



mitie

PLAN ZERO

# Bournemouth University

## Heat Decarbonisation Plan

Plan Excluding Appendices

March 2023

Version 1 – Approved by EDC 20.3.23 and CECAP Group on 13.3.23

## Executive Summary

Bournemouth University has undertaken this heat decarbonisation plan (HDP) to develop a long-term strategy to remove scope 1 fossil fuel emissions across its estate and explore options to reduce scope 2 emissions. This support's The Climate and Ecological Crisis Action Plan (CECAP) which has set a target of net zero GHG emissions by 2030/31.

There are twenty-one buildings in the scope of the study, across four campuses; Chapel Gate Sports Facility, Lansdowne Campus, Talbot Campus, and Yeovil Campus.

A review of the buildings' energy data highlights that the University emitted 2,835 tCO<sub>2</sub>e across the four campuses in 2022. The largest source of carbon emissions relates to scope 2 electricity (58%) followed by scope 1 fossil fuels (42%); these consist predominantly of natural gas (93%), LPG (6%) and Biomass (<1%) used for heat.

In order to decarbonise the estate and make significant progress towards BU's net zero target 2030/31, it is recommended that the following strategy is applied to each building in sequential order:

- 1. Fabric First Approach:** Reduce existing thermal demand by improving building fabric, this will reduce heat pump operation costs and could assist with heat pump sizing
- 2. Renewable Generation:** Where viable install Solar PV to part mitigate the expected additional electricity demand associated with heat electrification
- 3. Heat Electrification:** Remove scope 1 fossil fuel emissions by replacing existing fossil fuel (gas) fired heating systems with air or ground source heat pumps
- 4. Offsite Renewables:** Ensure that high quality green electricity tariffs are procured to mitigate scope 2 emissions

Mitie have undertaken site assessments to produce a detailed summary of the opportunities that are available across each campus and recommended a programme to implement this to 2030/31.

The assessments identified a number of key opportunities across the estate to reduce thermal and electrical load, and to decarbonise the heat systems using a combination of air source and ground source heat pumps.

- There are building fabric upgrade opportunities at 7 of the sites, glazing upgrades at Dorset House and cavity wall insulation at Poole House deliver the highest carbon savings
- There are 9 sites with the potential to install solar PV, Dorset House, Christchurch House and Sir Michael Cobham Library provide the best opportunity for onsite generation
- There are opportunities for heat pumps installations at 16 sites, 12 air source and 4 ground source heat pumps. Poole House (GSHP), Fusion Building (ASHP) Poole Gateway Building (GSHP), Bournemouth Gateway Building (ASHP) and Sir Michael Cobham Library (ASHP) provide the greatest opportunities for heat decarbonisation.
- This report excludes EBC, Student Village, Tolpuddle Annexes, Drewitts Industrial Unit and Wallisdown Playing Fields.

It is estimated that implementation of all identified projects would cost in the region of £14.1m (£13.78m ex VAT), this equates to an average capital spend of £2M per annum. The initiatives are estimated to deliver annual cost savings of £454k per annum.

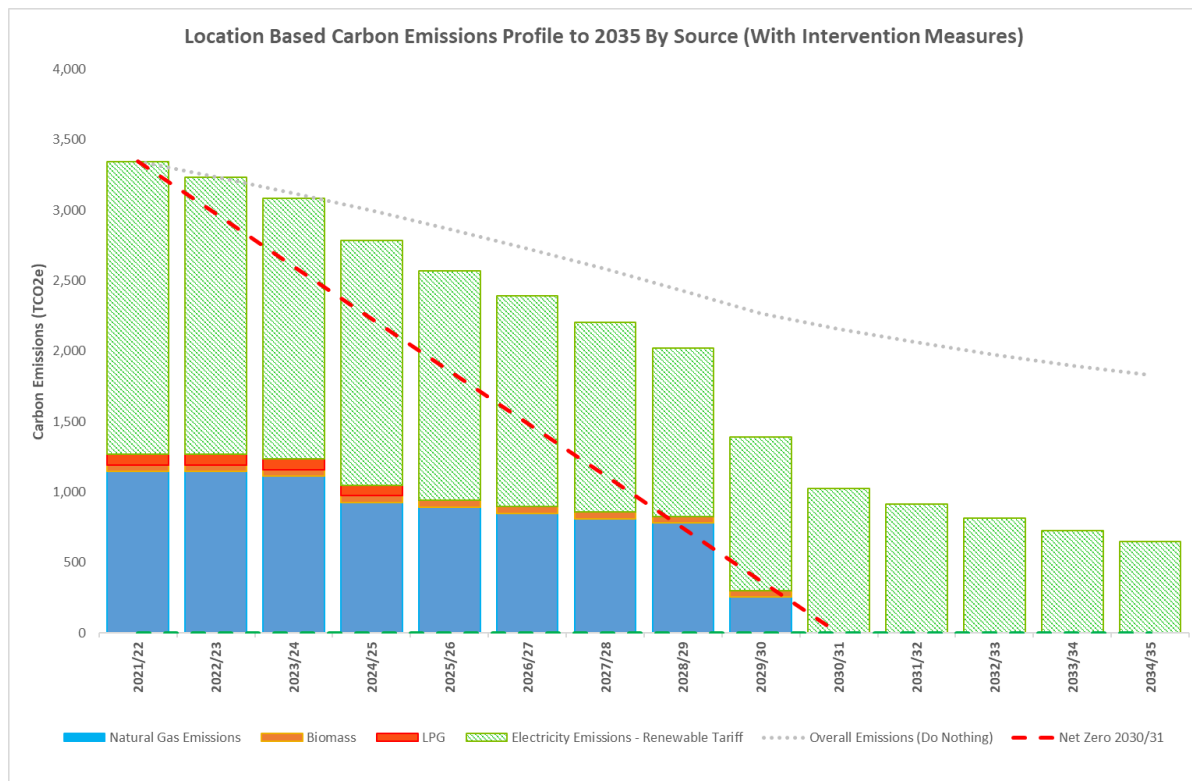
CAPEX and OPEX figures quoted in this report exclude VAT (except for the projects related to the 2023 PSDS 3b application for ASHPs for DH, KH and SMCL and PV DH worth £1.6m as this was a requirement of the funding and therefore VAT of £320k included). Figures do not include inflation.

	CAPEX (£)	Cost Savings (£)	Scope 1 Emissions (tCO <sub>2</sub> e)	Scope 2 Emissions (tCO <sub>2</sub> e)
<b>Cavity Wall Insulation</b>	£538,000	£18,187	21.5	-
<b>Glazing Upgrade</b>	£990,100	£30,024	43.8	-
<b>Heat Reutilisation</b>	-	£39,960	-	21.6

<b>Solar PV</b>	£554,573	£155,647	-	84.1
<b>ASHP</b>	£4,663,749	£58,772	665.3	-214.9
<b>GSHP/Ambient Loop</b>	£7,372,000	£151,877	495.3	-132.7
<b>Total</b>	<b>£14,118,422</b>	<b>£454,467</b>	<b>1226.0</b>	<b>-242.4</b>

Table 0.1 Summary decarbonisation projects by category

This assessment predicts that Bournemouth University could be able to achieve its Scope 1 and 2 operational Net Zero Target of 2030/31 if the following recommendations are delivered:



Year	Site	Measure
2023	Chapel Gate - Changing Rooms and Squash Courts	Building Fabric Upgrades
2024	Chapel Gate - Changing Rooms and Squash Courts Talbot Campus – Weymouth House	PV
	Chapel Gate - Clubhouse	Building Fabric Upgrades & PV

	Talbot Campus - Dorset House Talbot Campus - Kimmeridge House Talbot Campus - Sir Michael Cobham Library	Air Source Heat Pump & PV
2025	Talbot Campus - Poole House Yeovil - University Centre Yeovil	Building Fabric Upgrades
	Chapel Gate - Clubhouse Chapel Gate - Changing Rooms and Squash Courts	Air Source Heat Pump
2026	Lansdowne - The Old Fire Station	Air Source Heat Pump & Fabric Upgrades
	Talbot Campus – Talbot House	Air Source Heat Pump
	Yeovil - University Centre Yeovil	PV
2027	Lansdowne - Studland House	Air Source Heat Pump
	Talbot Campus – Talbot House	PV & Fabric Upgrades
2028	Yeovil - University Centre Yeovil	Air Source Heat Pump
2029	Talbot Campus - Poole House	Ground Source Heat Pump
	Talbot Campus - Student Centre	Air Source Heat Pump
2030	Lansdowne - BGB Talbot Campus - Fusion Building	Air Source Heat Pump
	Talbot Campus – Christchurch House	Ground Source Heat Pump and PV
	Talbot Campus - Poole Gateway Building Talbot Campus – Weymouth House	Ground Source Heat Pump

Table 0.2 Summary of decarbonisation initiatives by building and suggested year of implementation

In order to deliver this heat decarbonisation plan it is recognised that significant capital expenditure and internal resource will be required. It must be highlighted that there are a number of challenges associated with delivering this plan, in particular the age, condition and operation of the estate and funding. These can be mitigated with appropriate planning and governance.

Bournemouth University is in an excellent position to make this successful as the HDP will also be incorporated into the wider BU Estates Development Framework (EDF), which sets the University’s mid and long-term capital investment plans. The Heat Decarbonisation plan will underpin the formation of the next investment plan (EDF3) covering the period between 2025 and 2032. The HDP estimated budget to 2030 will inform the EDF3 decarbonisation budget.



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## Introduction

The Low Carbon Skills Fund (LCSF) enables public sector organisations to access funding to help them develop a Heat Decarbonisation Plan (“HDP”) with the intent of identifying opportunities and pathways in which they can decarbonise their estate.

In 2019 Bournemouth University (BU) made a commitment to achieving Net Zero Greenhouse Gas Emissions by 2030/31 in its Climate and Ecological Crisis Action Plan (CECAP). This represents a further 50% reduction in emissions across all areas of activity.

This builds on success to date where since 2005 BU has reduced its carbon footprint by over 45% through estate and infrastructure investments, as well as by the decarbonisation of the UK national grid. They have installed over 2000 solar panels across Talbot and Lansdowne Campuses, built four new buildings to BREEAM Excellent with a range of low carbon technology including GSHPs and ASHPs. They operate a Building Management System to enable close control of building HVAC and operate a combined Energy and Environmental Management System certified to ISO 140001 and ISO 50001. Their approach extends to the education provided to achieve 88% alignment of curriculum with one or more of the United Nations Sustainable Development Goals.

In order to deliver the net zero goal by 2030/31 heat decarbonisation must be a key focus as it makes up over half of BU’s total emissions. For this reason, Mitie were commissioned to undertake a comprehensive heat decarbonisation study assigned across 21 buildings selected from the BU portfolio. Selection was based on buildings which are owned or have long term lease arrangements to enable actions to be implemented.



## Purpose of a Heat Decarbonisation Plan

The *Public Sector Low Carbon Skills Fund: Guidance* document states the purpose of a HDP is to:

- Describe how an organisation intends to replace fossil fuel reliant systems with low carbon alternatives (for example heat pumps, electric heating, or other low-carbon fuel sources) within its estate.
- Meet the challenge of net zero: organisations throughout the UK need to decarbonise their buildings. It is also recognised that this needs to be approached in a way that supports the type of estate an organisation operates. Estate and property portfolios can range from one building to multiple buildings, to campus style activities, or a combination of the above. With diversity of an estate in mind, a heat decarbonisation plan should be made to fit its purpose but describe the current state of an organisation's energy use, where it is derived from, and the organisation's plans for reducing and/or decarbonising its energy use.
- Outline what an organisation has already done, what it is currently doing, and what it plans to do in the future. It is expected that a plan will lay out the current thinking and vision of how decarbonisation will be achieved. Outline what an organisation has already done, what it is currently doing, and what it plans to do in the future. It is expected that a plan will lay out the current thinking and vision of how decarbonisation will be achieved.
- Reflect the organisation's level of knowledge, an understanding of the technical solutions that are needed to decarbonise, the associated budget costs or estimates, as well as how and when over a timeline it might be delivered.

It is worth noting at this stage that irrespective of the content of this report, a HDP should be a continually evolving program, kept live to reflect the changing landscapes and state conditions, and tracked against progress.



## What is Net Zero?

“Net Zero” means achieving a balance between the greenhouse gases put into the atmosphere and those taken out.

Carbon dioxide (CO<sub>2</sub>), a greenhouse gas (GHG), is released when carbon-based fuels are burned in homes, buildings, power stations and vehicles. Greenhouse gases absorb and emit radiant energy within the thermal infrared range. This effect causes the Earth’s atmosphere to trap heat that would otherwise be emitted out into space. The primary greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.

Greenhouse gases are a vital part of maintaining life on Earth but have, in recent years, reached levels where an excess of heat is being trapped causing global temperatures to rise. The effect of this temperature increase has dire consequences such as:

### **Primary impacts:**

Natural/ catastrophic disasters including wildfires, floods, hurricanes, landslides.

### **Secondary impacts:**

Diminished food supplies, strains on medical and rescue services, loss of homes and crucial wildlife, rising sea levels, and so forth.

Across the globe, countries, states, organisations, and key stakeholders have pledged to enhance their climate effort in accordance with the Paris Agreement. The Kyoto Protocol identified a 'basket' of six GHGs, including carbon-dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>).

## Project Overview

### Purpose

This report has been produced to identify the opportunities across the BU estate to transition away from fossil fuels as a source of heat to electrically derived heat, namely through the replacement of gas fired boiler plant with electrically driven heat pumps. The scope of this report is to quantify the energy saving and decarbonisation opportunities associated with this initiative; as well as provide a high-level strategy and practical timeline to remove scope 1 fossil fuel emissions across the estate in line with the University's net zero target of 2030/31.

### Scope

For the purposes of this report, we are considering Scope 1 and 2 emissions from the following four campuses:

1. **Chapel Gate Sports Facility** – Christchurch, Dorset, BH23 6BL
2. **Lansdowne Campus** - 12 Christchurch Rd, Boscombe, Bournemouth, BH1 3NA
3. **Talbot Campus** – Fern Barrow, Poole, BH12 5BB
4. **Yeovil Campus** - 91 Preston Road, Yeovil, Somerset, BA20 2DN

Across these four campuses a total of 21 buildings have been selected for this study.

The assessment focuses on operational carbon emissions associated with building energy use across the estate.

**Scope 1 emissions** are direct emissions that result from activities owned or controlled by BU which release emissions straight into the atmosphere. This includes all the fuels directly burned in university, owned vehicles and boilers and emissions due to leaks of gases which cause climate change from air-conditioning units.

**Scope 2 emissions** are indirect emissions resulting from the University's consumption of purchased electricity and heat. These are emissions due to the University's activities but occur at sources not owned or controlled by the University. This includes all the electricity that the University purchases. This also includes any heat that is purchased through the district heating scheme

In scope and out of scope activities are listed below:

Scope	Source	Activity	In Scope
1	Stationary Combustion Emissions	Natural gas used for space heating and hot water	Yes
		Liquefied petroleum gas (LPG) used for space heating	Yes
		Biomass used for space heating (Poole house - Talbot Campus)	Yes
		Natural Gas or LPG used across the campuses for catering demand	No
1	Fugitive Emissions	Refrigerant leakage from air conditioning equipment	No
1	Mobile Combustion	Fuels consumed by company-owned or operated vehicles	No
2	Purchased Electricity	Electricity consumed by building services	Yes

*Table 1 In scope and out of scope emissions and activities*

Transport and fugitive emissions are deemed outside of this project's remit, however it is recommended that there is a separate strategy created to address these sources of carbon.

## Approach

Each campus has been audited by an Energy Solutions Engineer to identify the opportunities available across each building, this is to ensure that proposed solutions can be tailored to each building's requirement and situation. The audit findings have been developed into a series of recommendations that feed into a projects register for energy efficiency and low carbon transition. These Energy Conservation Measures (ECM) create the basis for the proposed heat decarbonisation strategy.

## Objectives

Mitie have identified 7 key objectives as part of the proposal for a HDP we felt would have the biggest impact for the BU Portfolio.

No.	Building	Solution	BU Benefit
1	Net Zero Scope 1,2 and 3 by 2030/31	We will provide a holistic Heat Decarbonisation Plan (HDP) for Talbot campus	Enables you to meet your net zero ambition
2	Rapidly reduce GHG emissions through technology solutions	We will also look at fabric and a range of demand reduction measures	A clear heat map of building fabric and insulation to clearly identify areas for improvement in efficiencies
3	Long term strategic action plan for heat provision	We will develop an HDP adopting a 'whole house' approach, aligned to your CECAP and the wider Estate's strategy	Delivers an integrated strategy considering the various heating sources at BU to develop a unified approach
4	Implementing net zero capital development	We will provide a summary of government and private funding options for implementation of the HDP.	Phased implementation to deploy identified measures.
5	Moving away from the use of natural gas for providing space heating and domestic hot water	We will deploy heat experts from Mitie to understand your existing systems and provide you with options to include centralised, decentralised and heat network options.	A plan that you can deploy with high confidence to accelerate your CECAP (measure 2A).
6	Looking at options for the data centre cooling provision	We will assess opportunities to recover waste heat from data centres to boost thermal system performance.	Enhanced carbon savings for the measures.
7	Priority on carbon reduction over payback	We will provide heat decarbonisation scenarios with costed business cases for all measures identified with the capital investment required as well as carbon savings and payback.	This will enable you to make informed decisions on the best implementation option for the University.

Table 2 BU Portfolio Objectives

## Buildings

The buildings contained within this study are split across four campuses:

**Talbot Campus** – the main campus located on the outskirts of Bournemouth, containing a variety of building types on a pedestrianised site

**Lansdowne Campus** – A grouping of buildings in central Bournemouth containing offices, nightclubs, and student facilities

**Chapel Gate** – A sports complex near Bournemouth Airport containing facilities for playing sport, changing, and socialising.

**Yeovil** – a standalone lecture facility

Across these four campuses a total of 21 buildings have been selected for this study, these have a variety of functions, ages, and existing building services. Three of the campuses, Talbot, Lansdowne, and Chapel Gate, are located in and around Bournemouth, with the Yeovil Campus being located in Yeovil.

The table below identifies the selected buildings from within the BU portfolio, all of which are either owned or occupied under long term leases by Bournemouth University. DEC ratings have been taken from the most recent records available online..

Campus	Building	Approximate Age of Building	Floor Area (m <sup>2</sup> )	DEC Rating
Chapel Gate	Changing Rooms and Squash Courts	1985	859	F
	Clubhouse	1985	1,241	C
	Cricket Pavilion	2010	270	N/A
	Football Club Changing Rooms	2000	82	N/A
	Groundsman's Compound	2000	32	N/A
	Summer Cricket Pavilion	2000	19	N/A
	<b>Sub Total</b>		<b>2,503</b>	
Lansdowne	Bournemouth Gateway Building	2022	10,368	A
	Studland House	1980	1,706	C
	The Old Fire Station	1900	5,971	C
	<b>Sub Total</b>		<b>12,074</b>	
Talbot	Christchurch House	1990	5,133	C
	Dorset House	1985	3,378	D
	Fusion Building	2016	5,935	D
	Jurassic House	2020	176	N/A
	Kimmeridge House	2003	1,541	D
	Poole Gateway Building	2020	6,790	D
	Poole House	1970	18,628	D
	Sir Michael Cobham Library	2010	3,135	C
	Student Centre	2015	6,117	B
	Talbot House	1985	1,909	B
	Weymouth House	1980	7,285	B
<b>Total</b>		<b>60,027</b>		
Yeovil	University Centre Yeovil	1980	2,197	B
	<b>Sub Total</b>		<b>2,197</b>	

Table 3. Heat Decarbonisation Study Scope

The Talbot campus is the largest of the four campuses assessed and consists of 11 buildings, with display energy certificates ranging from a B to a D rating indicating that most building’s energy performance operational rating efficiency is typical to good. These reflect the varying ages and condition of the estate, with several buildings less than 3 years old. The Lansdowne campus is the second largest campus and has relatively good energy performance ratings of A-C. The Chapel Gate and Yeovil campuses are of a similar size, yet Yeovil’s energy performance appears to be slightly better.

### Future changes

A key part of the future emissions landscape at BU will be driven by the existing programme of the addition, refurbishment and disposal of buildings. The following changes are expected:

Building	Change
Arne House	2026/27 - Opening*
Sir Michael Cobham Library	2027/28 - redevelopment and extension
Changing Rooms and Squash Courts	Proposed upgrade of changing room area

Table 4. Future Estate Strategy \*This construction is to be confirmed

## Energy Analysis

This assessment has used a mixture of data collected from half hourly and monthly meter readings to obtain a greater insight and understanding of site operations. This covers the period 1st August 2021 to 31st July 2022 to reflect BU's financial year, and the 21/22 reporting year has been selected as the baseline year.

Emissions for the financial year of 21/22 have been selected for the baseline year as they reflect emissions under current business conditions. The Covid-19 pandemic has altered energy consumption patterns across the estate; however upon review with the BU it was deemed to be most reflective of the organisation in its current form.

Source	Activity	2022 Consumption (kwh)	Proportion
Electricity	Electricity consumed by building services	7,859,654	53%
Natural Gas	Natural gas used for space heating and hot water	6,277,506	42%
Biomass	Biomass used for space heating (Poole house - Talbot Campus)	438,000	3%
Liquified Petroleum Gas (LPG)	Liquefied petroleum gas (LPG) used for space heating	351,779	2%

Table 5. Energy Profile for in scope sites

A review of the University's energy profile indicates that approximately 47% of total energy consumption is associated with the production of heat via combustion predominantly using gas, while electricity is used for the various heat pumps, electrical radiators and AC systems across the campuses.

The table below outlines the annual energy consumption for the various buildings, ranked alphabetically. Excluded from this data set is sub-metered natural gas used for catering loads and bottled LPG. For Chapel Gate the electricity and LPG consumption have been split by floor area for those buildings that use that fuel type.

Data highlights that the campus with the highest energy consumption is Talbot followed by Lansdowne. These two campuses also consume 96% of all natural gas used, with the remaining 4% consumed by Yeovil. Data also highlights that Chapel Gate consumes liquified petroleum gas (LPG) rather than natural gas, The Talbot Campus also used biomass for space heating at Poole House which contributes to 7.5% of the overall total heat demand for the campus.

Analysis indicates that Chapel Gate has the highest thermal intensity, followed by a number of buildings on the Talbot Campus, namely Kimmeridge House, Fusion Building, Dorset House and Poole House in descending order. Any heat decarbonisation strategy should focus on these sites in the first instance as well as larger consumers such as Bournemouth Gateway Building, Poole Gateway Building, Student Centre and Weymouth House.



Campus	Building	Annual Electricity Consumption	Annual Natural Gas Consumption	Annual LPG Consumption	Annual Biomass Consumption	Electrical Intensity (kWh/m <sup>2</sup> )	Thermal Intensity (kWh/m <sup>2</sup> )
Chapel Gate	Changing Rooms and Squash Courts	90,865	0	143,894	0	106	168
	Clubhouse	131,273	0	207,885	0	106	168
	Cricket Pavilion	28,561	0	0	0	106	0
	Football Club Changing Rooms	8,674	0	0	0	106	0
	Groundsman's Compound	3,385	0	0	0	106	0
	Summer Cricket Pavilion	0	0	0	0	0	0
Lansdowne	Bournemouth Gateway Building	1,190,983	557,643	0	0	115	54
	The Old Fire Station	167,099	124,314	0	0	98	73
	Studland House	592,062	192,275	0	0	99	32
Talbot	Christchurch House	428,140	295,724	0	0	83	58
	Dorset House	330,258	388,314	0	0	98	115
	Fusion Building	637,735	805,724	0	0	107	136
	Jurassic House	617,843	0	0	0	3,510	0
	Kimmeridge House	116,340	213,639	0	0	75	139
	Poole Gateway Building	581,352	606,722	0	0	86	89
	Poole House	1,646,382	1,490,947	0	438,000	88	104
	Student Centre	270,733	253,047	0	0	86	81
	Sir Michael Cobham Library	419,040	594,569	0	0	69	97
	Talbot House	97,524	142,913	0	0	51	75
	Weymouth House	441,498	394,972	0	0	61	54
Yeovil	University Centre Yeovil	59,907	216,703	0	0	27	99
<b>Total</b>		<b>7,859,654</b>	<b>6,277,506</b>	<b>351,779</b>	<b>438,000</b>		

Table 6. Energy Profile by site

The energy data provided is of generally good quality, with multiple buildings having 12 months of full half hourly data for electricity and natural gas. Where half hourly data is not available, monthly data was provided. Biomass data was provided via a heat meter and converted back to a fuel demand using a boiler efficiency rating. For several buildings, partial half hourly data was provided for a few months. This data was used to provide understanding of peak loading on the electrical and natural gas systems, with the 12 monthly reads used to calculate the annual energy consumption.

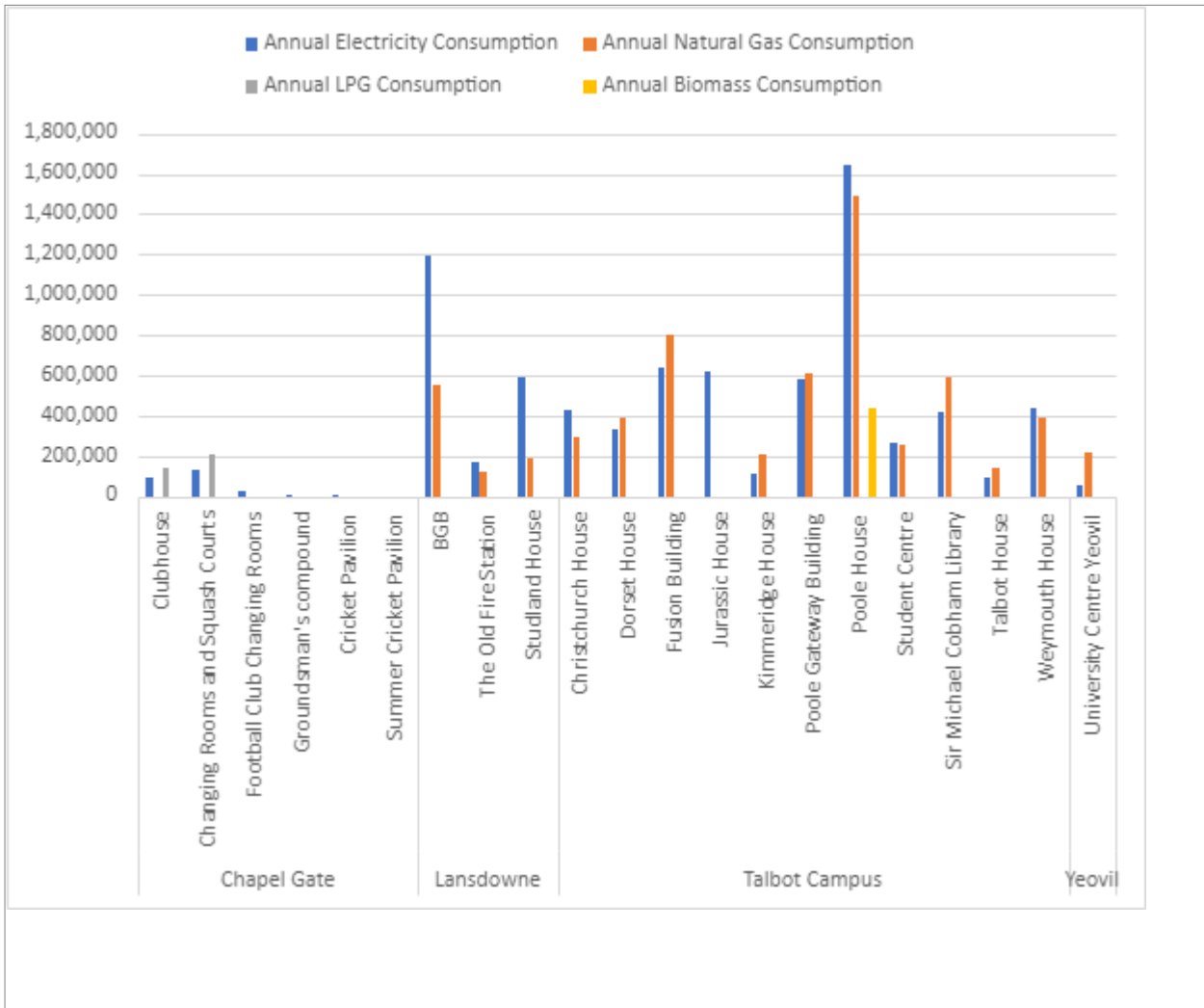
Data Quality	Electricity	Natural Gas	LPG	Biomass	Catering
Clubhouse	Full 12 months AMR	N/A	Monthly Data	N/A	Assumed LPG for catering is bottled
Changing Rooms and Squash Courts			N/A		N/A
Football Club Changing Rooms					
Groundsman's compound					
Cricket Pavilion					
Summer Cricket Pavilion	N/A				
BGB	Full 12 months AMR	Full 12 months AMR	N/A	N/A	N/A
The Old Fire Station	Full 12 months AMR	Monthly Data	N/A	N/A	N/A
Studland House	Full 12 months AMR	Monthly Data	N/A	N/A	N/A
Christchurch House	Full 12 months AMR	Full 12 months AMR	N/A	N/A	N/A
Dorset House	Full 12 months AMR	Full 12 months AMR	N/A	N/A	N/A
Fusion Building	Full 12 months AMR	Full 12 months AMR	N/A	N/A	N/A
Jurassic House	Full 12 months AMR	N/A	N/A	N/A	N/A
Kimmeridge House	Full 12 months AMR	Full 12 months AMR	N/A	N/A	N/A

Data Quality	Electricity	Natural Gas	LPG	Biomass	Catering
Poole Gateway Building	4 months AMR, 8 months monthly reads	4 months AMR, 8 months monthly reads	N/A	N/A	N/A
Poole House	Full 12 months AMR	Full 12 months AMR	N/A	Monthly reads from heat meter	N/A
Student Centre	4 months AMR, rest taken from manual reads	5 months AMR, rest taken from manual reads	N/A	N/A	N/A
Sir Michael Cobham Library	Partial AMR backfilled with a regression model	Full 12 months AMR	N/A	N/A	N/A
Talbot House	4 months AMR, 8 months monthly reads	4 months AMR, 8 months monthly reads	N/A	N/A	N/A
Weymouth House	4 months AMR, 8 months monthly reads	4 months AMR, 8 months monthly reads	N/A	N/A	N/A
University Centre Yeovil	Full 12 months AMR	Monthly Data	N/A	N/A	N/A

Table 7. Energy Data Source by Site

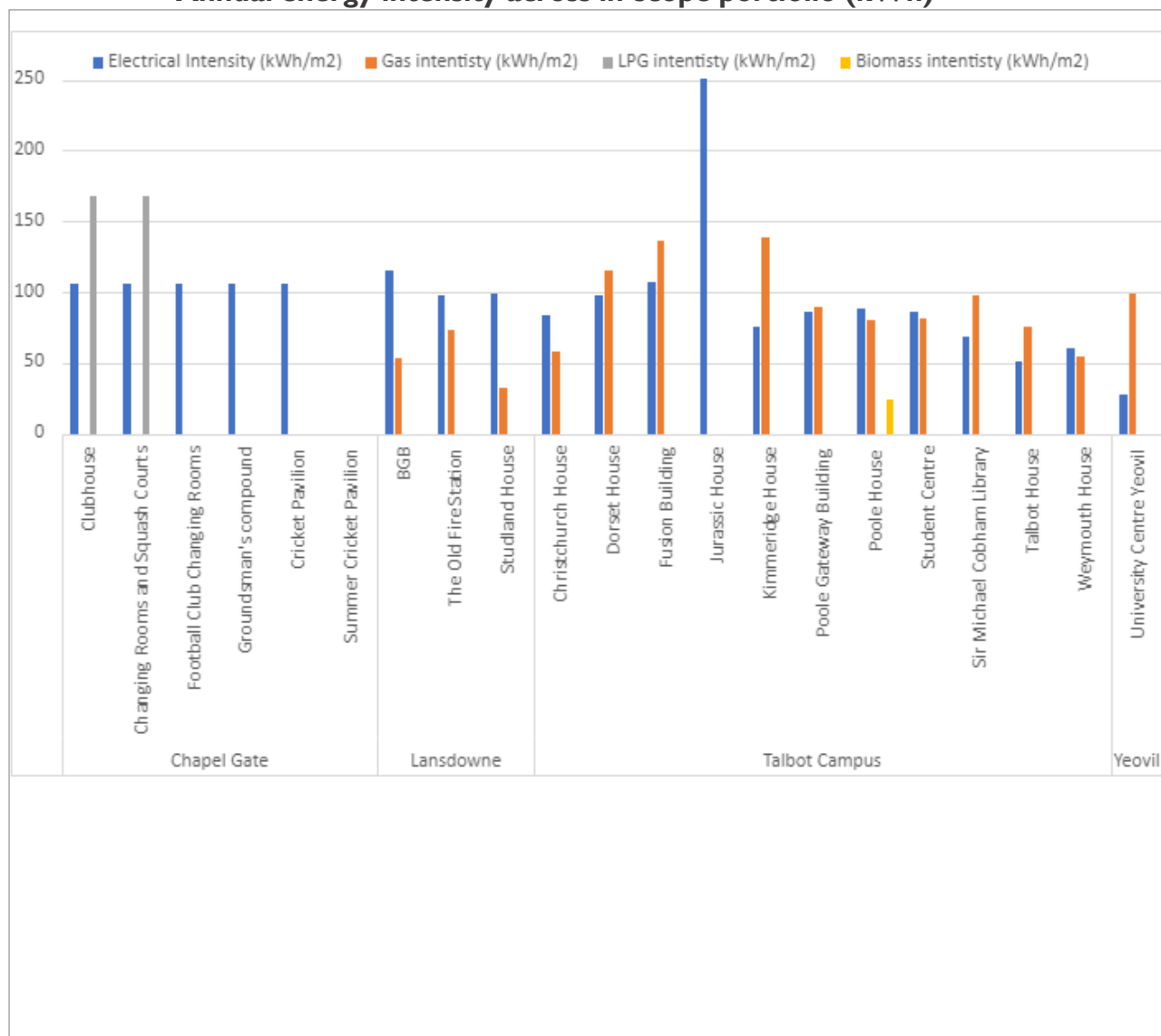
The chart below illustrates the annual energy consumption on a building-by-building level. Poole House is clearly the largest consumer overall which is of no surprise given its large floor area. Bournemouth Gateway Building has a large electrical consumption compared to its natural gas consumption; this is likely due to the electrical demand required for the heat pumps.

**Annual energy consumption across in-scope portfolio (kWh)**



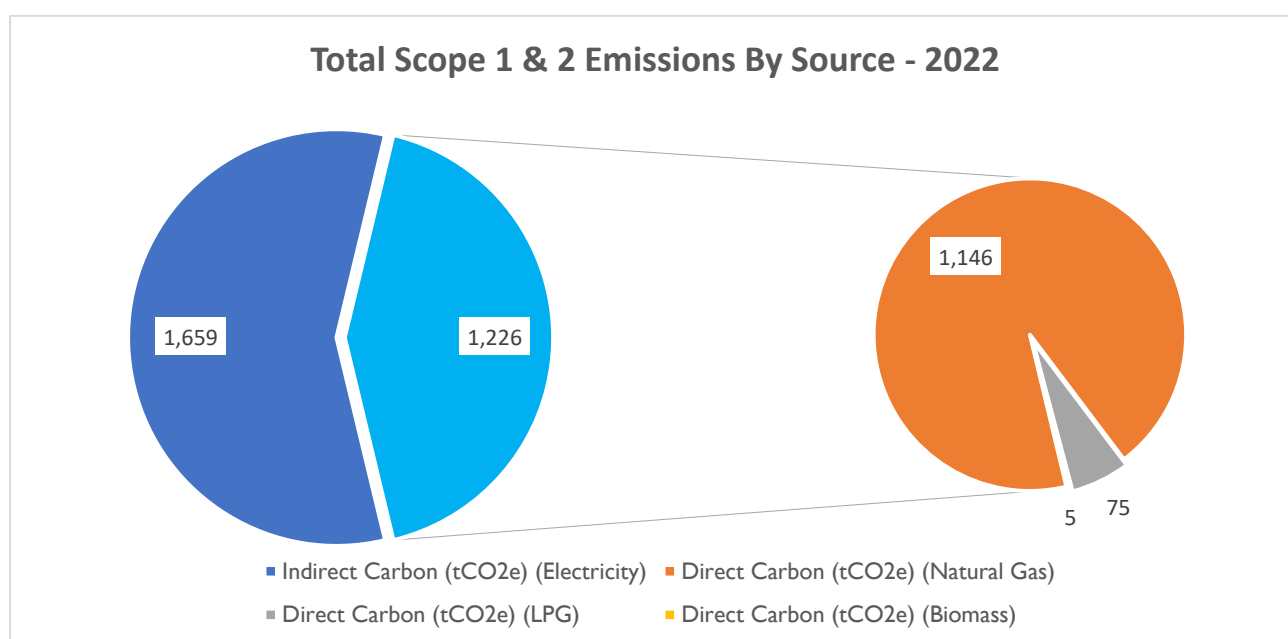
Despite having a large energy consumption, the energy intensity of Poole House is relatively low. Jurassic House, however, has an extremely intensive electrical demand due to the data centre and cooling plant located within.

### Annual energy intensity across in-scope portfolio (kWh)



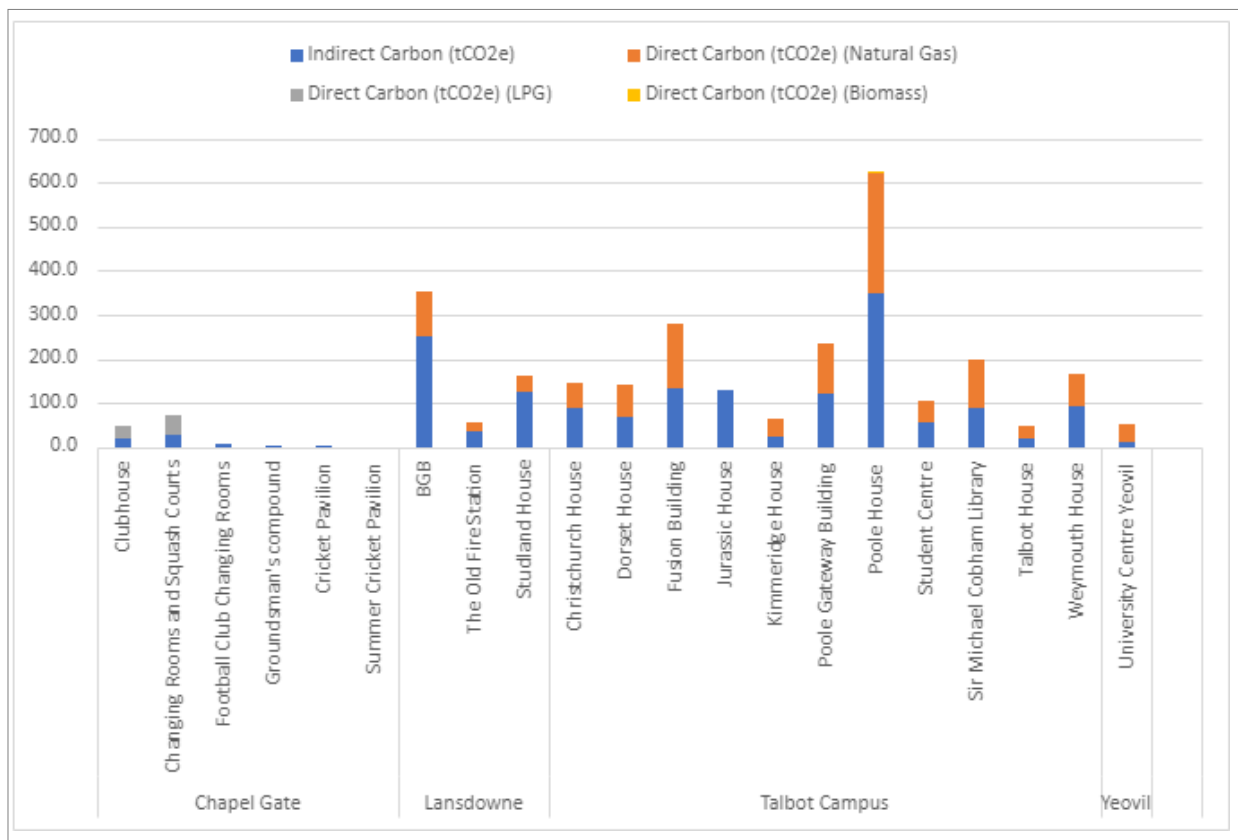
## Carbon Emissions

A review of the buildings' energy data highlights that the University emitted 2,835 tCO<sub>2</sub>e across the four campuses in 2022. The largest source of carbon emissions relates to scope 2 electricity (58%) followed by scope 1 fossil fuels (42%). Scope 1 emissions consist predominantly of natural gas (93%), LPG (6%) and Biomass (<1%).



The chart below illustrates the emissions on a building-by-building level, with the data indicating that the highest emitting campus is Talbot. As the largest building emitters for scope 1 and 2 Poole House, the Fusion building, the Poole Gateway building, and Sir Michael Cobham Library should be key areas of focus. The BGB building at the Lansdowne Campus is the second largest emitter after Poole House and therefore should also be a priority area.

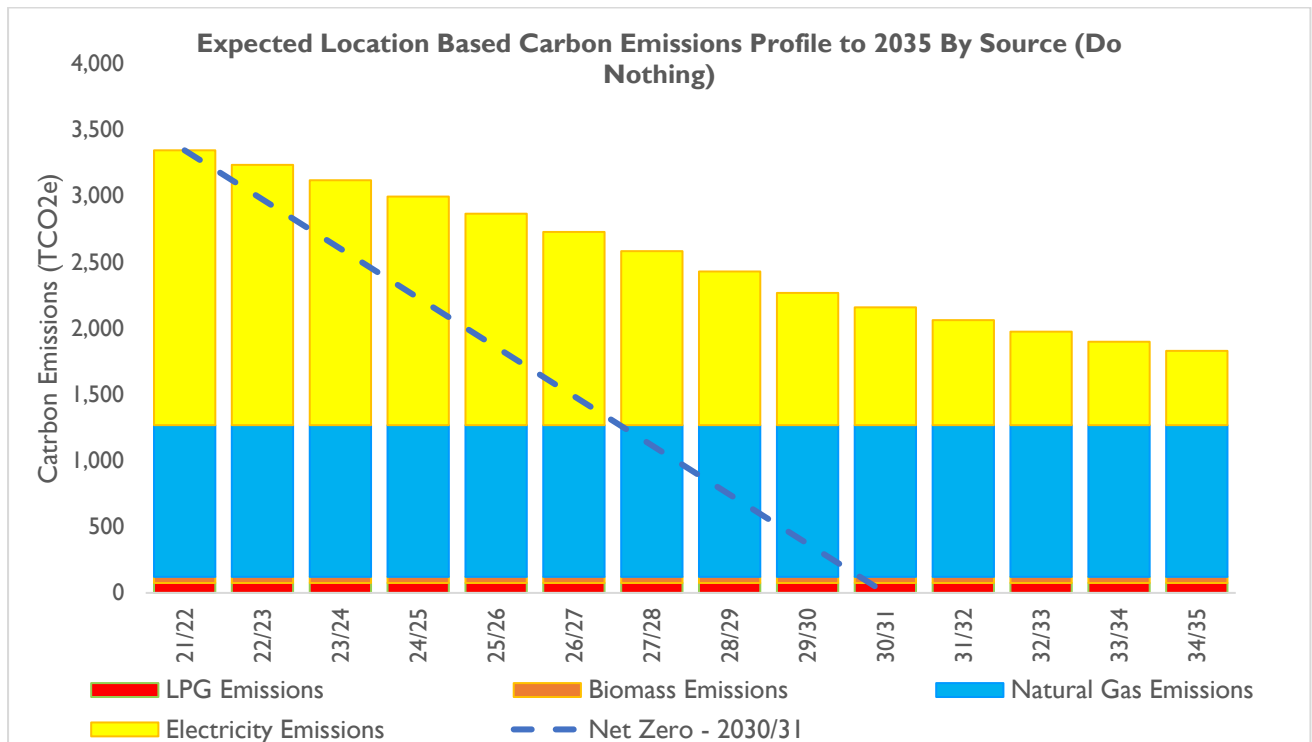
### Carbon footprint for building services across in-scope portfolio (tCO2e)



## **Business As Usual Scenario**

A review of the future long-term emissions trajectory has been undertaken using static baseline consumption figures (2022 to 2050), and emission factors obtained from the 2019 set of tables that support the Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas emissions, with emission factors having been modelled based on the predicted grid mix of energy generation. The trajectory outlines a do-nothing scenario to examine how location-based emissions will change over time should Bournemouth University continue with business as usual and not pursue a heat decarbonisation strategy. The trajectory is reviewed against a 2030 Net Zero target to understand how achievable it currently is.





The modelled trajectory highlights that BU’s reportable emissions (location-based) from electricity will reduce over the next two decades as the grid decarbonises. This is mainly due to the shift away from coal and gas-fired power stations to lower carbon alternatives such as nuclear, offshore wind and solar.

Key to note is that the current emission factor for gas and fuel will remain constant if infrastructure remains in its current form. This may decrease with the addition of biogas or hydrogen into the grid; however, this is yet to be confirmed with several technological hurdles needing to be addressed. For the purpose of this report, we are assuming that fossil fuel emission rates will remain static for some years to come. This means that fossil fuel emissions will increase in proportion as grid electricity becomes less carbon intensive. Analysis highlights that compared to the 2020/21 reporting year:

**Overall emissions are expected to reduce by 36% by 2030/31**

**Scope 2 Electricity Emissions will decrease by 57% by 2030/31**

**Scope 1 Gas and Fuel Emissions will remain static**

**Scope 1 Gas and Fuel Emissions will cover 58% of forward modelled emissions by 2030/31**

**A 2030 Net Zero or Science Based Reduction target will not be achievable without intervention**

## Existing Heating System – See Appendix I

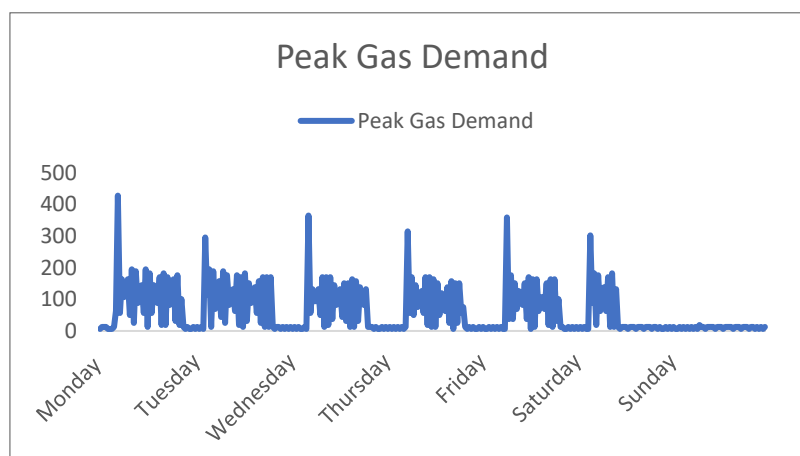
## Thermal Survey Results – See Appendix 2

### Opportunities

Several opportunities have been considered to understand the potential for BU achieve net zero carbon (Scope 1 and 2) and the associated impacts on operating costs as well as capital investment.

Fundamentally, carbon is prioritised over return on investment however all steps will be taken to reduce operational cost and deliver the greatest value and savings over the project duration.

When considering the decarbonisation of the heating systems, a whole building approach should be considered with the intention of reducing the thermal demand to its lowest possible level before transitioning to a new generation system. When conducting the surveys across the estate it was observed that the buildings are run very efficiently and have had many energy efficiency projects already carried out. For example, the vast majority of the lighting across the estate has already been upgraded to LED, and the BMS is controlled very tightly whereby heating is turned off overnight and during periods of no occupancy, such as the weekend, as can be seen below:



The energy conservation measures recommended have therefore been focussed around two aspects;

**Reducing the existing thermal demand by improving the building fabric**

**Installation of Solar PV to improve overall carbon and reduce electricity demand**

The main opportunity for reducing carbon is to remove scope 1 emissions through the electrification of the heat, which for the majority of the sites is provided by natural gas or LPG. By providing this heat by electricity, the university can take advantage of a rapidly decarbonising electricity grid, against a static carbon intensity for natural gas, LPG, and biomass.

There are multiple technologies that exist that could be used to decarbonise the heat demand, however several have been discounted for the reasons below:

**Solar Thermal** – high capital cost, using space that would be better suited to solar PV

**Hydrogen** – Uncertainty over zero carbon credentials and not a mature technology

**Biomass** – high operating costs, issues with resilience and Scope 1 emissions

**Direct electric** – very high operating costs, requiring a large electrical connection

**District Heat Networks** – Carbon savings are dependant on the input heat generation, usually a CHP and gas boilers.

Initial reviews have identified that there are no existing district heating networks in the Bournemouth area, however a study was conducted back in 2017 to explore the suitability of a heat network using Royal Bournemouth Hospital's incinerator as the primary heat source. This would require a 5km pipeline which would not be viable.

Having discounted the above technologies, the primary heating opportunity to decarbonise the estate would be a form of heat pump. These units maximise carbon savings by turning 1 unit of electricity into 2-4 units of heat, heat pumps both deliver efficiencies and enable BU to capitalise upon the decarbonising electricity grid.

Two types of heat pumps have been considered:

#### **Air Source Heat Pump – (ASHP)**

These units upgrade ambient heat from external air into a heating system, either wet or dry. They are cheaper and quicker to install, but operate at a lower COP and have size limitations.

#### **Ground Source Heat Pump (GSHP)**

These units upgrade heat from the ground either via an open or closed loop system, and operate at higher efficiencies than ASHPs. They require substantially more work in the design and installation, and therefore attract higher capital costs.

Heat pumps however have several key challenges which will need to be considered when assessing their feasibility at each site:

Having sufficient electrical capacity to install these units

Being able to modify the existing services to accommodate a low flow temperature to maximise efficiency

Costs have been estimated based on benchmarks from previous installation history, with specific costs highlighted for emitter upgrades

## Electrical Load Capacity

The electrical capacity of each building needs to be considered when changing from a fossil fuel heating system to an electrical heating system. A review of the maximum demand seen at each meter has been made to understand the peak loading seen over the 12 month period and compared against the known or estimated capacity of the building. This should be viewed as an illustration of loading and spare capacity only, and further investigation will be required.

As detailed in each of the site energy reports, there are several sites where solar PV has been recommended as part of the decarbonisation plan which will reduce energy consumption further and the subsequent impact on the electricity network across the portfolio.

Talbot Campus has an HV supply, which feeds it's own HV ring of 5 substations /6 transformers. As such, there is more flexibility in moving LV supplies across transformers however the rating of the main incomer is likely to require upgrading and will need a reinforcement from the DNO.

For sites lacking a medium voltage supply, there may also be a requirement to upgrade the electrical infrastructure to meet the requirements of the proposed heat pumps and electrical water heating systems. A detailed review and costing will be required once the design work for sizing of heat pump (after accounting for reduced heat load from fabric improvements), has been completed. This will need to accommodate plans for other projects; EV charging, solar PV and data centres as examples.

Campus	Site	Site Capacity (kW)	Confirmation	Electrical capacity needed (kW)	Existing peak demand (kW)	Sufficient Capacity
Chapel Gate	Clubhouse	199	Confirmed	40	155	NO
	Changing Rooms and Squash Courts			48		
	Football Club Changing Rooms	N/A				
	Groundsman's compound					
	Cricket Pavilion					
	Summer Cricket Pavilion					
Lansdowne	BGB	637	Confirmed	88	690	NO
	The Old Fire Station	159	Assumed	60	72	YES
	Studland House	318	Assumed	120	102	YES
Talbot Campus	Christchurch House	318	Assumed	136	92	YES
	Dorset House	318	Assumed	116	58	YES
	Fusion Building	239	Assumed	100	171	NO
	Jurassic House	N/A				
	Kimmeridge House	99	Assumed	80	174	NO
	Poole Gateway Building	318	Assumed	100	142	YES
	Poole House	995	Assumed	360	376	YES
	Student Centre	159	Assumed	64	50	YES
	Sir Michael Cobham Library	398	Assumed	140	190	YES
	Talbot House	139	Assumed	72	42	YES
Weymouth House	199	Assumed	180	88	NO	
Yeovil	University Centre Yeovil	99	Confirmed	80	27	NO

## Decarbonisation Opportunities

A technical review of the opportunities to decarbonise the heat at the various buildings on a campus and building level were considered to understand suitability and how to maximise the carbon savings.

Due to the independent heating systems on most buildings, along with the relatively small heat demand, individual Air Source Heat Pumps were selected as the preferred technology with three exceptions: a combined system at Chapel Gate, an ambient loop around Jurassic House and a GSHP Poole House.

Below are further details on these schemes, as well as technical details on all measures on a building by building basis.

Campus	Site	Calculated peak heat loss (kW)	Post ECM Heat loss (kW)	Chosen design heat loss (kW)	Type of technology
Chapel Gate	Clubhouse	60	59	100	ASHP
	Changing Rooms and Squash Courts	68	66	120	ASHP
	Football Club Changing Rooms	N/A			
	Groundsman's compound				
	Cricket Pavilion				
	Summer Cricket Pavilion				
Lansdowne	BGB	152	152	220	ASHP
	The Old Fire Station	98	83	150	ASHP
	Studland House	213	213	300	ASHP
Talbot Campus	Christchurch House	260	260	340	Ambient Loop
	Dorset House	175	115	290	ASHP
	Fusion Building	149	149	250	ASHP
	Jurassic House	N/A			
	Kimmeridge House	115	115	200	ASHP
	Poole Gateway Building	146	146	250	Ambient Loop
	Poole House	605	592	900	Ambient Loop
	Student Centre	97	97	160	ASHP
	Sir Michael Cobham Library	198	183	350	ASHP
	Talbot House	110	106	180	ASHP
	Weymouth House	323	323	450	Ambient Loop
Yeovil	University Centre Yeovil	151	114	200	ASHP



**Chapel Gate** Changing Rooms and Clubhouse could have individual systems installed, there is the opportunity to have a centralised system with the current LPG tank acting as a possible location for the ASHP.



**Jurassic House** has no fossil fuel load, however it does have a considerable cooling demand. There is an opportunity to recover some of this heat into an ambient loop, with individual boosting water source heat pumps on Christchurch, Weymouth and Poole Gateway Buildings. The cooling system at Jurassic House could also be replaced to make use of this ambient loop, however this is not considered in this study. A GSHP could be located to the east of Jurassic House.



**Poole House** has such a high heat demand that an air source heat pump is unlikely to be the most appropriate technology. Instead, a GSHP would be better to serve the load. Location is difficult as aside to a piece of grass near the northeast of the building there is limited space. An alternative proposal could be to split the catering and teaching circuits feeding each from a dedicated, smaller system.



## Opportunities by building – See Appendix 3

### Decarbonisation Plan and Roadmap

#### Approach

In order to decarbonise the estate it is recommended that the following strategy is applied to each building in sequential order:

1. **Fabric First Approach:** Reduce existing thermal demand by improving building fabric, this will reduce heat pump operation costs and could assist with heat pump sizing
2. **Renewable Generation:** Where viable install Solar PV to part mitigate the expected additional electricity demand associated with heat electrification
3. **Heat Electrification:** Remove scope 1 fossil fuel emissions by replacing existing fossil fuel fired heating systems with air source heat pumps
4. **Offsite Renewables:** Ensure that high quality green electricity tariffs are procured to mitigate remaining scope 2 emissions

It is proposed that in the short term all fabric first and renewable generation measures are prioritised and implemented across the estate before any heat pump installations occur. This is recommended as Bournemouth University's current energy costs are high due to current wholesale market prices; energy conservation measures will reduce exposure to these, additionally high rates can also be capitalised upon to improve the return-on-investment periods. Following this heat pump installations should occur in line with the existing boiler lifecycle replacement program to ensure that older or inefficient systems are prioritised for replacement.

## Business Case

It is anticipated that implementation of all identified projects would cost in the region of **£14.1M**, this equates to an average capital spend of **£2M** per annum. Initiatives would deliver annual cost savings of **£454k** per annum.

Projects	CAPEX (£)	Cost Savings (£)	Scope 1 Emissions (tCO <sub>2</sub> e)	Scope 2 Emissions (tCO <sub>2</sub> e)
<b>Cavity Wall Insulation</b>	£538,000	£18,187	21.5	0.0
<b>Glazing Upgrade</b>	£990,100	£30,024	43.8	0.0
<b>Heat Reutilisation</b>	£0	£39,960	0.0	21.6
<b>Solar PV</b>	£554,573	£155,647	0.0	84.1
<b>ASHP</b>	£4,663,749	£58,772	665.3	-214.9
<b>GSHP/Ambient Loop</b>	£7,372,000	£151,877	495.3	-132.7
<b>Total</b>	<b>£14,118,422</b>	<b>£454,467</b>	<b>1226.0</b>	<b>-242.4</b>

## Key Recommendations

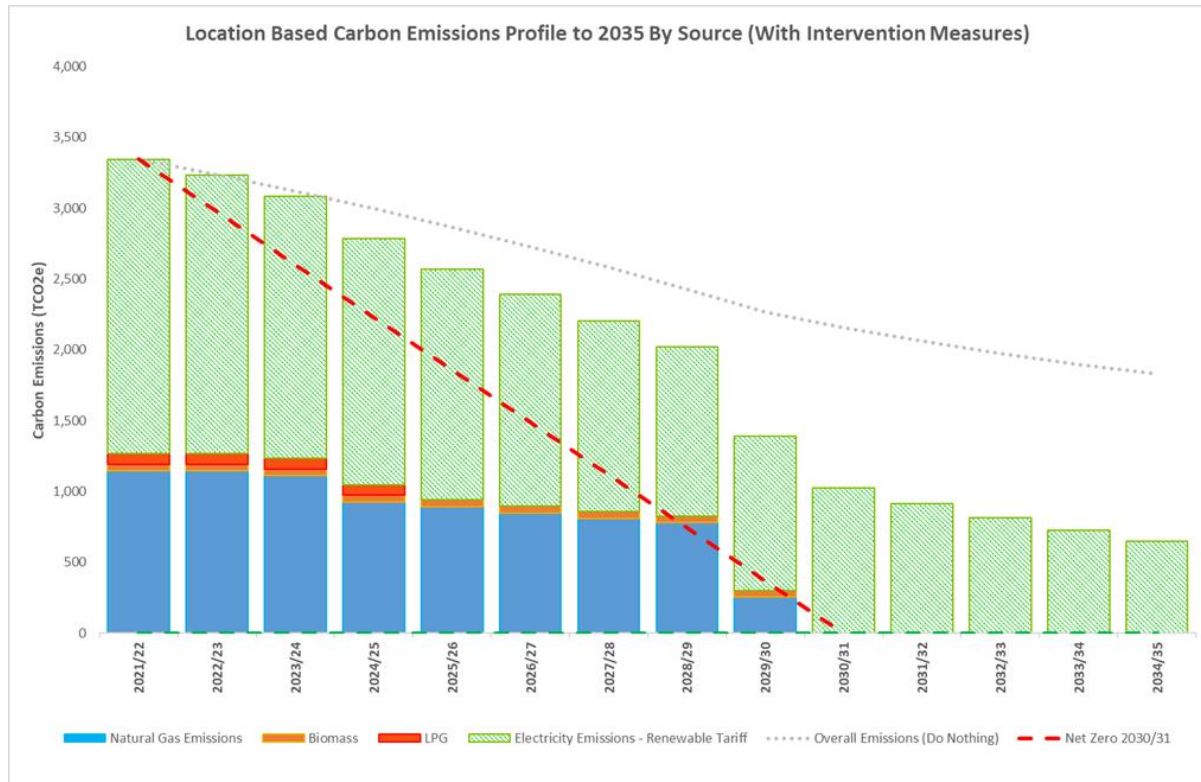
The site assessments have identified that the following interventions could be made at each site:

Capital Projects Carbon Savings (tCO <sub>2</sub> e Scope 1 & 2)								
Campus	Building	Cavity Walls Insulation	Heat Reutilisation	Glazing Upgrade	Solar PV	ASHP	GSHP/ Ambient Loop	Total
Chapel Gate	Changing Rooms & Squash Courts	1.1			6.3	31.3		38.4
	Clubhouse	0.6			7.9	0.6		7.9
	Cricket Pavilion							
	Football Club Changing Rooms							
	Groundsman's Compound							
	Summer Cricket Pavilion							
Lansdowne	Bournemouth Gateway Building					68.4		68.4
	The Old Fire Station			3.4		12.9		16.4
	Studland House					23.6		23.6
Talbot	Christchurch House				15.9		41.3	57.2
	Dorset House	0.3		23.8	19.3	31.4		74.8
	Fusion Building					98.8		98.8
	Jurassic House		21.6					21.6
	Kimmeridge House				4.0	26.2		30.2
	Poole Gateway Building						84.8	84.8
	Poole House	18.3					181.3	199.6
	Student Centre					31.0		31.0
	Sir Michael Cobham Library	1.1		6.7	11.9	67.6		87.4
	Talbot House			1.1	10.2	16.8		28.0
Weymouth House				2.2		55.2	57.4	
Yeovil	University Centre Yeovil			8.8	6.3	20.6		35.8

- The site with the largest carbon saving potential is Poole House
- There are building fabric upgrade opportunities at 7 of the sites, glazing upgrades at Dorset House and cavity wall insulation at Poole House deliver the highest carbon savings
- There are 9 sites with the potential to install solar PV, Dorset House, Christchurch House and Sir Michael Cobham Library provide the best opportunity for onsite generation
- There are opportunities for heat pumps installations at 16 sites, 12 air source and 4 ground source heat pumps. Poole House (GSHP), Fusion Building (ASHP) Poole Gateway Building (GSHP), Bournemouth Gateway Building (ASHP) and Sir Michael Cobham Library (ASHP) provide the greatest opportunities for heat decarbonisation.

### Interventions Trajectory

This assessment predicts that Bournemouth University could be able to achieve its Scope 1 and 2 operational Net Zero Target of 2030/31 if the following recommendations are delivered



Year	Site	Measure
2023	Chapel Gate - Changing Rooms and Squash Courts	Building Fabric Upgrades
2024	Chapel Gate - Changing Rooms and Squash Courts Talbot Campus – Weymouth House	PV
	Chapel Gate - Clubhouse	Building Fabric Upgrades & PV
	Talbot Campus - Dorset House Talbot Campus - Kimmeridge House Talbot Campus - Sir Michael Cobham Library	Air Source Heat Pump & PV
2025	Talbot Campus - Poole House Yeovil - University Centre Yeovil	Building Fabric Upgrades
	Chapel Gate - Clubhouse	Air Source Heat Pump
	Chapel Gate - Changing Rooms and Squash Courts	Air Source Heat Pump
2026	Lansdowne - The Old Fire Station	Air Source Heat Pump & Fabric Upgrades
	Talbot Campus – Talbot House	Air Source Heat Pump
	Yeovil - University Centre Yeovil	PV
2027	Lansdowne - Studland House	Air Source Heat Pump
	Talbot Campus – Talbot House	PV & Fabric Upgrades
2028	Yeovil - University Centre Yeovil	Air Source Heat Pump
2029	Talbot Campus - Poole House	Ground Source Heat Pump
	Talbot Campus - Student Centre	Air Source Heat Pump
2030	Lansdowne - BGB Talbot Campus - Fusion Building	Air Source Heat Pump
	Talbot Campus – Christchurch House	Ground Source Heat Pump and PV
	Talbot Campus - Poole Gateway Building Talbot Campus – Weymouth House	Ground Source Heat Pump

## Delivery Plan

Through analysing the findings from the site assessment and aligning recommendations with the estates boiler lifecycle replacement plan it is also possible to create a capital projects pipeline for the proposed initiatives. It is estimated that this will involve around £14.1m of project works. Around 85% (£12m) of capital project cost is associated with the replacement of boilers with heat pumps, 11% (£528k) relates to building fabric upgrades, with the remaining 4% (£554k) relating to Solar PV.

Capital Projects Cost (£k ex VAT)										
Campus	Building	2023	2024	2025	2026	2027	2028	2029	2030	Total
Chapel Gate	Changing Rooms & Squash Courts	£49k Cavity Wall	£42k PV	240k ASHP						£331k
	Clubhouse		£34k/£53k Cavity Wall & PV	£200k ASHP						£287k
	Cricket Pavilion									
	Football Club Changing Rooms									
	Groundsman's Compound									
	Summer Cricket Pavilion									
Lansdowne	Bournemouth Gateway Building								£440k ASHP	£440k
	The Old Fire Station					£111k Glazing	£300k ASHP			£411k
	Studland House					£600k ASHP				£600k
Talbot	Christchurch House								£106k / £1,292k PV & GSHP	£1,398k
	Dorset House	£429k Glazing & cavity wall	*£556k ASHP & PV							£985k
	Fusion Building								£500k ASHP	£500k
	Jurassic House									£0k
	Kimmeridge House		*£367k ASHP & PV							£367k
	Poole Gateway Building								£950k GSHP	£950k
	Poole House				£368k Cavity Wall				£3,420k GSHP	£3,788k

	Student Centre							£320k ASHP		£320k
	Sir Michael Cobham Library	£228k Glazing & cavity wall	*£608k ASHP & PV							£836k
	Talbot House		£68k PV	£33k Cavity Wall	£360k ASHP					£461k
	Weymouth House		£14k PV						£1,710k GSHP	£1,724k
Yeovil	University Centre Yeovil		£42k PV	£275k Glazing			£400k ASHP			£717k
<b>Total</b>		<b>£706K</b>	<b>£1,784K</b>	<b>£1,116K</b>	<b>£360K</b>	<b>£711K</b>	<b>£700K</b>	<b>£3,740K</b>	<b>£4,998K</b>	<b>£14,115K</b>

\*£1.6m (incl. VAT) funding secured in PSDS3b for ASHP KH, DH and SMCL and PV DH (meaning that VAT is £320k included in the above).

Note: Figures do not include inflation.

### Delivery Mechanism

Individual decarbonisation projects will be listed within EDF ‘in principle’ and initiated by means of individual detailed business cases presented to Estates Development Committee.

The BU Estates Development Committee oversees capital works on campus and will approve any and all activity within this plan. Specific business cases will be submitted for each project to enable their implementation.

The Heat Decarbonisation Plan will also be incorporated into the wider BU Estates Development Framework (EDF), which sets the University’s mid and long-term capital investment plans. The Heat Decarbonisation plan will underpin the formation of the next investment plan (EDF3) covering the period between 2025 and 2032. The HDP estimated budget to 2030 will inform the EDF3 decarbonisation budget.

Procurement route for HDP projects will need to comply with BU relevant procurement policies and will be reviewed on case-by-case basis. Procurement strategy for each project will be approved as part of the BU established business case approval process.

Once a business case for a project is approved, Estates Development will allocate a Senior Project Manager who will procure a consultants team, manage the design process, procure the main contractor and manage the delivery on site. Sustainability will oversee the delivery against the CECAP targets and timescales and FM team will ensure that the proposed works are aligned with the planned preventative maintenance strategy.

The Senior Project Manager will also appoint a cost consultant that will undertake the role of contract administrator. The delivery of the outputs will be closely monitored by Estates Development, Sustainability and FM teams and reported monthly to the Estates Development Committee. Project delivery would be supported by external contractors who would carry out any project installations, this would be managed by the BU senior project manager. Bournemouth University will follow the Procurement Manual to appoint contractors to deliver the identified HDP projects.

## Resources

In order to deliver this heat decarbonisation plan it is recognised that significant capital expenditure and internal resource is required. In total 16 heating systems will need to be replaced with heat pumps by 2030, this averages at 2 per year however it is recognised that a greater number of the larger more complex installations will need to be completed in 2029 and 2030 when existing systems reach the end of their serviceable lives. Significant planning and resources will therefore need to be allocated to this heat decarbonisation plan to ensure it is successful.

The proposed solutions in this HDP are based on a technical assessment undertaken by Mitie. Further investigations will be carried out by BU's energy management team with the capital development team to ensure that they are practical, fit for purpose and achievable

### Responsibilities

This programme will be owned and driven as part of the Climate and Ecological Crisis Action Plan (CECAP) which is signed off by BU board and includes a commitment to move away from gas for heating. The Sustainability Committee own delivery of the CECAP and will oversee the implementation of the Heat Decarbonisation Plan which is an essential part of its success.

- The senior sponsor is the Estates Director. Reports on progress will be received by the Sustainability Committee from the CECAP group
- Responsibility for delivering the HDP will sit with the Sustainability Manager and the Energy Manager who will work closely with the Estates Director and the Head of Estates Development
- Individual heat decarbonisation projects, aligned with EDF, CECAP and HDP will be delivered by BU Estates Development team in partnership with Sustainability and Facilities Management teams

### Competence and Training

The highlighted individuals and teams that have overall responsibility to deliver the HDP are at present deemed competent and in possession of the necessary skills, expertise and knowledge. No additional training is anticipated for the delivery of the HDP; however, this will be reviewed regularly and identified through the project plans that will be required to manage individual projects. Any additional training can be funded through the estates training budget at BU.

### Measurement and Verification

The sustainability team currently manage and monitor ongoing energy consumption through processes defined in BU's ISO50001 certified Energy Management System. This uses an automatic metering system to monitor building energy consumption. Within the eight person sustainability team there are three energy staff (Energy Manager, Energy Officer and Sustainability and Energy Analyst). The Sustainability and Energy Manager will measure and verify building energy consumption and proposed savings of any implemented initiative. This will be supported by adequate submetering of any new assets.



## Challenges

There will be a number of challenges associated with delivering this heat decarbonisation plan and achieving net zero carbon across the estate:

### **Capital Expenditure and Funding**

A key challenge will be sourcing and signing off on the significant capital sums required to replace the existing plant as the installation of heat pump technology will be significantly more expensive than like for like replacement.

In total a budget of £14.1m will be required, which will need to be earmarked for low carbon projects. Individual projects will range in cost from £34k-£3.4m and therefore these will require different levels of approval, budgeting and funding routes. The HDP estimated budget to 2030 will inform the EDF3 decarbonisation budget.

If additional financial resources are required for delivery in excess of the normal cycle of capital expenditure, this could be met through a combination of savings from the implementation of energy saving projects or pursuing grant funding from external services, such as the Public Sector Decarbonisation Scheme.

Funding is available to support with delivery as highlighted in the Funding Routes and Procurement Options section. However commercial risks will need to be reviewed if considering third party funding; an eligibility and availability review will be also required if considering public funding to guarantee chances of application success.

A challenge for BU is that many of the buildings still have useable gas boilers with 10 years of life remaining making them less suitable for obtaining external funding through opportunities like PSDS. However third party funding may be able to address this challenge.

### **Age, Condition and Operation Across the Estate**

Many of the buildings considered are inherently energy inefficient due to their age, therefore they are challenged with improving fabric insulation U values to ensure that that heat pumps provide sufficient heat demand. Improving the thermal efficiency of the buildings will therefore be a challenge due to the level of financial investment required and their relatively long paybacks.

Full feasibility studies are required to further understand the practicality and viability for low carbon transition at these sites to ensure that this HDP is deliverable. This will need to include further assessment of the correct technology application/ guarantee of carbon savings, particularly where energy costs increase due to the electrification of heat.

Although the installation of heat pumps will save a significant amount of energy and carbon, energy cost savings are negligible due to the fact that gas is directly replaced for electricity. There is also the potential for an increased cost of operating buildings through electrically derived heat rather than gas. Whilst heat pumps are over three times more efficient, electricity rates are significantly higher than gas at present meaning any cost savings will be mitigated by this cost differential. This will impact the opex budgets and impact capex business cases if energy cost savings are the sole consideration. BU will take a lifecycle approach to any project to identify the long-term cost and carbon savings

BU will investigate opportunities to further invest in M&V for the HDP, to accurately understand the quantified savings and deploy early mitigation/ correction to facilitate NZ strategy. A supporting metering strategy will also need to be in place to monitor operational performance. A review of operational changes as a result of implementing HDP is also required to understand the operational impact i.e., additional maintenance costs. Finally, campus behavioural training and energy awareness will also be implemented to ensure the buildings and new assets are managed as efficiently as possible.

### **Grid Constraints**

The success of this plan will be defined by the ability to increase energy capacity onsite. It is expected that in order to deliver this plan, grid infrastructure upgrades will be required at sites lacking a medium voltage supply. This will need to accommodate plans for other projects; EV charging, solar PV and data centres as examples. Additional project works and cost incursions will be required to increase this with the DNO if sites wish to increase demand. Site's will therefore factor in additional infrastructure costs and undertake an assessment to fully understand feasibility and liability challenges.

### **Governance**

Effective governance strategies and processes will be required to deliver this HDP and bring projects to fruition, processes, frameworks and signoff approval policies will need to align with the HDP to facilitate its implementation. BU will ensure that the current procurement frameworks and project approval purposes are fit for purpose, HDP Critical Path Planning will also occur. A review of upcoming legislation changes will also be implemented to ensure this HDP aligns with current government NZ strategies.

Finance and legal departments review business cases and contract approval forms before contracts to third parties can be issued, projects over a certain level also require approval by the BU board. Both elements may delay delivery timelines therefore Bournemouth University will ensure that there is sufficient knowledge of the HDP from a governance level and that budgets and resources are forward allocated to this plan.

### **Other**

There are a number of challenges around delivery on a live student campus. Areas will need to be fenced off, staff and students will need to be reallocated where required. This may require work during term holidays where practical. BU are familiar with managing these processes.

## Funding Routes and Procurement Options

### Carbon Performance Contract

As part of a first step approach to heat decarbonisation and reaching Net Zero, Bournemouth University could agree a Carbon Performance Contract (CPC) which targets existing assets to make your buildings more efficient without investing in new assets or infrastructure.

The approach is based on optimisation - adjusting existing equipment and comfort policies to bring your building back to peak efficiency without any capital expenditure. The contractor will agree a target carbon saving (starting from 10%) and connect your BMS, a team of experts continually audit the collected data to identify ways to optimise. All carbon savings are independently verified through the IPMVP® Standard and the cost savings shared.

### Public Sector Decarbonisation Scheme (PSDS)

The Public Sector Decarbonisation Scheme provides grants for public sector bodies to fund heat decarbonisation and energy efficiency measures. The Scheme aims to support the public sector in taking a 'whole building' approach when decarbonising their estates and is aimed at heat decarbonisation, energy efficiency, and renewable generation.

PSDS funding is available through Phase 3 application windows with a total of £1.425 billion of grant funding over the financial years 2022-2023 to 2024-2025, through multiple application windows. Whilst the application window for Phase 3b closed in October 2022, it is anticipated the next available opportunity to apply for funding will be late Summer/Autumn 2023 through Phase 3c.

BU have been successful accessing PSDS 3b funding for £1.4m for 2023-24 so have experience with this programme.

### Third Party Funding

There are a wide variety of third-party contracting and financing techniques for energy efficiency and renewable energy projects, generally covered under terms such as Third Party Financing (TPF), Energy Performance Contracting (EPC), and Contract Energy Management (CEM). TPF solutions often combine both technical and financial instruments ensuring that the most suitable technical solutions are backed up with the necessary financial resources to implement the projects successfully.

While exact approaches may differ, the essence of these approaches is that energy efficiency projects generate energy costs savings, which can be turned into cash flows to the lender (e.g., ESCo) based on the commitment of the energy user to pay for the savings. Projects funded through the lender transfer the technology and management risks away from the end-user to the lender, placing emphasis of these financing routes typically on results rather than upfront costs.

If considering third party finance options, factors such as aggregation of projects (for maximum benefit), project payback, length of contracting period, future site strategy, and procurement routes need to be considered.

## Carbon Compensation

Carbon compensation, or offsetting, is the action or process of compensating for carbon dioxide emissions arising from industrial or other human activity, by participating in schemes designed to make equivalent reductions of carbon dioxide in the atmosphere. For example, a manufacturing company could offset its carbon dioxide emissions through investing in wind and solar projects in a different location.

Carbon offsetting could be considered as part of the Heat Decarbonisation Plan, as well as the wider Net Zero journey. Once all cost-effective energy efficient measures have been exhausted it is likely carbon offsetting will be required in the short term to obtain net zero status. As carbon offsetting funds a majority solution to cut carbon emissions, it is generally accepted that carbon offsetting reduces emissions faster than a company/ individual can achieve.

On a more holistic consideration, carbon offsetting projects help to combat global climate change as well as caring for local communities and in many instances, provides much needed employment, community improvement, biodiversity, reforestation and broad social benefits to many communities.

It is important to remember that carbon offsetting is not the solution to climate change. Offsetting provides a mechanism to reduce greenhouse gas (GHG) emissions in the most cost-effective and economically efficient manner. Offsetting plays a vital role in combatting climate change but should not be an isolated solution.

PAS 2060 is the BSI standard that specifies the requirements an entity requires if they are seeking to become carbon neutral, allowing them to improve their environmental credentials with accuracy and transparency and this standard is recognised within the industry.

Carbon Offsetting is an accepted practice within the PAS 2060 framework which must satisfy the following criteria;

- Credits generated or allowance credits surrendered shall represent genuine, additional GHG emission reductions elsewhere.
- Projects involved in delivering carbon credits shall meet the criteria of additionality, permanence, leakage and double counting. (for further information see WRI Greenhouse Gas Protocol)
- Carbon credits shall be verified by an independent third-party verifier. (see below for further details)
- Credits from Carbon offset projects shall only be issued after the emission reduction associated with the offset project has taken place.
- Credits from carbon offset projects other than events shall be retired within 12 months of the date of the declaration of achievement. For events, the period of retirement should be as short as can be reasonably achieved and shall be not more than 36 months.
- Credits from carbon offset projects shall be supported by publicly available project documentation on a registry or equivalent publicly available record, which shall

provide information about the offset project, quantification methodology and validation and verification procedures.

- Credits from Carbon offset projects shall be stored and retired in an independent and credible registry or equivalent publicly available record.

Globally there are a broad range of options for carbon offsetting projects, the majority are developed by non-profit organisations. As it currently stands, a singular verification standard does not exist; however, multiple organisations exist and fit the criteria set by PAS 2060.

The Carbon Footprint offers a broad range of opportunities from multiple organisations. Costs can vary between £5- £20 a tonne carbon equivalent depending on the type of projects the organisation are interested in and required volume.

## Conclusion & Recommendations

This Heat Decarbonisation Plan has identified the most practical and achievable strategy for Bournemouth University to decarbonise its heating systems and achieve its Climate and Ecological Crisis Action Plan (CECAP) goal of net zero GHG emissions by 2030/31.

In order to understand the overall footprint of the estate half hourly data and monthly meter readings were collated for the period 1st August 2021 to 31st July 2022 to reflect BU's financial year, this also acts as the baseline year for analysis as it was deemed to be most reflective of the organisation in its current form.

A review of the buildings' energy data highlights that the University emitted 2,835 tCO<sub>2</sub>e across the four campuses in 2022. The largest source of carbon emissions relates to scope 2 electricity (58%) followed by scope 1 fossil fuels (42%); these consist predominantly of natural gas (93%), LPG (6%) and Biomass (<1%) used for heat. Removal of scope 1 emissions must be the priority intervention as scope 2 emissions can be mitigated through offsite and onsite renewable generation.

Bournemouth University operate across four large campuses: Chapel Gate Sports Facility, Lansdowne Campus, Talbot Campus, and Yeovil Campus, collectively these accommodate twenty-one buildings.

Each campus has been audited by an Energy Solutions Engineer to identify the opportunities available across each building, this is to ensure that proposed solutions can be tailored to each building’s requirement and situation.

The following strategy was applied to each building in sequential order to identify potential measures:

1. **Fabric First Approach:** Reduce existing thermal demand by improving building fabric, this will reduce heat pump operation costs and could assist with heat pump sizing
2. **Renewable Generation:** Where viable install Solar PV to part mitigate the expected additional electricity demand associated with heat electrification
3. **Heat Electrification:** Remove scope 1 fossil fuel emissions by replacing existing fossil fuel fired heating systems with air source heat pumps
4. **Offsite Renewables:** Ensure that high quality green electricity tariffs are procured to mitigate remaining scope 2 emissions

The audit findings have been developed into a series of recommendations that feed into a projects register for energy efficiency and low carbon transition. These Energy Conservation Measures (ECM) create the basis for the proposed heat decarbonisation strategy. Further to this a delivery programme has been designed to ensure that all projects are implemented before the net zero GHG emissions target of 2030/31.

It is proposed that all fabric first and renewable generation measures are prioritised and implemented across the estate before or in tandem with heat pump installations. This is recommended as Bournemouth University’s current energy costs are high due to current wholesale market prices; energy conservation measures will reduce exposure to these, additionally high rates can also be capitalised upon to improve the return-on-investment periods. Heat pump installations should occur in line with the existing boiler lifecycle replacement program to ensure that older or inefficient systems are prioritised for replacement.

This assessment has identified in total £14.1M (£13.78m ex VAT), of potential decarbonisation projects, £12M of this cost relates to the replacement of boiler systems with air source or ground source heat pumps which will be a key intervention if Bournemouth University wish to remove scope 1 fossil fuel emissions.

Projects	CAPEX (£)	Cost Savings (£)	Scope 1 Emissions (tCO2e)	Scope 2 Emissions (tCO2e)
<b>Cavity Wall Insulation</b>	£538,000	£18,187	21.5	0.0
<b>Glazing Upgrade</b>	£990,100	£30,024	43.8	0.0
<b>Heat Reutilisation</b>	£0	£39,960	0.0	21.6

<b>Solar PV</b>	£554,573	£155,647	0.0	84.1
<b>ASHP</b>	£4,663,749	£58,772	665.3	-214.9
<b>GSHP</b>	£7,372,000	£151,877	495.3	-132.7
<b>Total</b>	<b>£14,118,422</b>	<b>£454,467</b>	<b>1226.0</b>	<b>-242.4</b>

(£13.78m ex VAT)

More specifically the following key initiatives have been identified:

- There are building fabric upgrade opportunities at 7 of the sites, glazing upgrades at Dorset House and cavity wall insulation at Poole House deliver the highest carbon savings
- There are 9 sites with the potential to install solar PV, Dorset House, Christchurch House and Sir Michael Cobham Library provide the best opportunity for onsite generation
- There are opportunities for heat pumps installations at 16 sites, 12 air source and 4 ground source heat pumps. Poole House (GSHP), Fusion Building (ASHP) Poole Gateway Building (GSHP), Bournemouth Gateway Building (ASHP) and Sir Michael Cobham Library (ASHP) will provide the greatest opportunities for heat decarbonisation.
- This report excludes EBC, Student Village, Tolpuddle Annexes, Drewitts Industrial Unit and Wallisdown Playing Fields.

Through analysing the findings from the site assessment and aligning recommendations with the estates boiler lifecycle replacement plan it is also possible to create a capital projects pipeline for the proposed initiatives. It is expected that the following pipeline of projects will need to be implemented in order to decarbonise the estate’s heating systems and reduce overall emissions:

Capital Projects Cost (£k ex VAT)										
Campus	Building	2023	2024	2025	2026	2027	2028	2029	2030	Total
Chapel Gate	Changing Rooms & Squash Courts	£49k Cavity Wall	£42k PV	240k ASHP						£331k
	Clubhouse		£34k/£53k Cavity Wall & PV	£200k ASHP						£287k
	Cricket Pavilion									
	Football Club Changing Rooms									
	Groundsman’s Compound									
	Summer Cricket Pavilion									

Lansdowne	Bournemouth Gateway Building							£440k ASHP	£440k	
	The Old Fire Station					£111k Glazing	£300k ASHP		£411k	
	Studland House					£600k ASHP			£600k	
Talbot	Christchurch House							£106k / £1,292k PV & GSHP	£1,398k	
	Dorset House	£429k Glazing & cavity wall	*£556k ASHP & PV						£985k	
	Fusion Building							£500k ASHP	£500k	
	Jurassic House								£0k	
	Kimmeridge House		*£367k ASHP & PV						£367k	
	Poole Gateway Building							£950k GSHP	£950k	
	Poole House			£368k Cavity Wall				£3,420k GSHP	£3,788k	
	Student Centre							£320k ASHP	£320k	
	Sir Michael Cobham Library	£228k Glazing & cavity wall	*£608k ASHP & PV						£836k	
	Talbot House		£68k PV	£33k Cavity Wall	£360k ASHP				£461k	
Weymouth House		£14k PV					£1,710k GSHP	£1,724k		
Yeovil	University Centre Yeovil	£42k PV	£275k Glazing			£400k ASHP		£717k		
<b>Total</b>		<b>£706K</b>	<b>£1,784K</b>	<b>£1,116K</b>	<b>£360K</b>	<b>£711K</b>	<b>£700K</b>	<b>£3,740K</b>	<b>£4,998K</b>	<b>£14,115K</b>

\*£1.6m (incl. VAT) funding secured in PSDS3b for ASHP KH, DH and SMCL and PV DH (meaning that VAT is £320k included).

Note: Figures do not include inflation.

In order to deliver this heat decarbonisation plan it is recognised that significant capital expenditure and internal resource will be required. It must be highlighted that there will also be a number of challenges associated with delivering this plan, in particular the age, condition and operation of the estate, further feasibility work will be required to understand how practical some of the proposed measures will be to deliver.



Funding, planning and governance will also provide key challenges. Bournemouth University is in an excellent position to make this successful as the HDP will be incorporated into the wider BU Estates Development Framework (EDF), which sets the University’s mid and long-term capital investment plans. The Heat Decarbonisation plan will underpin the formation of the next investment plan (EDF3) covering the period between 2025 and 2032.

## Recommended Next Steps

Bournemouth University aims to implement the above solutions in a phased approach, in line with the availability of capital funding through various means, including capital budgeting and external grants or loans for example PSDS funding. In order to progress these opportunities further, other enabling actions will be carried out alongside securing the capital required, which are summarised below:

- Conduct geological and ground surveys to ascertain the feasibility for GSHP installations, and if viable engage the Environment Agency to discuss permitting
- Undertake ASHP feasibility studies to understand their viability, confirm the type required and identify what heating system modifications are required
- Undertake further PV and heat pump design work to identify the options available on site and to refine costing models
- Engage the relevant District Network Operator, DNO, to understand local electrical infrastructure limitations and the potential requirement to increase available capacity
- Incorporate the outlined projects into the wider BU Estates Development Framework (EDF) to secure capital funding up to 2030/31
- Identify alternative funding routes for building fabric improvements and low carbon projects that have not been secured through BU Estates Development Framework (EDF), utilising options outlined within the “Funding Routes and Procurement Options” section of this report.
- Engage potential suppliers relevant to all projects outlined, in order to obtain quotes and time-frames for works, thus enabling the creation of shovel ready project portfolios.
- Implement a monitoring and verification program for any projects implemented
- Recommend that Sustainable Construction Policy is updated to avoid new gas boilers being added to any future development.

## Glossary of Terms

Term	Description	Definition
ASHP	Air Source Heat Pump	A type of heat pump that can absorb heat from outside a structure and release it inside using the same vapor-compression refrigeration process and much the same equipment as air conditioners but used in the opposite direction.
AHU	Air Handling Unit	An AHU is used to re-condition and circulate air as part of a heating, ventilating and air-conditioning system.

Term	Description	Definition
Carbon Compensation	Carbon compensation, or Carbon Offsetting	Schemes which allow individuals and businesses to invest in environmental projects around the world to balance out their own carbon emissions.
Carbon Intensity Ratio	Carbon Intensity Ratio	A method of defining emissions data in relation to an appropriate business metric, such as tonnes of CO <sub>2</sub> e per sales revenue, or tonnes of CO <sub>2</sub> e per total square metres of floor space.
Carbon Saving	Carbon Saving	Averaging BEIS electrical emission factors over anticipated lifetime
CO <sub>2</sub>	Carbon Dioxide	A Greenhouse Gas (GHG) which is colourless with a density ~53% higher than that of dry air.
CO <sub>2</sub> e	Carbon Dioxide Equivalent	A standard unit for measuring carbon footprints
CCM	Carbon Conservation Measure	The upgrades, retrofits, repairs, and replacements that businesses can implement to become more carbon neutral.
ECM	Energy Conservation Measure	The upgrades, retrofits, repairs, and replacements that businesses can implement to become more energy efficient.
FEED	Front-End Engineering Design	Basic engineering which is conducted after completion of Conceptual Design or Feasibility Study.
GHG	Greenhouse Gas	A gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect on planets.
GSHP	Ground Source Heat Pump	A heating/ cooling system for buildings that uses a type of heat pump to transfer heat to or from the ground, taking advantage of the relative constancy of temperatures of the earth through the seasons.
HPHW	High Pressure Hot Water	Water systems which operate at 1.0 bar pressure (10m of drop) or greater are considered high pressure systems.
IGP	Investment Grade Proposal	
kW	Kilowatt	
kWh	kilowatt-hour	a unit of energy equal to 3600 kilojoules (3.6 megajoules) and commonly used as a billing unit for energy delivered.
LTHW	Low Temperature Hot Water	A low-temperature heating system is defined as one in which the hot water leaving the heat generator is always at a temperature not exceeding 45°C or 35°C,
MAC	Marginal Abatement Cost	The marginal abatement cost, in general, measures the cost of reducing one more unit of pollution. Although marginal abatement costs can be negative, such as when the low carbon option is cheaper than the business-as-usual option, marginal

Term	Description	Definition
		abatement costs often rise steeply as more pollution is reduced.
m <sup>2</sup>	Square metre	The area equal to a square that is 1 meter on each side.
m <sup>3</sup>	Cubic metre	Unit of volume (length/ width/ height).
MW	Megawatt	Unit of power equal to one million watts, especially as a measure of the output of a power station.
Net Zero	Net Zero Carbon	The balancing of amount of emitted greenhouse gases with the equivalent emissions that are either offset or sequestered.
NPV	Net Present Value	The difference between the present value of cash inflows and the present value of cash outflows over a period of time
Persistence Factors	Persistence Factors	Anticipated lifetime of an energy efficiency technology in years
PPA	Power Purchase Agreement	Also known as electricity power agreement, is a contract between two parties, one which generates electricity and one which is looking to purchase electricity.
Scope 1	Scope 1 Emissions	Emissions are direct emissions from owned or controlled sources.
Scope 2	Scope 2 Emissions	Emissions are indirect emissions from the generation of purchased energy.
Scope 3	Scope 3 Emissions	Emissions are all indirect emissions (not included in Scope 2) that occur in the value chain of both upstream and downstream emissions.
Sequestration	Carbon Sequestration	The process of capturing and storing atmospheric carbon dioxide.
VSD	Variable Speed Drive	Devices that can vary the speed of a normally fixed speed motor.
WBT	Wet Bulb Temperature	The lowest temperature to which air can be cooled by the evaporation of water into the air at a constant pressure

## Change control log

Version no.	Date	Changes made by	Changes made
I	20.3.23	Lois Betts BU Sustainability Manager following feedback from Estates Development Committee	<ul style="list-style-type: none"> <li>- Recommendation for Sustainable Construction Policy added into recommended next steps.</li> <li>- Clarified in table page 99 that figures are ex VAT and don't include inflation. PSDS3b grant fund amounts do include VAT. Summary statement added showing that £320k VAT is removed from CAPEX total for consistency.</li> <li>- Removed appendix with heat network map which is deemed irrelevant as stated on page 63.</li> </ul>
