

Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Programme - MSc Sustainable Construction

**Module - Services & Energy Performance of
Buildings**

Lecturer - Paul Manley

**Assignment Title - Building Services and Energy
Audit**

Submission Deadline - 10 May 2023

Student – Paul Davies

Student I.D. - 2203997

(Word Count – 4151)

Building Services and Energy Audit

Case Study Report for

Julian Hodge Building (Cardiff University)

Introduction

In this Case Study / Report, we will be looking at the Assets' "Major Plant", and "Maintenance Strategy", then finally we will look at the "Energy Audit" carried out on the Asset (Julian Hodge Building).

The "Major Plant" will give us an idea of the services that run the building and need to be maintained by the Facilities Management (FM) team.

Using this information, we will then be able to make an informed decision / proposal for a "Maintenance Strategy" to be implemented / suggested.

Finally, we will look at the "Energy Audit" conducted, to give us an idea of the Assets' performance and provide feedback / suggestions as to any improvements / alterations that could be made to the Asset, in relation to cost savings and energy consumption.

Asset Schedule of Major Plant

The Asset (Julian Hodge Building) is divided into two buildings, the old section / building, housing the café area and the new section / building, housing the lecture theatre, IT suites', resource centre and offices.

The 'Ground Floor Map' below highlights the layout and locations of the Assets Major Plant to both the new section in 'Green' and old section in 'Red' of the building, with additional Plant rooms on each floor of the new section of the building.

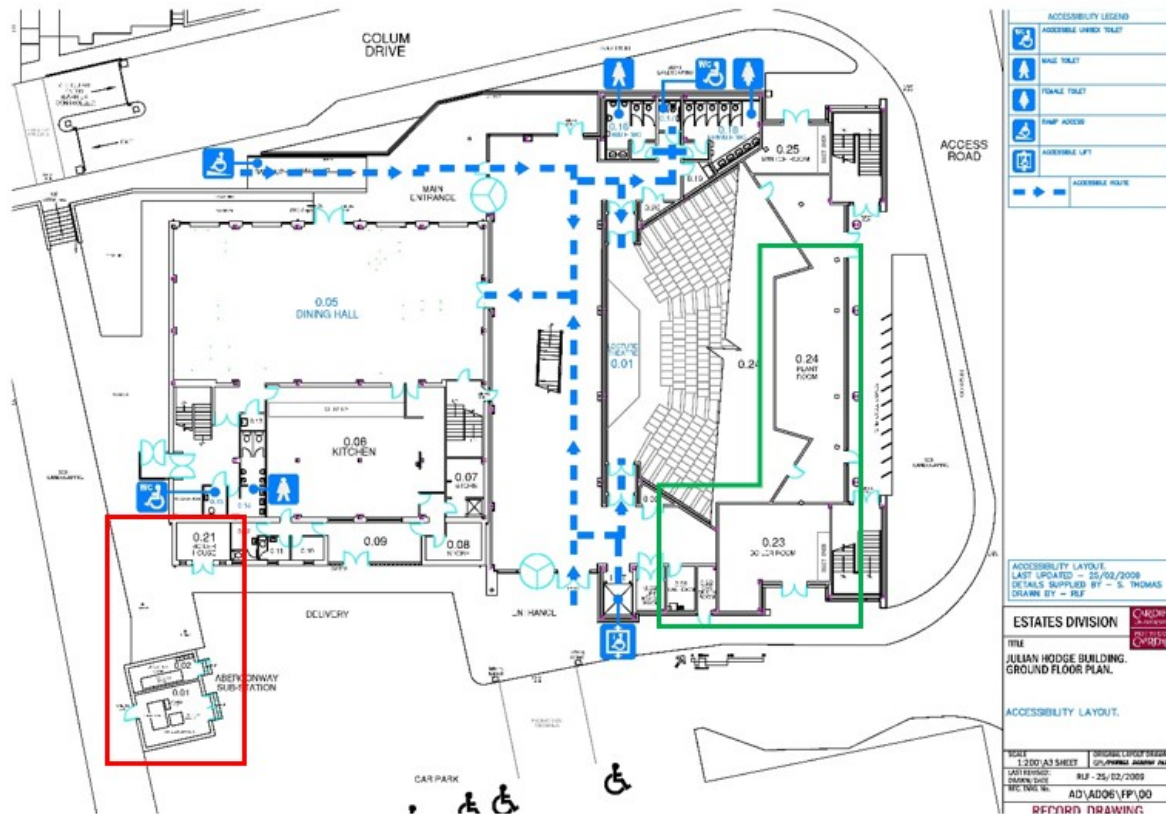


Fig. 1. Ground Floor Map

Sourced from - Cardiff University (2023). Julian Hodge Building.

The building also benefits from the use of an active Building Management System (BMS) supplied by a Trend software application to control the Assets major plant and operational facilities to the building.



Julian Hodge Building Illustrating the Old and New Sections of the Building / Asset.

Sourced from - Cardiff University (2023). Julian Hodge Building.

The Old Section of the Building / Asset (Café)



Front Area of the Building



Rear Area of the Building

This section of the building is supplied with its own heating and hot water supply from Boiler House 0.21 and Aberconway Sub – Station 0.02 as highlighted in the 'Ground Floor Map' in **RED** (Fig. 1.).



Gas Meter



Switching Control Panel



Twin Boiler set up (Modular)



Unvented Hot Water



Grundfos Twin Pumps



Low Loss header supply

The New Section of the Building / Asset (Lecture Theatre and Associated Rooms)



West Side View

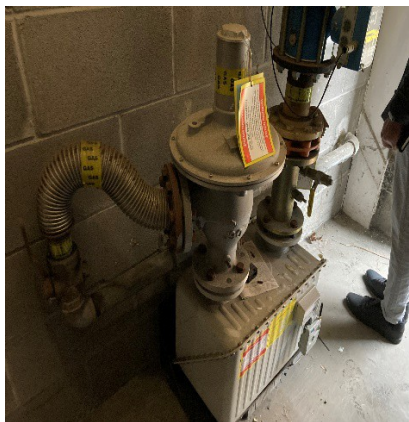


North Side View



East Side View

The New area of the building is also supplied by its own gas supply, wet heating system and displacement air conditioning, Air Handling Units (AHU's) from Gas Meter Room 0.22, Boiler Room 0.23 and Plant Room 0.24 as highlighted in the 'Ground Floor Map' in **Green** (Fig. 1.), Further AHU's can be found in Plant Room 2.12, 2nd Floor and Plant Room 3.18, 3rd Floor with its own electrical supply / circuit also supplied from Aberconway Sub-Station 0.02.



Gas Meter



Switching Control Panel



Four Boiler set up (Modular)



Grundfos Twin Pumps



Htg. & Chilled Pump Set



Under Floor Htg. Manifold



Boosted Cold Water Set



Air Handling Unit



Vents to Lecture Theatre

The Main electrical supply for the building is supplied via the Aberconway Sub – Station which has several Main supplies for the Julian Hodge building. This Data has been supplied by Mark Durdin, Facilities Manager for Cardiff University which illustrates different area metering.

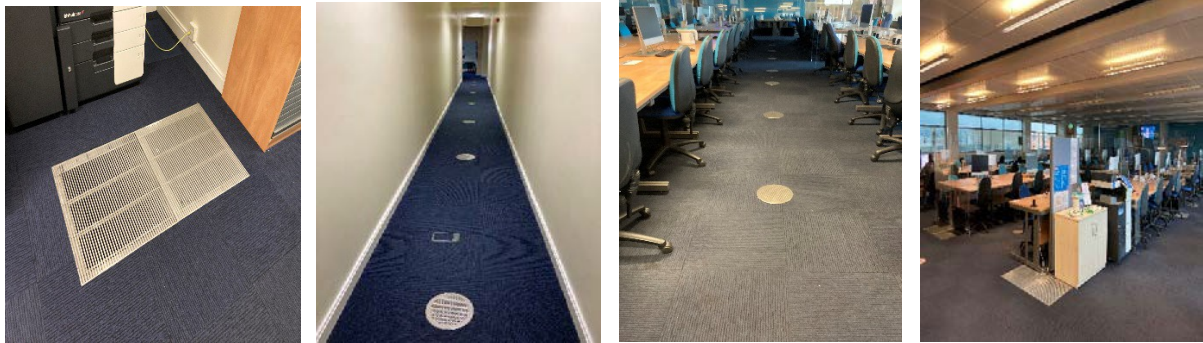
AD - Academic - Colum Road and Humanities Site Buildings Electricity Meter Tree with Consumption							
Dates: Jan 21 to Dec 22							
Meter Id	Meter Name	Meter Type	Unique Meter Id	Building Name	Main Incomer?	Area m2	
72182	AD06 Julian Hodge Bldg M1 Main Incomer L1 Current	Electricity	AD06E02477AD06	AD06 Julian Hodge Building	0	0.00	
72183	AD06 Julian Hodge Bldg M1 Main Incomer L2 Current	Electricity	AD06E02478AD06	AD06 Julian Hodge Building	0	0.00	
72184	AD06 Julian Hodge Bldg M1 Main Incomer L3 Current	Electricity	AD06E02479AD06	AD06 Julian Hodge Building	0	0.00	
44138	AD06 Julian Hodge Bldg M1 Main Incomer	Electricity	AD06E00173AD06	AD06 Julian Hodge Building	1	3585.35	
35130	AD06 Julian Hodge M2 Lecture Theatre	Electricity	AD06E00174AD06	AD06 Julian Hodge Building	0	0.00	
44137	AD06 Julian Hodge M5 Aberconway Refectory (CARBS?)	Electricity	AD06E00177AD06	AD06 Julian Hodge Building	1	3585.35	
44139	AD06 Julian Hodge Sub - Local D.B. Elec kWh Stark	Electricity		AD06 Julian Hodge Building	0	0.00	
47176	Julian Hodge L/T Elec	Electricity	MPRN NOT KNOWN	No Building (MI)	0	0.00	
55658	AD06 Julian Hodge M4 DB Switch Room (Zero)	Electricity	AD06E00176AD06	AD06 Julian Hodge Building	0	0.00	
55659	AD06 Julian Hodge M3 Spare	Electricity	AD06E00175AD06	AD06 Julian Hodge Building	0	0.00	
72081	AD06 Julian Hodge Refectory Outside LTG	Electricity	AD06E02077AD06	AD06 Julian Hodge Building	0	0.00	
72085	AD06 Julian Hodge M6 (Refectory?)	Electricity	AD06E02111AD06	AD06 Julian Hodge Building	0	0.00	

AD06 Julian Hodge Electricity.xlsx

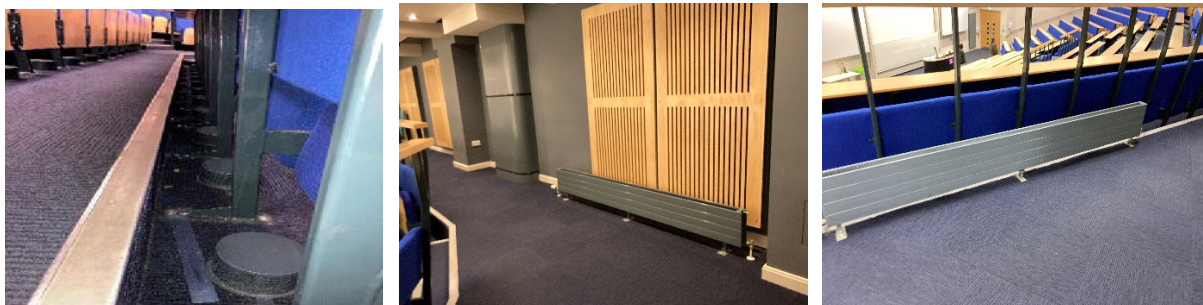
Source – Mark Durdin, Cardiff University



During the site visit to the Julian Hodge Building Mark Durdin stated the building benefited from both wet heating (traditional Panel Radiators and Underfloor Heating) and displacement Air Conditioning units fed from the plant room on various floors, with heating and chilling supplied from the ground floor boiler house of the new building.



Displacement Air ducts in corridors and IT / Office suites



Displacement Air ducts (under seat and Wall) and wet heating in the Lecture Theatre

He also pointed out the lighting scheme had a mixed variety of, fluorescent, halogen, and LED lighting throughout the old and new section of the building, although LED lighting was now the preferred method of lighting, upgrading the lights are done as and when the old fittings fail. Passive Infrared (PIR) sensors are used in some locations, toilet areas for example to activate lighting on occupancy sensing.



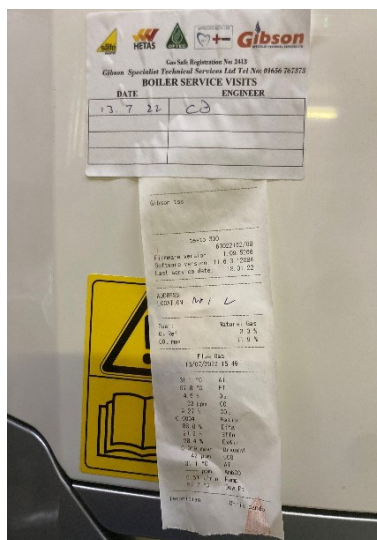
Various lighting used in both the New and Old Buildings

Maintenance Strategy for Building Services Engineering

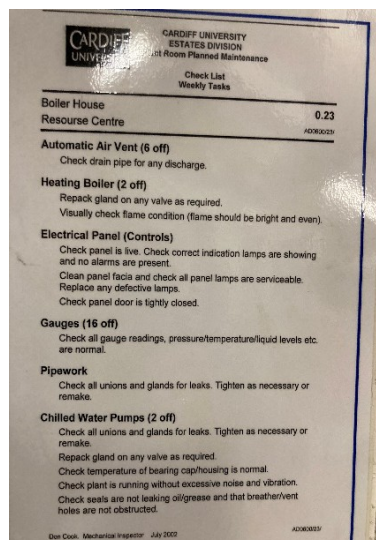
Overview

The Julian Hodge Building is divided into two buildings, the 'Old' section and the 'New' section. The 'Old' section provides a kitchen and dining area while the 'New' section, a three-storey build, provides a lecture theatre, I.T. resource centre with 136 networked computers and office spaces for staff. The building supplies services to the general public as well as academic and research facilities. It has a dated Mechanical and Electrical (M&E) plant including gas fired boilers, air handling units on various floors of the building, wet and dry heating using traditional panel radiators and displacement air circulation, which are essential to the building's general day to day operation and usage.

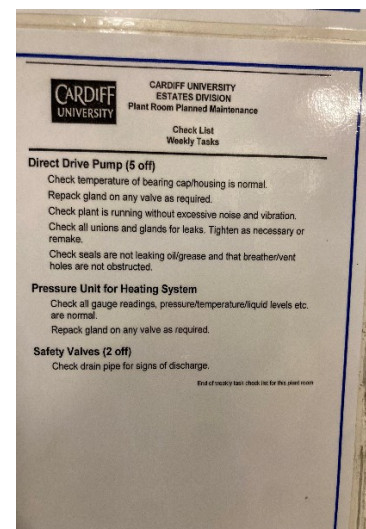
The Facilities Manager, Mark Durdin said that the maintenance of M&E equipment is conducted by a combination of in-house and outsourced Service Providers. It was noted that Gas Servicing and Maintenance was undertaken by Gibson STS Ltd. and that the in-house team conduct minor maintenance and checks given complexity of the plant.

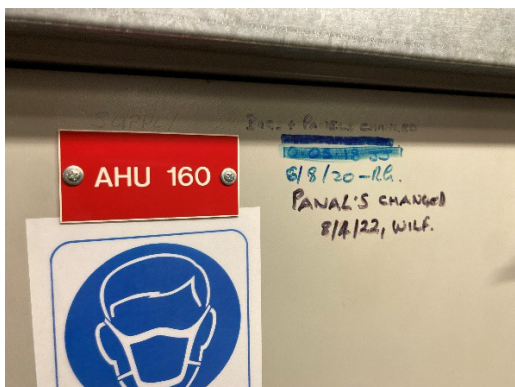
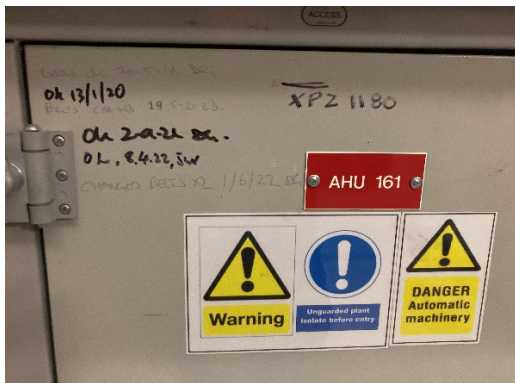


Gibson's Boiler Service



In – House Maintenance Schedule's





Examples of Air Handling Units In – house Maintenance Records of work for Panel and Belt Changes / Maintenance.

The Trend Building Management System (BMS) is also managed in – house by the FM team, with more specialist works that need to be undertaken performed by an external contractor.

With this in mind, we will review the requirements for planned and reactive maintenance of the building engineering services for the Julian Hodge Building. Taking into consideration, existing Maintenance strategies and evaluate and suggest a new Maintenance delivery model if applicable to the Building /Asset.

The main aims would be to: -

1. Maintain equipment compliance with current legislation, Health & Safety regulations, statutory requirements, and ACOP.
2. Fulfil the current Key Performance Indicators (KPIs) for planned and reactive maintenance.
3. Enhance the efficiency and efficacy of the maintenance service for building services engineering.
4. Minimise maintenance expenses while keeping the quality of the provided service.

To achieve this, a business case study has been undertaken reviewing the following documents to ascertain an informed decision for the outsourcing vs in – house maintenance of the Asset. –

- The Management of Health and Safety at Work Regulations 1999
- BS EN 15341:2019 Maintenance – Maintenance Key Performance Indicators
- BSRIA BG 24/2012 Asset Management & Maintenance Audits
- CIBSE Guide M 2014 – Maintenance Engineering and Management
- Review of on – line journals on Maintenance Strategies

Potential benefits of outsourcing

- Specialised engineers have extensive knowledge of equipment and are supported by a larger labour force.
- Resource levels to adapt to your project's needs.
- Outsourcing to a national company can tap into a wider parts stock network, resulting in reduced material costs due to increased volume.
- Supply competitive labour rates without the concerns of in-house salary increases, sick leave, or annual leave.
- Contracts can include financial penalties to ensure performance standards are met.
- Improved capabilities for monitoring and enhancing productivity.

Potential risks of outsourcing

- Closer supervision of the work being performed may be needed.
- A heavier administrative burden may be experienced by the client.
- Performance levels may be influenced by the remaining duration of the contract.
- Depending on the type of contract employed, effectively controlling costs may pose challenges.

Potential benefits of in – house

- Enhanced capacity to promptly respond to mechanical or electrical breakdowns.
- Extensive expertise and familiarity with the plant equipment and assets installed on-site.
- Management can maintain greater control over the in-house maintenance regime and uphold quality standards.
- Improved financial control and expenditure management.

Potential risks of in – house

- Possible resource scarcity during peak periods.
- Need for a supervisory role.
- Challenges in adjusting labour resources adequately during slow or busy periods.
- Costs associated with training and developing staff.
- Risk of staff attrition after the training process, resulting in knowledge loss.
- Availability of specialised tools and equipment.

There are three available options that we can use for our Maintenance Strategy –

1. Do Nothing - Continue with Existing Mixed Regime:

Under this option, the current approach to maintenance, which combines both planned and reactive maintenance strategies, would be maintained without any significant changes. Consideration to whether the current mixed regime is effective in meeting the maintenance needs and goals of the organisation. Considering factors such as cost-effectiveness, resource allocation, and overall maintenance performance.

2. Outsource all Planned and Reactive Maintenance to a Service Provider:

In this option, the organisation would decide to transfer the responsibility for all planned and reactive maintenance tasks to an external service provider. Outsourcing maintenance can offer numerous benefits, including access to specialised expertise, reduced administrative burden, and potentially lower costs.

3. Bring all Planned and Reactive Maintenance In-House:

Alternatively, the organisation could choose to bring all planned and reactive maintenance activities in-house. This would mean expanding their internal maintenance team, dedicated to handling all maintenance tasks. Following this route would give them direct control over the maintenance processes, resources, and decision-making, giving greater flexibility, customisation, and alignment of maintenance strategies. This would also incur associated costs of recruiting and training skilled personnel, investing in equipment and technology, and establishing efficient maintenance workflows.

Alexander (1996) identifies several drivers for outsourcing maintenance services in organisations or companies. The increasing complexity of modern building technologies often makes it challenging to employ or retain engineers with the necessary skill sets for maintaining diverse equipment. Additionally, organisations face the risk of managing manpower shortages due to annual leave or sickness, which can make it economically non-viable to maintain an in-house maintenance team.

According to Alexander and Young (1996), outsourcing servicing and maintenance to external contractors provides organisations with more assurance that they are achieving market value while reducing expenditure on in-house salaries and costs. Outsourcing can bring discipline to costs and prevent in-house costs from exceeding market levels over time (Ender and Mooney, 1994).

Yik and Lai (2005) argue that specialist O&M contractors can deliver maintenance services more efficiently due to their greater knowledge and skill sets. They can also deploy their labour force more readily, allowing the organisation to focus on its core business. This specialised knowledge enables plants to run more efficiently, resulting in financial savings for the organisation.

There are other costs and risks associated with outsourcing. These include the expenses related to the tender exercise itself and the management of the contractor to ensure that servicing and maintenance are conducted according to the agreed specification. Another risk is that an organisation may become overly dependent on the contractor and their knowledge of the site and equipment. Outsourcing can also lead to performance deterioration and increased costs if not effectively managed, and therefore, the focus should not solely be on short-term advantages (Alexander & Young, 1996; Jennings, 2002).

Without tight control and management of an outsourced contractor, there is a possibility of premature equipment failure if maintenance specifications are reduced without the client's knowledge, aiming to increase profits for the contractor (Redden, 2007). This can result in critical failures, service interruptions, and increased life cycle costs.

Outsourcing maintenance services may also lead to a loss of in-house staff with specialised skills and knowledge. If the outsourced contractor fails to perform to the required standards, bringing these activities back in-house may not be possible without sufficient time for re-recruitment (Campbell, 1995). In-house staff may also have a greater sense of ownership and responsibility for the plant and assets. Clearly defining contractual responsibilities is essential to avoid disputes that may affect ongoing performance (Lai, Yik & Jones, 2004).

When deciding on a maintenance strategy, careful consideration should be given to the procurement method or form of contract. CIBSE Guide M - 2014 - Chapter 4 provides details on several types of contracts that an organisation can choose from. The selection of the most suitable contract will depend on the available maintenance budgets and the scale of the portfolio. In the case of outsourcing, multiple providers with specialised expertise and market competitiveness in specific areas may be utilised instead of relying on a larger company that subcontracts to specialist subcontractors.

Example of Contracts that may be used could be: –

ICE (2005) NEC3: *Term Service Contract*

JCT (2006) *Measured Term Contract*

CIOB (2008) *Facilities Management Contract*

Conclusion

Considering both arguments for a wholly outsourced or in-house maintenance service, there are risks associated with both approaches. Considering the specialist equipment within the building and Cardiff University's M&E assets (300 plus) stock, maintaining a solely in-house maintenance regime would likely be unfeasible, unless significant investment in training and staff recruitment is undertaken. Retaining a smaller in-house team capable of performing basic maintenance tasks, checks, and providing a first response to breakdowns would be a practical solution, allowing for gathering more information for the specialist contractor. This approach is also supported by Tsang (2004).



Julian Hodge Building
Adeilad Julian Hodge

Dolce Vita Gallery
JHB Lounge
Lecture Theatre
Study Centre

Canolfan Astudio
Darlithfa
Lolfa JHB
Oriel Dolce Vita

CARDIFF
UNIVERSITY
PRIFYSGOL
CAERDYDD

Building Services & Energy Audit for Julian Hodge Building Cardiff University

Site Visit – 15th March, Arrival 13:30, Approx 3 Hours duration

Weather – Raining,

Temperature - 10°C

My Approach to conduct an Energy Audit on said Building.

The following flow diagram, illustrated from the “Elements of the Energy Audit Process” listed in BS EN 16247-2-2014 BSi Energy Audits Part 2: Buildings, highlights the strategy used I have used below.

Pre – Arrival Building Information

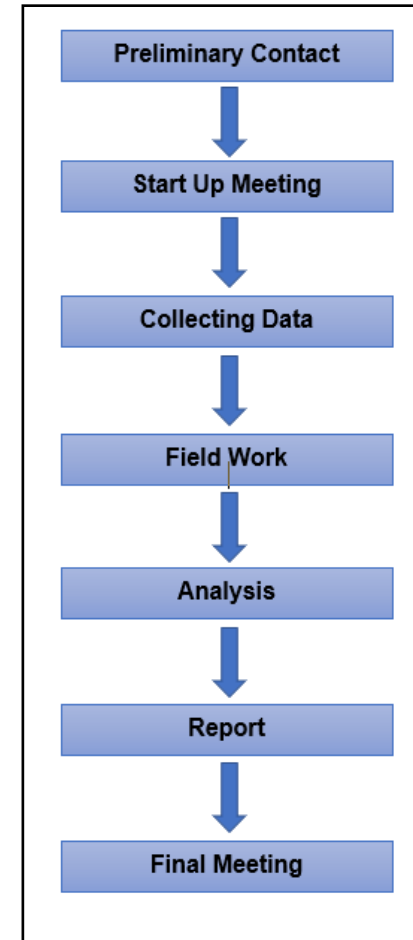
(Information gathered from research)

On – Site Building Information

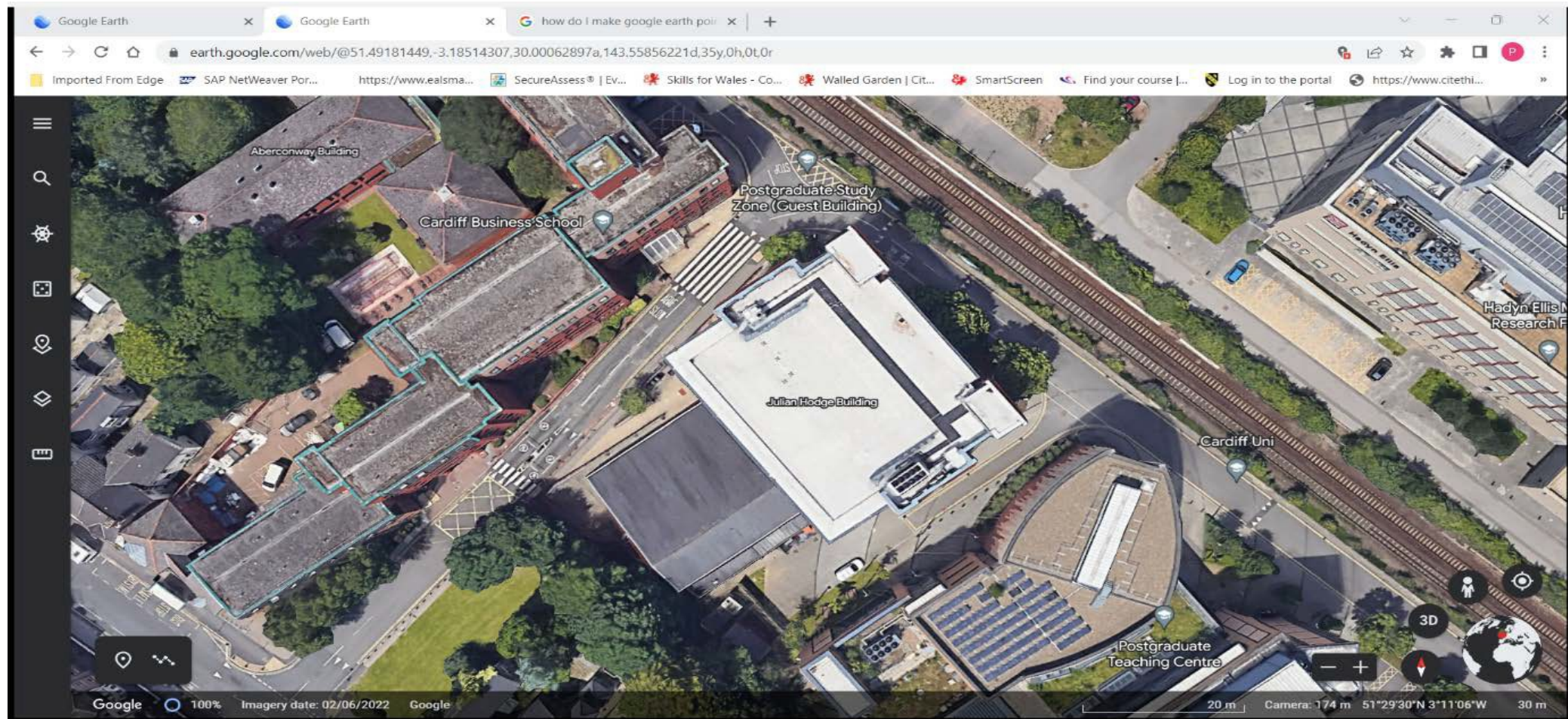
(Information collated from observations
and Questioning of Staff)

Post - Visit Building Information

(Analyses of Data to help create a judgement
of the Assets Energy performance)



Pre – Arrival Building Information



Imagery Date 02 – 05 – 2022

Source - Google (2023). Google Earth.

Pre – Arrival Building Information

Display energy certificate (DEC)

! This certificate has expired.

You can get a new certificate by visiting www.gov.uk/get-new-energy-certificate

Get help with certificates for this property

If you need help getting a new certificate or if you know of other certificates for this property that are not listed here, contact the Department for Levelling Up, Housing and Communities (DLUHC).

dluhc.digital-services@levellingup.gov.uk
Telephone: 020 3820 0748

Cardiff University Julian Hodge Building Colum Drive CARDIFF CF10 3EU	Operational rating F	Certificate number: 0529-0163-2710-7100-1003 Valid until: 24 May 2021 Total useful floor area: 3700.48 square metres
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Energy performance operational rating

The building's energy performance operational rating is based on its carbon dioxide (CO₂) emissions for the last year.

It is given a score and an operational rating on a scale from A (lowest emissions) to G (highest emissions).

The typical score for a public building is 100. This typical score gives an operational rating of D.

Previous operational ratings	
Date	Operational rating
May 2020	139 F
June 2019	140 F
June 2018	81 D

Total carbon dioxide (CO ₂) emissions				
This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO ₂ .				
Date	Electricity	Heating	Renewables	
May 2020	349	116	0	
June 2019	350	119	0	
June 2018	182	93	0	

Assessment details

<https://find-energy-certificate.service.gov.uk/energy-certificate/0529-0163-2710-7100-1003/print4ue>

1/2

Display energy certificate (DEC) – Find an energy certificate – GOV.UK

Score	Operational rating	This building	Typical
9-25	A		
26-50	B		
51-75	C		
76-100	D		
101-125	E		
126-150	F	139 F	
150+	G		

This building's energy use		
Energy use	Electricity	Other fuels
Annual energy use (kWh/m ² /year)	171	162
Typical energy use (kWh/m ² /year)	81	237
Energy from renewables	0%	0%

Assessor's name	Antony Woodliss
Employer/Trading name	Energy Intelligence Centre Limited
Employer/Trading address	3 Brooklands, Moors Moat Drive, North Moors Moat, Redditch, B98 9DW
Assessor's declaration	Contractor to the occupier for EPBD services only.
Accreditation scheme	Sterling Accreditation Ltd
Issue date	10 June 2020
Nominated date	25 May 2020

<https://find-energy-certificate.service.gov.uk/energy-certificate/0529-0163-2710-7100-1003/print4ue>

2/2

Recommendation report – Find an energy certificate – GOV.UK

Display energy certificate (DEC) recommendation report	
Cardiff University Julian Hodge Building Colum Drive CARDIFF CF10 3EU	Report number 9139-2078-0182-0100-8501
	Valid until 11 February 2026

Operational rating and DEC

This building's operational rating is D.

For more information on the building's energy performance, [see the DEC for this building / energy certificate 0529-0163-2710-7100-1003](https://find-energy-certificate.service.gov.uk/energy-certificate/0529-0163-2710-7100-1003).

<https://find-energy-certificate.service.gov.uk/energy-certificate/9139-2078-0182-0100-8501/print4ue>

1/5

Recommendation report – Find an energy certificate – GOV.UK

Building and report details	
Building occupier	
Building type	Restaurant, University Campus
Building environment	Air Conditioning
Electricity used	330878 kWh
Gas used	481366 kWh
Total useful floor area	3700.48 square metres
Building reference	RRN-0510-0122-3129-9729-5002
Report issued on	12 February 2019
Calculation tool	DCLG, ORCalc, v3.6.3
Type of inspection	Physical

<https://find-energy-certificate.service.gov.uk/energy-certificate/9139-2078-0182-0100-8501/print4ue>

4/5

Sourced from - GOV.UK (2019).

Sourced from - GOV.UK (2020).

Pre – Arrival Building Information

Information collated from Pre – Arrival Sources

The Asset appears to be South – Westerly facing giving Southern light to the Glazed area of the building by day. The Asset has a useful floor area totalling 3700.48 m².

It has a Display Energy Certificate (DEC) Operational Rating of F (139) which is now out of date (24 May 2021).

Using this information, we can Benchmark against similar building types (Rating D (100)) to manage the assets performance as directed in CIBSE Guide F - 2012 – Energy Efficiency.

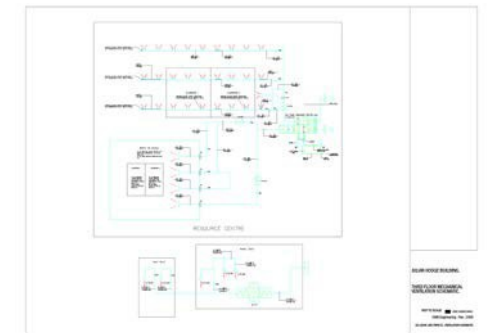
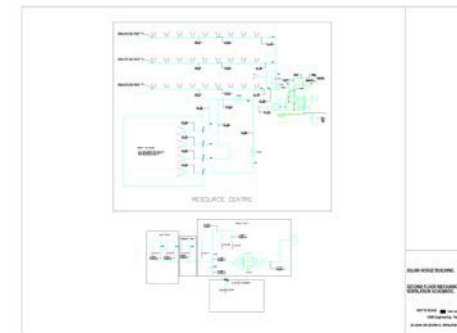
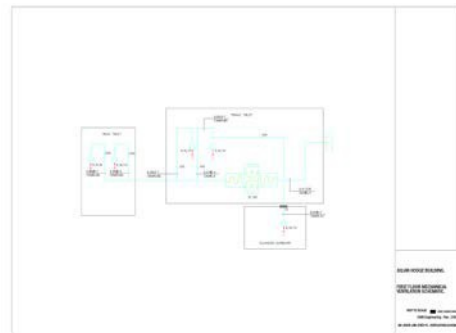
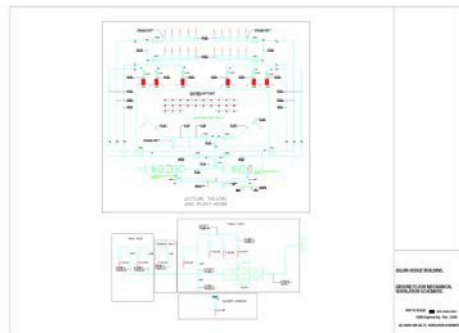
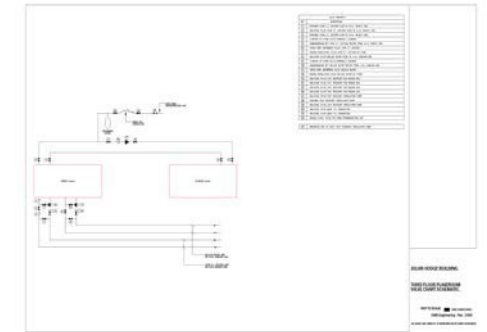
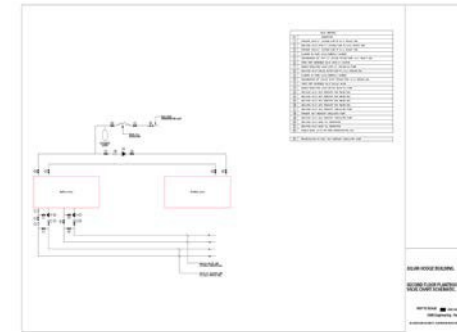
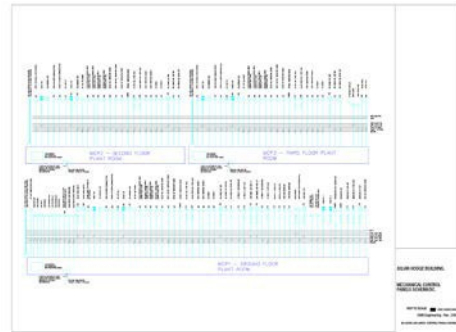
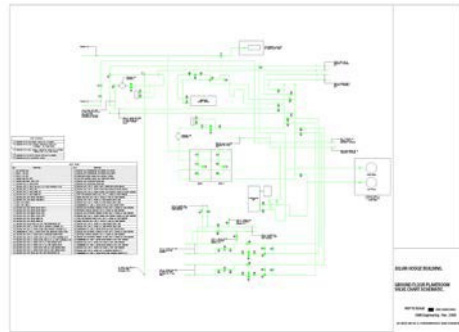
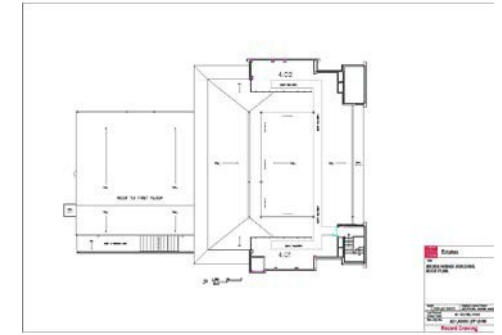
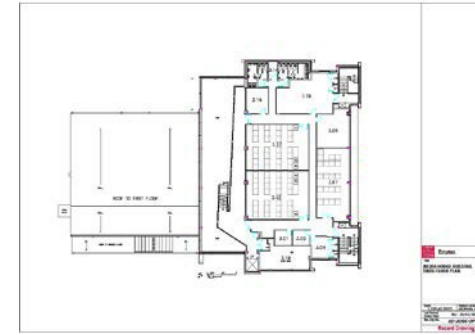
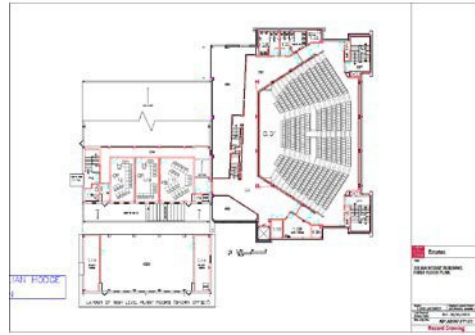
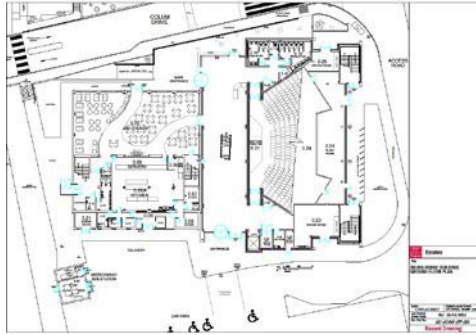
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Energy from renewables	0%	0%

Sourced from - GOV.UK (2019).

Pre – Arrival Building Information



Source from – Mark Durdin (Cardiff University FM Manager)

Pre – Arrival Building Information

From the Pdf documents supplied by Mark Durdin (Cardiff University) we can get an idea of the assets Electrical, Gas, Water, Heating and Mechanical layout from this we can see there could be areas of improvement that may be possible.

Electrical – Primary – Secondary – Tertiary Metering?

Gas - Primary – Secondary – Tertiary Metering?

Water – Primary – Secondary Metering – Maintenance?

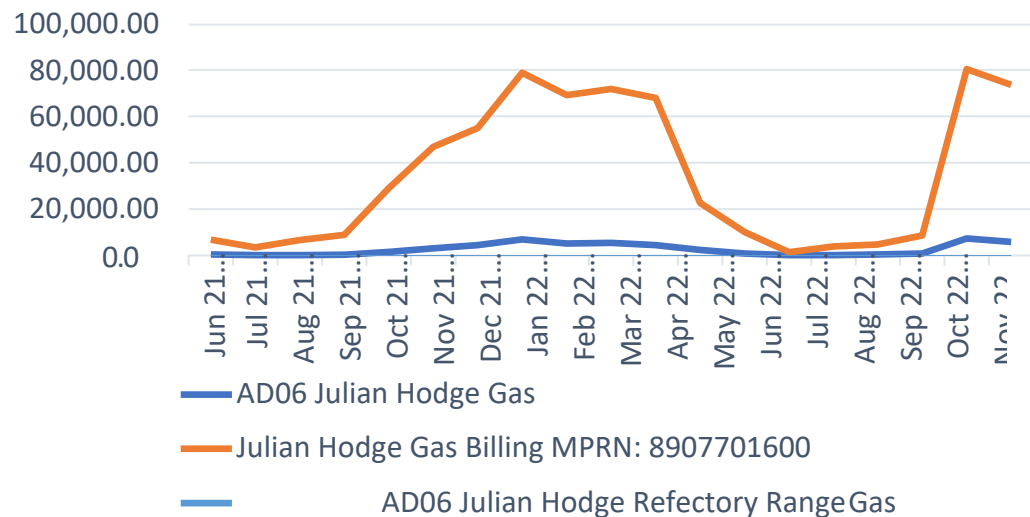
Heating – Wet Heating - Control systems - Maintenance?

Mechanical – Types of Air Conditioning systems in place – Maintenance?

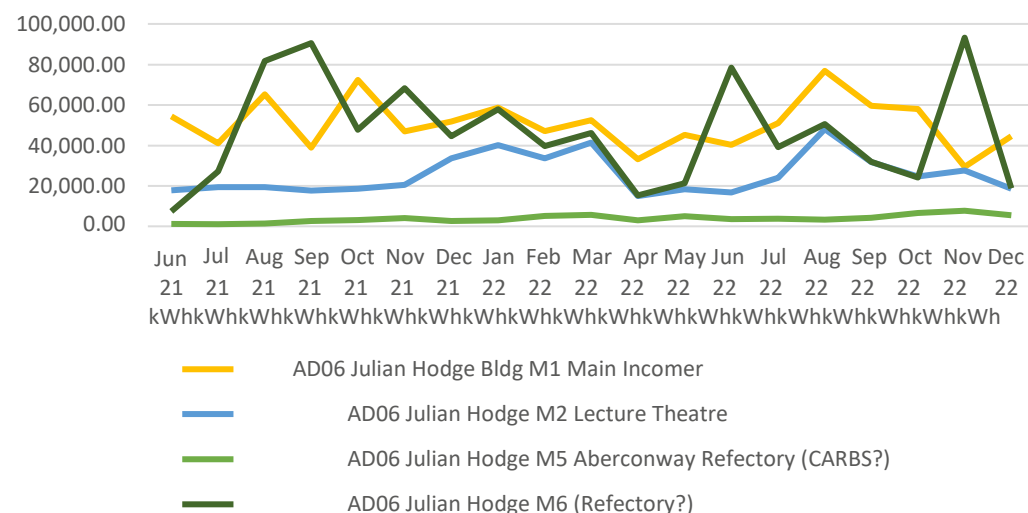
Pre – Arrival Building Information

Mark Durdin (Cardiff University) also supplied us with Data sheets for the Gas and Electrical installations. From this information we could identify how much Gas and Electric has been used and when (Time of year). (The charts below are for illustration purposes only to show fluctuation of the Gas and Electrical consumption throughout the year).

AD06 Julian Hodge Gas



AD06 Julian Hodge Electricity



AD - Academic - Colum Road and Humanities Site Buildings Gas Meter Tree with Consumption						
Dates: Jan 21 to Dec 22						
Meter Id	Meter Name	Meter Type	Unique Meter Id	Building Name	Main Incomer?	Area m2
47177	AD06 Julian Hodge Gas	Gas	AD06G01145AD06	AD06 Julian Hodge Building	1	0.00
46793	Julian Hodge Gas Billing MPRN: 8907701600	Gas	8907701600	Julian Hodge (MI)	1	0.00
47180	AD06 Julian Hodge Refectory Range Gas	Gas	AD06G01148AD06	No Building (MI)	0	0.00
47181	AD06 Julian Hodge Refectory Boilers Gas	Gas	AD06G01149AD06	No Building (MI)	0	0.00
52460	Julian Hodge L/T Gas	Gas	8010	No Building (MI)	0	0.00
52461	Julian Hodge L/T Gas boilers - on Bems	Gas	5172	No Building (MI)	0	0.00
52462	Julian Hodge Refec Gas x100 cuft	Gas	8009	No Building (MI)	0	0.00

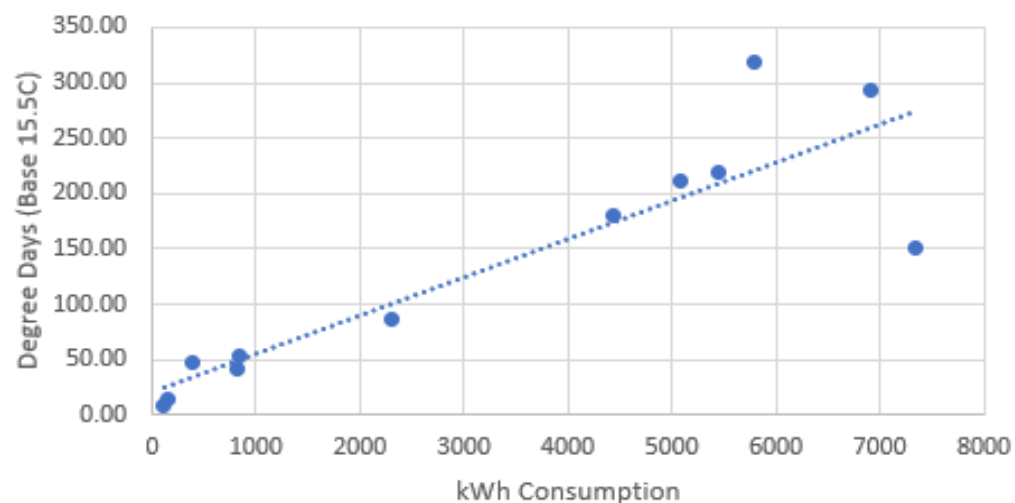
AD - Academic - Colum Road and Humanities Site Buildings Electricity Meter Tree with Consumption						
Dates: Jan 21 to Dec 22						
Meter Id	Meter Name	Meter Type	Unique Meter Id	Building Name	Main Incomer?	Area m2
44138	AD06 Julian Hodge Bldg M1 Main Incomer	Electricity	AD06E00173AD06	AD06 Julian Hodge Building	1	3585.35
35130	AD06 Julian Hodge M2 Lecture Theatre	Electricity	AD06E00174AD06	AD06 Julian Hodge Building	0	0.00
44137	AD06 Julian Hodge M5 Aberconway Refectory (CARBS?)	Electricity	AD06E00177AD06	AD06 Julian Hodge Building	1	3585.35
72085	AD06 Julian Hodge M6 (Refectory?)	Electricity	AD06E02111AD06	AD06 Julian Hodge Building	0	0.00

Degree Day Tables and Charts for the Gas and Electricity Consumption (Jan 2022 – Dec 2022)

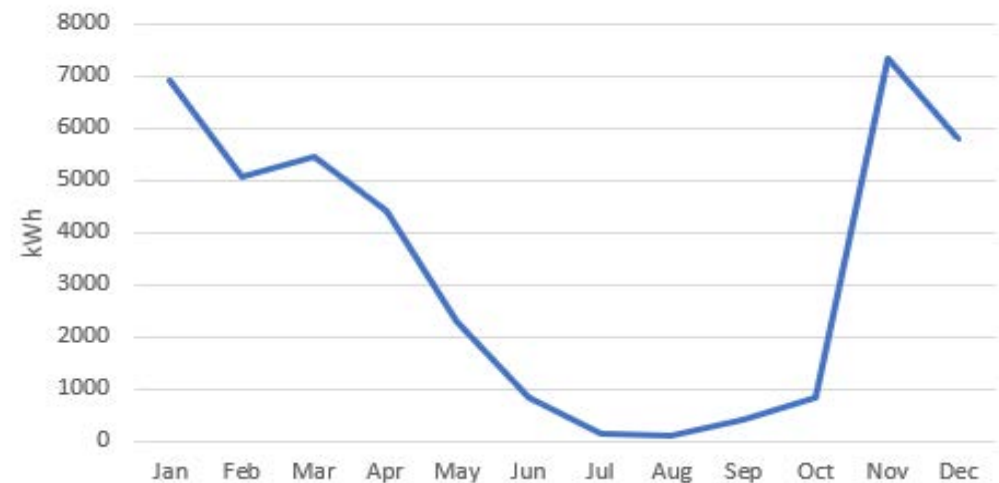
AD06 Julian Hodge Building (Gas)				
Month	Gas (AD06)	Gas (MPRN)	Gas (Refectory)	Degree Days
Jan	6901	78860	6.706	293.20
Feb	5072	69242	4.432	211.70
Mar	5446	71811	6.865	219.80
Apr	4429	68022	0.000	179.70
May	2305	22616	0.000	87.30
Jun	823	10063	0.000	42.20
Jul	155	1401	0.000	14.70
Aug	112	3839	0.000	9.20
Sep	390	4684	0.000	47.00
Oct	849	8620	44.312	53.50
Nov	7342	80414	23.465	151.60
Dec	5784	73700	0.007	319.60

AD06 Julian Hodge Building (Electrical)					
Month	Electric (M1 Main Income)	Electric (M2 Lecture Theatre)	Electric (M5 <u>Aberconway</u> Refectory)	Electric (M6 Refectory?)	Degree Days
Jan	58,700	40,188	3,020	57,987	293.2
Feb	47,149	33,671	5,294	39,743	211.7
Mar	52,555	41,485	5,625	46,167	219.8
Apr	33,293	14,981	3,041	15,337	179.7
May	45,246	18,402	5,106	21,409	87.3
Jun	40,386	16,771	3,574	78,525	42.2
Jul	51,169	24,052	3,763	39,218	14.7
Aug	76,941	48,142	3,298	50,586	9.2
Sep	59,604	31,766	4,259	31,983	47
Oct	58,142	24,638	6,679	24,171	53.5
Nov	29,426	27,732	7,732	93,397	151.6
Dec	44,692	18,736	5,525	18,811	319.6

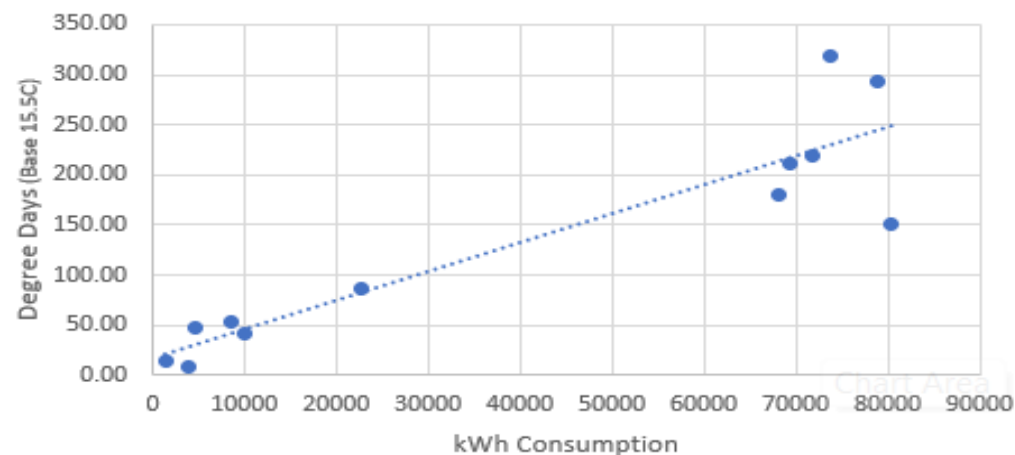
Degree Days Gas (AD06)



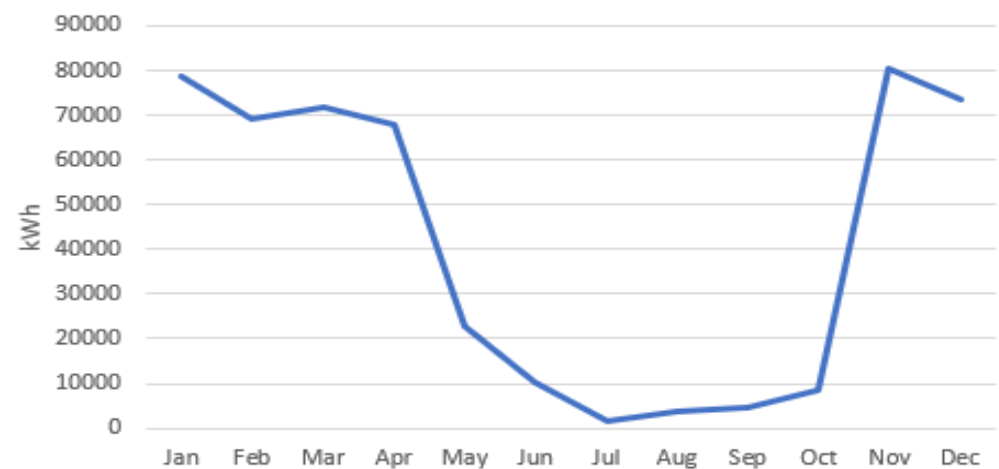
kWh - Gas (AD06)



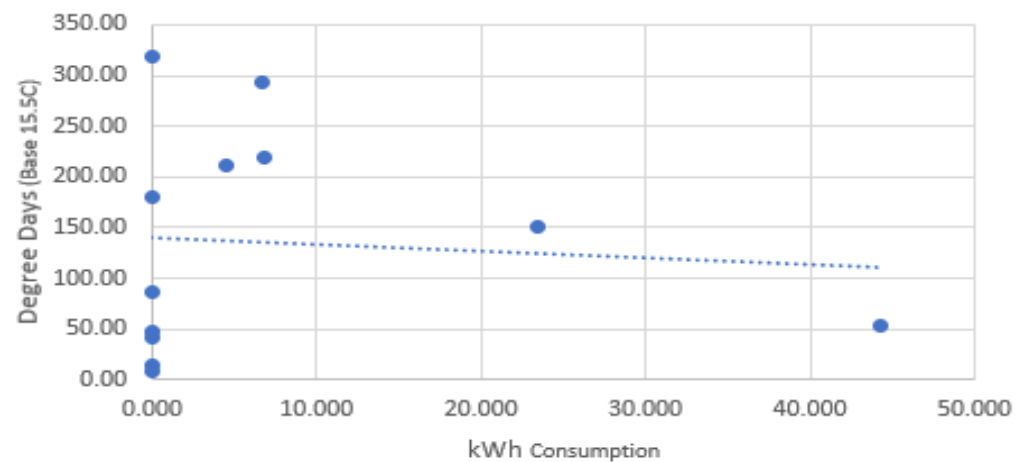
Degree Days Gas (MPRN)



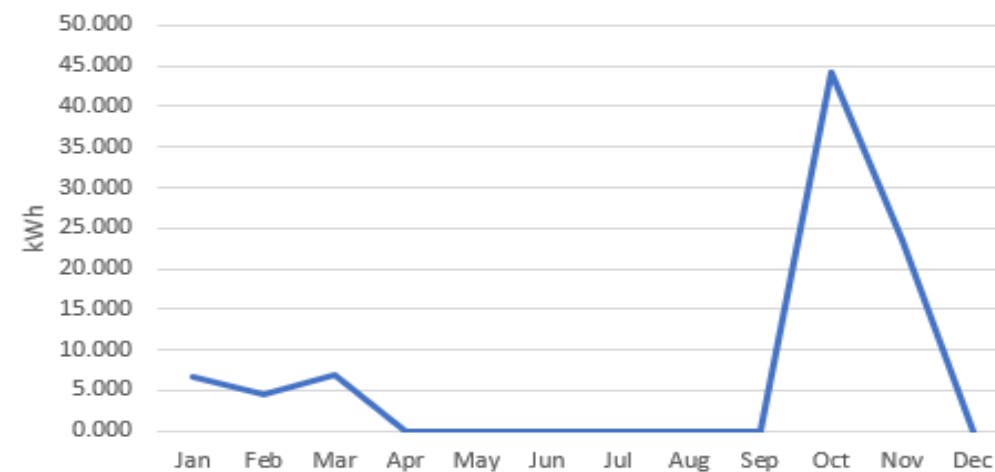
kWh - Gas (MPRN)



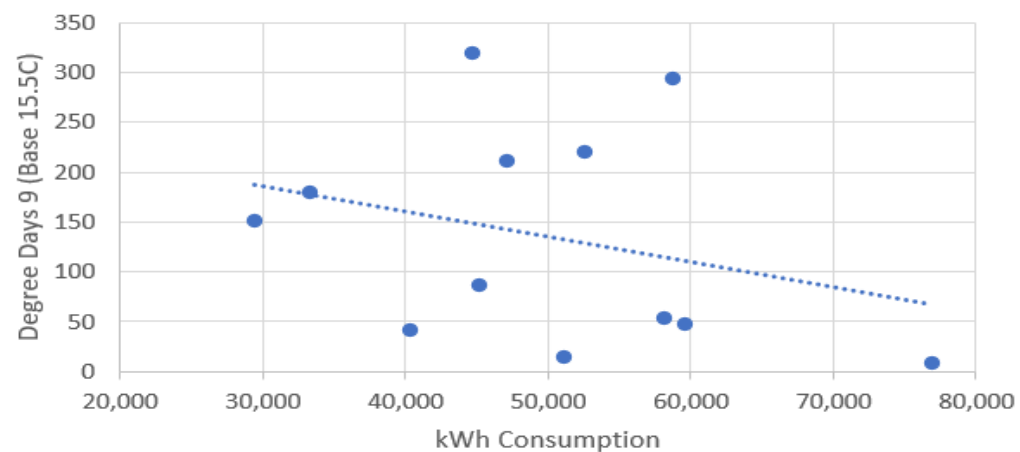
Degree Days Gas (Refectory)



kWh - Gas (Refectory)



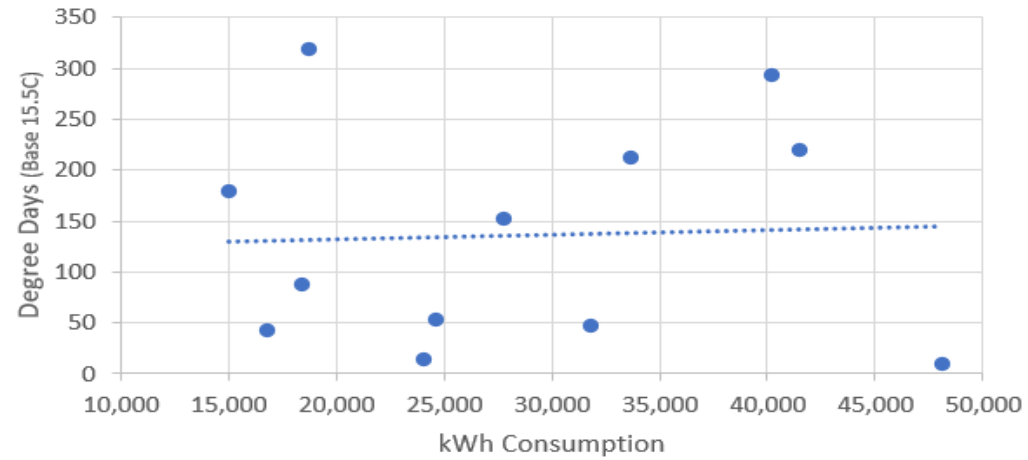
Degree Days Julian Hodge (M1 Main Income)



kwh - Electric (M1 Main Income)



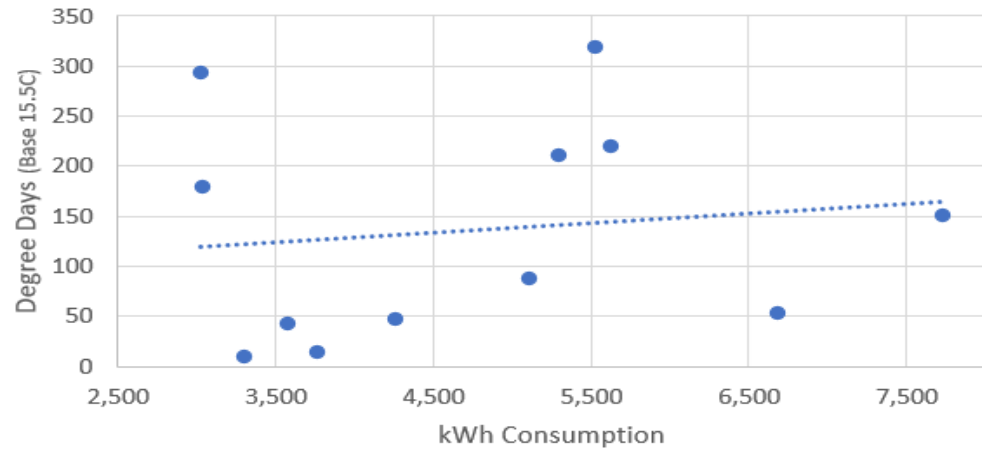
Degree Days Julian Hodge (M2 Lecture Theatre)



kWh - Electric (M2 Lecture Theatre)

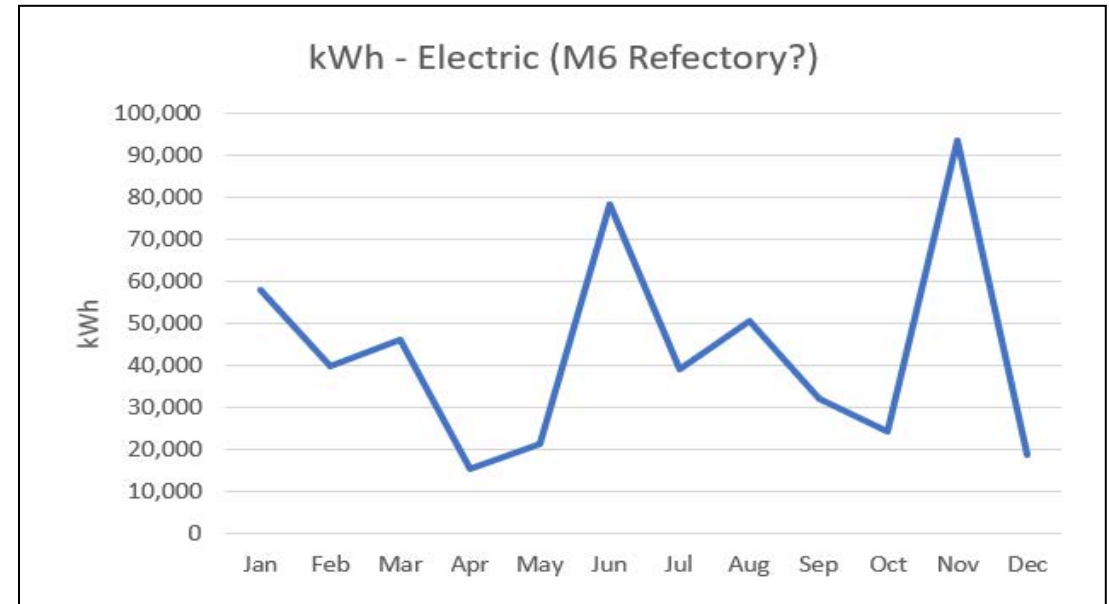
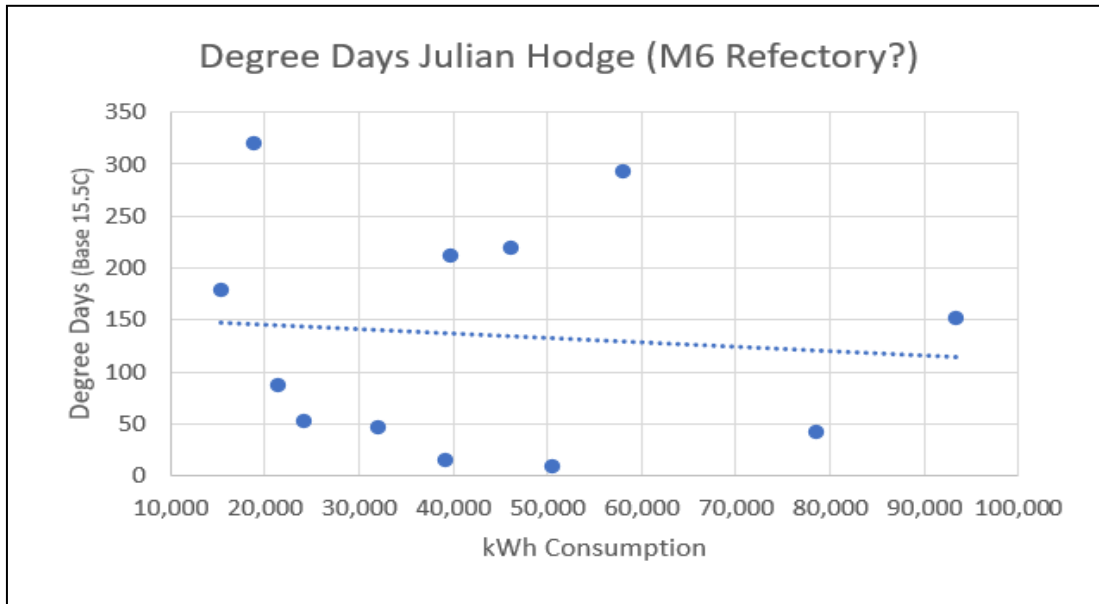


Degree Days Julian Hodge (M5 Aberconway Ref.)



kWh - Electric (M5 Aberconway Refectory)





Scatter charts of monthly energy consumption against monthly degree - days

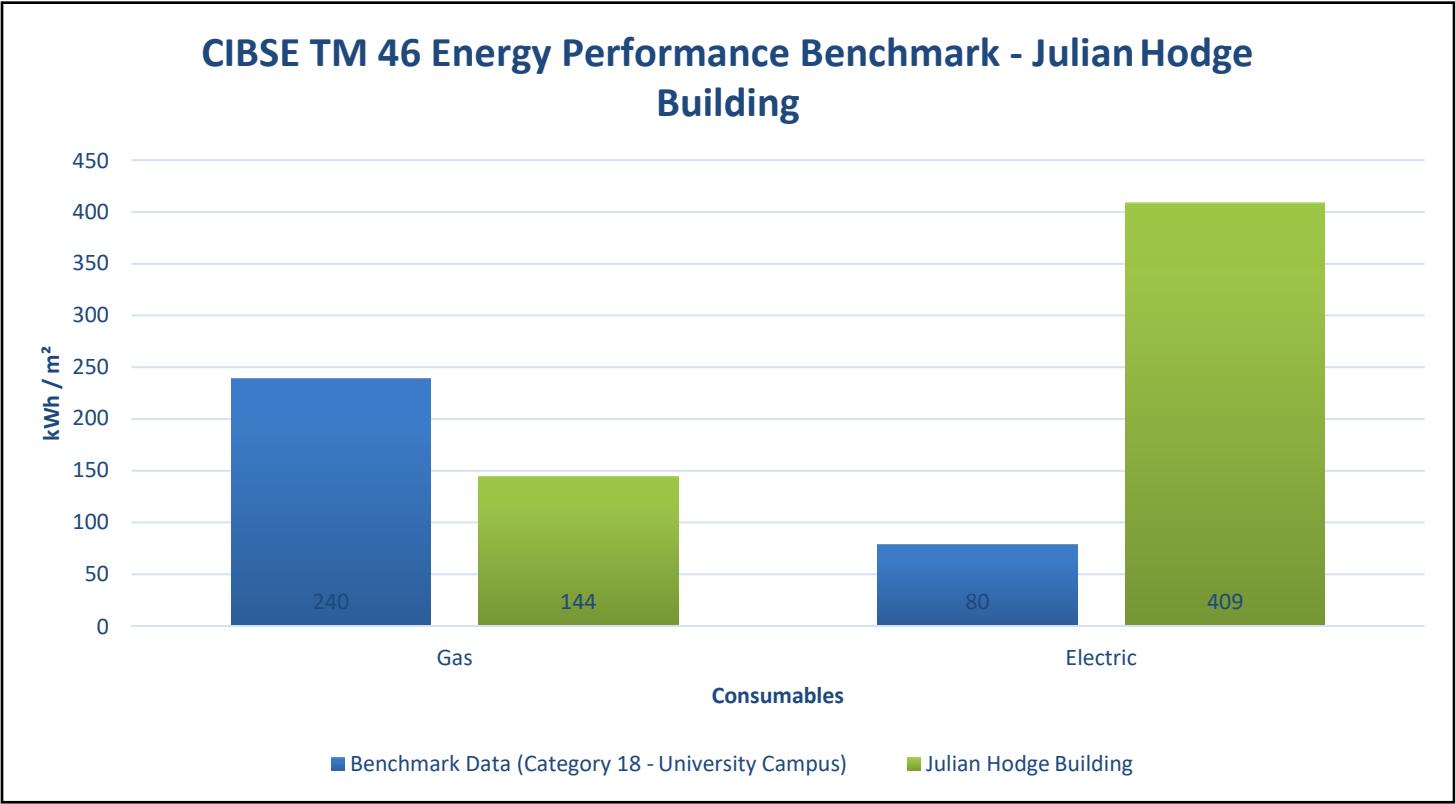
Charts created following - CIBSE Guide - TM41:2006 Degree – days: theory and application.

Based on the data provided we are able to calculate the previous twelve months' worth of energy consumption for the building. Although there have been some discrepancies and anomalies found with some of the data and readings. A percentage of the readings provided seem to be misleading and difficult to comprehend. Other meters appeared to be reset to '0' for no apparent reason.

The table below details a breakdown of the data into gas and electricity consumption for the year January 2022 – December2022 and illustrates the buildings carbon output –

Energy Type	Consumption (kWh)	Carbon Output (kgCO ²)	Cost of Energy (£)	Price per kWh
Gas	532964.24	124255.28	£5,063,160.28	9.5p
Electric	1512116.68	352534.88	£37,046,858.66	24.5p

Using this information, we can benchmark the building / asset against similar property types following CIBSE TM46:2008 Energy Benchmarks to compare and ascertain the buildings current performance –



The chart shows the Julian Hodge Building is currently using five times the amount electricity of similar building in its category, although it uses almost half as much gas as others, reasoning behind this can be explored in the site visit later.

On – Site Building Information



Sourced from - Cardiff University (2023). Julian Hodge Building.





On – Site Building Information

Electrical And Lighting Systems

- Main Electricity Supply
- Circuit Breaker
- Meters for Lecture Theatre, DB Switch, Aberconway.
- Main Switch Aberconway Ref.
- Lecture Theatre Lighting
- Student Computer Room Lighting
- Main Entrance Lighting



On – Site Building Information

Gas system 1 (New Building)

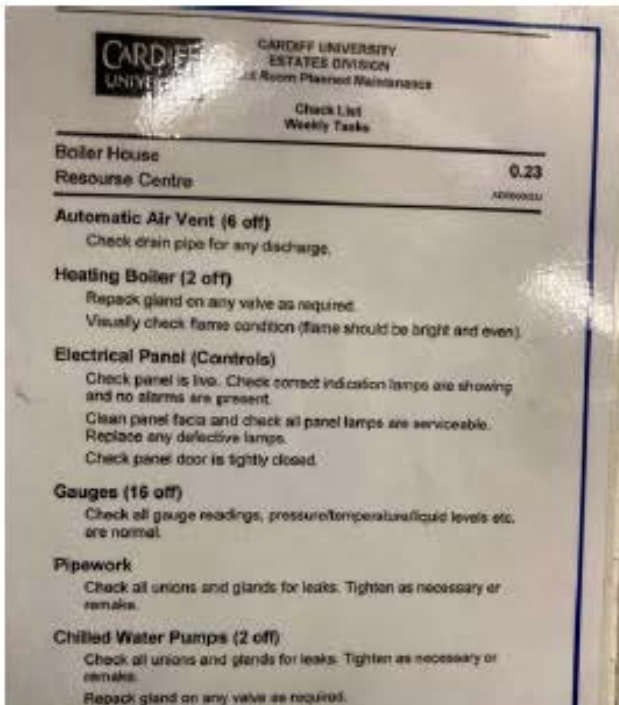
- Gas Meter
- Close up of Gas Meter G40
- Gas Meter Reader
- Gas Meter Reading
- Gas Meter BMS system Reading



On – Site Building Information

Gas system 2 (Old Building)

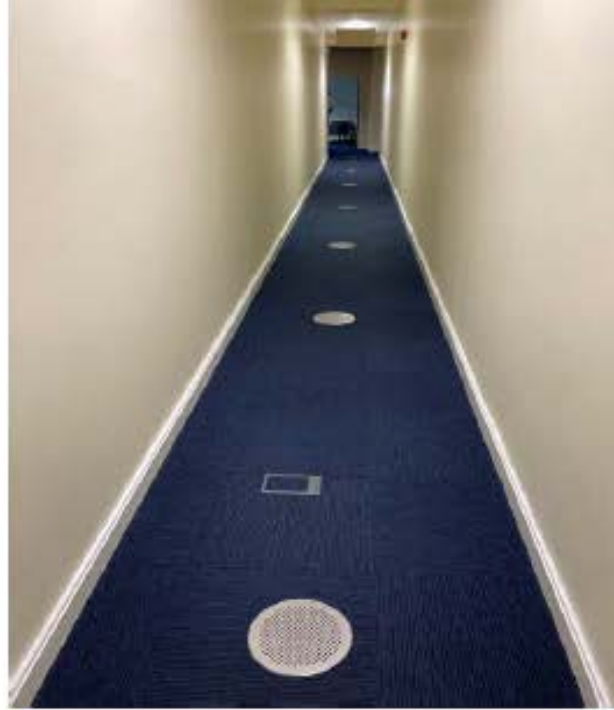
- Gas Meter
- Close up of Gas Meter G25
- Cello Meter Reader
- Gas Meter Reading
- Gas Meter BMS system Reading



On – Site Building Information

Heating (Wet) system

- Under Floor Heating
- Switch Panel for Heating Controls
- LST Fan Convactor
- Panel Radiator
- 4 inline Boilers
- Weekly task list (Maintenance)



On – Site Building Information

Mechanical (AC) Displacement Ventilation systems

- Floor Grill
- Wall Panel
- Floor Grill along Corridor
- Under seat displacement air
- Lecture area with under seat displacement
- Wall Paneling at back of Lecture theatre

Post - Visit Building Information

Considering pre – arrival and on – site information gathered. We are now able to collate the data and information, to make an accurate assessment on the performance of the asset so we can suggest some improvements that could be made to services of the building and suggest new maintenance strategies that can help with the asset's performance and costings.

It was apparent when questioning staff that recommendations for improvements have been made via the “Air conditioning inspection report” valid through 25 February 2026 and the “Display Energy Certificate (DEC) recommendation report” valid through 11 February 2026 both illustrate issues with the systems inspected that will improve the Energy Efficiency and running costs of the systems installed. At present the recommendations have yet to be implemented.

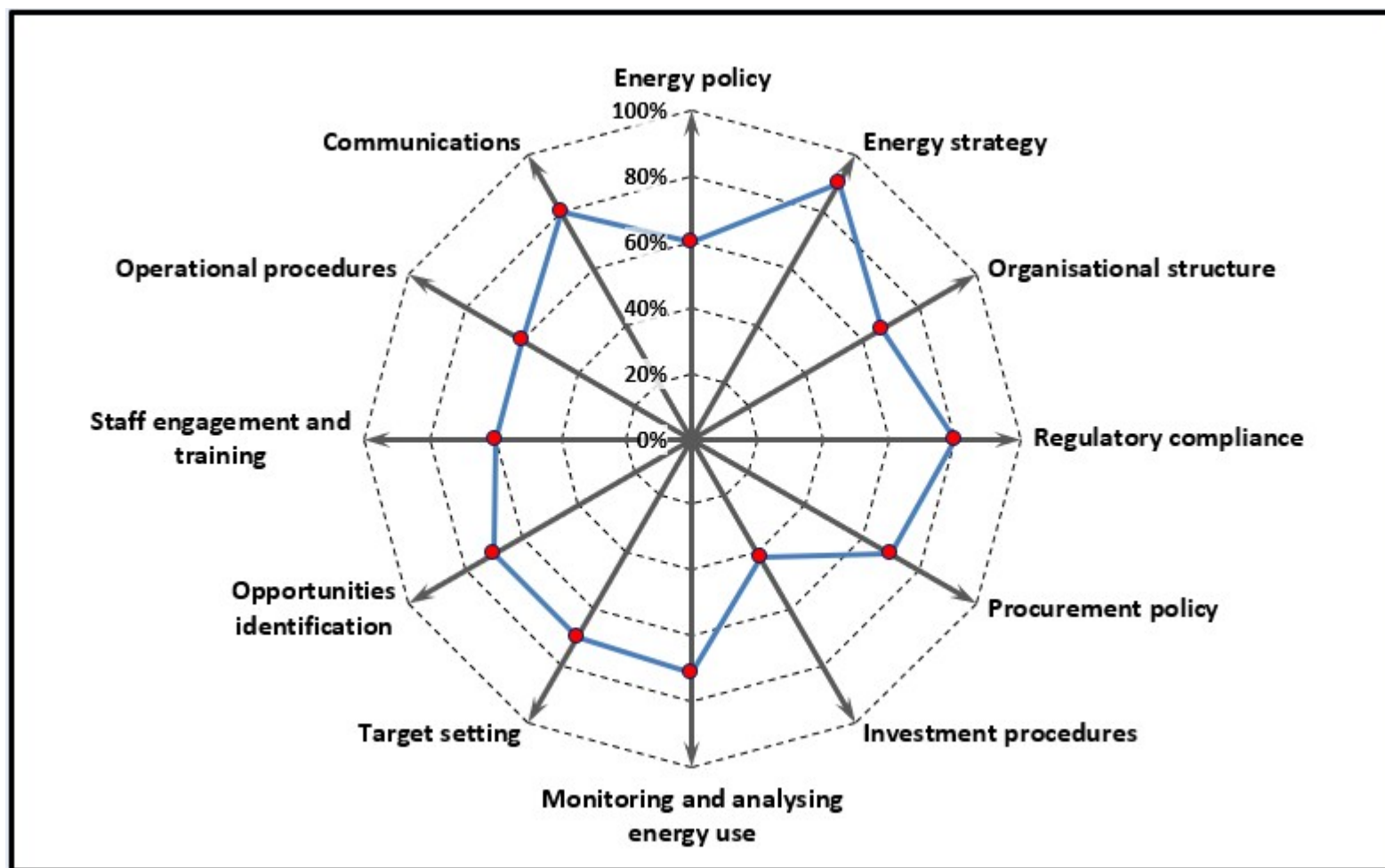
It is stated in CIBSE Guide F - 2012 “Cost savings of over 60% have been achieved at sites where the potential had not previously been recognised. Such savings are usually obtained with payback periods of less than three years”.

When on – site speaking to the FM Mark Durdin we were able to obtain information to make some judgement calls to complete the Carbon Trust -2011 - Energy Management Matrix CTG 054 – Self Assessment Tool, this would give us some feedback to the organisations current position in respect to Energy Management detailed below –

Level	Energy Policy	Organising	Training	Performance Measurement	Communication	Investment
4	Energy Policy, Action Plan and regular review have active commitment at top management	Fully integrated into senior management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside of organisation	Resources routinely committed to energy efficiency in support of organisational objectives
3	Formal policy but no active commitment from top management	Clear line management accountability for consumption and responsibility for	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit, or building	Regular staff briefing, performance reporting and energy promotion	Some appraisal criteria used for energy efficiency or for other cost reduction projects
2	Un-adapted policy	Some delegation of responsibility but line management and authority unclear	Ad-hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of organisational communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	An unwritten set of guidelines	Informal, mostly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	Ad-hoc informal contacts used to promote energy efficiency	Only low or no cost measures taken
0	No explicit energy policy	No delegation of responsibility for managing energy	No energy related staff training provided	No measurement of energy costs or consumption	No communication or promotion of energy issues	No investment in improving energy efficiency

Input Score	3	3	2/3	3	2/3	2/3
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Characteristic	Score		% score
	Actual	Max	
Management Commitment	23	32	72%
Energy policy	6	10	60%
Energy strategy	9	10	90%
Organisational structure	8	12	67%
Regulatory Compliance	8	10	80%
Regulatory compliance	8	10	80%
Procurement and Investment	12	22	55%
Procurement policy	7	10	70%
Investment procedures	5	12	42%
Energy Information Systems & Identifying Opportunities	24	34	71%
Monitoring and analysing energy use	10	14	71%
Target setting	7	10	70%
Opportunities identification	7	10	70%
Culture & Communications	20	30	67%
Staff engagement and training	6	10	60%
Operational procedures	6	10	60%
Communications	8	10	80%
GRAND TOTAL	87	128	68%



Source – Carbon Trust, 2011. CTG 054.

Recommendations

Heating and Hot water Services

Both sections of the building are supplied by their individual plant and boiler rooms, both boiler rooms use Remeha Quinta modulating boilers, two supplying the old section of the building and four supplying the new. The boilers are used to supply heated water to the unvented hot water systems and also for the wet heating system and heating coils to the air conditioning units in the plant rooms. The boilers are coupled up to the Trend BMS system to be controlled by the FM team. During our visit on – site it was observed that most of the pipework had insulation and valve jackets fitted.

Recommendation

Faults were identified by Mark Durdin on the BMS relating to false temperature readings, these should be resolved to ensure maximum efficiency. Timings of the BMS system should be adjusted to correspond with occupancy hours. As stated, most of the pipework was insulated, additional pipe lagging and repairs to old lagging would increase the efficiency of the heating pipework and reduce boiler cycling.

Ventilation and Cooling

Cooling and ventilation of the new section of the build is conducted by the air handling units placed in their respective plant rooms on each floor. Displacement air supplies are used throughout, using floor grills and wall panels as previously shown elsewhere within this document. The system is linked to the BMS system, but FM Mark Durdin suggested it is not being used to its full potential. Earlier inspection reports have highlighted upgrades could be made to the system, but as yet this has not been followed up.

Recommendation

A review of temperature set points should be looked at and timings adjusted to correspond with occupancy hours.

Lighting Systems

The lighting system has a mixture of fluorescent tubes, compact fluorescent tubes, halogen bulbs and LED's. The system is controlled via the BMS system, this again, is not being run to its full potential as Mark Durdin suggests. Currently there is no proactive plan in place to replace the older lighting fittings and system, lighting fittings are upgraded as and when the old fittings fail.

Recommendation

Renewal / replacement of the older light fittings should be a priority, LED light fittings should be utilised to replace failed tubes and / or fittings as required and priority should be given to replace all T12, T8 or halogen bulbs as soon as practicably possible given the running costs and efficiency. This intern will also reduce maintenance given the improvements in life expectancy with the LEDs (50,000 hrs) compared to traditional fluorescent / halogen bulbs (10,000 hrs – 2-4,000 hrs respectively). Additionally, where there are areas that may not be controlled by the BMS system, PIR or occupancy sensors could be installed to control lighting when unoccupied.

Water Savings

Water savings is possibly one of the lowest thoughts of the organisation. The highest use of water within the building is the kitchen area, which can arguably be suggested as part of a day-to-day essential cost.

Recommendation

Water savings in the toilet and cleaning areas could be looked at by renewing W.C. cisterns for low water (9 litre) content short flush also changing water outlets (taps) for non-concussive / self-closing, this would give a water saving of approximately 50% throughout the year.

The Building Envelope

The construction of the two sections of this building are quite different, where the old section has a brick cavity wall construction and the New section has a more modern mixed insulation with 'K' rendering and terracotta external tiling with a Southern facing glazed section which is assumed to be installed to Building Regulations at the time of construction.

Recommendation

There could be a possibility of changing the glazed area to the newer more efficient 'K' glass or reflective window film could be used, this could also prevent any low sunlight from entering the building causing glare to students and staff.

Considerations

Behaviour Changes

Behaviour change is a low-cost effective way of reducing energy use and wastage in large buildings. Simple switching lights off when there is nobody in a room or turning down heating controls can make a significant difference. Behaviour changes in individual departments can be implemented quickly during departmental meetings and can be monitored through the BMS system to check for improvements in each area.

Renewable Technologies

The building is positioned in a southerly direction, the installation of photovoltaics on the roof space could benefit from uninterrupted hours of sunshine, with no buildings or trees overshadowing the roof space. There is also the potential for air source heat pumps on the roof area that could be looked at as a retrofit energy saving solution. A feasibility study would need to be conducted to check the costings and practicality of this type of installation.

Cost Savings Identified

Low - Cost Measures	Cost	INFO	Low - Cost Measures	Cost	INFO
Launch a "Switch Off" initiative to promote energy conservation in the use of lighting and equipment.	£100	By simply powering down photocopiers overnight and during weekends, significant savings of £46 and 183kg of CO2 emissions per year can be achieved.	Enforce a practice where cleaners are instructed to turn off lights in areas not equipped with sensors once their work is completed.	£0.00	Training / toolbox talks.
Avoid operating air conditioning systems when doors or windows are open.	£0.00	Conduct training sessions and raise staff awareness regarding energy conservation and sustainable practices.	Make it a priority to clean windows thoroughly to maximise the entry of natural daylight into the space.	£500	
Make it a daily priority to monitor the Building Management System (BMS) for any malfunctioning sensors or equipment.	£0.00	Enhance the proactive approach of the in-house team in monitoring and promptly replacing any malfunctioning items.	Configure computers to automatically enter standby mode during short to medium periods of inactivity in the daytime to conserve energy.	£0.00	
Engage with occupants / departments to conduct a comprehensive assessment of the building's temperature set points.	£0.00		Keep a vigilant eye out for any available grant funding opportunities that support initiatives aimed at reducing carbon emissions.	£0.00	
Implement PIR (Passive Infrared) or photocell sensors for enhanced automation and efficiency.	£95.00 per area	The amount of energy savings achieved is dependent upon the specific installation location. A comprehensive report will provide detailed information regarding energy savings based on the specific installation site.	Conduct an in-house review of fuel procurement and tariffs, which incurs no additional costs, to ensure optimal efficiency and cost-effectiveness.	£0.00	

Medium - Cost Measures	Cost	INFO	Medium - Cost Measures	Cost	INFO
Apply glazing film for improved energy efficiency and enhanced insulation.	£6,000	Experience a notable reduction in heat gains and an enhanced level of visual comfort through effective measures.	Perform a comprehensive investigation into any faults within the Building Management System (BMS) and take prompt corrective actions to resolve them.	£1,000	
Execute the necessary tasks to achieve seamless integration of lighting into the Building Management System (BMS) infrastructure.	£3,800	Implementing improved controls enables cost savings while enhancing operational efficiency.	Replace outdated light fittings and tubes with more energy-efficient alternatives to achieve a significant reduction in energy consumption.	£60.00	Approx £60 per fitting. Data will need to be collated on number

Conclusion

Both sections of this building could use an upgrade. The building was constructed in 2001 and most of the major plant has not had any major upgrade since then. Although there have been new replacement boilers installed and the introduction of the Trend BMS system there is still some work to be done going forward to improve the efficiency and energy savings of this building. If the BMS system was to be modified and all current faults rectified as suggested by Mark Durdin, then the system could be optimised by reviewing temperature set points within each zone and especially the lecture theatre because of the vast space / area of the room. Start-up / optimum start times could be considered and reviewed to reflect when rooms are being occupied.

Until investment is put into this building it would see that there will a culture of repair / upgrade as and when, rather than improve the whole building. Yes, there is a financial cost implication, and this building is only one of over 300 assets in the Cardiff University portfolio and we do not know the condition of the other assets to make judgement on them.

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