Lands at Hollystown-Kilmartin
Sites 2&3 and Local Centre

Glenveagh
Home of the new.

Energy Analysis Report

IN2 Project No. D2035
08th December 2021
REV02

Revision History

Date	Revision	Description
31.03.2021	00	Initial issue for client review
19.11.2021	01	Planning stage issue (DRAFT)
08.12.2021	02	Planning stage issue

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1.0 Executive Summary

The proposed development relates to at a site of c. 25.3 ha at the townlands of Hollystown, Kilmartin, Hollywoodrath, Cruiserath, Yellow Walls, Powerstown, and Tyrrelstown, Dublin 15, which includes lands in the former Hollystown Golf Course and lands identified under the Kilmartin Local Area Plan 2013 (as extended). The lands are bound by the R121 and Hollywoodrath residential development to the east, the under construction Bellingsmore residential development to the south and north, the former Hollystown Golf Course to the north, Tyrrellstown Educate Together National School, St.Luke's National School and Tyrellston Community Centre to the west and south and the existing Tyrrellstown Local Centre to the south.

The proposed development will consist of the development of 548 no. residential units, consisting of 147 apartments/duplexes and 401 houses, ranging in height from 2 to 5 storeys and including retail/café unit, 2 no. crèches, 1 no. Montessori, 1 no. community hub, car and bicycle parking, open space, public realm and site infrastructure over a site area of c. 25.3 ha. On lands to the north of the application site (referred to as Hollystown Sites 2 & 3) the proposed development includes for 428 units consisting of 401 no. 2 and 3 storey houses and 27 no. apartments set out in 9 no. 3-storey blocks. On lands to the south of the application site and north of the Tyrellstown Local Centre (referred to as Kilmartin Local Centre) the proposed development includes 120 no. apartment/duplex units in 4 no. blocks ranging in height from 3 to 5 storeys. The local centre includes 2 no. crèches (including 1 standalone 2 storey crèche), 1 no. Montessori, a retail/café unit, and 1 no. community hub.

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, 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.

The analysis determined that an Air Source Heat Pump supplemented with a Mechanical Heat Recovery Ventilation Unit should enable compliance for each of the houses to Part L 2019/ NZEB and that an A3/A2 BER be obtainable:

Improvements to building thermal transmittance (U-Values), air permeability and thermal bridging with respect to Part L defaults.

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

Figure 1.1 – Hollystown-Kilmartin SHD Site Location and Boundary

2.0 Building Regulations

2.1 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.

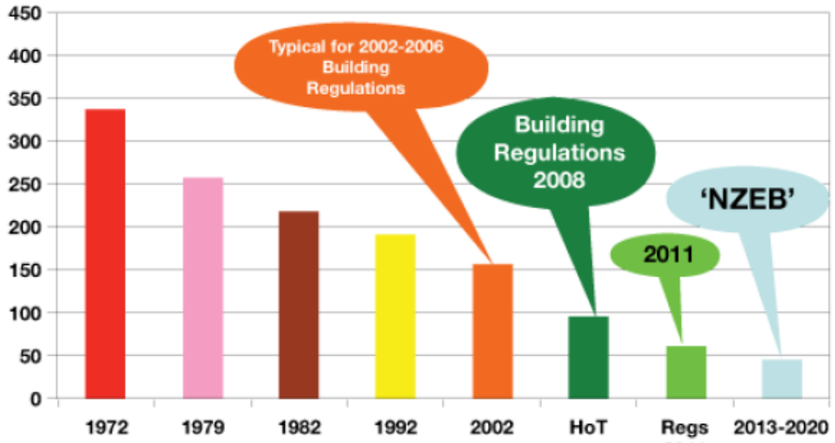

Figure 2.1.1 – Primary Energy Consumption in Irish Housing

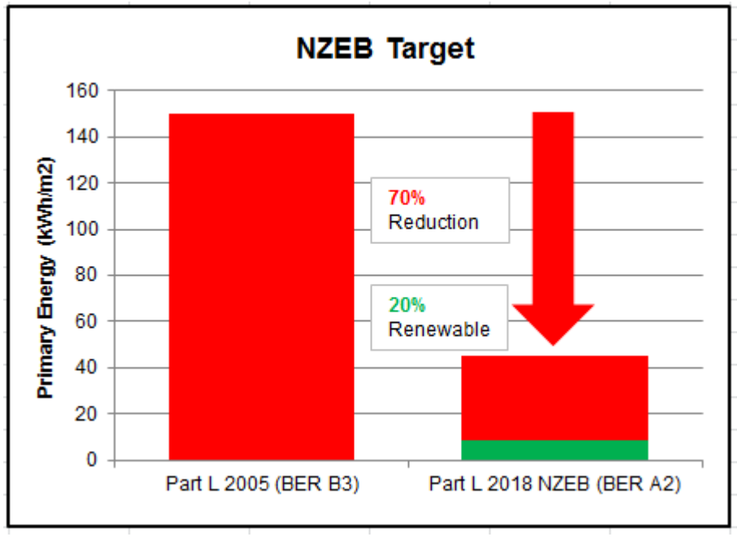

Figure 2.1.2 – NZEB Targets

2.2 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.

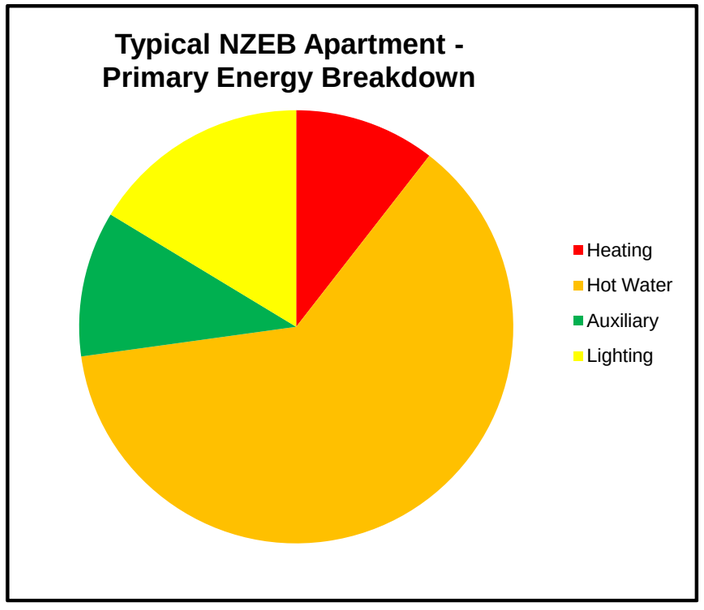

Figure 2.2.1 –Primary Energy Breakdown

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:

Hollystown Building Construction and U-Values		
Element Type	Part-L 2019 Regulations	Targeted
Roof	0.16 W/m^{2}k	0.15 W/m^{2}k
External Wall	0.18 W/m^{2}k	0.18 W/m^{2}k
Ground/Exposed Floors	0.18 W/m^{2}k	0.18 W/m^{2}k
Windows/Doors/Rooflights	1.4 W/m^{2}k	1.3 W/m^{2}k
Heat Transmission Coefficient	0.15 W/m^{2}k0	0.08 W/m^{2}k (ACD's)

Figure 2.2.2 – Hollystown Construction U-Values

Hollystown site 2&3 Glazing Parameters	
Total Solar Heat Transmittance	0.60
Framing Factor	0.70
Overshadowing	Average

Figure 2.2.3 – Hollystown site 2&3 Glazing Parameters

Kilmartin LC Building Construction and U-Values		
Element Type	Part-L 2019 Regulations	Targeted
Roof	0.16 W/m^{2}k	0.15 W/m^{2}k
External Wall	0.18 W/m^{2}k	0.18 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	1.2 W/m^{2}k
Heat Transmission Coefficient	0.15 W/m^{2}k	0.08 W/m^{2}k (ACD's)

Figure 2.2.4 – Kilmartin LC Construction U-Values

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

Figure 2.2.5 – Kilmartin LC Glazing Parameters

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

Figure 2.2.6 – Building Parameters

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.

2.3 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).

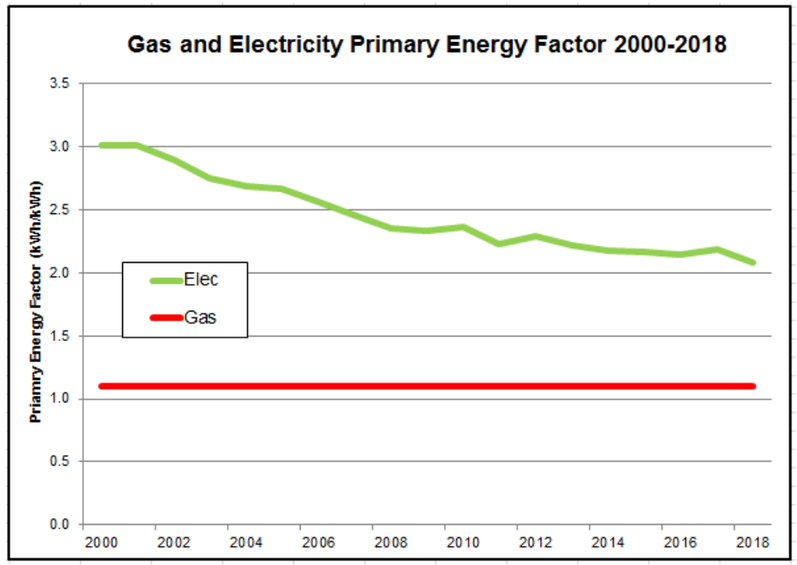

Figure 2.3.1 – Primary Energy Factors for Gas and Electricity 2000-2018

2.4 Renewable Technologies

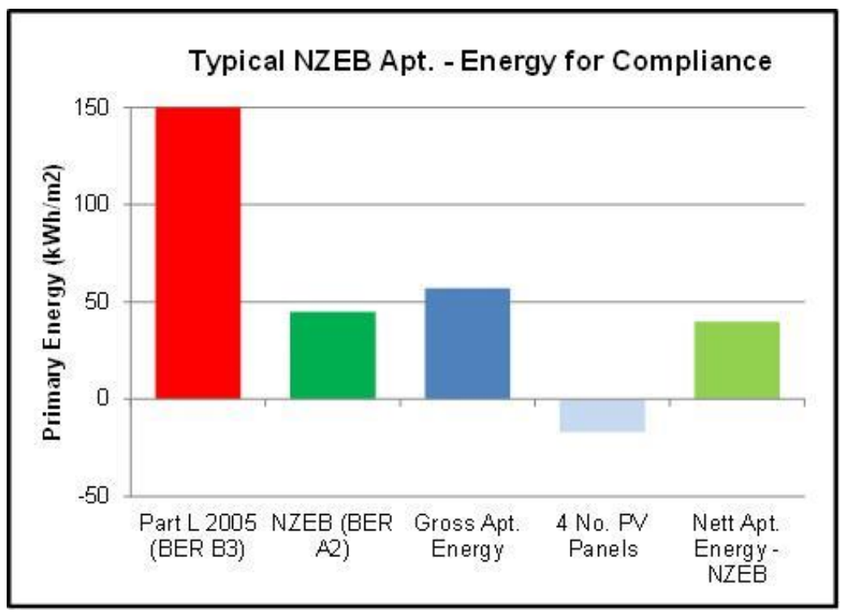

Figure 2.4.1 –EPC Compliance for Typical Apartment

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).

3.0 DEAP Methodology and Analysis

3.1 DEAP Parameters – Hollystown site 2&3

It is proposed that each of the dwellings within the Hollystown Residential Development site 2&3 are served by an Air Source Heat Pump. The house will also be served by a highly efficient Mechanical Ventilation Heat Recovery Unit in order to minimise heat loss while providing fresh air to the dwellings.

The Air Source Heat Pump will provide the dwellings with all their Heating and Domestic Hot Water Requirements.

De-Centralised Option Hollystown site 2&3	
Element	
Method of Heat Generation	Air Source Heat Pump
Model(s)	Daikin
Ventilation Method	Heat Recovery Unit
Fuel	Electricity
Heating Flow Temperature	45^{O}C
Hot Water Flow Temperature	60^{O}C

Table 3.1.1 – Decentralised Parameters

3.2 Part-L Compliance (Hollystown site 2&3)

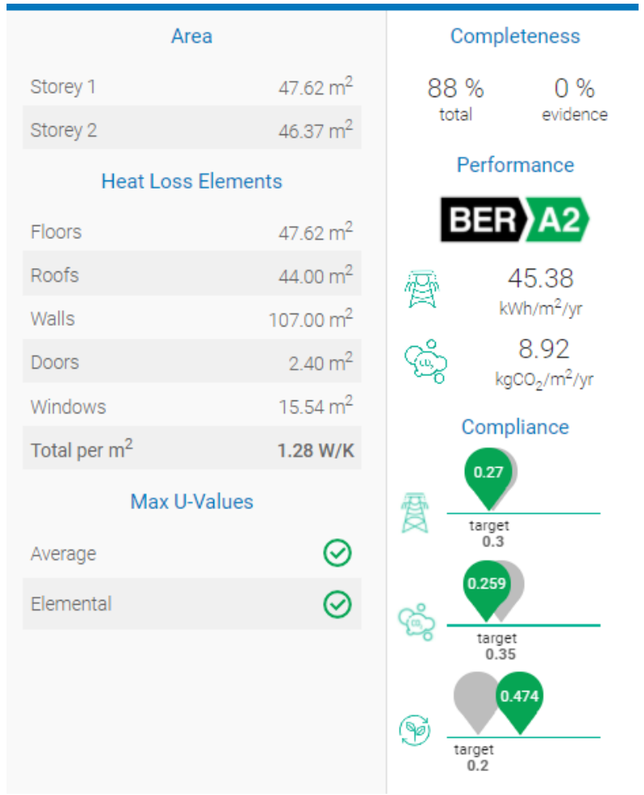

Figure 3.2.1 – Part-L Compliance – Primary Energy

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

- Energy Performance Coefficient (EPC) < 0.30
- Carbon Performance Coefficient (CPC) < 0.35
- Renewable Energy Ratio (RER) > 0.20

3.3 DEAP Parameters – Kilmartin LC

The Kilmartin Residential Development will avail of Exhaust Air Heat Pump system as outlined below; 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 system analysed for the development is a de-centralised system in the form of an Exhaust Air Heat Pump (EAHP). Details of this system can be found in the table below:

De-centralised Option – Kilmartin LC	
Element	
Method of Heat Generation	Exhaust Air Heat Pump
Model	Comfortzone EX35[1]
Ventilation Method	Passive Fresh Air
Fuel	Electricity
Heating Flow Temperature	40°C
Hot Water Flow Temperature	60°C

Figure 3.1.1 – Decentralised Parameters

For the de-centralised option, a Gas boiler with supplementary PV was also considered. Due to the layout, the location, the requirement for a Green roof and the number of PV required, it was, at the time of this report, considered not to be a viable option.

[1] Units mentioned within table 3.1.1 are indicative for the purposes of analysis only and may be subject to change

3.4 Part-L Compliance (Kilmartin)

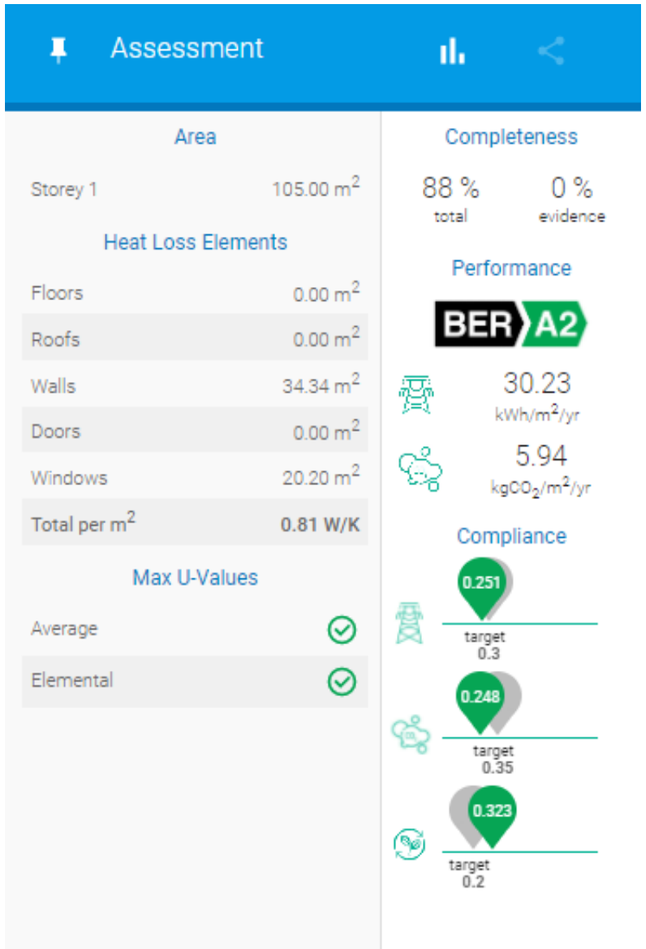

Figure 3.2.1 –Part-L Compliance – Primary Energy Breakdown

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
- Renewable Energy Ratio (RER) > 0.20

4.0 Appendix

4.1 DEAP Results – Hollystown site 2&3

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Dwelling Details Report
Date report created: 31/03/2021
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Property details

MPRN		**Shared MPRN**	
BER Number	N/A	**BER number assigned to shared dwelling**	N/A
Address line 1		**Type of Rating**	New Dwelling - Provisional
Address line 2		**Purpose of Rating**	Sale
Address line 3		**Building Regulations**	2019 TGD L
County	Co. Dublin	**Planning Reference**	
Eircode		**Date of Plans**	
Dwelling Type	Semi-detached house	**Assessor Name**	
Year of construction	2021	**Date of Assessment**	31/03/2021
Dwelling Extension	N/A	**Assessor Comments**	
Storeys	2	**Assessor Description**	Hollystown Site 2&3 2.D - C.A.2

Dimension details

	Area [m^2]	Height [m]	Volume [m^3]
Ground floor	47.62	2.70	128.57
First floor	46.37	2.70	125.20
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	93.99		253.77

Living Area	23.10 m^2	**Living Area Percentage**	24.58 %

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?	No
Infiltration rate due to structure [ac/h]	0.15	Draught lobby air change [ac/h]	0.05
Intermediate infiltration rate	0.24	Openings infiltration [ac/h]	0.09
Number of sides sheltered	2	Structure type	N/A
Adjusted infiltration rate	0.20	Is there a suspended wooden ground floor?	No
Effective air change rate [ac/h]	0.36	Windows/doors/attic hatches draught stripped [%]	N/A
Ventilation heat loss [W/K]	30.44	Ventilation method	Balanced whole-house mechanical ventilation with heat recovery
Adjusted result of air permeability test [ac/h]	0.15		

Manufacturer and Model name	N/A	How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?	5
Specific fan power [W/(l/s)]	0.50	Is MVHR ducting uninsulated where outside of insulated envelope?	Yes
Heat exchanger efficiency [%]	80.00	Adjusted heat exchanger efficiency	68.00
Electricity for ventilation fans [Kwh/y]	154.80		
Heat gains from ventilation fans [W]	7.61		

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]
Ground Floor - Solid		No	No	2010 onwards	N/A	47.62	0.18	8.57
Non-Heat Loss Floor		N/A	No	2010 onwards	N/A	46.37	0.00	0.00
Total area [m^2]								93.99

Building Elements - Roofs

Type	Description	Insulation Thickness [mm]	Age Band	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
Pitched Roof - Insulated on Rafter			2010 onwards	44.00	0.15	6.60
Total area [m^2]						44.00

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]
225mm Solid Brick		No	No	2005 -2009	107.00	0.18	19.26
Total area [m^2]							107.00

Building Elements - Doors

Count	Type	Description	Draught Stripped	Area [m^2]	U-Value [W/m^2K]	Heat Loss (AU) [W/K]
1	Solid semi-exposed door between house and unheated space		Yes	2.40	1.71	4.10
Total area [m^2]						2.40

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	0.630	No	Very Little	South	6.20	1.30
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	North	9.34	1.30
Total area [m^2]									15.54

Heat loss details

Total glazed area [m^2]	15.54	**Glazing ratio**	0.08
Total glazed heat loss [W/K]	19.20	**Summer solar gain [W/m^2]**	559.84
Total effective collection area [m^2]	6.17	**Total element area [m^2]**	216.56
Total plane heat loss [W/K]	57.74	**Thermal bridging factor [W/m^2K]**	0.1500
Fabric heat loss [W/K]	90.22		
Total heat loss [W/K]	120.66	**Per m2**	1.28

Lighting and Internal Gains

Lighting Design Calculation Method	Bulb type only	**Average Efficacy [lm/W]**	66.90
		Top up lighting requirement [klmh/y]	0.00
Fixed lighting provision [klmh/y]	3274.51	**Energy required for top up lighting [kWh/y]**	0.00
Energy required for fixed lighting [kWh/y]	87.31		
Energy required for portable lighting [kWh/y]	137.11		
Basic energy consumption for lighting [kWh/y]	808.83	**Water heating (In watts [W])**	106.35
		Occupants (In watts [W])	133.82
Annual energy used for lighting [kWh/y]	224.42	**Mechanical ventilation (In watts [W])**	7.61
Internal gains from lighting during heating season [kWh/hs] (In watts [W])	171.68 (29.44)	**Heat loss to the cold water network (In watts [W])**	-38.09
Lighting (In watts [W])	29.44	**Net internal gains (In watts [W])**	439.77
Appliance and cooking (In watts [W])	200.64		

Lights

Count	Name	Description	Type	Efficiency	Power [W]
1	Default LED/CFL		LED/CFL	66.90	

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]	1842.76
Standard number of occupants	2.68	Temperature factor unadjusted	0.60
Number of mixer showers	1	Temperature Factor Multiplier	1.30
Number of electric showers	0	Hot water storage loss factor [kWh/l d]	0.00
Number of baths	1	Volume factor	0.00
Daily hot water use [Litres/d]	117.52	Combi-boiler electricity consumption [kWh/y]	0.00
Hot water energy reqs. at taps [kWh/y]	1566.35	Adjusted storage loss [kWh/y]	398.58
Distribution losses [kWh/y]	276.41	Adjusted primary circuit loss [kWh/y]	0.00
Water storage volume [Litres]	200.00	Heat gains from water heating system [W]	106.35
Is manufacturers declared loss factor available?	Yes	Output from supplementary heater [kWh/y]	0.00
Declared loss factor [kWh/d]	1.40		
Manufacturer and Model name	Daikin		
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 :			48.03				0.00

Combi-boiler Type	None	Output from main water heater [kWh/y]	2241.34
Combi-boiler loss [kWh/y]	0.00	Annual Heat gains from water heating system [kWh/y]	931.58
Keep Hot facility	None	WWHRS input to main system [kWh/y]	0.00
Storage Loss	398.58	WWHRS input to supplementary system [kWh/y]	0.00
Storage Type	Cylinder, indirect		

Primary Circuit loss type	Separate boiler and thermal store connected by no more than 1.5 m of insulated pipework

Primary circuit loss [kWh/y]	0.00	Heat Pump Type of DHW	Integral and separate Hot Water Storage
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	24.58	**Heat use during heating season [kWh/y]**	3063.70
Required mean internal temperature [C]	18.74	**Heat use for full year [kWh/y]**	3126.33
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]	18.80	10.34

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	17.39	1458	643	0.42	0.98	864	595	167
February	5.5	17.41	1437	501	0.50	0.97	745	692	277
March	7.0	17.56	1274	380	0.65	0.93	511	763	384
April	8.3	17.69	1133	239	0.81	0.87	332	801	483
May	11.0	17.96	840	84	1.22	0.71	112	727	585
June	13.5	18.21	568	19	1.83	0.52	26	543	601
July	15.5	18.41	351	3	2.86	0.35	4	348	565
August	15.2	18.38	384	5	2.49	0.39	7	377	515
September	13.3	18.19	590	36	1.47	0.62	50	540	426
October	10.4	17.90	905	187	0.84	0.86	251	654	323
November	7.5	17.61	1220	430	0.53	0.96	598	622	210
December	6.0	17.46	1383	600	0.43	0.98	806	576	149

Space Heating

Manufacturer & Model	Type	Space Heating Standard	Fuel	Design flow temp[°C]	Daily Operation [h]	SH Seasonal eff.	WH Seasonal eff.	Heats water
Daikin, ERGA06 6kW	Heat pumps	I.S. EN 14825	Electricity	45	8	499.3	225.34	Yes

Heating System Test data: I.S. EN 14825

Heat Pump Type Air to Water

Test Condition - Low (35°C)

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-10
Sink	W34	W30	W27	W24	W35
Heating Capacity (kW)	6.00	3.90	3.20	3.30	6.00
Coefficient of Performance (kW/kW)	2.86	4.25	6.30	7.78	2.49

Test Condition - High (55°C) *

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-10
Sink	W52	W42	W36	W30	W55
Heating Capacity (kW)	5.90	3.90	3.00	3.30	6.10
Coefficient of Performance (kW/kW)	1.98	3.16	4.49	6.10	2.12

Heating System Test data: I.S. EN 16147

Source of Data Water heating energy efficiency, nwh [%]
Co-efficient of Performance [kW/kW] 0.00
Water heating energy efficiency, nwh [%] 133.00
Reference Hot water Temperature [°C] 52.50
Capacity of Heat Pump [kW] 5.80
Declared load profile XL
Standby Heat Loss [kWh/day] 1.40
Volume of DHW accounted for in test [litre] 220
Heat Pump Type Air to Water

Dist. System Losses and Gains

Temperature adjustment [C]	0	Additional heat emissions due to non ideal control and responsiveness [kWh/y]	238.72
Heating system control category	2		
Heating system responsiveness category	1	Gross heat emission to heated space [kWh/y]	3302.41
Mean internal temperature during heating hours [C]	19.11	Mean internal temperature [C]	17.96

	Number present	Boiler controlled by thermostat	Inside dwelling	Electricity consumption [kWh/y]	Heat gain [W]
Central heating pumps	1	Yes	Yes	26	10
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				26	10

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	58	Is there underfloor heating on the ground floor?	No
Average utilisation factor, October to May	0.91	U-Value of ground floor [W/m^{2}K]	0.00
Useful net gain [kWh/y]	53	Fraction of heating system output from ground floor	0.67
Net heat emission to heated space [kWh/y]	3250	Additional heat loss via envelope element	0.00
		Annual space heating requirement [kWh/y]	3250

Energy Requirements: Individual Heating Systems

Efficiency of main heating system [%]	499.3	Fraction of heat from secondary system	N/A
Manufacturer name	Daikin	Efficiency of secondary system [%]	N/A
Model name	ERGA06 6kW	Energy required for main heating system [kWh/y]	650.83
Efficiency adjustment factor	1.00	Energy required for secondary heating system [kWh/y]	0
Adjusted efficiency of main heating system [%]	499.30		

Fraction of main space and water heat from CHP	N/A	Efficiency adjustment factor	1.0000
Heat demand from CHP	0.0	Adj. efficiency of main water heating system [%]	225.34
Efficiency of main water heating system [%]	225.34	Water Heating Efficiency, ηwh	133
Manufacturer name	Daikin	Energy req. for main water heater [kWh/y]	2068.87
Model name	ERGA06 6kW	Energy req. for secondary water heater [kWh/y]	0.00
Heat Pump Type	Air to Water	Water Heating Standard	I.S. EN 16147

	Fuel Type	Primary energy conversion factor	CO_2 emission factor
Main space heating system	Electricity	2.08	0.409
Secondary space heating system	None	0.00	0.000
Main water heating system	Electricity	2.08	0.409
Pumps, fans	Electricity	2.08	0.409
Energy for lighting	Electricity	2.08	0.409

CHP data

Heat output from CHP [kWh/y]	0.00	CHP Fuel type	N/A
Electrical efficiency of CHP		Energy delivered to CHP [kWh/y]	0
Heat efficiency of CHP		Electrical output from CHP [kWh/y]	0

Summer internal gains

Dwelling volume [m^3]	253.773	Total gains in summer [W]	999.61
Effective air change rate for summer period [ac/h]		Temperature increment due to gains [C]	11.08
Ventilation heat loss coefficient [W/K]	0.00	Summer mean external temperature [C]	15
Fabric heat loss coefficient [W/K]	90.22	Heat capacity parameter	0.20
Heat loss coefficient under summer conditions [W/K]	90.22	Temperature increment related to thermal mass [C]	0.60
Total Solar Gains from Summer Period	559.84	Threshold internal temperature [C]	26.68
Internal gains [W]	439.77		

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kgCO_2/y]
Main space heating system	651	1354	266
Secondary space heating system	0	0	0
Main water heating system	995	2069	407
Supplementary water heating system	0	0	0
Pumps and fans	181	376	74
Energy for lighting	224	467	92
CHP input (individual heating systems only)	0	0	0
CHP electric output (individual heating systems only)	0	0	0
Renewable and energy saving technologies			
Energy produced and saved	0	0	0
Energy consumed by the technology	0	0	0
Total	2051	4265	839
Per m^2 floor area	21.82	45.38	8.92
Energy Rating	A2		

4.2 DEAP Results – Kilmartin LC

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Dwelling Details Report
Date report created: 19/11/2020
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Property details

MPRN		**Shared MPRN**	
BER Number	N/A	**BER number assigned to shared dwelling**	N/A
Address line 1	Kilmartin,	**Type of Rating**	New Dwelling - Provisional
Address line 2	Tyrrelstown,	**Purpose of Rating**	Sale
Address line 3	Fingal,	**Building Regulations**	2019 TGD L
County	Co. Dublin	**Planning Reference**	
Eircode		**Date of Plans**	
Dwelling Type	Mid-floor apartment	**Assessor Name**	
Year of construction	2020	**Date of Assessment**	18/11/2020
Dwelling Extension	N/A	**Assessor Comments**	
Storeys	1	**Assessor Description**	D2036 - Kilmartin LC Residential

Dimension details

	Area [m^2]	Height [m]	Volume [m^3]
Ground floor	105.00	2.40	252.00
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	105.00		252.00

Living Area	36.00 m^2	**Living Area Percentage**	34.29 %

Ventilation details

	Number	Air Change Rate [ac/h]
Chimneys	0	0.00
Open Flues	0	0.00
Fans & vents	4	40.00
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	0.31	Openings infiltration [ac/h]	0.16
Number of sides sheltered	2	Structure type	N/A
Adjusted infiltration rate	0.26	Is there a suspended wooden ground floor?	No
Effective air change rate [ac/h]	0.62	Windows/doors/attic hatches draught stripped [%]	N/A
Ventilation heat loss [W/K]	51.52	Ventilation method	Exhaust Air Heat Pump
Adjusted result of air permeability test [ac/h]	0.15		

Exhaust air flow rate [m^3/h]	180.00	How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?	N/A
Manufacturer and Model name	N/A	Is MVHR ducting uninsulated where outside of insulated envelope?	N/A
Specific fan power [W/(l/s)]	0.26	Adjusted heat exchanger efficiency	0.00
Heat exchanger efficiency [%]	0.00		
Electricity for ventilation fans [Kwh/y]	98.78		
Heat gains from ventilation fans [W]	0.00		

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	First Floor	N/A	No	2010 onwards	N/A	105.00	0.00	0.00
Total area [m^2]								105.00

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]
225mm Solid Brick		No	Yes	2010 onwards	34.34	0.18	6.18
Total area [m^2]							34.34

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	Very Little	Northwest	7.00	1.20
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Very Little	Northwest	4.32	1.20
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Very Little	Northwest	4.56	1.20
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.400	No	Very Little	Northeast	4.32	1.20
Total area [m^2]									20.20

Heat loss details

Total glazed area [m^2]	20.20	**Glazing ratio**	0.10
Total glazed heat loss [W/K]	23.13	**Summer solar gain [W/m^2]**	473.41
Total effective collection area [m^2]	5.09	**Total element area [m^2]**	54.54
Total plane heat loss [W/K]	29.31	**Thermal bridging factor [W/m^2K]**	0.0800
Fabric heat loss [W/K]	33.67		
Total heat loss [W/K]	85.20	**Per m2**	0.81

Lighting and Internal Gains

Lighting Design Calculation Method	Lighting Design	**Average Efficacy [lm/W]**	77.30
		Top up lighting requirement [klmh/y]	19.75
Fixed lighting provision [klmh/y]	2053.60	**Energy required for top up lighting [kWh/y]**	0.93
Energy required for fixed lighting [kWh/y]	80.47		
Energy required for portable lighting [kWh/y]	146.01		
Basic energy consumption for lighting [kWh/y]	867.75	**Water heating (In watts [W])**	89.47
		Occupants (In watts [W])	139.06
Annual energy used for lighting [kWh/y]	227.41	**Mechanical ventilation (In watts [W])**	0.00
Internal gains from lighting during heating season [kWh/hs] (In watts [W])	173.97 (29.83)	**Heat loss to the cold water network (In watts [W])**	-39.03
Lighting (In watts [W])	29.83	**Net internal gains (In watts [W])**	435.18
Appliance and cooking (In watts [W])	215.84		

Lights

Count	Name	Description	Type	Efficiency	Power [W]
7	B1 Lights	B1 Lights	LED/CFL	66.90	8.00
4	B2 lights	B2 lights	LED/CFL	66.90	8.00
5	CEILING ROSE PENDANT	P1 lights	LED/CFL	66.90	12.00

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]**	1557.25
Standard number of occupants	2.78	**Temperature factor unadjusted**	0.89
Number of mixer showers	2	**Temperature Factor Multiplier**	0.89
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]	99.31	**Combi-boiler electricity consumption [kWh/y]**	0.00
Hot water energy reqs. at taps [kWh/y]	1323.66	**Adjusted storage loss [kWh/y]**	332.48
Distribution losses [kWh/y]	233.59	**Adjusted primary circuit loss [kWh/y]**	0.00
Water storage volume [Litres]	170.00	**Heat gains from water heating system [W]**	89.47
Is manufacturers declared loss factor available?	Yes	**Output from supplementary heater [kWh/y]**	0.00
Declared loss factor [kWh/d]	1.15		
Manufacturer and Model name	Comfort Zone EX35		
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 :			63.28				0.00

Combi-boiler Type	None	**Output from main water heater [kWh/y]**	1889.74
Combi-boiler loss [kWh/y]	0.00	**Annual Heat gains from water heating system [kWh/y]**	783.77
Keep Hot facility	None	**WWHRS input to main system [kWh/y]**	0.00
Storage Loss	332.48	**WWHRS input to supplementary system [kWh/y]**	0.00
Storage Type	Integrated thermal store and gas-fired CPSU		

Primary Circuit loss type Boiler and thermal store within a single casing (cylinder thermostat present)

Primary circuit loss [kWh/y]	0.00	**Heat Pump Type of DHW**	Integral Hot Water Storage
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	34.29	**Heat use during heating season [kWh/y]**	1752.99
Required mean internal temperature [C]	19.03	**Heat use for full year [kWh/y]**	1758.20
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]	21.00	11.55

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	18.12	1092	425	0.48	0.99	572	521	90
February	5.5	18.13	1076	320	0.57	0.98	476	601	177
March	7.0	18.23	957	180	0.81	0.92	242	715	341
April	8.3	18.32	854	58	1.17	0.78	81	773	561
May	11.0	18.50	639	6	1.90	0.52	9	630	782
June	13.5	18.66	440	1	2.88	0.35	1	439	832
July	15.5	18.80	281	0	4.26	0.23	0	281	762
August	15.2	18.78	305	0	3.53	0.28	0	304	641
September	13.3	18.65	456	4	1.90	0.52	6	450	431
October	10.4	18.46	687	85	0.97	0.86	114	573	230
November	7.5	18.27	917	277	0.59	0.98	385	533	110
December	6.0	18.17	1037	401	0.48	0.99	539	497	67

Space Heating

Manufacturer & Model	Type	Space Heating Standard	Fuel	Design flow temp[°C]	Daily Operation [h]	SH Seasonal eff.	WH Seasonal eff.	Heats water
Unitherm, EX35	Heat pumps	I.S. EN 14825	Electricity	40	24	502.28	251.86	Yes

Heating System Test data: I.S. EN 14825

Heat Pump Type Exhaust Air to Water

Test Condition - Low (35°C)

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-10
Sink	W34	W30	W27	W24	W35
Heating Capacity (kW)	3.50	2.30	1.55	1.30	3.10
Coefficient of Performance (kW/kW)	3.20	4.55	5.60	5.70	3.10

Test Condition - High (55°C) *

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-10
Sink	W52	W42	W36	W30	W55
Heating Capacity (kW)	3.60	2.50	1.65	1.50	3.20
Coefficient of Performance (kW/kW)	2.40	3.20	4.10	4.40	2.30

Heating System Test data: I.S. EN 16147

Source of Data Water heating energy efficiency, nwh [%]
Co-efficient of Performance [kW/kW] 0.00
Water heating energy efficiency, nwh [%] 118.00
Reference Hot water Temperature [°C] 53.60
Capacity of Heat Pump [kW] 3.50
Declared load profile L
Standby Heat Loss [kWh/day] 1.15
Volume of DHW accounted for in test [litre] 170
Heat Pump Type Exhaust Air to Water

Dist. System Losses and Gains

Temperature adjustment [C]	0	Additional heat emissions due to non ideal control and responsiveness [kWh/y]	152.47
Heating system control category	2		
Heating system responsiveness category	1	Gross heat emission to heated space [kWh/y]	2181.48
Mean internal temperature during heating hours [C]	19.36	Mean internal temperature [C]	18.58

	Number present	Boiler controlled by thermostat	Inside dwelling	Electricity consumption [kWh/y]	Heat gain [W]
Central heating pumps	1	Yes	Yes	26	10
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				26	10

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	58	Is there underfloor heating on the ground floor?	No
Average utilisation factor, October to May	0.92	U-Value of ground floor [W/m^{2}K]	0.00
Useful net gain [kWh/y]	54	Fraction of heating system output from ground floor	1.00
Net heat emission to heated space [kWh/y]	2128	Additional heat loss via envelope element	0.00
		Annual space heating requirement [kWh/y]	2128

Energy Requirements: Individual Heating Systems

Efficiency of main heating system [%]	502.28	Fraction of heat from secondary system	N/A
Manufacturer name	Unitherm	Efficiency of secondary system [%]	N/A
Model name	EX35	Energy required for main heating system [kWh/y]	423.63
Efficiency adjustment factor	1.00		
Adjusted efficiency of main heating system [%]	502.28	Energy required for secondary heating system [kWh/y]	0

Fraction of main space and water heat from CHP	N/A	**Efficiency adjustment factor**	1.0000
Heat demand from CHP	0.0	**Adj. efficiency of main water heating system [%]**	251.86
Efficiency of main water heating system [%]	251.86	**Water Heating Efficiency, ηwh**	118
		Energy req. for main water heater [kWh/y]	1560.65
Manufacturer name	Unitherm	**Energy req. for secondary water heater [kWh/y]**	0.00
Model name	EX35		
Heat Pump Type	Exhaust Air to Water	**Water Heating Standard**	I.S. EN 16147

	Fuel Type	Primary energy conversion factor	CO_2 emission factor
Main space heating system	Electricity	2.08	0.409
Secondary space heating system	None	0.00	0.000
Main water heating system	Electricity	2.08	0.409
Pumps, fans	Electricity	2.08	0.409
Energy for lighting	Electricity	2.08	0.409

CHP data

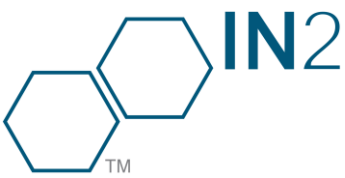
Heat output from CHP [kWh/y]	0.00	**CHP Fuel type**	N/A
Electrical efficiency of CHP		**Energy delivered to CHP [kWh/y]**	0
Heat efficiency of CHP		**Electrical output from CHP [kWh/y]**	0

Summer internal gains

Dwelling volume [m^3]	252.000	Total gains in summer [W]	908.58
Effective air change rate for summer period [ac/h]		Temperature increment due to gains [C]	26.98
Ventilation heat loss coefficient [W/K]	0.00	Summer mean external temperature [C]	19.43
Fabric heat loss coefficient [W/K]	33.67	Heat capacity parameter	0.20
Heat loss coefficient under summer conditions [W/K]	33.67	Temperature increment related to thermal mass [C]	0.60
Total Solar Gains from Summer Period	473.41	Threshold internal temperature [C]	46.58
Internal gains [W]	435.18		

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kgCO_2/y]
Main space heating system	424	881	173
Secondary space heating system	0	0	0
Main water heating system	750	1561	307
Supplementary water heating system	0	0	0
Pumps and fans	125	260	51
Energy for lighting	227	473	93
CHP input (individual heating systems only)	0	0	0
CHP electric output (individual heating systems only)	0	0	0
Renewable and energy saving technologies			
Energy produced and saved	0	0	0
Energy consumed by the technology	0	0	0
Total	1526	3174	624
Per m^2 floor area	14.53	30.23	5.94
Energy Rating	A2		



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