Heuston South Quarter
Residential Development

St John's Road West
Dublin 8

Energy Analysis Report

IN2 Project No. D2026
17.09.2021
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Revision History

Date	Revision	Description
17.09.2021	00	Initial issue for planning

Registered Office:. Unit E, Mount Pleasant Business Park, Upper Mount Pleasant Avenue, Dublin 6

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1.0 Executive Summary

This report summarises the Energy Analysis undertaken for the proposed Build-to-Rent development at Heuston South Quarter, St Johns Road West, Dublin 8.

Energy analysis has been undertaken in order to demonstrate compliance to Building Regulations Technical Guidance Document (TGD) Part L 2019 and Section 2.0 outlines the requirements to ensure compliance: outlining the overarching EU Directive for Near Zero Energy Buildings (NZEB) and how this is implemented in Ireland and detailing associated requirements within Part L 2019. The report then examines the methodology in terms of Primary Energy, Renewable Technologies and options between Centralised and Decentralised plant, illustrating how electrically based technologies (Air Source Heat Pumps, Photovoltaic panels etc.) are increasingly favoured within Part L and associated Building Energy Rating (BER) calculations techniques within the approved software Dwelling Energy Assessment Procedure (DEAP).

This DEAP software was used to undertake energy analysis for Part L and BER for the development. Section 3.0 details the assumptions made in terms of Building Construction, Mechanical and Electrical Systems and Renewable Technologies, before confirmation of compliance is confirmed in terms of Primary Energy, Carbon Emissions and Renewable Energy Ratio. Improvements to building thermal transmittance (U-Values), air permeability and thermal bridging with respect to Part L defaults are detailed in Section 3.0.

The analysis determined that a centralised plant solution will enable compliance for the Apartments to Part L 2019/ NZEB and that an A3/A2 BER will be achieved.

The detailed DEAP report, compiling all assumptions and calculations undertaken within the software, is included as an Appendix.

2.0 Development Description

The proposed development will consist of a residential development of 399 no. 'Build To Rent' residential units and all ancillary and associated uses, development and works, and a retail unit of 120 sq m, on a site of 1.08 ha. The proposed development consists of:

- Site clearance and localised demolitions to remove part of the podium and Basement Level -1 reinforced concrete slabs at the interface of the proposed Blocks A and B, together with the incorporation of part of the existing double basement level structure extending to approximately 7,613 sq.m over two levels (excluding an area of 3,318 sq.m that will be backfilled at Basement Level -1) within the proposed development.
- The construction of 5 no. buildings (Blocks A to E) ranging in height between 3- to 18-storeys over double basement level / podium level to provide a residential / mixed use development to provide 399 Specific BTR (Build to Rent) units with a total gross floor area of 29,391 sq.m, comprising 46 no. studios, 250 no. one bedroom units, 90 no. 2 bedroom / 4 person units and 13 no. 2 bedroom / 3 person units; internal communal ancillary residential services / amenities to include a shared co-working area / lounge (178 sq.m) and gym (102 sq.m) at lower ground floor level, and lounges on either side of a residential foyer at ground floor / podium level within Block A (196 sq.m), and a TV Room / lounge (57 sq.m) at ground floor / podium level within Block C.
- An independent retail unit (120 sq.m) is proposed at ground floor / podium level within Block B.
- A double basement is provided that will be integrated within the existing basement levels serving the wider HSQ development and will be accessed from the existing vehicular ramped accesses/egresses onto/off St. John's Road West and Military Road to the north and east, respectively. Basement level -1 provides: a refuse store; 80 no. car parking spaces (including 4 no. disabled spaces and 8 car club spaces); 4 no. motorcycle parking spaces; and, secure bicycle parking / storage in the form of 251 no. double stacked cycle parking spaces providing capacity for 502 no. secure bicycle storage spaces for residents. An additional 49 no. Sheffield type bicycle stands are provided at basement level -1 to provide 98 no. visitor cycle spaces (inclusive of 8 no. designated cargo bike spaces, that will also be available for the shared use with residents of the scheme) and a further 55 no. Sheffield type bicycle stands are provided at podium level to provide 110 no. cycle parking spaces (108 no. visitor cycle parking spaces (inclusive of 6 no. designated cargo bike spaces) and 2 no. cycle parking spaces in connection with the retail unit). All bicycle parking at basement level is accessed via a dedicated cycle lift from podium to basement level -1 that is situated to the south of Block B.
- Works proposed along the St John's Road West frontage include the omission of the existing left-turn filter lane to the vehicular ramped access to the HSQ development and re-configuration of the pedestrian crossings at the existing junction together with the re-configuration of the existing pedestrian crossing over the westbound lanes of St. John's Road West leading to an existing pedestrian refuge island. Re-alignment of the existing footpath along the site frontage onto St John's Road West to tie into the reconfigured junction arrangement and provision of a link to a new lift to provide wheelchair access from St John's Road West to the HSQ podium.
- Communal Outdoor Amenity space is provided for residents in the form of rooftop terraces (totalling 1,179sqm), and lower-level communal courtyards between blocks (totalling 960sqm).
- Hard and soft landscaping works are proposed at podium level which includes the extension and completion of the public plaza to the east of Block A; the provision of footpaths; a MUGA (Multi Use Games Area) and informal play areas for children (totalling 1,670sqm).
- A double ESB substation/switch room at ground / podium level within Block A, and a single substation/switch room at ground / podium level within Block B together with associated site development works, which includes the realignment / reprofiling of an existing vehicular access ramp at the southern end of the site between basement levels -1 and -2 and the closure / removal of a second vehicular access ramp between the subject site at basement level -1 and the raised basement level -1 under the Telford building.

3.0 Building Regulations

3.1 NZEB

Building energy has been long understood as contributing a major component of greenhouse gas emissions which was acknowledged within the 2030 Communication published by the European Commission (2014) which stated that “the majority of the energy-saving potential (for the EU) is in the building sector.” Figure 2.1.1 above illustrates comparative Primary Energy (see Section 2.3) for Dwellings in Ireland from 1970’s through to NZEB,

The EU Energy Performance of Buildings Directive set out the target that all *new* developments should be Nearly Zero-Energy Buildings (NZEB) by the end of 2020, with the intention having been that all Public buildings be in accordance with this by the end of 2018.

A Nearly-Zero Energy Building is defined as having “very high energy performance”, with Article 2 of the EPBD outlining that “the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby”; the latter understood to refer to district heating systems and centralised plant arrangements.

Interpretation and implantation of these statements within the directive are at the discretion of each EU Member State in accordance with their “National, Regional or Local considerations” and thus the definition of NZEB itself varies greatly between different countries.

For new dwellings in Ireland, NZEB has been defined was being (primarily) associated with demonstrating the following characteristics are achieved:

- Primary Energy/ Carbon Emissions: 70% reduction against Part L 2005
- Renewable Energy: 20% of this Primary Energy required

Figure 2.1.2 above illustrates the NZEB targets for Primary Energy (and Carbon Emissions) and Renewable Energy. The Part L 2005 benchmark could be expected to be achieving a B3 BER, in comparison to A2 for NZEB compliance.

These NZEB targets have been now incorporated within the Technical Guidance Document (TGD) Part L 2019, as discussed below.

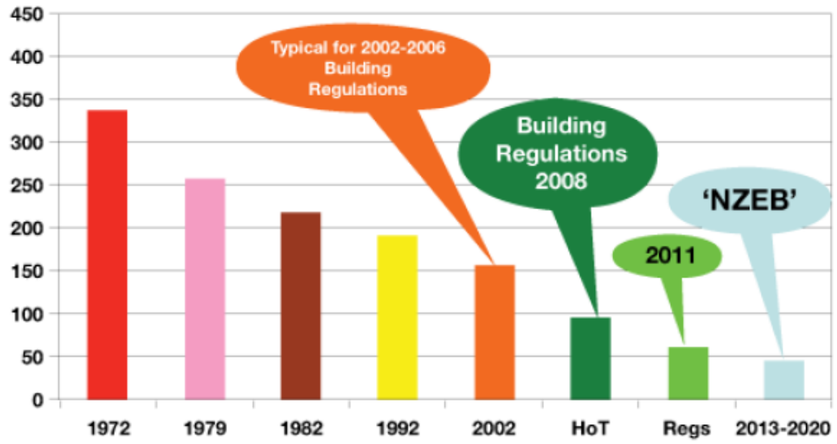

Figure 2.1.1 – Primary Energy Consumption in Irish Housing 1972-2020

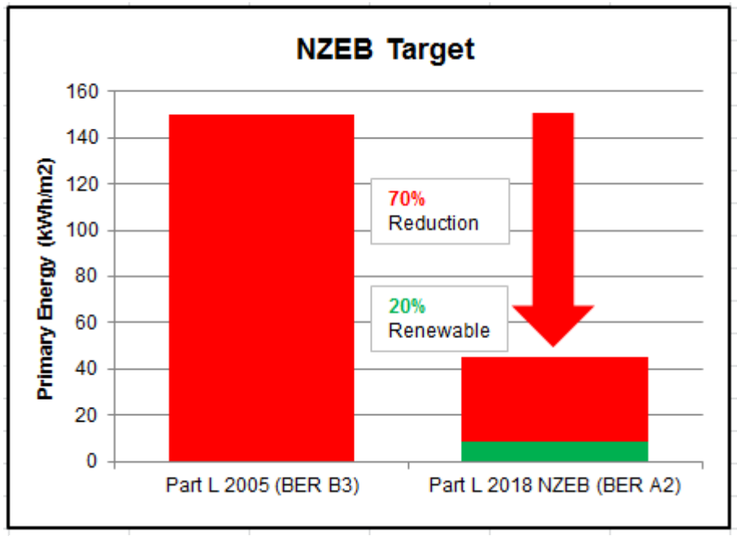

Figure 2.1.2 – NZEB Targets

3.2 Part L 2019

Technical Guidance Document (TGD) Part L Conservation of Fuel and Energy – Dwellings outlines how compliance to this element of the Building Regulations can be demonstrated through the utilisation of the Dwelling Energy Assessment Procedure (DEAP) software, which analyses comparative energy usage for a particular residence.

The energy assessment is determined annually on a floor area basis (kWh/m^2.ann) for the following usages, known as “regulated loads”:

- Heating
- Hot Water
- Auxiliary (Fans, Pumps and Controls)
- Lighting

It may be noted therefore that considerable energy usages within dwellings; particularly equipment associated with cooking, washing etc. are excluded from DEAP analysis and associated Part L Compliance/ BER calculations. These energy usages, known as “unregulated loads” are deemed to be associated with *operational* usage, as opposed to the building’s fabric and services performance.

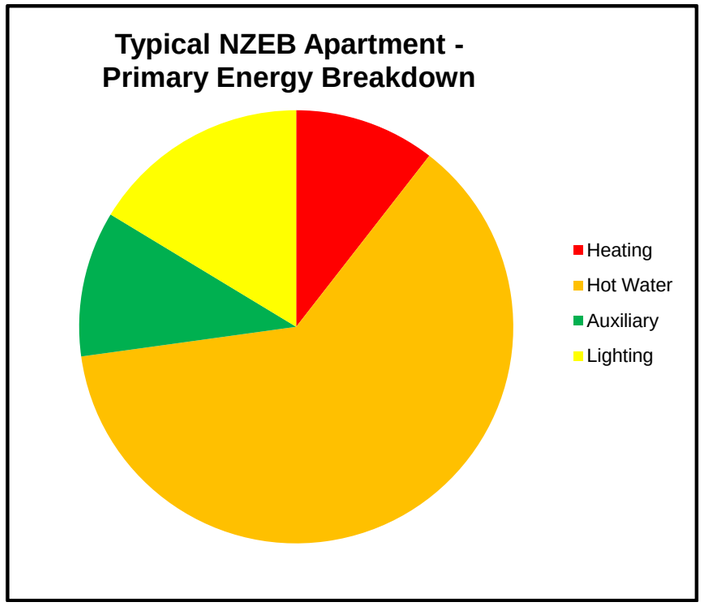

Figure 2.2.1 –Primary Energy Breakdown

Figure 2.2.1 above indicates an energy breakdown for a typical apartment (100m^2, local gas-fired boiler) compliant to NZEB/ Part L 2019. It can be seen that Hot Water Energy consumption pre-dominates, with Heating Energy considerably lower; reflective of the extensive improvement in insulation/ air permeability/ thermal bridging/ glazing/ heating system efficiency etc. through successive Building Regulations improvements.

However, as both Hot Water and Lighting Energy consumption are effectively fixed within the calculation methodology (as based on standardised databases of hot water usage etc.), further improvements to Heating related items (insulation etc.) are generally required to ensure overall compliance can be achieved.

In summary, DEAP analysis must demonstrate the following to ensure compliance to Part L 2019:

- Energy Performance Coefficient (EPC): 0.30 or lower (i.e. 70% reduction in Primary Energy against Part L 2005 benchmark)
- Carbon Performance Coefficient (CPC): 0.35 or lower
- Renewable Energy Ratio (RER): 0.20

In addition, minimum Fabric Performance is defined as follows in Part L 2019:

Building Construction and U-Values		
Element Type	Part-L 2019 Regulations	Targeted
Roof	0.16 W/m^{2}k	0.12 W/m^{2}k
External Wall	0.18 W/m^{2}k	0.15 W/m^{2}k
Ground/Exposed Floors	0.18 W/m^{2}k	0.12 W/m^{2}k
Windows/Doors/Rooflights	1.4 W/m^{2}k	1.4 W/m^{2}k
Heat Transmission Coefficient	0.08 W/m^{2}k (ACD’s)	0.15 W/m^{2}k

Glazing Parameters	
Total Solar Heat Transmittance	0.40
Framing Factor	0.70
Overshadowing	Average

Miscellaneous Building Parameters	
Element	Value Targeted
Air Leakage Rate	3m^3/hr.m^2 @ 50Pa
Shower Flow Rates	6 l/min
Water Usage	125 l/person/day
Lighting	100% LED

In terms of apartments or other terraced residential buildings, Part L allows that the compliance can be demonstrated based on the *average* of all dwellings for each of the parameters associated with Part L, namely Primary Energy (EPC), Carbon Emissions (CPC) and Renewable Energy (RER). Therefore, for the purposes of analysis, an apartment representative of the average attributes of the dwellings has been selected.

3.3 Primary Energy

In assessing energy performance for dwellings, Part L (and BER) utilises *Primary Energy* as a means of comparative analysis. This relates to the energy *at source* as required for the dwelling, as opposed to that consumed within the actual building. For example, electrical Primary Energy relates to that required for both generation (based on average of power plant fuels and efficiencies) and transmission for electricity through the ESB grid.

Primary Energy Factor (PEF) conversions for main fuel types are as follows

- Electricity: 2.08
- Natural Gas/ LPG/ Oil/ Biomass: 1.10

It can be seen from the above that the Primary Energy conversion for Electricity is twice that of Natural Gas (as well as other fossil fuels and biomass); therefore a direct electric heater would consume double the Primary Energy of a LPHW radiator. However, as can be seen from Figure 2.3.1 above, the underlying trend over time has been that the Primary Energy of electricity with respect to Natural Gas (and other fuels) has been reducing (due to the increased “greening” of the ESB grid with Wind and Solar renewables and more efficient plant operation), with the following impacts in terms of technologies and associated Part L compliance, as PEF for electricity reduces.

Heat Pump, both Air Source and Geothermal, are becoming increasingly viable.

Natural Gas Combined Heat and Power (CHP) is becoming less viable.

Larger Photovoltaic (PV) arrays required to offset electricity usage (albeit offset by increases in PV efficiency for equivalent array sizes).

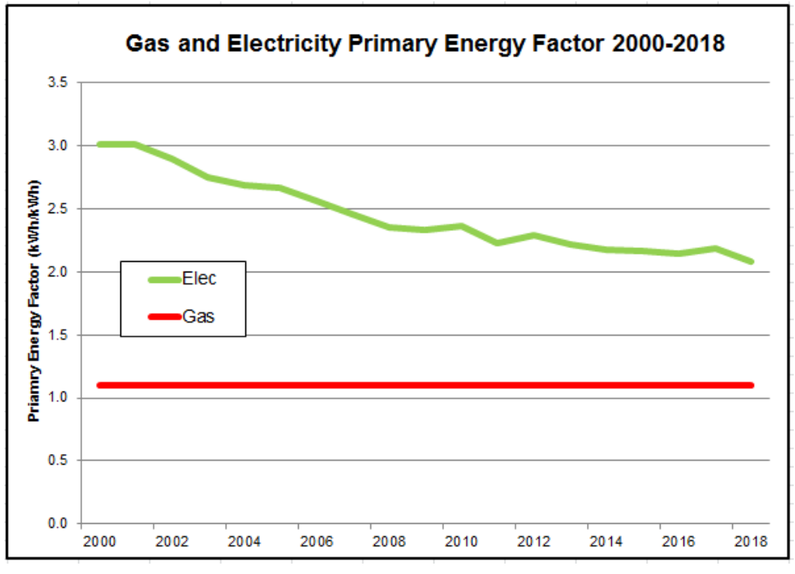

Figure 2.3.1 –- Primary Energy Factors

3.4 Renewable Technologies

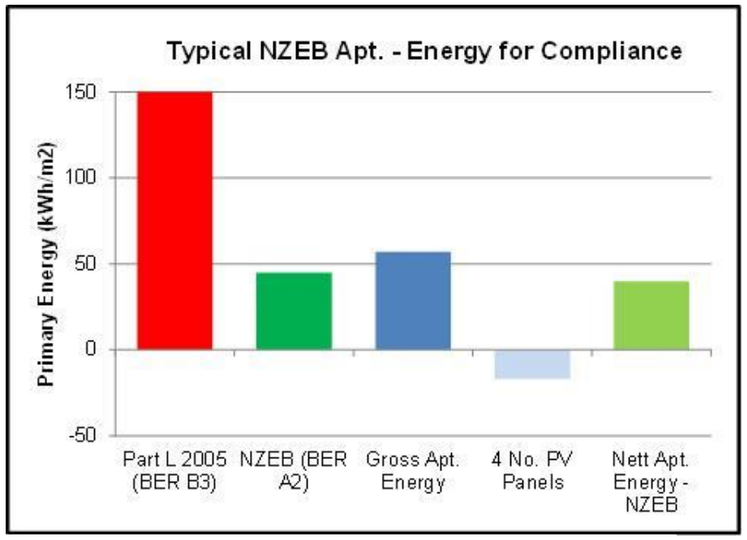

Figure 2.4.1 –EPC Compliance for Typical Apartment

In addition to improving heating energy related aspects, renewable technologies can be utilised to significantly reduce Primary Energy requirements (in addition to ensuring the renewable energy percentage is achieved). Figure 2.4.1 above indicates how, for a typical apartment (notional 100m^2) designed to ensure NZEB compliance, 4 no. (250W) PV panels would offset the excess energy within the gross consumption. This extent of renewable energy must be at least 20% of the overall Primary Energy (RER =0.20+).

With regards to renewable energy technology types, the most effective for integration within apartment design to ensure compliance to Part L in a cost-effective manner are as follows:

- Air Source Heat Pumps (ASHP)
  Reduces Primary Energy associated with both Heating and Hot Water compared to gas boilers.

- Exhaust Air Heat Pump (EAHP)
  Reduces Primary Energy associated with both Heating and Hot Water compared to gas boilers.

- Photovoltaics (PV)
  Offsets Primary Energy associated with Electricity. Most cost-effective where installed as part of Centralised plant arrangement, with single array interlinked to Landlord electricity supply (as opposed to individual units).

4.0 DEAP Methodology and Analysis

4.1 DEAP Parameters

The Heuston South Quarter SHD residential development will avail of a Centralised Plant room linked to the existing site wide district heating network. Low-energy systems were selected and analysed for the mechanical and electrical installations, comprising of heat generators, heating and hot water systems, ventilation and lighting.

The local centralised system dedicated to the proposed residential apartment blocks is made up of an Air Source Heat pump supplemented by a connection from the existing district heating system. Details of this system can be found in the table below:

Centralised Option	
Element	
Method of Heat Generation	Local Air Source Heat Pump and Existing District Heating (Gas Boilers)
Ventilation Method	Heat Recovery Unit
Fuel	Electricity & Gas
Heating Flow Temperature	65^{O}C
Hot Water Flow Temperature	60^{O}C

Table 3.1.1 –Centralised Plant Details

4.2 Part-L Compliance (Centralised)

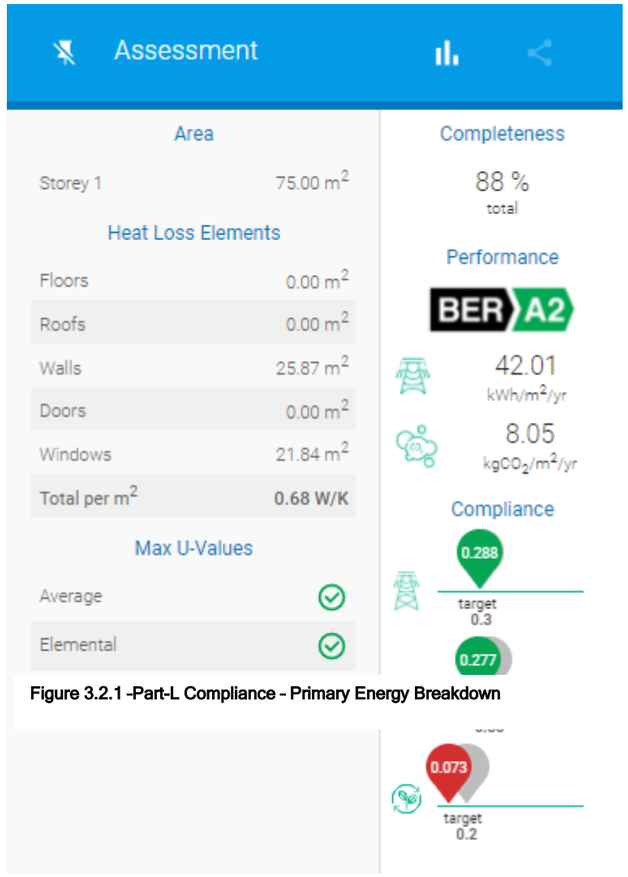

Figure 3.2.1 -Part-L Compliance - Primary Energy Breakdown

Figure 3.2.1 –Part-L Compliance – Primary Energy Breakdown

Figure 3.2.1 above, indicates confirmation of compliance to Part-L for the apartments with the following parameters achieved:

- Energy Performance Coefficient (EPC) < 0.30
- Carbon Performance Coefficient (CPC) < 0.35

From figure 3.2.1, it is evident that the renewable energy ratio, RER, shown is not sufficient to meet the requirement within DEAP 4.2.1. The RER requirement is as per the value indicated below:

- Renewable Energy Ratio (RER) > 0.20

The SEAI have released a new heat pump calculator which considers heat pumps used within group schemes. Based on inputs from both DEAP and the overall design of the system, an adjusted RER is generated and is shown in Figure 3.2.1.

RESULTS: Part L compliance Renewable Energy Ratio (RER) Adjustment. Applies to New final and New provisional assessments only. BER Assessor must advise the client of any adjustment to RER, and attach details of adjusted RER to Part L compliance report. This section is completed AFTER the above heat pump calculation results are entered in DEAP software.		
Total renewable contribution adjustment	594.82	
Total renewables primary energy from DEAP software	174.19	
Total Primary Energy from DEAP software	2388.09	
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.26**	

Figure 3.2.2 –Part-L Compliance – Primary Energy Breakdown

Figure 3.2.2 shows that a centralised system, as designed, complies with the regulations for the Heuston South Quarter SHD residential devlopment.

5.0 Appendix

5.1 Centralised DEAP Results

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Dwelling Details Report
Date report created: 25/06/2021
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Property details

MPRN		**Shared MPRN**	
BER Number		**BER number assigned to shared dwelling**	N/A
Address line 1		**Type of Rating**	New Dwelling - Final
Address line 2		**Purpose of Rating**	New dwelling for owner occupation
Address line 3		**Building Regulations**	2019 TGD L
County		**Planning Reference**	
Eircode		**Date of Plans**	
Dwelling Type	Mid-floor apartment	**Assessor Name**	
Year of construction	2020	**Date of Assessment**	24/06/2021
Dwelling Extension	No	**Assessor Comments**	
Storeys	1	**Assessor Description**	

Dimension details

	Area [m^2]	Height [m]	Volume [m^3]
Ground floor	75.00	2.70	202.50
First floor	0.00	0.00	0.00
Second floor	0.00	0.00	0.00
Third and other floors	0.00	0.00	0.00
Room in Roof	0.00	0.00	0.00
Totals	75.00		202.50

Living Area	35.60 m^2	**Living Area Percentage**	47.47 %

Ventilation details

	Number	Air Change Rate [ac/h]
Chimneys	0	0.00
Open Flues	0	0.00
Fans & vents	1	10.00
Flueless combustion room heaters	0	0.00

Has a permeability test been carried out	Yes	**Is there a draught lobby on main entrance?**	Yes
Infiltration rate due to structure [ac/h]	0.15	**Draught lobby air change [ac/h]**	0.00
Intermediate infiltration rate	0.20	**Openings infiltration [ac/h]**	0.05
Number of sides sheltered	2	**Structure type**	N/A
Adjusted infiltration rate [ac/h]	0.17	**Is there a suspended wooden ground floor?**	No
Effective air change rate [ac/h]	0.21	**Windows/doors/attic hatches draught stripped [%]**	N/A
Ventilation heat loss [W/K]	14.33	**Ventilation method**	Balanced whole-house mechanical ventilation with heat recovery
Adjusted result of air permeability test [ac/h]	0.15		
Manufacturer and Model name	Vent Axia LO-CARBON SENTINEL KINETIC ADVANCE	**How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?**	3 (K+3)
		Is MVHR ducting uninsulated where outside of insulated envelope?	No
		Adjusted heat exchanger efficiency	91.00
Specific fan power [W/(l/s)]	0.51		
Heat exchanger efficiency [%]	91.00		
Electricity for ventilation fans [Kwh/y]	126.00		
Heat gains from ventilation fans [W]	6.20		

Building Elements - Floors

Type	Description	U/F Heating	In Roof	Age Band	Exposed Perimeter [m]	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
Non-Heat Loss Floor		N/A	No	2010 onwards	N/A	75.00	0.00	0.00
Total area [m^2]								75.00

Building Elements - Roofs

Type	Description	Insulation Thickness [mm]	Age Band	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
Total area [m^2]						0.00

Building Elements - Walls

Type	Description	Wall is semi-exposed	Include in compliance check	Age Band	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
325mm Solid Brick		No	Yes	2010 onwards	25.87	0.15	3.88
Total area [m^2]							25.87

Building Elements - Doors

Count	Type	Description	Draught Stripped	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
Total area [m^2]						0.00

Building Elements - Windows

Count	Glazing Type	Frame Type	Frame Factor	Solar Transm.	In Roof	Over shading	Orient.	Area [m^2]	U-value [W/m^2K]
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Average or Unknown	Southwest	3.60	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Average or Unknown	Southwest	7.92	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Average or Unknown	Southwest	4.08	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Average or Unknown	Northwest	6.24	1.40
Total area [m^2]									21.84

Heat loss details

Total glazed area [m^2]	21.84	**Glazing ratio**	0.12
Total glazed heat loss [W/K]	28.95	**Summer solar gain [W/m^2]**	538.5
Total effective collection area [m^2]	4.24	**Total element area [m^2]**	47.71
Total plane heat loss [W/K]	32.84	**Thermal bridging factor [W/m^2K]**	0.0800
Fabric heat loss [W/K]	36.65		
Total heat loss [W/K]	50.98	**Per m2**	0.68

Lighting and Internal Gains

Lighting Design Calculation Method	Lighting Design	**Average Efficacy [lm/W]**	86.52
		Top up lighting requirement [klmh/y]	0.00
Fixed lighting provision [klmh/y]	5032.55	**Energy required for top up lighting [kWh/y]**	0.00
Energy required for fixed lighting [kWh/y]	58.17		
Energy required for portable lighting [kWh/y]	115.34		
Basic energy consumption for lighting [kWh/y]	685.47	**Water heating (In watts [W])**	91.15
Annual energy used for lighting [kWh/y]	173.51	**Occupants (In watts [W])**	118.06
Internal gains from lighting during heating season [kWh/hs] (In watts [W])	132.73 (22.76)	**Mechanical ventilation (In watts [W])**	6.20
Lighting (In watts [W])	22.76	**Heat loss to the cold water network (In watts [W])**	-35.25
Appliance and cooking (In watts [W])	171.86	**Net internal gains (In watts [W])**	374.78

Lights

Count	Name	Description	Type	Efficiency	Power [W]
27	B1 Lights	Downwards ligths	LED/CFL	66.90	10.00
1	STRIP LIGHT	Kitchen Strip Lights	LED/CFL	66.90	13.00
1	WALL MOUNTED LED		LED/CFL	66.90	10.00

Water heating details

Are there distribution losses?	Yes	**Is supplementary electric water heating used in summer?**	N/A
Are there storage losses?	Yes	**Is there a combi boiler?**	No
Is there a solar water heating system?	No	**Total hot water demand [kWh/y]**	1401.91
Standard number of occupants	2.36	**Temperature factor unadjusted**	1.00
Number of mixer showers	2	**Temperature Factor Multiplier**	1.00
Number of electric showers	0	**Hot water storage loss factor [kWh/l d]**	0.00
Number of baths	0	**Volume factor**	0.00
Daily hot water use [Litres/d]	89.40	**Combi-boiler electricity consumption [kWh/y]**	0.00
Hot water energy reqs. at taps [kWh/y]	1191.63	**Adjusted storage loss [kWh/y]**	129.21
Distribution losses [kWh/y]	210.29	**Adjusted primary circuit loss [kWh/y]**	286.25
Water storage volume [Litres]	4.00	**Heat gains from water heating system [W]**	91.15
Is manufacturers declared loss factor available?	Yes	**Output from supplementary heater [kWh/y]**	0.00
Declared loss factor [kWh/d]	0.35		
Manufacturer and Model name			
Insulation type	None		
Insulation thickness [mm]	0		

Type of mixer shower	Flow restriction	Flow rate [l/min]	HW usage [l/day]	WWHRS Manufacturer/Model	WWHRS efficiency	WWHRS Utilisation Factor	Energy Savings [kWh/yr]
Unvented hot water system	Yes	6.000		Any / Any			
Total :			56.97				0.00

Combi-boiler Type	None	**Output from main water heater [kWh/y]**	1817.38
Combi-boiler loss [kWh/y]	0.00	**Annual Heat gains from water heating system [kWh/y]**	798.51
Keep Hot facility	None	**WWHRS input to main system [kWh/y]**	0.00
Storage Loss	129.21	**WWHRS input to supplementary system [kWh/y]**	0.00
Storage Type	Plate heat exchanger in a group heating system		
Primary Circuit loss type	Community heating		
Primary circuit loss [kWh/y]	360.00	**Heat Pump Type of DHW**	None
Is hot water storage indoors or in group heating system	Yes		

Net space heat demand

Required temp. during heated hours	21.00	**Length of one unheated period [h]**	8
Required temperature rest of dwelling	18.00	**Unheated periods per week**	14
Living area percentage	47.47	**Heat use during heating season [kWh/y]**	485.96
Required mean internal temperature [C]	19.42	**Heat use for full year [kWh/y]**	486.44
Thermal mass category of dwelling	Medium		

	Utilisation factor	Intermittent heating
Internal heat capacity of dwelling [per m^2]	0.20	0.11
Internal heat capacity [MJ/K]	15.00	8.25

Space heat demand details

Month	Mean Ext. Temp [C]	Adj. Int. Temp [C]	Heat Loss [W]	Heat Use [kWh]	Gain/Loss Ratio	Utilisation Factor	Heat Use [W]	Useful Gains [W]	Solar Gain [W]
January	5.3	18.63	680	145	0.75	0.96	195	485	132
February	5.5	18.64	670	86	0.89	0.91	128	542	220
March	7.0	18.73	598	37	1.15	0.80	50	548	310
April	8.3	18.80	535	11	1.47	0.66	15	520	413
May	11.0	18.95	405	1	2.15	0.46	2	404	499
June	13.5	19.09	285	0	3.03	0.33	0	285	489
July	15.5	19.20	189	0	4.42	0.23	0	189	461
August	15.2	19.19	203	0	3.99	0.25	0	203	436
September	13.3	19.08	295	0	2.50	0.40	0	294	361
October	10.4	18.92	434	9	1.48	0.66	12	422	267
November	7.5	18.76	574	66	0.94	0.89	92	482	167
December	6.0	18.67	646	131	0.77	0.95	175	471	120

Space Heating

Manufacturer & Model	Type	Space Heating Standard	Fuel	Design flow temp[°C]	Daily Operation [h]	SH Seasonal eff.	WH Seasonal eff.	Heats water

Dist. System Losses and Gains

Temperature adjustment [C]	0.000	**Additional heat emissions due to non ideal control and responsiveness [kWh/y]**	73.73
Heating system control category	2	**Gross heat emission to heated space [kWh/y]**	559.69
Heating system responsiveness category	1	**Mean internal temperature [C]**	19.01
Mean internal temperature during heating hours [C]	19.69		

	Number present	Boiler controlled by thermostat	Inside dwelling	Electricity consumption [kWh/y]	Heat gain [W]
Central heating pumps	0	No	No	0	0
Oil boiler pumps	0	No	No	0	0
Gas boiler flue fan	0			0	
Warm air heating or fan coil radiators present	No			0	0
Totals				0	0

Note: Wet central heating systems are likely to have one or more central heating pumps.

Gains from fans and pumps associated with space heating system	0	**Is there underfloor heating on the ground floor?**	No
Average utilisation factor, October to May	0.79	**U-Value of ground floor [W/m^{2}K]**	0.00
Useful net gain [kWh/y]	0	**Fraction of heating system output from ground floor**	1.00
Net heat emission to heated space [kWh/y]	560	**Additional heat loss via envelope element**	0.00
		Annual space heating requirement [kWh/y]	560

Energy Requirements: Group Heating Systems

Is charging based on heat consumed?	Yes	**Distribution loss factor**	1.05
Heat for space heating delivered to dwelling [kWh/y]	559.69	**Fraction of heat from CHP/recovered from power station**	
Percentage of heat from secondary system			
Efficiency of secondary system [%]			
Energy required for secondary space heating [kWh/y]	0		

CHP

	Fuel Type	Efficiency [%]	Percentage of Heat [%]	Primary energy conversion factor	CO_2 emission factor [kg/kWh]
Heating System 1	Mains Gas	95	46	1.10	0.203
Heating System 2	Electricity	374.23	10	2.08	0.409
Heating System 3	Electricity	226.15	44	2.08	0.409

Heat demand from CHP	0	**Efficiency adjustment factor**	N/A
Manufacturer name	N/A	**Adjusted efficiency of main water heating system [%]**	0.00
Model name	N/A	**Energy required for main water heater [kWh/y]**	1894.7
		Energy required for secondary water heater [kWh/y]	0

	Primary energy conversion factor	CO_2 emission factor
Factors for CHP fuel	0.00	0.00
Factors for electricity displaced from grid	2.08	0.41
Factors for heat leaving CHP plant	1.10	0.02
Factors for waste heat from power stations	1.05	0.02
Factors for heat delivered to dwelling	1.04	0.20

	Fuel Type	Primary energy conversion factor	CO_2 emission factor
Main space heating system	group heating scheme	1.04	0.20
Secondary space heating system	Mains Gas	1.10	0.20
Main water heating system	group heating scheme	1.04	0.20
Supplementary water heating system		0.00	0.00
Pumps, fans		2.08	0.41
Energy for lighting		2.08	0.41

	Type	Part L Total Contribution [kWh/y]	Delivered Energy [kWh/y]	Primary energy conversion factor	CO_2 emission factor [kg/kWh]
Energy produced or saved 1	Electrical (Solar PV/Wind)	0.000	0.000	0.00	0.000
Energy consumed by the technology 1			0.000	0.00	0.000
Energy produced or saved 2	N/A	0.000	0.000	0.00	0.000
Energy consumed by the technology 2			0.000	0.00	0.000
Energy produced or saved 3	N/A	0.000	0.000	0.00	0.000
Energy consumed by the technology 3			0.000	0.00	0.000

Summer internal gains

Dwelling volume [m^3]	202.500	**Total gains in summer [W]**	913.27
Effective air change rate for summer period [ac/h]	0.5	**Temperature increment due to gains [C]**	13.03
Ventilation heat loss coefficient [W/K]	33.41	**Summer mean external temperature [C]**	15
Fabric heat loss coefficient [W/K]	36.65	**Heat capacity parameter**	0.20
Heat loss coefficient under summer conditions [W/K]	70.06	**Temperature increment related to thermal mass [C]**	0.60
Total Solar Gains from Summer Period	538.50	**Threshold internal temperature [C]**	28.63
Internal gains [W]	374.78		

Results

	Delivered energy [kWh/y]	**Primary energy [kWh/y]**	**CO_2 emissions [kgCO_2/y]**
Main space heating system	560	584	111
Secondary space heating system	0	0	0
Main water heating system	1817	1895	360
Supplementary water heating system	0	0	0
Pumps and fans	150	312	61
Energy for lighting	174	361	71
CHP input (individual heating systems only)			
CHP electric output (individual heating systems only)			
Renewable and energy saving technologies			
Energy produced and saved	0	0	0
Energy consumed by the technology	0	0	0
Total	2700	3151	603
Per m^2 floor area	36.00	42.01	8.05
Energy Rating	A2		

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