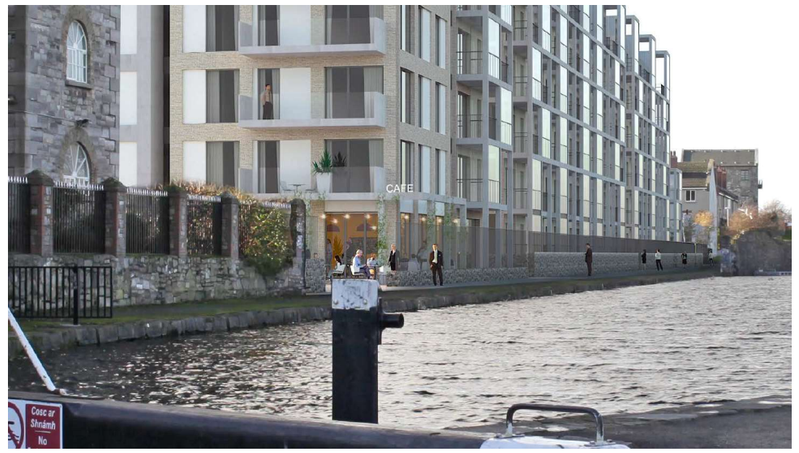
CrossGuns Bridge Residential

Phibsborough,
Dublin 7
Co. Dublin



Energy Analysis Report

IN2 Project No. D2012
22/01/2021
REV02

Revision History

Date	Revision	Description
24/11/2020	00	Initial issue for client review
18/01/2021	01	Project description updated
22/01/2021	02	Project description updated

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

Company Registration No.: 466565

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1.0 Executive Summary

This report summarises the Energy Analysis undertaken for the proposed development at Crossguns Bridge, Dublin.

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.

The analysis determined that either of the two following energy and servicing strategies should enable compliance for the Apartments to Part L 2019/ NZEB and that an A2 BER be obtainable:

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

De-Centralised Heating and Hot Water Plant arrangement to each apartment.

Exhaust Air Heat Pumps (EAHP’s)/Centralised plant delivering the annual heating and hot water

Exhaust Air Heat Pump/Heat Recovery Unit extracting stale air from apartment creating negative pressure. Passive make-up air from ducts passing façade supply fresh air to space.

In the case of a decentralised solution, the landlord areas will be served with a renewable technology in the form of heat pumps or split units in order to comply with the requirements set out in Part-L of the building regulations.

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

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.

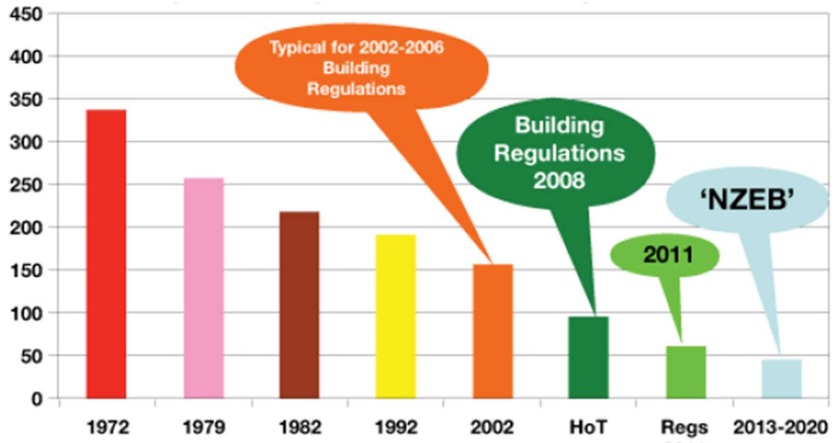

Figure 2.1.1 - Primary Energy Consumption in Irish Housing 1972-2020

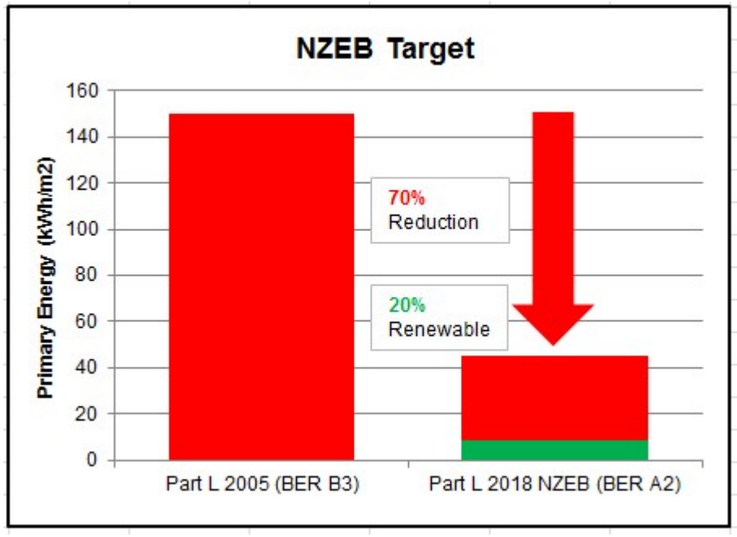

Figure 2.1.2 - NZEB Targets

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.

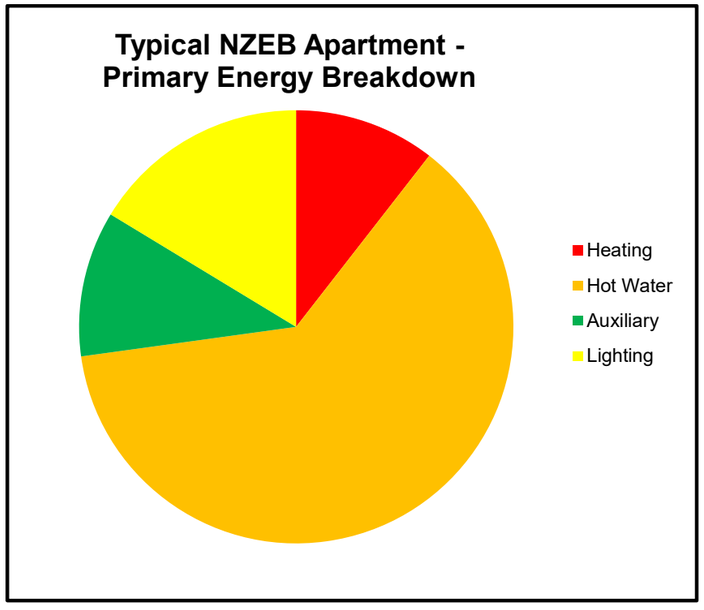

Figure 2.2.1 -Primary Energy Breakdown

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:

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	0.18 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	0.08 W/m^{2}k (ACD's)	0.08 W/m^{2}k

Glazing Parameters	
Total Solar Heat Transmittance	0.60
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.

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).

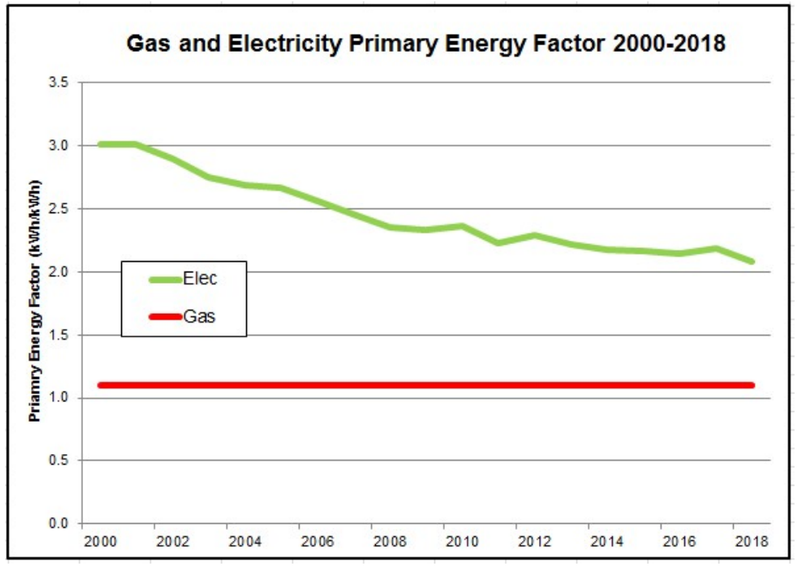

Figure 2.3.1 – Primary Energy Factors

2.4 Renewable Technologies

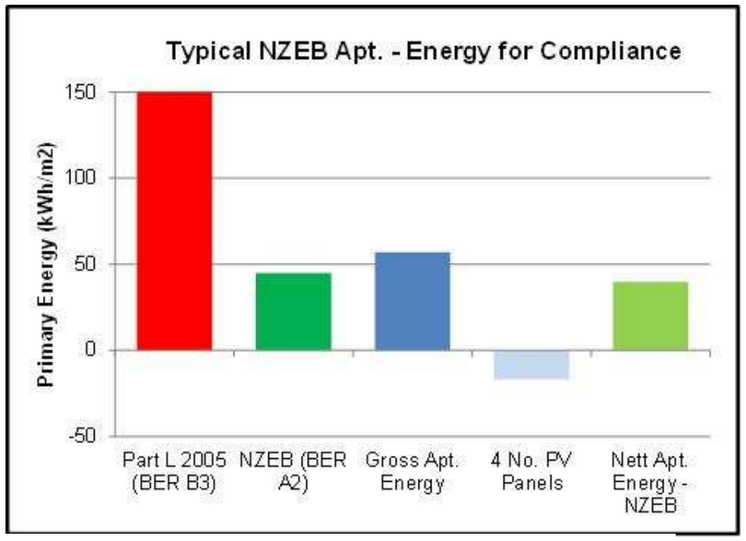

Figure 2.4.1 -EPC Compliance for Typical Apartment

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

The Crossguns Bridge Development will avail of one of two system types which are 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 first of the two systems analysed for the development is a de-centralised system in the form of an Exhaust Air Heat pump. Details of this system can be found in the table below:

De-centralised Option	
Element	
Method of Heat Generation	Exhaust Air Heat Pump
Model	Comfortzone EX35
Ventilation Method	T12 Fresh Air Unit
Fuel	Electricity
Heating Flow Temperature	40^{O}C
Hot Water Flow Temperature	60^{O}C

The final of the two systems analysed for the development is a centralised system in the form of an Air Source Heat pump supplemented with a cascade boiler system and CHP. Details of this system can be found in the table below:

Centralised Option	
Element	
Method of Heat Generation	Air Source Heat Pump, Cascade Boilers and CHP
Model(s)	Daikin Air Source Heat Pump, Wessex ModuMax Boilers, Dachs Micro-CHP in Basement Plantroom. Heat Interface Unit in each apartment.
Ventilation Method	Heat Recovery Unit
Fuel	Electricity & Gas
Heating Flow Temperature	65^{O}C
Hot Water Flow Temperature	60^{O}C

3.2 Part-L Compliance (De-centralised)

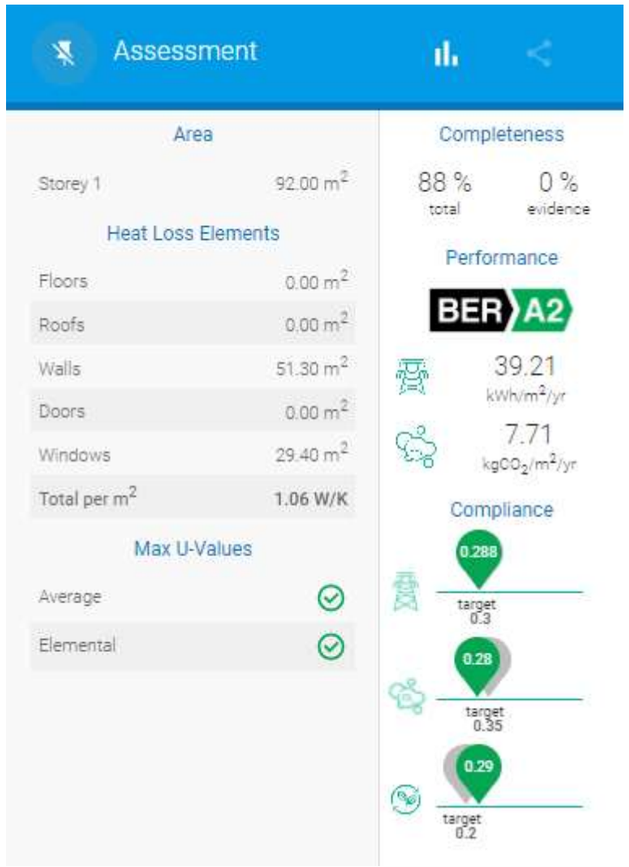

Figure 3.2.1 -Part-L Compliance - Primary Energy Breakdown

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

3.3 Part-L Compliance (Centralised)

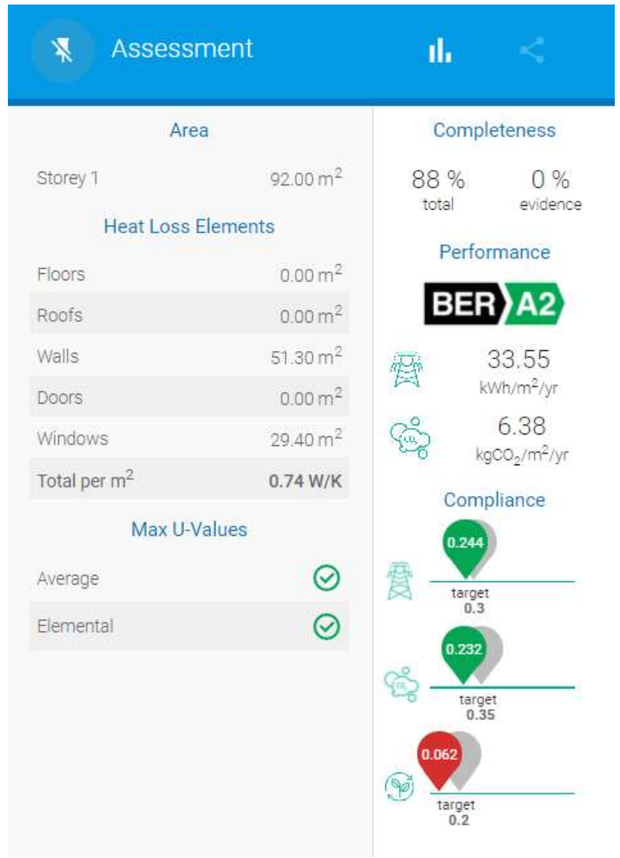

Figure 3.3.1 -Part-L Compliance - Primary Energy Breakdown

Figure 3.3.1 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

From figure 3.3.1, it is clear that the renewable energy ratio, RER, shown is not sufficient to meet the requirement within DEAP 4.2.1.

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 3.4.1.

Figure 3.4.1 shows that a centralised system, as designed, complies with the regulations for the Cross Guns Bridge Development.

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	729.23
Total renewables primary energy from DEAP software	270.96
Total Primary Energy from DEAP software	4377.24
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.20**

Figure 3.4.1 -Adjusted RER

4.0 Appendix

4.1 De-Centralised DEAP Results

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Dwelling Details Report
Date report created: 24/11/2020
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Property details

MPRN		Shared MPRN	
BER Number	N/A	BER number assigned to shared dwelling	N/A
Address line 1		Type of Rating	New Dwelling - Provisional
Address line 2		Purpose of Rating	Sale
Address line 3		Building Regulations	2019 TGD L
County		Planning Reference	
Eircode		Date of Plans	
Dwelling Type	Ground-floor apartment	Assessor Name	
Year of construction	2020	Date of Assessment	24/11/2020
Dwelling Extension	N/A	Assessor Comments	
Storeys	1	Assessor Description	Crossguns de-centralised System (Copy)

Dimension details

	Area [m²]	Height [m]	Volume [m³]
Ground floor	92.00	2.70	248.40
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	92.00		248.40

Living Area	39.00 m²	Living Area Percentage	42.39 %

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	0.19	Openings infiltration [ac/h]	0.04
Number of sides sheltered	2	Structure type	N/A
Adjusted infiltration rate	0.16	Is there a suspended wooden ground floor?	No
Effective air change rate [ac/h]	0.52		
Ventilation heat loss [W/K]	42.96	Windows/doors/attic hatches draught stripped [%]	N/A
Adjusted result of air permeability test [ac/h]	0.15	Ventilation method	Exhaust Air Heat Pump
Exhaust air flow rate [m³/h]	160.00	How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?	N/A
Manufacturer and Model name	N/A		
Specific fan power [W/(l/s)]	0.26	Is MVHR ducting uninsulated where outside of insulated envelope?	N/A
Heat exchanger efficiency [%]	0.00	Adjusted heat exchanger efficiency	0.00
Electricity for ventilation fans [Kwh/y]	82.35		
Heat gains from ventilation fans [W]	0.00		

Building Elements - Floors

Type	Description	U/F Heating	In Roof	Age Band	Exposed Perimeter [m]	Area [m²]	U-Value [W/m²K]	Heat Loss (AU) [W/K]
Non-Heat Loss Floor		N/A	No	2005 -2009	N/A	92.00	0.00	0.00
Total area [m²]								92.00

Building Elements - Roofs

Type	Description	Insulation Thickness [mm]	Age Band	Area [m²]	U-Value [Wm²K]	Heat Loss (AU) [W/K]
Total area [m²]						0.00

Building Elements - Walls

Type	Description	Wall is semi-exposed	Include in compliance check	Age Band	Area [m²]	U-Value [W/m²K]	Heat Loss (AU) [W/K]
225mm Solid Brick		No	No	2005 -2009	51.30	0.18	9.23
Total area [m²]							51.30

Building Elements - Doors

Count	Type	Description	Draught Stripped	Area [m²]	U-Value [W/m²K]	Heat Loss (AU) [W/K]
Total area [m²]						0.00

Building Elements - Windows

Count	Glazing Type	Frame Type	Frame Factor	Solar Transm.	In Roof	Over shading	Orient.	Area [m²]	U-value [Wm²K]
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	Northwest	12.50	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	Southeast	8.30	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	Northeast	8.60	1.40
Total area [m²]									29.40

Heat loss details

Total glazed area [m²]	29.40	Glazing ratio	0.16
Total glazed heat loss [W/K]	38.98	Summer solar gain [W/m²]	1157.68
Total effective collection area [m²]	11.67	Total element area [m²]	80.7
Total plane heat loss [W/K]	48.21	Thermal bridging factor [W/m²K]	0.0600
Fabric heat loss [W/K]	54.67		
Total heat loss [W/K]	97.62	Per m2	1.06

Lighting and Internal Gains

Lighting Design Calculation Method	Lighting Design	Average Efficacy [lm/W]	91.00
Fixed lighting provision [kWh/y]	2038.39	Top up lighting requirement [kWh/y]	0.00
Energy required for fixed lighting [kWh/y]	62.80	Energy required for top up lighting [kWh/y]	0.00
Energy required for portable lighting [kWh/y]	134.15		
Basic energy consumption for lighting [kWh/y]	797.27	Water heating (in watts [W])	103.58
Annual energy used for lighting [kWh/y]	196.95	Occupants (in watts [W])	132.61
Internal gains from lighting during heating season [kWh/hs] (in watts [W])	150.67 (25.83)	Mechanical ventilation (in watts [W])	0.00
Lighting (in watts [W])	25.83	Heat loss to the cold water network (in watts [W])	-37.87
Appliance and cooking (in watts [W])	197.79	Net internal gains (in watts [W])	421.94

Lights

Count	Name	Description	Type	Efficiency	Power [W]
1	2 Bed Bulb		LED/CFL	66.90	119.00

Water heating details

Are there distribution losses?	Yes	Is supplementary electric water heating used in summer?	NA
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]	1740.27
Standard number of occupants	2.65	Temperature factor unadjusted	0.89
Number of mixer showers	1	Temperature Factor Multiplier	1.10
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]	110.96	Combi-boiler electricity consumption [kWh/y]	0.00
Hot water energy reqs. at taps [kWh/y]	1479.23	Adjusted storage loss [kWh/y]	410.94
Distribution losses [kWh/y]	261.04	Adjusted primary circuit loss [kWh/y]	0.00
Water storage volume [Litres]	200.00	Heat gains from water heating system [W]	103.58
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	ComfortZone		
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]
Vented hot water system	Yes	6.000		Any / Any			
Total :			47.75				0.00

Combi-boiler Type	None	Output from main water heater [kWh/y]	2151.20
Combi-boiler loss [kWh/y]	0.00	Annual Heat gains from water heating system [kWh/y]	907.39
Keep Hot facility	None	WWHRS input to main system [kWh/y]	0.00
Storage Loss	410.94		
Storage Type	Integrated thermal store and gas-fired CPSU	WWHRS input to supplementary system [kWh/y]	0.00
Primary Circuit loss type	None		
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		

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Net space heat demand

Required temp. during heated hours	21.00	Length of one unheated period [h]	6
Required temperature rest of dwelling	18.00	Unheated periods per week	14
Living area percentage	42.39	Heat use during heating season [kWh/y]	1793.18
Required mean internal temperature [C]	19.27	Heat use for full year [kWh/y]	1800.80
Thermal mass category of dwelling	Medium		

	Utilisation factor	Intermittent heating
Internal heat capacity of dwelling [per m²]	0.20	0.11
Internal heat capacity [MJ/K]	18.40	10.12

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	18.09	1249	461	0.52	0.97	620	629	223
February	5.5	18.11	1231	311	0.66	0.94	463	768	395
March	7.0	18.23	1097	160	0.97	0.83	216	881	637
April	8.3	18.34	980	54	1.39	0.66	75	906	943
May	11.0	18.57	739	8	2.24	0.44	11	726	1231
June	13.5	18.78	516	1	3.27	0.30	2	514	1264
July	15.5	18.95	337	0	4.73	0.21	0	337	1172
August	15.2	18.93	364	0	4.02	0.25	1	363	1039
September	13.3	18.77	534	6	2.24	0.44	8	526	773
October	10.4	18.52	793	76	1.15	0.75	102	691	493
November	7.5	18.28	1052	264	0.67	0.94	394	658	278
December	6.0	18.15	1186	439	0.52	0.97	590	596	189

Space Heating

Manufacturer & Model	Type	Space Heating Standard	Fuel	Design flow temp[°C]	Daily Operation [h]	SH Seasonal eff.	WH Seasonal eff.	Heats water
ComfortZone, EX35	Heat pumps	I.S. EN 14825	Electricity	45	24	428.64	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 [%] 116.00
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] 200
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]	150.12
Heating system control category	2		
Heating system responsiveness category	1	Gross heat emission to heated space [kWh/y]	1943.31
Mean internal temperature during heating hours [C]	19.56	Mean internal temperature [C]	18.55

	Number present	Boiler controlled by thermostat	Inside dwelling	Electricity consumption [kWh/y]	Heat gain [W]
Central heating pumps	1	Yes	Yes	25	10
Oil boiler pumps	0	No	No	0	0
Gas boiler flue fan	0			0	
Warm air heating or fan coil radiators present	Yes			149.04	14.904
Totals				175.04	24.904

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	145	Is there underfloor heating on the ground floor?	No
Average utilisation factor, October to May	0.81	U-Value of ground floor [W/m²K]	0.00
Useful net gain [kWh/y]	118	Fraction of heating system output from ground floor	1.00
Net heat emission to heated space [kWh/y]	1825	Additional heat loss via envelope element	0.00
		Annual space heating requirement [kWh/y]	1825

Energy Requirements: Individual Heating Systems

Efficiency of main heating system [%]	428.64	Fraction of heat from secondary system	NA
Manufacturer name	ComfortZone	Efficiency of secondary system [%]	NA
Model name	EX35	Energy required for main heating system [kWh/y]	425.75
Efficiency adjustment factor	1.00		
Adjusted efficiency of main heating system [%]	428.64	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
Manufacturer name	ComfortZone	Energy req. for main water heater [kWh/y]	1776.58
Model name	EX35	Energy req. for secondary water heater [kWh/y]	0.00
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

	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

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]	248.400	Total gains in summer [W]	1579.62
Effective air change rate for summer period [ac/h]		Temperature increment due to gains [C]	28.90
		Summer mean external temperature [C]	19.43
Ventilation heat loss coefficient [W/K]	0.00	Heat capacity parameter	0.20
Fabric heat loss coefficient [W/K]	54.67	Temperature increment related to thermal mass [C]	0.60
Heat loss coefficient under summer conditions [W/K]	54.67	Threshold internal temperature [C]	48.50
Total Solar Gains from Summer Period	1157.68		
Internal gains [W]	421.94		

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kgCO_2/y]
Main space heating system	426	886	174
Secondary space heating system	0	0	0
Main water heating system	854	1777	349
Supplementary water heating system	0	0	0
Pumps and fans	257	535	105
Energy for lighting	197	410	81
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	1734	3607	709
Per m^2 floor area	18.85	39.21	7.71
Energy Rating	A2		

4.2 Centralised DEAP Results

IN2 Engineering Design
Unit E&F
Mount Pleasant Business Park
Upper Mount Pleasant Avenue
Dublin 6
(01) 496 0900

info@in2.ie

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	(copy) (copy)	**Building Regulations**	2019 TGD L
County		**Planning Reference**	
Eircode		**Date of Plans**	
Dwelling Type	Ground-floor apartment	**Assessor Name**	
Year of construction	2020	**Date of Assessment**	24/11/2020
Dwelling Extension	No	**Assessor Comments**	
Storeys	1	**Assessor Description**	Crossguns Centralised System (Copy)

Dimension details

	Area [m^2]	Height [m]	Volume [m^3]
Ground floor	92.00	2.40	220.80
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	92.00		220.80

Living Area	39.00 m^2	**Living Area Percentage**	42.39 %

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
Infiltration rate due to structure [ac/h]	0.15
Intermediate infiltration rate	0.20
Number of sides sheltered	2
Adjusted infiltration rate	0.17
Effective air change rate [ac/h]	0.22
Ventilation heat loss [W/K]	15.74
Adjusted result of air permeability test [ac/h]	0.15

Is there a draught lobby on main entrance?	Yes
Draught lobby air change [ac/h]	0.00
Openings infiltration [ac/h]	0.05
Structure type	N/A
Is there a suspended wooden ground floor?	No
Windows/doors/attic hatches draught stripped [%]	N/A
Ventilation method	Balanced whole-house mechanical ventilation with heat recovery

Manufacturer and Model name	N/A
Specific fan power [W/(l/s)]	0.40
Heat exchanger efficiency [%]	90.00
Electricity for ventilation fans [Kwh/y]	107.75
Heat gains from ventilation fans [W]	5.30

How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?	N/A
Is MVHR ducting uninsulated where outside of insulated envelope?	No
Adjusted heat exchanger efficiency	90.00

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		N/A	No	2010 onwards	N/A	92.00	0.00	0.00
Total area [m^2]								92.00

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	No	2005 -2009	51.30	0.18	9.23
Total area [m^2]							51.30

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	0.630	No	Very Little	Northwest	12.50	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	Southeast	8.30	1.40
1	Double-glazed, air filled (low-E, en = 0.05, soft coat)	Wood/PVC	0.700	0.630	No	Very Little	Northeast	8.60	1.40
Total area [m^2]									29.40

Heat loss details

Total glazed area [m^2]	29.40	**Glazing ratio**	0.16
Total glazed heat loss [W/K]	38.98	**Summer solar gain [W/m^2]**	1157.68
Total effective collection area [m^2]	11.67	**Total element area [m^2]**	80.7
Total plane heat loss [W/K]	48.21	**Thermal bridging factor [W/m^2K]**	0.0500
Fabric heat loss [W/K]	52.25		
Total heat loss [W/K]	67.98	**Per m2**	0.74

Lighting and Internal Gains

Lighting Design Calculation Method	Lighting Design	**Average Efficacy [lm/W]**	91.00
Fixed lighting provision [klmh/y]	2038.39	**Top up lighting requirement [klmh/y]**	0.00
Energy required for fixed lighting [kWh/y]	62.80	**Energy required for top up lighting [kWh/y]**	0.00
Energy required for portable lighting [kWh/y]	134.15		
Basic energy consumption for lighting [kWh/y]	797.27	**Water heating (In watts [W])**	96.77
Annual energy used for lighting [kWh/y]	196.95	**Occupants (In watts [W])**	132.61
Internal gains from lighting during heating season [kWh/hs] (In watts [W])	150.67 (25.83)	**Mechanical ventilation (In watts [W])**	5.30
Lighting (In watts [W])	25.83	**Heat loss to the cold water network (In watts [W])**	-37.87
Appliance and cooking (In watts [W])	197.79	**Net internal gains (In watts [W])**	420.43

Lights

Count	Name	Description	Type	Efficiency	Power [W]
1	2 Bed Bulb		LED/CFL	66.90	119.00

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]**	1509.50
Standard number of occupants	2.65	**Temperature factor unadjusted**	1.00
Number of mixer showers	1	**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]	96.26	**Combi-boiler electricity consumption [kWh/y]**	0.00
Hot water energy reqs. at taps [kWh/y]	1283.08	**Adjusted storage loss [kWh/y]**	132.86
Distribution losses [kWh/y]	226.43	**Adjusted primary circuit loss [kWh/y]**	299.35
Water storage volume [Litres]	4.00	**Heat gains from water heating system [W]**	96.77
Is manufacturers declared loss factor available?	Yes	**Output from supplementary heater [kWh/y]**	0.00
Declared loss factor [kWh/d]	0.36		
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 :			61.34				0.00

Combi-boiler Type	None	**Output from main water heater [kWh/y]**	1941.71
Combi-boiler loss [kWh/y]	0.00	**Annual Heat gains from water heating system [kWh/y]**	847.67
Keep Hot facility	None	**WWHRS input to main system [kWh/y]**	0.00
Storage Loss	132.86	**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	42.39	**Heat use during heating season [kWh/y]**	644.81
Required mean internal temperature [C]	19.27	**Heat use for full year [kWh/y]**	645.04
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]	18.40	10.12

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	18.43	892	206	0.72	0.96	277	616	223
February	5.5	18.44	880	105	0.93	0.89	156	724	395
March	7.0	18.53	784	28	1.35	0.70	38	746	637
April	8.3	18.61	701	5	1.95	0.51	6	694	943
May	11.0	18.77	528	0	3.13	0.32	0	528	1231
June	13.5	18.92	369	0	4.57	0.22	0	369	1264
July	15.5	19.04	241	0	6.61	0.15	0	241	1172
August	15.2	19.03	260	0	5.61	0.18	0	260	1039
September	13.3	18.91	381	0	3.13	0.32	0	381	773
October	10.4	18.73	567	9	1.61	0.61	13	554	493
November	7.5	18.56	752	95	0.93	0.89	132	620	278
December	6.0	18.47	848	197	0.72	0.96	264	583	189

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]**	107.29
Heating system control category	2	**Gross heat emission to heated space [kWh/y]**	752.11
Heating system responsiveness category	1	**Mean internal temperature [C]**	18.84
Mean internal temperature during heating hours [C]	19.56		

	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	0.73	**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]	752	**Additional heat loss via envelope element**	0.00
		Annual space heating requirement [kWh/y]	752

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]	752.11	**Fraction of heat from CHP/recovered from power station**	
Percentage of heat from secondary system			
Efficiency of secondary system [%]	0		
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	Electricity	355.21	14	2.08	0.409
Heating System 2	Mains Gas	95	50	1.10	0.203
Heating System 3	Electricity	401.81	36	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]**	1727.44
		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	0.89	0.17

	Fuel Type	Primary energy conversion factor	CO_2 emission factor
Main space heating system	group heating scheme	0.89	0.17
Secondary space heating system	group heating scheme	0.89	0.17
Main water heating system	None	0.89	0.17
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]	220.800	**Total gains in summer [W]**	1578.11
Effective air change rate for summer period [ac/h]		**Temperature increment due to gains [C]**	30.21
Ventilation heat loss coefficient [W/K]	0.00	**Summer mean external temperature [C]**	15
Fabric heat loss coefficient [W/K]	52.25	**Heat capacity parameter**	0.20
Heat loss coefficient under summer conditions [W/K]	52.25	**Temperature increment related to thermal mass [C]**	0.60
Total Solar Gains from Summer Period	1157.68	**Threshold internal temperature [C]**	45.81
Internal gains [W]	420.43		

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [$kgCO_2/y$]
Main space heating system	752	669	126
Secondary space heating system	0	0	0
Main water heating system	1942	1727	325
Supplementary water heating system	0	0	0
Pumps and fans	135	280	55
Energy for lighting	197	410	81
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	3025	3086	587
Per m^2 floor area	32.89	33.55	6.38
Energy Rating	A2		