Energy and Water Management Strategy -2021 to 2031

Approved 28th June 2021

Contents

1. INTRODUCTION

The Sustainability Strategy, adopted in September 2020 outlined the University's commitment to achieving Net Zero Carbon in all three scopes by 2030. The Energy and Water Management Strategy (EWMS) is a continuation of the University's Energy Management Strategy (EMS) and Water Strategy which were first published 2013 and considers this new ambitious target.

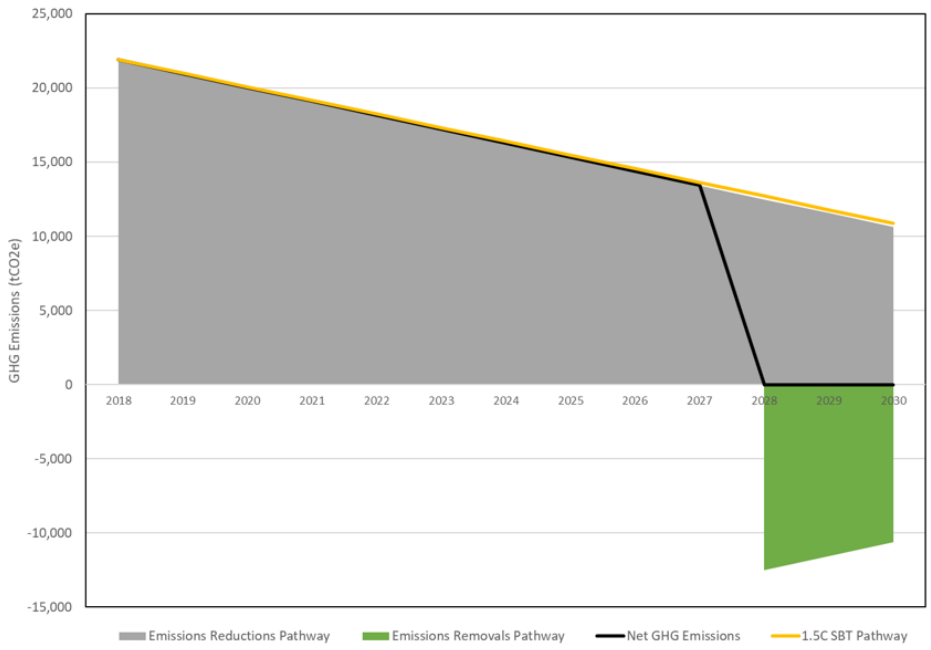


***Figure 1**: Projected total carbon emissions per annum and carbon removal necessary to achieve Net Zero 2030. Source Sustainability Strategy 2020-2030 p.19*

The Net Zero Carbon target requires a 50% carbon emission reduction across all emissions types by 2030, against 2018/19 as the carbon reporting baseline year. In 2018/19 the University produced 21,931 GHGe tonnes carbon emissions and is required to reduce to 10,614 tonnes by 2030 with the remaining emissions being offset by carbon removal techniques. The strategy has assigned a carbon reduction commitment to energy-related activities of 1,780 tonnes for gas heating and 1,399 for electricity use. This provides a combined 2018-19 baseline year carbon figure of **3,180 GHGe tonnes associated with Scope 1 and 2 emissions**. See figure two.

The EWMS sets out to:

- Outline the drivers for effective energy and water management.
- Sets objectives and targets.
- Translates Net Zero 2030 carbon reduction objectives outlined in the Sustainability Strategy into absolute energy reduction objective/targets.
- Defines key performance indicators (KPIs).
- Outlines approaches to achieve energy targets.
- Outlines the process for reporting performance.

This strategy will be continuously reviewed to ensure it takes account of changes in government priorities and legislation as well as best practice.

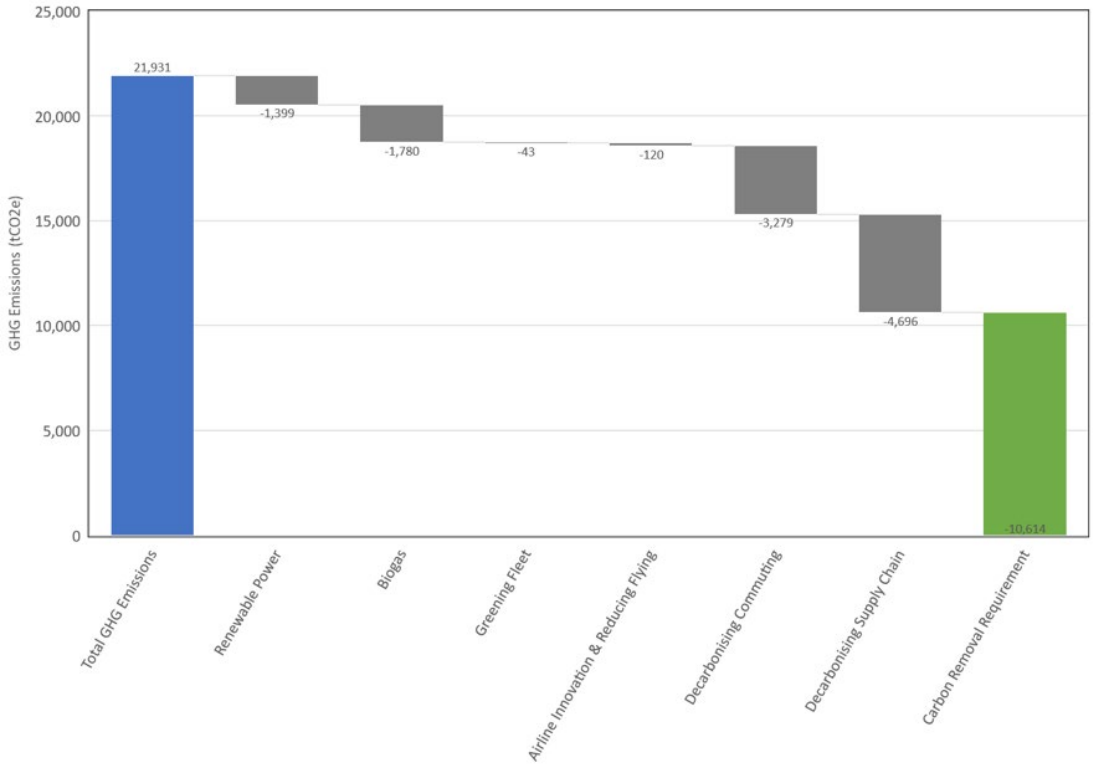


***Figure 2**: Breakdown of required carbon emission by carbon emission category. Source Sustainability Strategy 2020-2030 p.18*

2. DRIVERS FOR CHANGE

REPUTATION

Higher Education recognises the need to deliver positive social impacts and mitigate negative impacts, such as the release of carbon emissions, which contribute to climate heating. Sustainability has become an increasingly important factor for students when choosing a university. Effective energy and water management is essential to reduce the University's carbon emissions which is a key element for maintaining a positive sustainability reputation.

SDG ACCORD AND NET ZERO CARBON

The University signed up to the SDG Accord in 2018, a commitment for Higher Education to contribute towards the 17 Sustainable Development Goals, we have been reporting annually on progress since. The Board of Governors declared a Climate Emergency in July 2019 and in September 2020 set the Net Zero Carbon emission by 2030 across all scopes in the revised Sustainability Strategy. The Sustainability Strategy combines both a commitment to be Net Zero Carbon with supporting social justice and responsibility, economic and environmental sustainability. It sets this out under four themes and 12 commitments. Most relevant to this strategy is **Theme 3: Mitigation, adaptation, and resource efficiency**. Under this theme the two most pertinent commitments are:

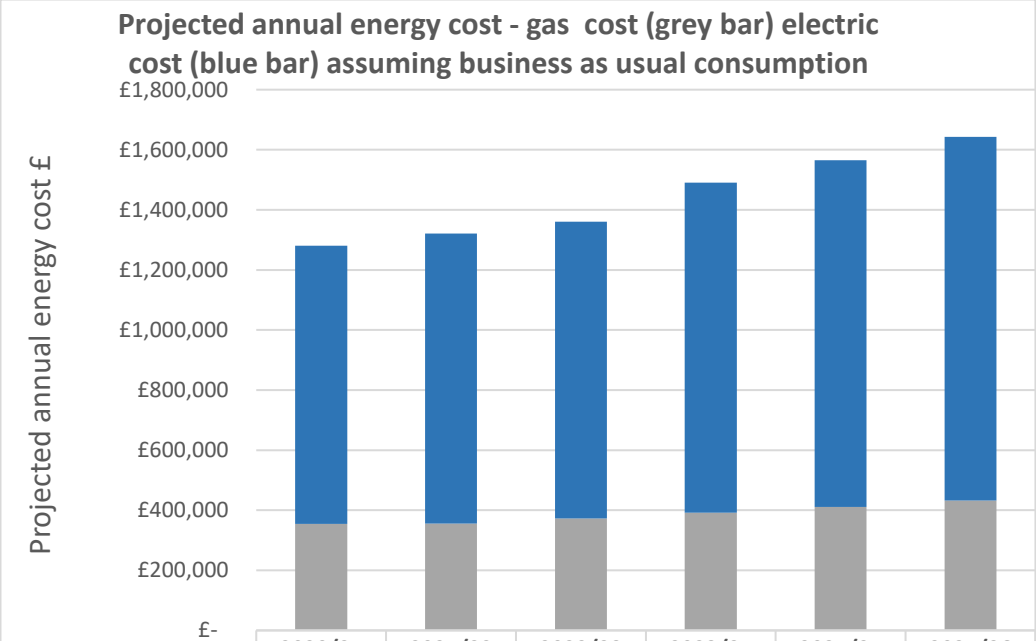
7. Manage our estate to mitigate against climate change (through reduction of carbon emissions) and to ensure future resilience through engagement in adaptive strategies

8. Optimise resource efficiency and stimulate a shift to sustainable models of consumption amongst our stakeholders

ECONOMIC

Energy and water price inflation is a significant driver for the University to manage and reduce consumption. Energy markets are becoming increasingly volatile; a reduction in energy use would reduce the University's exposure to these markets and rising prices.

Energy is procured through The Energy Consortium (TEC) a not-for-profit public buying organisation who support us to manage our energy, keep costs down and reduce our carbon. The supply framework has projected variable and fixed energy costs for the University up to 2023/24. TEC have projected costs based on pre-purchased energy baskets and know fixed cost changes (e.g. Climate Levy) up to the academic year 2023-2024. In 2020-2021 the average energy costs were electricity £172 per MWh and gas £33.60 per MWh. These unit costs are projected to increase to electricity £204 per MWh and gas £37 per MWh. Energy prices are not known beyond 2024 but assuming a conservative 5% inflation rate with business as usual annual consumption, energy financial commitments are estimated to rise from £1.28 Million in 2020-2021 to £1.64 Million by 2025-2026. Business as normal consumption has assumed flat energy consumption rates based on 2018- 2019 levels and have not factored in consumption from future developments such as Severn Campus.



	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Electricity Cost £pa	£926,048	£965,190	£987,103	£1,098,659	£1,153,592	£1,211,272
Gas Cost £pa	£354,346	£355,717	£373,117	£391,773	£411,362	£431,930

Figure 3: Projected energy cost based on the TEC unit costs and business as usual consumption scenario.

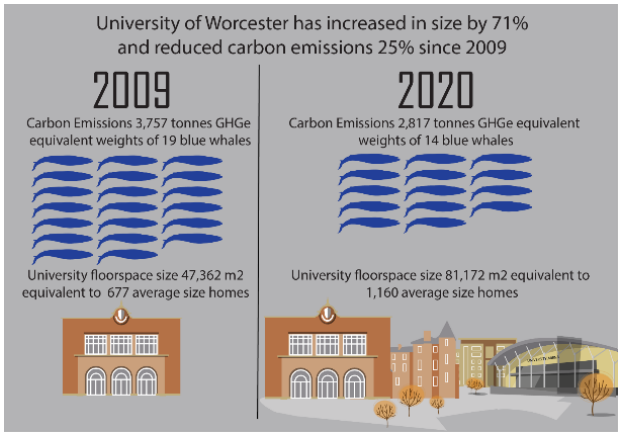
LEGISLATION

As the threat from climate change has escalated, the government has introduced legislation to ensure a reduction in the United Kingdom's emissions. The Climate Change Act 2008 committed the UK to a reduction in carbon dioxide emissions of at least 80% by 2050 compared to a 1990 baseline. The Paris Agreement 2016 for the first time developed a common international agreement to reduced greenhouse gases and limit global warming to 1.5 degrees Celsius. International and national responses to climate change have transcended into several legislative measures to enforce the reduction of energy consumption. For example, the University is required to produce a Display Energy Certificates (DEC) for all buildings over 250 m^2. The DEC provides an indication of the energy efficiency of the building based on size, energy consumption and the function of each building.

3. PROGRESS SO FAR

PROGRESS AGAINST CARBON TARGETS

The University's target to reduce absolute Scope 1 and 2 carbon emissions by 40% between 2009 and 2020 was not achieved. Scope 1 and 2 emissions reduced by 25% during the period with the impact of Covid-19 enhancing the carbon reduction performance in the last reporting year. The emissions reduction performance should be considered in the context of the University's expansion during the period which witnessed the size of the estate increase from 47,362 m^2 in 2008-2009 to 81,172 m^2 in 2020-2021, a 71% increase.



DISPLAY ENERGY CERTIFICATES PERFORMANCE

Display Energy Certificates benchmark a building's energy performance, with ratings ranging from A to G, with G indicating the most energy-intensive buildings. The Energy Management Strategy 2013-19 identified the objective for 'All university owned buildings to achieve a C rating or above' DEC ratings. In 2013 only 18% of University buildings were certified to a C rating or above, by 2019 77% of the building in the estate were DEC certified C or above.

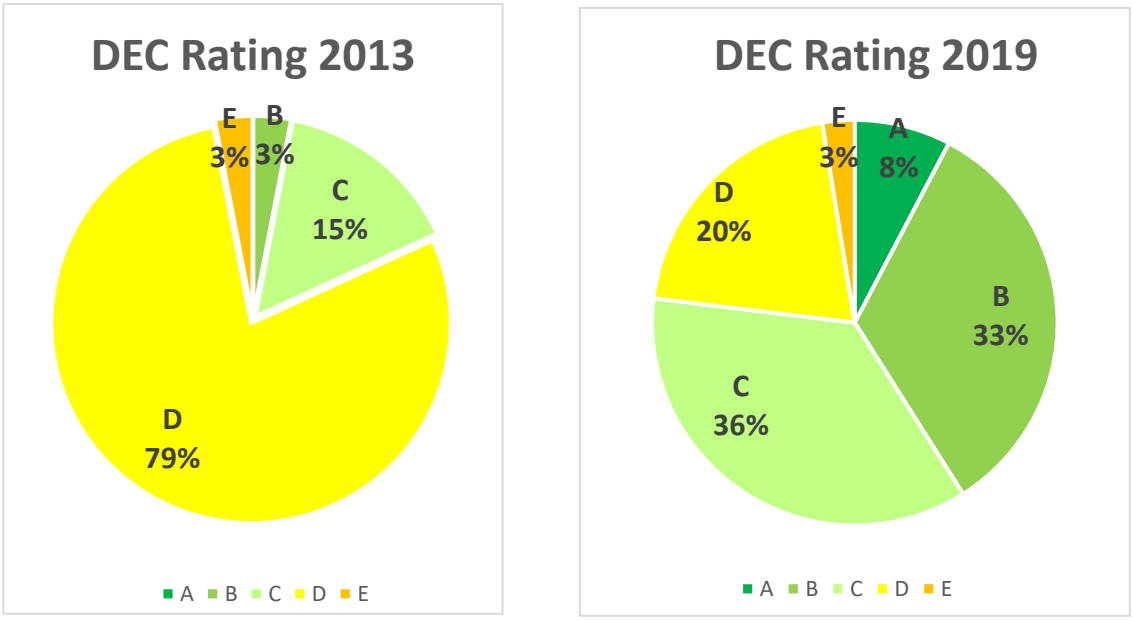
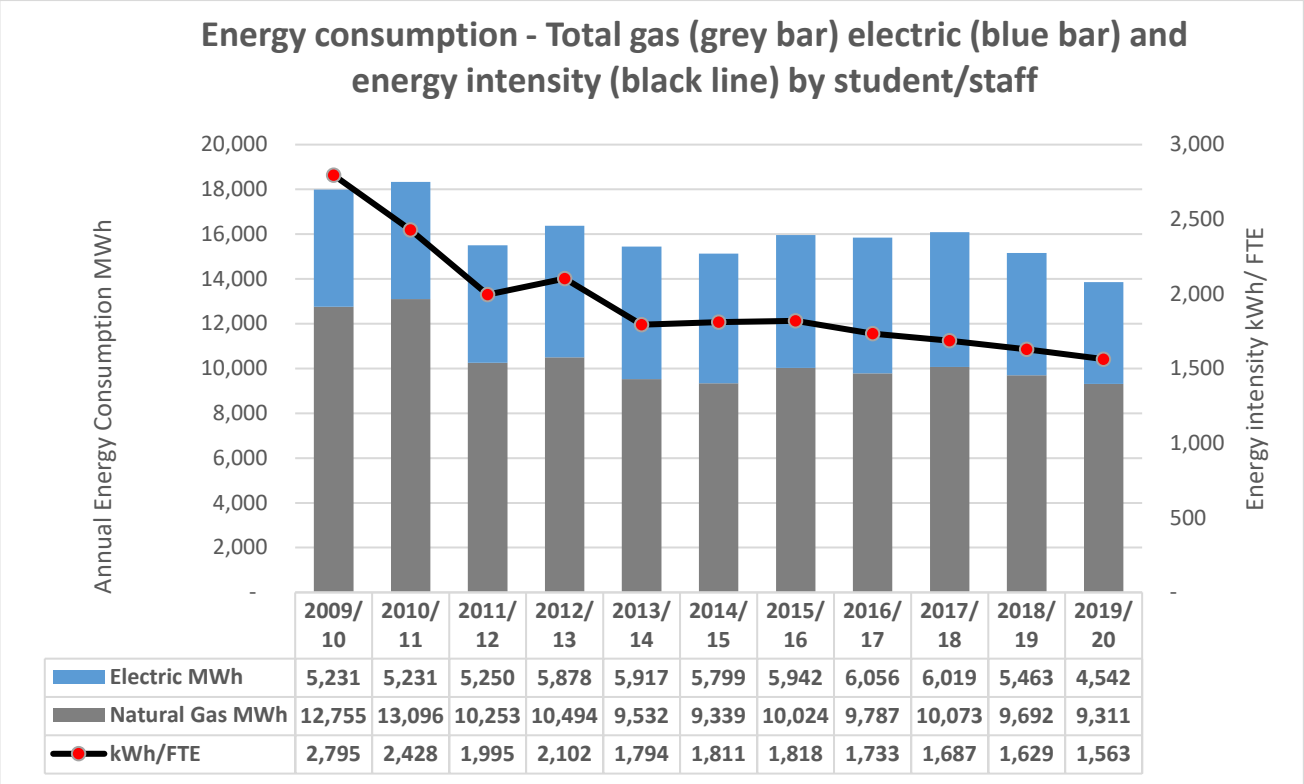


Figure 4: DEC ratings percentage, 2013 compared to 2019.

ENERGY REDUCTION PERFORMANCE

To evaluate energy management performance, it is necessary to de-link energy consumption from its associated carbon emissions. Energy carbon factors are not static, especially electricity which has been steadily declining over time as the national energy mix has removed fossil fuel generation capacity.

In absolute terms, the University's energy consumption of natural gas and electricity declined from 17,986 MWh in 2009-2010 to 13,853 MWh in 2019-2020, representing a 23% absolute reduction in energy consumption during the period. This should be reviewed in the context of University expansion, with a 30% increase in the size of the estate gross internal area (GIA) m2 and 37% increase in the number of students and staff full-time equivalent (FTE) since 2009-2010. Consequently, energy reduction against key performance indicators (KPIs), expansion of the estate (kWh/m2 GIA) and the number of students and staff (kWh/FTE) provide more favourable performance indicators. In 2009-2010, the University had a space energy intensity of 288 kWh/m2 GIA which reduced to 171 kWh/m2 GIA by 2019-2020, representing a 41% improvement. Using staff and student numbers as energy intensity indicators, consumption reduced by 44% during the period, represented in Figure 5.

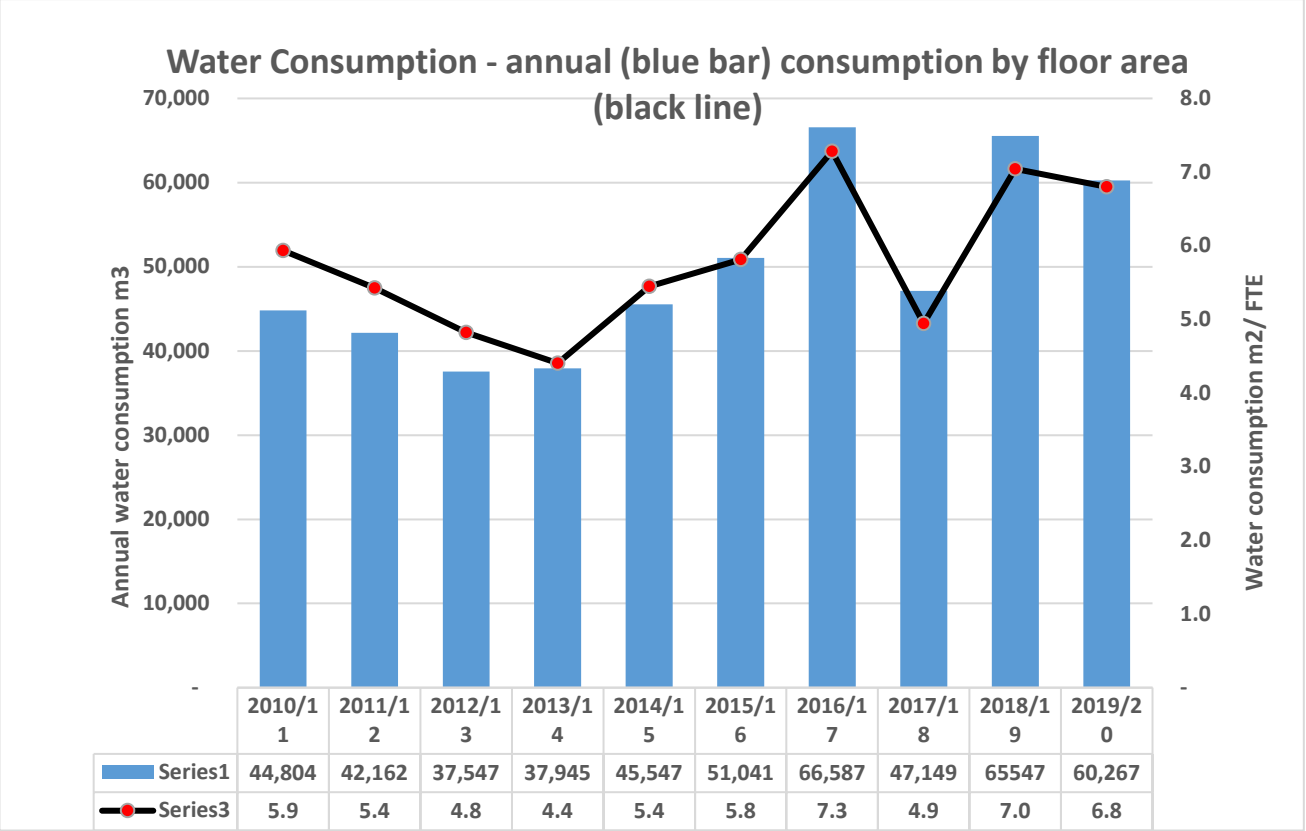


	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Electric MWh	5,231	5,231	5,250	5,878	5,917	5,799	5,942	6,056	6,019	5,463	4,542
Natural Gas MWh	12,755	13,096	10,253	10,494	9,532	9,339	10,024	9,787	10,073	9,692	9,311
kWh/FTE	2,795	2,428	1,995	2,102	1,794	1,811	1,818	1,733	1,687	1,629	1,563

Figure 5: Absolute energy consumption spilt by gas and electric in MWh and energy intensity by kWh/FTE.

WATER REDUCTION PERFORMANCE

Water consumption increased from 44,804m3 in 2010- 2011 to 60,267m3 in 2019- 2020. The increase in consumption can be partly attributed to the increase in the size of the estate. When considering the expansion of the estate as a KPI, consumption has increased from 5.9 m3/FTE to 6.8 m3/FTE during the period. The increased consumption also is the result of improvements in water metering infrastructure, as City Campus water consumption data became available for the first time during this period. The consumption spike in 2016 -2017 is linked to a serious water leak at St Johns Campus that was identified using automatic metering software.



	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Series1	44,804	42,162	37,547	37,945	45,547	51,041	66,587	47,149	65547	60,267
Series3	5.9	5.4	4.8	4.4	5.4	5.8	7.3	4.9	7.0	6.8

Figure 6: Absolute water consumption m^3 and water consumption by floor area m^3/FTE.

4. OBJECTIVE AND TARGETS

SUSTAINABILITY STRATEGY TARGETS

The Sustainability Strategy 2020-2030 has set the following targets. It should be noted both strategies are being continually reviewed and are likely to change as innovations and opportunities arise.

SDG Commitment 7: Manage our estate to mitigate against climate change (through reduction of carbon emissions) and to ensure future resilience through engagement in adaptive strategies	
• In 2020 we will set new science-based targets to a 1.5 degree warming to achieve net carbon neutrality by 2030. These will be based on scopes 1, 2 and 3 from a new base line of 2018-19.	
• By 2020 we will investigate the viability of utilising geo-thermal within the re-development of the Riverside Campus and connecting all University Buildings to a district heating system.	
• Average DEC rating for the university significant buildings is 60 in 2019. By September 2023 reduce the average DEC rating to 45.	

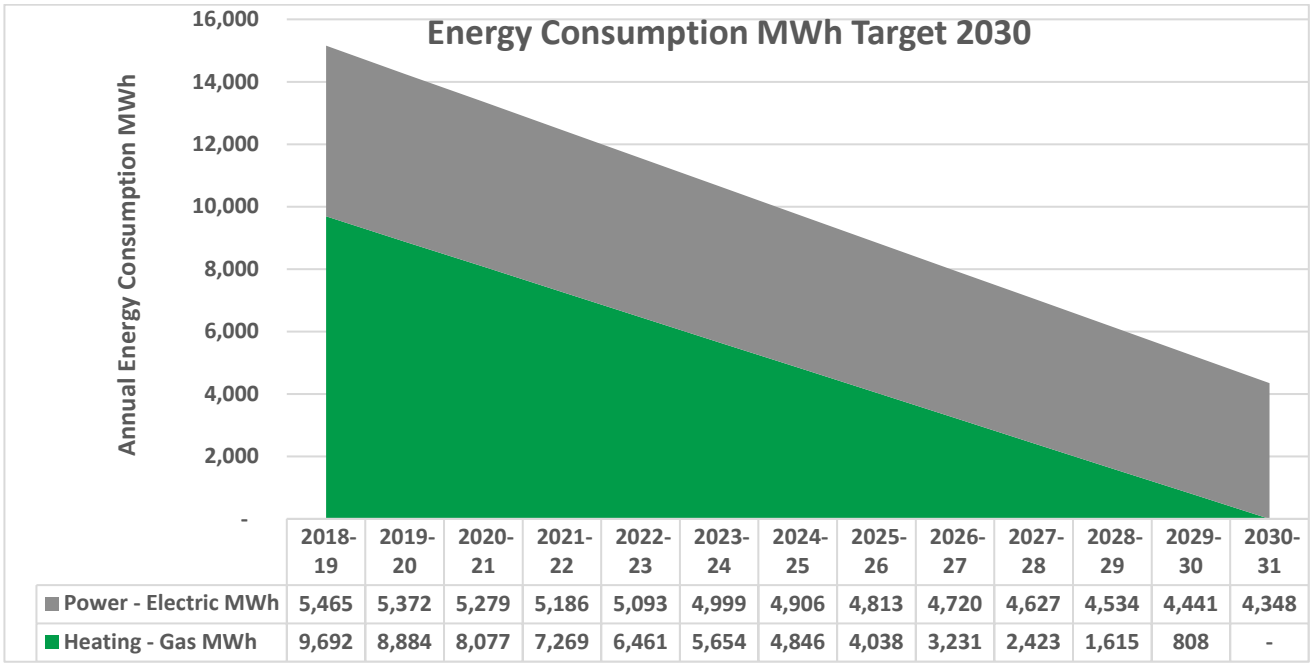
ENERGY CARBON TARGETS

The 2030 Net Zero commitment requires Scope 1 and 2 emissions from energy to achieve zero carbon emissions by 2030. The commitment will require the removal of carbon emissions from baseline year figures of 1,782 GHGe natural gas and 1,398 GHGe electricity. To achieve Net Zero against carbon emission targets, energy will need to reduce on average by **8.4%** against the 2018/19 baseline year. Heating/gas carbon emission baseline year figure of 1,782 GHGe will need to reduce an average of **149 GHGe** tonnes per annum during the life of the strategy. Electricity carbon emission baseline year figure of 1,398 GHGe will need to reduce on average of **117 GHGe** tonnes per annum.

Combined Energy Target

Energy performance will be reported against a combined natural gas and electricity figure to aggregate performance across Scope 1 and 2 and factor in the rate of decarbonisation of heating during the period. The combined 2018/20 baseline year figure of 15,157 MWh is targeted to reduce to 4,348 MWh by 2030/31, at an average annual rate of **901** MWh per annum, an **5.9%** average annual percentage reduction.

Specific energy reduction targets
• An absolute energy consumption reduction of 901 MWh p.a. (5.9% p.a.) from 2019 to 2030, reducing consumption from 15,157 MWh in 2018-2019 to 4,348 in 2030-2031.
• A combined energy intensity reduction of target of p.a. 5.9% p.a. from 2019 to 2030, reducing consumption energy intensity from 162 kWh/GIA m2 in 2018-2019 to 53.56 kWh/GIA m2 in 2030-2031.



	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Power - Electric MWh	5,465	5,372	5,279	5,186	5,093	4,999	4,906	4,813	4,720	4,627	4,534	4,441	4,348
Heating - Gas MWh	9,692	8,884	8,077	7,269	6,461	5,654	4,846	4,038	3,231	2,423	1,615	808	-

Figure 7: Energy Natural Gas and Electricity Targets 2030.

Natural Gas

Natural Gas consumption baseline year figure of 9,692 MWh will need to reduce an average of 808 MWh per annum consistently during the reporting period to achieve Net Zero, 8.4% average reduction per annum. The conversion factor for natural gas consumption (MWh) to carbon emission (GHGe) is expected to remain constant during the reporting period. A reduction in natural gas consumption will directly correspond with the reduction in carbon emissions.

Electricity

The absolute electricity consumption needed to achieve Net Zero from Scope 2 emissions is less clear compared to natural gas, and several factors need to be considered.

Decarbonisation of the national energy mix

Carbon emission conversion factors from electricity do not remain constant but change based on the energy mix of the national grid. As the national energy mix decarbonises the carbon conversion factor has reduced, for example, 1 kWh =

0.49 GHGe in 2014 which decreased to 0.23 GHGe in 2020. The decarbonisation of the national grid is expected to accelerate between 2021-2030 with offshore wind, solar, nuclear and carbon capture expected to take a dominant role in energy generation. The University of Worcester energy consumption targets have assumed that the energy mix decarbonisation will continue during the period and 50% of Scope 2 carbon emissions reduction will be delivered from its changes to the national energy mix.

Decarbonisation of heating

The University of Worcester Heat Decarbonisation Plan sets out an approach of introducing additional distract heating networks and changing the current fuel from gas to electricity using Heat Pump technology, although consideration is being given to Hydrogen. This approach to decarbonise heating will provide additional electricity demand. Air Source Heat Pumps typically operate at a coefficient of performance (CoP) at rate of 3, offsetting gas consumption at a rate of 3 kWh of natural gas offset to 1 kWh electricity consumed. Assuming a decarbonising of heating CoP of 3 it is estimated removing 9,692 MWh of natural gas will result in an additional 3,231 MWh of electricity consumed leading up to 2030.

This is an area which is being kept under continuous review, as innovations and funding opportunities along with regulations emerge.

Electricity energy target

Electricity energy consumption targets have taken from the 2018- 2019 baseline year consumption of 5,465 MWh and added 3,231 MWh associated with the additional demand for the decarbonisation/electrification of heating (added annually at a rate of 269 MWh) by 2030. The electricity target is to reduce against this combined electricity consumption figure (8,696 MWh) by 50% by 2030. To achieve this absolute electricity consumption target electricity will need to reduce annually by 93 MWh a 1.7% reduction against the baseline year figure.

WATER TARGETS

Water reduction targets of 3% per annum have been set for the duration of the EWMS. Targets have been set in absolute terms and using floor area as a KPI.

Specific water reduction targets
• A 3% absolute water consumption reduction p.a. 2019-2030 to 2030-2031, reducing consumption from 60,267 m^3 in 2018/19 to 41,815 m^3 by 2030- 2031
• A 3% reduction in water consumption expressed relative to the estate floor area, reducing from 6.8 m^3/FTE in 2017-2018 to 4.7m m^3/FTE in 2030-2031

BASELINE

The year 2018-2019 has been selected as the baseline year to review energy and water consumption performance against defined targets. The baseline has been selected to be compliant with the ISO50001:2018 Energy Management System standard which initially requires an energy baseline that reflects the organisation's recent energy performance. The baselined year reflects a period whereby the University expansion had stabilised and comprehensive energy data was available with pre-Covid-19 consumption. The year also offers a comprehensive water consumption profile whereby all major sites have metering data available and no major leaks identified.

5. HOW TO GET THERE

DECARBONISATION OF HEATING

The University of Worcester high level Heat Decarbonisation Plan 2021 has reviewed each campus and developed a four-phase approach to achieve NetZero from Scope 1 emissions.

- Phase 1- Connect buildings that require a minor heating system modification to decarbonised district heating network.
- Phase 2- Connect buildings that require a major heating system modification to decarbonised district heating network.
- Phase 3- Connect buildings that require a major fabric improvement and heating system modification to decarbonised district heating network.
- Phase 4- Buildings ready to connect to district heating network with a combination of gas and/or hydrogen boilers and heat pump due to limited fabric improvements possible.

Throughout the Heat Decarbonisation Plan phased approach buildings will require fabric improvements so to facilitate the connection of buildings to decarbonised district heating networks in later phases.

The plan proposes district heating networks for the university once the relevant fabric improvements and systems modifications have been made. Air and ground source heat pump and hydrogen boilers have been considered as part of the renewable technologies generation solution to provide district heating across campuses. Demolition and replacement of buildings which is not suitable for future decarbonised district heating networks will also play an integral part in the decarbonisation of the heating approach.

MANAGING ELECTRICITY FOR NET ZERO

The EWMS continues a six-sided approach for managing and reducing electricity consumption to achieve targets defined in the strategy. The approach focuses on identifying opportunities to reduce energy consumption first, through the removal of wasted consumption and implementing energy efficiency opportunities. In the context of the increasing electricity demand through the decarbonisation of heating and the expansion of electric vehicle charging, efficiency projects alone will not be enough to reduce electricity consumption in line with targets. To achieve these ambitious targets, it will be necessary to also expand the institutions onsite renewable energy generation capacity and procurement mechanisms for renewable energy through market agreements.

1- Electricity Efficiency Projects

The University of Worcester has implemented a programme of energy efficiency projects through the duration of previous Carbon Management Plans. Resources will be allocated for the ongoing implementation of energy efficiency projects during the period of the EWMS. Electricity efficiency projects to be identified through continual energy assessments, engineer/technical audits and recommendations made through DEC advisory reports. Efficiency projects to be selected and implemented based on their financial viability and added benefit to the estate such as improvements to the aesthetics and reducing maintenance commitments. Performance of significant energy reduction projects to be evaluated and reported using defined measurement and verification procedures.

2- Monitoring, Targeting and Controls

The University has an extensive automatic metering reading (AMR) system with meters providing automatic reading in 15-minute intervals. The AMR system provides the University with the ability to see where energy and water are being consumed and target resources to provide the greatest impact on potential savings. The AMR system will continue to be utilised to provide live building consumption profiles and trigger exception reports to identify proactively system failures and energy wastage. AMR data will be used to measure the impact of energy efficiency projects so to verify and

quantify savings. Building controls offer an important route to achieve energy efficiency by avoiding heating buildings out of core hours and to excessive temperatures. Building management systems have been installed throughout the estate to allow remote monitoring and controls of buildings while smaller buildings deploy local controls.

Extending and refining building monitor and controls systems will allow the University to further optimise buildings to energy consumption to demand patterns. Developments in IoT and machine learning will provide opportunities for the University to further develop building controls allowing collection of asset-based, occupational, environmental and energy data through wirelessly deployed field devices. Such a system will provide knowledge of how, where, and by whom rooms and spaces are being used. This data can be applied to machine learning algorithms which identify patterns and trends in the data and make predictions for failure when data patterns are recognised as unusual. Automation is further enhanced by advanced artificial intelligence, whereby decisions are made without human intervention through the utilisation of data and analytics. The implementation of this technological development in building controls will offer opportunities to better control energy patterns, contributing to the decarbonisation of heating and enhancing the utilisation electricity consuming equipment.

3- Behaviour Change

Continual development of a positive energy-saving culture by enhancing energy literacy and campaigns focused on awareness-raising. Energy awareness initiatives include providing building/room controls guides for building users and encouraging user feedback to identify potential savings for specific areas. Energy-awareness campaigns to focus and be tailor to specific groups including residential students and office-based members of staff.

4- Procurement of Sustainable Goods

The procurement process to consider the energy performance on a products lifecycle basis when procuring equipment. The University will inform suppliers that energy performance is one of the evaluating criteria for procurement on equipment which will have a significant life cycle energy burden.

5- Onsite Renewable Energy Generation

The University will continue to expand onsite renewable energy generation during the EWMS timeframe. As energy prices increase and the cost of renewable technology decline, the financial viability of renewable projects will continue to become more attractive during the period. The University of Worcester currently has renewable solar photovoltaics (PV) capacity of 264KWp which is anticipated to expand to 427kW by the end of 2021. The continual expansion of solar PV infrastructure will be a key component of achieving NetZero by 2030.

The Sustainable Construction and Refurbishment Policy sets a target of 15% energy produced from renewable or LZC technologies will be sought for capital projects and major refurbishments OR equivalent fabric improvements made to the design to reduce demand by the same 15%. This is under review.

6- Procurement of renewable energy

The University of Worcester procures electricity from renewable sources which are backed with Renewable Energy Guarantees of Origins (REGO) certificates. In 2019 the University joined TEC Higher Education first Power Purchase Agreement PPA, which committed to purchasing 20% of electricity from renewable energy generator Statkraft during a ten-year contract. The University will continue to support the national development of renewable energy generation through market products.

6. REPORTING

Performance against Scope 1 & 2 carbon and energy targets defined in the Sustainability Strategy/EWMS will be monitored and reported annually. Carbon emission performance reports will continue to be presented in the annual 'Progress against carbon emissions target' reviewed at the Sustainability Strategy Group.

Energy performance targets will be reported annually as part of the Energy Management System – ISO 50001 review and management report process. An annual 'Energy Review' report will be created as part of the ISO 50001 process; the report will include an analysis of energy performance against targets. The annual ISO 50001 review will also evaluate significant energy users and develop an energy action plan, potential efficiency projects to be explored during the next year. The annual Energy Review report will be presented to the Sustainability Strategy Group and colleagues involved in the delivery of the energy management system. Heating degree days will be factored into the reporting of energy consumption as a key driver for gas consumption.

The energy performance of individual buildings will be reported through the submission of DEC operational ratings in line with requirements of The Energy Performance of Buildings (England and Wales) Regulation 2015. Estate DEC operational ratings will be summarised annually, and performance tracked against targets defined in the report.