Conference.
11 January 2022.

UK Building Services Engineers Declare Climate & Biodiversity Emergency.

Agenda

2.00pm	1. Welcome and introductions – Ashley Bateson (Chair, Building Services Engineers Declare Steering Group)
2.05pm	2. Review of the commitment principles
2.15pm	3. Update on UK signatories and activities.
2.20pm	4. Update on Built Environment Declares and survey findings
2.35pm	5. Case study presentations (4 presentations) a) GSK Centre for Sustainable Chemistry Carbon Neutral Laboratory – Alan Fox, AECOM b) Whole-life carbon comparison of HVAC systems- Will Belfield, Hoare Lea c) Sustainable design: a case study for fit-out- Marian Ferguson, Energy Lab d) Practice approach to zero carbon - Andrew Leiper, Max Fordham
3.20pm	6. Discussions in break-out sessions
3.45pm	7. Summary and feedback from breakout sessions
4pm	8. Close

Break-out sessions

Hosts	Break out session - discussion topic
Natasha Fox- Method Consulting Lee Hargreaves- Buro Happold Lauma Balina- Max Fordham	1. How can engineers influence clients to adopt low and zero carbon strategies?
David Buick- AECOM Andy Cane- Hoare Lea	2. How should our industry collaborate to influence better climate and biodiversity outcomes?
Marian Ferguson- Energy Lab Consulting Andrew Leiper- Max Fordham	3. What should signatories of Building Services Declare focus on during 2022?
Ashley Bateson- Hoare Lea Eleanor Hoey- Method Consulting Jonathan McMillan- Hulley and Kirkwood	4. Are there specific activities or initiatives that the declaration group should consider?

Commitment Principles.

UK Building Services Engineers Declare Climate & Biodiversity Emergency.

We will seek to:

- Raise awareness.
- Advocate for faster change.
- Climate mitigation as the key measure of success.
- Share knowledge.
- Loudly evaluate all new projects against climate breakdown.
- Retain existing buildings whenever possible
- Evaluate carbon as part of our basic scope of work.
- Adopt regenerative design.
- Collaborate to reduce construction waste.
- Shift to low embodied carbon materials.
- Minimise wasteful use of resources in architecture.

Steering Group

Representatives from the following signatories:

AECOM
Buro Happold
chapmanbdsp
Energy Lab
Hoare Lea
Hulley & Kirkwood
Max Fordham
Method Consulting

UK Building Services Engineers Declare Climate & Biodiversity Emergency

www.buildingservicesengineersdeclare.com

112 UK signatories

World-wide:

UK

Canada

France

Spain

Singapore

Proposed:

Ireland

USA

UK Building Services Engineers Declare Climate & Biodiversity Emergency

www.buildingservicesengineersdeclare.com

Built Environment Declares

Overarching organisation for the various built environment signatory disciplines.

Includes:

- Architects
- Building Services Engineers
- Structural Engineers
- Civil Engineers
- Project Managers
- Contractors
- Interior Designers
- Landscape Architects

www.builtenvironmentdeclares.com

Built Environment Declares Survey

Autumn 2021 Signatory Survey:

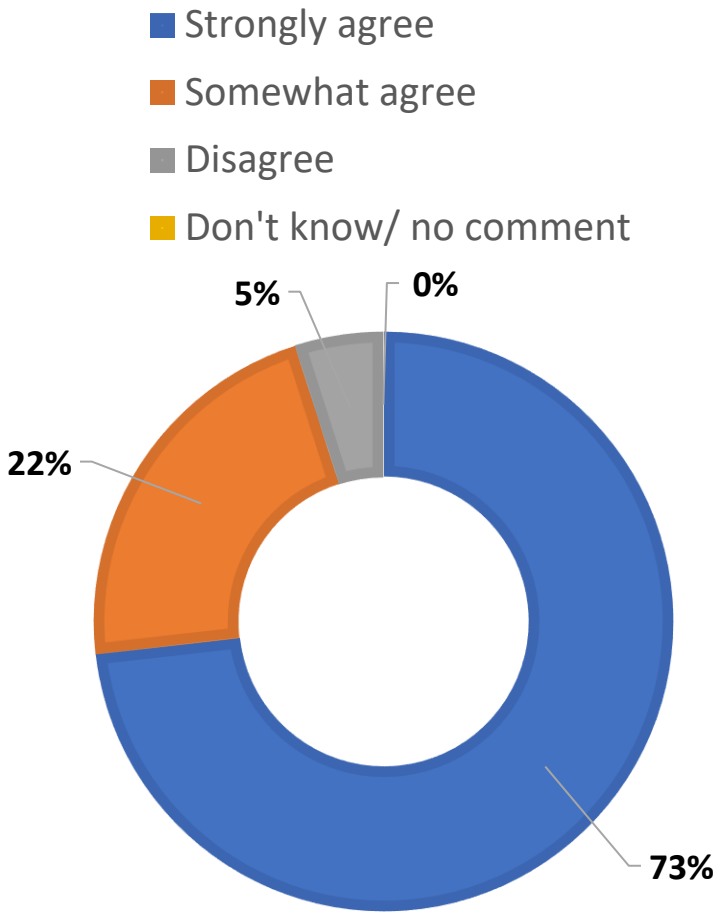
- Responses from over 200 practices.

- Includes wide-range of practices in the built environment (architects, contractors and engineers etc.).

Survey findings

Planning

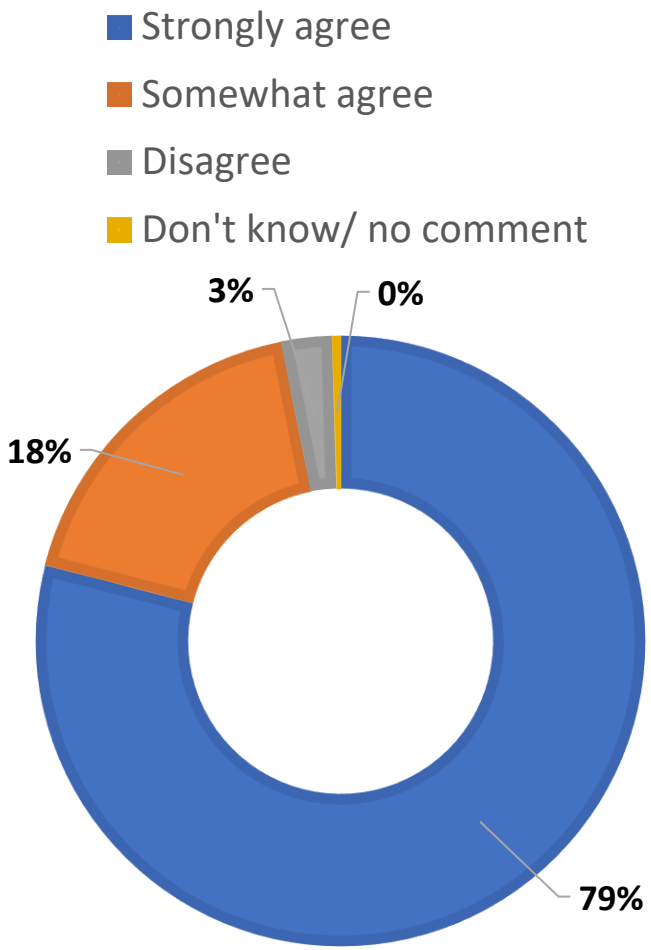
Whole life carbon calculations (or informed estimates) and targets should be mandatory at planning stage and should be a factor in determining whether a project is granted planning permission.



Survey findings

Building regulations

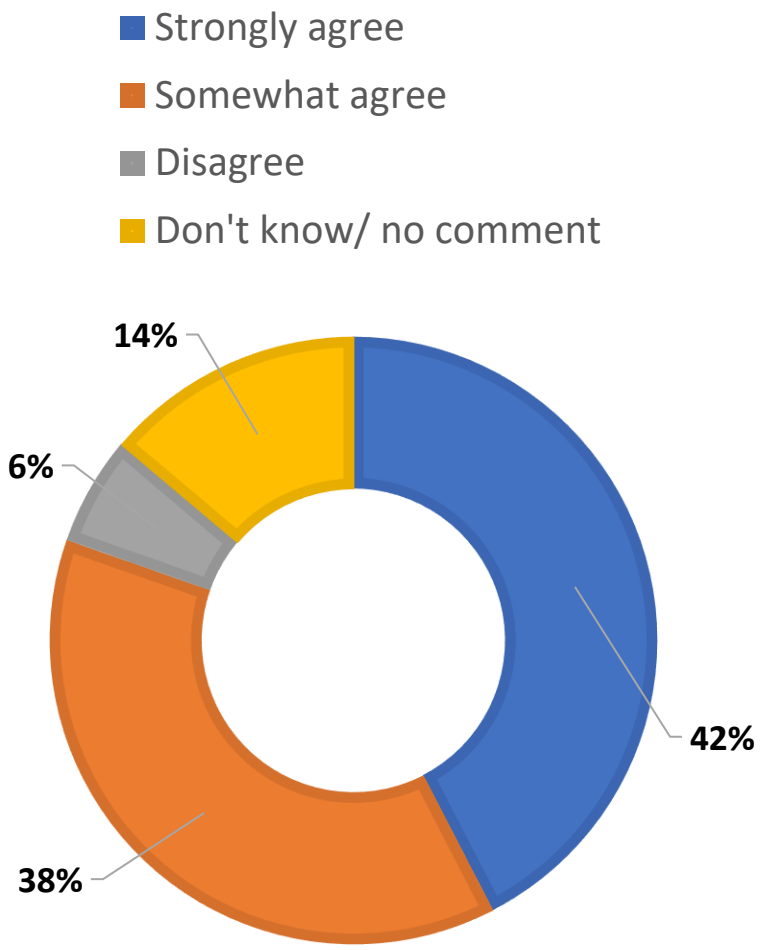
Building regulations should regulate embodied carbon of construction.



Survey findings

Urban greening factor

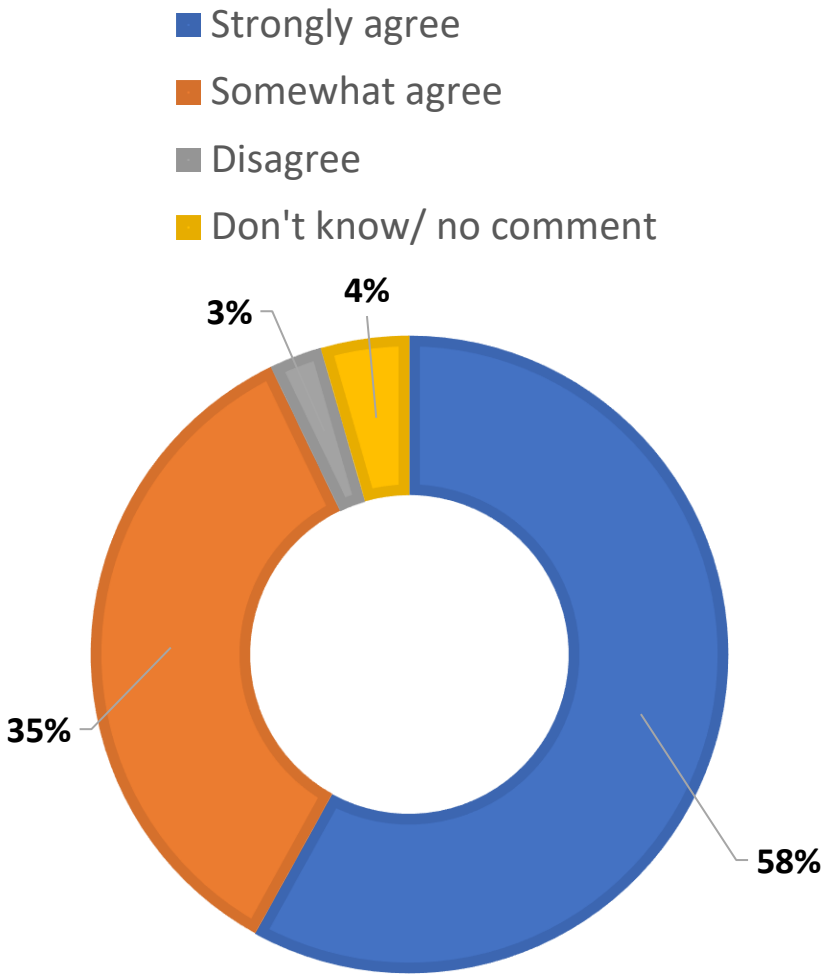
Planning permission should only be granted if an Urban Greening Factor (UGF) of 0.4 is achieved.



Survey findings

Post occupancy evaluation

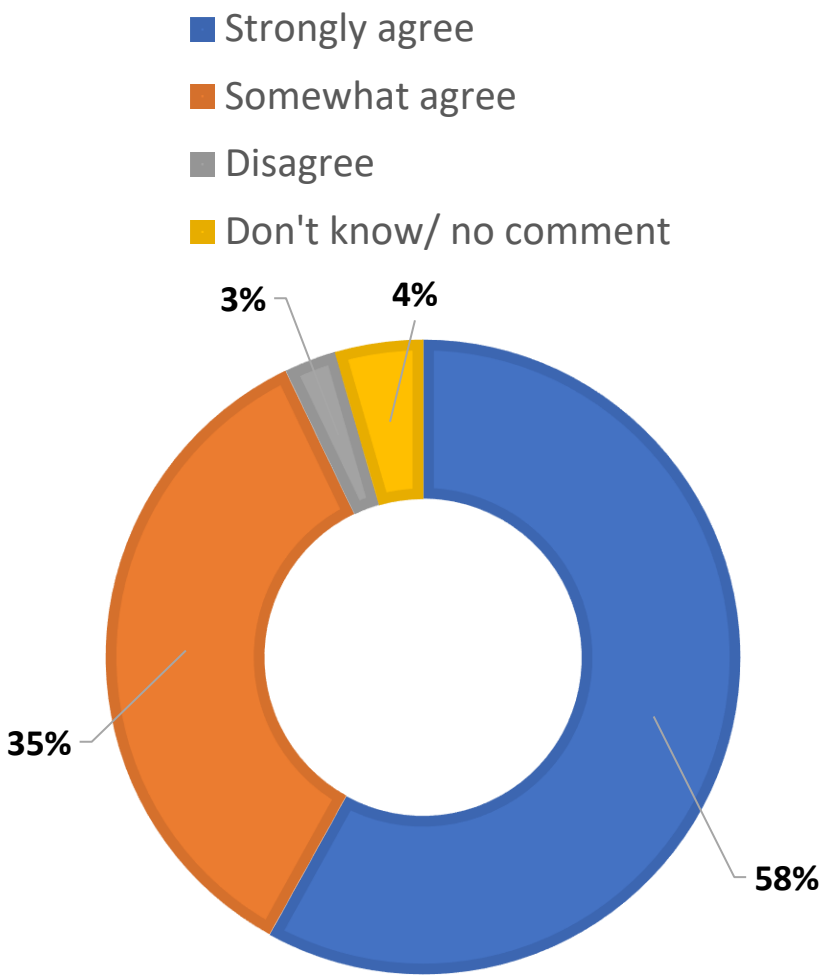
Commitment to Post Occupancy Evaluations (POE) should be mandatory for planning permission for all new buildings, major refurbishments and their associated land.



Survey findings

Regulating energy performance

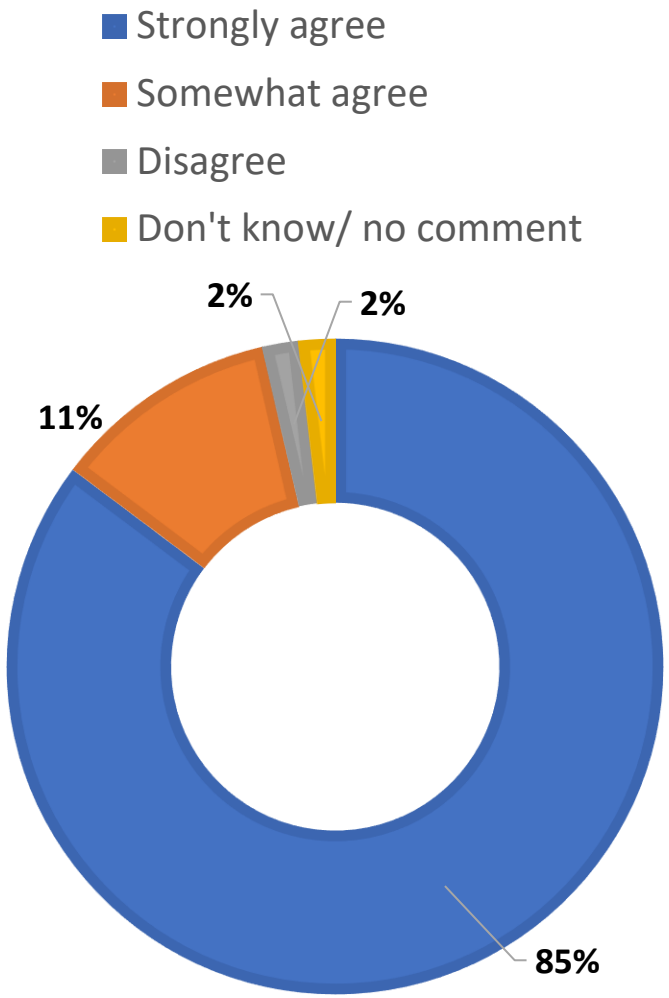
Building Regulations should regulate energy performance in-use (post occupancy), not merely predicted.



Survey findings

Promoting refurbishment

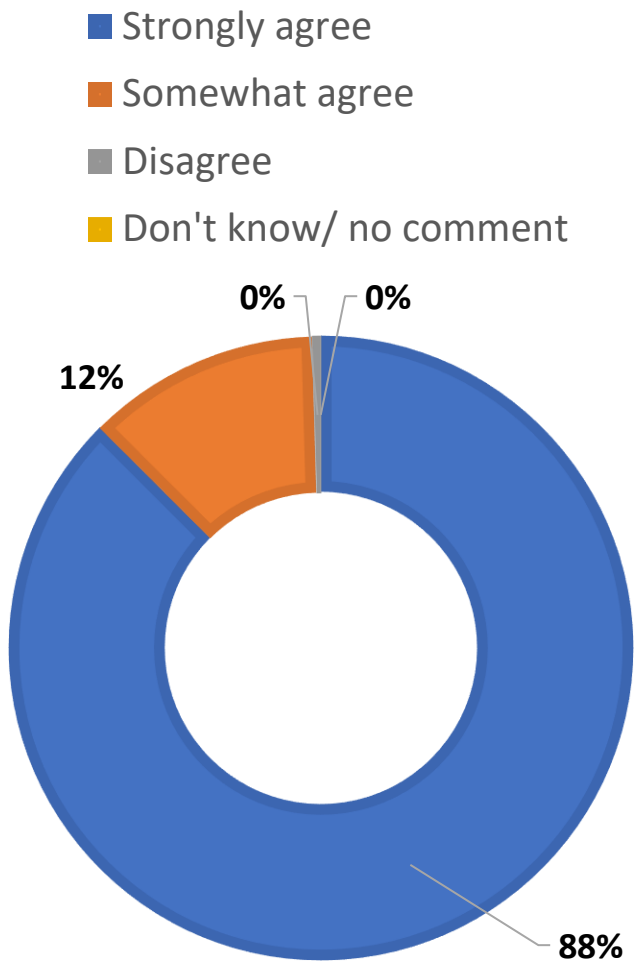
VAT should be reformed to promote refurbishment over new-build.



Survey findings

Public procurement leadership

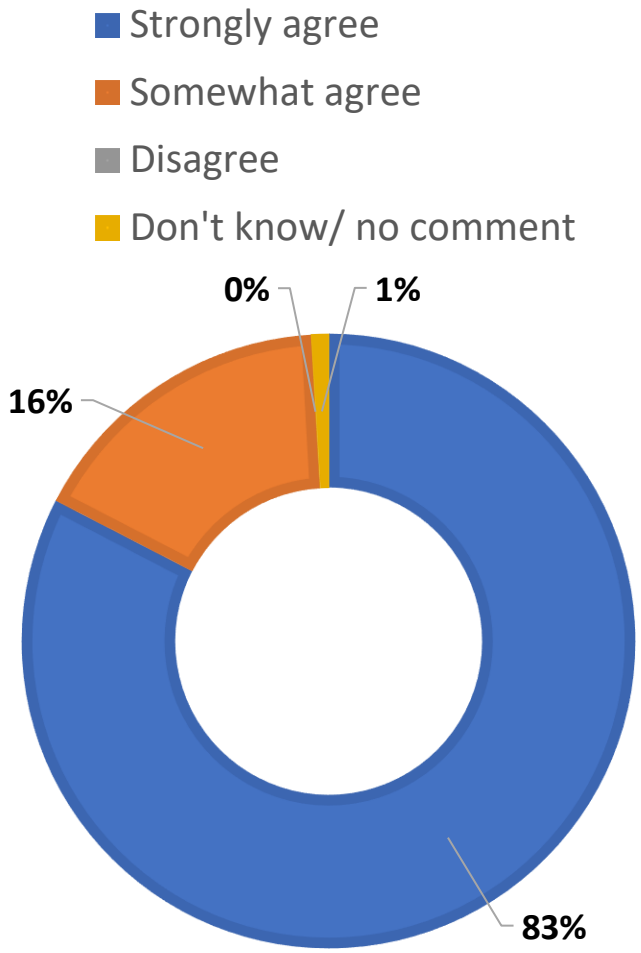
Publicly procured and/or funded projects should strive for regenerative design and development (net positive).

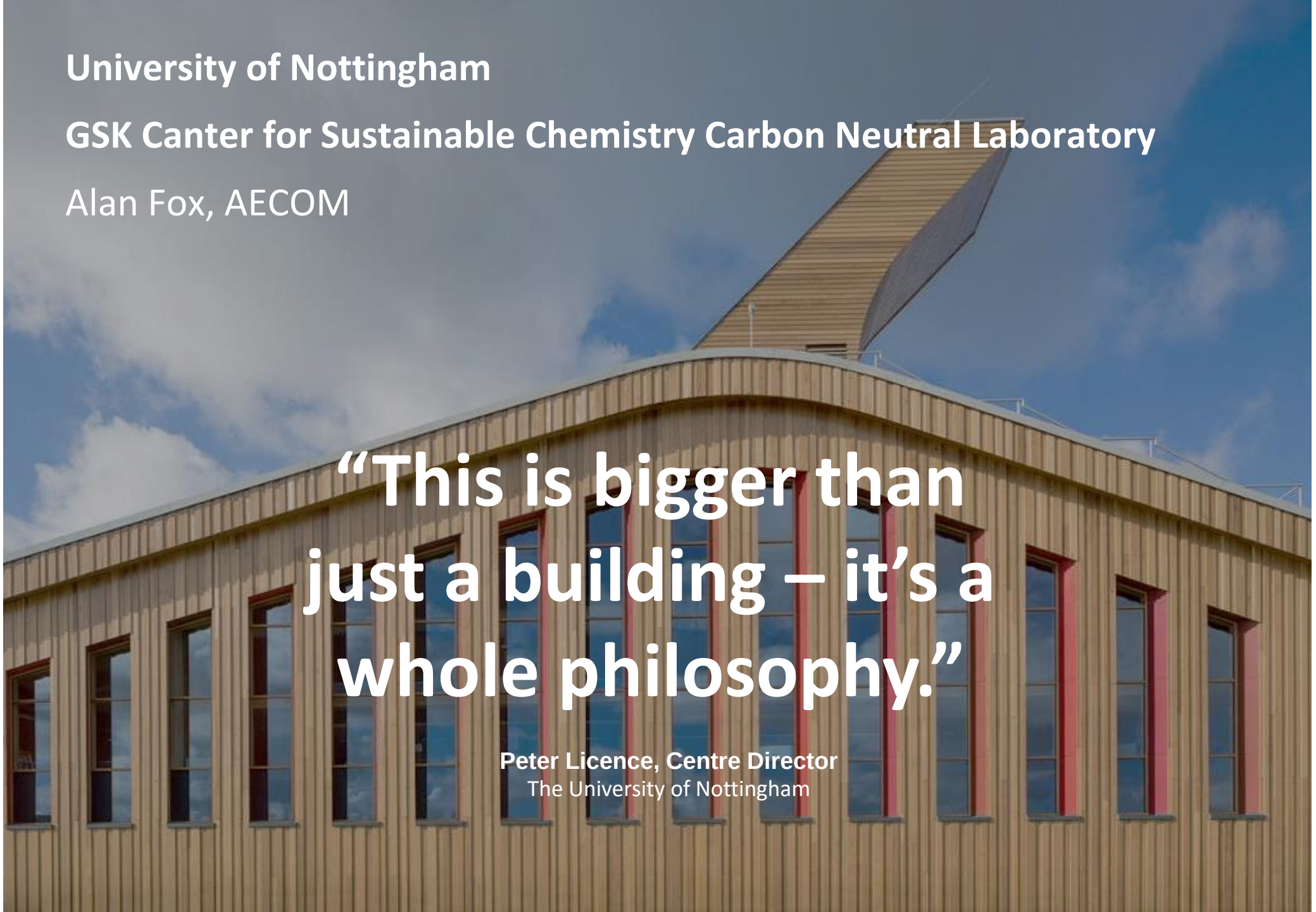


Survey findings

Practice leadership

Practices should make an explicit shift in their missions and goals to prioritise the goal of planetary health, including human wellbeing





University of Nottingham

GSK Canter for Sustainable Chemistry Carbon Neutral Laboratory

Alan Fox, AECOM

“This is bigger than just a building – it’s a whole philosophy.”

Peter Licence, Centre Director
The University of Nottingham


To rethink a typical GSK
laboratory building to make less
demand on both the company
as an overhead and
the wider environmental impact
of its construction and
operation

Carbon Neutral in 25 years

Construction
Kg CO^2e

Emissions
Kg CO^2e

TOTAL
Kg CO^2e

Pays back

Net Export Energy
Offsets Grid Elect
Kg CO^2e

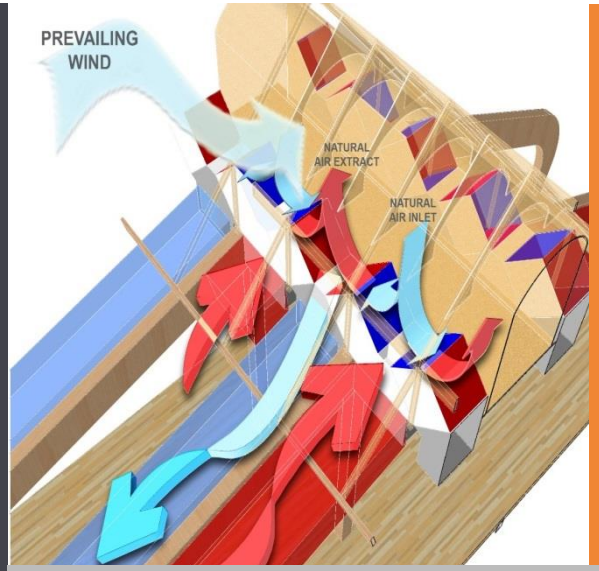
The Concept – Not Chemistry…

25 Year Carbon Payback

Low Energy Consumption	Low Embodied Carbon	Renewable Energy
Wind Driven Vent Low Energy FC's 'Off' State Air tightness Insulation Winter Garden	Use of Timber – Sequestration Low Carbon – Natural Materials Selective use of high energy materials Minimised Transport	BIPV BIO Fuel CHP

The Concept – Not Chemistry…

Carbon Neutral – Pay back in 25 years

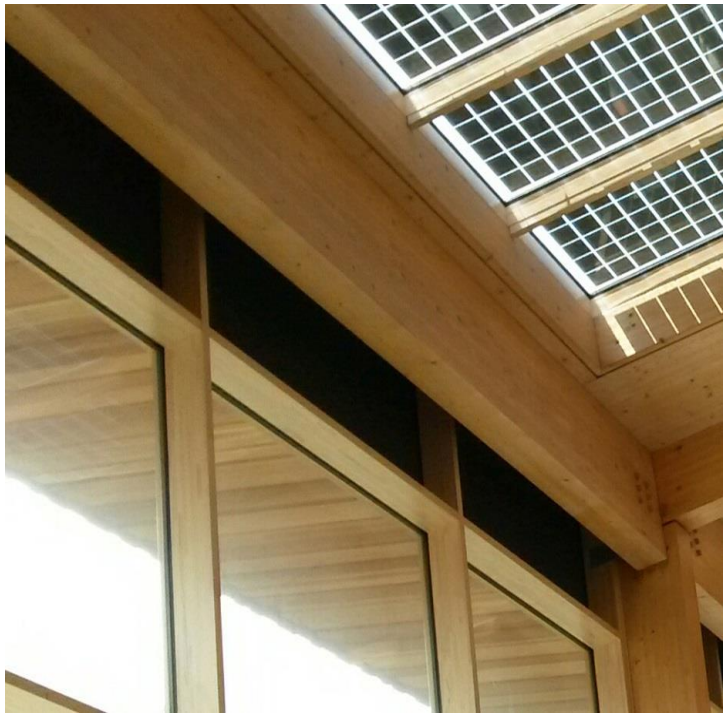


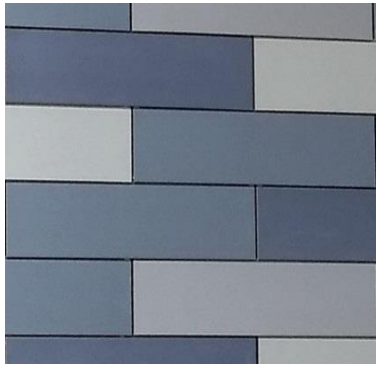
Low Carbon and Low Energy

Naturally Ventilated Laboratories and shared Lab – Write Up Zones

BREEAM ‘Outstanding’ LEED ‘Platinum’

The Materials





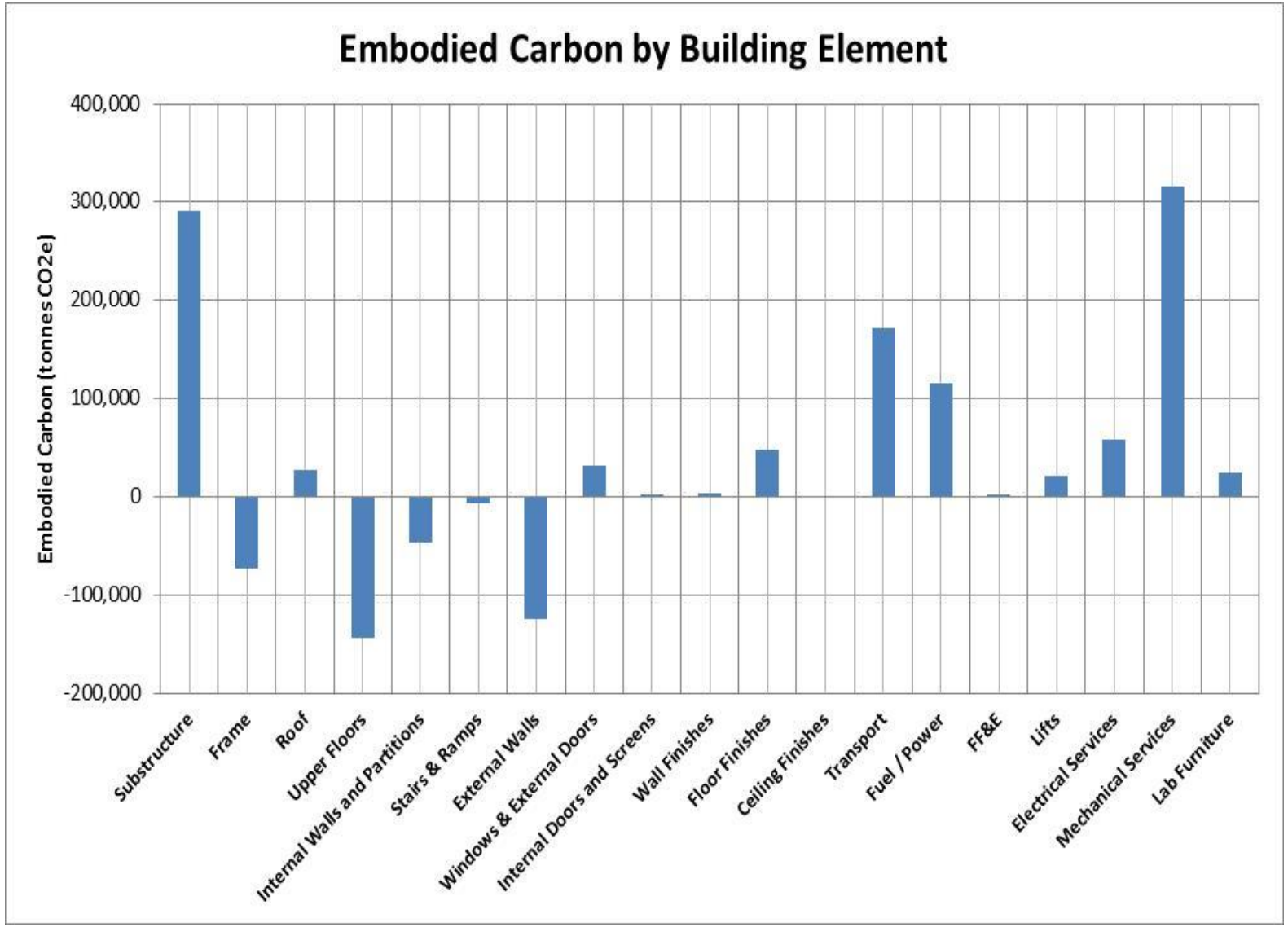
Once Fired Terracotta Cladding

Internal walls in timber stud or solid CLT

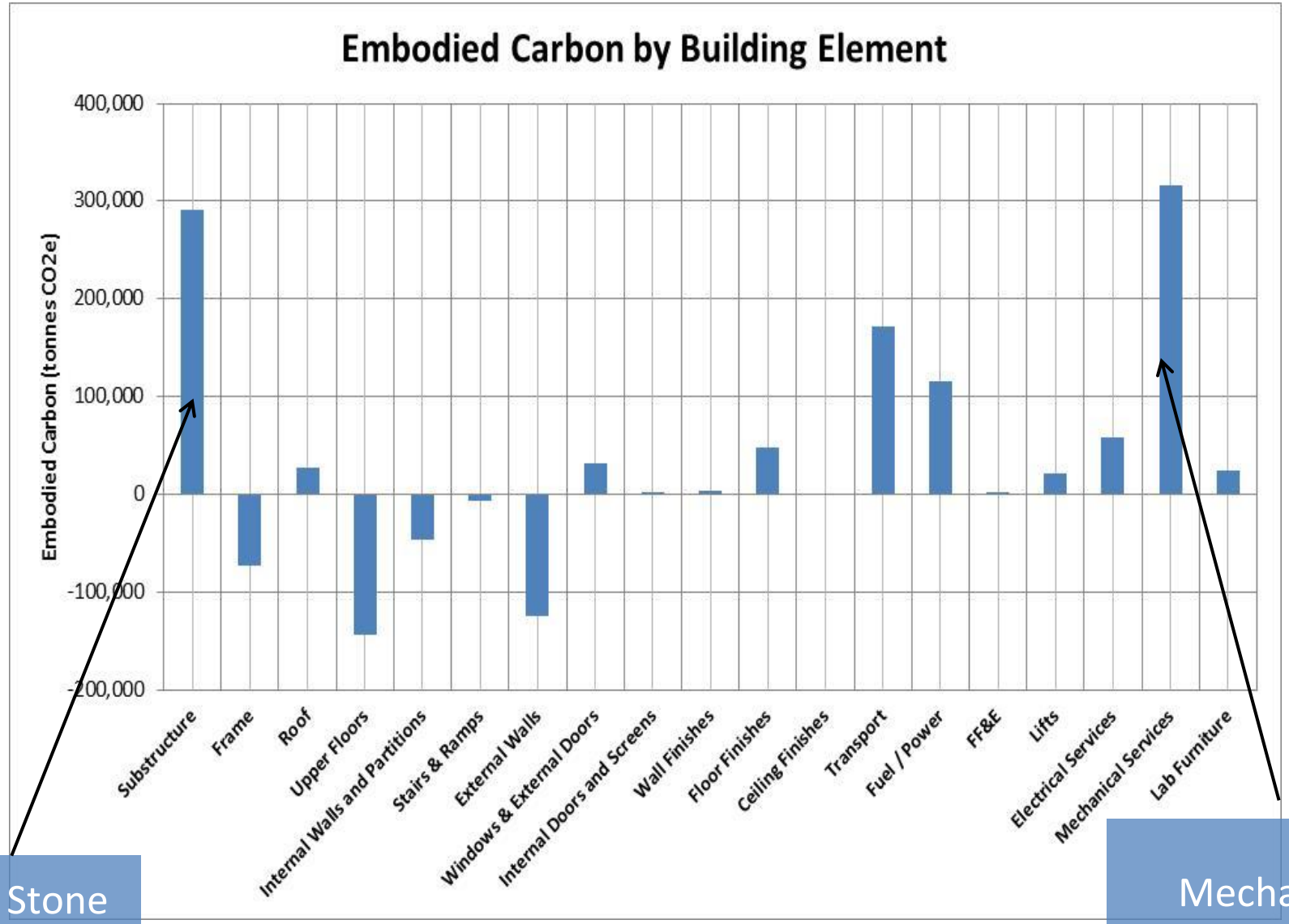
CLT solid timber upper floor slab, external wall panels and roof deck

Diverse native mix of species in wild flower blanket roof

Low Carbon Construction



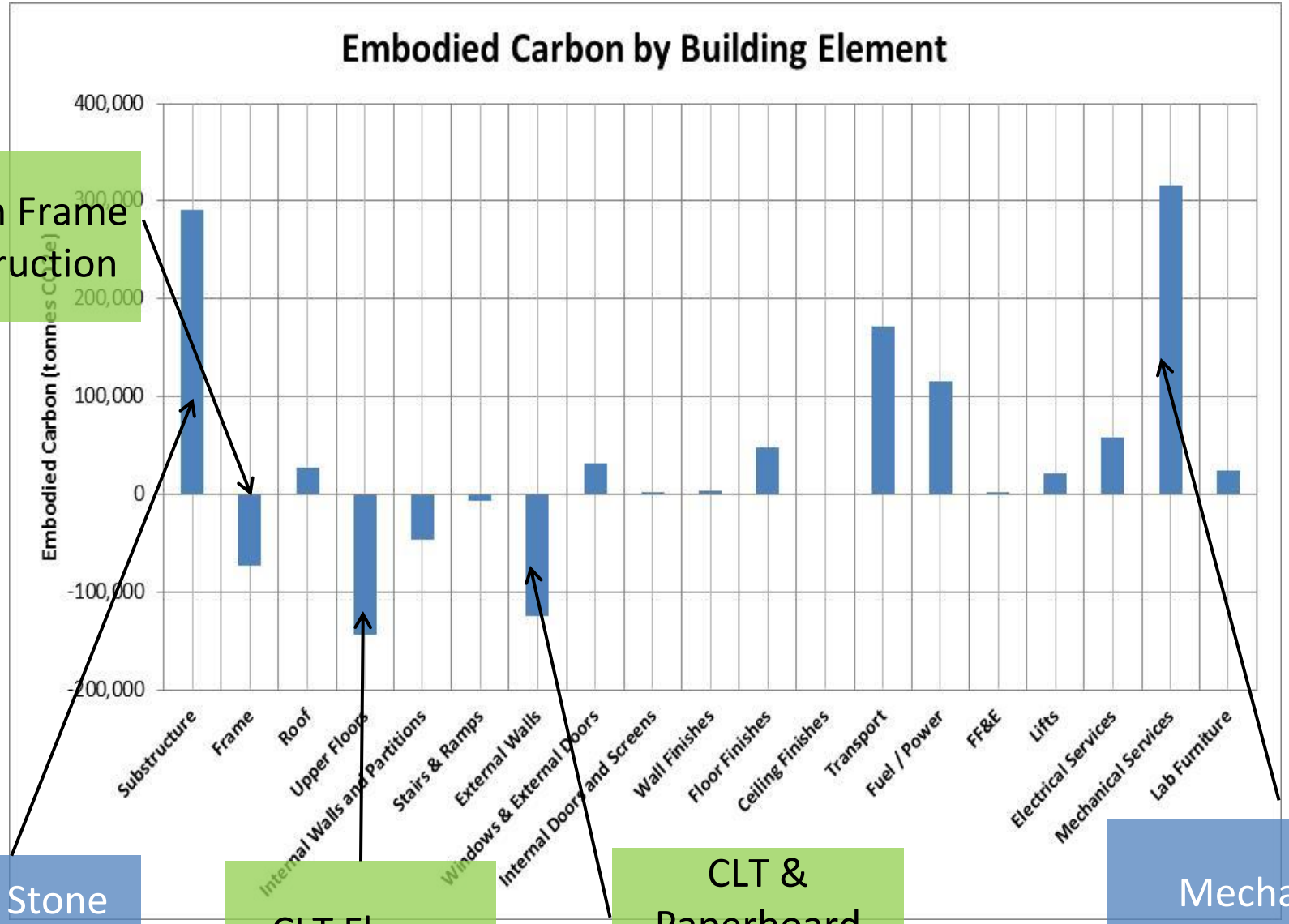
Low Carbon Construction



Vibro Stone Column Piles

Mechanical Services

Low Carbon Construction



Glulam Frame Construction

Vibro Stone Column Piles

CLT Floors

CLT & Paperboard Partitions

Mechanical Services

Operational Profiles

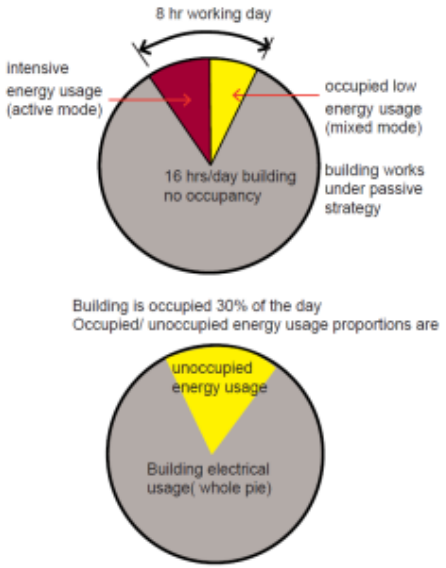
This building is alive – think of it like a large metabolism

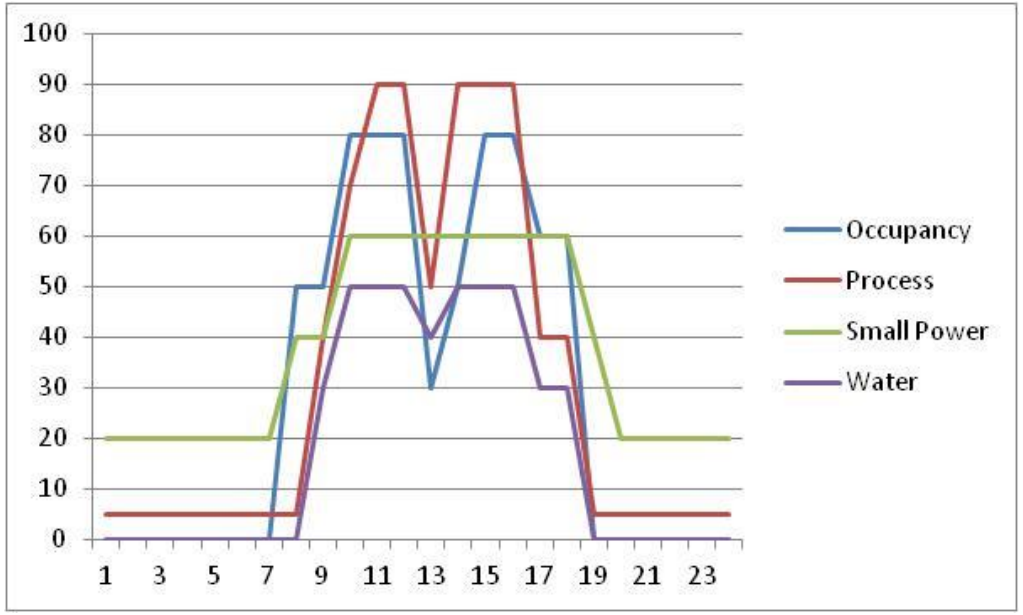
70 % of the time it is empty

Then 30 % of the time it wakes up

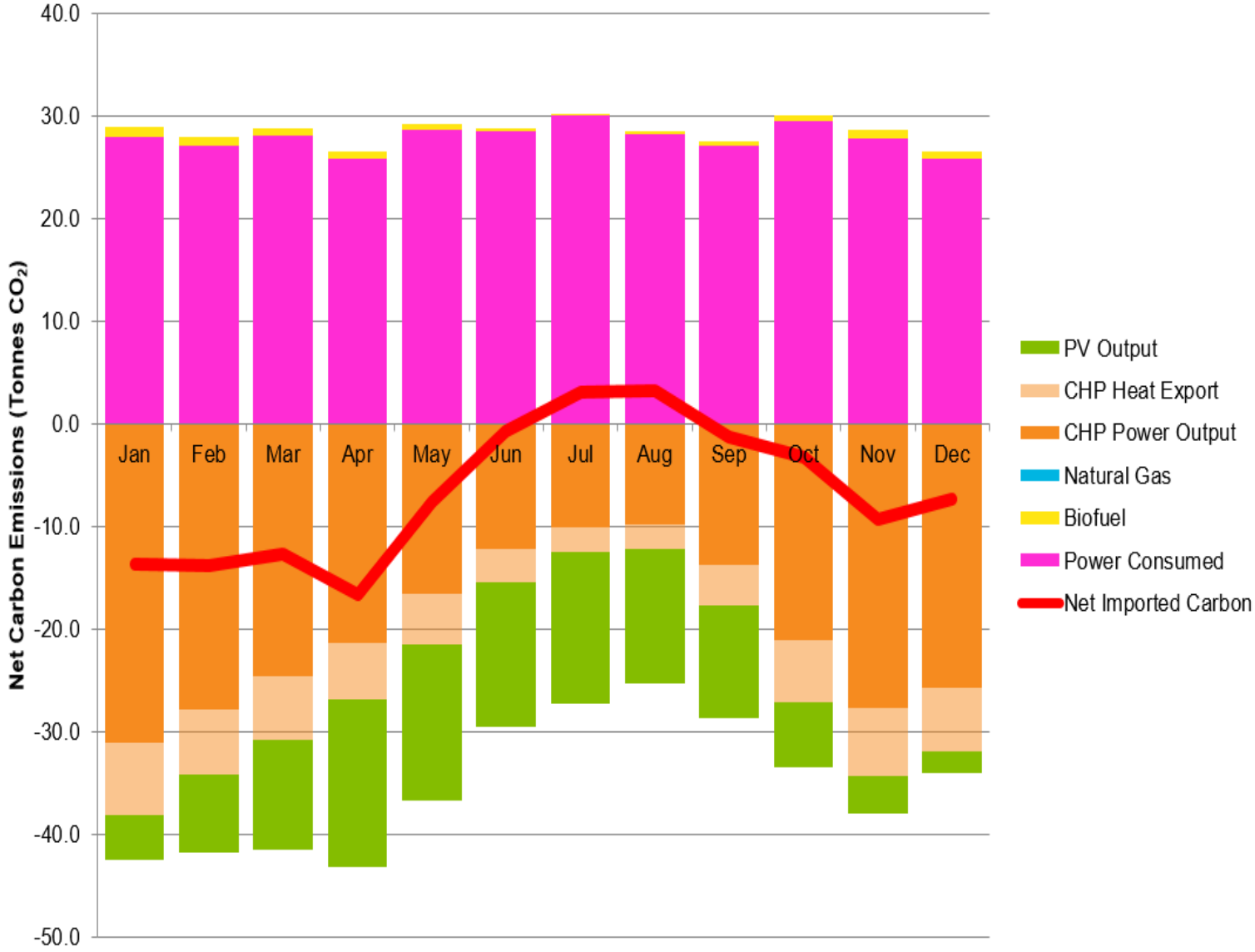
Scientists want to run experiments
Fume cupboards are switched on and power consumption goes up. Scientists are meeting, planning and writing up their research.

90% of the equipment is used only 10% of the time.

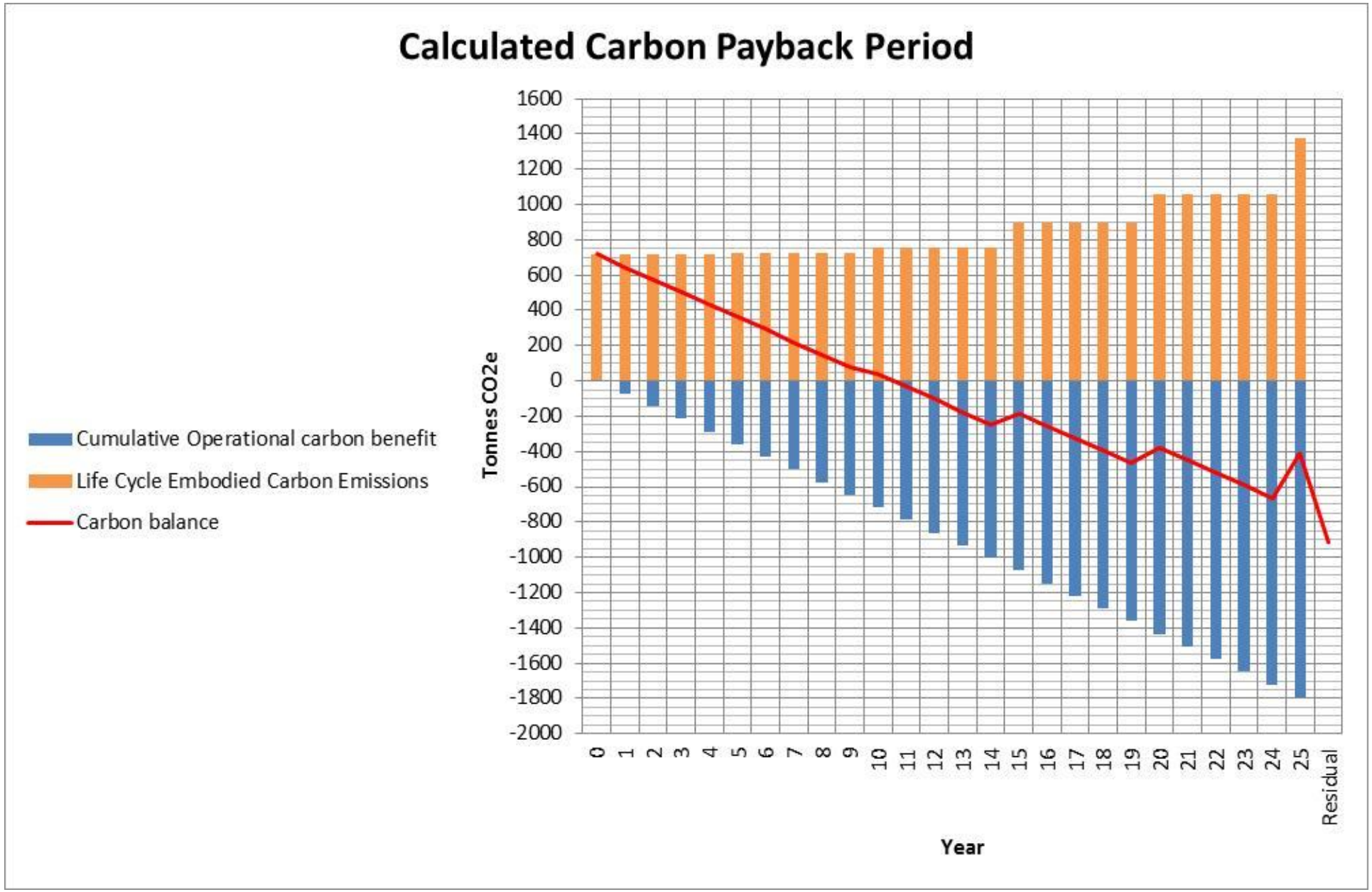




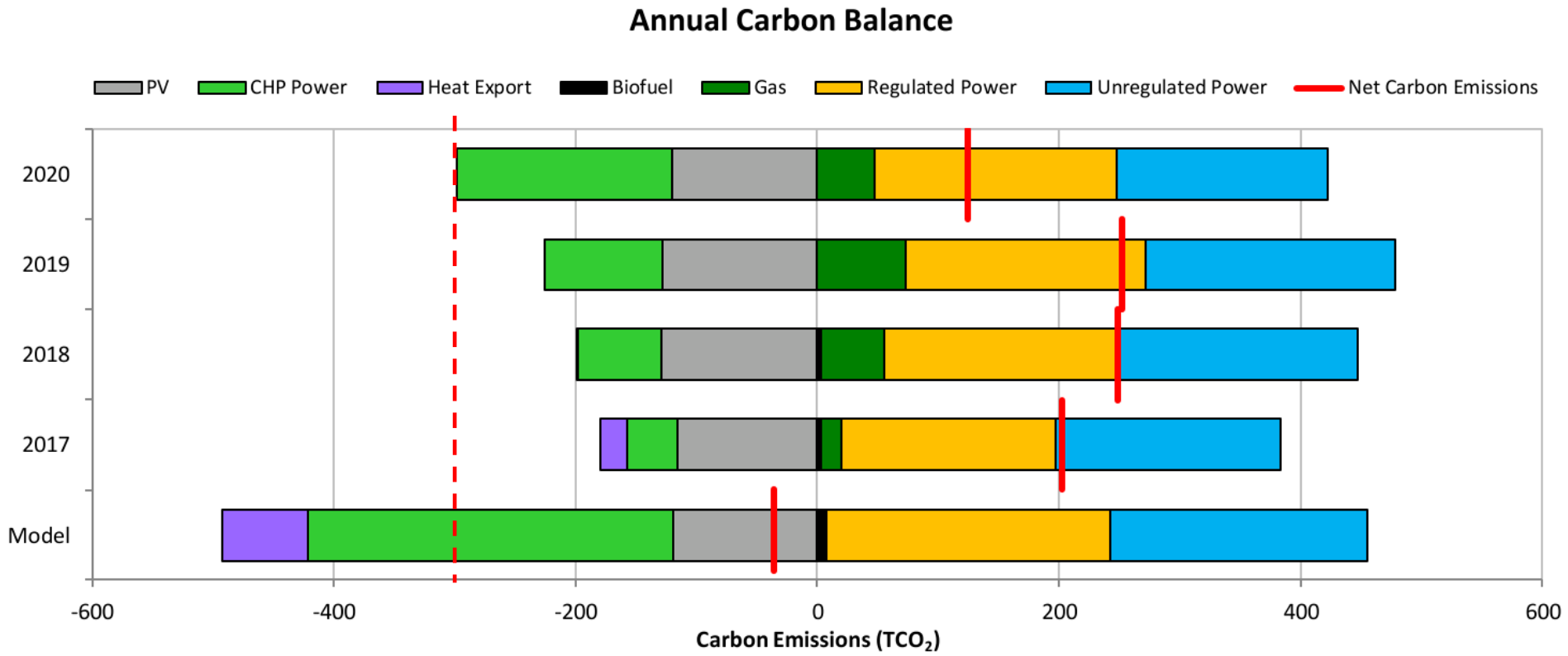
The Concept – Annual Carbon Balance



Predicated Carbon Payback Graph

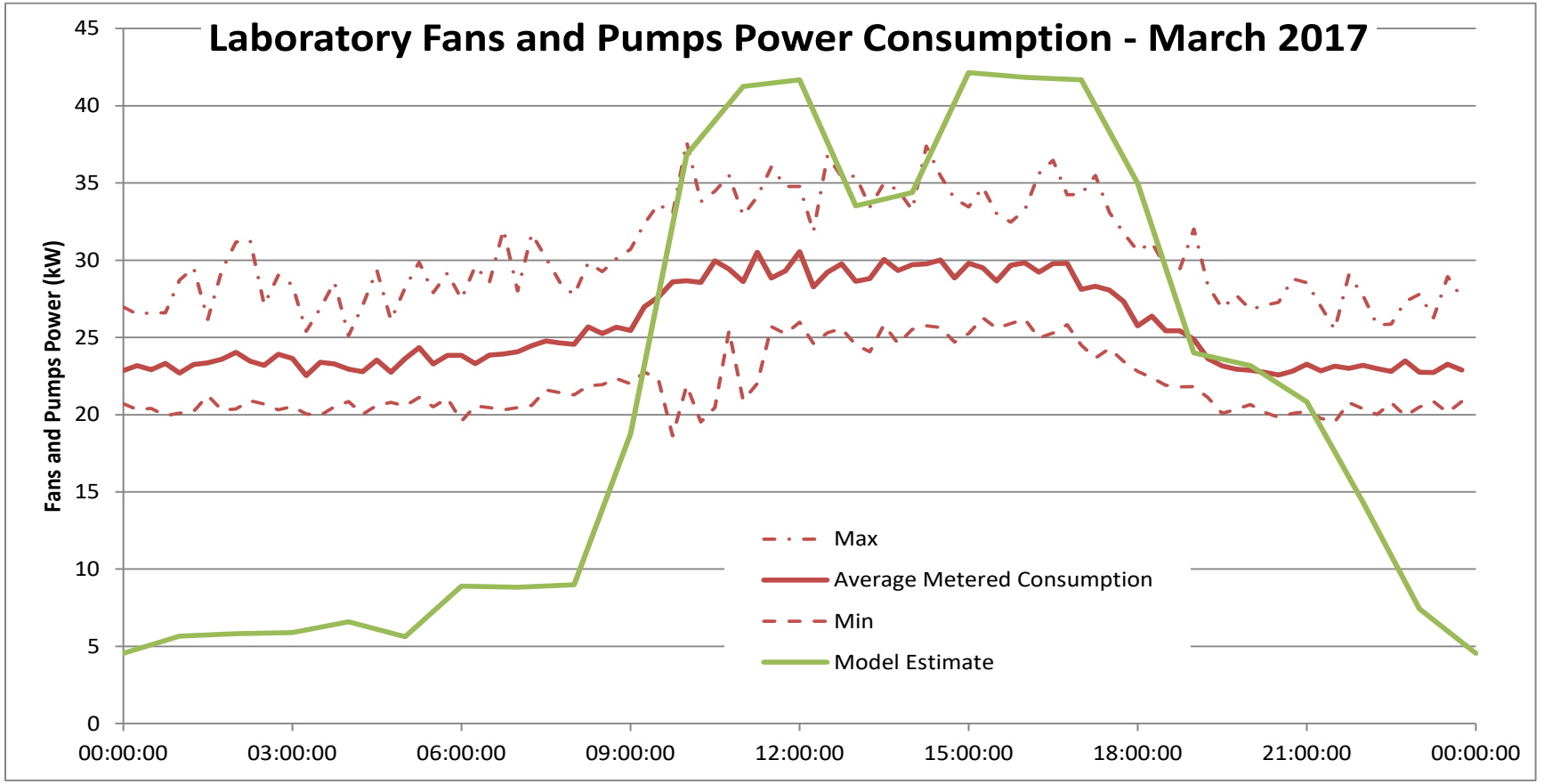


Annual Carbon Balance

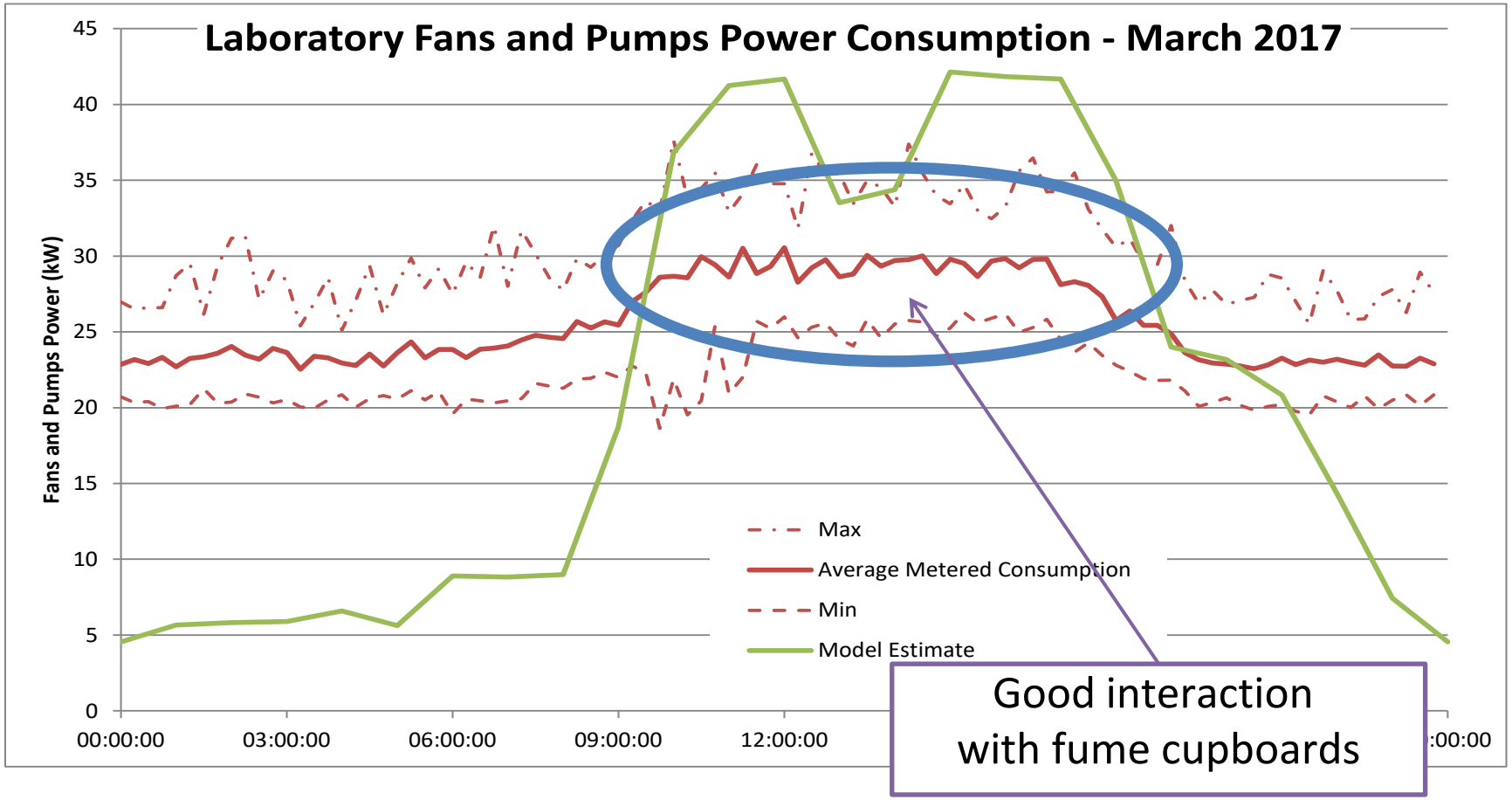


In a typical month the laboratories are occupied about 33% of the time, yet almost 50% of energy consumed by laboratory equipment and 40% of the building services energy consumption occurs whilst the laboratories are unoccupied. There is undoubtedly room for improvement.

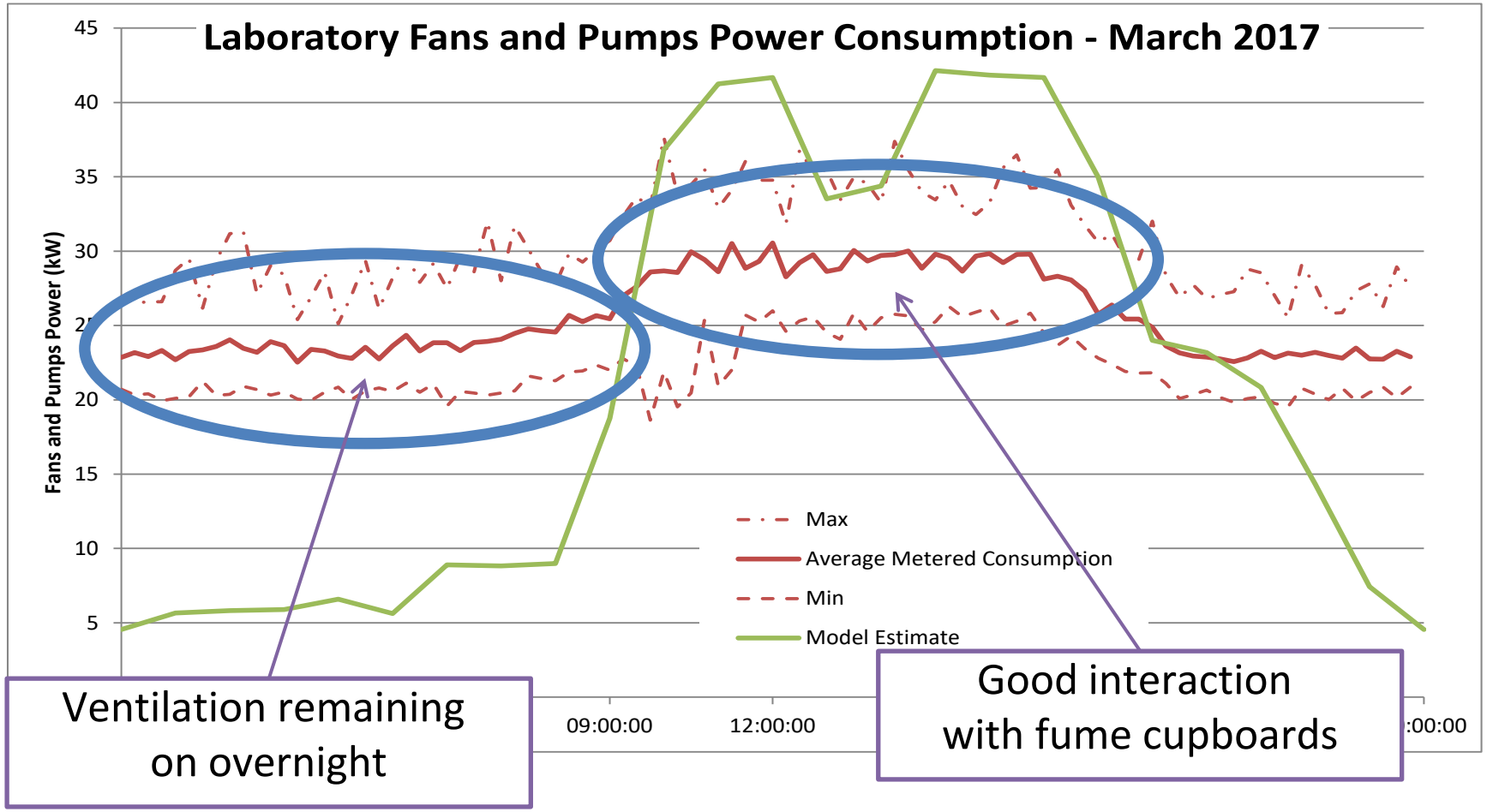
In use – Energy Fans & Pumps



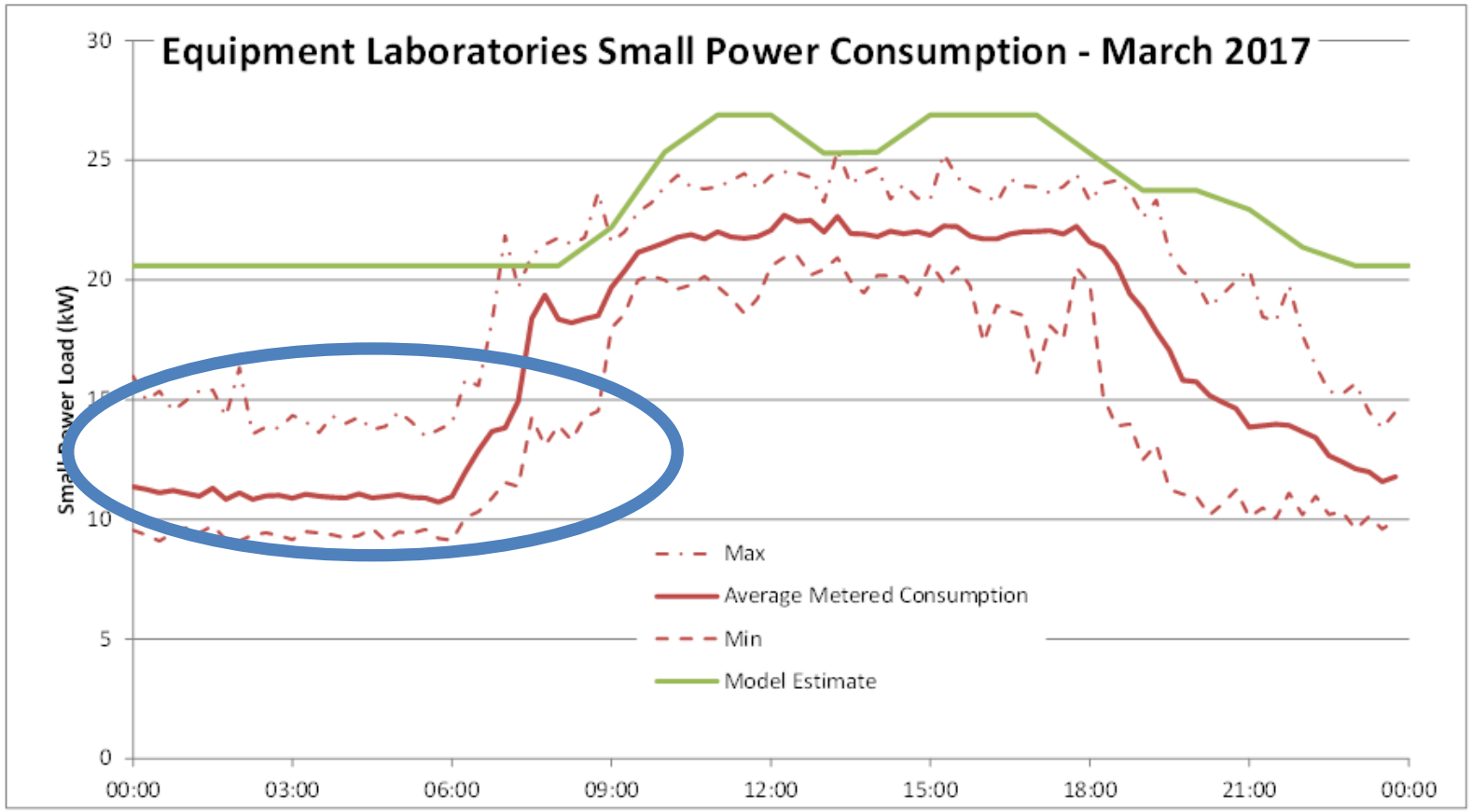
In use – Energy Fans & Pumps



In use – Energy Fans & pumps



In use – Energy small power Equipment Labs



Post Occupancy Review

Environmental Control – summer/winter requires fine tuning
Extended working hours impact on energy usage
Operational Issues with CHP took time to resolve
CHP heat export to heat network- not available as anticipated
PV provides excellent offset
Data collection anomalies occured
Fine tuning of systems complex and require time
User interaction feedback has been good

POE requires more detailed analysis where environmental issues arise

Inspiring the next Generation

HOARE LEA

Whole life carbon comparison of UK office heating and cooling systems.

Summary findings.

WILL BELFIELD
11.01.2022

BUILDING SERVICES ENGINEERS
DECLARES MINI-CONFERENCE

Introduction

Whole carbon MEP comparison

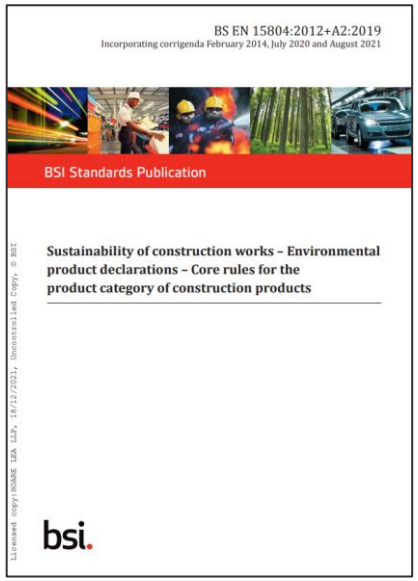
- **Comparison of three different UK commercial heating and cooling systems.**
  - Air Source Heat Pump (ASHP) 4 pipe Fan Coil Unit (FCU)
  - Variable Refrigerant Flow (VRF)
  - Hybrid-Variable Refrigerant Flow (HVRF)
- **Includes both embodied (OneClick Environmental Product Declarations (EPDs) / TM65) and operation carbon (ApacheHVAC).**
- **Based on reference building with associated designs for each from MEP.**
  - The case study is based on a notional building of 12,500 sqm of office space over 8 floors. Each floorplate is assumed to have a two tenancy split for flexibility of letting.

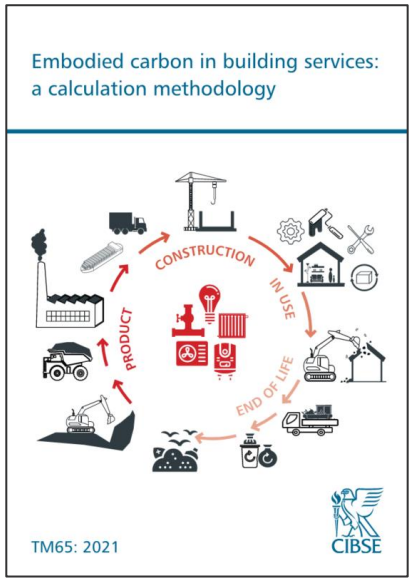
Developing the analysis.

ASHP 4 Pipe FCU	VRF	HVRF
ASHP	Condenser	Condenser
Refrigerant	Refrigerant	Refrigerant
Energy consumption	Energy consumption	Energy consumption
Fan coil units	On-floor VRF units	On-floor HVRF units
Pipework (LTHW and CHW)	Pipework (VRF)	Pipework (VRF)
Condensate pipework	Condensate pipework	Pipework (LTHW and CHW)
Pipework fittings and valves	Pipework fittings and valves	Condensate pipework
Pipework suspension	Pipework suspension	Pipework fittings and valves
Pipework Insulation	Pipework Insulation	Pipework suspension
Pumps	Branch controller	Pipework Insulation
Buffer Vessel	Supply ductwork / grilles	Expansion vessels
Supply ductwork / grilles		Hybrid branch controller
		Supply ductwork / grilles

CIBSE TM65

EPD





Developing the analysis.

ASHP 4 Pipe FCU	VRF	HVRF
ASHP	Condenser	Condenser
Refrigerant	Refrigerant	Refrigerant
Energy consumption	Energy consumption	Energy consumption
Fan coil units	On-floor VRF units	On-floor HVRF units
Pipework (LTHW and CHW)	Pipework (VRF)	Pipework (VRF)
Condensate pipework	Condensate pipework	Pipework (LTHW and CHW)
Pipework fittings and valves	Pipework fittings and valves	Condensate pipework
Pipework suspension	Pipework suspension	Pipework fittings and valves
Pipework Insulation	Pipework Insulation	Pipework suspension
Pumps	Branch controller	Pipework Insulation
Buffer Vessel	Supply ductwork / grilles	Expansion vessels
Supply ductwork / grilles		Hybrid branch controller
		Supply ductwork / grilles

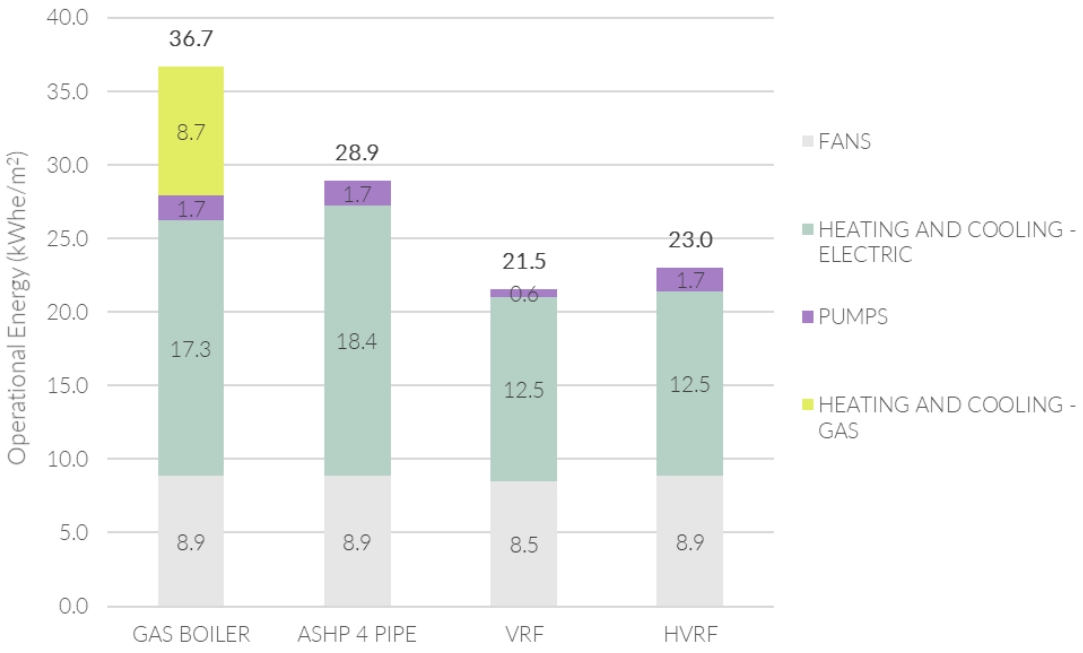
Potential design options (as per spec)

Design Options:

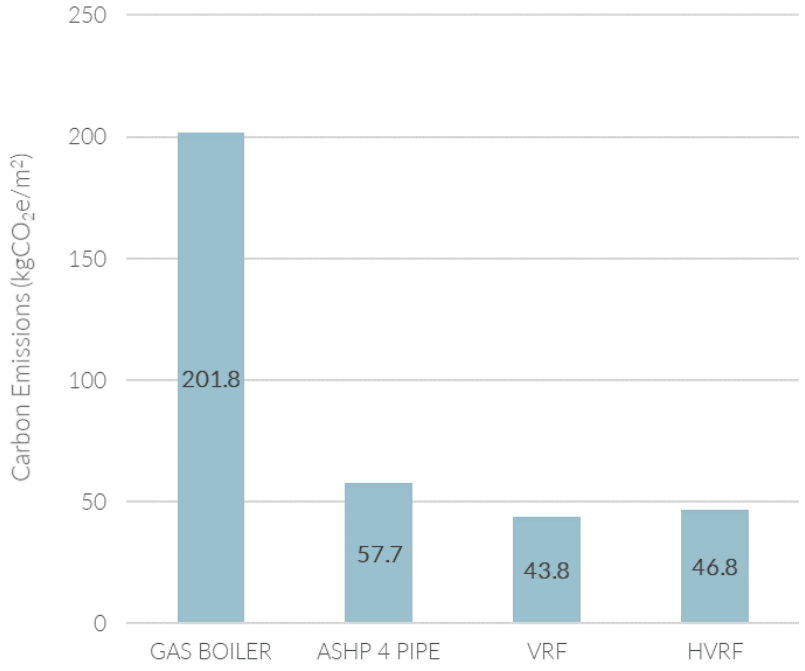
- Refrigerant: R32, R410A & 1234yf
- Pipework: Stainless steel, black steel & copper
- Insulation: Phenolic, mineral wool & closed cell
- Condensate: Copper & plastic
- On-floor units: FCU vs Cassette

Operational Energy.

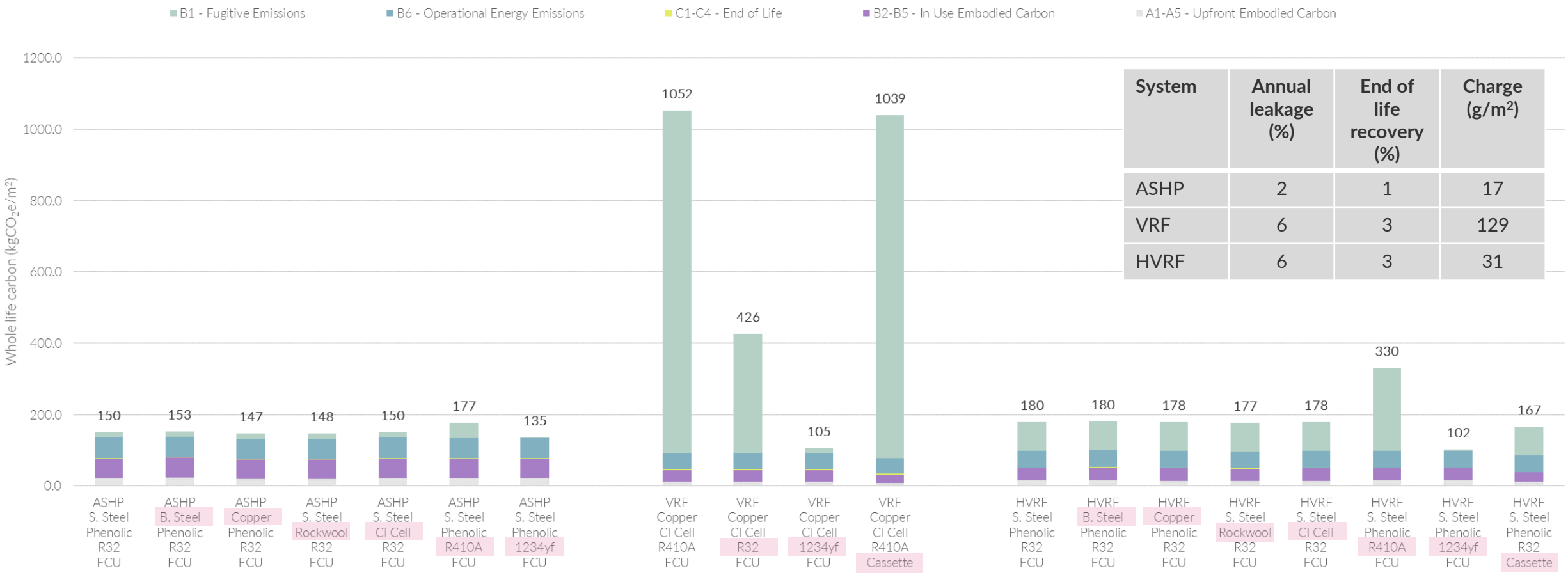
Energy Consumption (kWhe/m²)



Carbon Emission $kgCO_2e/m^2$

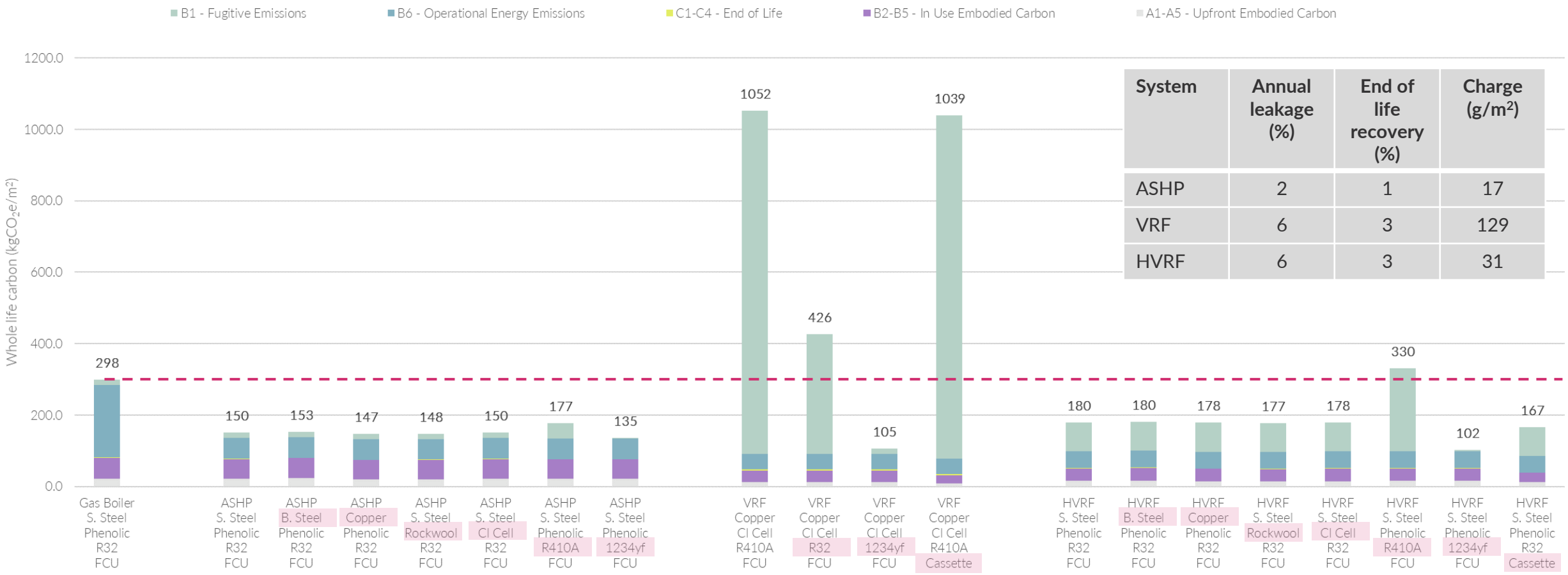


Results Overview. Refrigerant Leakage as per TM65.



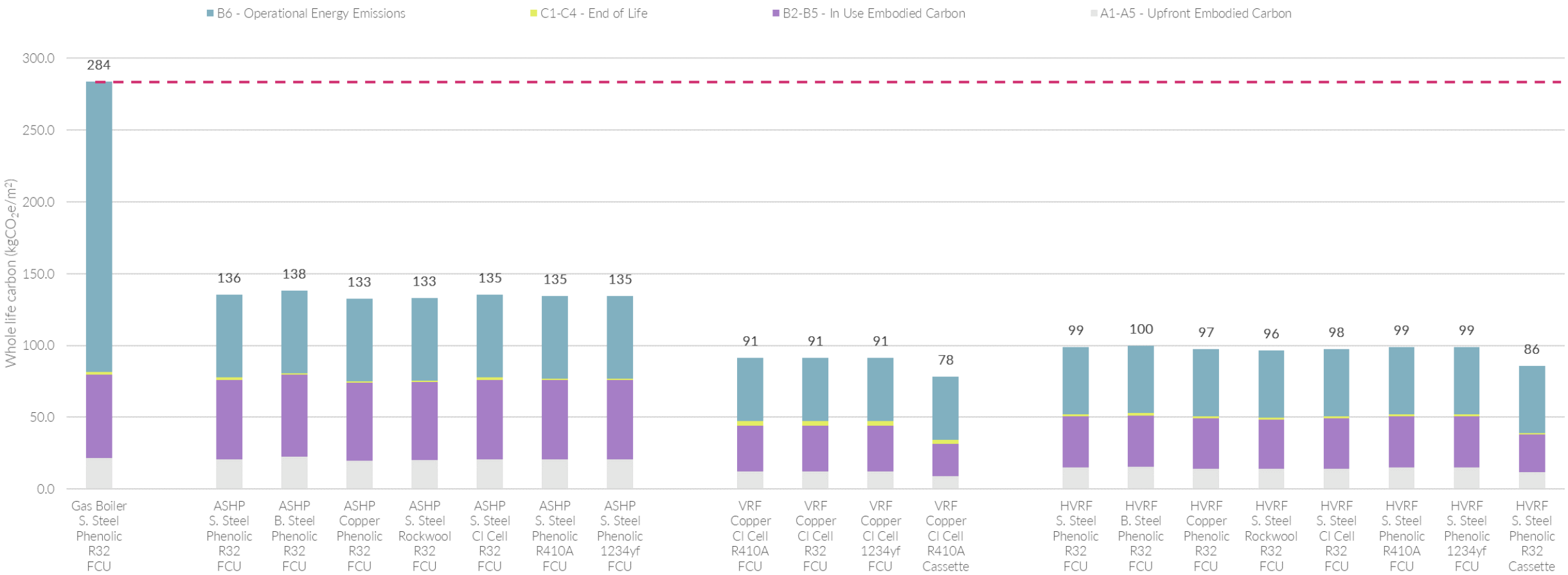
System	Annual leakage (%)	End of life recovery (%)	Charge (g/m^2)
ASHP	2	1	17
VRF	6	3	129
HVRF	6	3	31

Results Overview. Vs Gas Boiler Baseline.

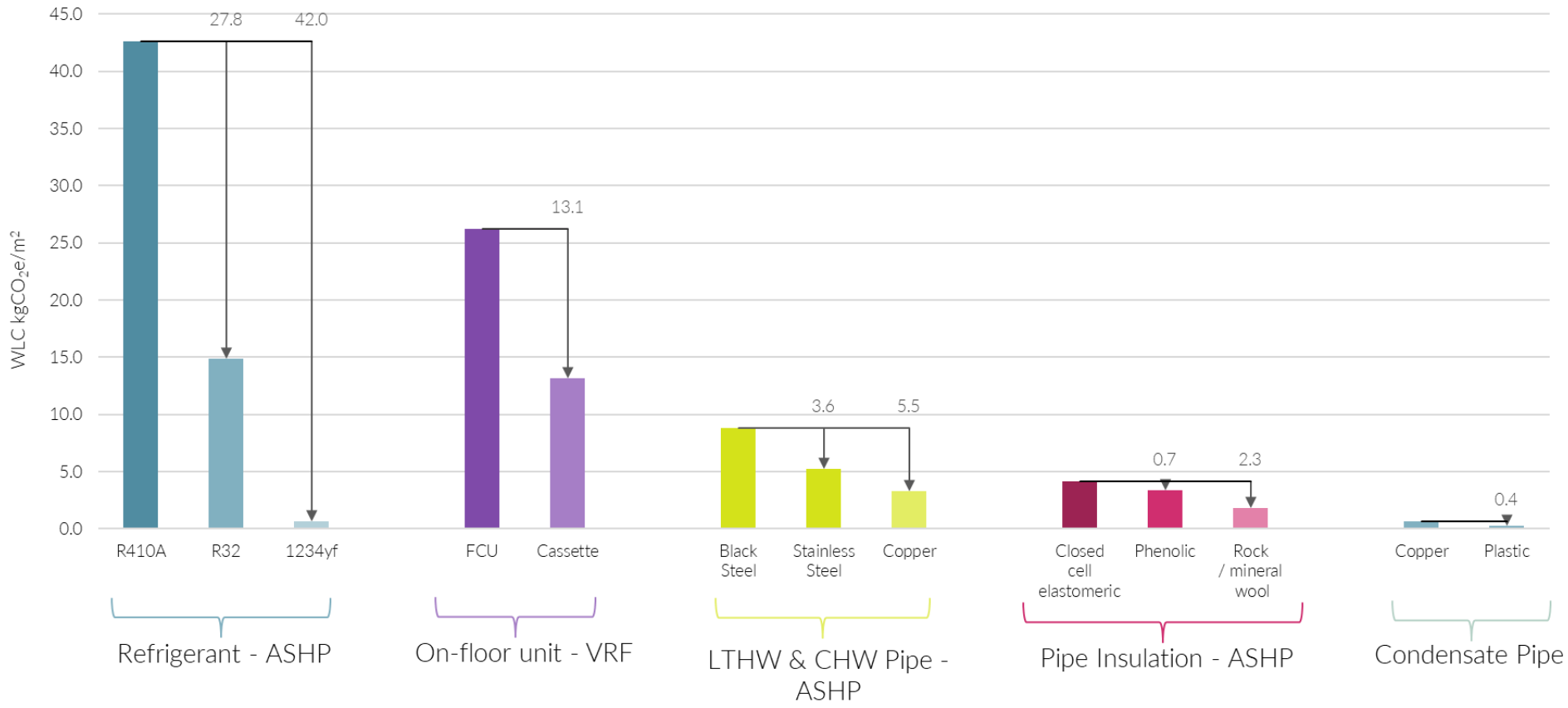


System	Annual leakage (%)	End of life recovery (%)	Charge (g/m^2)
ASHP	2	1	17
VRF	6	3	129
HVRF	6	3	31

Results Overview. Theoretical 0% leakage.

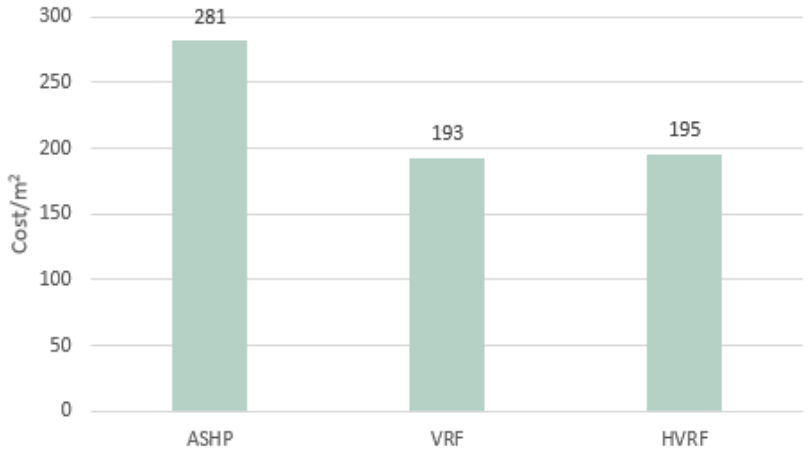


Example opportunities to save embodied carbon.



Cost & Thermal Comfort.

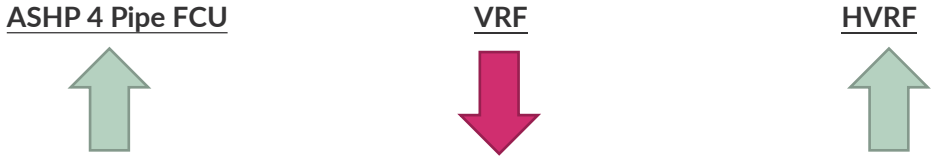
System Upfront Cost £/m²



Cost information gathered from previous projects of a similar nature.

ASHP is more expensive than both the VRF and HVRF systems which are more comparable.

Thermal Comfort



Water based systems, such as ASHPs, allow for better control of the off-coil temperature of terminal units, allowing better thermal comfort

Main drawbacks of VRF systems is this lack of control, resulting in compromised thermal comfort

HVRF overcomes this by utilising the hybrid branch controller to switch to a water based system on the room side

Key Findings.

- The global warming impact of refrigerant gases can be a significant factor in the whole life carbon footprint of HVAC systems.

- Strategies for reducing refrigerant impact include:
    - Reduce leakage rates (key role for inspections and maintenance).
    - Specify refrigerants with a low global warming potential.
    - Minimise volume of refrigerants.

Conclusion.

	ASHP	VRF	HVRF
Operational Energy Performance	✗	✓	✓
Whole Life Carbon Inc. CIBSE TM65 refrigerant leakage	✓	✗ ✗	✓
Whole Life Carbon Inc. Theoretical Refrigerant	✗	✓	✓
Internal Plant Space	✗	✓	✗
Low Refrigerant GWP	✓	✗	✓
Availability of Refrigerant	✓	✗	✓
Capital Cost	✗	✓	✓
Thermal Comfort	✓	✗	✓

HOARE LEA

Thank you.
hoarelea.com

Energylab Case Studies

Marian Ferguson

Sustainable Design - a case study for fit out

energylab

The issue

Question	Statement	Answer
How can I design sustainably in a fit out scenario?	The base systems have been designed by others - I have no influence in this	We can all design sustainably if we look deep enough into what we do

energylab

Fit Out

Example of reusing & repurposing existing services

energylab

Fit Out

Example of wastage

energylab

Summary

Point 1 → Point 2 → Point 3

Regenerative design

- What can I reuse?
- Can I refurbish rather than replace?
- Is it fit for purpose?

Reduce wastage

- Can I minimise interventions through smart design?
- How can I apply circular economy principles?

Client buy-in

- Can I demonstrate best value?
- Can I demonstrate time savings?
- Will it be easier to install?

energylab

Questions?

energylab

UK Building Services Engineers Declare Climate & Biodiversity Emergency

Our Practice Approach.

Andrew Leiper, Max Fordham

67%

of the British public support the UK being a world climate leader. It's time for the UK Government to lead by example.

Source: YouGov

global witness

What does the declaration mean to us at Max Fordham?

We will seek to:

- **Raise awareness** of the climate and biodiversity emergencies
- **Advocate** for faster change
- Establish climate mitigation as the key measure of success
- **Share knowledge** and research on an open source basis
- **Evaluate** new projects against climate breakdown
- Upgrade existing buildings whenever possible
- Evaluate lifecycle carbon as part of our basic scope of work
- Adopt regenerative design
- **Collaborate** to reduce construction waste
- **Accelerate the change** to low energy and net zero energy
- Minimise wasteful use of resources in architecture

Max Fordham’s response to the climate emergency

net zero group

wider practice

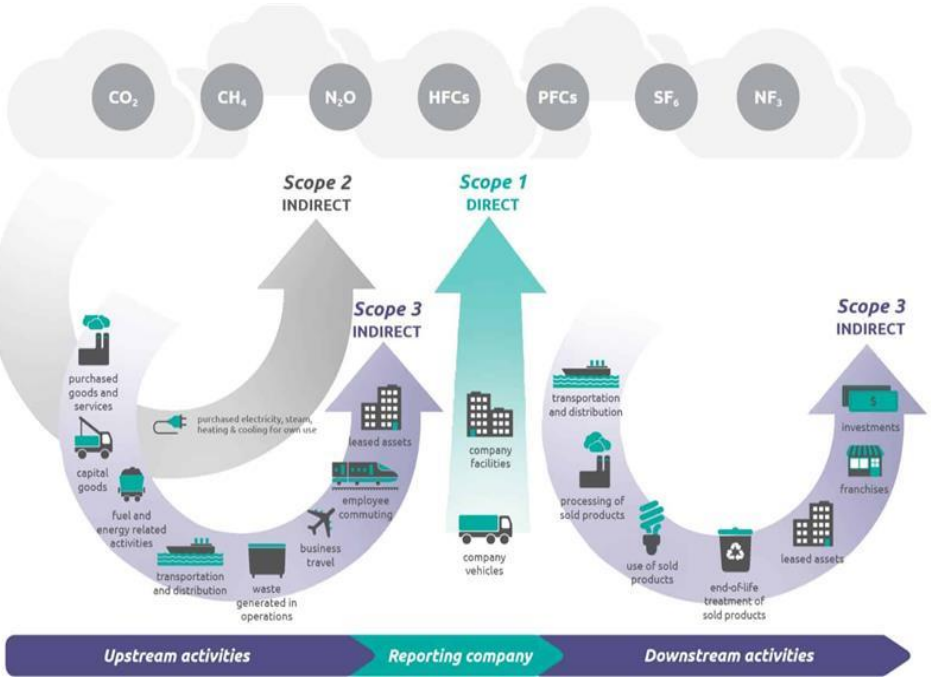
(net zero champions)

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Max Fordham LLP will reduce the business's scope 1 and 2 carbon emissions by 46% by 2030 compared to its 2019 baseline, We will formalise this commitment by setting a **"science-based target"**

Science Based Targets, 2019 Base Year



Scope	Examples	Status
Scope 1: Direct emissions from owned or controlled sources	Fuel combustion	Data already collected
	Company vehicles	N/A - We don't have any company vehicles
	Fugitive emissions	TBC – Limited fugitive emissions, limited refrigeration plant
Scope 2: Indirect emissions from purchased electricity, steam, heating and cooling consumed	Purchased electricity, heat and steam	Data already collected
Scope 3: All other indirect emissions that occur in a company's value chain	Purchased goods and services	We currently review ethical and environmental credentials but we do not calculate emissions
	Business travel	We currently monitor business travel
	Employee commuting	Annual commuting surveys until 2019; from December 2020 twice annually in December and June
	Waste disposal	We measure and monitor residual, recyclable and food waste. Food waste is converted to fuel in all offices except Bristol currently.
	Emissions from home working	TBC – TA factor to be considered by the future working group

MAX FORDHAM

UK GBC

Net Zero Carbon Buildings:
A Framework Definition

APRIL 2019

Advancing Net Zero Programme Partners

Lead Partner:

Programme Partners:

Approach to our clients and projects at Max Fordham


Waste
Management
Cue

KEY ELEMENTS CONTRIBUTING TO NZC

Operational carbon + Embodied carbon - Offsetting = Net Zero Carbon

- Energy efficiency
- Low carbon heating
- Renewable Energy
- Close the performance gap
- Design for users, refine in use
- Measure

- Optimise the design
- Low carbon materials
- Measure

Offset the remainder

+ Design to LETI targets
+ Passivhaus certification
+ Soft Landings
+ Low carbon heat
+ On-site renewables

65 kWh/m².yr
55 kWh/m².yr
35 kWh/m².yr

+ Design to LETI/ RIBA 2030 targets
+ Life cycle carbon assessment (LCA)

<600 kgCO₂/m²

Carbon offsets *or* Power Purchase Agreement

MAX FORDHAM

OUR NZC SERVICE

2 Concept	3 Develop	4 Technical	5 Construct	6 Handover	7 In use
NZC presentation				NZC verification and offsetting guidance	NZC verification report + offsetting guidance
Discuss client's requirements (PH/RICS LCA/Soft landings)					
Form NZC compatible strategy	Design MEP to meet NZC compatible strategy				Basic POE
Form NZC risk register	Monitor NZC risk register as project progresses				
	Assist in setting performance targets for building fabric (form factor/u-value/nat-vent/daylight)				

MAX FORDHAM

Open source sharing

www. NetZeroCarbon.co.uk

MAX FORDHAM

Net Zero
Carbon Guide

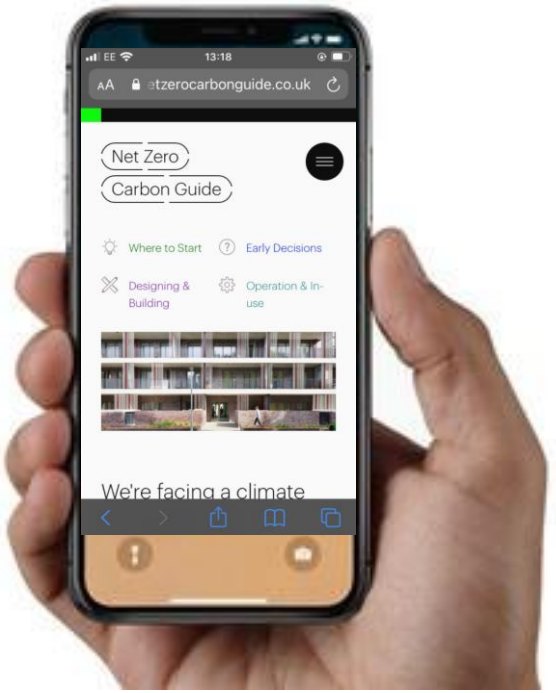
Newsletter About Contact

Where to Start

Early Decisions

Designing & Building

Operation & In-use



Thank You

Break-out sessions

Hosts	Break out session - discussion topic
Natasha Fox- Method Consulting Lee Hargreaves- Buro Happold Lauma Balina- Max Fordham	1. How can engineers influence clients to adopt low and zero carbon strategies?
David Buick- AECOM Andy Cane- Hoare Lea	2. How should our industry collaborate to influence better climate and biodiversity outcomes?
Marian Ferguson- Energy Lab Consulting Andrew Leiper- Max Fordham	3. What should signatories of Building Services Declare focus on during 2022?
Ashley Bateson- Hoare Lea Eleanor Hoey- Method Consulting Jonathan McMillan- Hulley and Kirkwood	4. Are there specific activities or initiatives that the declaration group should consider?

Close.

Thank-you.