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The Energy Consortium

20 June 2025

Halve the Half?

Built Environment – Issues as Opportunities

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OUT OF HOURS ENERGY

+/- 50% of Energy consumption is when buildings are empty

INEFFICIENT SPACE UTILISATION

Average HE Teaching Space Utilisation =

22.9%

The sector expanded by

852,000 m^2 in three years

(AUDE EMR 2022, 2023 & 2024)

FUTURE BUILDING LANDSCAPE

80%

of the buildings we'll see in 2050 are already standing today

(UKGBC 2023)

SUSTAINABILITY AND NEW BUILDINGS

It takes between

156-220 years

For new high-performing structures to emit less CO2 than retrofitting buildings. The design life of new structures is typically 50 years before first major maintenance.

(Abbey, et al., 2022) (EN 1990-2002)

STRIKING PERFORMANCE DISCREPANCY

The actual performance of buildings exceeds design stage projections by

1-4 times

(Shi, et al., 2019))

HEALTH & PRODUCTIVITY IN VENTILATED BUILDINGS

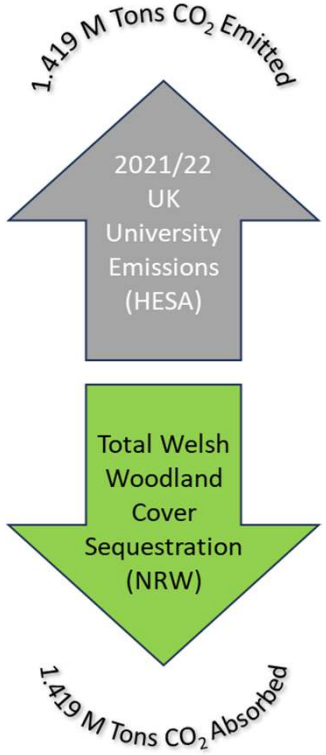
Properly ventilated spaces boost cognitive function by

26-51%

(MacNaughton, et al, 2017 & Allen, et al., 2015)

Net Zero By Sequestration?

Welsh CO_2 Emissions vs Sequestration, and proportion of Welsh Woodland (Welsh Government, 2021) and (ADAS, 2020)



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Building Performance Gap & Out of Hours Energy

Immediate opportunities to reduce cost and carbon

Built Environment, Energy and Carbon

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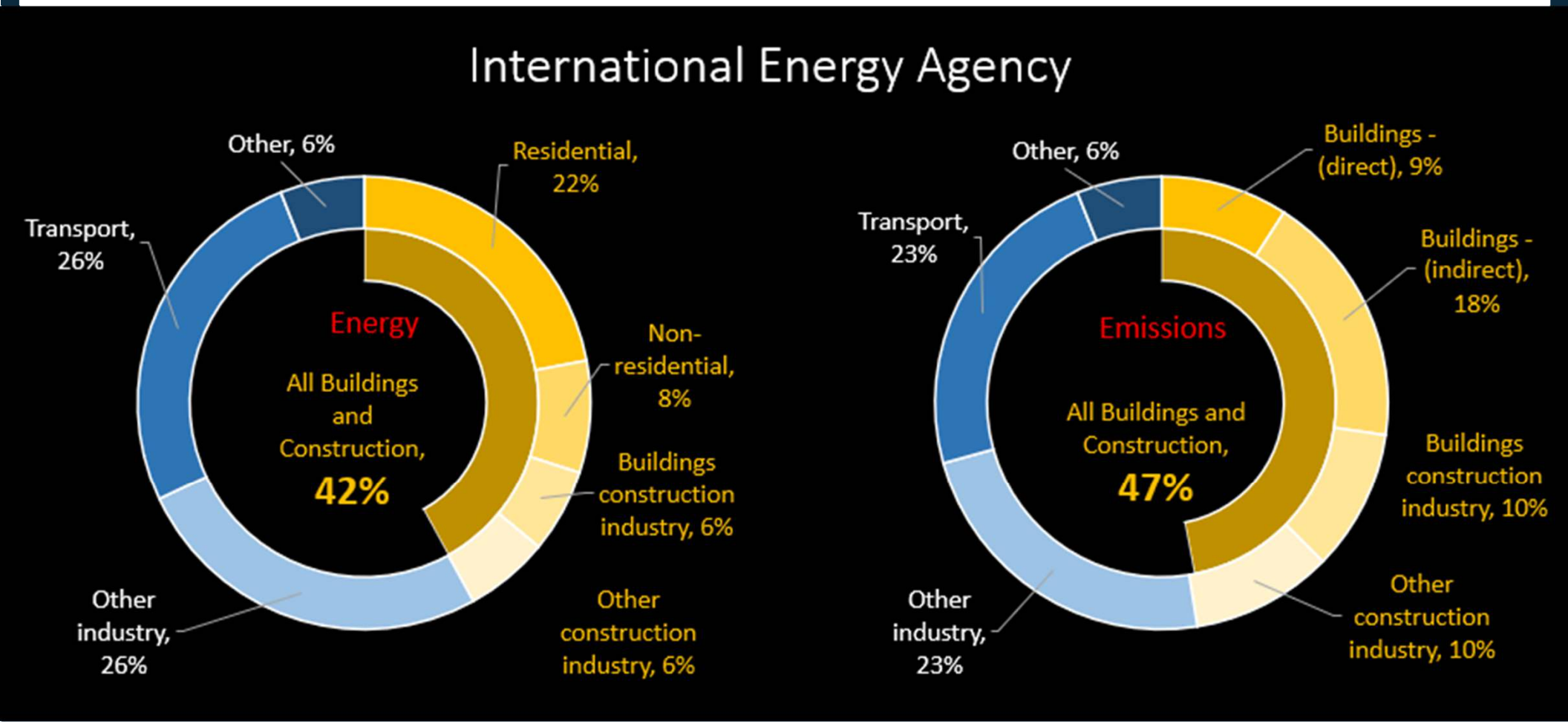
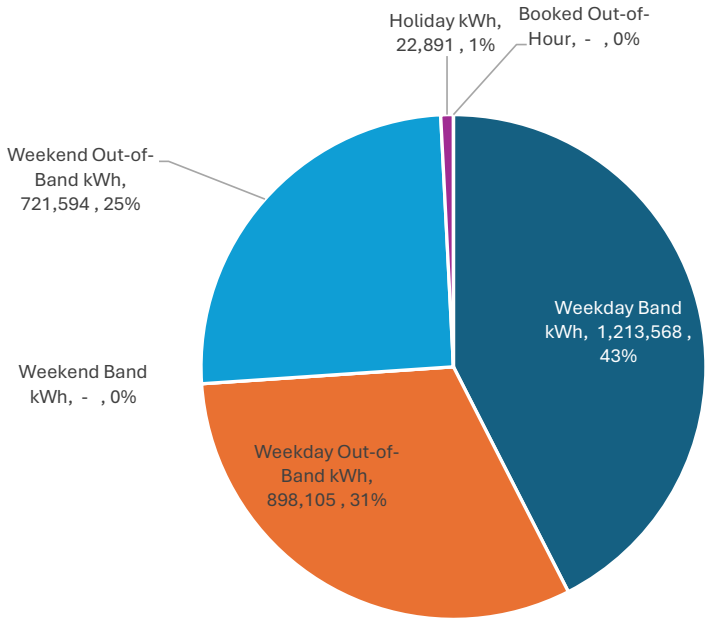
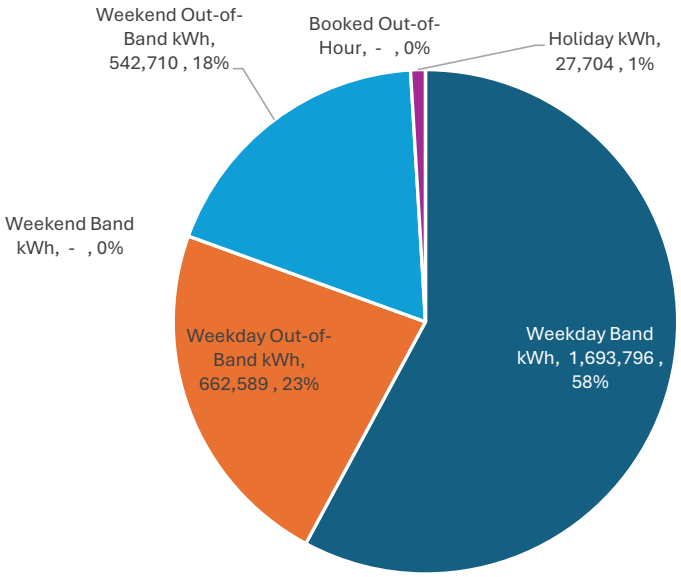


Out of Hours – prior year

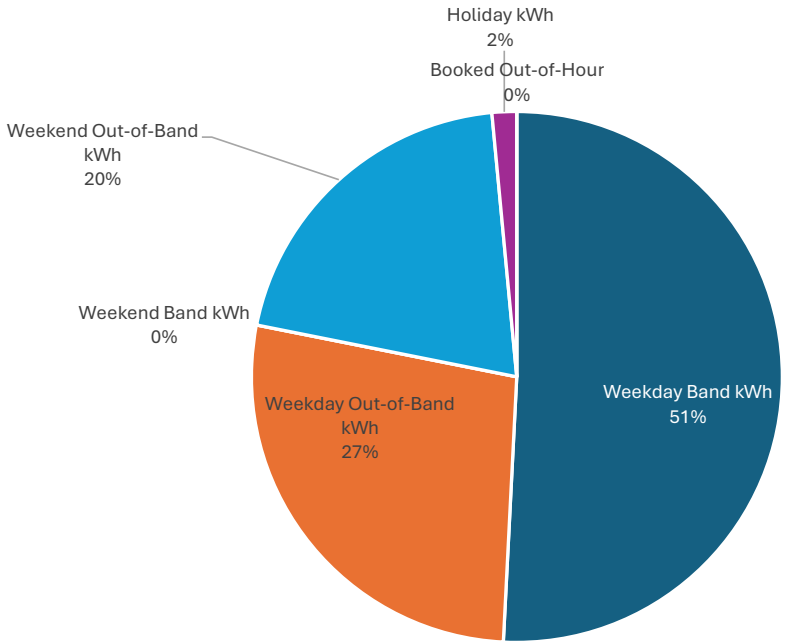


Llandaff.Main Electric (kWh) 13/05/2023 - 12/05/2024

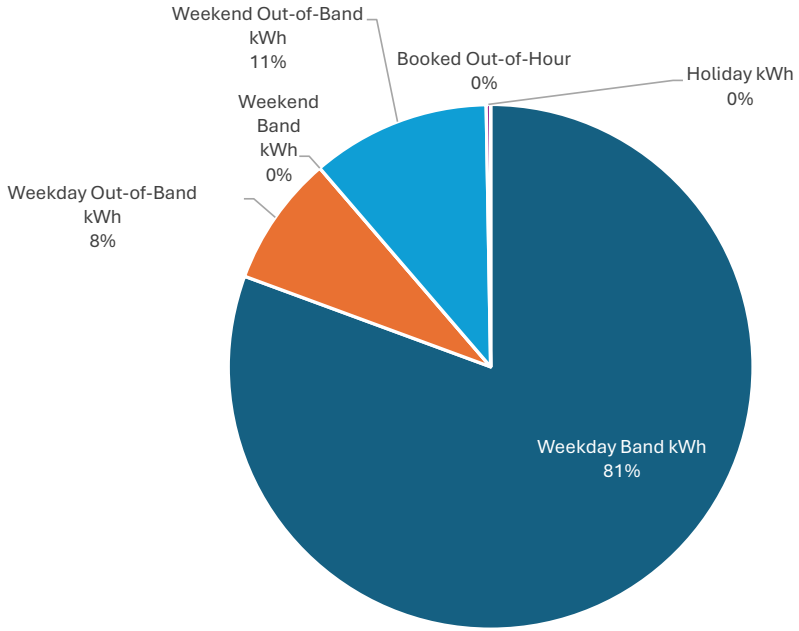


Llandaff.Main Gas (kWh) 13/05/2023 - 12/05/2024

Out of Hours – last 12 months



Llandaff.Main Electric (kWh) 12/05/2024 - 12/05/2025



Llandaff.Main Gas (kWh) 12/05/2024 - 12/05/2025

Out of Hours – comparing the years

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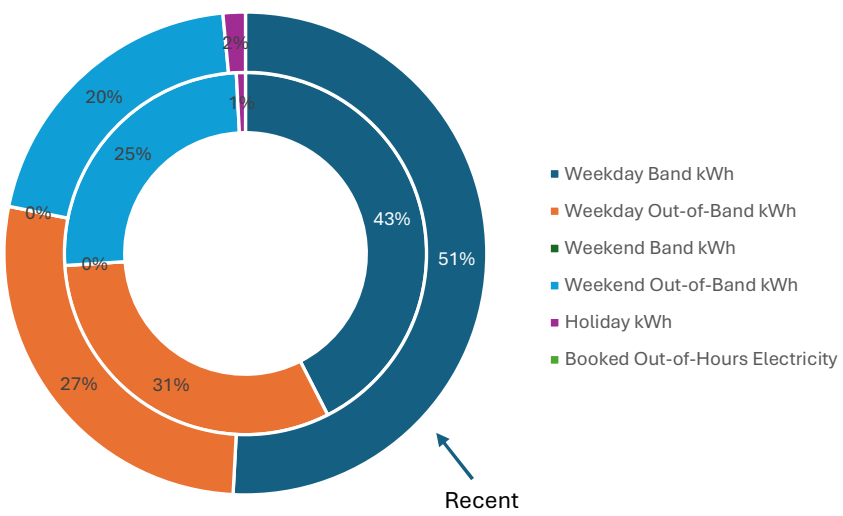
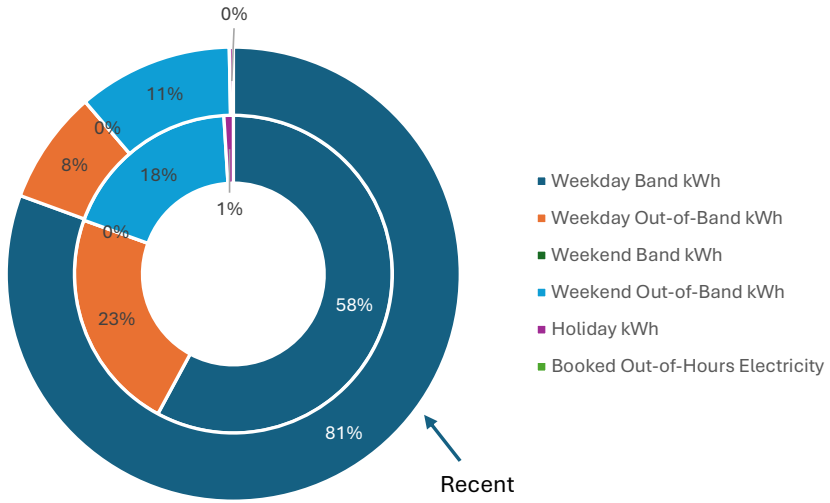
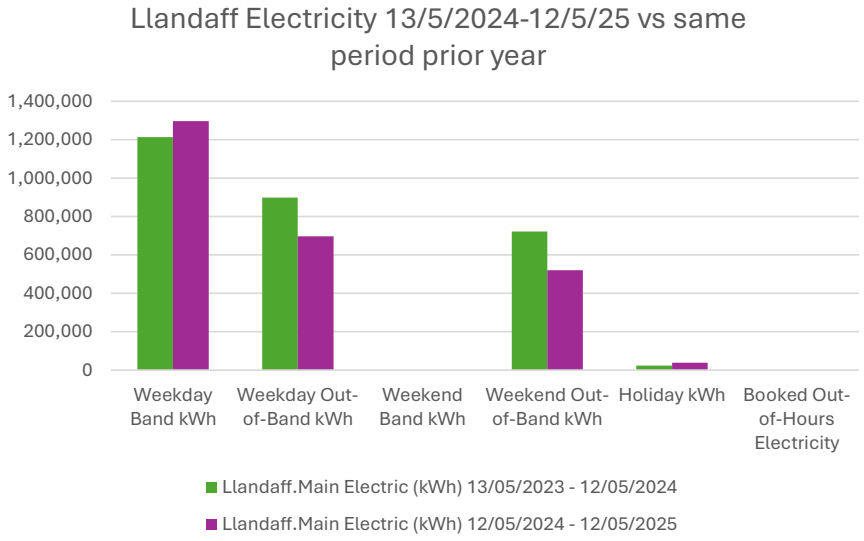
Llandaff Electricity 13/5/2024-12/5/25 vs same period prior year

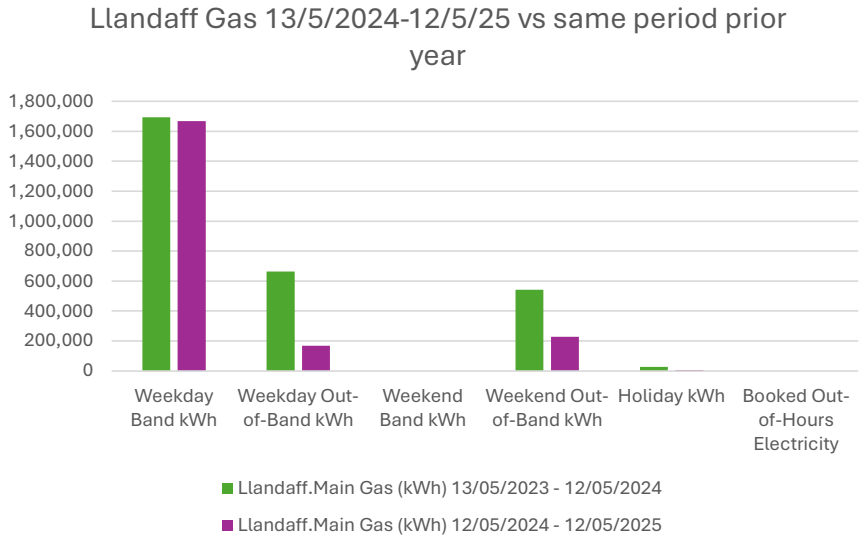


Llandaff Gas 13/5/2024-12/5/25 vs same period prior year

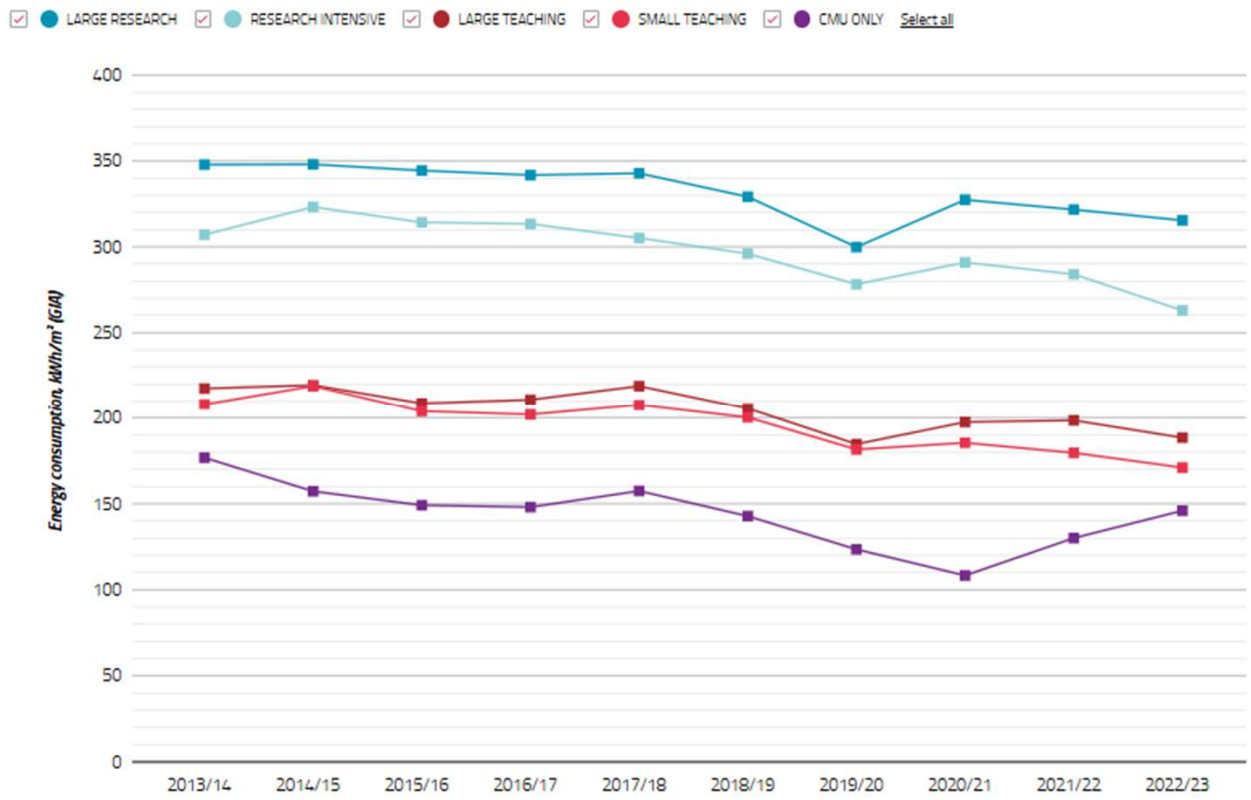


Out of Hours Compared





Benchmarking: kWh/m2 of GIA (by Segment)



Net Zero Performance Gap – The Evidence

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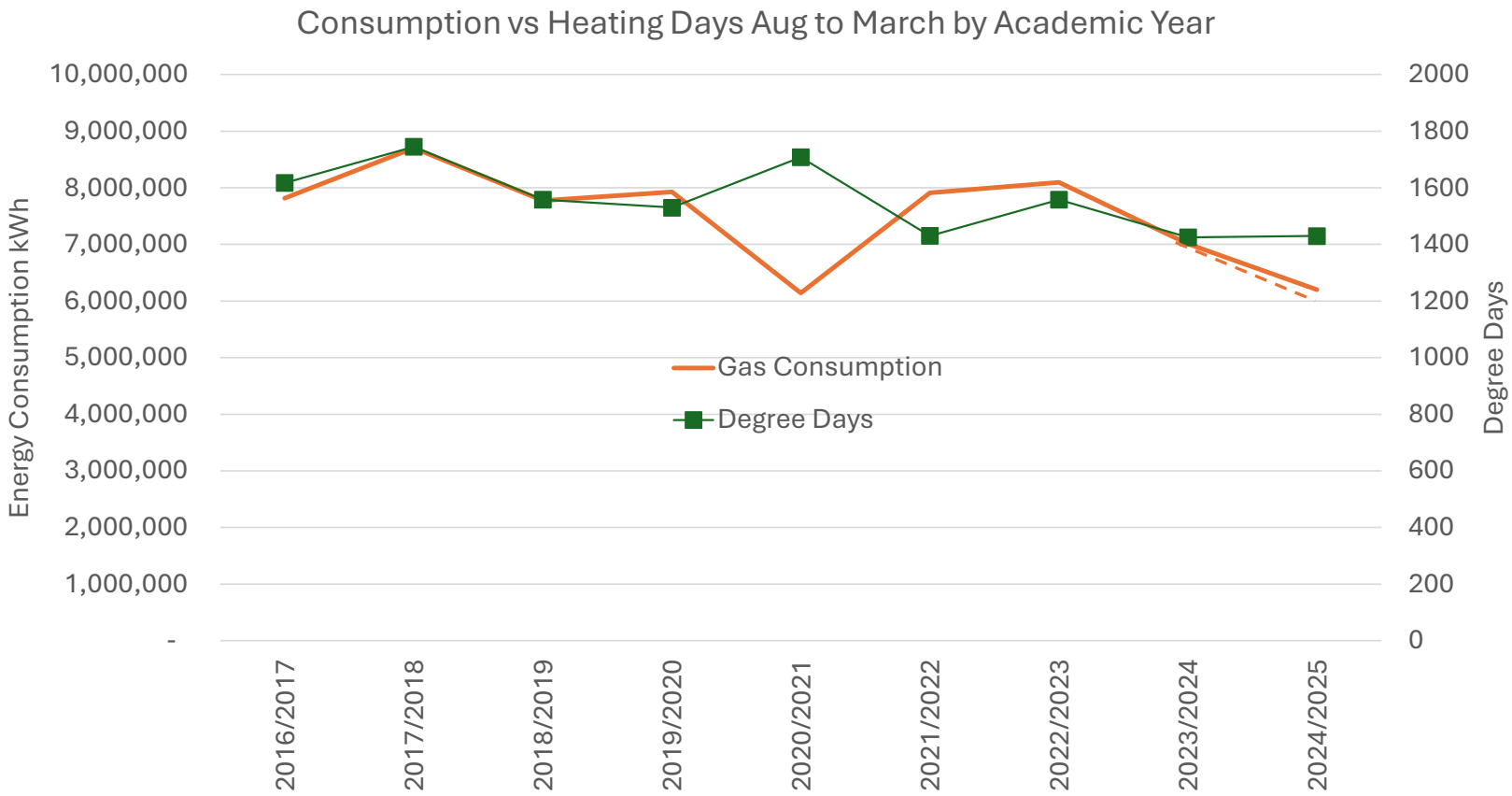

Net Zero Performance Gap – The Evidence

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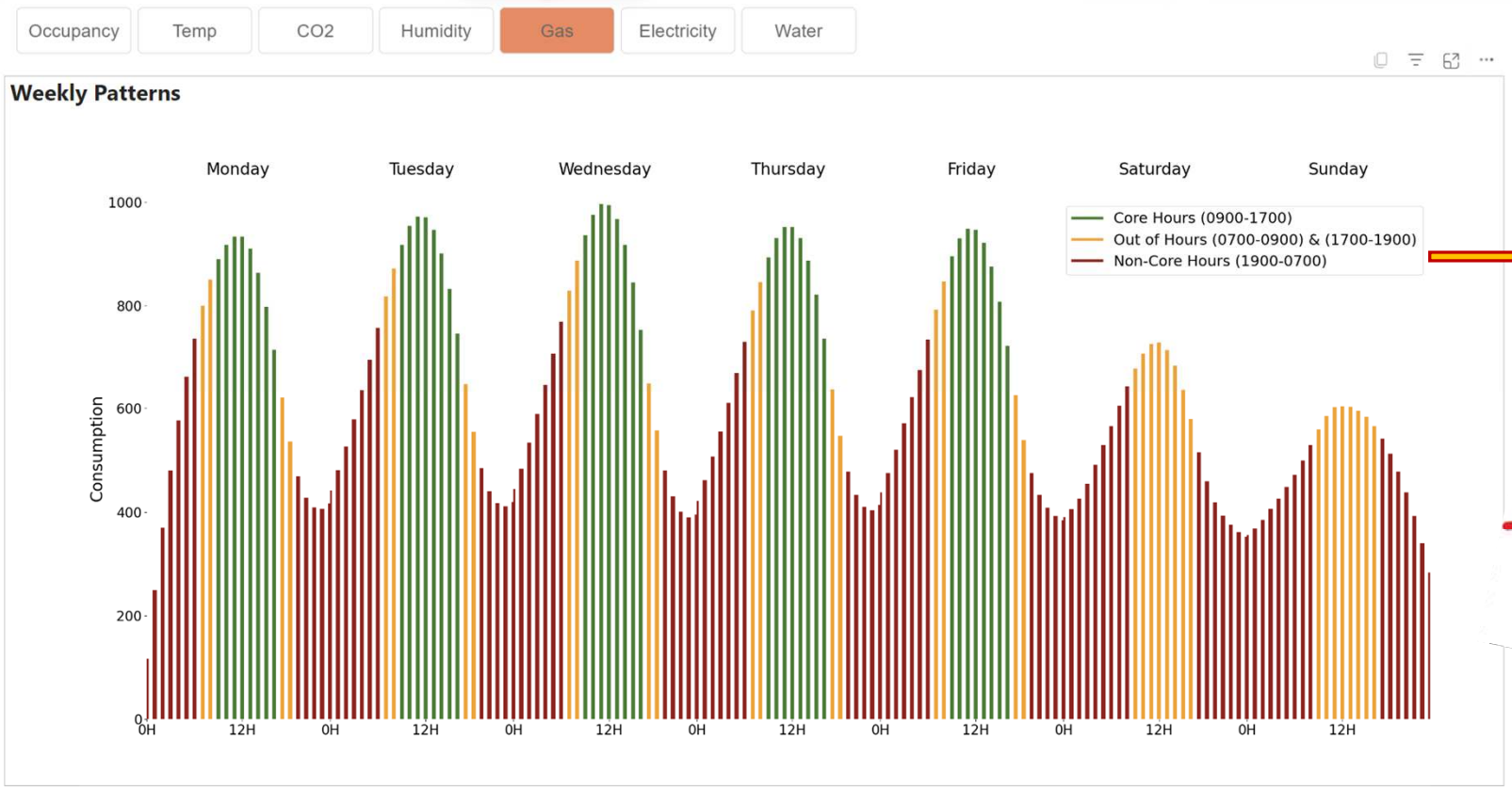

5-85%
(schools)

* Includes both tariff and consumption reduction

The Journey: From Space to Sector-wide Revelations

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-20.77 %
Gas Consumption
(9 Months)

-8.12 %
Electrical Consumption
(10 Months exc EV)

-9.4 %
Water Consumption
(10 Months)

-2.03 GWh
Energy Reduction vs
period last year

-7,138 m3
Water Consumption

-£721k
10 Months accounting
for tariff changes

Energy savings delivered within existing maintenance budgets

No Capital.

No grid upgrades.

No planning permission.

Informed by existing half hourly data

Energy Reduction – Investing in Maintenance

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- Equipment left “In Hand”
- Maint’ contractors coming back and putting things back “In Hand”!
- Primary and Secondary circuits
- Time Clock settings
- Link to occupancy
- Things running when they shouldn’t be…
- Security as eyes and ears
- Inventory lists – is it being maintained !

- Just turn stuff off…
- Replacing Filters – and making sure they are done…
- Control & Faulty sensors
- Billing errors
- Backing the engineers

Target out of hours – no one minds!

Where to focus?

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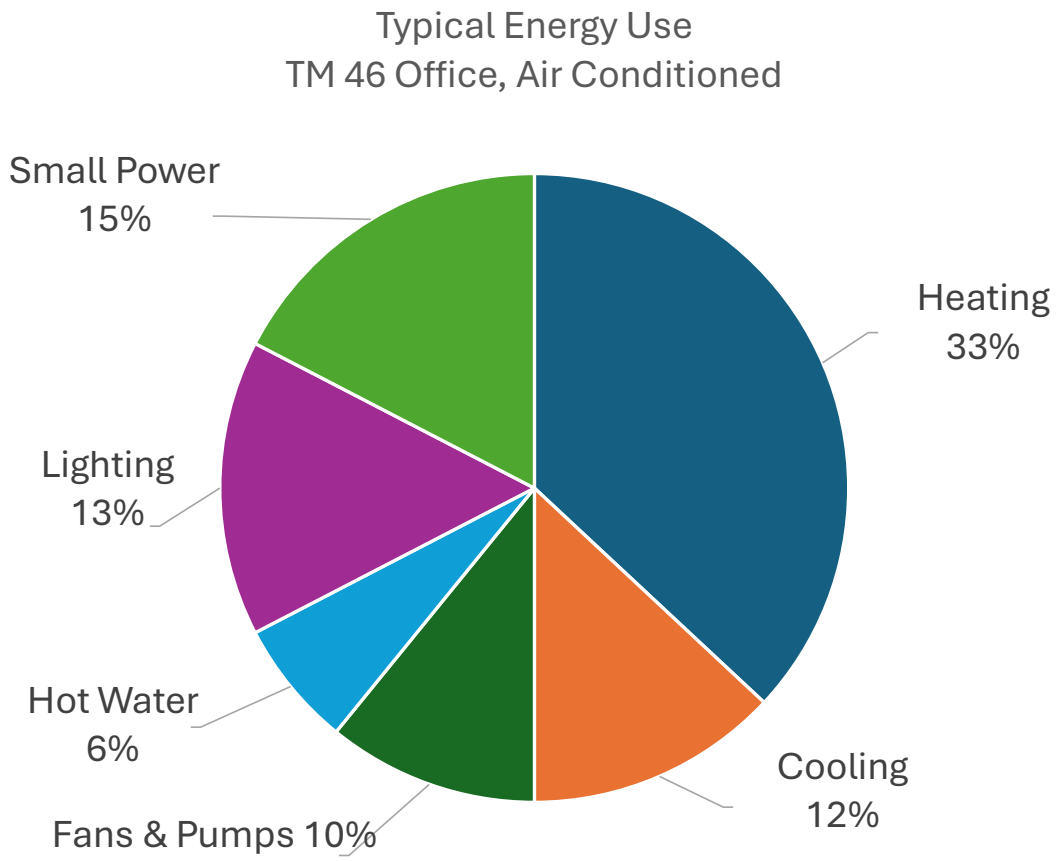

Performance Gap – Our Energy Revelation

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Buildings don't need energy, people do.

55.3 %
University Electrical use outside M-F 7-7

TEC: 70% UK Universities

1650 Fiscal Meters

56.1 %
University Gas use outside M-F 7-7

60 %
Schools Out-of-Hours Energy

Energy Sparks | Inspired Efficiency | Barkers: 1700 Schools

£764M
Annual savings in Education if we half the half

25% of DFE Budget 2024/25 +

25% of Energy Spend based on Hesa spend 22/23

HALF THE HALF

CIBSE TM46 – Education EUI is not an outlier

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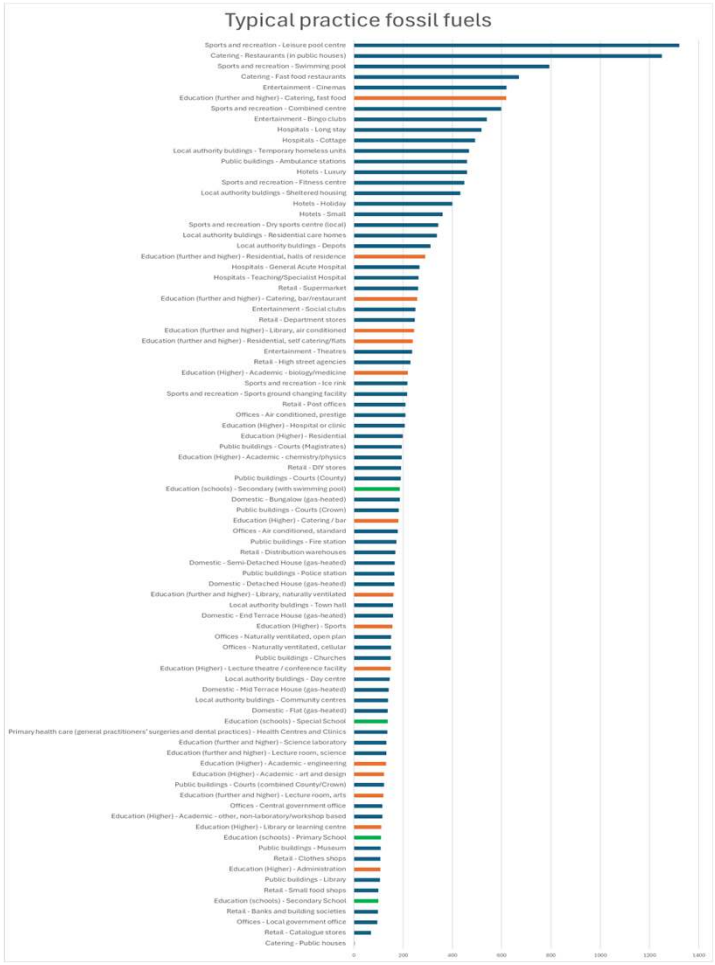

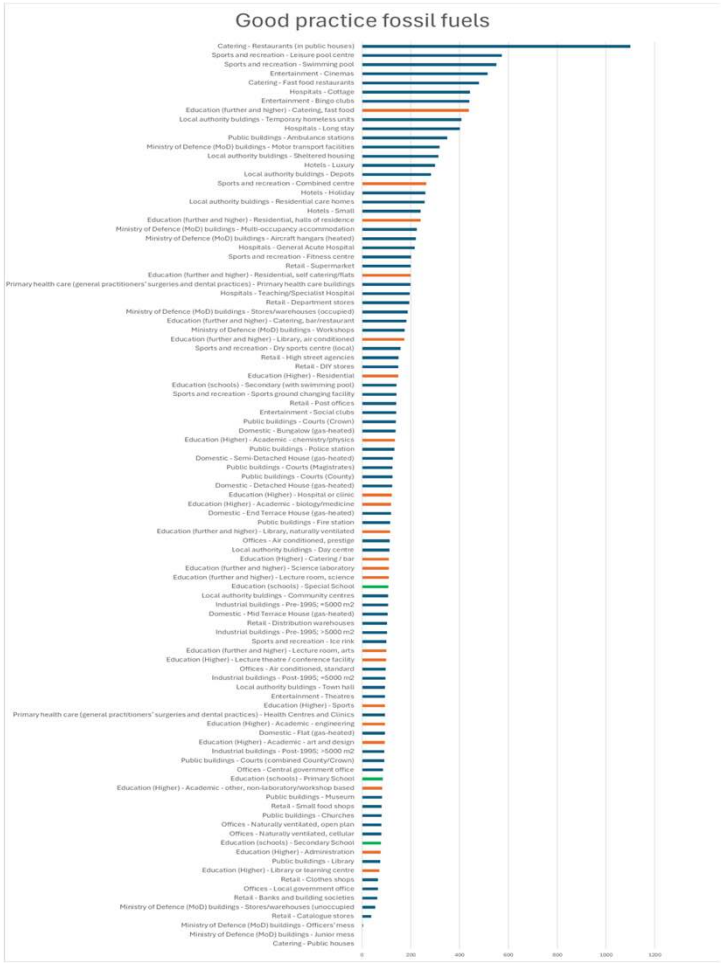

HE
Schools
Other

Scaling Beyond Institutions: Built Environment Impact

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80 %
Buildings in 2050 already exist

UKGBC

27%
Global Energy Emissions from building operations

International Energy Agency

20%
Global Energy Emissions from construction

1-4 x
Performance Gap

Actual vs Design Energy use.

Study of Studies - Shi et al.

Transforming the Built Environment?

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Cardiff Metropolitan University's initiative suggests that systemic optimisation of existing buildings could offer rapid, scalable cost and carbon reduction, without major investment.

Immediate
Impact timeline

Replicable
Across the built environment

Scalable
You already have the data

Llywodraeth Cymru Welsh Government | Gwasanaeth Ynni Energy Service | CIOB | AUDE Together, for excellent university estates & facilities | TEC ENERGY & EDUCATION CONNECTED | Energy Sparks

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Internal Environment:

A Healthy & Productive Environment?

Internal Environment – Another Performance Gap

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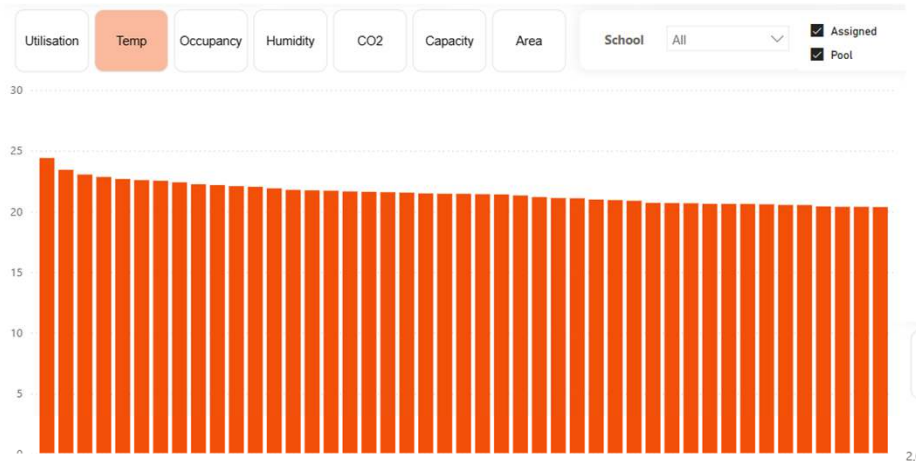

SmartViz

Internal Environment – Another Performance Gap

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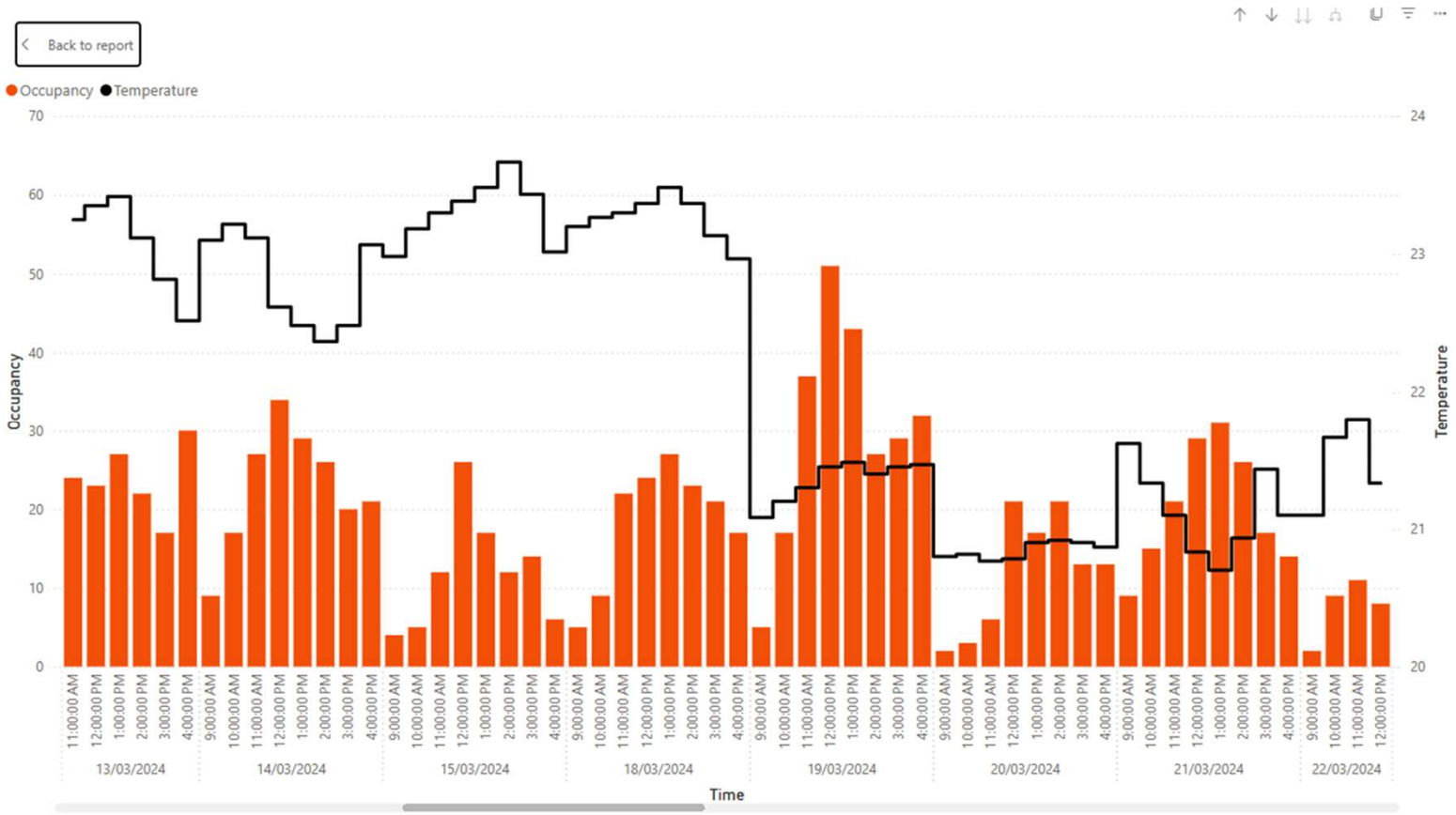

Internal Environment – Another Performance Gap

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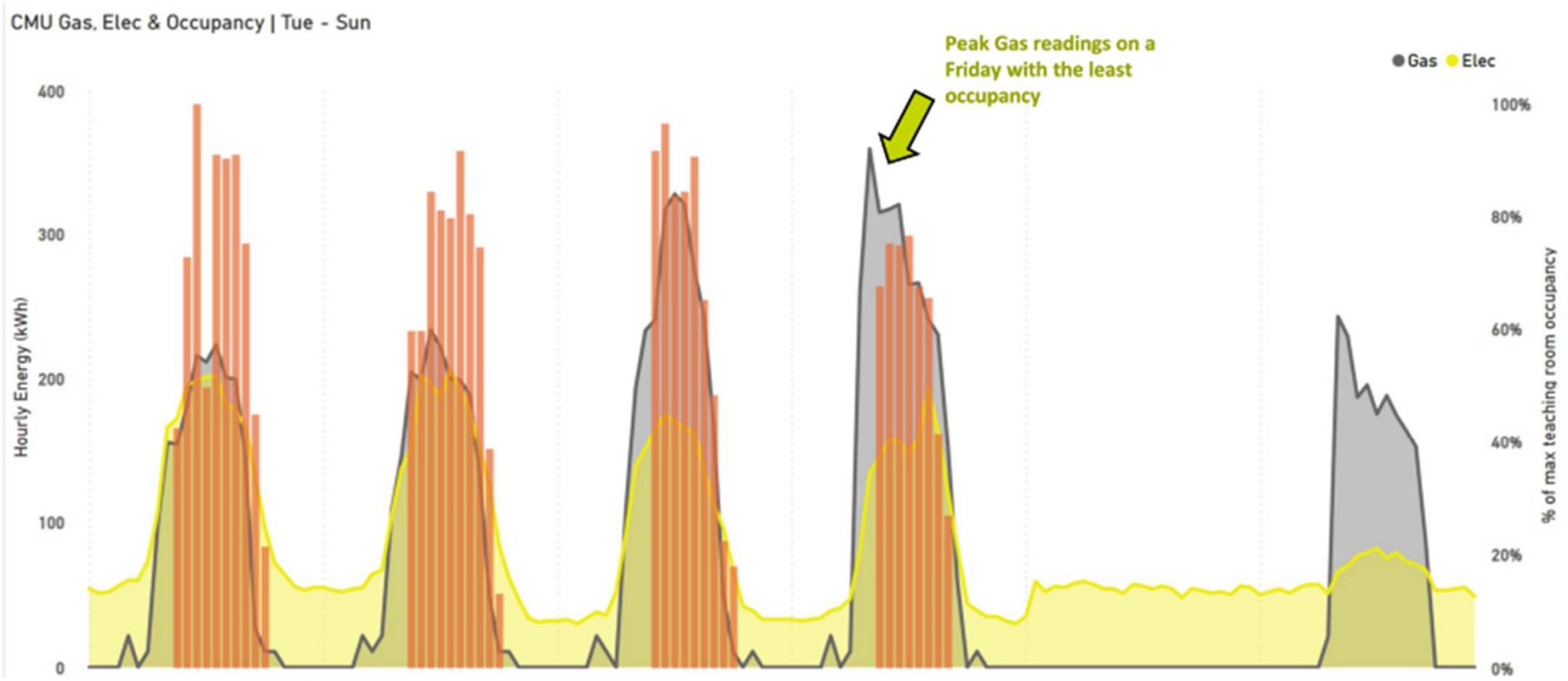

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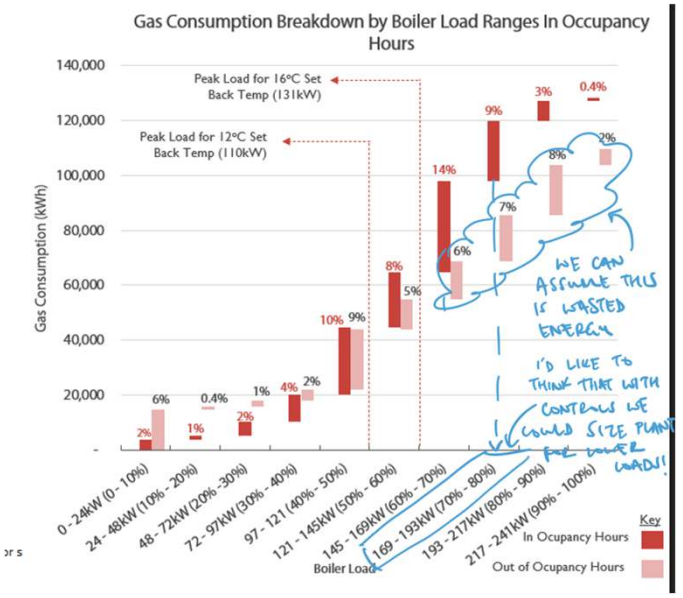
Rethinking MEP: Replacement design criteria

Replacement plant – how big?

Example Building Gas Load for different Occupancy Periods



Challenging the standards…

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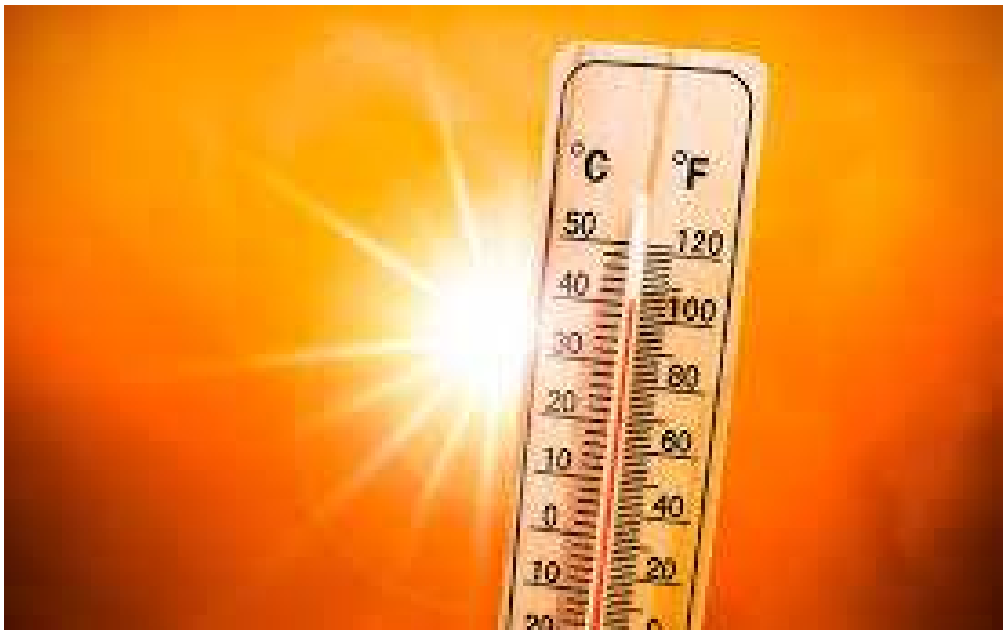

Air Handling and Chillers:
Sized to achieve design parameters based on

- 100% occupancy
- on the maximum external temperature
- at the beginning and duration of the day.

Heating plant:
Sized to achieve design parameters based on

- 0% occupancy
- On the lowest external temperature
- From a cold start
- For the beginning and duration of the day

Challenge the standards…

Requires client-led conversations about design parameters and dispensation from standards:

- Potential to reduce plant and distribution sizing
- Releasing floor area otherwise used for enlarged plant and distribution
- Reducing peak loads – reducing grid impact, capital cost and reserved capacity cost
- Plant efficiency curves – Sizing for efficient typical use vs peak of peak capacity

Client/end-users to agree plan for potential response lag/tolerance during temperature extremes

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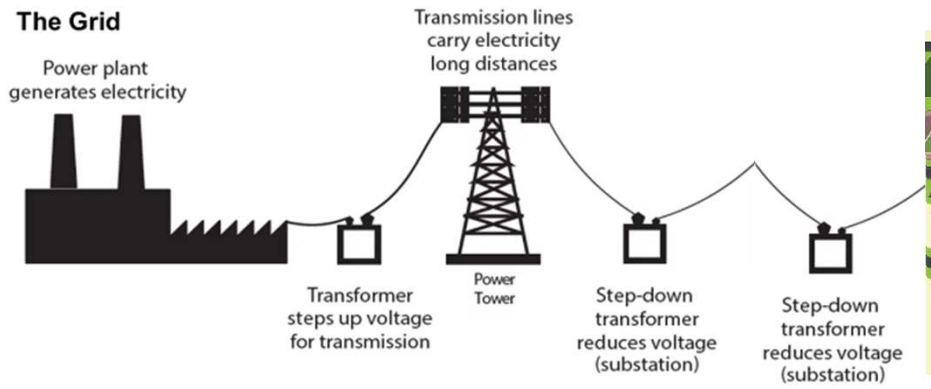
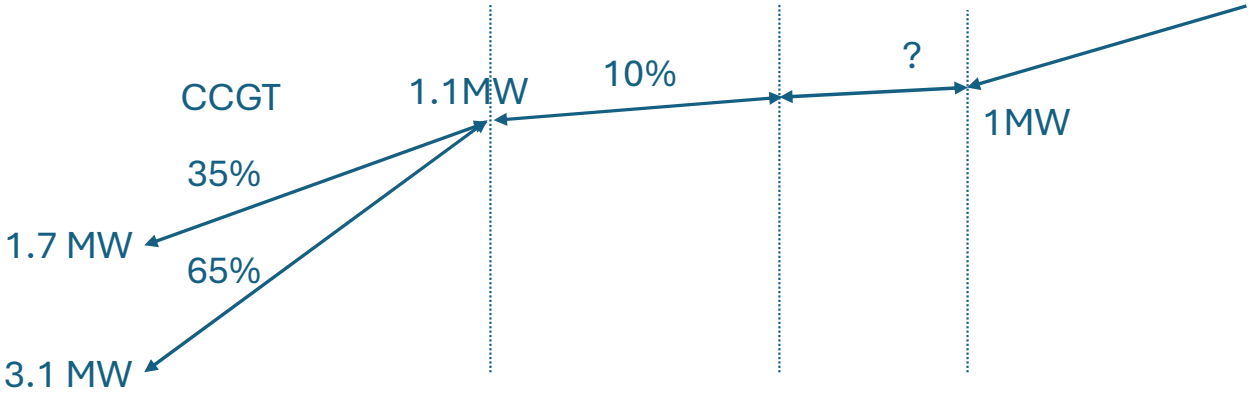
Grid & Macro Potential

Net Zero – Upstream Grid Savings





(In)efficiency data source: National Energy System Operator data

Infographic Source: NEED.org Electricity (2019)

Education Sectors relative to Government Portfolio

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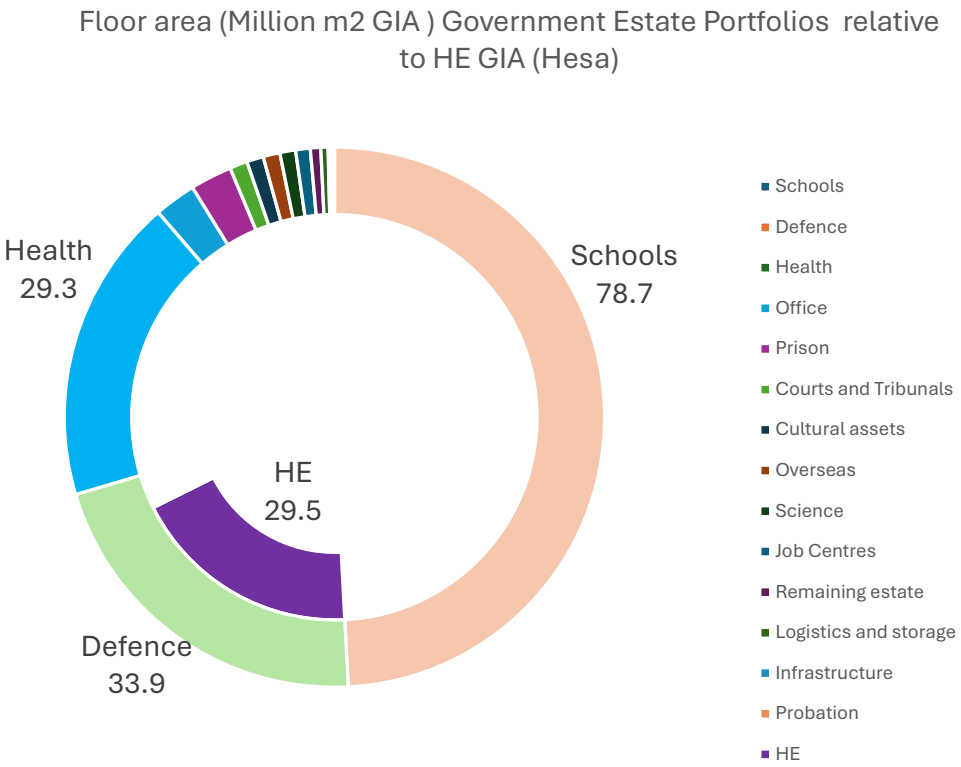

HE + Schools are equivalent to 67+ % Government Portfolio (160 M m^2)

HE and Schools are equivalent to 18+ % Non-domestic UK Real Estate (594 M m^2)

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Putting it together

Internal Environment – Another Performance Gap

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Data-led Baselining

Address the OOH (Out of Hours)

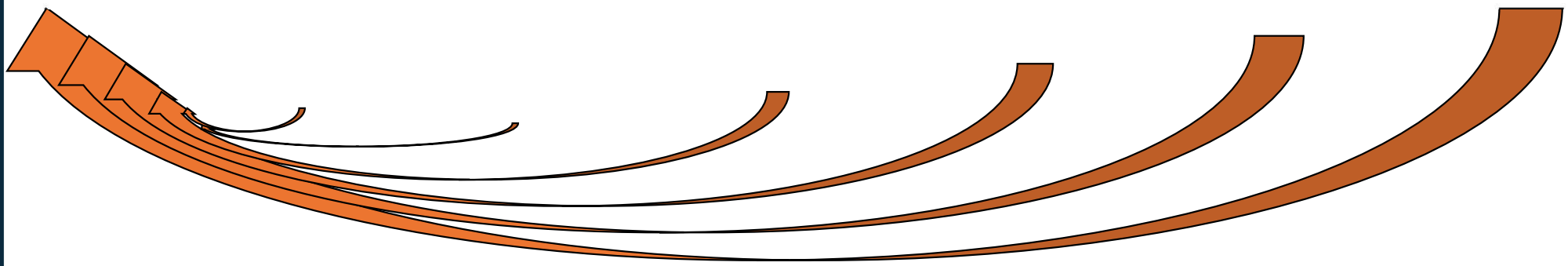
Behavioural Change challenges and opportunities

Fabric and Heat Decarb Projects

Verify the Real Need

Energy audits and assessments– worst first

Develop Building / System specific roadmap



No/Low cost
Quick Wins

Higher investment
Increased Complexity, Longer lead-in and pay-back

Lessons Learnt

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- Do you understand your energy consumption out of hours?
- Replace perceptions with facts.
  Business cases should evidence usage and environment before appointing design teams
- Use of IoT occupancy sensors addresses challenges to manual occupancy counts
- Monitoring the internal environment in conjunction with occupancy reduces territorial barriers if aligned to resultant priority-based investment decisions
- Linking environmental quality to cognitive function, carbon and energy cost creates a compelling case for a taking a different approach
- Addressing out of hours energy use is a win-win for cost, carbon and building momentum towards net zero.
- Piloting drives Progress

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Rethinking the grid upgrade challenge

Ynni Cymru Funded Solar PV

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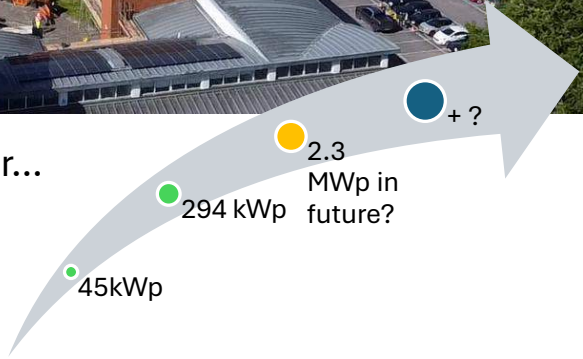
Our six-fold increase this year...



Rethinking the grid upgrade to get us to Net Zero

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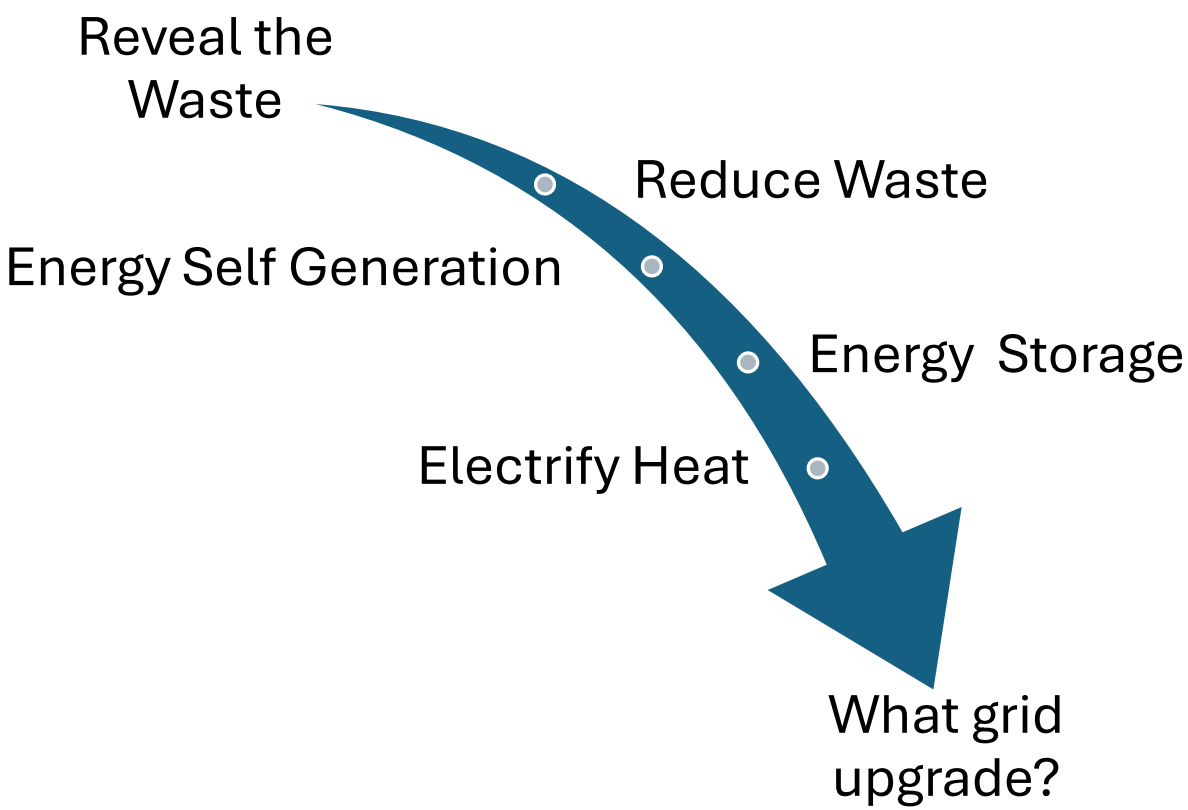
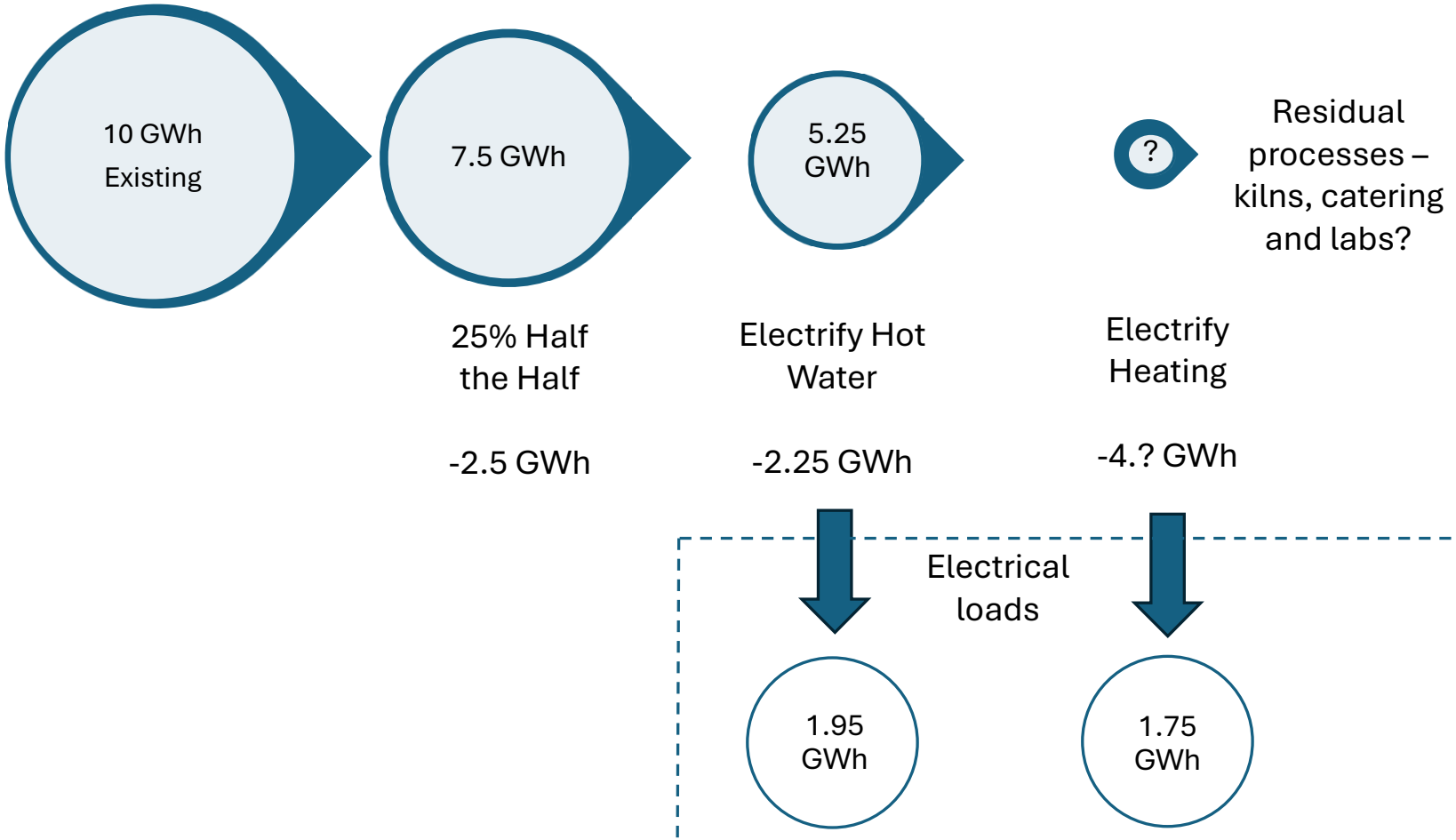


Efficiency, self-generation, electrification of gas and…



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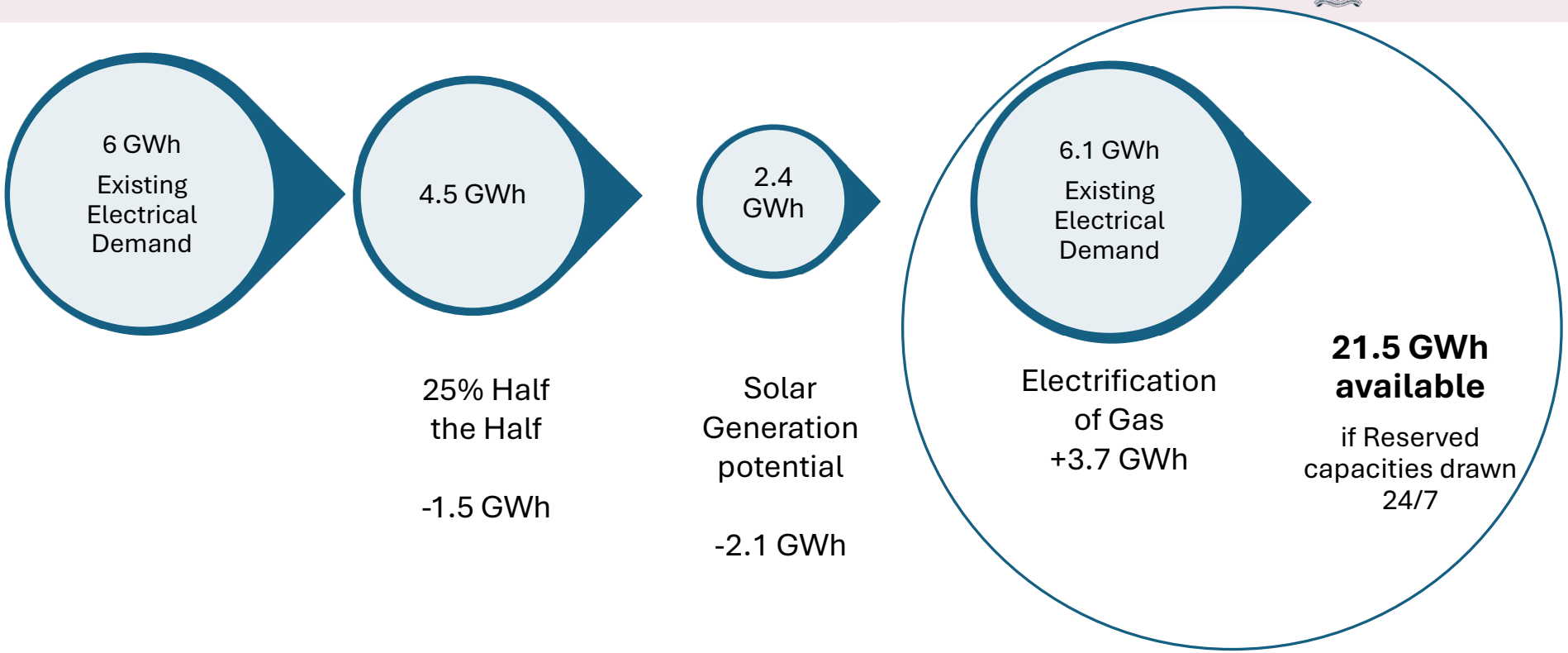

Llandaff example –heat electrification average (Stc)

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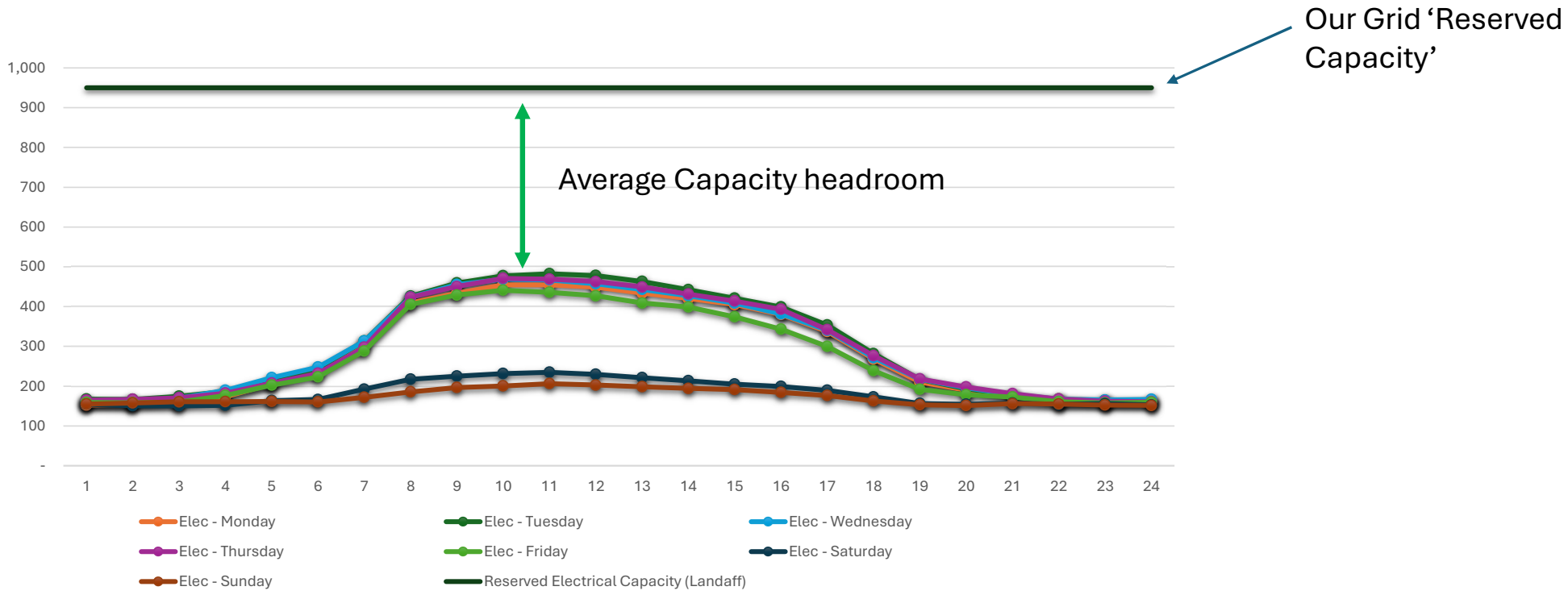

Llandaff Elec and Gas peak loads in last 5 years electrified (stc)

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Llandaff Reserved Capacity may be sufficient if energy is stored…

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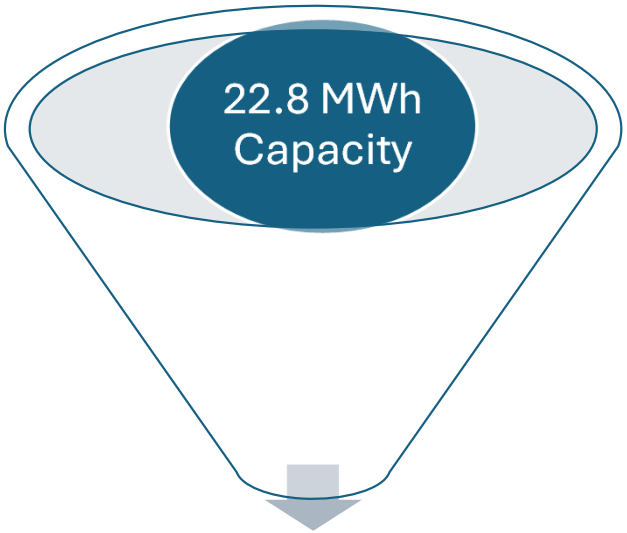
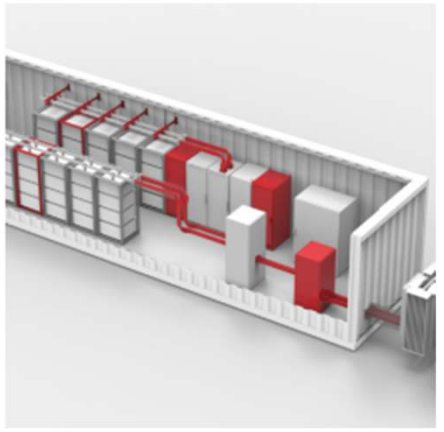
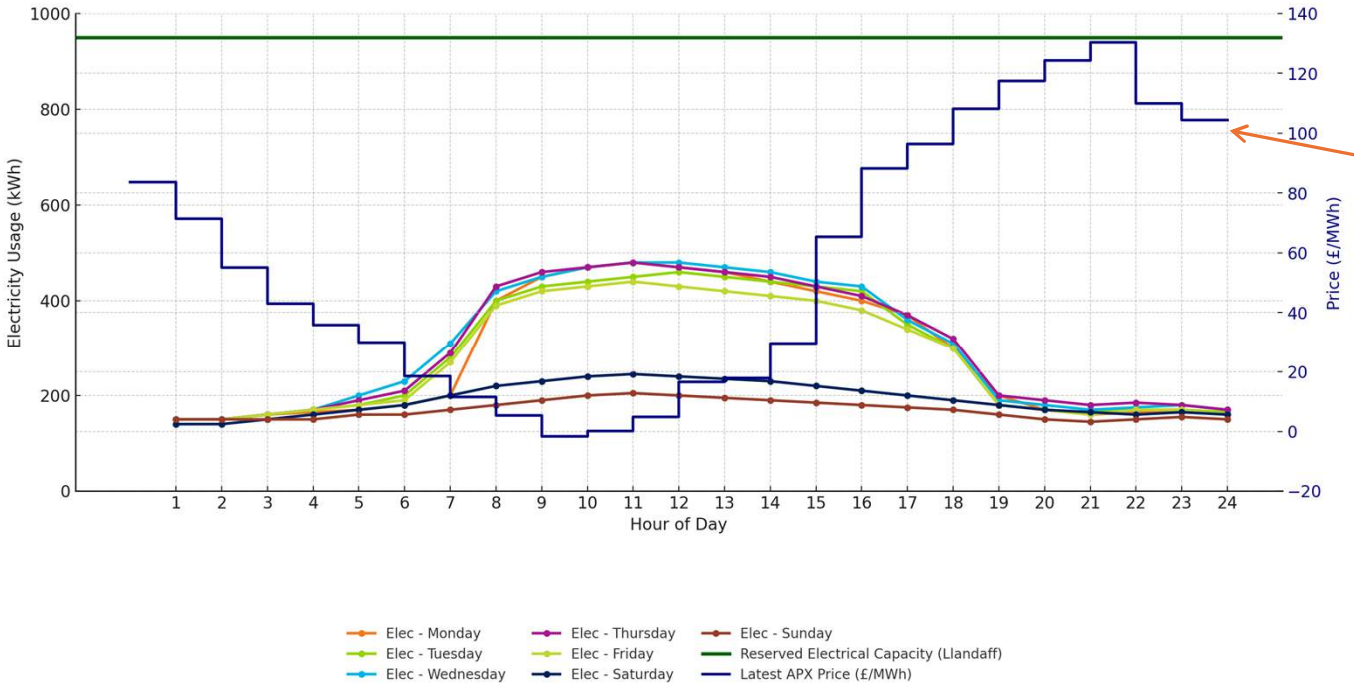


Total day's consumption on day with peak load = 21.5 MWh



6.83 MWh Storage to manage the peak

Headroom = Commercial opportunity for Arbitrage



Example intraday block pricing

Intraday energy pricing varies significantly in hourly blocks

Battery storage provides an opportunity to buy low sell high when we don't need the power

Potential opportunities to procure commercial partners under various scenarios for commercial gain or energy price protection.

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Collaboration

Building Level Benchmarks

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	A	B	C	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1	Organisation name	Confidential	Address	Building Usage (eg office / store /dist)	Gross Internal Floor Area m2	Number of Floors	EPC	Meter reference/identifier	Utility type (Elec/gas/water /oil/district heat)	Unit (kWh or m3)	Opening Time of building	Closing Time of Building	Days of operation	Bank Holidays	Air Conditioning	Space Heating Type	Water Heating Type	Onsite Generation Type	Onsite Generation (kWh)	Onsite Generation Type	Bed spaces (if applicable)	Contains dedicated server room(s)	Contains highly-serviced lab(s)	Contains freezers - commercial catering or ultra-low temperature	Other comme
2	Essential	Assumes No	Essential	Essential	Essential	Desirable	Desirab	Essential	Essential	Essential	Essential	Essential	Essential	Essential	Desirable	Desirable	Desirable	Desirabl	Desirable	Desirable	Desirable	Desirable	Desirable	Desirable	Desira
3	Notes	Y/N		Where combined uses, list uses with % floor area for each				Must be unique identifier that matches half hourly export data in Consumption Tab			24hr format (eg 0900)	24hr format (eg 0900)	Mon-Fri, 6 days, 7 days or state custom opening arrangements	Open on Bank Holidays (Y/N)	None / Part (%)/Fully Air conditioned								Labs which require more than one air-change an hour 24/7	Commercial catering or ultra-low temperature	
4	Example Building 1		Address (Minimum info -	Office	21038	2	d	35921	Gas	kWh	08:00	20:00	7	N	Fully air conditioned	Gas heating	Gas heating	Gas heating	Gas heating	Gas heating					Gas he
5	Example Building 1		Address (Minimum info -	Office	21038	2	d	35922	Electricity	kWh	08:00	20:00	7	N	Fully air conditioned	Gas heating	Gas heating	Gas heating	Gas heating	Gas heating					Gas he
6	Example Building 1		Address (Minimum info -	Office	21038	2	d	35923	Water	m3	08:00	20:00	7	N	Fully air conditioned	Gas heating	Gas heating	Gas heating	Gas heating	Gas heating					Gas he

	A	B	C	D
1	RoundedTimeStamp	Units consumed	Units	Meter reference /identifier
2	01/06/2024 00:00	2	(kWh)	35921
3	01/06/2024 00:30	1.5	(kWh)	35921
4	01/06/2024 01:00	1.25	(kWh)	35921
5	01/06/2024 01:30	4	(kWh)	35921
6	01/06/2024 00:00	9	(kWh)	35922
7	01/06/2024 00:30	9	(kWh)	35922
8	01/06/2024 01:00	12	(kWh)	35922
9	01/06/2024 01:30	12	(kWh)	35922
10	01/06/2024 00:00	0.2	(m3)	35923
11	01/06/2024 00:30	0.5	(kWh)	35923
12	01/06/2024 01:00	0.4	(kWh)	35923
13	01/06/2024 01:30	0.5	(kWh)	35923

Llywodraeth Cymru Welsh Government | Gwasanaeth Ynni Energy Service

CIOB

AUDE Together, for excellent university estates & facilities

TEC ENERGY & EDUCATION CONNECTED

Energy Sparks

Building Benchmarks – What would be informative?

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Organisation name
Confidential
Address
Postcode
UPRN
Primary Sector
Building Usage (eg office / store /dist)
Gross Internal Floor Area m2
Number of Floors
EPC
Meter reference/identifier
Utility type (Elec/gas/water/oil/district heat)
Unit (kWh or m3)
Opening Time of building
Closing Time of Building

Days of operation
Bank Holidays
Air Conditioning
Space Heating Type
Water Heating Type
Onsite Generation Type
Onsite Generation (kWh)
Onsite Generation Type
Bed spaces (if applicable)
Contains dedicated server room(s)
Contains highly-serviced lab(s)
Contains freezers - commercial catering or ultra-low temperature
Other comments

Llywodraeth Cymru Welsh Government
Gwasanaeth Ynni Energy Service
CIOB
AUDE Together, for excellent university estates & facilities
TEC ENERGY & EDUCATION CONNECTED
Energy Sparks