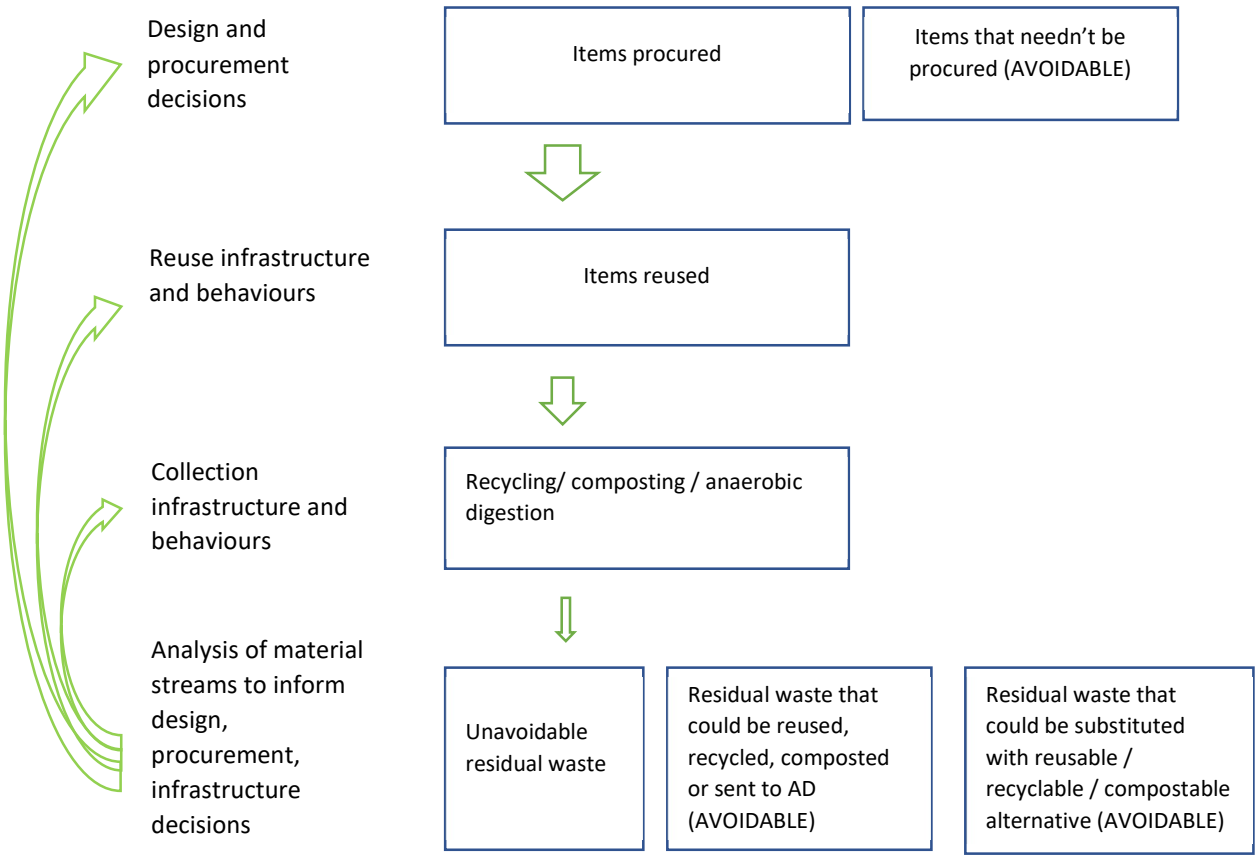
Avoidable Waste is defined in the Government's Resources and Waste Strategy as:

Waste that is technically, economically and environmentally feasible to reuse or recycle, or, where this does not apply, it is (technically, economically and environmentally) feasible to replace with alternatives that are reusable or recyclable.

It is important to note that the university also has a responsibility to prevent and avoid waste being created in the first place.

Therefore, the key to reducing avoidable waste is to gather information on the materials ending up in the residual waste stream (waste sent for landfill or incineration with or without energy recovery) and use best management practices to apply the waste hierarchy to these materials: prevent, reduce, reuse and recycle.

The strategy to achieve zero avoidable waste has been developed with the global, national and local context in mind, and shifts the previous focus on purely management of waste to responsible resource use and sustainable waste management. The aim is to increase resource efficiency, to move towards the efficiency of a circular economy; designing out waste from the start, and align with the Waste Hierarchy, ensuring avoidable waste is not being sent for landfill or incineration (with or without energy recovery). The aim is also to reduce the Scope 3 emissions associated with waste and ensure reduced total impact of waste management services.



Increased regulatory focus on environmental impact and how to measure this, rather than solely on the weight of waste generated, may require targets to be amended during the timeframe of the Strategy.

Objectives

The following objectives are intended to help achieve Zero avoidable waste by 2030. More work will be required to embed circular thinking within University processes and improve waste management infrastructure to dramatically reduce residual waste. Communication and engagement with partners, staff and students is key to the success of these objectives.

The Overall Objective is to ensure that Circular Economy principles, life-cycle thinking and the waste hierarchy are an integral part of University decision making and business processes including

Design of projects, systems and infrastructure

By designing out waste, we prevent materials becoming waste in the first place. Therefore, we need policies and processes and codes of practice in place to ensure these principles are applied before any new University project or activity is introduced. For example, building flexible modular working spaces to avoid regular wastage of partition walls.

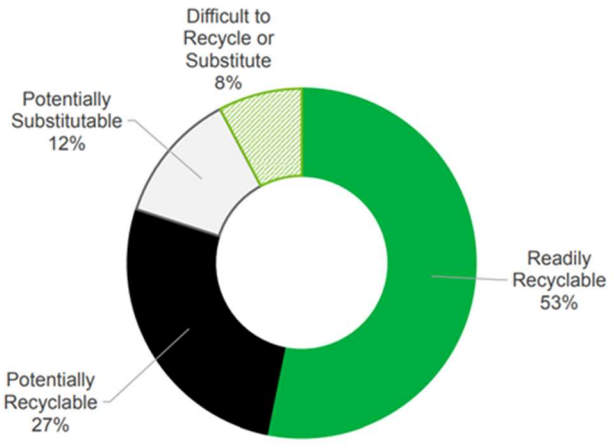
Procurement policies, processes and practice

Procurement decisions and processes have a vital role in preventing avoidable waste from not buying something in the first place, to, for example, leasing a piece of equipment for return to the supplier, avoiding single use items, making sure equipment purchased is durable, and has replaceable and recyclable parts, that packaging is minimised, returnable, reusable or recyclable.

Lifetime Use and Disposal

Preventing creation of avoidable waste through operational choices and ensuring that waste hierarchy principles and practice is applied to prevent reusable, recyclable, compostable, and anaerobic digestible waste from entering the residual waste stream. For example, changing a process that requires multiple printing of paper copies of documents, or catering processes that create excessive food waste.

Chart 13. Avoidable residual waste from household sources, England, 2017, proportion of total residual waste, by category (WP2a)



(source Resources and waste strategy for England: monitoring and evaluation)

A study completed by WRAP in 2017 shows that 80% of household residual waste is readily or potentially recyclable.

Material stream analysis is the key to help us understand which practices and areas are leading to excessive waste. Through regular waste compositional analysis and capture rate monitoring we will be able to shape our delivery plan and focus time / communication resource to places that need it.

Objective 1 - Circular Economy principles built into design of new projects, operations, and initiatives.

Processes and projects change from year to year and there is an opportunity to integrate the CE principles into these changes through introducing new codes of practice, communication and awareness raising of these principles, and auditing business processes to evaluate how well the principles are being integrated in order to continually improve and make savings.

Objective 2 - Achieve Level 4 DEFRAs sustainable procurement framework (further detail) and establish CE procurement framework

This framework is used widely by universities and achieving level 4 will mean that the University has

- included sustainable procurement in competencies of staff,
- endorsed a sustainable procurement strategy that recognises the potential of new technologies and covers risk, process integration, marketing, supplier engagement, measurement and review
- assessed detailed sustainability risks for high impact contracts, with a life-cycle approach to cost / impact assessment
- targeted key suppliers for development and supply chain improvement through sustainability audit
- measured and compared its performance through a balanced scorecard approach

The CE procurement framework is a resource that follows the basic outline of the procurement journey and presents the circular intervention points that can be used by an organisation in every step.

Circular economy intervention points along the procurement journey

(Source Ellen Mac Arthur Foundation)

Objective 3 - Resource use and efficiency applied in building design and construction activities.

This would be demonstrated by fulfilling maximum points in the relevant BREEAM Material Efficiency and Waste sections or equivalent measure / standard.

Objective 4 - Reduce total waste arisings per FTE staff / student from 2018-19 baseline (0.328 tonnes)

Total waste reduction will be a reflection of measures to prevent waste being produced in the first place, through procurement and design processes – although projects designed efficiently now due to life of projects may not be realised for several years**.**

Objective 5 - Reduction of food waste from catering outlets

This focusses on processes to reduce pre-consumer food waste via university operations.

Objective 6 - Increase amount of items reused

Capturing data on reuse can be difficult as some re-use transactions happen informally, however there is potential to increase this proportion of materials – to give second life rather than becoming waste.

Objective 7 - Identify significant waste streams in residual waste, investigate avoidance and reuse, and increase capture rates for recycling, composting and anaerobic digestion.

This objective focusses on shifting waste up the waste hierarchy and reducing the proportion of residual waste sent for incineration through interventions to reduce, reuse, recycle, compost or send for anaerobic digestion.

Objective 8 - Reduce scope 3 emissions / life cycle impacts from waste management operations

Although this is covered in the Net carbon target, it is worth mentioning here that the operational footprint of our waste management infrastructure has an impact on scope 3 emissions and therefore should be taken into consideration in the waste delivery plan.

KPIs

The following performance indicators are suggested to ensure progress is being made. However, they will be evaluated over the period to ensure they are effectively monitoring our improvement and may be changed.

Achievement of Level 4 DEFRA flexible framework achieved – (through self assessment)

CE Procurement framework embedded in procurement processes – (through audit of sample number of contracts)

Construction waste per m2

Construction Recycling rate

Waste reduction per head (staff and student FTE)

Pre- consumer food waste / kg or £ per ‘cover’.

Tonnes / number of items / volume ‘waste’ reused

Capture rates for recyclable waste material streams (as a percentage of total material in waste)

Recycling rate / % total waste

Percentage of residual waste that could have been avoided

kg CO2e per waste tonne (for different end routes)

Implementation

This is a high level implementation plan and activities will be further developed as more detailed information becomes available to ensure they support the objectives and deliver our target of zero avoidable waste.

Activity	Comments
Explore opportunities for collaborative working with academic ‘sphere’	Academic expertise in CE, supply chain and waste fields – potential for Living lab / Urban Observatory
Conduct evaluation of all processes which use lots of consumables , or have high spend on materials	Links with procurement objectives
Develop process to integrate CE principles into design of projects / values / culture	Initial trials to include environmental considerations within B3.1 process but needs to be wider
Review baseline position re Flexible framework and CE procurement framework	What needs to be emphasised is in the specification formation stage i.e. designed for maximum use and dispersal – we will pull together a training process for circulation and briefing as part of any large engagement
Actions to get to level 4 and embed CE procurement framework	Project plan and delivery Communication and awareness (eg e-learning tools)
Development of Design Standards to include BREEAM Material Efficiency and Waste requirements Ensure requirements in Design and Build briefs	Needs to be in place for upcoming new builds Beacon, MKU etc
Resources and Waste Policies / Code**s** of Practice / procedures, development, delivery and communication	Includes Duty of Care, waste hierarchy, single use items, plastics, food waste, waste infrastructure (ie what goes in which bin) and collection of waste data.
Waste management infrastructure and delivery partner contract designed to**:** support zero avoidable waste target , measuring and maximising on source segregation and to measure and aim to reduce scope 3 emissions / life cycle impacts from waste management operations (contract to enhance monitoring capabilities)	Aim for cost of recycling / composting / AD which is no more per tonne than cost of residual ‘general commercial waste’ per tonne. 18/19 costs: average cost general residual waste per tonne = £144 average cost per tonne recycling / composting / AD = £128 More detailed reporting on Scope 3 emissions from waste. Exploring new initiatives as they become viable such as reverse vending, Deposit Return

	Schemes etc effective communication and ensuring competence. There will be a more detailed delivery plan to cover infrastructure.
Establish firmer relationship with re-use partners and embed reuse processes within university operations (how) Improve data collection on re-use	This forms part of waste management infrastructure improvements. Includes maximising reuse of items during student changeover periods.
Establish On-site composting	This forms part of waste management infrastructure improvements
Ensure competence framework, communication channels and materials are effective, supporting objectives and target	Communication and engagement with partners, staff and students is key to improvement
Set up methodology and monitoring regime of waste compositional analysis	This forms part of waste management infrastructure improvements
Evaluate information from waste compositional analysis	Will allow focus on and prioritisation of specific areas, processes, materials, for further action to maximise prevention, reduction, substitution and source segregation.

Costs

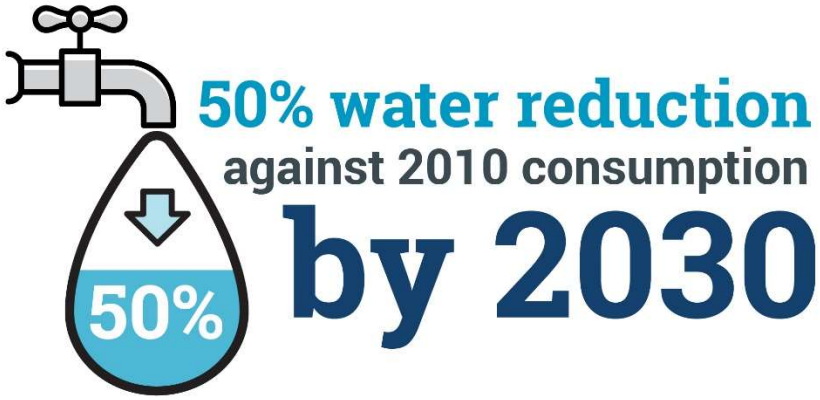
Analysis of potential costs and savings of prevention through design and procurement decisions TBC

Waste management costs in 2018-19 were £402,547 (not including construction waste). This translates as £129.30 per head (staff FTE + student)

With more students living on campus from 21-22 academic year, the future development of MKU, and predicted increased costs of residual and low grade mixed recycling its anticipated that if we continue with existing operational processes, waste costs will increase.

Therefore, a focus on waste reduction, reuse, and ensuring that the cost of recycling, composting and anaerobic digestion is lower than residual collection and disposal is key to ensuring costs do not increase dramatically.

Water



Target

Target to reduce water consumption by 50% from 2010 levels to 0.5 m3/m2/annum.

Objectives

Objective 1 - Improve water monitoring

The current water metering on site is largely manually read and a number of buildings do not have water meters. Upgrading the meters to provide automatic readings would allow leaks to be monitored more effectively. More meters will also help prioritise area of high consumption.

Objective 2 - Reduce leaks and waste by monitoring and targeting

There is a continuous base level of water use throughout the night and even over the Christmas shut down. This indicates a high level of leakage possibly made of many small leaks across the campus. More effective metering will allow the buildings where this is happening to be identified.

Objective 3 – Improve the efficiency of water use.

A review of water fitting and devices will help to identify improvements which can be made to the existing infrastructure. Behaviour change campaigns will also be an important element

Objective 4 – Investigate water recycling, rainwater capture and storage

The opportunity to collect, reuse and store water on site needs investigating.

KPIs

Consumption in m3 per m2

Consumption in m3 per head

Consumption in m3 per bed in areas of accommodation

Implementation

The priority is to install effective water metering across the campus and particularly in areas of likely high consumption. Without this it will be impossible to identify all except the largest leaks. It will also be difficult to target area of high consumption. At the same time it will be possible raise awareness and develop behaviour change promotions to engage with staff and students to reduced water use where possible.

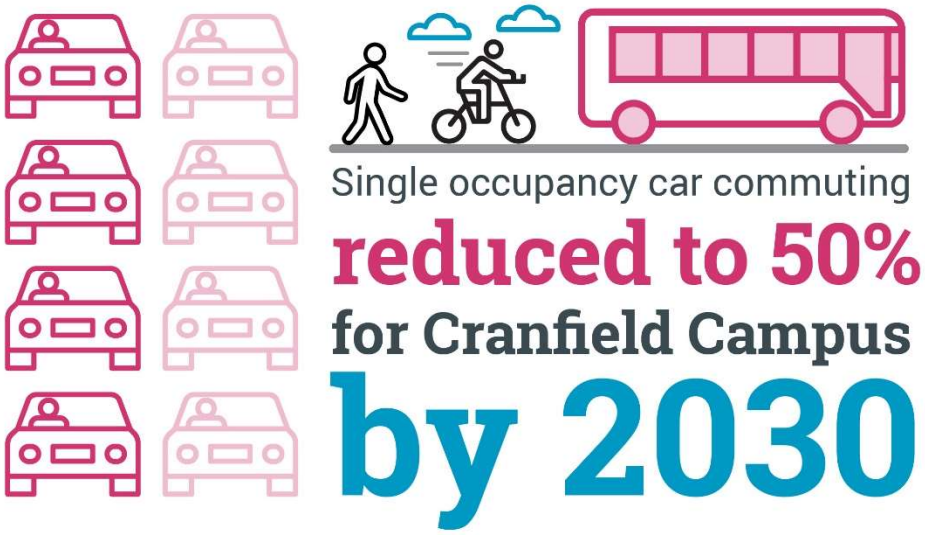
There is an ongoing PhD research project to measure the impact of shower monitors. Lessons learnt from this will help with other areas of consumption.

The feasibility of collecting rainwater and also recycling water for certain operations will be investigated.

Costs

Water costs around £130,000 per annum. A large part of this relates to the daily maximum demand and not just volume. The opportunity is being taken to go out to tender for a new water contract. This could potentially bring in extra resources for metering and water saving initiatives.

Sustainable Commuting



Progress so far

Sustainable commuting is covered by the University Travel Plan which is refreshed every five years and reviewed on an annual basis. The first Travel Plan was put in place in 2012. Since then, a new bus service has been established which provide a regular and frequent service between Cranfield and Milton Keynes and Cranfield and Bedford, 7 days/week and from early morning to late at night. A new cycle path was installed to link the south of campus with Cranfield Village and another path to go around the north of the airfield is planned for this year. Since 2012 bus usage has more than doubled and cycling and walking have also increased as a result.

The current Travel Plan has a target to reduce single occupancy car commuting to 53% of journeys by 2023 from a baseline of 70% in 2012. Current levels (prior to Covid) were at around 59%.

Target

The target is to reduce single occupancy car commuting to 50% of all journeys by 2030. However, given the experience of working from homes as a result of Covid it may be sensible to reframe that target in terms of number of journeys per population rather than a percentage of journeys approach. This would reinforce the benefits of working from home as an option for reducing car commuting.

Next steps

A new version of the Travel Plan will be developed in 2023.

Biodiversity

Progress so far

Since developing a Biodiversity Action Plan in 2016 the Cranfield Campus has seen a transformation in terms of the number and extent of areas set aside for biodiversity to flourish.

Much work has gone into increasing the area of certain habitats for wildlife and promoting the importance of biodiversity on campus. So far this has been largely achieved at relatively low cost by changes in grounds management practices. More varied habitats will require a greater investment. The University has an aging tree stock which needs replacement and expansion, combined with a more extensive understory (including hedges) and a wildlife corridor along the western edge of the campus.

Target

The target is to ensure “net environmental gain including biodiversity gain of 20%” for any developments on the campus. In order to maximise the potential on site for biodiversity.

Net environmental gain ensures that measures to provide biodiversity gain also have other environmental benefits. Government (DEFRA) guidance will be used for measuring the environmental biodiversity gain. Including this in the budgets for future development should provide extra resources to develop a greater range of habitats. Given the commitment was made in 2020 projects coming forwards from 2021 onwards will need to budget for this extra requirement.

Next steps

The Biodiversity Action Plan is 5 years old and a new version will be developed over the next 12 months.

Pollution Control

Progress so far

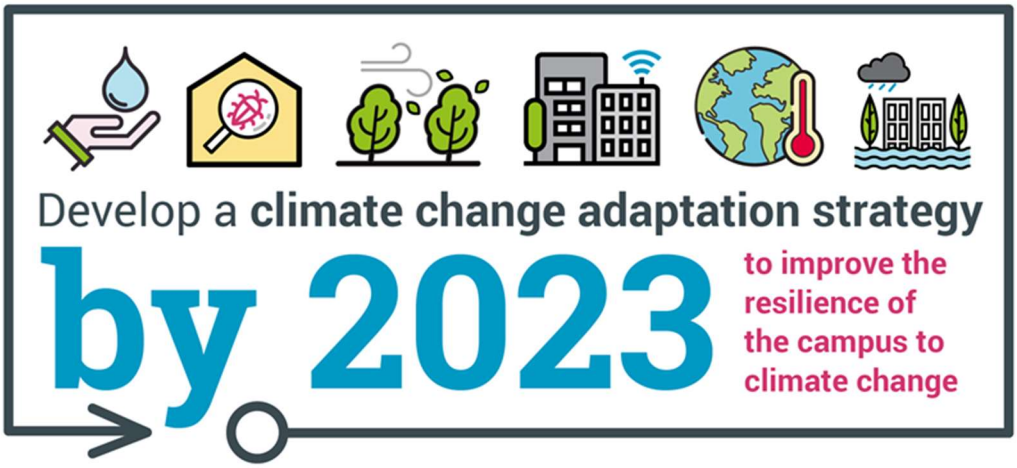
The University has a water course (Chicheley Brook) running through the campus which is very vulnerable to any pollution spillages on site as most the surface water drainage feeds into it. The proximity of the airport and its operations to the centre of campus has also raised issue with odours and emission infiltrating adjacent buildings. Whilst care is taken to avoid pollution incidents the current response is often reactive. A detailed monitoring of air and water pollutants will help with planning and strategies to proactively reduce pollution. It will also provide an early warning for when something does go wrong.

Through the Urban Observatory project a number of sensors have been installed in the brook to monitor flows and measure key indicators of potential pollutants. Air monitoring equipment is also being deployed this summer across site and within the airport.

Setting a target

The aim is to have a measurement system in place by 2023 which allows for the ongoing monitoring of key pollutants in ground, water and air. Whilst some instrumentation is already installed it has yet to be fully commissioned. Once it is providing reliable data targets for reducing levels of key pollutants and emissions will then be developed. A plan to maintain existing and develop any additional monitoring equipment will also need to be developed.

Climate Adaptation



Progress so far

An MSc Thesis looking specifically at climate change adaptation for Cranfield University Campus has been carried out. This reviewed the flooding event in 2016 and a range of staff across the University were interviewed about their experience and views on climate change risks on campus.

This has provided a useful base for developing further a strategy for mitigating some of the key risks.

Developing a plan

A strategy will now be developed over the next 12 months. This will need to take into account new building specifications, new planting designs and upgrading of existing infrastructure.

Sustainable Development Goals

Progress so far

The University has now signed up to the SDG Accord and has made a submission to the EAUC (Environmental Association of Universities and Colleges) on Cranfield contribution to the SDGs. This was not extensive but based on a sample of the information on the Cranfield University website. This reporting is as part of an annual survey EAUC undertakes to report on the University sector. Individual submissions are anonymous.

Developing a plan

It is becoming clear that Cranfield University as a whole makes a makes a significant contribution to the SDGs but that this is not sufficiently highlighted nor promoted as much as other Universities or institutions. A plan will be developed to develop this further. This will need to incorporate a review of the existing delivery and reporting structure. It will also require the input of a cross section of disciplines, both academic and professional services.

Discussion

The new environmental targets particularly the SDG commitment will extend into a wider range of University operations and activity. There is already a blossoming relationship developing between the academic side of the university and the operational in the form of the Living Lab initiative. This levers in academic expertise to help with estates issue such as water management and renewable energy and provides research and learning opportunities in return. The expansion of the environmental targets to include wider sustainability issues will more directly involve all aspects of the University's activities and functions.

There will also be opportunities to develop partnerships as other organisations, companies and institutions strive to meet similar goals. The Forest of Marston Vale is a good example of a local charity established to create a community forest in the local area the University is located in. The University was founding member of the charity and has collaborated over the years in various academic projects. There is an obvious overlap here in their remit to plant trees and the University's need to offset carbon. There are also other opportunities such as harnessing the forest's expertise in biodiversity enhancement. Other partnership opportunities will arise from the many contacts and relationships developed by the academic side of the University which could be applied to the operational side. Again, an example of how the Living Lab approach could be developed.

Meeting the new targets should result in a more efficient and resilient organisation which is able to avoid pollution and climate impacts and avoid higher energy and waste costs. However, this will require investment. The Salix revolving fund for energy efficiency is a good example of how investments to make savings can be done. This could be applied to waste and water as well. Other targets such as sustainable commuting, pollution control and biodiversity may need other investment models. It will be important to make sure that funding is sourced to make the necessary investments. A review of how funding can be sourced internally and externally is needed.

Conclusions

The Environmental Targets are very challenging, particularly the carbon and waste targets. However, they are necessary if the University is to be seen to be taking a lead and to be seen to make an appropriate contribution to sustainability.

The achievability of the targets will depend on both internal and external factors. The University will need to incorporate the targets into its wider plans. All staff and students will need to be engaged. The University will need to invest in more sustainable technology and systems. At the same time, it is hoped that Government will provide incentives and support to make these investments more viable. There will be opportunities to partner with third parties to develop and trial some of the solutions to meeting the targets.

The University has academic expertise which is relevant to all the targets. This needs to be harnessed. The “Living Lab” is an example of the benefits of applying research and learning to the operational aspects of the University.

Many measures to meet the targets are about being more efficient and less wasteful. This will save money, however in many case investments in new equipment or processes will need to be made. It will be important to make sure that funding is put aside to make the necessary investments. The Salix revolving fund for energy efficiency is a good example of how this can be done. Where savings resulting from investments from the revolving fund are reinvested in new savings projects. This could be applied to waste and water as well. Other targets such as sustainable commuting, pollution control and biodiversity may need other investment models.

Recommendations

1. Make sure the environmental targets are incorporated into the University’s strategies and planning.
2. Expand the opportunities for staff and students to be involved.
3. Develop implementation plans and review progress towards the targets annually.
4. Review funding options and sources so that the necessary investments in new equipment and processes can be made.
5. Develop the Living Lab to harness and apply the University’s academic expertise to help meet the targets.
6. Develop strategic partnerships to help develop affordable solutions to meeting the targets.
7. Develop a plan to highlight and promote the Universities contribution to sustainability and the SDGs.
8. Review the current delivery and governance structure. Does the inclusion of social and ethical considerations in reporting on the SDGs require the more formal involvement of other parts of the University?

Gareth Ellis
Energy & Environment Manager
21st October 2021