



Greenheys Redevelopment

Energy Audit Report (Ref 3280127)

We are **Sustainability** Experts

We are **Daylighting** Experts

We are **Energy Modelling** Experts

We are **Building Compliance** Experts

We are **Thermal Comfort** Experts

We are **ZED**



zero carbon
building physics
sustainability

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Summary

This report has been compiled by ZED on behalf of Bruntwood to detail the results of an Energy Audit for the proposed Greenheys Redevelopment, Manchester.

The current estimated space heating Energy Use Intensity is 13.85 kWh_e/m² which is below the LETI target of 15 kWh_e/m².

ZED Ltd has undertaken an energy audit for the proposed Greenheys building with the desire to deliver a Reduced Carbon in operation development. This report sets out details of the assessment process and the predicted energy demand for the proposed Greenheys Redevelopment.

The thermal modelling and energy assessment has been carried out using IES Virtual Environment software version 2022.3.0.0 in accordance with CIBSE TM54 (Evaluating operational energy use at the design stage). The IES model has been metered for each energy consumption use.

There are currently no defined LETI/Paris Proof Energy Use Intensity (EUI) targets for Laboratory buildings. Based on market intelligence and energy data from similar exiting facilities Bruntwood has set an EUI target of 300 kWh_e/m². The current proposed building achieves an EUI of 289.29 kWh_e/m² excluding the Tenant's Ultra Low Temperature (ULT) Archives and Chillers. Additional results are shown including the ULT Archives and Chillers and the impact of on-site renewables (roof mounted PV system).

* LETI EUI target for space heating demand.

** Included within Small Power

*** Tenant's ULT Archives and Chillers.

	Bruntwood Laboratory Target (kWh/m ²)	Predicted EUI, without ULT/Chillers (kWh/m ²)	Predicted EUI, with ULT/Chillers (kWh/m ²)	Predicted EUI +PV, without ULT/Chillers (kWh/m ²)	Predicted EUI +PV, with ULT/Chillers (kWh/m ²)
Heating	15 *	13.58	13.58	13.58	13.58
Domestic Hot Water		5.21	5.21	5.21	5.21
Internal Lighting		38.20	38.20	38.20	38.20
Aux., Fans & Pumps		65.07	65.07	65.07	65.07
Cooling		18.80	18.80	18.80	18.80
Small Power		32.57	32.57	32.57	32.57
Lifts		0.64	0.64	0.64	0.64
Building Services **		0.00	0.00	0.00	0.00
External Lighting		0.13	0.13	0.13	0.13
Server		3.89	3.89	3.89	3.89
Catering **		0.00	0.00	0.00	0.00
ICT Equipment		111.21	111.21	111.21	111.21
Specific Equipment ***		0.00	156.91	0.00	156.91
PV system		0.00	0.00	-3.27	-3.27
Total	300.00	289.29	446.21	286.02	442.94

Table 1. EUI summary

Summary

The TM54 Energy Model will be developed through the design stages.

Following the Stage 3 Energy Model, a Developed Energy Model will be undertaken to provide a more detailed representation of the final design of the project. This will include final design specifications and updated values, such as:

- the final construction data
- detailed HVAC system performance specifications
- expected occupancy densities
- expected DHW and other unregulated energy consumptions
- DHW supplied by waste heat from air compressors.
- developed controls strategy

The aim is to deliver a Reduced Carbon building. Whilst there are defined targets for Office buildings produced (LETI and Paris Proof Targets) there are currently no defined targets for Laboratory buildings. The Energy Strategy centres around delivering a building with an Office building equivalent Energy Use Intensity (EUI) in line with LETI/Paris Proof target of 55 kWh_e/m², or lower. Working in conjunction with the client and their consultant team we have agreed an alternative EUI target for laboratory buildings of 300 kWh_e/m² and this has been used as the benchmark for Laboratory use.

Summary

The Energy Intensity Target for a commercial office building has been set at 55 kWh_e/m².

The Whole Building Energy Intensity Target for a commercial office building has been set at 55 kWh_e/m². kWh_e is equivalent electrical energy and is the standard used to compare buildings with a all-electric energy. We have tested the Greenheys building EUI as if this were an office, and then with the increased ventilation rates and small power load typical of a Laboratory building. This is because there are currently no defined targets for laboratory buildings. LETI also define other target parameters including fabric performance and space heating demand of 15 kWh_e/m².

Commercial offices

Operational energy

Implement the following indicative design measures:

Fabric U-values (W/m².K)

Walls	0.12 - 0.15
Floor	0.10 - 0.12
Roof	0.10 - 0.12
Windows	1.0 (triple glazing) - 1.2 (double glazing)
Doors	1.2

Fabric efficiency measures

Air tightness	<1 (m ³ /h, m ³ @50Pa)
Thermal bridging	0.04 (γ-value)
G-value of glass	0.4 - 0.3

Power efficiency measures

Lighting power density	4.5 (W/m ² peak NIA)
Lighting out of hours	0.5 (W/m ² peak NIA)
Tenant power density	8 (W/m ² peak NIA)
ICT loads	0.5 (W/m ² peak NIA)
Small power out of hours	2 (W/m ² peak NIA)

System efficiency measures

MVHR	90% (efficiency)
Heat pump SCOP	≥ 2.8
Chiller SEER	≥ 5.5
Central AHU SFP	1.5 - 1.2 W/Ls
A/C set points	20-26°C

Window areas guide (% of wall area)

North	25-40%
East	25-40%
South	25-40%
West	25-40%

Balance daylight and overheating

- Include external shading
- Include operable windows and cross ventilation
- Maximise renewables to generate the annual energy requirement for at least two floors of the development on-site

- Form factor of 1 - 2

Reduce energy consumption to:

55 kWh/m².yr
Energy Use Intensity (EUI) in GIA, excluding renewable energy contribution

Reduce space heating demand to:

15 kWh/m².yr

Heating and hot water

Implement the following measures:



Fuel
Ensure heating and hot water generation is fossil fuel free



Heat
The average carbon content of heat supplied (gCO₂/kWh_h) should be reported in-use



Heating
Maximum 10 W/m² peak heat loss (including ventilation)



Hot water
Maximum dead leg of 1 litre for hot water pipework



'Green' Euro Water Label should be used for hot water outlets (e.g.: certified 6 L/min shower head - not using flow restrictors).

Demand response

Implement the following measures to smooth energy demand and consumption:



Peak reduction
Reduce heating and hot water peak energy demand



Active demand response measures
Install heating and cooling set point control



Reduce lighting, ventilation and small power energy consumption



Electricity generation and storage
Consider battery storage



Electric vehicle (EV) charging
Electric vehicle turn down



Reverse charging EV technology



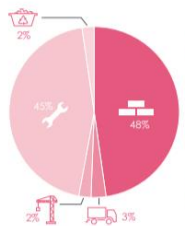
Behaviour change
Incentives to reduce power consumption and peak grid constraints

Encourage responsible occupancy.

Embodied carbon

Focus on reducing embodied carbon for the largest uses:

- Products/materials (A1-A3)
- Transport (A4)
- Construction (A5)
- Maintenance and replacements (B1-B5)
- End of life disposal (C1-C4)



Reduce embodied carbon by 40% or to:

<600 kgCO₂/m²
Area in GIA

Data disclosure

Meter and disclose energy consumption as follows:



Metering (Metering strategy following BIP Better Metering Toolkit guidance)

- Record meter data at half hourly intervals
- Separate landlord and tenant energy use meters and clearly label meters with serial number and end use
- Submeter renewable energy generation
- Use a central repository for data that has a minimum of 18 months data storage
- Provide thorough set of meter schematics and information on maintenance and use of meters
- Ensure metering commissioning includes validation of manual compared to half hourly readings.



123 Disclosure

- Carry out an annual Display Energy Certificate (DEC) and include as part of annual reporting
- Report energy consumption by fuel type and respective benchmarks from the DEC technical table
- For multi-let commercial offices produce annual landlord energy (base building) rating and tenant ratings as well as or instead of a whole building DEC
- Upload five years of data to a publicly accessible database such as GIA and/or CarbonBuzz.

Figure 1. LETI Design Guide for Commercial Offices

Summary

The current Stage 3 proposed building fabric, structure, and Building Services strategies would result in an office equivalent predicted EUI of 55 kWh_e/m².

The current Stage 3 proposed building fabric, structure, and Building Services strategies would result in an office equivalent predicted EUI of 55 kWh_e/m². However, based on typical Laboratory ventilation rates, a small power load of 50W/m² and an increased 24/7 occupancy profile, with 50% occupancy out of the core hours of 7am to 7pm, the EUI increases to 289.29 kWh_e/m².

Scope	Metric	Interim Targets			Paris Proof Target
		2020-2025	2025-2030	2030-2035	2035-2050
Whole building energy	kWh _e /m ² (NLA) / year	160	115	90	70
	kWh _e /m ² (GIA) / year	130	90	70	55
	DEC rating	D90	C65	B50	B40
Base building energy	kWh _e /m ² (NLA) / year	90	70	55	35
	kWh _e /m ² (GIA) / year	70	55	45	30
	NABERS UK star rating	4.5	5	5.5	6
Tenant energy	kWh _e /m ² (NLA) / year	70	45	35	35

NLA = net lettable area GIA = gross internal area

Figure 2. Paris Proof Targets for Offices

This benchmarks the building as being Net Zero Carbon in operation if it were an office and in line with the agreed typical EUI for a low carbon Laboratory building.

The estimated EUI under 300 kWh_e/m² is in the best practice range, with other examples of laboratory type buildings within the Bruntwood portfolio having EUIs circa 400 to 600 kWh_e/m².

Model Input Data

Thermal modelling has been undertaken by a CIBSE Level 5 DSM Energy Assessor using fully dynamic IES-VE Apache software.

Building typology and geometry

A thermal model has been created from the design teams drawings provided by BDP Ltd.. The building has a Gross Internal Area (GIA) of circa 16,788m² split between the landlord and tenant areas.

Building surroundings

Surrounding structures or canopies are included within the model as appropriate.

Climate data

The model has been coordinated for solar access and simulated against the CIBSE Manchester TRY (Test Reference Year) weather file. The weather data used for simulations was sourced from CIBSE (Chartered Institute of Building Services Engineers), an industry recognised organisation.

Model Data

The results provided within this report are achieved with the settings below. Any amendments from these settings will result in changes to the annual energy consumption estimated within the model.

The fourth and fifth floors will be fitted out as Laboratories once the Tenants requirements are know. To account the energy use of future tenants, these floors have been estimated to follow the 3rd floor layout and input data.



Figure 3. IES-VE geometry model

Model Input Data

The input data detailed within this report is a representation of the proposed use of the building, in regard to occupancy, equipment, lighting and systems usage. These inputs are based on a combination of academic and project specific data. ZED are not responsible for ensuring these settings reflect the building in use nor for any differences between proposed simulation data, such as any weather files used.

Fabric

The Thermal Performance of each building element is listed in the table below.

Element	U-value (W/m ² K)	Notes
Ground floor	0.16	
External Walls Gr. & 1st. Floor	0.23	
External Walls Cladding	0.28	
Roof	0.16	
Glazing Curtain wall *	1.44	G-Value = 0.37 LT = 0.73
External Doors	1.60	
Air Permeability		0.15ACH reflecting an air permeability of 3m ³ (hr.m ²)@50Pa (CIBSE Guide A)

Table 2. Fabric Performance

* Blinds with a shading coefficient of 0.4 have been applied to all occupied spaces.

Model Input Data

The input data detailed within this report is a representation of the proposed use of the building, in regard to occupancy, equipment, lighting and systems usage. These inputs are based on a combination of academic and project specific data. ZED are not responsible for ensuring these settings reflect the building in use nor for any differences between proposed simulation data, such as any weather files used.

Design Criteria

Temperature set points for each space type are set as per the table below:

Room Type	Heating Setpoint (°C) (Occupied/Set back)	Cooling Setpoint (°C)
Office / Meeting Rooms / Reception / Tea Points	21	24
Labs	21	24
Lab G25 Main Storage: -80C	16	24
WCs / Showers	18	-
Circulation / Stairs	18	-
Server Rooms	21	21 - 24
Plant / Stores	-	-

Table 3. Heating Setpoints

Occupancy

As per the project specific Room Data Sheets by BDP Ltd. (Work Stage Three Appendices - Room Data Sheets_S3). Occupancies within each defined space type are detailed within the table below:

Room type	Max Occupancy (m ² /person)	Period	Details
Office / Office Open Plan	9	24/7	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Meeting Rooms / Communal Space	9	24/7	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Reception / Tea Points / Kitchen	5	24/7	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Labs	12	24/7	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 30% Weekends: 60%
WC / Showers	0 (unoccupied or transient)	n/a	n/a
Circulation / Stairs	0 (unoccupied or transient)	n/a	n/a
Server Rooms	0 (unoccupied or transient)	n/a	n/a
Plant Rooms / Stores	0 (unoccupied or transient)	n/a	n/a

Table 4. Occupancy/Profiles

Model Input Data

Equipment Gains

The below table summarises the equipment gains assigned within the TM54 model for all spaces.

Room type	Equipment Gain (W/m ²)	Period	Details
Office / Office Open Plan / Reception	20	24/7	On continuously, including ICT and small power.
Meeting Rooms / Communal Space	20	24/7	On continuously, including ICT and small power.
Tea Points / Kitchen	10	24/7	On continuously, including ICT and small power.
Labs	30	24/7	On continuously, including ICT and small power.
WC / Showers / Stores	-	n/a	-
Circulation / Stairs	-	n/a	-
Server Rooms	100	n/a	On continuously. (01_F45 Data Centre: 50 W/m ²)
Plant Rooms	5	24/7	On continuously.

Table 5. Equipment Gains/Profiles

In addition to above, the following specific equipment of Tenant's ULT Archives and Chillers have been assigned to the G25 Main Storage Sample space,

- Tenant ULT Archives: 150kW average hourly electrical demand.
- Water Chiller system: 150kW average hourly electrical demand.
- 20no. small freezers: 550W/unit electrical peak demand.

Refer to Appendix for EUI results with alternative ULT Archive and associated chiller plant suppliers.

Model Input Data

Lighting Gains

The below table summarises the lighting gains assigned within the TM54 model for all spaces:

Room type	Lighting Gain (W/m ²)	Diversity	Profile
Office / Office Open Plan	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Communal Space	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Meeting Rooms	8	0.82 (PIR absence) (0.90 Small Meeting Rooms)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Reception / Tea Points / Kitchen	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Labs	15	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 30% Weekends: 60%
WC / Showers / Stores	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Circulation / Stairs	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Server Rooms	8	0.90 (PIR presence)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%
Plant Rooms	2	1.00 (Manual)	Core hours: 7am-7pm at 100% (lunch break at 50%) Night shift: 15% Weekends: 50%

Table 6. Lighting Gains/Profiles

Areas with access to daylight diversities have been given installed lighting power to account for daylight control. A suitable formula has been applied as a dimming profile controlling lighting gain as a function of available daylight. This profile modulates the lighting gain as a function of the illuminance (room specific value), thereafter remaining constant at this value. The value 0.5 (which is set as appropriate) represents a fraction of the rooms lighting gain which is not subject to daylight control. The illuminance has been completed using the link to IES Radiance module.

External lighting is estimated to have a 500W peak demand.

Model Input Data

Building Services

The following Building Services performance criteria have been used in the TM54 model:

Building Service	Description	Notes
Heating	ASHP serving FCUs	SCOP 4.00
Heating	ASHP serving AHUs	SCOP 3.00
Cooling	ASHP serving FCUs, AHUs and server room	SEER 4.00, EER 4.00
DHW Landlord	ASHP heat source Storage vessel Secondary Circulation	COP 3.00 Total volume: 337.5 Litres Pump: 150W (losses: 8W/m ²) Loop Length: 225m
DHW Landlord	ASHP heat source Storage vessel Secondary Circulation	COP 3.00 Total volume: 312.5 Litres Pump: 150W (losses: 8W/m ²) Loop Length: 75m
MVHR	Mechanical Ventilation with Heat Recovery	SFP 1.60W/l/s Heat Recovery 73%
AHU	Supply and Extract AHU	SFP 1.6W/l/s Heat Recovery 73%

Table 7. Building Services

Renewables – PV system

EUIs are calculated without on site renewable energy.

For information, additional EUIs have been calculated to show the impact of the proposed roof mounted PV system. The PV system specifications used at this stage of the design are summarised in the table below:

Annual Generation (MWh)		54.91	
Panel Type	Monocrystalline Silicone	Temp. Coefficient Pmax (%/°C)	0.36
No. of Panels (Area, m ² /panel)	192 (2.00m ² /panel)	Degradation Factor	0.99
Total PV System Area (m ²)	384.00	Electrical Conversion Efficiency	0.96
Module Nominal Efficiency	0.20	Azimuth (° clockwise from north)	183.00
Nominal Cell Temp (NOCT)(°C)	42.00	Inclination (° from horizontal)	7.10
Ref. Irradiance for NOCT (W/m ²)	1000.00	Shading Factor	Taken from nearby parapets and roof plants

Table 8. PV System specifications

Results Summary

The results are summarised in this section of the report.

There are currently no defined LETI/Paris Proof Energy Use Intensity (EUI) targets for Laboratory buildings. Based on market intelligence and energy data from similar exiting facilities Bruntwood has set an EUI target of 300 kWh_e/m². The current proposed building achieves an EUI of 289.29 kWh_e/m² excluding the Tenant's Ultra Low Temperature (ULT) Archives and Chillers.

The current estimated space heating Energy Use Intensity is 13.85 kWh_e/m² which is below the LETI target of 15 kWh_e/m².

Additional results are shown including the ULT Archives and Chillers and the impact of on-site renewables (roof mounted PV system).

* LETI EUI target for space heating demand.

** Included within Small Power

*** Tenant's ULT Archives and Chillers.

	Bruntwood Laboratory Target (kWh/m ²)	Predicted EUI, without ULT/Chillers (kWh/m ²)	Predicted EUI, with ULT/Chillers (kWh/m ²)	Predicted EUI +PV, without ULT/Chillers (kWh/m ²)	Predicted EUI +PV, with ULT/Chillers (kWh/m ²)
Heating	15 *	13.58	13.58	13.58	13.58
Domestic Hot Water		5.21	5.21	5.21	5.21
Internal Lighting		38.20	38.20	38.20	38.20
Aux., Fans & Pumps		65.07	65.07	65.07	65.07
Cooling		18.80	18.80	18.80	18.80
Small Power		32.57	32.57	32.57	32.57
Lifts		0.64	0.64	0.64	0.64
Building Services **		0.00	0.00	0.00	0.00
External Lighting		0.13	0.13	0.13	0.13
Server		3.89	3.89	3.89	3.89
Catering **		0.00	0.00	0.00	0.00
ICT Equipment		111.21	111.21	111.21	111.21
Specific Equipment ***		0.00	156.91	0.00	156.91
PV system		0.00	0.00	-3.27	-3.27
Total	300.00	289.29	446.21	286.02	442.94

Table 9. EUI summary

Conclusion

Further improvements to reduce the Energy Use Intensity (EUI) may be possible.

The total EUI is estimated to be 289.29 kWh/m², below the minimum agreed 300 kWh/m² target.

The Tenant's Ultra Low Temperature (ULT) Archives and Chillers have a significant impact on the EUI for the building. Sourcing the most efficient ULT Archives and Chillers is crucial to minimising the operational energy impact of the development and this should be reviewed at RIBA Stage 4 to see if alternatives are available.

Optimising the available area for PV would also allow greater on site energy generation to help offset the electricity being used by the ULT Archives. However, as the grid continues to decarbonise the benefit of this will reduce.

Further improvements to reduce the EUI may be possible. More detailed modelling at RIBA Stage 4 may help refine the results. The inclusion of DHW supplied by waste heat from air compressors could be potentially included in the calculations as part of the ongoing rationalisation of the developments energy use.

Drawings Register

Drawing Title	Revision
GRE-BDP-ZZ-XX-DRL00-101 – Landscape General Arrangements	P03
GRE-BDP-ZZ-00-DR-A-20-001 - General arrangement - Ground floor	P19
GRE-BDP-ZZ-01-DR-A-20-001 - General arrangement - First floor	P19
GRE-BDP-ZZ-02-DR-A-20-001 - General arrangement - Second floor	P17
GRE-BDP-ZZ-03-DR-A-20-001_General arrangement - Third floor_S3	P14
GRE-BDP-ZZ-04-DR-A-20-001_General arrangement - Fourthfloor_S3	P13
GRE-BDP-ZZ-05-DR-A-20-001_General arrangement - Fifth floor_S3	P13
GRE-BDP-ZZ-06-DR-A-20-001_General arrangement - Sixth floor(Plant)_S3	P09
GRE-BDP-ZZ-00-M3-A-XX_0001_P15.rvt *	P15
* Elevations based on above Revit model	

Table 10. Drawing Register

Appendix

Alternative Suppliers

Alternative Suppliers

EUI results for alternative ULT Archive and associated chiller plant suppliers.

* LETI EUI target for space heating demand.

** Included within Small Power

*** Tenant's ULT Archives and Chillers

	Bruntwood Laboratory Target (kWh/m ²)	Predicted EUI, without ULT/Chillers (kWh/m ²)	Predicted EUI, with ULT/Chillers (kWh/m ²)	Predicted EUI +PV, without ULT/Chillers (kWh/m ²)	Predicted EUI +PV, with ULT/Chillers (kWh/m ²)
Heating	15 *	13.58	13.58	13.58	13.58
Domestic Hot Water		5.21	5.21	5.21	5.21
Internal Lighting		38.20	38.20	38.20	38.20
Aux., Fans & Pumps		65.07	65.07	65.07	65.07
Cooling		18.80	18.80	18.80	18.80
Small Power		32.57	32.57	32.57	32.57
Lifts		0.64	0.64	0.64	0.64
Building Services **		0.00	0.00	0.00	0.00
External Lighting		0.13	0.13	0.13	0.13
Server		3.89	3.89	3.89	3.89
Catering **		0.00	0.00	0.00	0.00
ICT Equipment		111.21	111.21	111.21	111.21
Specific Equipment ***		0.00	76.56	0.00	76.56
PV system		0.00	0.00	-3.27	-3.27
Total	300.00	289.29	365.85	286.02	362.58

Table 11. EUI summary – Supplier B

	Bruntwood Laboratory Target (kWh/m ²)	Predicted EUI, without ULT/Chillers (kWh/m ²)	Predicted EUI, with ULT/Chillers (kWh/m ²)	Predicted EUI +PV, without ULT/Chillers (kWh/m ²)	Predicted EUI +PV, with ULT/Chillers (kWh/m ²)
Heating	15 *	13.58	13.58	13.58	13.58
Domestic Hot Water		5.21	5.21	5.21	5.21
Internal Lighting		38.20	38.20	38.20	38.20
Aux., Fans & Pumps		65.07	65.07	65.07	65.07
Cooling		18.80	18.80	18.80	18.80
Small Power		32.57	32.57	32.57	32.57
Lifts		0.64	0.64	0.64	0.64
Building Services **		0.00	0.00	0.00	0.00
External Lighting		0.13	0.13	0.13	0.13
Server		3.89	3.89	3.89	3.89
Catering **		0.00	0.00	0.00	0.00
ICT Equipment		111.21	111.21	111.21	111.21
Specific Equipment ***		0.00	52.55	0.00	52.55
PV system		0.00	0.00	-3.27	-3.27
Total	300.00	289.29	341.84	286.02	338.57

Table 12. EUI summary – Supplier C

Our Services

We offer a wide range of high-quality building performance advice and evaluation,
Sustainability & Net Zero Carbon Consultancy.

We work across all construction sectors in the UK, Europe and Worldwide.



Building Physics



Carbon



Sustainability



Compliance



Projects



Planning Support

