Carmanhall Road SHD 2022

Former Avid Technology International Site
Carmanhall Road
Sandyford Industrial Estate
Dublin 18

Energy Analysis Report

IN2 Project No. D2005
16/08/2022
REV04

Revision History

Date	Revision	Description
15/12/2021	00	Initial issue for client review
21/03/2022	01	Planning Issue
11/07/2022	02	Project Description Update
29/07/2022	03	Project Description Update
16/08/2022	04	Updated for planning submittal

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1.0 Executive Summary

This report summarises the Energy Analysis undertaken for the proposed development at the former ‘Avid Technology International’ site.

Energy analysis has been undertaken in order to demonstrate compliance to Building Regulations Technical Guidance Document (TGD) Part L 2021. Section 2.0 gives a brief overview of the development. Section 3 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 2021. 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 4.0 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 a centralised heating plant solution should enable compliance for the Apartments to Part L 2021/ 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.

The report prepared by Enviroguide should be referenced for further information with regards to climate change and the impact of the overall development.

2.0 Project Description

Atlas GP Limited, intend to apply to An Bord Pleanála for planning permission for a strategic housing development at this site of c.0.99 ha at the ‘Former Avid Technology site’, at the junction of Blackthorn Road and Carmanhall Road Sandyford, Dublin 18.

The proposed development consists of 334 Build to Rent residential apartment units within 4 no. apartment blocks and as follows:

- 79 No. Studio
- 175 No. 1 bed
- 80 No. 2 bed

- All residential units provided with private balconies/terraces to the north/south/east and west elevations
- Crèche 272 sq.m.
- Residential amenity spaces 893 sq.m. (including resident’s gym, business centre, multipurpose room, staff facilities, multimedia/cinema room, shared working space, concierge and games room)
- Height ranging from 5 to 16 storeys (over basement)
- Landscaped communal space in the central courtyard
- Provision of a new vehicular entrance from Ravens Rock Road and egress to Carmanhall Road
- Provision of pedestrian and cycle connections
- 125 No. Car Parking, 6 No. Motorcycle Parking and 447cycle spaces at ground floor/under croft and basement car park levels
- Plant and telecoms mitigation infrastructure at roof level

The development also includes 2 no. ESB substations, lighting, plant, storage, site drainage works and all ancillary site development works above and below ground

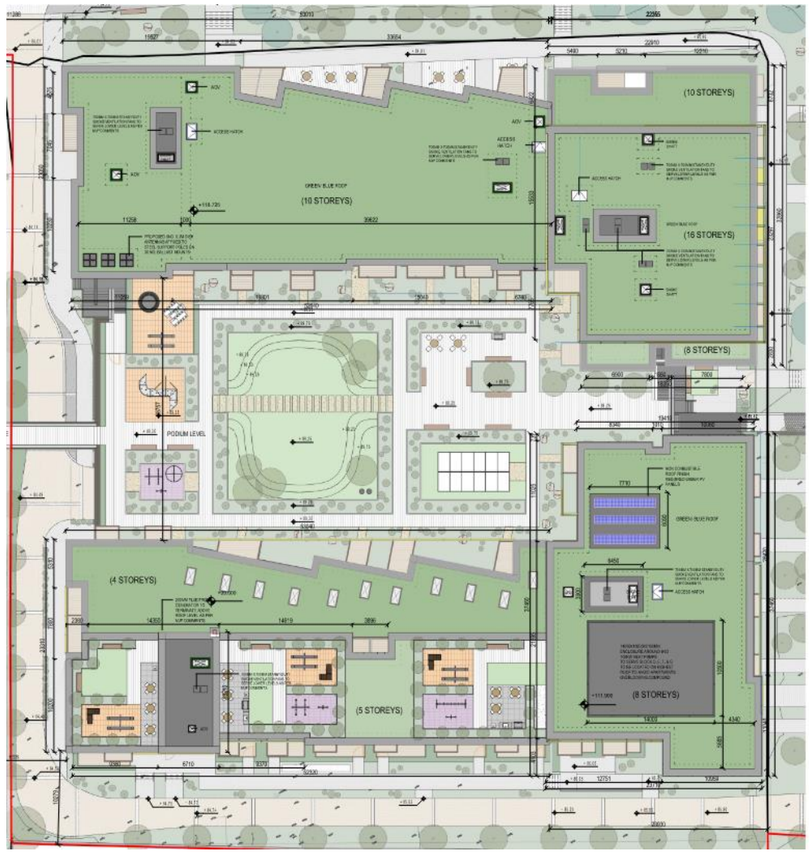

Figure 2.1.2 – Proposed Residential Development

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 3.1.1 above illustrates comparative Primary Energy (see Section 3.3) 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. This Directive was further amended in 2018 and 2019. The amendments have been included in the latest Part L 2021 building regulations which include minimum requirements for Electric Vehicle charging stations to all new developments.

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 2021, as discussed below.

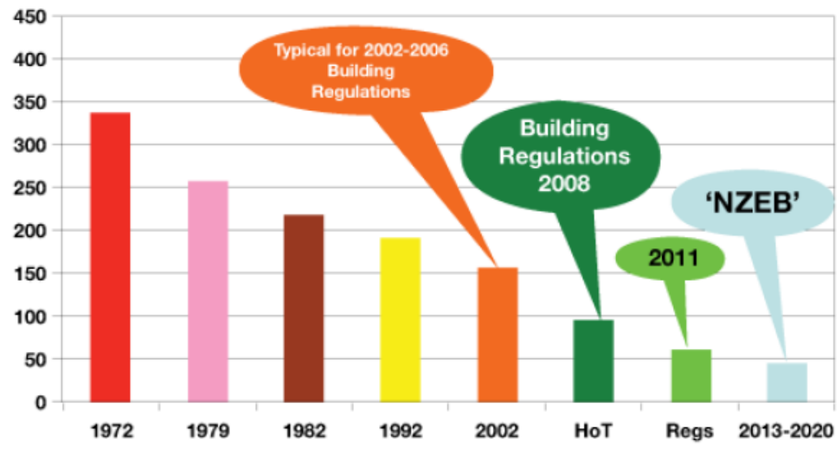

Figure 3.1.1 – Primary Energy Consumption in Irish Housing 1972-2020

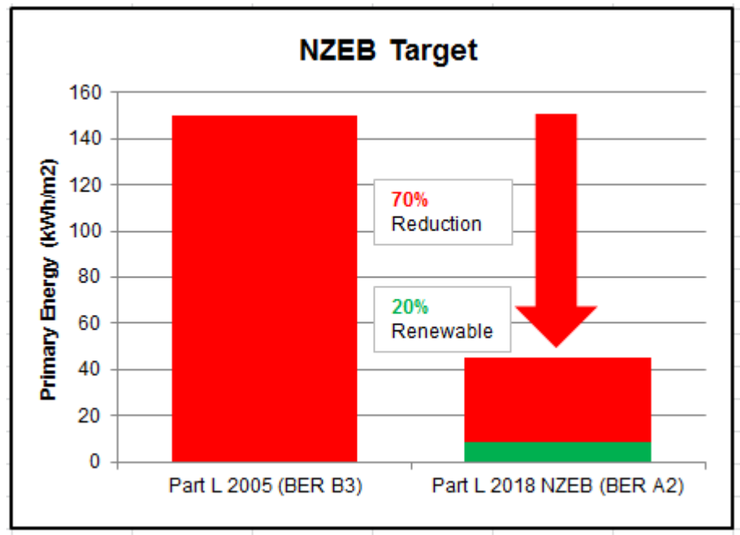

Figure 3.1.2 – NZEB Targets

3.2 Part L 2021

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.

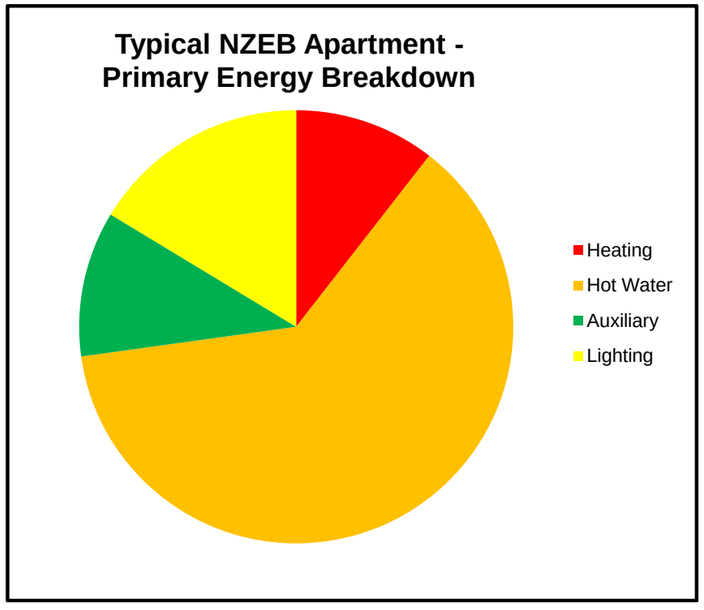

Figure 3.2.1 –Primary Energy Breakdown

Figure 3.2.1 above indicates an energy breakdown for a typical apartment (100m^2, local gas-fired boiler) compliant to NZEB/ Part L 2021. 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 2021:

- 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 2021:

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	0.60
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.

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 3.3.1 below, 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).

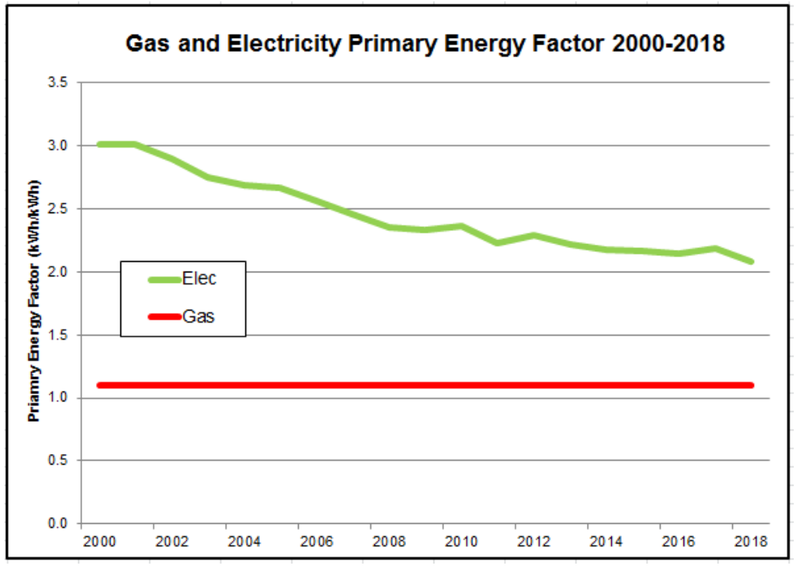

Figure 3.3.1 –- Primary Energy Factors

3.4 Renewable Technologies

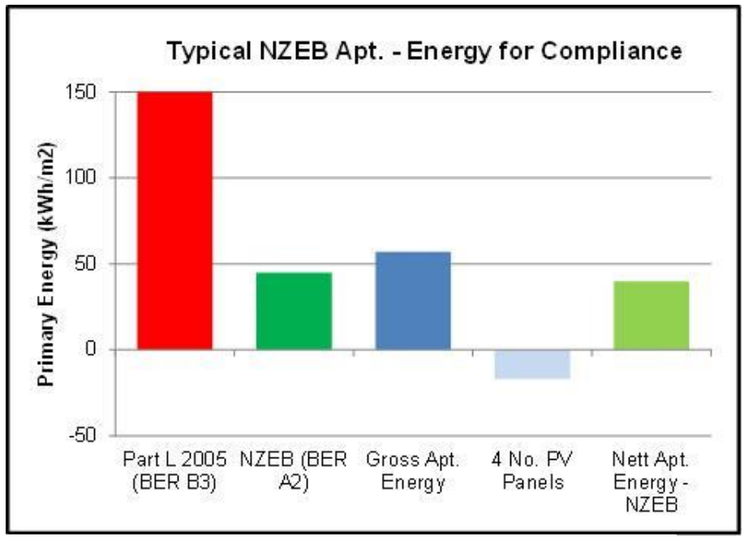

Figure 3.4.1 – EPC Compliance for Typical Apartment

In addition to improving heating energy related aspects, renewable technologies will be utilised to significantly reduce Primary Energy requirements (in addition to ensuring the renewable energy percentage is achieved). Figure 3.4.1 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).

3.5 Electric Vehicle Charging

The Directive amending the Energy Performance of Buildings Directive (2018/844/EU) introduces the requirement to provide Electric Vehicle (EV) charging points to all new developments. The Part L building regulations 2021 reflect this, including a requirement to provide EV Charging to a minimum of 10% of the parking spaces. There is also a requirement to provide EV charging infrastructure, comprising cable ducting systems, cable ladders, cable trays, cable trunking systems, conduit, etc., to every parking space.

The Dun Laoghaire Rathdown County Council (DLRCC) Development Plan 2022 – 2028 includes a further requirement to provide EV Charging to 20% of all parking spaces.

The Carmanhall development will comply with both the Part L 2021 and the DLRCC Development Plan requirements.

4.0 DEAP Methodology and Analysis

4.1 DEAP Parameters

The Carmanhall Road Development will avail of a centralised heating plant option. Details of this are outlined in the Table 4.1.1 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.

Centralised Option	
Element	
Method of Heat Generation	Air Source Heat Pump
Model(s)	Kronotherm Air Source Heat Pump or Aqua Snap Heat Pump. 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

Table 4.1.1 –Centralised Plant Details

4.2 Part-L Compliance (Centralised)

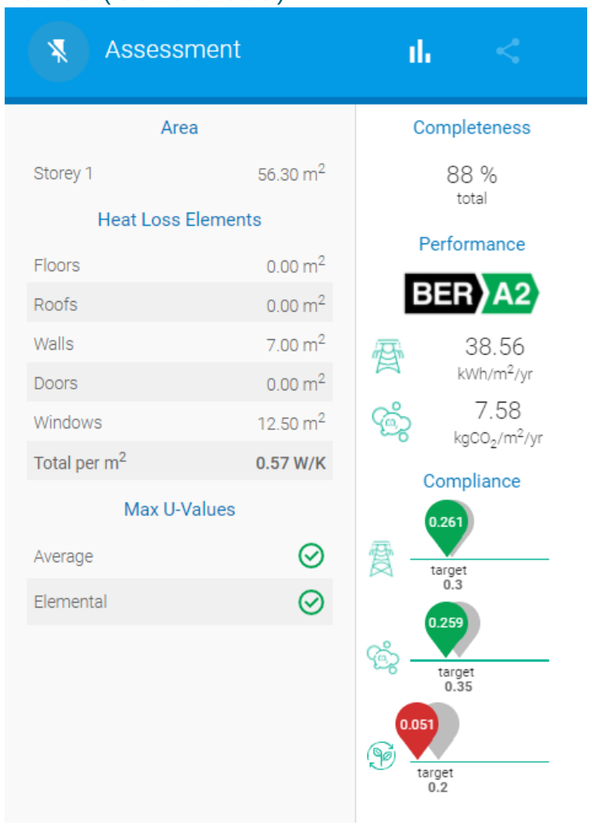

Figure 4.2.1 – Part-L Compliance – Primary Energy Breakdown

Figure 4.2.1 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 4.2.1, it is clear 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 4.3.1.

Figure 4.3.1 shows that a centralised system, as designed, complies with the regulations for the Avid Residential 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	1122.80
Total renewables primary energy from DEAP software	160.28
Total Primary Energy from DEAP software	3126.71
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.30**

Figure 4.3.1 –Adjusted RER

5.0 Appendix

5.1 Centralised DEAP Results

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**	15/12/2021
Dwelling Extension	No	**Assessor Comments**	
Storeys	1	**Assessor Description**	Avid Residential Carmanhall Road

Dimension details

	Area [m^2]	Height [m]	Volume [m^3]
Ground floor	56.30	2.70	152.01
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	56.30		152.01

Living Area	29.30 m^2	**Living Area Percentage**	52.04 %

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	0.22	**Openings infiltration [ac/h]**	0.07
Number of sides sheltered	2	**Structure type**	N/A
Adjusted infiltration rate [ac/h]	0.18	**Is there a suspended wooden ground floor?**	No
Effective air change rate [ac/h]	0.23	**Windows/doors/attic hatches draught stripped [%]**	N/A
Ventilation heat loss [W/K]	11.71	**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 Sentinel B plus	**How many wetrooms (inc. kitchen)? Is the vent. ducting flexible/rigid/both?**	K+2
Specific fan power [W/(l/s)]	0.70	**Is MVHR ducting uninsulated where outside of insulated envelope?**	No
Heat exchanger efficiency [%]	90.00	**Adjusted heat exchanger efficiency**	90.00
Electricity for ventilation fans [Kwh/y]	129.82		
Heat gains from ventilation fans [W]	6.38		

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	56.30	0.00	0.00
Total area [m^2]								56.30

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	7.00	0.15	1.05
Total area [m^2]							7.00

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
Total area [m^2]									12.50

Heat loss details

Total glazed area [m^2]	12.50	**Glazing ratio**	0.11
Total glazed heat loss [W/K]	16.57	**Summer solar gain [W/m^2]**	461.4
Total effective collection area [m^2]	4.96	**Total element area [m^2]**	19.5
Total plane heat loss [W/K]	17.62	**Thermal bridging factor [W/m^2K]**	0.1500
Fabric heat loss [W/K]	20.55		
Total heat loss [W/K]	32.26	**Per m2**	0.57

Lighting and Internal Gains

Lighting Design Calculation Method	Lighting Design	**Average Efficacy [lm/W]**	91.00
Fixed lighting provision [klmh/y]	2244.27	**Top up lighting requirement [klmh/y]**	0.00
Energy required for fixed lighting [kWh/y]	42.31	**Energy required for top up lighting [kWh/y]**	0.00
Energy required for portable lighting [kWh/y]	90.39		
Basic energy consumption for lighting [kWh/y]	537.17	**Water heating (In watts [W])**	89.80
Annual energy used for lighting [kWh/y]	132.70	**Occupants (In watts [W])**	93.77
Internal gains from lighting during heating season [kWh/hs] (In watts [W])	101.51 (17.41)	**Mechanical ventilation (In watts [W])**	6.38
Lighting (In watts [W])	17.41	**Heat loss to the cold water network (In watts [W])**	-30.88
Appliance and cooking (In watts [W])	140.19	**Net internal gains (In watts [W])**	316.68

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]**	1410.18
Standard number of occupants	1.88	**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	1	**Volume factor**	0.00
Daily hot water use [Litres/d]	89.93	**Combi-boiler electricity consumption [kWh/y]**	0.00
Hot water energy reqs. at taps [kWh/y]	1198.66	**Adjusted storage loss [kWh/y]**	132.86
Distribution losses [kWh/y]	211.53	**Adjusted primary circuit loss [kWh/y]**	264.39
Water storage volume [Litres]	4.00	**Heat gains from water heating system [W]**	89.80
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 :			38.69				0.00

Combi-boiler Type	None	**Output from main water heater [kWh/y]**	1807.43
Combi-boiler loss [kWh/y]	0.00	**Annual Heat gains from water heating system [kWh/y]**	786.69
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	52.04	**Heat use during heating season [kWh/y]**	200.08
Required mean internal temperature [C]	19.56	**Heat use for full year [kWh/y]**	200.11
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]	11.26	6.19

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	18.88	438	65	0.85	0.94	88	350	56
February	5.5	18.89	432	36	0.99	0.89	54	378	110
March	7.0	18.96	386	8	1.37	0.71	11	375	211
April	8.3	19.03	346	1	1.92	0.52	1	345	347
May	11.0	19.15	263	0	3.04	0.33	0	263	484
June	13.5	19.27	186	0	4.46	0.22	0	186	515
July	15.5	19.37	125	0	6.32	0.16	0	125	471
August	15.2	19.35	134	0	5.33	0.19	0	134	397
September	13.3	19.26	192	0	3.03	0.33	0	192	267
October	10.4	19.13	281	2	1.63	0.61	3	279	143
November	7.5	18.99	371	27	1.04	0.86	38	333	68
December	6.0	18.92	417	60	0.86	0.94	81	336	41

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]**	0.00
Heating system control category	3	**Gross heat emission to heated space [kWh/y]**	200.08
Heating system responsiveness category	1	**Mean internal temperature [C]**	18.99
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	0.72	**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]	200	**Additional heat loss via envelope element**	0.00
		Annual space heating requirement [kWh/y]	200

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]	200.08	**Fraction of heat from CHP/recovered from power station**	0
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	496	10	2.08	0.409
Heating System 2	Electricity	264	90	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]**	1425.3
		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	0.79	0.16

	Fuel Type	Primary energy conversion factor	CO_2 emission factor
Main space heating system	group heating scheme	0.79	0.16
Secondary space heating system	Mains Gas	1.10	0.20
Main water heating system	group heating scheme	0.79	0.16
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]	152.010	**Total gains in summer [W]**	778.07
Effective air change rate for summer period [ac/h]		**Temperature increment due to gains [C]**	37.87
Ventilation heat loss coefficient [W/K]	0.00	**Summer mean external temperature [C]**	15
Fabric heat loss coefficient [W/K]	20.55	**Heat capacity parameter**	0.20
Heat loss coefficient under summer conditions [W/K]	20.55	**Temperature increment related to thermal mass [C]**	0.60
Total Solar Gains from Summer Period	461.40	**Threshold internal temperature [C]**	53.47
Internal gains [W]	316.68		

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kgCO_2/y]
Main space heating system	200	158	31
Secondary space heating system	0	0	0
Main water heating system	1807	1425	280
Supplementary water heating system	0	0	0
Pumps and fans	150	312	61
Energy for lighting	133	276	54
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	2290	2171	427
Per m^2 floor area	40.68	38.56	7.58
Energy Rating	A2		

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