# Bournemouth University

## Heat Decarbonisation Plan

Full Plan

March 2023.

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

Version 2 - Revised numbers from Mitie in Feb 24

# 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 tCO2e 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.

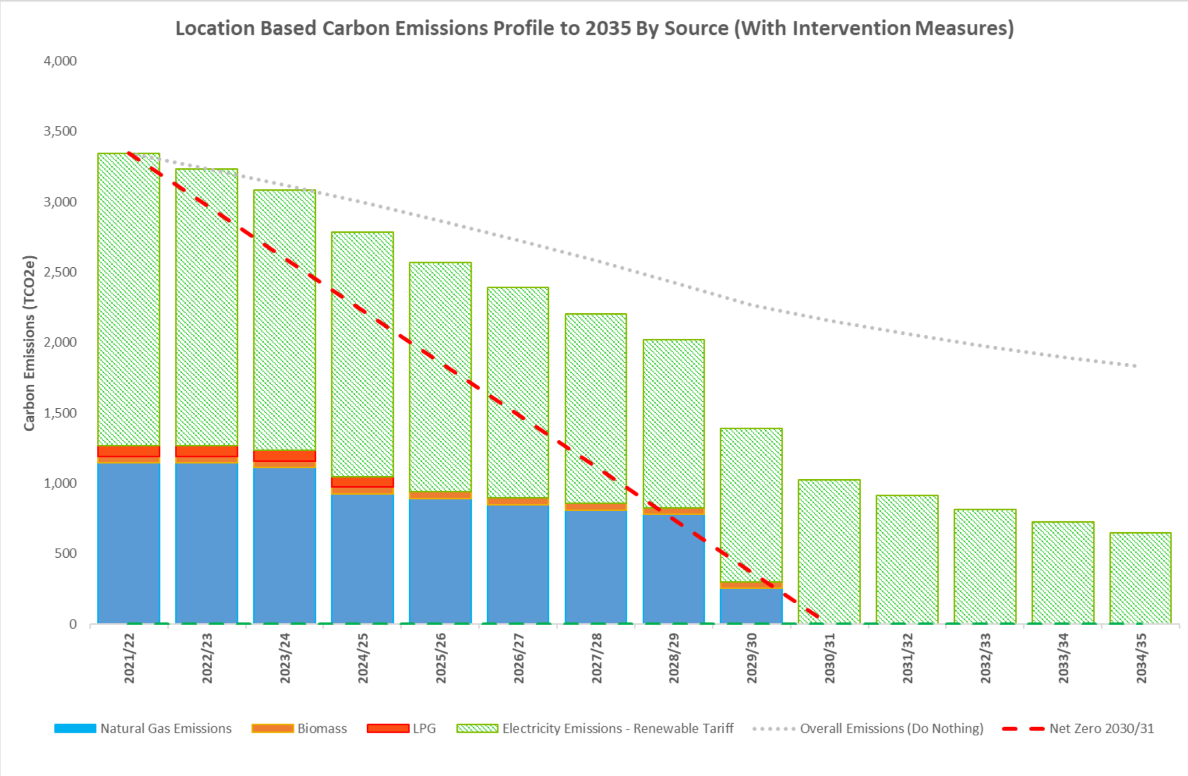
- There are building fabric upgrade opportunities at 7 of the sites, glazing upgrades at Dorset House and cavity wall insulation at Poole House deliver the highest carbon savings
- There are 9 sites with the potential to install solar PV, Dorset House, Christchurch House and Sir Michael Cobham Library 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 £21.8m this equates to an average capital spend of £3M per annum. The initiatives are estimated to deliver annual cost savings of £454k per annum.

| | CAPEX (£) | Cost Savings (£) | Scope 1 Emissions (tCO2e) | Scope 2 Emissions (tCO2e) |
|---|---|---|---|---|
| **Cavity Wall Insulation** | £538,000 | £18,187 | 21.5 | - |
| **Glazing Upgrade** | £990,100 | £30,024 | 43.8 | - |
| **Heat Reutilisation** | - | £39,960 | - | 21.6 |
| **Solar PV** | £554,573 | £155,647 | - | 84.1 |
| **ASHP** | £9,825,300 | £58,772 | 665.3 | -214.9 |
| **GSHP/Ambient Loop** | £9,885,445 | £151,877 | 495.3 | -132.7 |
| **Total** | **£21,793,418** | **£454,467** | **1226.0** | **-242.4** |

*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<br>Talbot Campus – Weymouth House | PV |
| | Chapel Gate - Clubhouse | Building Fabric Upgrades & PV |
| | Talbot Campus - Dorset House<br>Talbot Campus - Kimmeridge House<br>Talbot Campus - Sir Michael Cobham Library | Air Source Heat Pump & PV |
| 2025 | Talbot Campus - Poole House<br>Yeovil - University Centre Yeovil | Building Fabric Upgrades |
| | Chapel Gate - Clubhouse<br>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<br>Talbot Campus - Fusion Building | Air Source Heat Pump |
| | Talbot Campus – Christchurch House | Ground Source Heat Pump and PV |
| | Talbot Campus - Poole Gateway Building<br>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.

# Contents

# 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 ($CO_2$), 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 ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride ($SF_6$).

# 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 1fossil 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, Lansdown, 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 ($m^2$) | 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 |
| | **Sub Total** | | **2,503** | |
| Lansdowne | Bournemouth Gateway Building | 2022 | 10,368 | A |
| | Studland House | 1980 | 1,706 | C |
| | The Old Fire Station | 1900 | 5,971 | C |
| | **Sub Total** | | **12,074** | |
| 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 |
| | **Total** | | **60,027** | |
| Yeovil | University Centre Yeovil | 1980 | 2,197 | B |
| | **Sub Total** | | **2,197** | |

*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 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/m2) | Thermal Intensity (kWh/m2) |
|---|---|---|---|---|---|---|---|
| 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 |
| **Total** | | **7,859,654** | **6,277,506** | **351,779** | **438,000** | | |

*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.

<table>
<tr><th>Data Quality</th><th>Electricity</th><th>Natural Gas</th><th>LPG</th><th>Biomass</th><th>Catering</th></tr>
<tr><td>Clubhouse</td><td rowspan="5">Full 12 months AMR</td><td rowspan="6">N/A</td><td rowspan="2">Monthly Data</td><td rowspan="6">N/A</td><td rowspan="2">Assumed LPG for catering is bottled</td></tr>
<tr><td>Changing Rooms and Squash Courts</td></tr>
<tr><td>Football Club Changing Rooms</td><td rowspan="4">N/A</td><td rowspan="4">N/A</td></tr>
<tr><td>Groundsman's compound</td></tr>
<tr><td>Cricket Pavilion</td></tr>
<tr><td>Summer Cricket Pavilion</td><td>N/A</td></tr>
<tr><td>BGB</td><td>Full 12 months AMR</td><td>Full 12 months AMR</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>The Old Fire Station</td><td>Full 12 months AMR</td><td>Monthly Data</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
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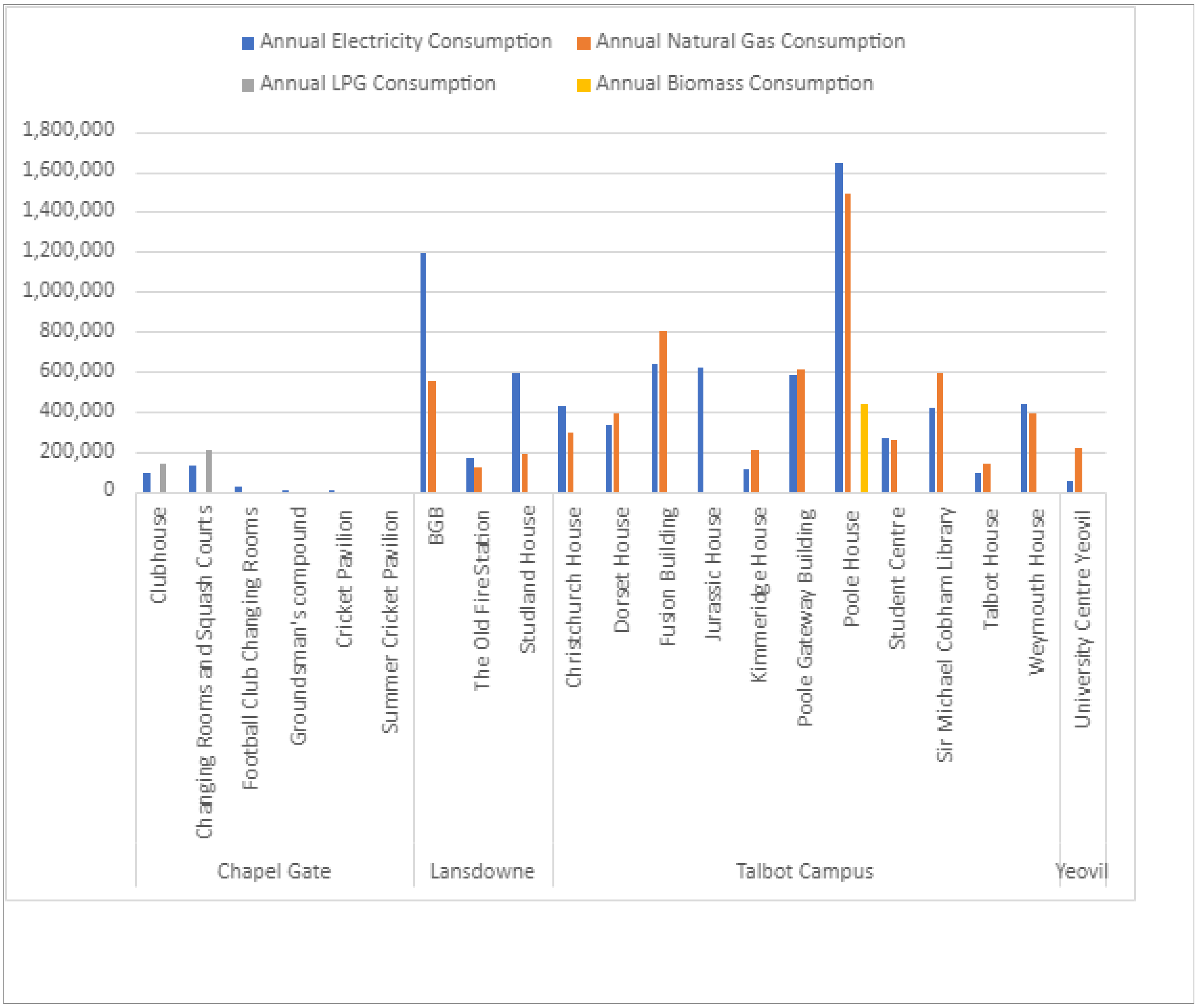
<tr><td>Dorset House</td><td>Full 12 months AMR</td><td>Full 12 months AMR</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Fusion Building</td><td>Full 12 months AMR</td><td>Full 12 months AMR</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Jurassic House</td><td>Full 12 months AMR</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Kimmeridge House</td><td>Full 12 months AMR</td><td>Full 12 months AMR</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

| 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 |

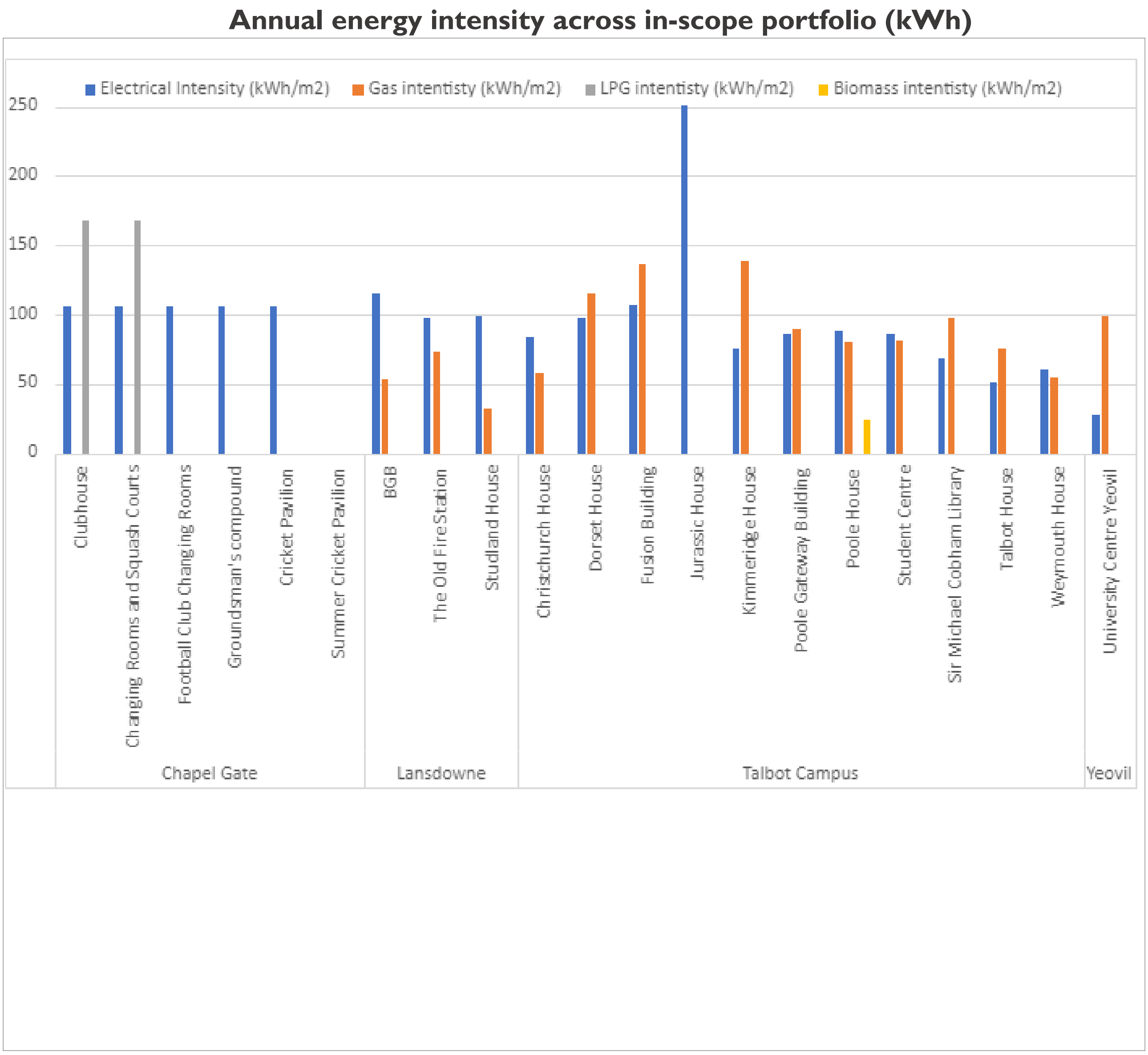
*Table 7. Energy Data Source by Site*

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)**

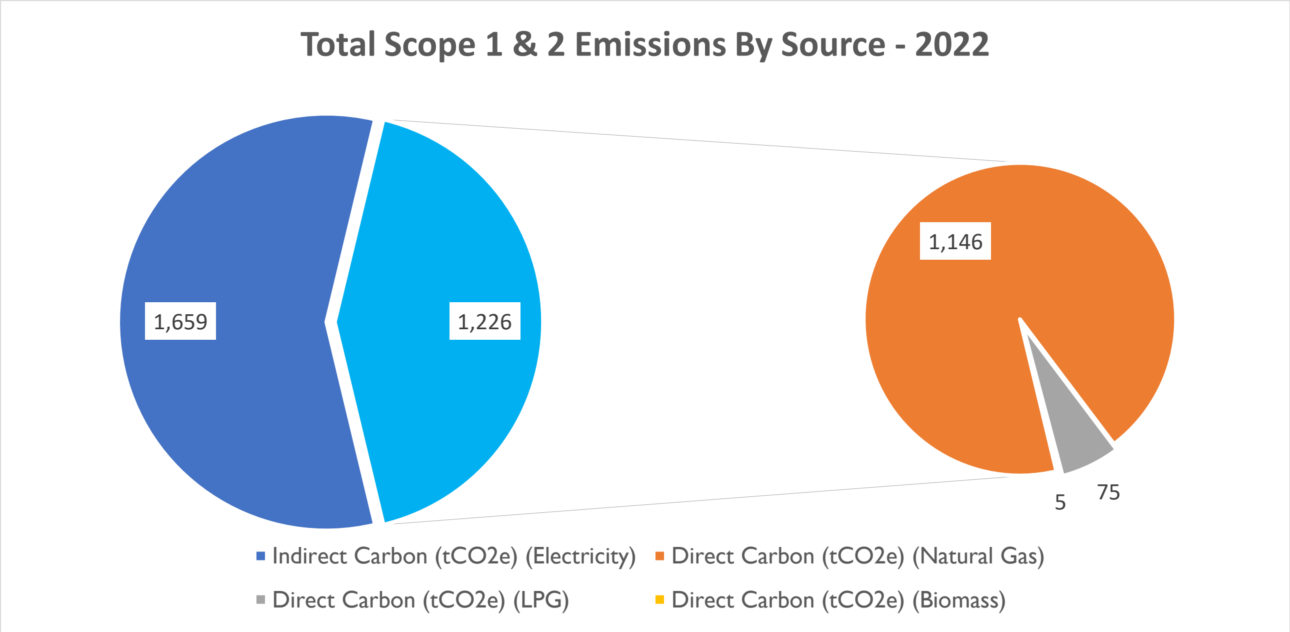



Despite having a large energy consumption, the energy intensity of Poole House is relatively low. Jurassic House, however, has an extremely intensive electrical demand due to the data centre and cooling plant located within.


Annual energy intensity across in-scope portfolio (kWh)
Electrical Intensity (kWh/m2)
Gas intentisty (kWh/m2)
LPG intentisty (kWh/m2)
Biomass intentisty (kWh/m2)
250
200
150
100
50
0
Clubhouse
Changing Rooms and Squash Courts
Football Club Changing Rooms
Groundsman's compound
Cricket Pavilion
Summer Cricket Pavilion
BGB
The Old Fire Station
Studland House
Christchurch House
Dorset House
Fusion Building
Jurassic House
Kimmeridge House
Poole Gateway Building
Poole House
Student Centre
Sir Michael Cobham Library
Talbot House
Weymouth House
University Centre Yeovil
Chapel Gate
Lansdowne
Talbot Campus
Yeovil

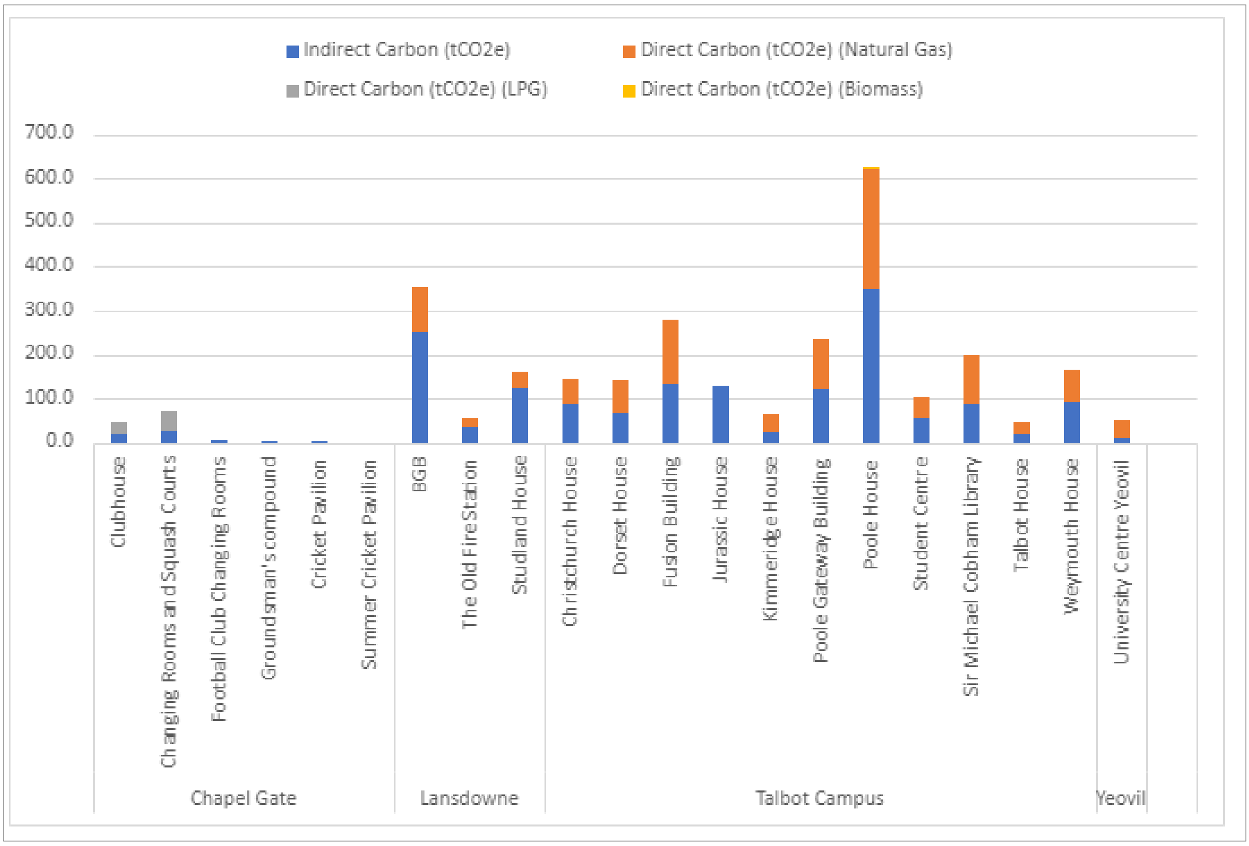
## Carbon Emissions

A review of the buildings' energy data highlights that the University emitted 2,835 $tCO_2e$ 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%).



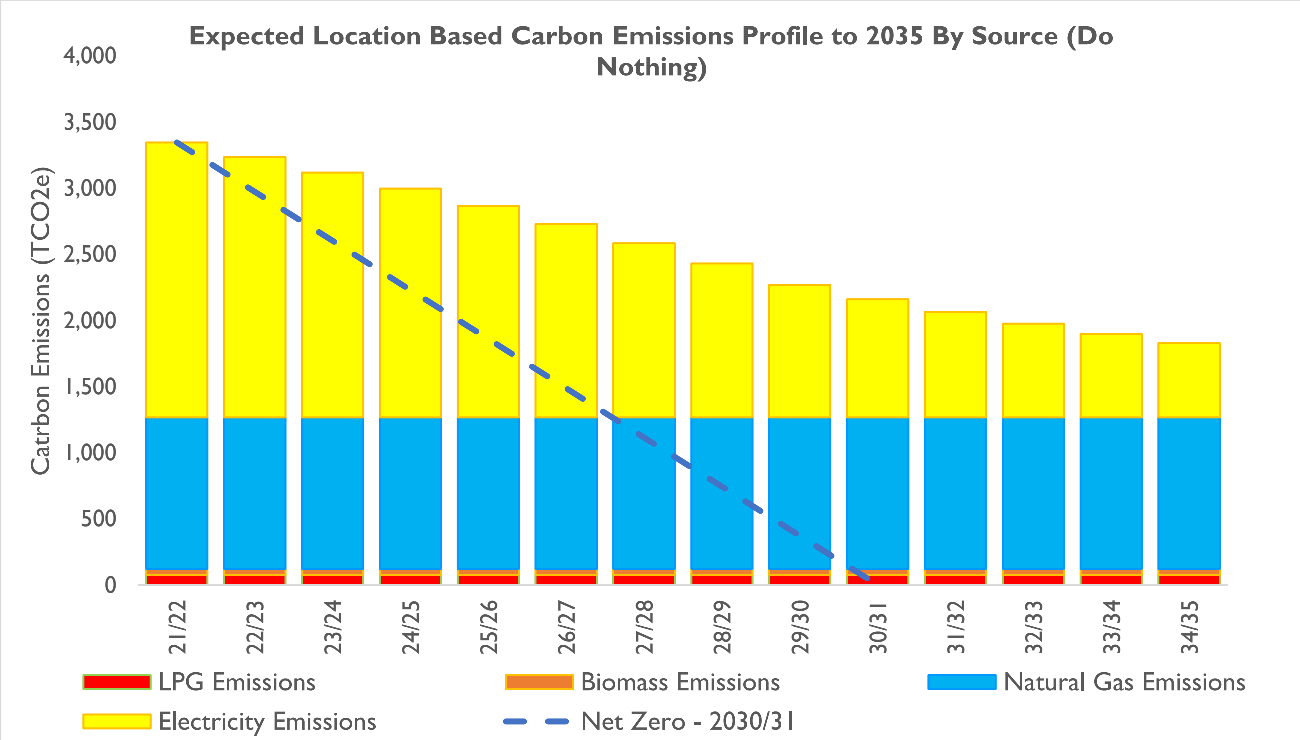

The chart below illustrates the emissions on a building-by-building level, with the data indicating that the highest emitting campus is Talbot. As the largest building emitters for scope 1 and 2 Poole House, the Fusion building, the Poole Gateway building, and Sir Michael Cobham Library should be key 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

Site assessments have been undertaken across each campus to highlight the building services present and to any identify opportunities to decarbonise heat.

## Chapel Gate Campus

The Chapel Gate campus is a sports facility located near Bournemouth Airport. The primary buildings are the Clubhouse and Changing Rooms/Squash Courts which have LPG fired heating systems. There are a variety of other buildings used for changing, sports activities and social functions, surrounded by a variety of sports pitches.


| Site | Primary Heating Source | Remaining Life (Years) | Condition |
|---|---|---|---|
| Clubhouse | - Remeha Gas 360 LPG | 10 | Fair |
| Changing Rooms & Squash Courts | - 3 x MHG ProCon 105kW | 10 | Fair |
| Football Club Changing Rooms | - Electrical panel radiators | N/A | Good |
| Groundsman's compound | - Electrical fan heaters | N/A | Fair |
| Cricket Pavilion | - Electrical panel radiators | N/A | Good |
| Summer Cricket Pavilion | N/A | N/A | N/A |

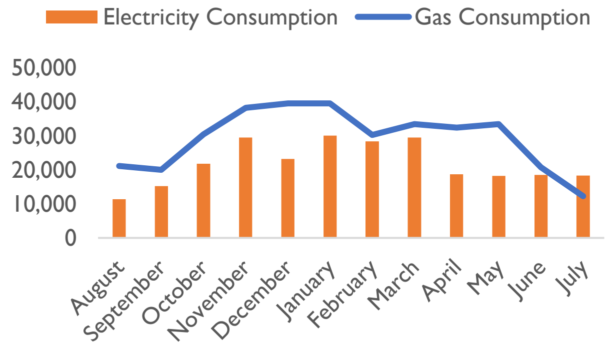
## Clubhouse

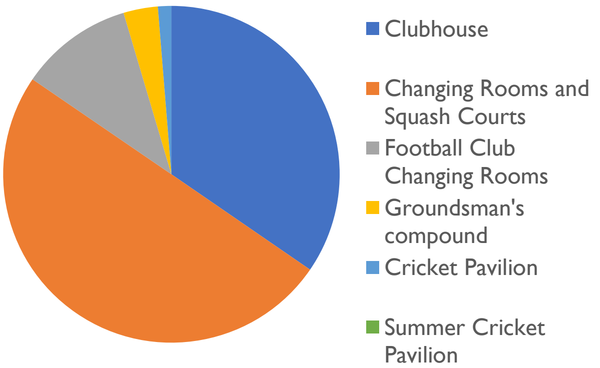
| Building | Floor Area | DEC Rating |
|---|---|---|
| Clubhouse | 859 | F |

### Description of building services

The Clubhouse is a two storey building, with a flat and nursery operating on the 1st floor and the ground floor comprising of catering and social facilities. The main bar area is glazed with full height, openable doors. The construction of the site is cavity wall, and due to the age of the building it is assumed that this is insulated as no evidence of drilling could be found. Heating is provided by a Remeha 360 LPG boiler which feeds three CT circuits which in turn supply a variety of LTHW radiators, most of which were fitted with TRVs. The boiler also feeds a 208 litre Gledhill calorifier for DHW, which has a 3kW immersion element for backup.  LPG is also used in the catering facilities. LPG and electricity are metered at a campus level, and so have been apportioned across buildings on a kWh/m2 basis.

### Energy Analysis




### Photos

## Changing Rooms and Squash Courts

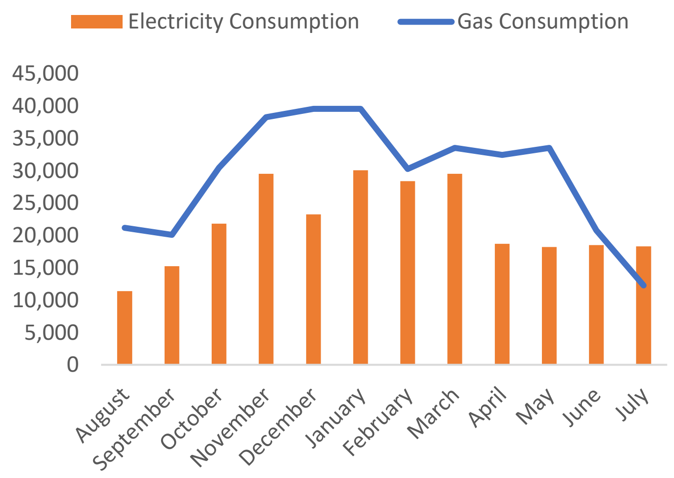
| Building | Floor Area | DEC Rating |
|---|---|---|
| Changing Rooms and Squash Courts | 1,241 | C |

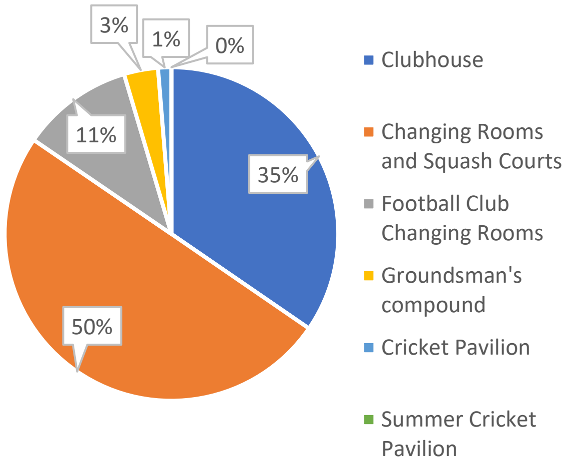
### Description of building services

The Changing Rooms and Squash Courts comprise of four squash courts, changing facilities, and gym and a small social area. Heating is provided by three MHG 105kW ProCon MC LPG boilers which feed two CT circuits. These supply radiators across the building, as well as a radiant pipe heating system that runs through the shower facilities. The boilers feed three 500l DHW tanks which are backed up by immersion elements (although not electrically connected). The tanks are dated from 2016.

The building is of cavity wall construction, and due to the age and lack of evidence around retrofit installation, cavity wall insulation has been recommended. There is very little glazing in this building, however there is sufficient roof space to accommodate a 35kWp solar PV system.

### Energy Analysis




### Photos

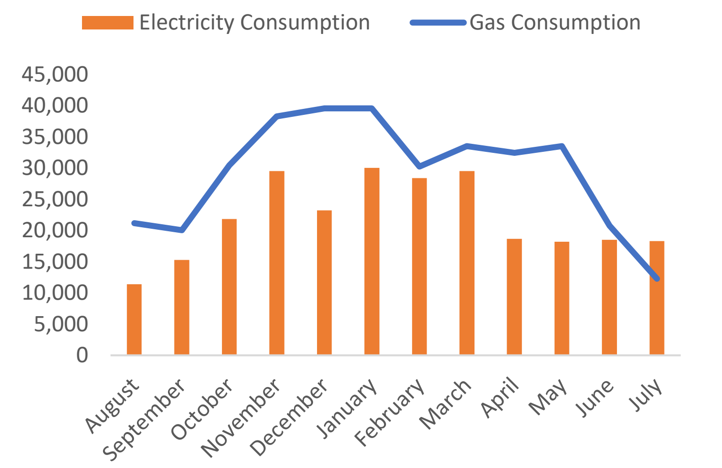
# Football Club Changing Rooms

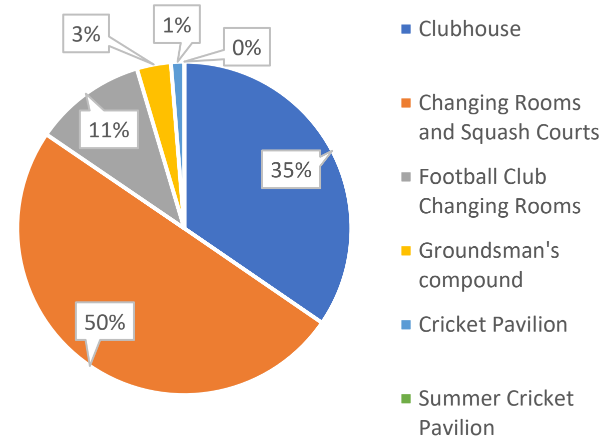
| Building | Floor Area | DEC Rating |
|---|---|---|
| Football Club Changing Rooms | 270 | N/A |

## Description of building services

The football club changing rooms are located away from the main buildings. They are portacabin style construction that are electrically heated using a number of wall mounted panel radiators. These radiators are on a timer circuit that is requested using a push button. The only other facilities are showers which are powered by electric shower units. There are no improvements recommended to these buildings.

## Energy Analysis




## Photos

## Groundsman's Compound

| Building | Floor Area | DEC Rating |
|---|---|---|
| Groundman's Compound | 82 | N/A |

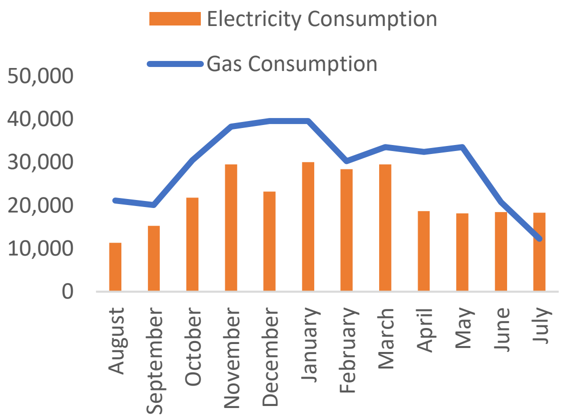
**Description of building services**

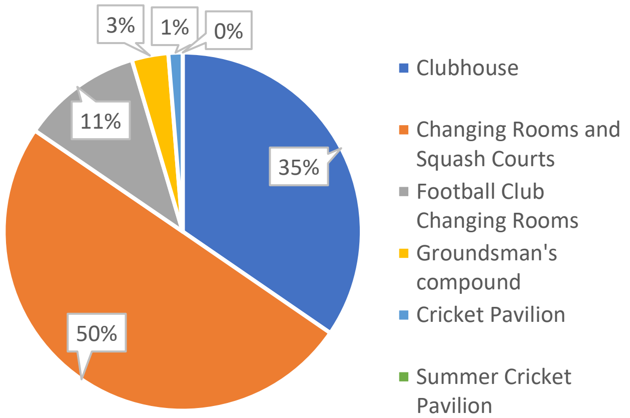
This building is a small single storey construction, with a small in-roof storage area access by a stairwell. The ground floor comprises of a single office room, and a workshop for maintenance and storage. The only sources of heating are a wall mounted electrical radiator and a portable fan heater, with no generation of DHW.

The building is single glazed with a broken window, however due to the very low heat demand of this site it is not recommended that any glazing works are carried out.

**Energy Analysis**

-




**Photos**

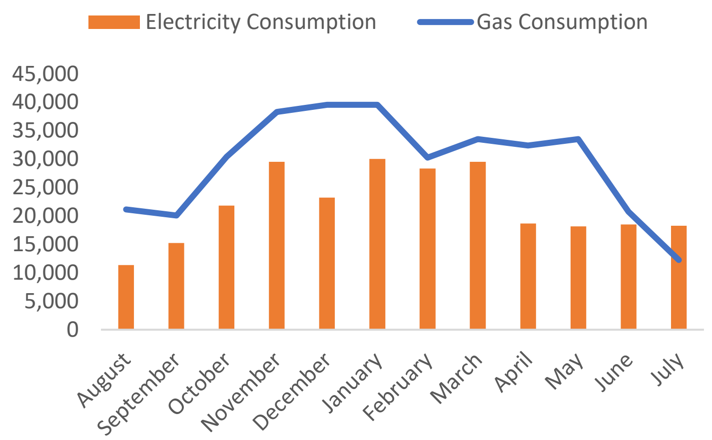
## Cricket Pavilion

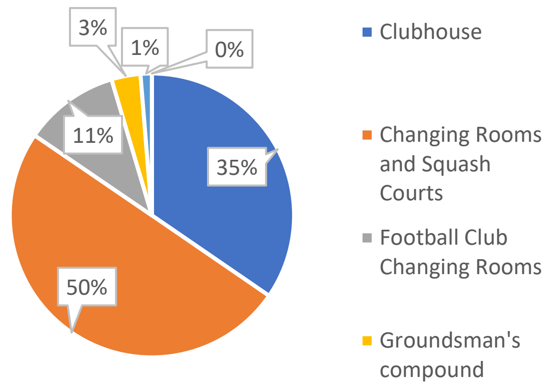
| Building | Floor Area | DEC Rating |
|---|---|---|
| Cricket Pavilion | 32 | N/A |

**Description of building services**

The cricket pavilion is a single storey structure containing a small bar, social area, kitchenette and changing facilities. Heating throughout is provided by wall mounted panel radiators, with DHW provided by point of use generators. There are several electrical showers in the changing areas. There is double glazing throughout the site, and no opportunities to improve the building fabric. As the site is already 100% electric and due to the minimal heat demand, it isn't recommended that any improvements are carried out to this building.

**Energy Analysis**




**Photos**

## Summer Cricket Pavilion

| Building | Floor Area | DEC Rating |
|---|---|---|
| Summer Cricket Pavilion | 19 | N/A |

**Description of building services**

This building is a small wooden shed, which has no power supplied to it. There is no heating or hot water generation, and no carbon footprint.

**Energy Analysis**

| | |
|---|---|
| N/A | N/A |

**Photos**

# Lansdowne Campus

Lansdowne Campus is located in the centre of Bournemouth and comprises of student entertainment, lecture and employee offices. The range of buildings is mixed with the Old Fire Station being over 100 years old, whilst Bournemouth Gateway Building being less than two years old.


| Site | Primary Heating Source | Remaining Life (Years) | Condition |
|---|---|---|---|
| BGB | - 3 x Remeha Quinta Ace 115<br>- 2 x Ecoforest 100kW GSHP | 20 | Excellent |
| The Old Fire Station | - 3 Vaillant EcoTech 100kW | 20 | Excellent |
| Studland House | - 3 Ideal EcoMax 100kW | 15 | Good |

## Bournemouth Gateway Building

| Building | Floor Area | DEC Rating |
|---|---|---|
| Bournemouth Gateway Building | 10,368 | A |

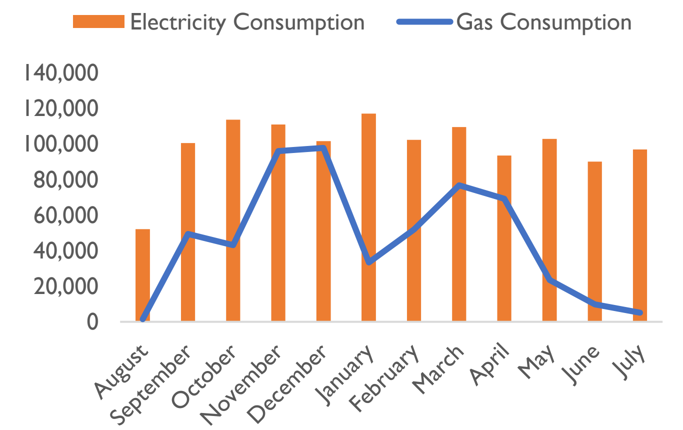
### Description of building services

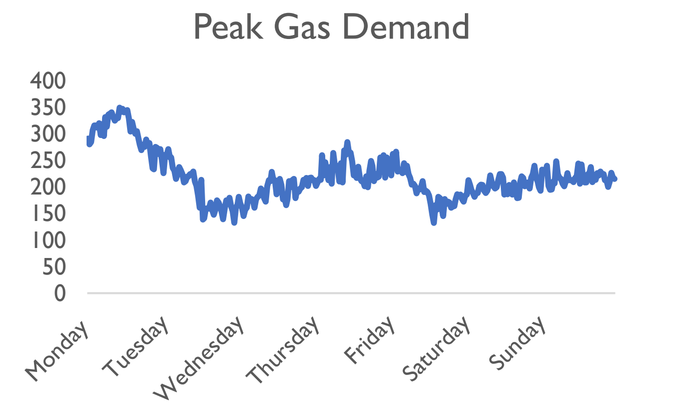
Bournemouth Gateway Building is a newly constructed site located over 7 stories comprising of lecture theatres, seminar rooms and faculty areas. The heating is provided by a combination of LTHW boilers and a GSHP system, which is capable of providing heating and cooling.

The three boilers are Remeha Quinta Ace 115kW units which supply a header that is also connected to the GSHP. The GSHP system comprises of two 100kW Ecoforest units. The mechanical system is designed for a low flow temperature to maximise the performance of the GSHP, and a flow temperature on the header of 40degC was observed. This header feeds a CT and VT circuit, which in turn provide heat to radiators and two AHUs.

Domestic Hot Water is provided by two Lochinvar ECH 374l gas fired water heaters which have a 500l buffer vessel heated by the LTHW circuit. The mechanical schematics indicate two DHW systems, however only one was discovered during the survey. There is already a moderate solar PV array on the roof.

### Energy Analysis

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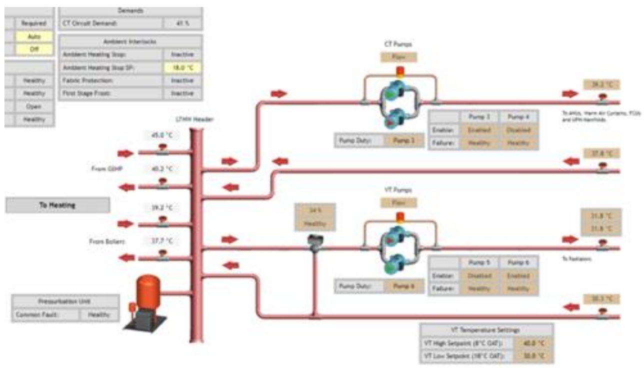


# The Old Fire Station

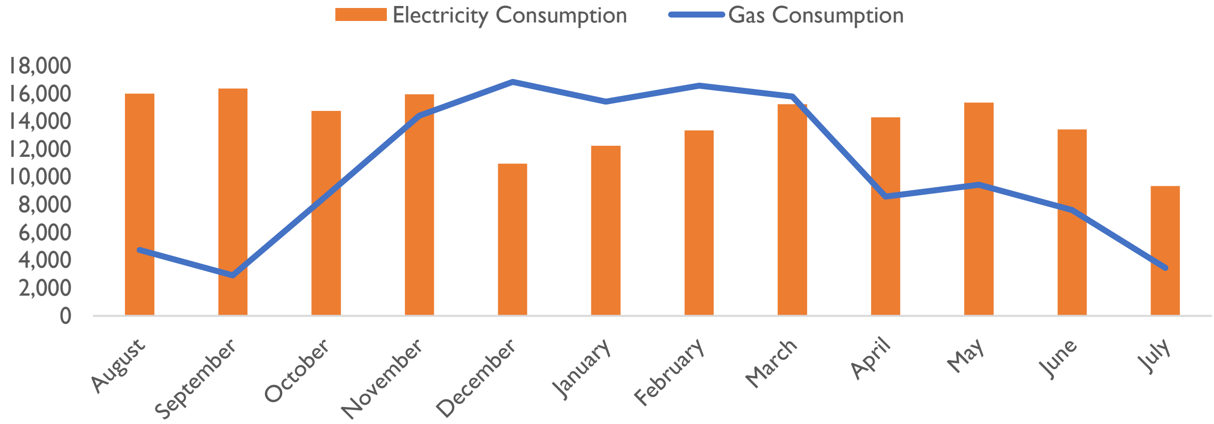
| Building | Floor Area | DEC Rating |
|---|---|---|
| The Old Fire Station | 1,706 | C |

## Description of building services

The Old Fire Station building is a entertainment venue complete with offices on the top floor. Heating is provided by a combination of LTHW natural gas boilers as well as various split units across the site. The boilers have recently been replaced in the basement plantroom with three Vaillant EcoTech VU1006 units rated at 100kW each. These feed a VT circuit for the radiators, a CT circuit for the AHUs and the DHW. The DHW system has been upgraded from a storage calorifier, to a PHEx system provided hot water at 62degC.

The building is solid wall construction and there are limited opportunities to improve the building fabric for conservation reasons. One of the main benefits that could be introduced, is upgrading the existing doors to a more suitable option which would reduce thermal loss through insultation and more importantly, reduced air infiltration. There is no opportunity to install solar PV for the reasons above.

## Energy Analysis

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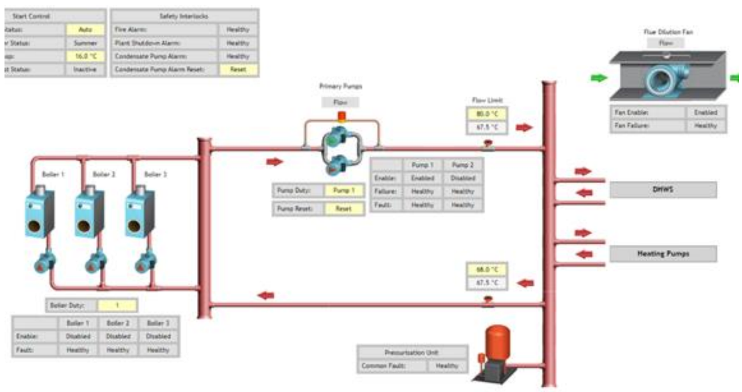


## Studland House

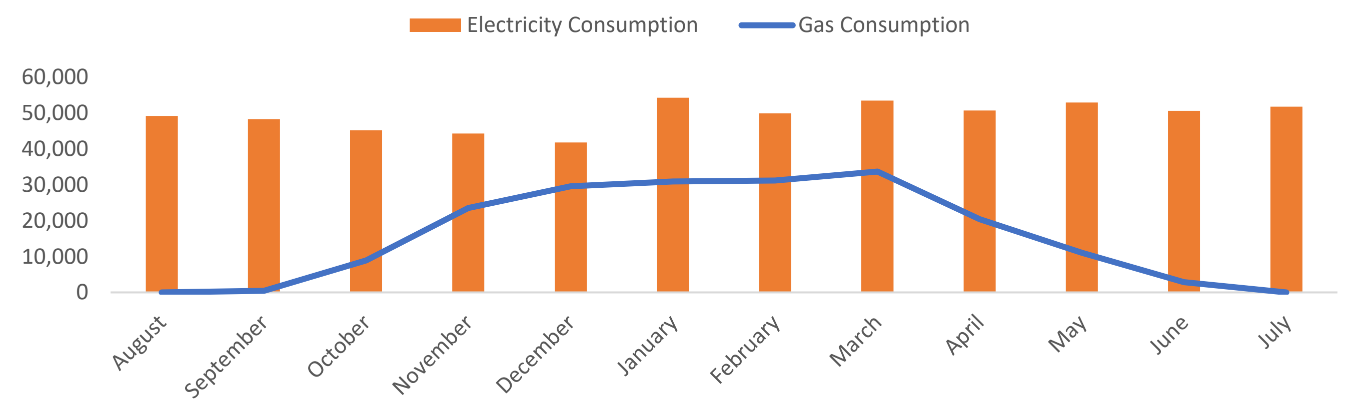
| Building | Floor Area | DEC Rating |
|---|---|---|
| Studland House | 5,133 | C |

### Description of building services

Studland House is split over eleven stories, including the basement and the roof top plant room. One half of the building only has 5 stories, including the open ground floor which houses the car park and data centre. The roof top plant room contains three Ideal Evomax boilers rated at 100kW each. These supply a CT circuit which feeds some radiators, trench heating and an AHU in the basement, as well as a VT circuit. The VT circuit has been modified to supply that radiators on a zoned basis, with floors 5,6,7 and 8 being controlled together, floor 4 having controls for the front and back halves of the building, and each floor below having individual control. The main heat emitters are radiators which are fitted with TRVs throughout. There is a large data centre located on the ground floor which could act as a heat source.

DHW is provided through point of use electrical heaters with 1 to 2 located per floor. The site also has a substantial PV array installed on the roof.

### Energy Analysis

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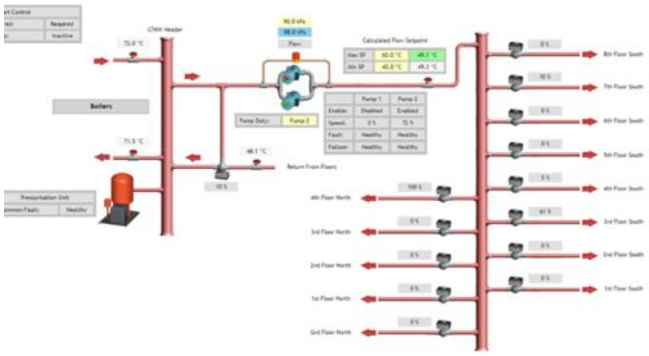
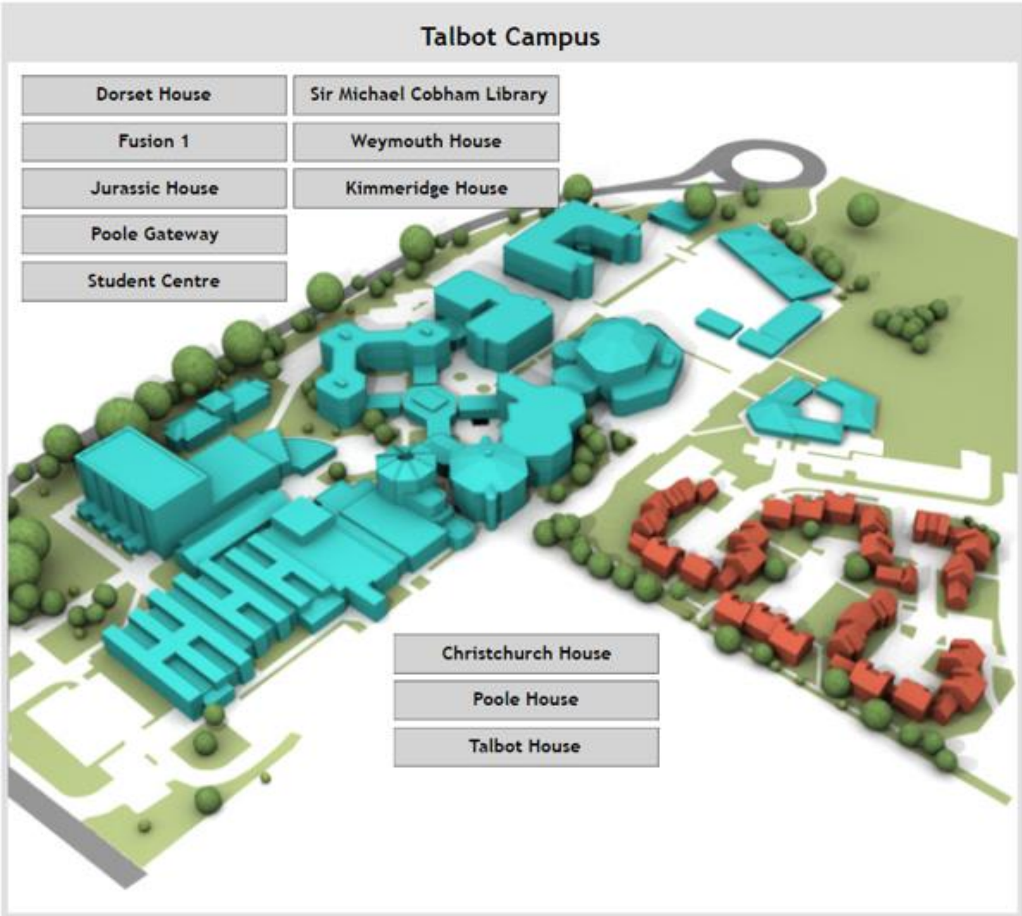


# Talbot Campus

Talbot Campus is located near the centre of Bournemouth, and comprises of 12 buildings spread over a pedestrianised site. There are various ages of buildings ranging from Poole House which was originally constructed in the 1970's and later extended, to Pool Gateway Building which is less than two years old. Near Talbot Campus are several student accommodation sites which are not part of this scope of works due to short term lease arrangements.



| Site | Primary Heating Source | Remaining Life (Years) | Condition |
|---|---|---|---|
| Christchurch House | - 2 x Hoval 250 | 15 | Good |
| Dorset House | - 3 x Hamworthy Wessex 200 | <5 | Poor |
| Fusion Building | - Carrier GSHP (6 x 55kW) | 15 | Excellent |
| | - 2no. Hoval Ultragas 500 (2 x 500kW) | 15 | Excellent |
| | - Micro CHP (17.3kW) | 10 | Poor |
| Jurassic House | - Electrical radiant heating | 15 | Good |
| Kimmeridge House | - 3 x Hamworthy Purewell Classic 95 | <5 | Poor |
| Poole Gateway Building | - 4 x Elco 120kW gas boilers | 20 | Excellent |
| Poole House | - Ideal Evomod 750 natural gas boiler | 15 | Good |
| | - 500kW Binder biomass boiler | 10 | Fair |
| Student Centre | -Ideal Evomax 100 x 3 | 15 | Good |
| | - Carrier GSHP (2 x 80kW) | 15 | Good |
| SMCL | - 2 x Hamworthy Wessex 200 | <5 | Poor |
| | - 3 x Hamworthy Purewell 95 | <5 | Poor |
| Talbot House | - 2x Ideal EVOMAX 80 (2 x 80kW) | 10 | Fair |
| | - 1x Keston 55kW | 10 | Fair |
| Weymouth House | - 6 x105kW Gassero Wallcon | 10 | Fair |

## Christchurch House

| Building | Floor Area | DEC Rating |
|---|---|---|
| Christchurch House | 5,133 | C |

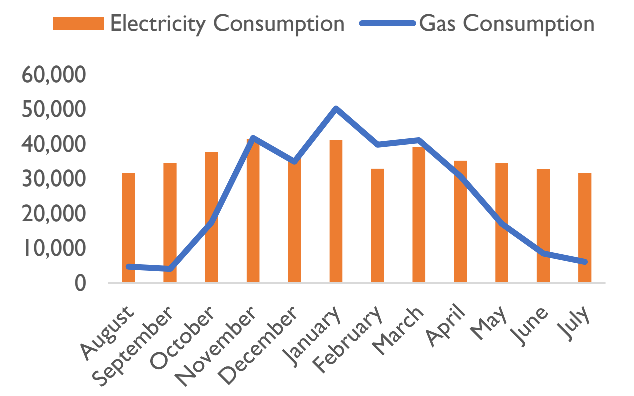
### Description of building services

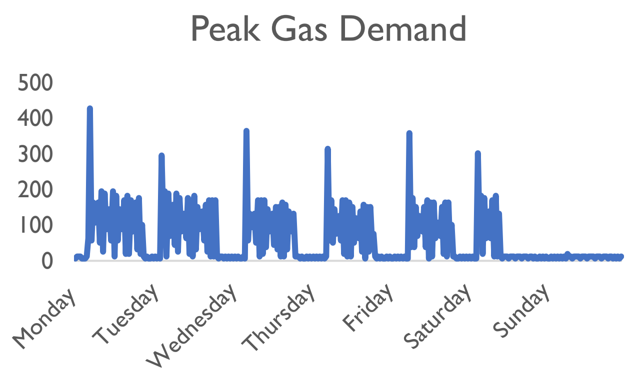
Christchurch Building comprises of an original section dating from the 1990's with a more modern extension in the early 2000's. Originally, the extension had a separate plant room with its own LTHW boilers, however this has now been adapted to be fed from the main boiler plant. The boilers are Hoval Ultragas 250 units with a combined output of 500kW, and a target flow and return of 80/65. Domestic hot water services are provided by two AO Smith natural gas fired tanks each with a capacity of 285l and a power rating of 31kW. The laboratories have a separate DHW system supplied by a roof mounted gas fired AO Smith unit which is future proofed to accept a solar thermal input..

The main heat emitters across the site are radiators fitted with TRVs alongside two large AHUs with LTHW coils supplied by the boilers. These are both fitted with heat recovery in the form of mixing chambers and thermal wheels.

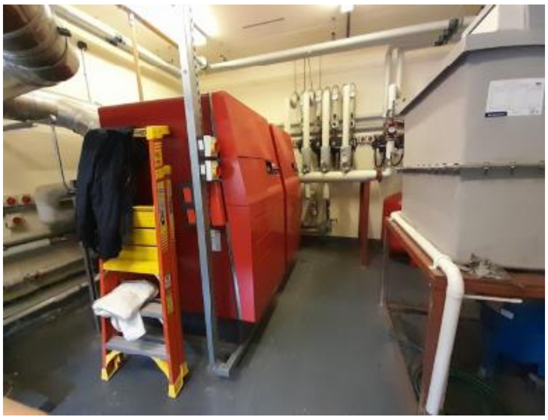
The building fabric appears in good condition with cavity wall construction and double glazing throughout. Based on the age of the building, it is assumed that no cost-effective improvements could be made.

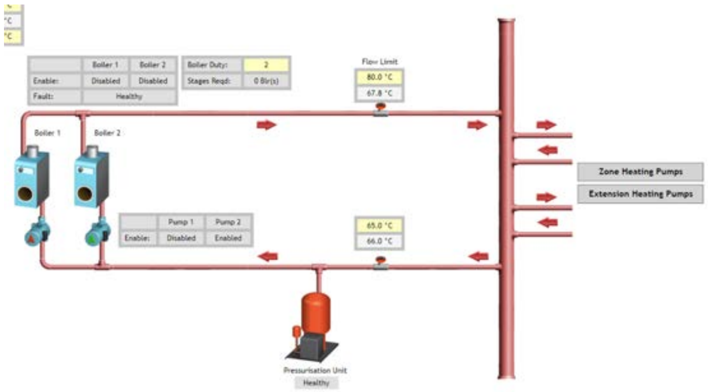
### Energy Analysis




### Photos





# Dorset House

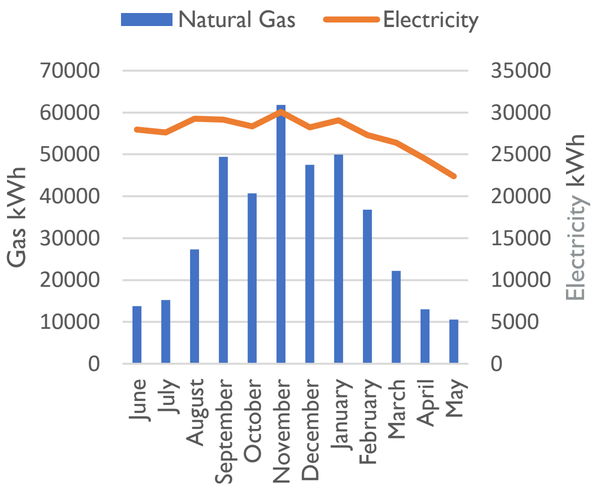
| Building | Floor Area | DEC Rating |
|---|---|---|
| Dorset House | 3,378 | D |

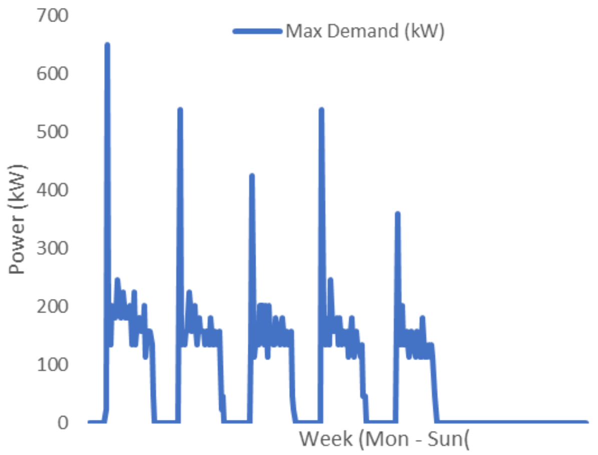
## Description of building services

Dorset House is a three-storey building dating from 1985 comprising of staff offices and science laboratories. The construction is a cavity wall, with cladding on the 1st and 2nd floors. A visual inspection of the cavity walls did not indicate that there had been any retrofit insulation, and therefore this has been recommended to reduce the thermal load. The glazing across the building is PVC framed single glazing and is generally floor to ceiling units.

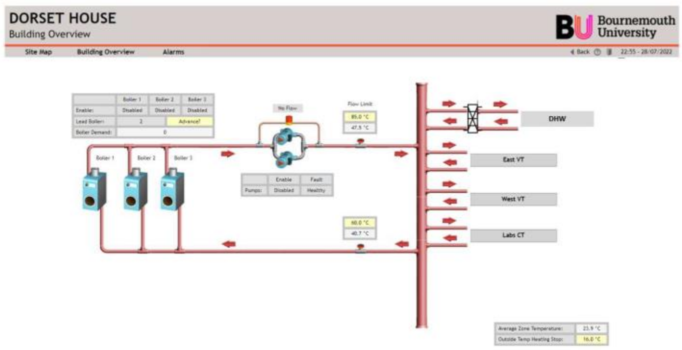
There are three Hamworthy Wessex 200 boilers located in the plant room with a maximum output of 600kW. These feed the DHW plates as well as a constant temperature and two variable temperature circuits (East and West). Access to the laboratories could not be granted, but it is believed that the CT circuit feeds radiant panels and AHU coils in the laboratories, and the VT circuits deliver heat to the radiators.

## Energy Analysis




## Photos

# Fusion Building

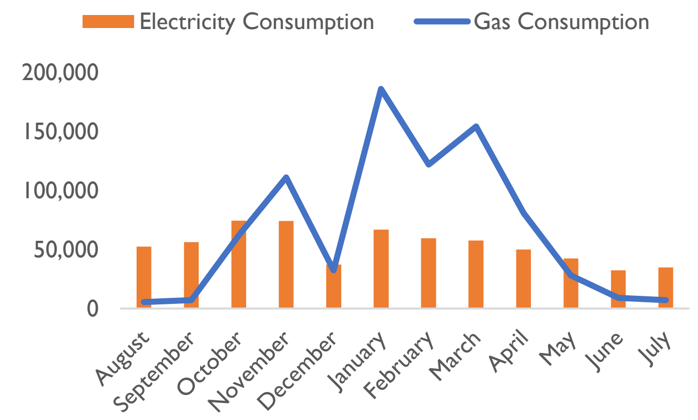
| Building | Floor Area | DEC Rating |
|---|---|---|
| Fusion Building | 5,935 | D |

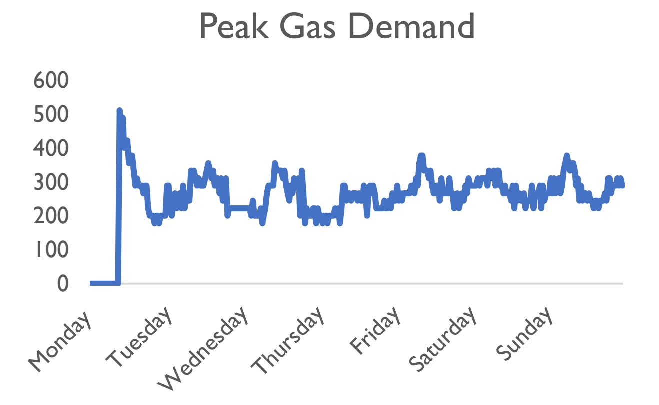
## Description of building services

Fusion Building is a modern construction, with a central atrium open over the four stories. The main heating plant are two Hoval Ultragas 500 LTHW boilers along with a micro CHP rated at 17kWth, the CHP is not operational at present. These supply a high grade heat header with a temperature of 67degC, which supplies DHW and radiators via a VT circuit. The high grade header also supplements a low grade header which is primarily supplied by a Carrier GSHP system comprising of 6x55kW units. The low grade header feeds AHUs and UFH systems at a flow temperature of 40degC. The GSHP system is capable of simultaneous heating and cooling via a set of chilled beams and AHU cooling coils.

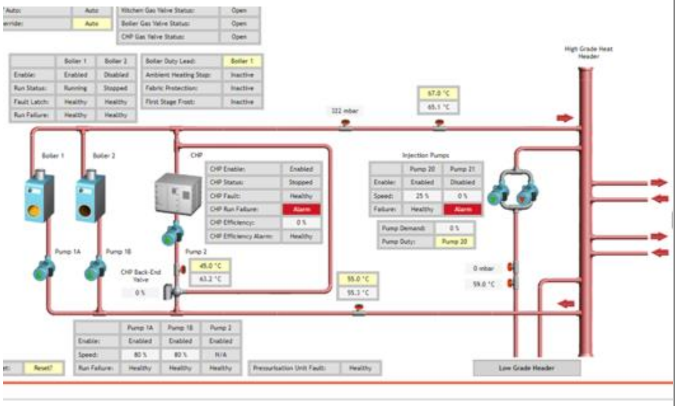
Hot water is provided via the high grade header into a PHEX and via a storage calorifier with a capacity of 1,500L. Fusion Building already benefits from Solar PV.

## Energy Analysis




## Photos

# Jurassic House

| Building | Floor Area | DEC Rating |
|---|---|---|
| Jurassic House | 176 | D |

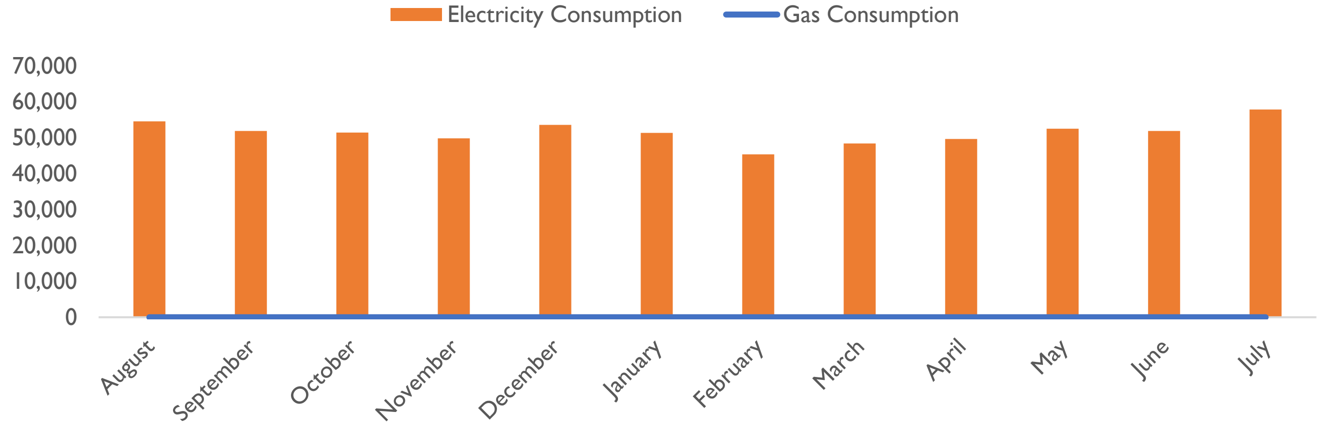
## Description of building services

Jurassic House is a new build data centre with extensive cooling demands. There is no heating demand aside from a small sized 6kW electrical heating unit which acts as frost protection. The building is split into two main areas, a UPS room housing the UPS and CRAC units, and data centre room housing the racks.

As the site has no scope 1 emissions associated with heating there is no opportunity to decarbonise the heating. There is, however, the opportunity to utilise the waste heat from the data centre to boost the COP of a heat pump serving other buildings, which will reduce the overall cooling demand.

The building benefits from a 20kWp solar PV installation which provides some of the electrical demand.

## Energy Analysis




## Photos

## Kimmeridge House

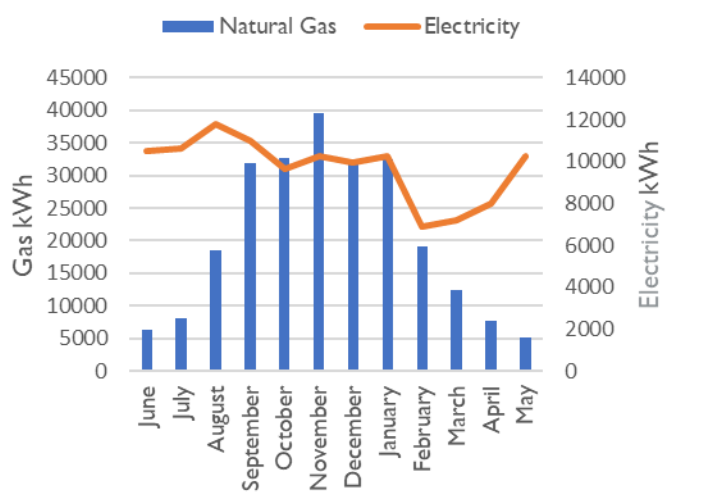
| Building | Floor Area | DEC Rating |
|---|---|---|
| Kimmeridge House | 1,541 | D |

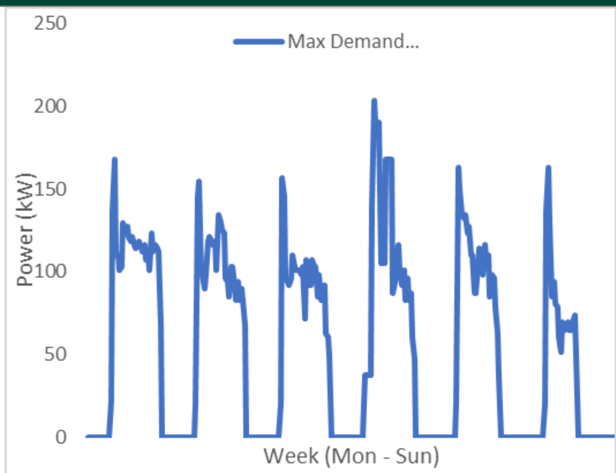
### Description of building services

Kimmeridge House is a teaching space constructed in 2003. It contains three lecture theatres and two seminar rooms over two storeys, with a high ground floor to accommodate the lecture theatres, and an open plan foyer utilising air curtains to reduce thermal loss.

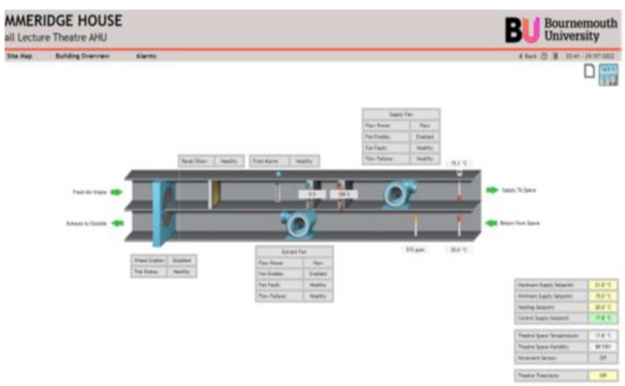
The plant room is located in the roof void and contains an air handling unit, the boilers, a DHW cylinder and the associated pump sets. Further plant is located externally, with two additional air handling units and a chiller. The boilers are Hamworthy Purewell Classics with a combined maximum output of 285kW. They are designed to supply two CT circuits, and one VT circuit which feed a combination of radiators, AHU coils and underfloor heating. The boilers also feed a DHW calorifier, however this is switched over to immersion heaters in the summer months to reduce gas consumption.

### Energy Analysis




### Photos



# Poole Gateway Building

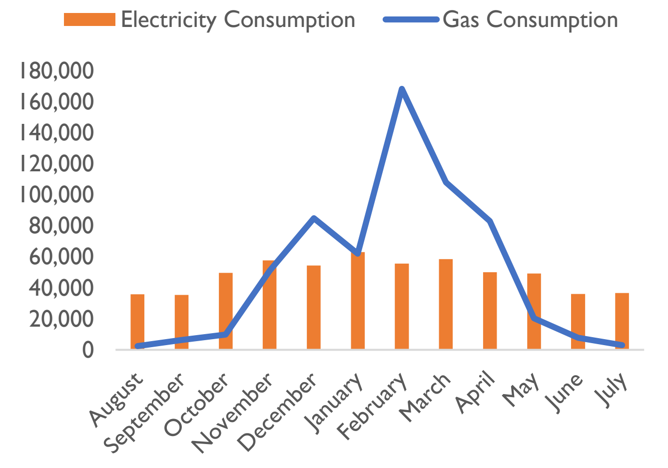
| Building | Floor Area | DEC Rating |
|---|---|---|
| Poole Gateway Building | 6,790 | D |

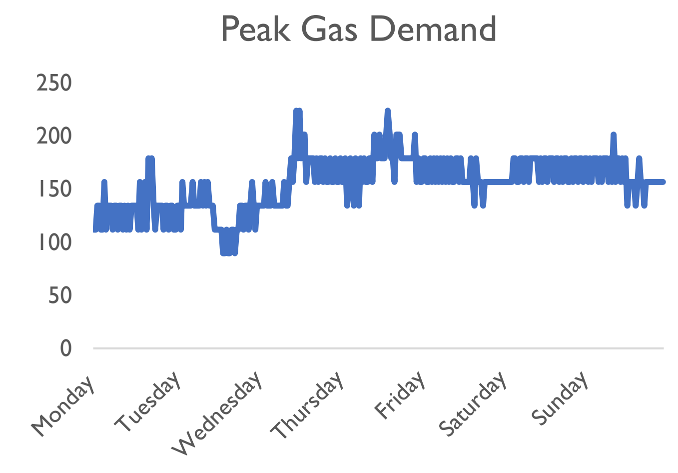
## Description of building services

Poole Gateway is a new build site located on the Talbot Campus. The building has four stories, and hosts a variety of IT and media facilities. The main plant room is located on the roof an contains four 120kW Elco natural gas boilers, which feed a LTHW header which in turn supplies a CT circuit and a VT circuit. The CT circuit had an observed flow temperature of 65degC and supplies AHUs, warm air curtains, FCUs and under floor heating manifolds. The VT circuit was operating at 51degC and supplies the radiators across the building. DHW is provided by gas fired water heaters which appear to be future proofed to accept solar thermal via a adequately sized coil.

Across the site there are approximately 13 AHUs of which most had heat recovery via thermal wheels, and cooling provided by externally located chillers. The building has solar PV installed as part of the construction.

## Energy Analysis

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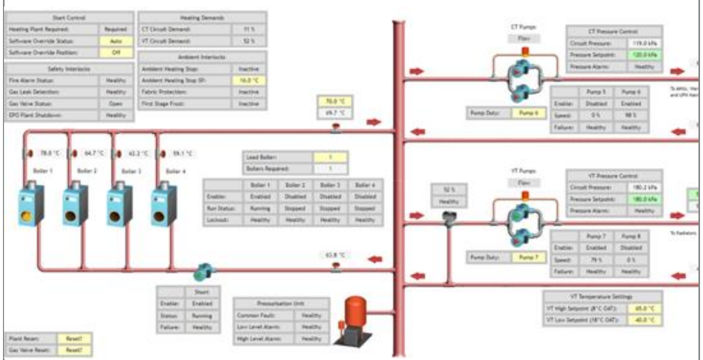


# Poole House

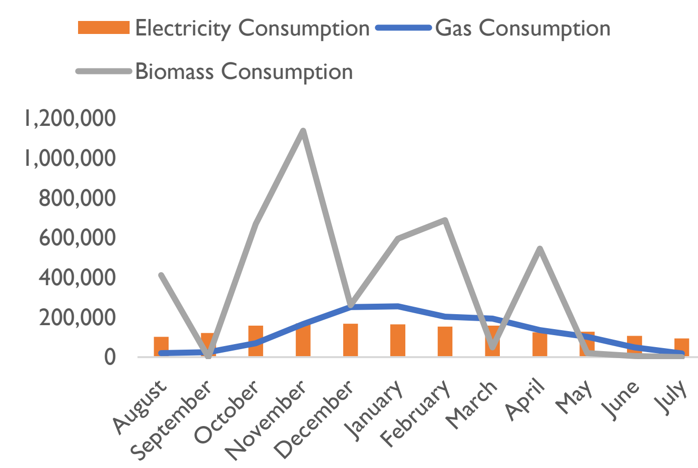
| Building | Floor Area | DEC Rating |
|---|---|---|
| Poole House | 18,628 | D |

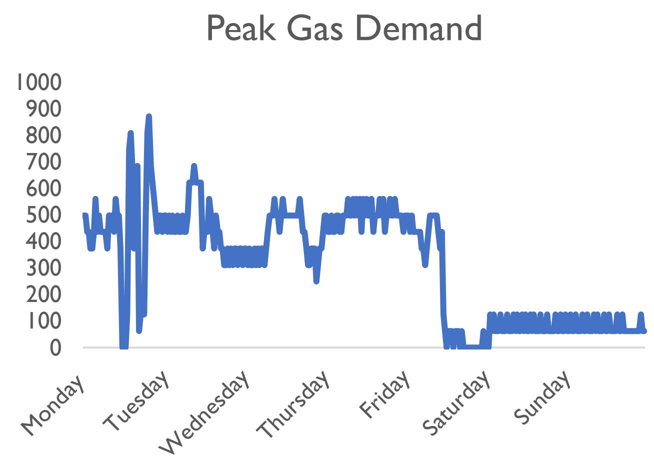
## Description of building services

Poole House consists of an original 6 storey tower dating from the 1970's, which was expanded with a single storey extension to provide a catering college. The tower has a small gas boiler which serves a small number of radiators, but the majority of the heating load is served via natural gas boilers and a biomass boiler. The boilers are new and consist of a 750kW modular Ideal OvoMod system, as well as a 500kW Binder biomass boiler. These boilers feed a header which in turn supplies a number of CT and VT circuits across the catering and teaching facilities, as well as a domestic hot water supply. The DHW is primarily supplied by a PHEx connected to the header, however there is also solar thermal that supplements the demand.

The site has a number of solar PV installations which is currently being expanded. There is the opportunity to improve the building fabric in approximately 50% of the structure.

## Energy Analysis

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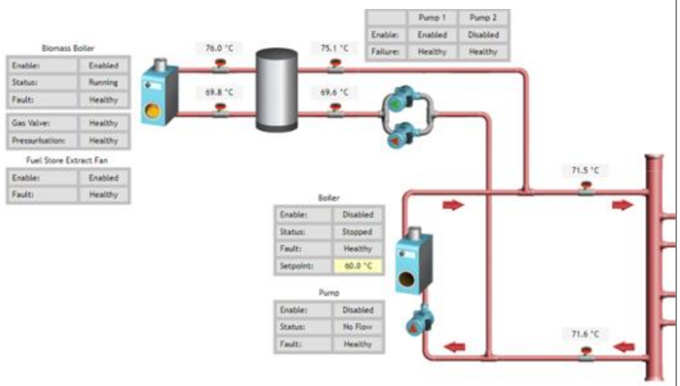


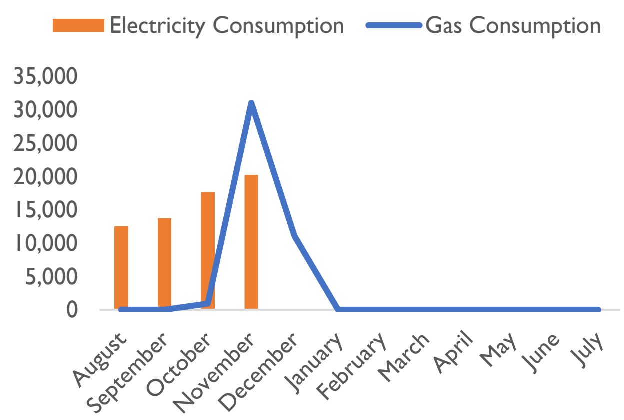
# Student Centre

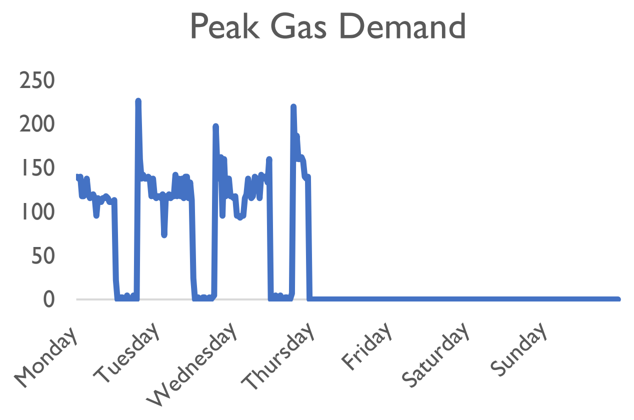
| Building | Floor Area | DEC Rating |
|---|---|---|
| Student Centre | 5,133 | C |

## Description of building services

The Student Centre is a recently constructed building with 6 floors and a roof top plant room. The heating is provided by a 160kW Carrier GSHP system which is boosted by three 100kW Ideal Evomax natural gas boilers. The GSHP has the option of feeding either the LTHW of CHW header. The LTHW headed in turn supplies circuits that supply the underfloor heating, AHUs and radiators. The AHUs observed utilised thermal recovery via a mixing chamber. Domestic hot water is provided by two gas fired heaters which were observed to have a flow temperature of 31degC. The roof is a circular, pitched type and due to the cost associated with installing at this height solar PV has not been recommended.

## Energy Analysis

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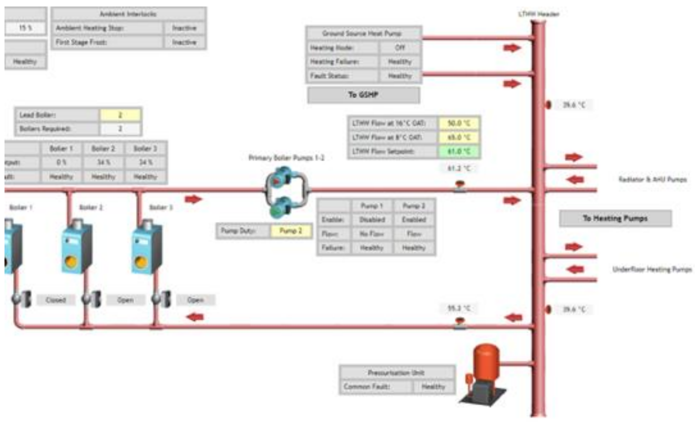


## SMCL

| Building | Floor Area | DEC Rating |
|---|---|---|
| SMCL | 6,117 | B |

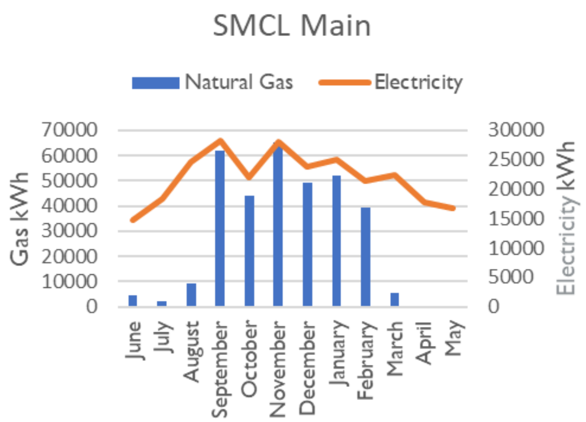
### Description of building services

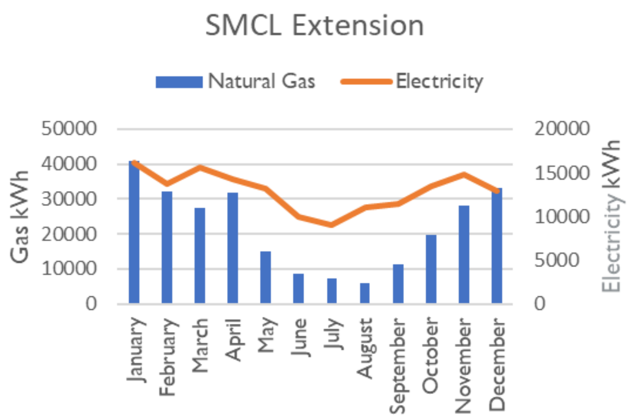
SMCL (Sir Michael Cobham Library) is a student library that is split into two connected spaces: Main and Tower. The Main was part of the original construction in 1987 and is a two-storey space of cavity wall construction and a flat roof. It comprises of open space study areas, as well as breakout rooms and several staff offices on the ground floor.

The Tower is a modern addition added in 2002 and comprises of open plan study areas over 5 storeys and is connected to the open study spaces of the Main on the ground and 1st floors. The Tower is connected via an unheated walkway to a separate building, and also houses a café which is sub-metered from the main supply and has no gas consumption. There are two separate plantrooms for the Main and the Tower, each with separate mechanical distribution systems. In addition to this, both the Main and the Tower have separate LV supplies.

The Main is primarily heated from a plant room that is accessed externally. There are two Hamworthy Wessex 200 natural gas boilers that feed a LTHW system that supplies three circuits. The tower plant room contains three Hamworthy Purewell 95 boilers with a combined maximum output of 285kW. These feed VT and CT circuits, as well as an AHU heating coil located in the same plant room.

### Energy Analysis




### Photos

# Talbot House

| Building | Floor Area | DEC Rating |
|---|---|---|
| Talbot House | 1,909 | B |

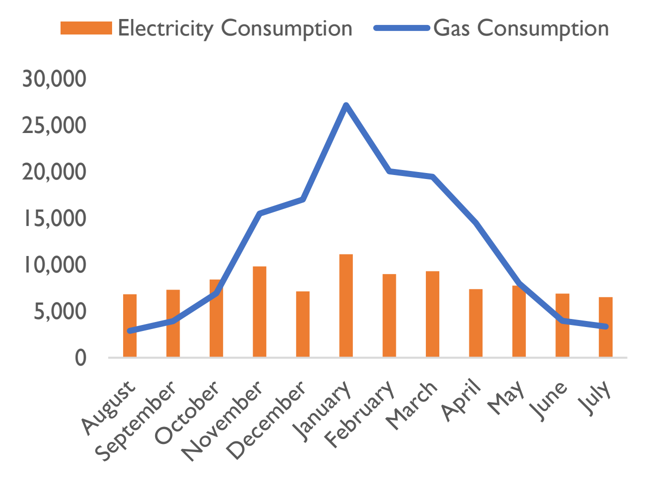
## Description of building services

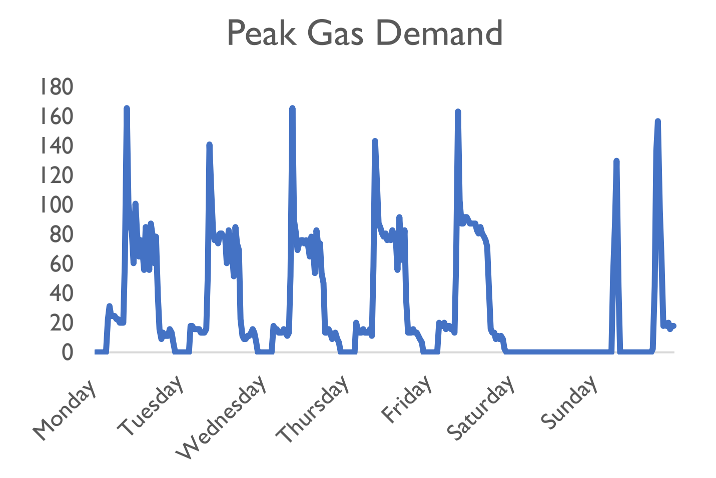
Talbot House is a two storey, multi use site with musical facilities and a children's nursery and medical centre. It is split into the original construction dating from the late 1980s, and a more modern extension from the early 2000's. Each site has a separate plantroom. The first contains two Evomax Ideal 80kW natural gas boilers, which feed two VT circuits to provide heating across the site and domestic hot water via a new PHEx. The second plantroom contains a Keston 55kW natural gas boiler which supplies underfloor heating to a nursery and radiators on the 1st floor.

Air infiltration issues were observed around some of the doors which will be leading to an increased heat demand. Therefore it is recommended that these doors are replaced with appropriately sealed units. There is the opportunity to install Solar PV on this site, and a indicative array size of 56kWp has been proposed.

Note added during review process: Talbot House is on a shorter lease (2027) so this needs to be considered when planning.

## Energy Analysis

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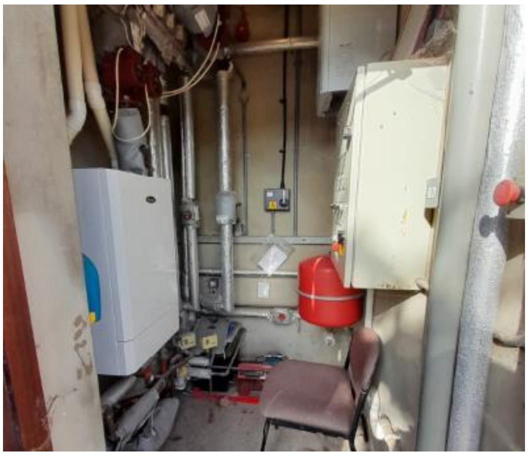
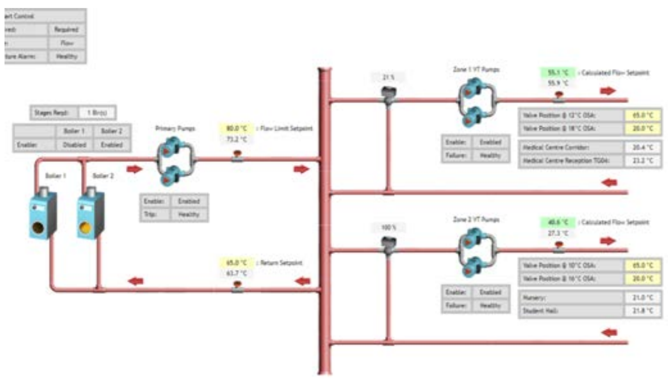




## Weymouth House

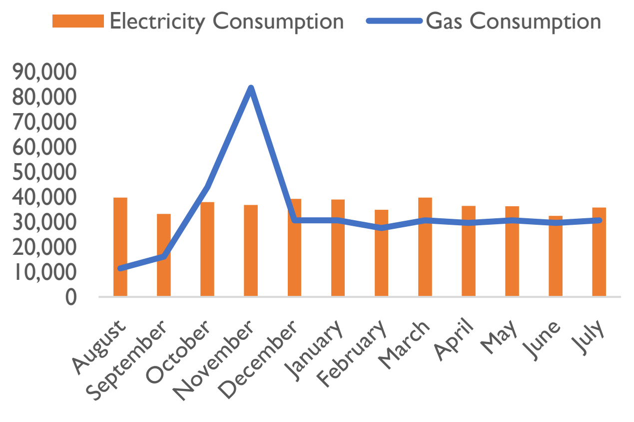
| Building | Floor Area | DEC Rating |
| --- | --- | --- |
| Weymouth House | 1,909 | B |

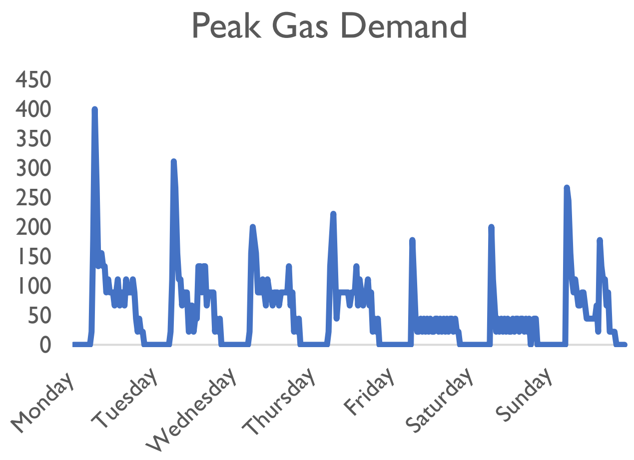
### Description of building services

Weymouth House originally was a 4 storey building, with the top two floors having a smaller footprint than the lower two. An extension was however built on the 3rd and 4th floors to increase their footprint. Heating is provided by rooftop plantrooms containing 6no. 105kW MHG Gassero Wallcon LTHW boilers which operate in three stages and feed an LTHW header. This header in turn supplies two VT circuits and a CT circuit that supply AHUs and radiators across the site. DHW is provided by an Innovo gas fired 245l heater. Observed AHUs already recover waste heat via mixing plenums.

There is a small opportunity to install solar PV and a 12kW opportunity has been proposed. It may be possible to increase this, however the roof space is crowded.

### Energy Analysis

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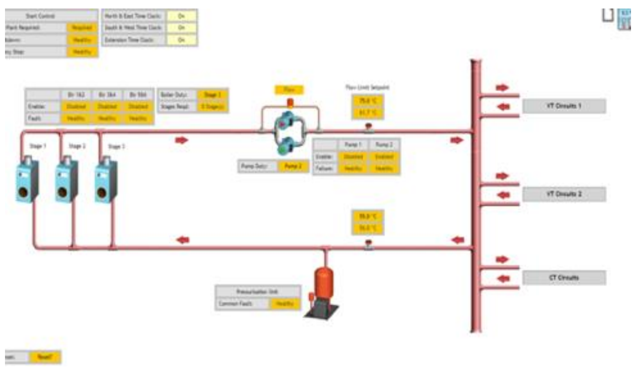


# Yeovil

University Centre, Yeovil, is a single building which acts as an education centre and regional hub for students on placements throughout the South West.

| Site | Primary Heating Source | Remaining Life (Years) | Condition |
|---|---|---|---|
| University Centre Yeovil | - 3 x Hamworthy Purewell 95 | <5 | Poor |
| | - 1 x Vaillant EcoTech 637 | 10 | Good |

# University Centre Yeovil

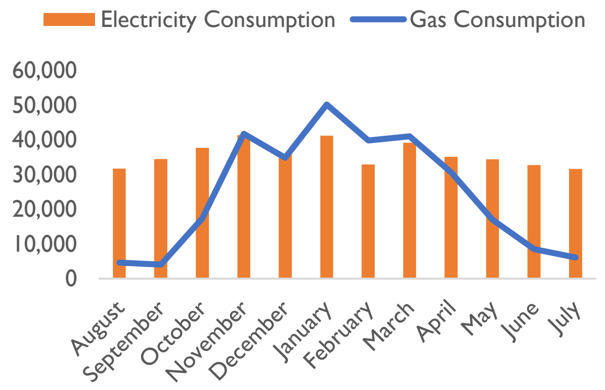
| Building | Floor Area | DEC Rating |
|---|---|---|
| University Centre Yeovil | 2,179 | B |

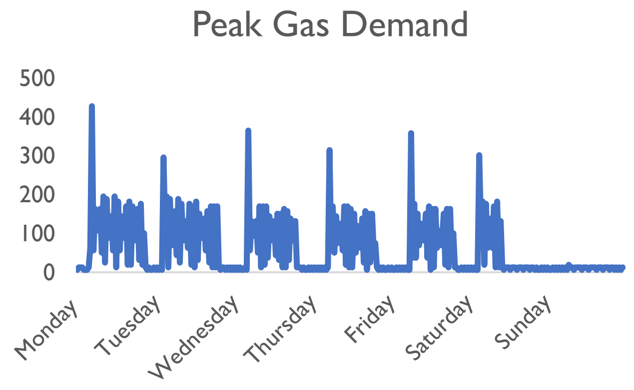
## Description of building services

University Centre Yeovil is an owned building split into two parts connected by a link corridor. The original construction is a two storey, heavily glazed unit which houses lecture facilities and IT rooms. This section is heated using three Hamworthy Purewell 95 boilers which feed three VT circuits (North, South and Ground) to supply heating via radiators. Flow and return temperatures of 74degC and 50degC were observed. Domestic hot water is provided by immersion elements in calorifiers, or by point of use generation. There is a significant opportunity to upgrade the glazing in this site to not only reduce thermal loss, but also thermal gain in summer.

The extension is a more modern construction and is heated using a Vaillant EcoTech 637 gas boiler, alongside a number of split units and electrical radiators. There is an opportunity to install a 35kWp solar PV system on this site.

## Energy Analysis




## Photos

# Thermal Survey Results

## Introduction

A thermal imaging survey was conducted with the purpose of identifying continuity of insulation, excessive thermal bridging and air leakages. These findings will support the business case for identified building fabric improvements, and also allow the university to further investigate these areas of heat loss.

The survey covered three buildings across Talbot Campus, as well as Chapel Gate and the Yeovil site. The three buildings at Talbot Campus were SMCL (both buildings), Poole House and Dorset House.

The surveying process was conducted in accordance with BRE 176 and BS EN ISO 13187 standards. The following criteria were met to ensure accurate results:

In order to effectively 'see' heat loss (or gain), buildings should maintain at least a 10°C temperature split between the interior and exterior for the duration of the survey. For unoccupied buildings, this difference should be achieved for 72 hours prior to the survey.

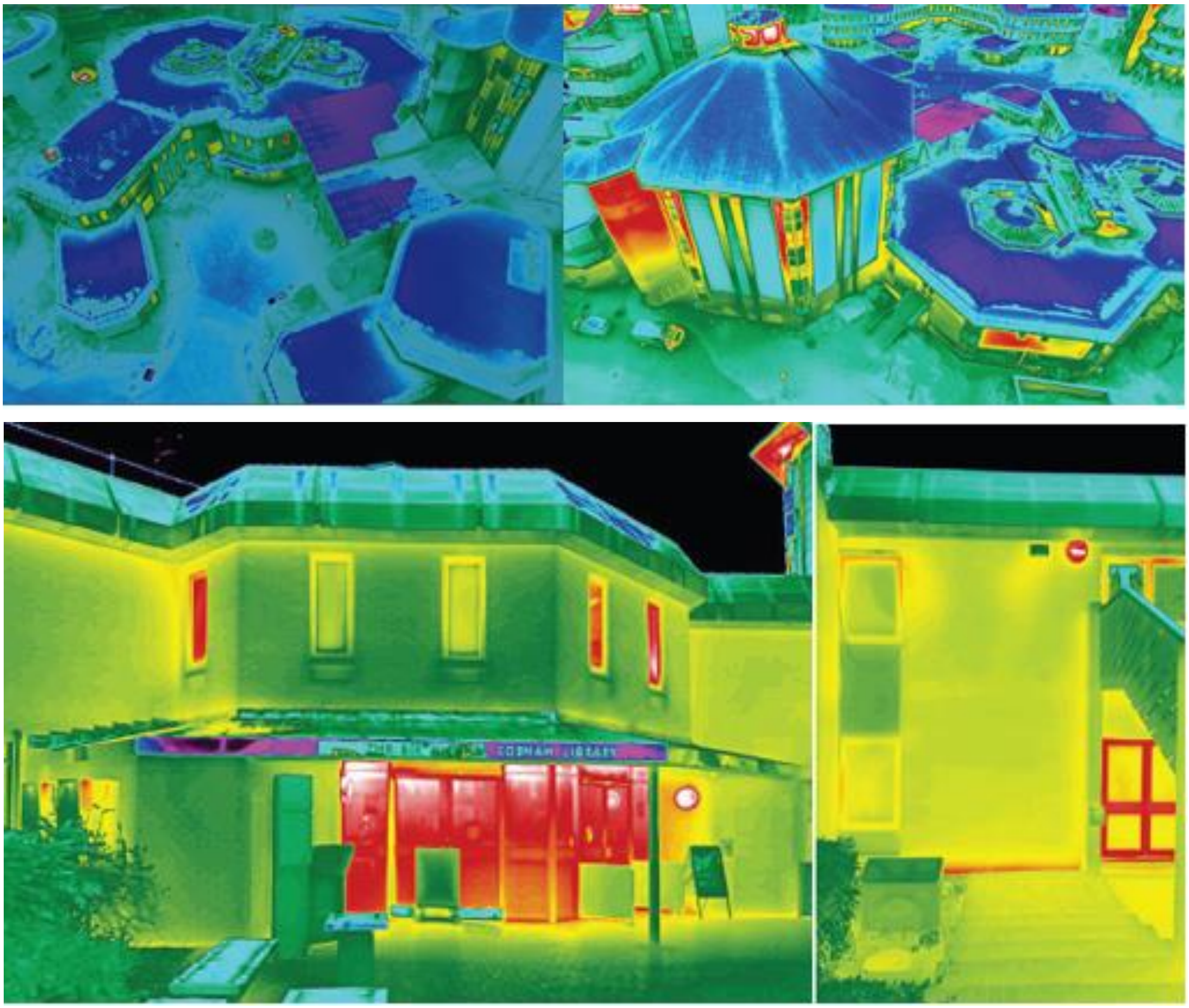
- Before a survey, building surfaces must be dry to ensure that artificial cooling from moisture evaporation does not affect the results. For heavy building fabrics such as brick, it's recommended that surfaces have been dry for at least 24 hours. For lightweight buildings, a minimum of 12 hours is recommended
- All areas must be free from obstructions such as furniture and building materials. Any obstructions must be moved at least 24 hours before the start of a survey, in order for local temperature conditions to stabilise.
- Building surfaces should be free from solar radiation for approximately 2 hours prior to the start of the survey - longer if the building consists of a heavyweight fabric. This is to allow for the effect of external heat gain in the wall to dissipate
- Wind speed during a survey should not exceed 5m/s (18kph). This is to avoid a cooling effect on the building fabric
- The survey used a mast mounted camera, with a drone mounted camera for roof shots and high elevations

Further buildings will be studied using thermal imagery as this HDP is developed.

## Key observations

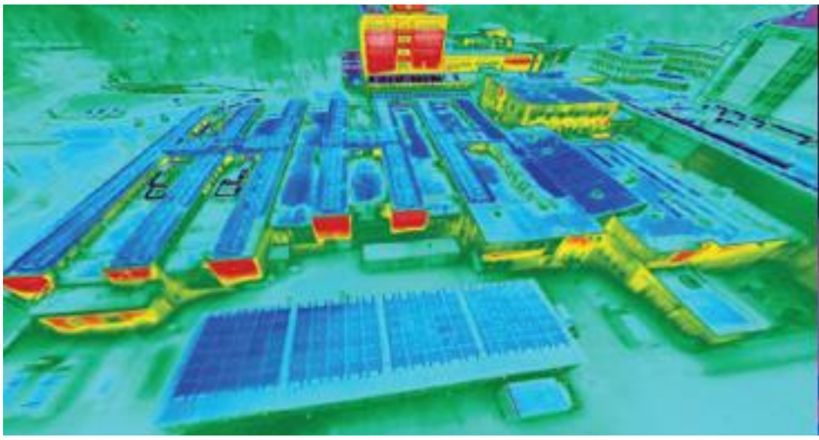
## Talbot Campus - SMCL

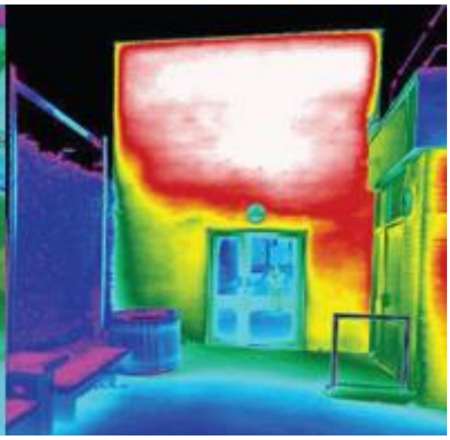
- The roof appears to be in good condition, with a uniform temperature observed
- The biggest concern with this building is the glazing on the original construction. These appear to have varying levels of performance with some showing temperatures of ~15degC indicating poor installation or air leakage
- On all elevations, there is evidence of a thermal leak between the roof joins including the crown on top of the tower

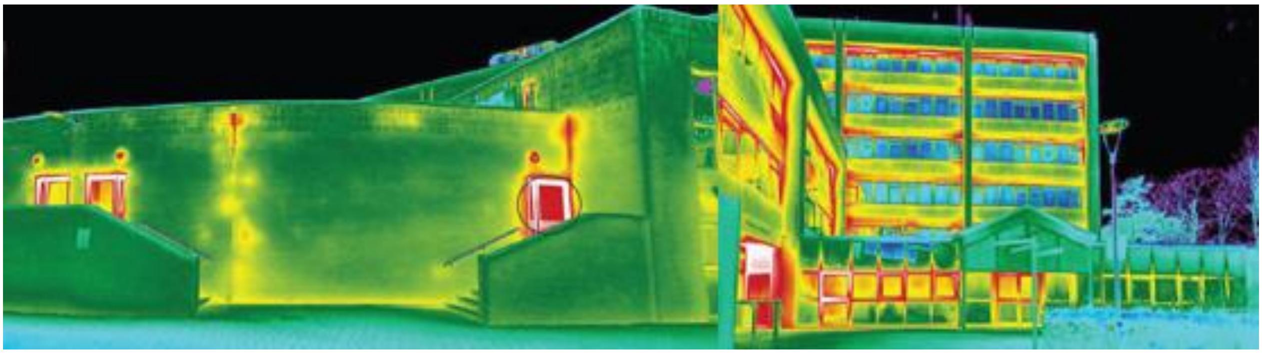


## Talbot Campus - Poole House

- The roof appears to be in good condition, with a uniform temperature observed
- The southern elevation (by the Estates Reception) appears to either be missing insulation, or installed insulation has degraded significantly
- The glazing across this building is mixed, with some performing as expected and others performing very poorly

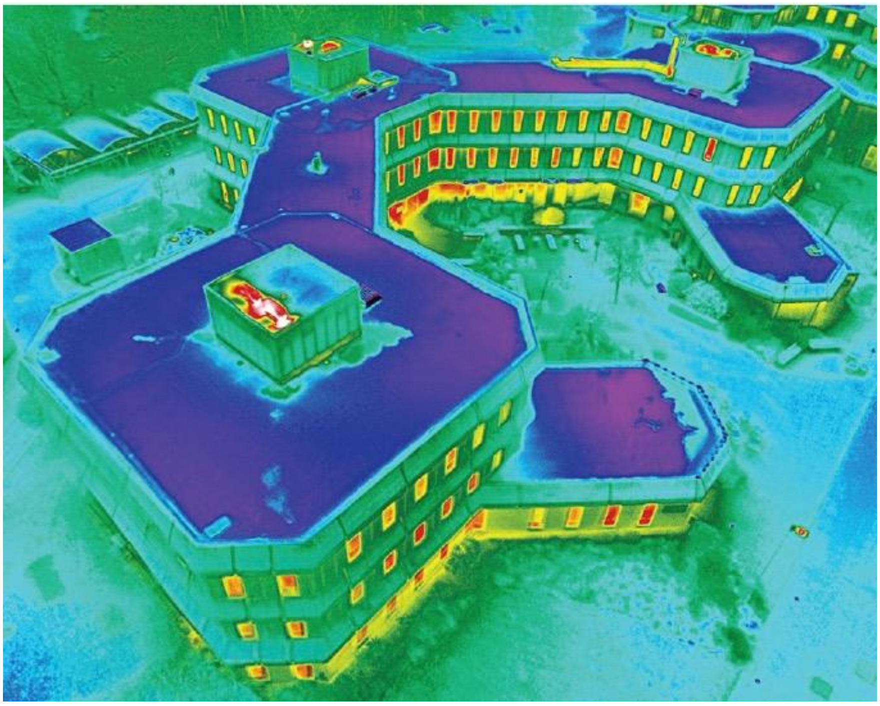


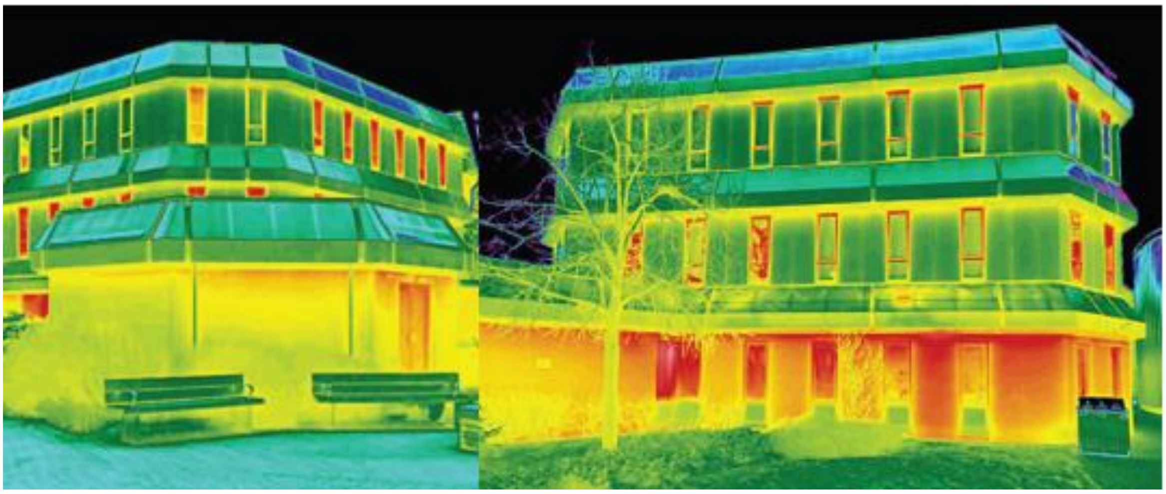




## Talbot Campus - Dorset House

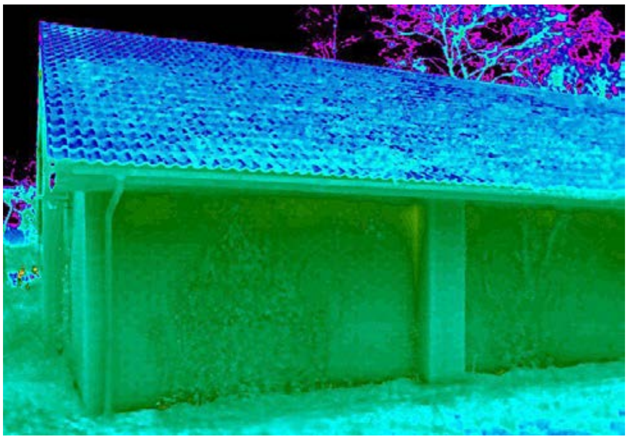
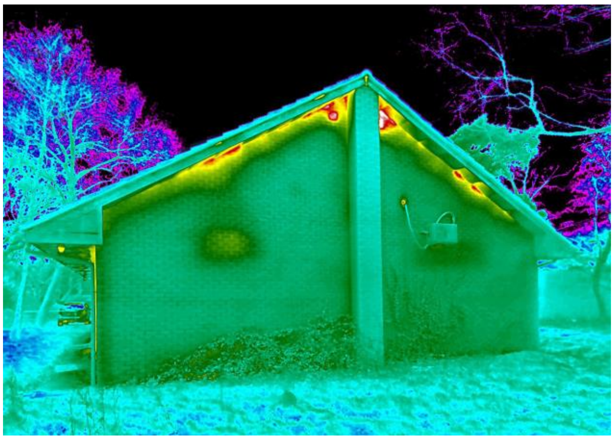
- The windows, and especially their frames, are operating poorly which may be due to aging assets or poor installation that hasn't prioritised thermal performance
- There is a clear difference between the ground floors and the upper two stories, with the ground floor leaking considerable amounts of heat
- The roof covering looks good, with little to no signs of thermal bridging

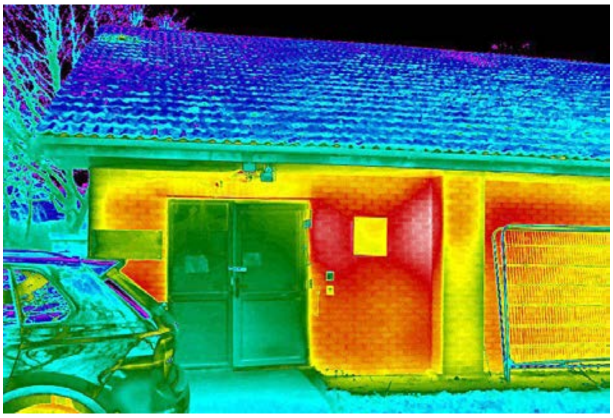




## Chapel Gate - Tennis Club

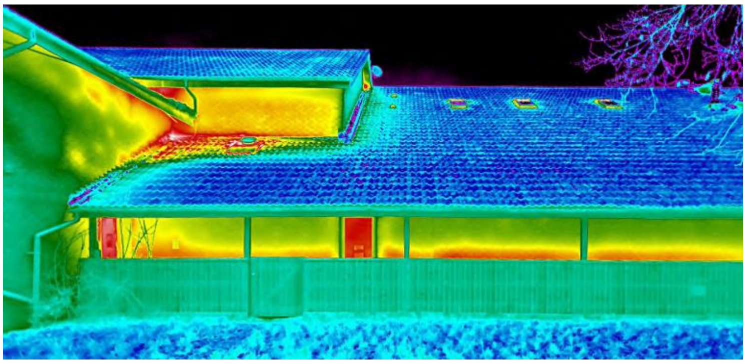
- There are good even temperatures across some of the elevations suggesting that the insulation is performing well
- Minor areas of heat loss noted at the roof line.
- The temperature across the south elevation appears high, further investigation is recommended in this area to ascertain insulation levels or other factors

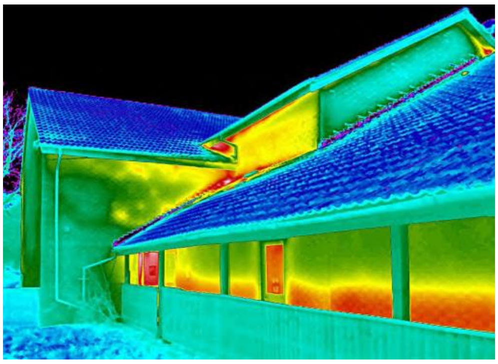



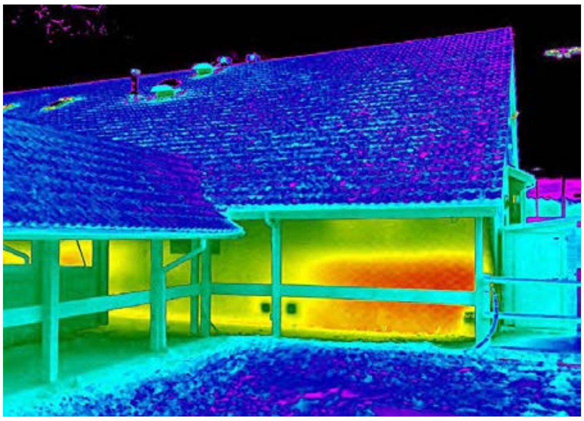


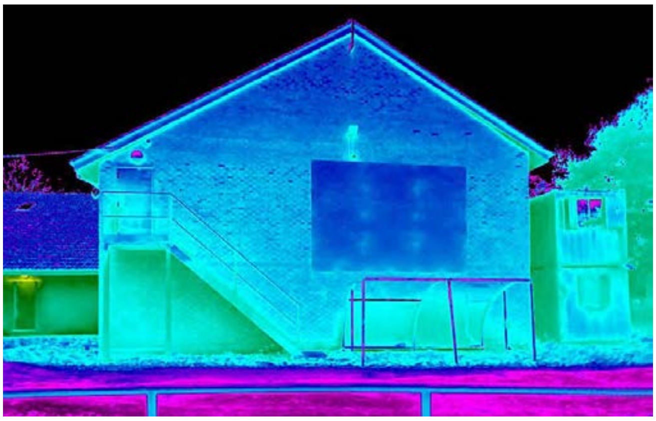
## Chapel Gate - Changing Rooms and Squash Courts

- There are even temperatures across the north and east elevations suggesting that the insulation is performing well
- Overall, the roof shows an even colour and temperature distribution, suggesting very little heat loss
- Insulation is not performing well in the elevations
- On the south elevation insulation appears to be performing poorly, this is evident from radiator located behind the section of wall which is indicating heat loss



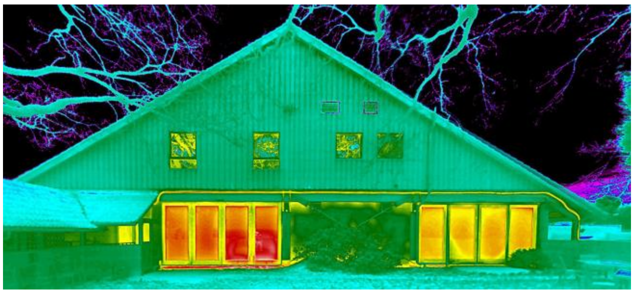
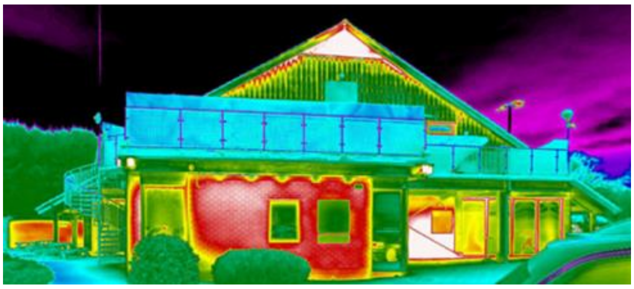
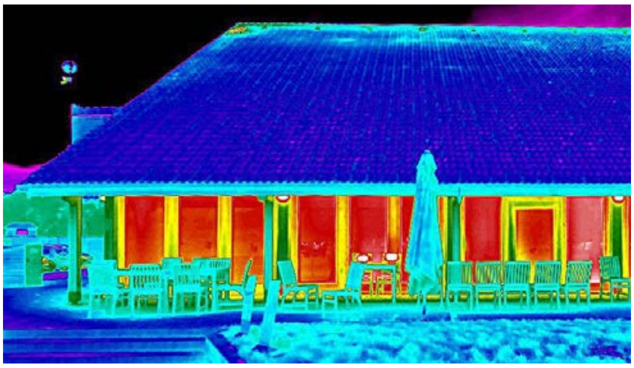
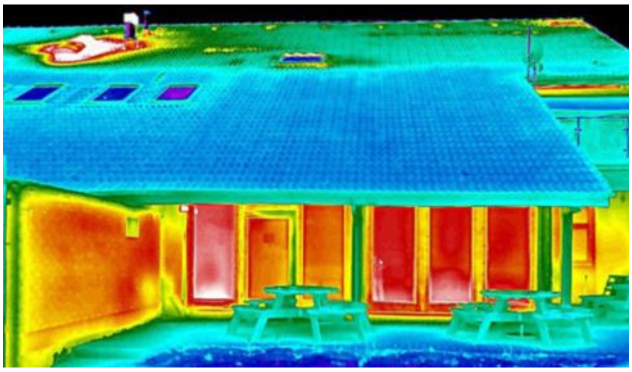






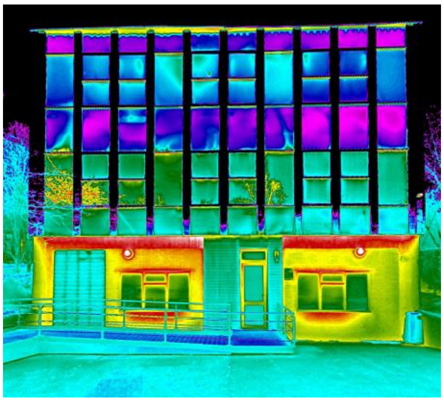
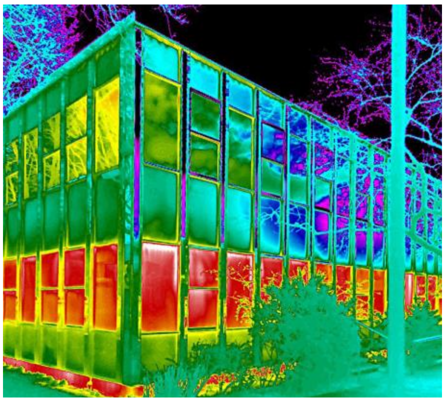
## Chapel Gate – Sports Campus

- Overall, the roof and elevations show an even colour and temperature distribution, suggesting very little heat loss
- The windows, and especially their frames, are operating very poorly which indicating aging assets or poor installation not prioritising thermal performance
- The red vented areas should be investigated further for missing or misaligned insulation
- Insulation is performing poorly on both walls of the south elevation, it appears to have little or no insulation
- The door appears to be performing poorly, this should be investigated further as it was in constant use at the time of the survey

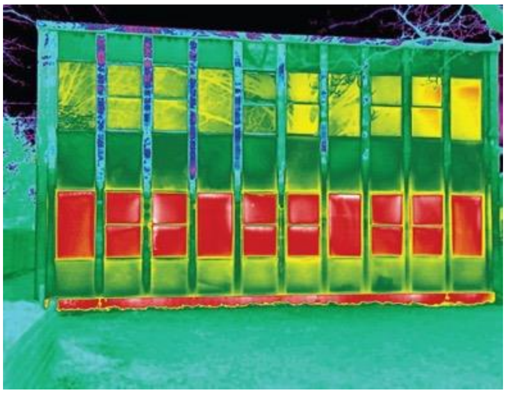
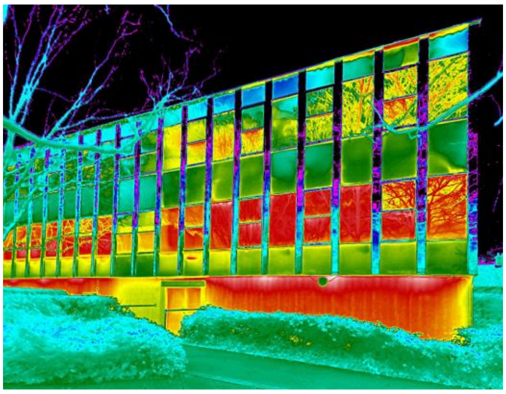






## University Centre, Yeovil

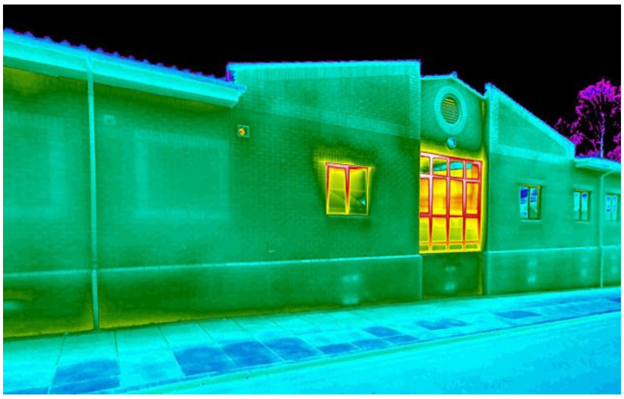
- Across both sites the windows, and especially their frames, are operating poorly which may be due to aging assets or poor installation not prioritising thermal performance
- Overall the roof covering looks good, with little to no signs of thermal bridging

Building 1: there is a clear difference between the ground floors and the upper two stories, with the lower ground floor glazing units and ground floor concrete slab leaking considerable amounts of heat

Building 2: On the west elevation it appears that the glazing units and frames are not performing well.

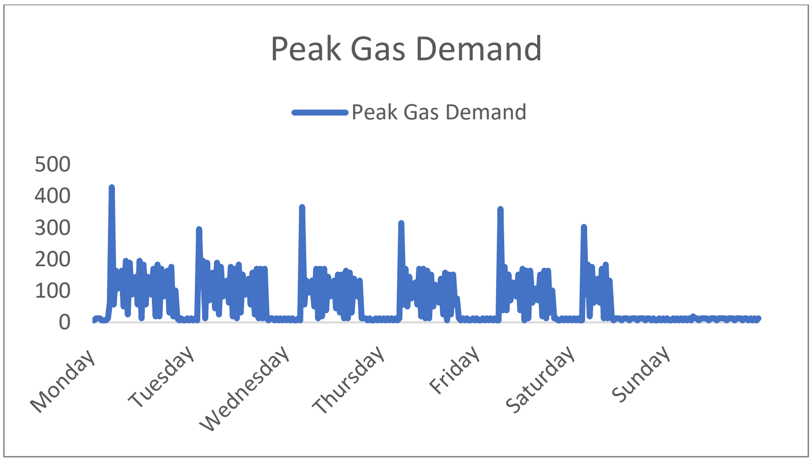


## Opportunities

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 I 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.

# Chapel Gate

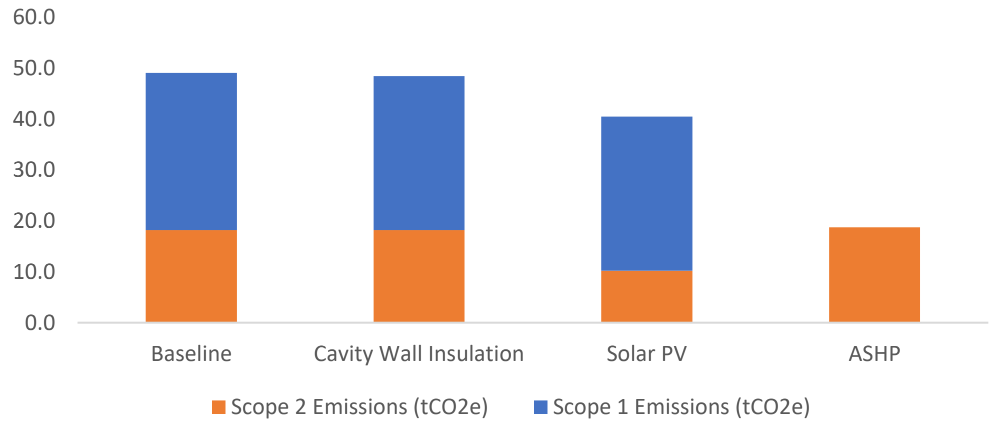
## Clubhouse

| Building |
|---|
| Clubhouse |
| **Technological Solution** |
| This building could be served using electrical panel radiators or similar, however the greatest carbon benefit and efficiency gains would be from a heat pump. An air source heat pump would be the recommended technology due to the relatively small size of the heating capacity which negates the need for investment in a ground source heat pump. The preferred solution would be one combined heating system that serves the Clubhouse and the Changing Rooms/Squash Courts. The recommended date for install has been suggested at 2025 due to the age of the boilers, and the relatively simple installation. Cavity wall insulation has been recommended to reduce the thermal load prior to replacing the boilers with a heat pump. |

### Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | N/A | £ 75,121 | 30.9 | 9.2 | N/A |
| Cavity Wall Insulation | £34,000 | £440 | 0.6 | 0.0 | 2023 |
| Solar PV | £52,941 | £14,691 | 0.0 | 7.9 | 2024 |
| ASHP | £344,599 | £5,497 | 30.2 | -8.5 | 2025 |
| **Total** | **£431,500** | **£20,629** | **30.9** | **-0.5** | |

### Pathway Comparison



# Changing Rooms and Squash Courts

| Building |
|---|
| Changing Rooms and Squash Courts |

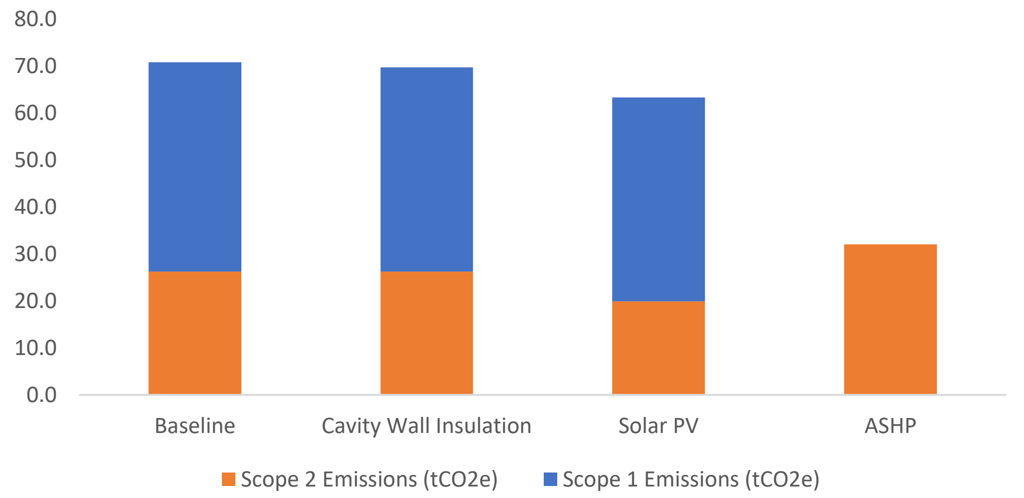
## Technological Solution

This building could be served using electrical panel radiators or similar, however the greatest carbon benefit and efficiency gains would be from a heat pump. An air source heat pump would be the recommended technology due to the relatively small size of the heating capacity which negates the need for investment in a ground source heat pump. The preferred solution would be one combined heating system that serves the Clubhouse and the Changing Rooms/Squash Courts. The recommended date for install has been suggested at 2025 due to the age of the boilers, and the relatively simple installation. In addition to these measures, cavity wall insulation is also recommended.

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £79,754 | 44.6 | 26.2 | Baseline |
| Cavity Wall Insulation | £49,100 | £803 | 1.1 | 0.0 | 2024 |
| Solar PV | £42,353 | £11,753 | 0.0 | 6.3 | 2024 |
| ASHP | £413,471 | £7,899 | 43.4 | -12.1 | 2025 |
| **Total** | **£504,924** | **£20,454** | **44.6** | **-6.2** | |

## Pathway Comparison



## Football Club Changing Rooms, Cricket Pavilion, Summer Cricket Pavilion, Groundkeepers Compound

| Building |
| --- |
| Football Club Changing Rooms, Cricket Pavilion, Summer Cricket Pavilion, Groundkeepers Compound |
| **Technological Solution** |
| The Summer Cricket Pavilion has no mechanical or electrical services and therefore no carbon footprint.<br><br>The other buildings are all electrically heated with sporadic occupancy and therefore replacing the heating systems would not yield any scope 1 emission savings and will only offer marginal scope 2 savings. |

# Lansdowne

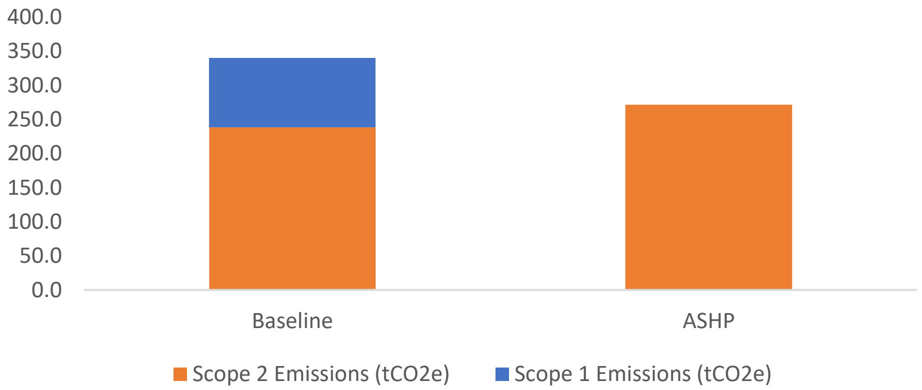
## Bournemouth Gateway Building

| Building |
|---|
| Bournemouth Gateway Building |
| **Technological Solution** |
| As BGB is a modern construction, already with a GSHP, the combined carbon emissions associated with the heating are relatively low despite using natural gas for part of the heating and hot water. It would be recommended that a new air source heat pump system would be installed, which would act as a reserve to the existing GSHP when peak heating levels are required.<br><br>Due to the age of the building and the low carbon emissions, it is recommended that this system is installed at the end of the programme in 2030, which will allow the university to benefit from the installed assets. |

Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £510,369 | 101.8 | 238.1 | |
| ASHP | £ £880,433 | £7,807 | 101.8 | -33.4 | 2030 |
| **Total** | **£880,433** | **£7,807** | **101.8** | **-33.4** | |

Pathway Comparison



# The Old Fire Station

## Building

The Old Fire Station

## Technological Solution

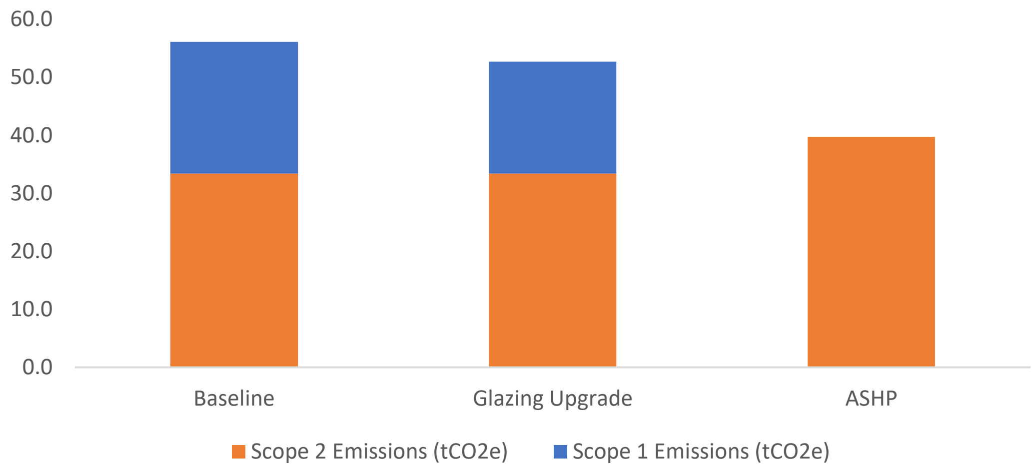
The Old Fire Station would be suitable for an air source heat pump installation; however modifications would be required to the radiators and the air handling units. The air handling unit on the top floor would need to be fully replaced due to it's age. It is recommended that a modular ASHP unit be installed so that DHW can be served as required by one dedicated heat pump, without impacting the COP of the other systems. It is recommended that this heating system is replaced in the middle of the programme despite having new boilers as the carbon intensity of the heating is high.

There are opportunities to reduce the thermal loss from the doors and windows however these will need to be carefully considered due to the status of the building.

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £108,862 | 22.7 | 33.4 | |
| Glazing Upgrade | £111,300 | £2,353 | 3.4 | 0.0 | 2027 |
| ASHP | £535,480 | £1,477 | 19.3 | -6.3 | 2028 |
| **Total** | **£646,780** | **£3,830** | **22.7** | **-6.3** | |

## Pathway Comparison



## Studland House

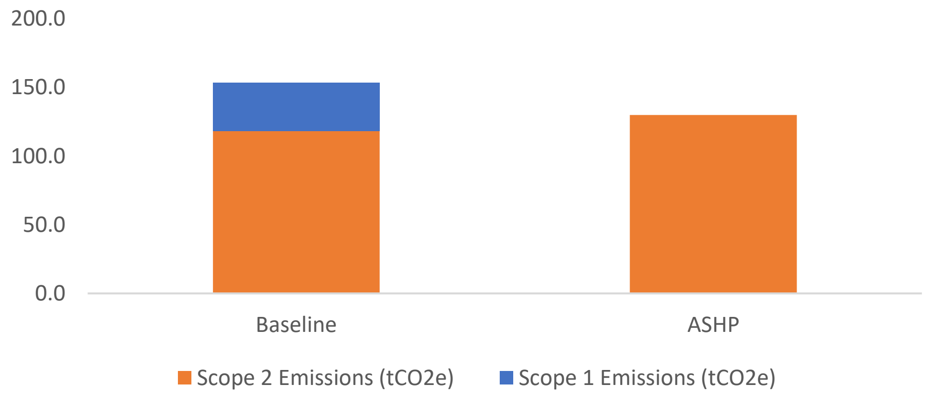
| Building |
|---|
| Studland House |

| Technological Solution |
|---|
| Due to the size of the required heat pump and the location of the building, a ground source heat pump wouldn't be recommended. Instead, an air source heat pump would be the preferred solution. An installation date of 2027 has been suggested to accommodate a complex design which would move the heat generation from the roof to the ground floor, and allow the heat pumps to use rejected heat from the data centre. |

**Recommended Decarbonisation Options**

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £243,097 | 35.1 | 118.3 | |
| ASHP | £ 1,070,960 | £2,692 | 35.1 | -11.5 | 2027 |
| **Total** | **£1,070,960** | **£2,692** | **35.1** | **-11.5** | |

**Pathway Comparison**



# Talbot Campus

## Christchurch House

| Building |
|---|
| Christchurch House |

### Technological Solution

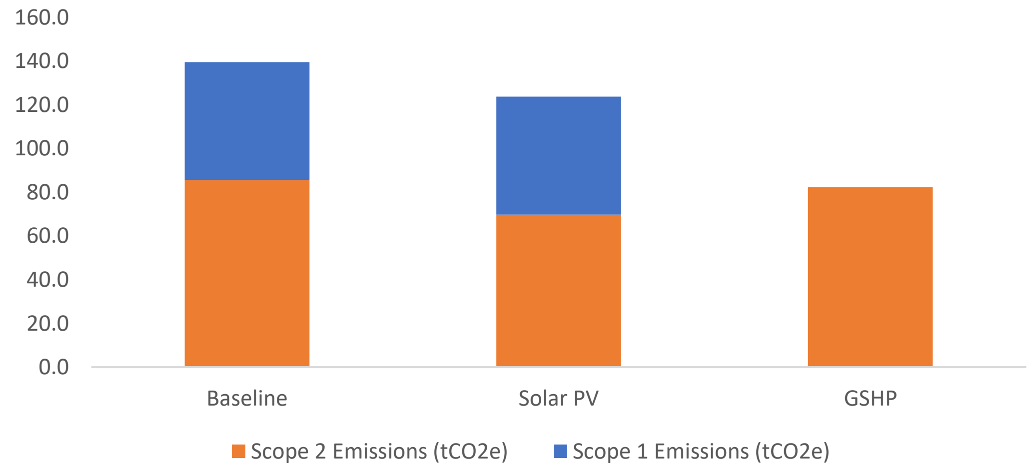
Whilst Christchurch House on it's own would justify an air source heat pump installation due to it's size and heat demand, there is an option, however, to link several buildings together and form a small communal heating system. The scope of this would require further consideration, however one proposal could be an ambient loop taking waste heat from Jurassic House and smaller water source heat pumps at a building level to boost the temperature.

The proposed date for installation is 2030 due to the complex design requirements and the required ground works.

### Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| *Baseline* | *£-* | *£195,377* | *54.0* | *85.6* | |
| Solar PV | £105,882 | £29,382 | 0.0 | 15.9 | 2030 |
| Ambient heating loop with Weymouth, PGB and Jurassic. | £1,732,501 | £13,519 | 54.0 | -12.7 | 2030 |
| **Total** | **£1,838,383** | **£42,901** | **54.0** | **3.2** | |

### Pathway Comparison



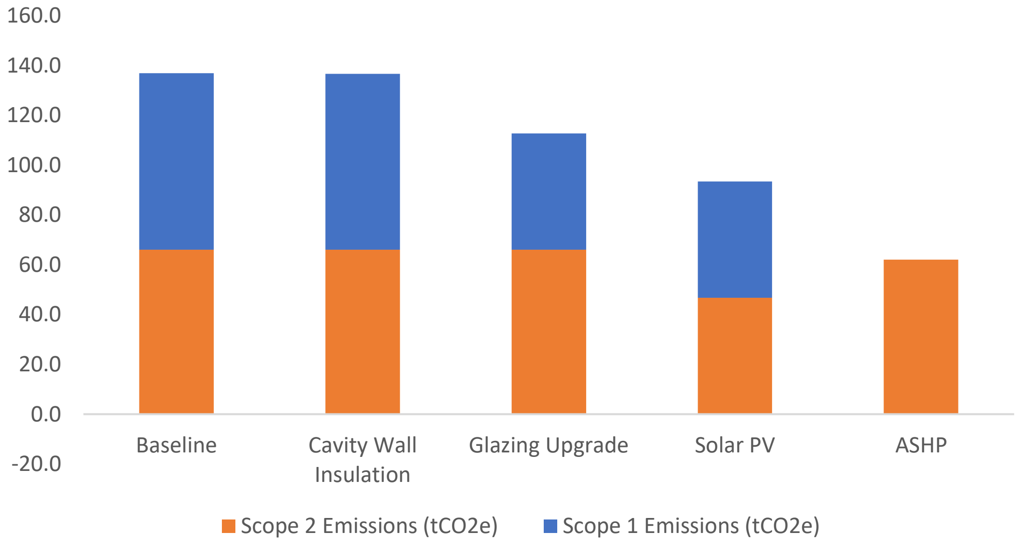
# Dorset House

| Building |
|---|
| Dorset House |
| **Technological Solution** |
| Dorset House has already had an Air Source Heat Pump project put forward for the Public Sector Decarbonisation Scheme with the aim of securing grant funding. This is partnered with a partial roof mounted PV array. If successful, these will need to be delivered by March 2024. There is the opportunity to further reduce the thermal loss through cavity wall insulation and a double glazing upgrade, however it was decided that these should be kept separate to the main bid. |

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £170,735 | 70.9 | 66.0 | |
| Cavity Wall Insulation | £18,700 | £199 | 0.3 | 0.0 | 2023 |
| Glazing Upgrade | £410,500 | £16,321 | 23.8 | 0.0 | 2023 |
| Solar PV | £107,055 | £35,755 | 0.0 | 19.3 | 2024 |
| ASHP | £1,959,442 | £3,586 | 46.8 | -15.4 | 2024 |
| **Total** | **£2,495,697** | **£55,861** | **70.9** | **4.0** | |

## Pathway Comparison



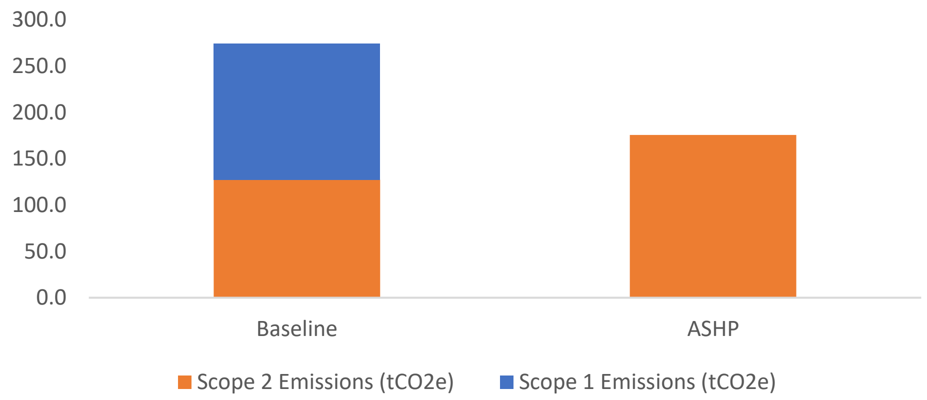
# Fusion Building

| Building |
|---|
| Fusion Building |
| **Technological Solution** |
| The Fusion House boilers could be replaced with a high temperature heat pump, which could serve the demands of the high-grade header (DHW and radiators). This may be via an ASHP or a WSHP fed from a new communal system, but extending the GSHP array of boreholes wouldn't be recommended as a retrofit solution. Timing has been proposed as 2030 as the building already has a low carbon intensity for it's heating, and the existing assets are new. |

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £336,677 | 147.1 | 127.5 | |
| ASHP | ££ 861,398 | £11,280 | 147.1 | -48.3 | 2030 |
| **Total** | **£861,398** | **£11,280** | **147.1** | **-48.3** | |

## Pathway Comparison



# Jurassic House

| Building |
| --- |
| Jurassic House |

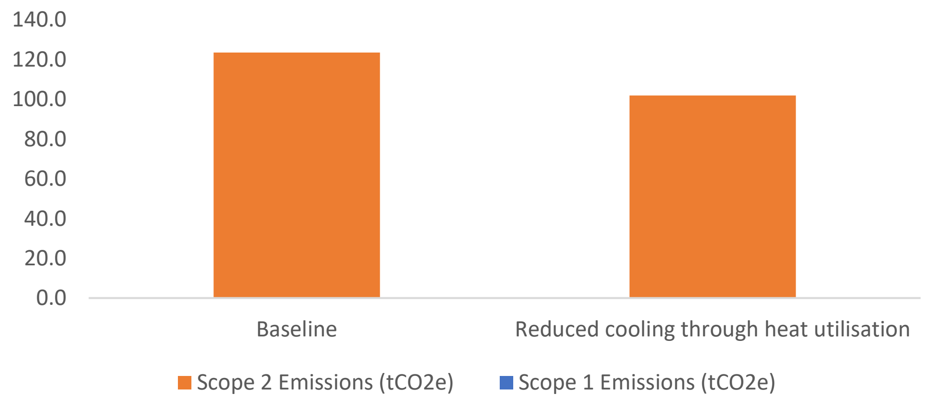
## Technological Solution

Whilst there is no opportunity to decarbonise the very small heating system in Jurassic house, there is the opportunity to reduce Scope 2 emissions associated with the cooling system by recovering some of the waste heat from the data centre and using it to supplement the heat in nearby buildings.

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
| --- | --- | --- | --- | --- | --- |
| Baseline | £- | £228,602 | 0.0 | 123.5 | |
| Reduced cooling through heat utilisation in ambient loop with Weymouth, Christchurch and PGB. | Included in heat pump projects for other projects | £39,960 | 0.0 | 21.6 | 2030 |
| **Total** | **£-** | **£39,960** | **0.0** | **21.6** | |

## Pathway Comparison



## Kimmeridge House

| Building |
|---|
| Kimmeridge House |

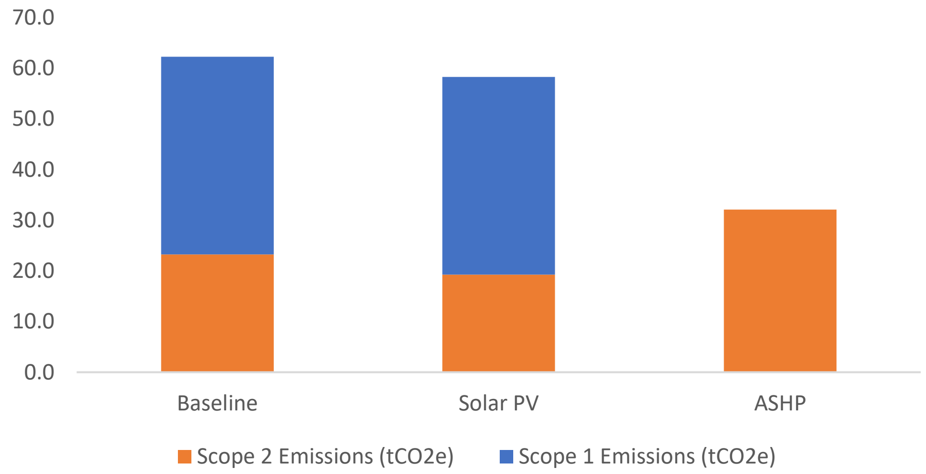
### Technological Solution

Kimmeridge House has already had an Air Source Heat Pump project put forward for the Public Sector Decarbonisation Scheme with the aim of securing grant funding. If successful this will require delivery by March 2024. Solar PV has also been recommended for this building, however it was decided to not include this in the grant application.

### Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £69,751 | 39.0 | 23.3 | |
| Solar PV | £33,000 | £7,349 | 0.0 | 4.0 | 2023 |
| ASHP | Included in Dorset House ASHP | £2,991 | 39.0 | -12.8 | 2024 |
| **Total** | **£33,000** | **£10,340** | **39.0** | **-8.8** | |

### Pathway Comparison



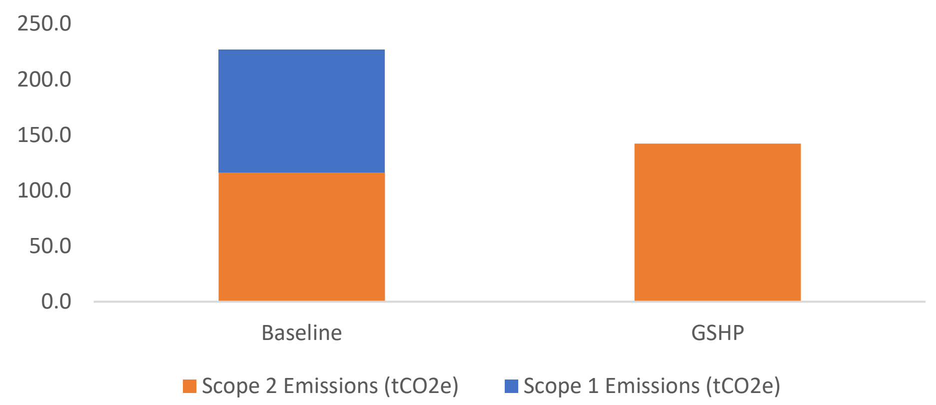
## Poole Gateway Building

| Building |
|---|
| Poole Gateway Building |
| **Technological Solution** |
| Due to the proximity of Jurassic House, there is an opportunity to connect Poole Gateway Building to a heat network utilising heat from the data centre, and boosting it at source to adequate temperatures using a WSHP. As the building is modern, and due to the complexity of any design, it would be recommended that this project is completed towards 2030. |

### Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £290,940 | 110.8 | 116.2 | |
| Ambient heating loop with Weymouth, Christchurch and Jurassic. | £1,273,898 | £27,736 | 110.8 | -26.0 | 2030 |
| **Total** | **£1,273,898** | **£27,736** | **110.8** | **-26.0** | |

### Pathway Comparison



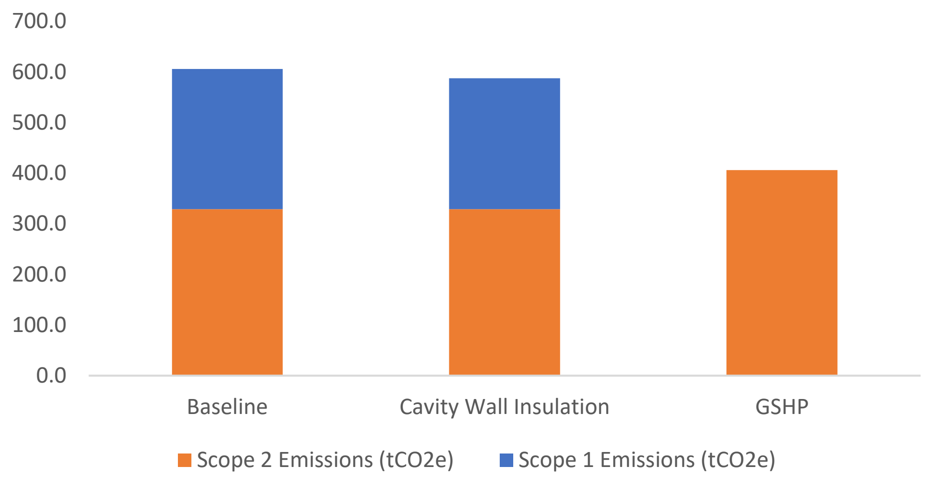
# Poole House

| Building |
|---|
| Poole House |
| **Technological Solution** |
| Poole House is a considerable heating load, and due to the recent installation of the gas boilers and the age of the biomass boilers (10years) it is recommended that any transition to a low carbon heating system is carried out towards the end of the 2030 target. Due to the size of the heating demand, it is recommended that a ground source heat pump is explored as this will maximise the COP of the system whilst negating some of the issues with amending a complicated, old heating system to accept a lower flow temperature. There are several areas that would benefit from cavity wall insulation to reduce thermal loss. |

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £886,448 | 276.8 | 329.1 | |
| Cavity Wall Insulation | £368,200 | £15,965 | 18.3 | 0.0 | 2023 |
| GSHP | £4,586,031 | £92,567 | 258.4 | -77.2 | 2029 |
| **Total** | **£4,954,231** | **£108,532** | **276.8** | **-77.2** | |

## Pathway Comparison



# Student Centre

| Building |
|---|
| Student Centre |

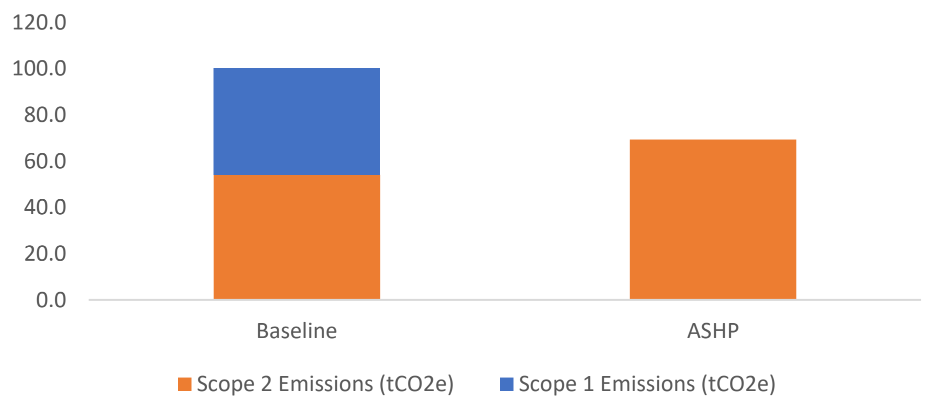
## Technological Solution

The Student Centre already benefits from a GSHP, which already lowers the blended carbon intensity of the heating system. It is proposed to replace the LTHW and DHW systems with air source heat pumps which will act as back-up/top-up to the GSHP system. The recommendation is for this to be completed towards the end of the 2030 target due to the ag of the installed assets.

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £131,802 | 46.2 | 54.1 | |
| ASHP | £551,294 | £3,543 | 46.2 | -15.2 | 2029 |
| **Total** | **£551,294** | **£3,543** | **46.2** | **-15.2** | |

## Pathway Comparison



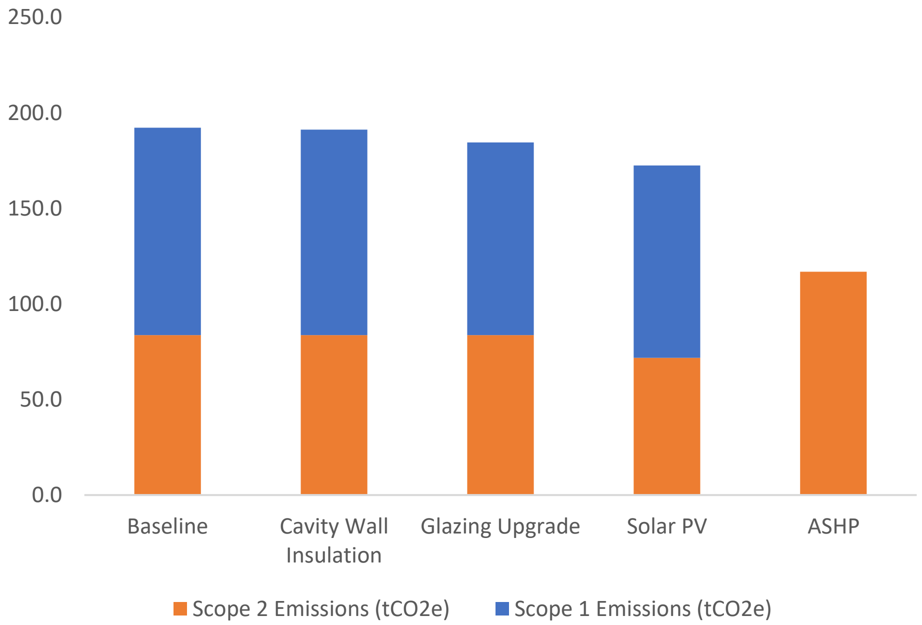
# SMCL

| Building |
|---|
| SMCL |
| **Technological Solution** |
| SMCL has already had an Air Source Heat Pump project put forward for the Public Sector Decarbonisation Scheme with the aim of securing grant funding. If successful this will require delivery by March 2024. Solar PV, double glazing and cavity wall insulation were also recommended however it was decided to keep these measures separate to the grant application. . |

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £229,366 | 108.5 | 83.8 | |
| Cavity Wall Insulation | £68,000 | £780 | 1.1 | 0.0 | 2023 |
| Glazing Upgrade | £160,000 | £4,597 | 6.7 | 0.0 | 2023 |
| Solar PV | £88,400 | £22,045 | 0.0 | 11.9 | 2024 |
| ASHP | £1,898,940 | £7,722 | 100.7 | -33.1 | 2024 |
| **Total** | **£2,215,340** | **£35,144** | **108.5** | **-21.2** | |

## Pathway Comparison



# Talbot House

| Building |
| --- |
| Talbot House |

## Technological Solution

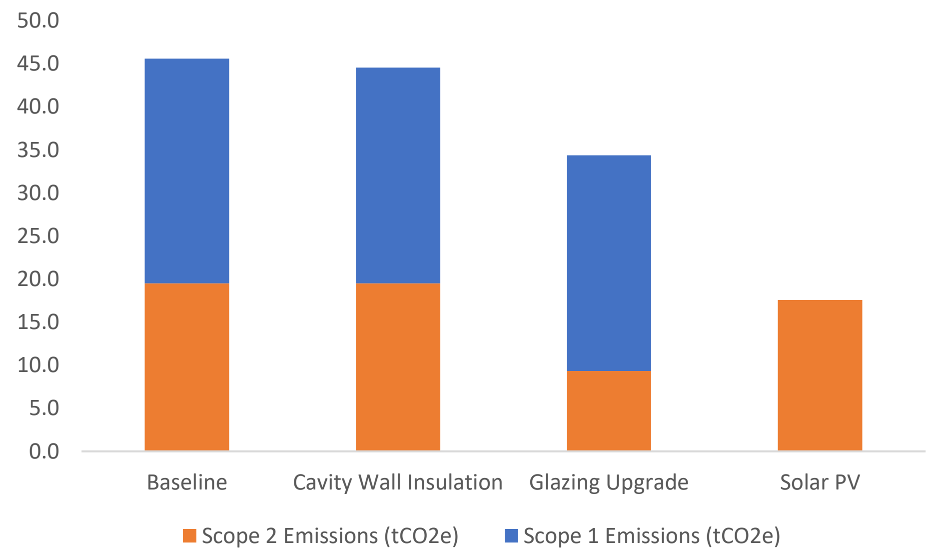
The recommended option for Talbot House would be to keep the two distinct plant rooms, with ASHP units installed in situ to supply each half of the building. Another option could be to combine, but due to the size of the building and it's heat demand the benefit versus cost of rerouting the mechanical infrastructure would not be justified.

There is the opportunity to improve the building fabric by replacing doors that were observed to be causing high volumes of air infiltration.

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
| --- | --- | --- | --- | --- | --- |
| Baseline | £- | £53,948 | 26.1 | 19.5 | |
| Glazing Upgrade | £33,200 | £720 | 1.1 | 0.0 | 2025 |
| Solar PV | £67,765 | £18,805 | 0.0 | 10.2 | 2024 |
| ASHP | £620,206 | £1,920 | 25.0 | -8.2 | 2026 |
| **Total** | **£721,171** | **£21,445** | **26.1** | **1.9** | |

## Pathway Comparison



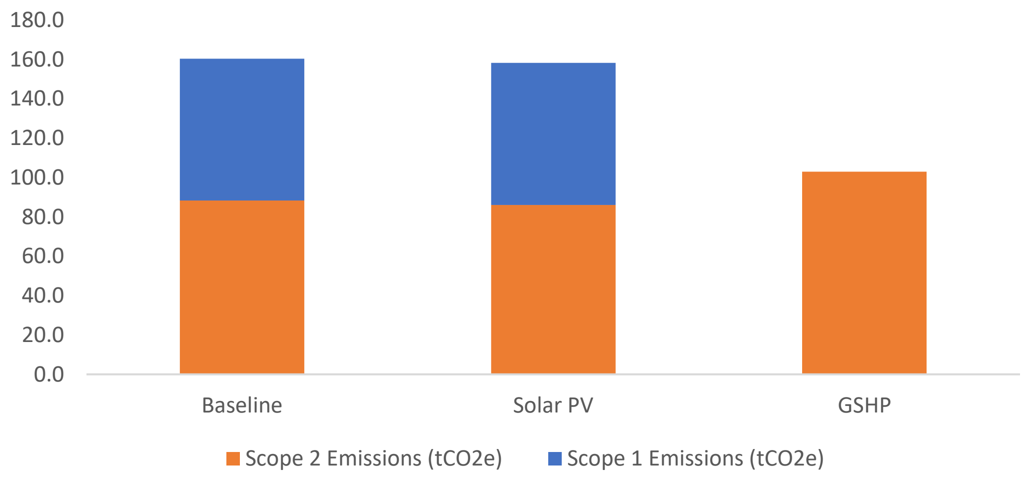
# Weymouth House

| Building |
|---|
| Weymouth House |
| **Technological Solution** |
| Due to the proximity of Jurassic House, there is an opportunity to connect Weymouth House to a heat network utilising heat from the data centre, and boosting it at source to adequate temperatures using a WSHP. As the building is modern and because of the complexity of any design, it would be recommended that this project is completed towards 2030. |

## Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £212,726 | 72.1 | 88.2 | |
| Solar PV | £14,824 | £4,114 | 0.0 | 2.2 | 2024 |
| Ambient heating loop with Christchurch, PGB and Jurassic. | £ 2,293,016 | £18,056 | 72.1 | -16.9 | 2030 |
| **Total** | **£2,307,839** | **£22,169** | **72.1** | **-14.7** | |

## Pathway Comparison



# Yeovil Campus

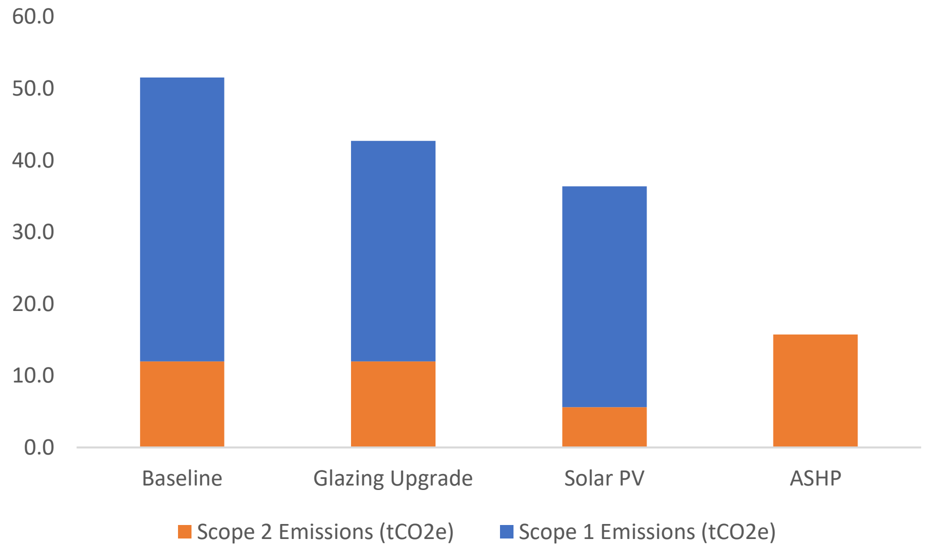
## University Centre Yeovil

| Building |
|---|
| University Centre Yeovil |
| **Technological Solution** |
| The recommended option for University Centre Yeovil would be to keep the two distinct plant rooms, with ASHP units installed in situ to supply each half of the building. Another option could be to combine, but due to the size of the building and it's heat demand the benefit versus cost of rerouting the mechanical infrastructure would not be justified. The building suffers from single glazing and low density fabric which could be upgraded to improve thermal performance. |

### Recommended Decarbonisation Options

| Technology | CAPEX (£) | OPEX Saving (£) | Scope 1 Savings (tCO2e) | Scope 2 Savings (tCO2e) | Proposed Installation Date |
|---|---|---|---|---|---|
| Baseline | £- | £49,253 | 39.6 | 12.0 | |
| Glazing Upgrade | £275,100 | £6,033 | 8.8 | 0.0 | 2025 |
| Solar PV | £42,353 | £11,753 | 0.0 | 6.3 | 2024 |
| ASHP | £689,118 | £2,358 | 30.7 | -10.1 | 2028 |
| **Total** | **£1,006,571** | **£20,144** | **39.6** | **-3.8** | |

### Pathway Comparison



# 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 **£21.8M**, this equates to an average capital spend of **£3M** per annum. Initiatives would deliver annual cost savings of **£454k** per annum.

| Projects | CAPEX (£) | Cost Savings (£) | Scope 1 Emissions (tCO2e) | Scope 2 Emissions (tCO2e) |
|---|---|---|---|---|
| **Cavity Wall Insulation** | £538,000 | £18,187 | 21.5 | 0.0 |
| **Glazing Upgrade** | £990,100 | £30,024 | 43.8 | 0.0 |
| **Heat Reutilisation** | £0 | £39,960 | 0.0 | 21.6 |
| **Solar PV** | £554,573 | £155,647 | 0.0 | 84.1 |
| **ASHP** | £9,825,300 | £58,772 | 665.3 | -214.9 |
| **GSHP/Ambient Loop** | £9,885,445 | £151,877 | 495.3 | -132.7 |
| **Total** | **£ 21,793,418** | **£454,467** | **1226.0** | **-242.4** |

## Key Recommendations

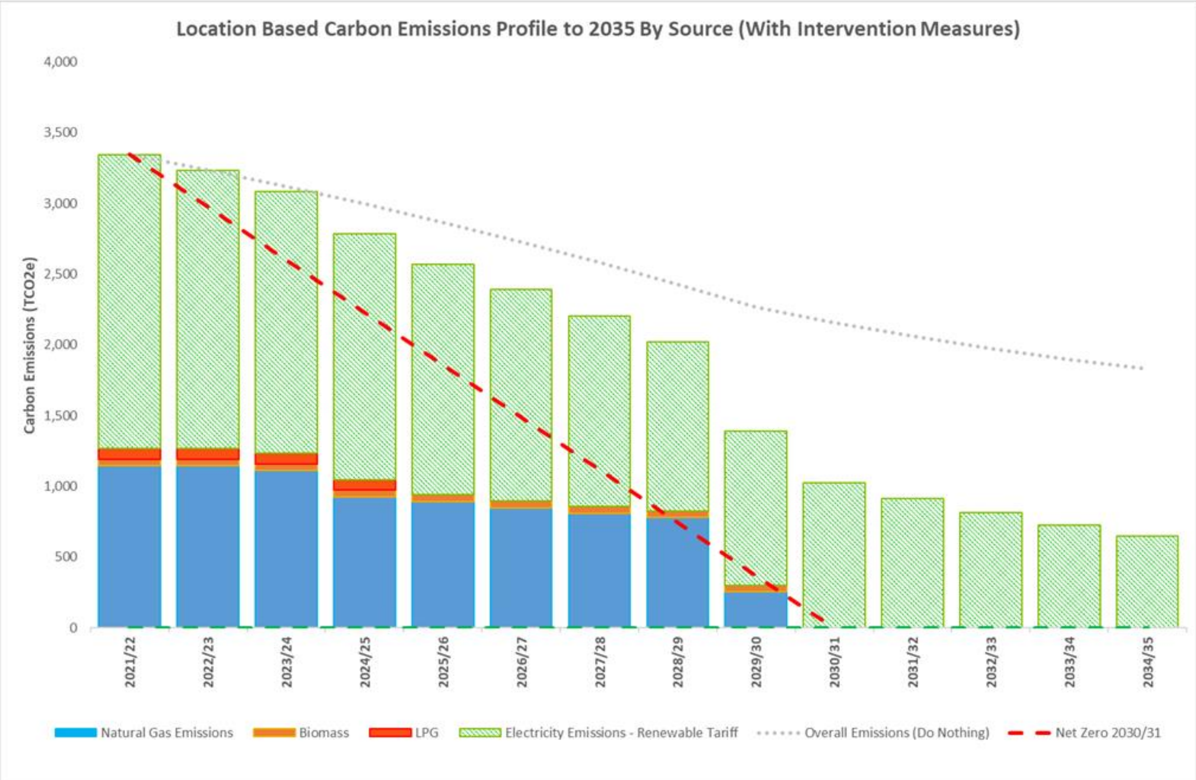
The site assessments have identified that the following interventions could be made at each site:

| Capital Projects Carbon Savings (tCO2e 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<br>Talbot Campus – Weymouth House | PV |
| | Chapel Gate - Clubhouse | Building Fabric Upgrades & PV |
| | Talbot Campus - Dorset House<br>Talbot Campus - Kimmeridge House<br>Talbot Campus - Sir Michael Cobham Library | Air Source Heat Pump & PV |
| 2025 | Talbot Campus - Poole House<br>Yeovil - University Centre Yeovil | Building Fabric Upgrades |
| | Chapel Gate - Clubhouse<br>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<br>Talbot Campus - Fusion Building | Air Source Heat Pump |
| | Talbot Campus – Christchurch House | Ground Source Heat Pump and PV |
| | Talbot Campus - Poole Gateway Building<br>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 £21.8m of project works. Around 90% (£19.7m) of capital project cost is associated with the replacement of boilers with heat pumps, 7% (£528k) relates to building fabric upgrades, with the remaining 2% (£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 | £345k ASHP | | | | | | **£431k** |
| | Clubhouse | | £34k/£53k Cavity Wall & PV | £413k ASHP | | | | | | **£505k** |
| | Cricket Pavilion | | | | | | | | | |
| | Football Club Changing Rooms | | | | | | | | | |
| | Groundsman's Compound | | | | | | | | | |
| | Summer Cricket Pavilion | | | | | | | | | |
| Lansdowne | Bournemouth Gateway Building | | | | | | | | £880k ASHP | **£880k** |
| | The Old Fire Station | | | | | £111k Glazing | £535k ASHP | | | **£647k** |
| | Studland House | | | | | £1,070k ASHP | | | | **£1,070k** |
| Talbot | Christchurch House | | | | | | | | £106k / £1,732k PV & GSHP | **£1,838k** |
| | Dorset House | £429k Glazing & cavity wall | £2,066k ASHP & PV | | | | | | | **£2,495k** |
| | Fusion Building | | | | | | | | £861k ASHP | **£861k** |
| | Jurassic House | | | | | | | | | **£0k** |
| | Kimmeridge House | | £33k PV | | | | | | | **£33k** |
| | Poole Gateway Building | | | | | | | | £1,274k GSHP | **£1,274k** |
| | Poole House | | | £368k Cavity Wall | | | | £4,586k GSHP | | **£4,954k** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Student Centre | | | | | | | £551k ASHP | | **£551k** |
| | Sir Michael Cobham Library | £228k Glazing & cavity wall | £1,987k ASHP & PV | | | | | | | **£2,215k** |
| | Talbot House | | £68k PV | £33k Cavity Wall | £620k ASHP | | | | | **£721k** |
| | Weymouth House | | £14k PV | | | | | | £2,293k GSHP | **£2,308** |
| Yeovil | University Centre Yeovil | | £42k PV | £275k Glazing | | | £ 690k ASHP | | | **£1,007k** |
| | | | | | | | | | | |

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 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 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 £21.8m will be required, which will need to be earmarked for low carbon projects. Individual projects will range in cost from £34k-£5m 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 tCO2e 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 £21.8M, of potential decarbonisation projects, £19M 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) |
|---|---|---|---|---|
| **Cavity Wall Insulation** | £538,000 | £18,187 | 21.5 | 0.0 |
| **Glazing Upgrade** | £990,100 | £30,024 | 43.8 | 0.0 |
| **Heat Reutilisation** | £0 | £39,960 | 0.0 | 21.6 |

| | | | | |
|---|---|---|---|---|
| **Solar PV** | £554,573 | £155,647 | 0.0 | 84.1 |
| **ASHP** | £ 9,825,445 | £58,772 | 665.3 | -214.9 |
| **GSHP** | £9,885,445 | £151,877 | 495.3 | -132.7 |
| **Total** | **£21,793,418** | **£454,467** | **1226.0** | **-242.4** |

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 | £345k ASHP | | | | | | **£431k** |
| | Clubhouse | | £34k/£53k Cavity Wall & PV | £413k ASHP | | | | | | **£505k** |
| | Cricket Pavilion | | | | | | | | | |
| | Football Club Changing Rooms | | | | | | | | | |
| | Groundsman's Compound | | | | | | | | | |
| | Summer Cricket Pavilion | | | | | | | | | |
| Lansdowne | Bournemouth Gateway Building | | | | | | | | £880k ASHP | **£880k** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | The Old Fire Station | | | | | £111k Glazing | £535k ASHP | | | **£647k** |
| | Studland House | | | | | £1,070k ASHP | | | | **£1,070k** |
| Talbot | Christchurch House | | | | | | | | £106k / £1,732k PV & GSHP | **£1,838k** |
| | Dorset House | £429k Glazing & cavity wall | £2,066k ASHP & PV | | | | | | | **£2,495k** |
| | Fusion Building | | | | | | | | £861k ASHP | **£861k** |
| | Jurassic House | | | | | | | | | **£0k** |
| | Kimmeridge House | | £33kPV | | | | | | | **£33k** |
| | Poole Gateway Building | | | | | | | | £1,274k GSHP | **£1,274k** |
| | Poole House | | | £368k Cavity Wall | | | | £4,586k GSHP | | **£4,954** |
| | Student Centre | | | | | | | £551k ASHP | | **£551k** |
| | Sir Michael Cobham Library | £228k Glazing & cavity wall | £1,987k ASHP & PV | | | | | | | **£2,215k** |
| | Talbot House | | £68k PV | £33k Cavity Wall | £ 620k ASHP | | | | | **£721k** |
| | Weymouth House | | £14k PV | | | | | | £2,293k GSHP | **£2,308** |
| Yeovil | University Centre Yeovil | | £42k PV | £275k Glazing | | | £690k ASHP | | | **£1,0077k** |
| | | | | | | | | | | |

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. |
| 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 CO2e per sales revenue, or tonnes of CO2e per total square metres of floor space. |

| Term | Description | Definition |
|---|---|---|
| Carbon Saving | Carbon Saving | Averaging BEIS electrical emission factors over anticipated lifetime |
| $CO_2$ | Carbon Dioxide | A Greenhouse Gas (GHG) which is colourless with a density ~53% higher than that of dry air. |
| $CO_2e$ | 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 abatement costs often rise steeply as more pollution is reduced. |
| $m^2$ | Square metre | The area equal to a square that is 1 meter on each side. |
| $m^3$ | 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. |

| Term | Description | Definition |
|---|---|---|
| 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 |
|---|---|---|---|
| 1 | 20.3.23 | Lois Betts BU Sustainability Manager following feedback from Estates Development Committee | - Recommendation for Sustainable Construction Policy added into recommended next steps.<br>- 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.<br>- Removed appendix with heat network map which is deemed irrelevant as stated on page 63. |
| 2 | 21.3.24 | Lois Betts BU sustainability manager | Edited with new costs provided by Mitie in Feb 24 |
| | | | |