1-4 East Road, Residential

Energy Statement

Glenveagh Living

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June 2019

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1-4 East Road, Residential Energy Statement

Glenveagh Living

CURRENT ISSUE			
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PREVIOUS ISSUES (Type Names)				
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P0	23/11/2018	Jamie Molony	PJ Ryan	Draft Issue for Planning
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P2	02/04/2019	Jamie Molony	PJ Ryan	Draft Issue for Planning
P3	19/04/2019	Jamie Molony	PJ Ryan	Issue for Planning

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1. Introduction

This Energy Statement prepared by Ethos Engineering is to form part of the planning submission documentation to An Bord Pleanala for the proposed East Road residential development.

Located at the address East Road, East Wall, Co. Dublin, the development is subject to the planning requirements applicable to the Dublin City Council Development Plan 2016-2022.

This report aims to satisfy the legislative planning requirements by addressing how the overall energy strategy of the proposed development has been approached in a holistic manner, striving to meet the highest standards of sustainable building design such as passive solar design, high efficiency systems and use of renewable energy technologies.

This report also addresses how the proposed development will comply with NZEB (Part L 2018 Dwellings). The principles underpinning Part L compliance are energy demand reduction through passive measures and increased supply from renewable and efficient sources. The proposed design will follow this principle.

Assessments carried out in this report are based on latest floor plans and elevations received from the architect.

1.1. Site and Building Summary

The subject site is located at East Road, East Wall, Co. Dublin.

The application consists of the demolition of all existing structures on site and the construction of a mixed use development with a gross floor area of c. 52,796 sq.m (excluding below podium parking areas) set out in 9 no. blocks, over two separate podium, ranging in height from 3 to 15 storeys to accommodate 554 no. apartments and commercial/enterprise space, 3 no. retail units, foodhub/café/exhibition space, residential tenant amenity, crèche and men's shed. The site will accommodate 241 no. car parking spaces, 810 no. bicycle parking spaces, storage, services and plant areas. Landscaping will include a new central public plaza and residential podium courtyards.

The proposed site development will meet or exceed where feasible the requirements of the Part L 2018 building regulations, which stipulates requirements on minimum renewable contribution, minimum fabric and air permeability requirements, maximum energy use and carbon dioxide emissions as calculated using the DEAP (Dwellings Energy Assessment Procedure) methodology.

Figure 1: East Road Residential Site location and floor plan layout (outlined in red)

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2. Legislative/Planning Requirements

2.1. Part L

Draft 'Technical Guidance Document Part L 2018 – Conservation of Fuel and Energy – Dwellings (public consultation edition)' (referred to in this document as "Part L or NZEB") stipulates requirements on, minimum fabric and air permeability requirements, maximum primary energy use and carbon dioxide (CO_2) emissions as calculated using the DEAP (Domestic Energy Assessment Procedure) methodology. This is a national standard and compliance is compulsory for all new dwellings. Three design aspects demonstrate compliance:

1. The limitation of primary energy use and CO_2 emissions
2. Building fabric
3. The use of renewable energy sources

2.1.1. Limitation of Primary Energy Use and CO_2 Emissions

In order to demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) will be no greater than the Maximum Energy Performance Coefficient (MEPC). The MPEPC is 0.30.

To demonstrate that an acceptable CO_2 emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) of the dwellings being assessed will be no greater than the Maximum Carbon Performance Coefficient (MPCPC). The MPCPC is 0.35.

2.1.2. Building fabric

In order to limit the heat loss through the building fabric the thermal insulation for each of the plane elements of a new dwelling must meet or better the area weighted average elemental U-Values (Um) as specified by Part L, listed in Table 1 (column; Part L 2018).

Table 1: Fabric U Values Comparison Part L 2011 vs Part L 2018 (Draft)

Element	U-value (W/m^2.K)	U-value (W/m^2.K)
	Part L 2011	Draft Part L 2018 (NZEB)
Pitched Roof (Insulated on slope or ceiling)	0.16	0.16
Flat Roof	0.20	0.20
Walls	0.21	0.18
Ground Floors	0.21	0.18
Exposed floors	0.21	0.18
External doors, windows and roof lights	1.60	1.40

2.1.3. Use of Renewable Energy Sources

In order to comply with NZEB, dwellings must conduct a comparative analysis for specified renewable technologies to demonstrate compliance with Regulation L3 (b).

Renewable Energy Ratio (RER) is the ratio of the primary energy from renewable energy sources to total primary energy as defined and calculated in DEAP. The following represents a very significant level of energy provision from renewable energy technologies in order to satisfy Regulation L3 (b).

Where the MPEPC of 0.3 and MPCPC of 0.35 are achieved, a RER of 0.20 represents a very significant level of energy provision from renewable energy technologies

2.2. Nearly Zero Energy Buildings (NZEB)

2.2.1. About NZEB Standard

The European Energy Performance of Buildings Directive Recast (EPBD) requires all new buildings to be Nearly Zero - Energy Buildings (NZEB) by 31st March 2020. This means that any building completed after these dates must achieve the standard irrespective of when they were started. This is quite different to the transitional arrangements for previous building regulations revisions.

'Nearly Zero - Energy Buildings' means a building that has a very high energy performance, Annex 1 of the Directive and in which "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"

2.2.2. Implementation of NZEB in Ireland

Each member Government has discretion in how the standard is applied nationally. To comply with the NZEB requirement, the Irish Government has amended the 2011 Part L to include the following paragraphs:

'In order to achieve the acceptable primary energy consumption rate for a nearly zero energy dwelling, the calculated energy performance coefficient (EPC) of the dwelling being assessed should be no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC). The MPEPC for a nearly zero energy dwelling is 0.30.

To demonstrate that an acceptable CO2 emission rate has been achieved for a nearly zero energy dwelling, the calculated carbon performance coefficient (CPC) of the dwelling being assessed should be no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC). The MPCPC for a nearly zero energy dwelling is 0.35.'

2.3. Dublin City Development Plan 2016-2022

The energy strategy will consider the following council policies and objectives as outlined in the Dublin City Development Plan 2016-2022.

Apartment Living
It is the **policy** of Dublin City Council:

- QH18: To promote the provision of high quality apartments within sustainable neighbourhoods by achieving suitable levels of amenity within individual apartments, and within each apartment development, and ensuring that suitable social infrastructure and other support facilities are available in the neighbourhood, in accordance with the standards for residential accommodation.
- QH19: To promote the optimum quality and supply of apartments for a range of needs and aspirations, including households with children, in attractive, sustainable, mixed-income, mixed-use neighbourhoods supported by appropriate social and other infrastructure.
- QH20: To ensure apartment developments on City Council sites are models of international best practice and deliver the highest quality energy efficient apartments with all the necessary infrastructure where a need is identified, to include community hubs, sports and recreational green open spaces and public parks and suitable shops contributing to the creation of attractive, sustainable, mixed-use and mixed-income neighbourhoods

Climate Change
It is the **policy** of Dublin City Council:

- CC1: To prioritise measures to address climate change by way of both effective mitigation and adaptation responses in accordance with available guidance and best practice.

- CC2: To mitigate the impacts of climate change through the implementation of policies that reduce energy consumption, reduce energy loss/wastage, and support the supply of energy from renewable sources.

It is an **objective** of Dublin City Council:

- CCO1: To implement the 'National Climate Change Adaptation Framework' (2012) by adopting a Climate Change Action Plan for Dublin City which will assist towards meeting National and EU targets. This will be adopted by end of 2018.
- CCO2: To support the implementation of the forthcoming 'Climate Change Strategy for Dublin and Climate Change Action Plan for Dublin City.
- CCO3: To support the implementation of the national level 'Strategy for Renewable Energy 2012-2020' and the related National Renewable Energy Action Plan (NREAP) and National Energy Efficiency Action Plan (NEEAP)
- CCO4: To support the implementation of the 'Dublin City Sustainable Energy Action Plan 2010-2020' and any replacement plan made during the term of this Development Plan.

Sustainable Energy / Renewable Energy

It is the **policy** of Dublin City Council:

- CCO5: To support and collaborate on initiatives aimed at achieving more sustainable energy use, particularly in relation to the residential, commercial and transport sectors.
- CCO6: To promote the concept of sustainable communities throughout the city and to seek to initiate and support carbon neutral demonstration projects in conjunction with local communities.
- CCO7: To actively promote and facilitate the growth of the new emerging green industries to contribute both to the reduction of the city's energy consumption levels and to the role of the city as a leader in environmental sustainability.
- CCO8: In conjunction with Codema, to complete a comprehensive spatial energy demand analysis to help align the future energy demands of the city with sustainable energy solutions
- CCO9: To encourage the production of energy from renewable sources, such as from BioEnergy, Solar Energy, Hydro Energy, Wave/Tidal Energy, Geothermal, Wind Energy, Combined Heat and Power (CHP), Heat Energy Distribution such as District Heating/Cooling Systems, and any other renewable energy sources, subject to normal planning considerations, including in particular, the potential impact on areas of environmental sensitivity including Natura 2000 sites
- CCO10: To support renewable energy pilot projects which aim to incorporate renewable energy into schemes where feasible
- CCO11: To support and seek that the review of the National Building Regulations be expedited with a view to ensuring that they meet or exceed the passive house standard or equivalent, with particular regard to energy performance and other sustainability considerations, to alleviate poverty and reduce carbon reduction targets

Sustainable Building Design/Quality

It is the **policy** of Dublin City Council:

- QH12: To promote more sustainable development through energy end-use efficiency, increasing the use of renewable energy, and improved energy performance of all new development throughout the city by requiring planning applications to be supported by information indicating how the proposal has been designed in accordance with the development standards set out in the development plan.

Energy Efficiency and the Built Environment

It is the **policy** of Dublin City Council:

- CC3: To promote energy efficiency, energy conservation, and the increased use of renewable energy in existing and new developments.
- CC4: To encourage building layout and design which maximises daylight, natural ventilation, active transport and public transport use.

It is an **objective** of Dublin City Council:

- CCO12: To ensure high standards of energy efficiency in existing and new developments in line with good architectural conservation practice and to promote energy efficiency and conservation in the design and development of all new buildings in the city, encouraging improved environmental performance of building stock.
- CCO13: To support and encourage pilot schemes which promote innovative ways to incorporate energy efficiency into new developments.

3. Part L Compliance

The proposed development will meet or exceed where feasible the requirements of Part L. Apartments have been assessed using the Sustainable Energy Authority of Ireland (SEAI) DEAP 4.1 (beta) software which demonstrates Part L compliance. Software inputs and outputs are summarised in section 5 of this report.

3.1. Building Fabric

In order to limit the heat loss through the building fabric of the proposed apartments the thermal insulation for each of the plane elements of the development will meet or better the area weighted average elemental U-Values (Um) as specified by Part L. Table 1 lists the Part L area weighted average elemental U-Values and the targeted U-Values of the proposed design.

Table 2: Fabric U Values (Apartments and Houses)

Element	U value (W/m^2.K)	
	Draft Part L 2018 (NZEB)	Targeted
Pitched Roof	0.16	0.16
Flat Roof	0.20	0.15
Walls	0.18	0.18
Ground Floors	0.18	0.15
Exposed floors	0.18	0.15
External doors, windows and roof lights	1.40	1.30
Glazing gv (EN410)		*0.4-0.6

* pending overheating calculation

3.2. Thermal Bridging

To avoid excessive heat losses and local condensation problems, consideration will be given to ensure continuity of insulation and to limit local thermal bridging, e.g. around windows, doors and other wall openings, at junctions between elements and other locations.

Acceptable Construction Details will be adopted for all key junctions where appropriate (i.e. typical/standard junctions). For all bespoke key junctions certified details which have been certified by a third party certification body (such as Agrément or equivalent) will be used or calculated by an NSAI registered thermal modeller.

Heat loss associated with thermal bridges is taken into account in the DEAP methodology and can heavily impact the calculated energy use and CO_2 emissions. In general this is done by including an allowance for additional heat loss due to thermal bridging, expressed as a multiplier (Ψ, psi) applied to the total exposed surface area or by the calculation of the transmission heat loss coefficient H_{TB}. A default Ψ value of 0.15 is applied in DEAP; the proposed design is targeting a Ψ value of at least 0.08 or equivalent H_{TB} value.

3.3. Building Envelope Air Permeability

In addition to fabric heat loss/gain, considerable care will be taken during the design and construction to limit the air permeability (Infiltration). High levels of infiltration can contribute to uncontrolled ventilation.

Part L requires an air permeability level no greater than $5m^3/m^2/hr$ @ 50Pa for a new dwelling; which represents a reasonable upper limit of air tightness. The design intent for the proposed apartments and houses will be to target an air permeability of $2m^3/m^2/hr$ @ 50Pa.

Air permeability testing will be carried out by a person certified by an independent third party (National Standards Authority of Ireland or equivalent certification body) in accordance with I.S. EN 13829: 2000 "Thermal performance of buildings: determination of air permeability of buildings: fan pressurisation method". All apartments will be tested in this way.

3.4. Building Services

3.4.1. Heating Appliance Efficiency

Regulation L3 (d) requires that space heating and water heating systems in dwellings are energy efficient, with efficient heat sources and effective controls. More specifically, Regulation L3 (e) provides that oil and gas fired boilers must achieve a minimum seasonal efficiency of 90%.

The proposed design for the apartments are to generate heat for space heating and domestic hot water (DHW) by using a centralised, group heating system with heat pump technology, delivering heat via heat interface units (HIUs). The design for houses intends to generate heat for space heating and domestic hot water (DHW) by using a central heating system.

In relation to apartments and houses, heating will be provided to the space by appropriately sized radiators or low temperature radiators which operate at lower flow and return temperature.

3.4.2. Space Heating and Hot Water Supply System Control

Space and water heating systems should be effectively controlled so as to ensure the efficient use of energy by limiting the provision of heat to that required to satisfy the user requirements.

The design intent is to provide the following minimum level of control;

- Automatic control of space heating on the basis of room temperature
- Automatic control of heat input to stored hot water on the basis of stored water temperature
- Separate and independent automatic time control of space heating and hot water
- Shut down of boiler or other heat source when there is no demand for either space or water heating from that source

We propose to use a control system with full time and temperature control in each occupied room

3.4.3. Insulation of Hot Water Storage Vessels, Pipes and Ducts

All hot water storage vessels, pipes and ducts (where applicable) will be insulated to prevent heat loss. Adequate insulation of hot water storage vessels will be achieved by the use of a storage vessel with factory applied insulation tested to BS 1566, part 1:2002 Appendix B. Water pipes and storage vessels in unheated areas will be insulated for the purpose of protecting against freezing. Technical Guidance Document G and Risk report BR 262, Thermal insulation avoiding risks, published by the BRE will be followed.

3.4.4. Low Flow Sanitary Ware

At the time of writing the official DEAP4 software is yet to be made available. It is expected that this updated version for assessing the building energy rating will give credit for water efficient showers, taps, wash hand basins and baths. The installation of flow restrictors is recommended. Good practice would include:

- Shower – 6L/min
- Bath Volumes – Can vary but 175-130 L would be usual. 150L would be a recommended design target.

These figures will be confirmed when the software officially becomes available.

3.4.5. Lighting Design

A focus on lighting design will be another new aspect of the DEAP4 software where it is expected that credit will be given for an appropriate LED lighting design in relation to the dwelling. In the case of a deprived or over-elaborated lighting design spec, there will be a penalty for the building energy rating. A full lighting design analysis using appropriate software i.e. Dialux or Relux can help create a balanced lighting design.

3.4.6. User Information

After the completion of the proposed Development the end user(s) will be provided with sufficient information about the building, its installed services and their maintenance requirements so that the Apartments can be operated in line with their optimum operation for energy efficiency.

3.5. Use of Renewable Energy Sources

The following low & zero carbon technologies were reviewed in terms of their applicability for this development;

- Wind Power
- Photovoltaic Cells (PV)
- Solar Thermal Collectors
- Biomass Heating
- Ground Source Heat Pumps (GSHPs)
- Air Source Heat Pumps (ASHPs)
- Exhaust Air Heat Pumps (EAHPs)
- Combined Heat & Power (CHP)

Technology	Feasibility			Comments
	High	Medium	Low	
Micro Wind 			√	**Technology Description:** Micro wind turbines can be fitted to the roof of a building but would contribute a negligible amount of energy to the development. **Applicability to this Development:** Due to the suburban nature of the development site, this renewable has not been deemed viable. Vertical axis wind turbines may be more suited to this building, but there would still be the obvious aesthetic and potential noise issues.

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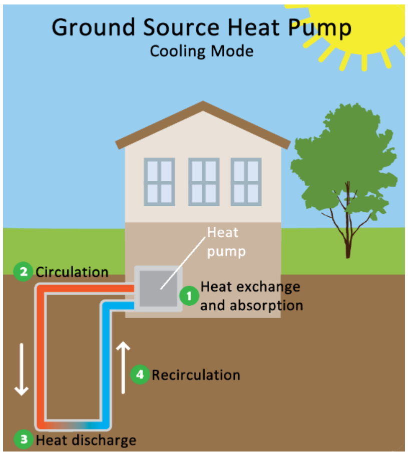
Technology	Feasibility			Comments
	High	Medium	Low	
Wind Power 			√	**Technology Description:** Mast-mounted wind turbines can be located in an open area away from obstructions such as buildings and tall trees. **Applicability to this Development:** Due to the suburban location of the site and its location close to other residential buildings it is deemed that a large wind turbine installation is not feasible.
Solar Photovoltaic (roof mounted) 	√			**Technology Description:** Photovoltaic (PV) Cell technology involves the conversion of the sun's energy into electricity. PV panels can be discrete roof-mounted units or embedded in conventional windows, skylights, atrium glazing, façade cladding etc. **Applicability to this Development:** Residential developments can be suitable locations for the installation of PV depending on orientation roof pitch and over-shading while also being virtually maintenance free. PV should be included for this development and assessed further at detailed design.
Solar hot water systems 			√	**Technology Description:** Active solar hot water technology uses the sun's thermal radiation energy to heat fluid through a collector in an active process. **Applicability to this Development:** Due to the maintenance factor surrounding solar panels a solar hot water system is not considered feasible at this site.

Technology	Feasibility			Comments
	High	Medium	Low	
Biomass Heating 			√	**Technology Description:** Biomass boilers work on the principle that the combustion of wood chip or pellets can create heat for space heating and hot water loads. **Applicability to this Development:** This technology requires substantial space allowance in a boiler room, access for delivery trucks, a thermal accumulator tank and considerable space for fuel storage of wood chips or pellets. The system also requires regular maintenance to remove ash etc. The use of biomass calls for a continuous local supply of suitable fuel to be truly sustainable. Concerns exist over the level of NOx and particulate emissions from biomass boiler installations, particularly in urban areas.
Ground source heat pump (GSHP) 			√	**Technology Description:** GSHP technologies exploit seasonal temperature differences between ground and air temperatures to provide heating in the winter and cooling in the summer. GSHP systems use some electricity to run the heat pump, but as most of the energy is taken from the ground, they produce less greenhouse gas than conventional heating systems. Ground source heat systems deliver low temperature heat and high temperature cooling, suitable for underfloor heating or chilled beams. **Applicability to this Development:** Site restrictions would require the use of vertical boreholes as opposed to horizontal ground loops. GSHP technology would need further investigation during detailed design and will depend on a favourable ground Thermal Response Test. Additionally capital costs are high and ideally, there should be a good balance between heating and cooling loads to allow for high COPs and reasonable capital payback. While a well-designed GSHP system operating under favourable conditions can achieve good efficiencies, the capital cost difference may still outweigh potential energy savings. As there is no cooling load, this investment is not deemed viable

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Technology	Feasibility			Comments
	High	Medium	Low	
Air source heat pump (ASHP) 	√			**Technology Description:** ASHP technologies exploit seasonal temperature differences between external air and refrigerant temperatures to provide heating in the winter and cooling in the summer. ASHP systems use more electricity to run the heat pump when compared to GSHP, but as most of the energy is taken from the air, they produce less greenhouse gas than conventional heating systems over the heating season. Their COP can reduce to below 2.0 when outside air temperatures are ≤0°C and they can require additional energy for a defrost cycle. **Applicability to this Development:** Heat pumps are generally safer than the combustible based heating systems and have a relatively low carbon footprint. Heat pumps can deliver heat at low outside temperatures which can be considered suited to the Irish climate. For this reason ASHP has been deemed suitable for the proposed development for the provision of space heating and/or DHW demand.
Exhaust Air source heat pump (EAHP) 	√			**Technology Description:** The exhaust air heat pump uses otherwise wasted heat in the warm air areas of your home (bathrooms, kitchen, utility..) and transfers that heat to hot water using the same principles as air source and ground source heat pumps. An Exhaust Air Heat Pump (EAHP) extracts heat from the exhaust air and transfers the heat to domestic hot water and/or hydronic heating system (underfloor heating, radiators).This type of heat pump requires a certain air exchange rate to maintain its output power. Since the inside air is approximately 20-22 degrees Celsius all year round, the maximum output power of the heat pump is not varying with the seasons and outdoor temperature **Applicability to this Development:** Exhaust Air Heat Pumps are best suited to apartments which will have low fabric heat losses. The latest units with inverter controlled compressor also have a ducted outside air supply which means the unit can draw on outside air when extract rates are low but without the need for an external condenser unit.

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Technology	Feasibility			Comments
	High	Medium	Low	
Combined Heat and Power (CHP) 	√			**Technology Description:** Combined heat and power (CHP), also known as co-generation, is the simultaneous generation of both useable heat and electrical power from the same source. A CHP unit comprises of an engine (referred to as the prime mover) in which fuel is combusted. The mechanical power produced by the engine is used to generate electricity using an integral electrical generator. The heat emitted from the engine (waste heat) is used to provide space heating and domestic hot water **Applicability to this Development:** CHP systems can be used in applications where there is a significant year-round demand for heating in addition to the electricity generated. CHP has been deemed suitable for the proposed development for the provision of space heating and/or DHW demand due to annual hours of operation considering the nature of the development.

4. Passive Design

A focus for this project is to operate the building with low energy consumption. The building will be designed to minimise/avoid the requirements for mechanical ventilation and/or air conditioning. This will be done with the use of passive systems to control the internal environment, where possible.

This will be further developed with the client, architect, structural engineer and cost consultant as the scheme develops. The passive systems will aim to reduce external noise and pollution, reduce heat loss (in winter), reduce solar gains (in summer), and maximum daylight while maintaining comfort conditions.

4.1. Natural Ventilation

Natural ventilation will be incorporated wherever possible via either single sided or cross ventilation. Where natural ventilation cannot provide the comfort and air quality needs of the occupants or the space and mechanical ventilation cannot be avoided, these systems will incorporate energy efficient solutions to maximise the efficiency of the systems through the use of heat recovery and the efficient controls. This will be fully assessed during detailed design in accordance with procedures in CIBSE TM59 – 'Design methodology for the assessment of overheating risk in homes'.

For dwellings that incorporate mechanical solutions as in paragraph 4.2 below, it should be noted that these systems will not be sufficient to prevent summertime overheating alone. CIBSE TM59 states that 'homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method'. This will involve detailed consideration of openable windows and doors and testing the design for a number of typical worst case apartments using dynamic simulation software.

4.2. Balanced Whole House Mechanical Ventilation with Heat Recovery

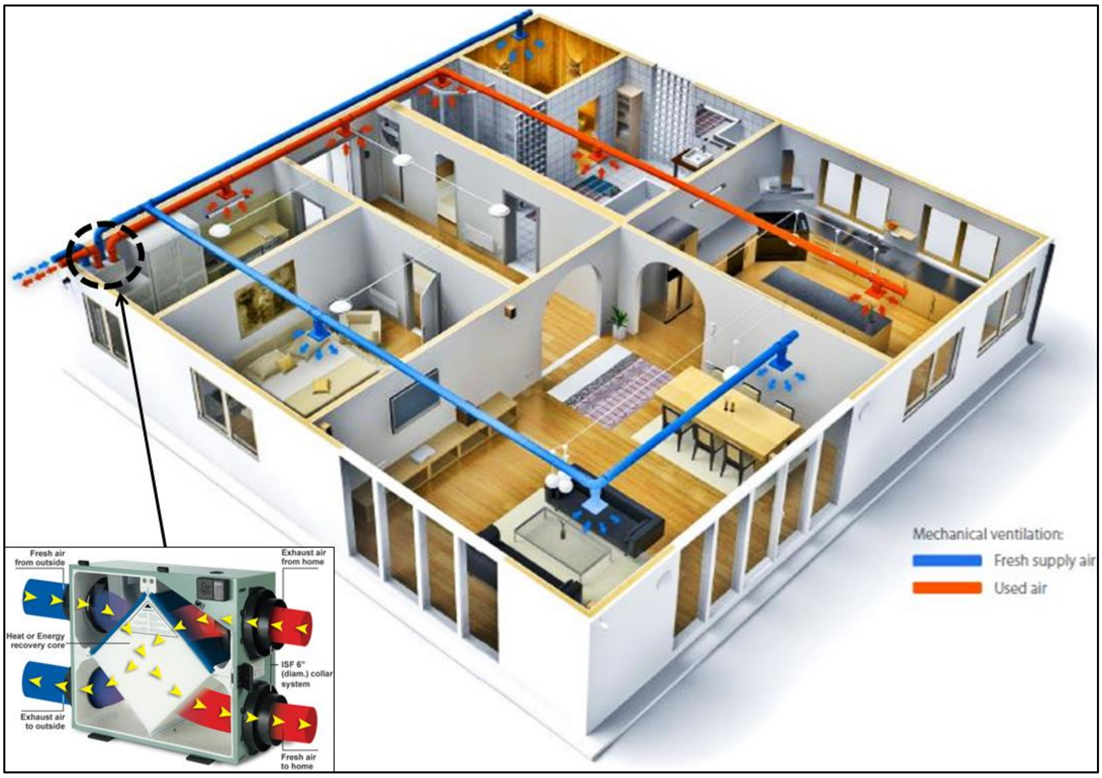


Figure 3: Balanced Whole house Mechanical Ventilation with heat recovery

The proposed system for apartments will use mechanical ventilation with heat recovery (MVHR), which is a whole-house ventilation system that generally supplies fresh air to dry rooms and extracts stale air from wet rooms.

Both air flows are to be ducted and driven by two fans, one on the supply side and one on the extract side. This will provide whole building ventilation as the mechanical extract fan will remove odours and excessive humidity to maintain a good air quality. A key component of the system is that a heat recovery unit is utilised to transfer heat from the warm exhaust air to the fresh air, achieving heat recovery.

The ventilation system should be listed on SAP appendix Q which ensures a suitable method of testing procedure for Irish use.

4.3. Passive Solar

Daylight in buildings creates a positive environment by providing connectivity with the outside world and assisting in the wellbeing of the building inhabitants. Daylight also represents an energy source; it reduces the need for artificial lighting, particularly in dwellings where natural light alone is often sufficient throughout the day. The design intent is to maximise the use of natural daylight to enhance visual comfort and not compromise thermal performance. The proposed development will have glazing specified that will minimise thermal conduction (u-value) while allowing for sufficient daylight levels and the maximisation of solar gain. Maximising solar gain within the limitations of thermal comfort will allow for a portion of the space heating load to be met passively during the day.

4.4. Water Conservation

During the detailed design stage for the proposed development the consumption of potable water in sanitary applications will be strongly considered and where possible low water use fittings and dual flush WCs will be specified.

A rainwater harvesting system will also be considered for this project and during the detailed design stage; calculations will be carried out to evaluate the suitability of this type of system. Reclaimed rainwater can be used for a range of applications such as toilet flushing, washing machines and irrigation. There are three main types of rainwater recovery systems: indirectly pumped, directly pumped, and gravity fed. The benefits of rain water harvesting is twofold as not only does it help to reduce the use of treated mains water for non-potable use, it can also help reduce water run –off and risk of flooding.

5. DEAP Calculation Summary

DEAP calculations have been carried out using SEAI DEAP 4.1 (beta) software in order to demonstrate compliance with Part L 2018 on a sample of 2-bed apartments. The DEAP calculations are based on the following provisional inputs:

5.1. SEAI DEAP 4.1 (beta) Inputs – Apartment (Centralised System)

- Fabric U Values
    - Wall U value = 0.18 W/m^{2}K
    - Semi exposed walls = 0.23 W/m^{2}K (walls to unheated voids)
    - Floor = 0.15 W/m^{2}K
    - Flat Roof = 0.15 W/m^{2}K
    - Doors = 1.40 W/m^{2}K
    - Glazing/Balcony door = 1.30 W/m^{2}K (whole window unit inclusive of frame)
    - Glazing gv (EN410) = 0.4-0.6 (subject to overheating study)
        - Frame Factor = 0.7 (i.e. 30% frame)
- Air permeability = 2 m^3/m^2/hr at 50 Pa
- Thermal bridging = 0.08 W/m^2.K
- Ventilation = MVHR
- Specific Fan Power = 0.38 W/l/s
- Heat Exchanger Efficiency = 93%
- Lighting = 100% Low energy
- Heating system = Community Heating
- Distribution system loss and gains;
    - Heating system category: Group heating schemes
    - Heating system: Group heating boilers
    - Heating System Controls: Full time and temperature zone control
- Charging on heat consumed = Yes
- Distribution loss factor = 1.05
- Heating system: Air-Water heat pump (electric)
    - Heat Pump efficiency = 273%
    - Heat Emitter Type: Fan coil/low temperature radiators only
- Sub-category: Boiler
    - Heating fuel = Mains gas
    - Boiler efficiency = 91%
- Space heating system also supplies DHW = Yes
- Heat Interface Unit Loss Factor = 0.364 kWh/day
- Heat Interface Unit Water Storage Volume = 3.4L
- Renewable Sources = 1no. PV Panel/Apt

5.2. SEAI DEAP 4.2(beta) Outputs – Apartments

Table 4 summaries the results of the preliminary DEAP calculations carried out for a representative 2-bed apartment using the energy strategy detailed in this report. Appendix 1 contains the DEAP output which demonstrates draft Part L 2018 (NZEB) compliance.

Table 3: DEAP Output Summary - Apartment – Centralised Sys (Draft Part L 2018)

Apartment		Energy Rating	EPC	CPC	RER
Top Floor - Block A2	2-Bed apartment	A2	0.298	0.276	0.250
Mid Floor - Block A2	2-Bed apartment	A2	0.244	0.230	0.260
Ground Floor - Block A2	2-Bed apartment	A2	0.265	0.246	0.260

5.3. Conclusions

5.3.1. Draft Part L 2018 - Apartment compliance (Centralised):

This report confirms that the proposed East Road apartments will comply with Part L regulations (NZEB). The report highlights that Part L will be achieved if applied as the report suggests. The strategies adopted for the East Road apartments are outlined here:

- U-values for floor and roof will exceed the building regulation backstops
- Using Glazing U-Value target outlined in this report
- Better performance air permeability than the backstop, adding to building air tightness and ventilation effectiveness
- Balanced whole house mechanical ventilation with heat recovery
- High performance thermal bridging
- Air source heat pump (ASHP) to provide space Heating (via radiators) and domestic hot water
- Renewable Sources – 1 no. PV Panel per apartment

Appendix 1: DEAP Part L Compliance Report

DEAP Report

DEAP Workbook: Aligned to DEAP software version 3.2 (plus draft changes for NZEB part L)
Inputs and results, with selected intermediate results shown in *italics*
Details not applicable for this dwelling are grayed out.
Print out 'Proj' worksheet separately if required.

Dwelling dimensions | **TGD L version** 2018

	Area [m2]	Height [m]
Ground floor	107	2.6
First floor	0	0.0
Second floor	0	0.0
Third and other floors	0	0.0
Total floor area [m2]	107	
Dwelling volume [m3]	278	
Living area [m2]	49.2	

Ventilation

Number of chimneys	0	
Number of open flues	0	
Number of intermittent fans and passive vents	1	
Number of flueless gas fires	0	
Is there a draught lobby on main entrance?	Yes	
Number of storeys in the dwelling	1	
Has an air permeability test been carried out?	Yes	1
If no Not applicable		
If yes :		
Air permeability [m3/h.m2 at 50 Pa]		0.1
End if		
Number of sides sheltered	3	
Ventilation method	Balanced whole-house mechanical ventilation with heat recovery	6
Effective air change rate [ac/h]	0.15	
Ventilation heat loss [W/K]	13	

Permeability test carried out and meets guidelines in TGD L?
For mechanical ventilation, other than positive input ventilation from loft: :

Is measured "Appendix Q" data available?	Yes
Manufacturer and model	Vent Axia Sentinel Kinetic Advance
Specific fan power [W/(l/s)]	0.42
Heat exchanger efficiency [%]	92

Windows

Orientation	North	East/West	North	SE/SW	South	North	North	North	Horizontal
Orientation ID	1	3	1	4	5	1	1	1	6
Area [m2]	11.4	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U-value [W/m2 K]	1.30	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Is U-value a manufacturer's certified value?	Yes	Yes	-	-	-	-	-	-	-
If yes:									
Manufacturer and model	-	-	-	-	-	-	-	-	-
Solar energy transmittance	0.4	0.4	-	-	-	-	-	-	-
End if									
Correction for roof window and/or metal frame if applicable (Table 6a, notes 1 and 2).									
	0	0	0	0	0	0	0	0	0
Overshading ID	2	3	0	0	0	0	0	0	0
Frame factor (Table 6c) [-]	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Window type ID	4	4	0	0	0	0	0	0	0

Fabric

Exposed element type	Area [m2]	U-value [W/m2 K]	*AU* *[W/K]*	Comment (optional)	Element type (for assessing TGD L conformity)
Windows/rooflights	20.0	1.24	24.7	-	
Doors	0.0	0.00	0.0	-	
Floor	106.8	0.15	16.0	Floor over Office	No underfloor heating
Floor (type 2)	0.0	0.00	0.0	-	-
Floor (type 3)	0.0	0.00	0.0	-	-
Walls	33.8	0.18	6.1	Wall Type 1	Wall relevant for TGD L fabric compliance check
Walls (type 2)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 3)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 4)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 5)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Roof	0.0	0.00	0.0	-	-
Roof (type 2)	0.0	0.00	0.0	-	-
Roof (type 3)	0.0	0.00	0.0	-	-
Roof (type 4)	0.0	0.00	0.0	-	-
Roof (type 5)	0.0	0.00	0.0	-	-
Total area of elements [m2]	160.62				
Heat loss via plane elements [W/K]			47		
Factor for thermal bridging [W/m2 K]			0.08		
Fabric heat loss [W/K]			60		
Dwelling heat loss coefficient [W/K]			73		
Heat loss parameter, HLP [W/K m2]			0.68		

Water heating		
Are there distribution losses?	Yes	
Distribution loss [kWh/y]	301	
Are there storage losses?	Yes	1
If yes :		
Water storage volume [litres]	3.4	
Is manufacturer's declared loss factor available?	Yes	1
If yes :		
Manufacturer and model name	Heatrae Sadia Hi Max Instant 5/80	
Manufacturer's declared loss factor [kWh/day]	0.364	
If no	Not applicable	
End if		
Temperature factor unadjusted (Table 2)	1	
Temperature factor multiplier (from Table 2 notes)	1	
End if		
Is there a solar water heating system?	No	0
If yes	Not applicable	
Solar fraction [%]	0	
End if		
Primary circuit loss [kWh/y] (Table 3)	360	
Additional loss for combi boiler [kWh/y] (Table 3a)	0	
Electricity consumption of electric keep-hot facility of combi boiler [kWh/y] (Table 4f)	0	
Is supplementary electric immersion heating is used in summer?	No	
Output from main water heater [kWh/y]	2457	
Output from supplementary heater [kWh/y]	0	
Heat gains from water heating system [W]	109	
Is hot water storage indoors or in group heating scheme?	Yes	
Lighting		
Proportion of fixed lighting outlets that are low-energy [-]	#REF!	
Annual energy used for lighting, EL [kWh/y]	262	
Internal gains		
Net internal gains [W]	489	
Heat use		
Living area fraction [-]	0.461086	
Thermal mass category of dwelling	Medium	
Heat use [kWh/y]	1442	
Space heating		
Control and responsiveness		
Temperature adjustment (Table 4e), where appropriate [C]	0	
Heating system control category (Table 4e)	3	
Heating system responsiveness category (Table 4a or 4d)	1	

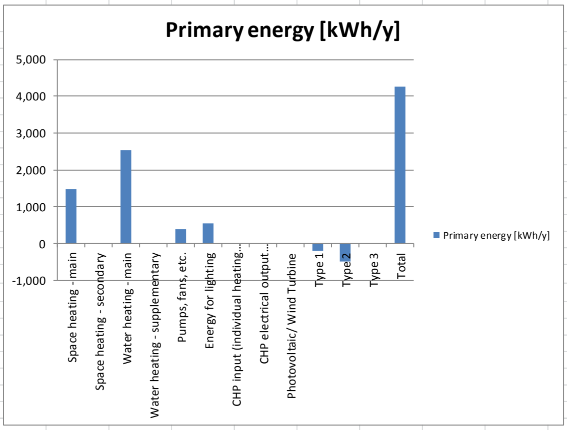
Pumps/fans	Enter number present	If present, is boiler controlled by room thermostat?	If present, inside dwelling?
Central heating pump (supplying hot water to radiators or underfloor system)	0	Yes	
Oil boiler - pump (supplying oil to boiler and flue fan)	0	-	-
Gas boiler - flue fan (if fan assisted flue)	0		
Is there a warm air heating system present?	No		

Emission efficiency		
Is main heat emission system within an envelope element? (e.g. underfloor heating in ground floor)	No	0
If yes, U-value of envelope element [W/m^2 K]	0.15	
Type of main heating system	Group / community heating scheme	2

Energy requirements - group/community heating scheme	:				
Secondary space heating					
Fraction of heat use from secondary / supplementary system (use value from Table 7, Table 10 or Appendix F)					0
Generation efficiency of secondary / supplementary heating system [%] (use value from Table 4a or Appendix E)					0
Main (group heating) system					
Is charging based on heat consumed?		Yes			
Distribution loss factor [-] (Table 9)		1.05			
Fraction of heat from CHP unit or fraction of heat recoverd from power station		0			
Boilers					
(If the fraction of heat from boilers is zero, this section is irrelevant).					
Heat source type	Fuel	Efficiency [%]	Percent of heat [%]		
Boiler type 1	mains gas	91	49		
Boiler type 2	-	0	0		
Heat pump	electricity	273	51		
Solar heating system			0		
CHP or waste heat from power stations					
(If the fraction of heat from CHP/waste heat is zero, this section is irrelevant).					
System type	-			2	
If CHP					
Electrical efficiency of CHP unit (e.g. 0.3) from operational records or the CHP design specification [					0.28
Heat efficiency of CHP unit (e.g. 0.5) from operational records or the CHP design specification [-]					0.57
Fuel type	mains gas				
Fuel data	Fuel				
Space heating - secondary	-				
Renewable and energy-saving technologies		Primary energy factor [-]	CO2 factor [kg/kWh]	Delivered energy [kWh/y]	
Type 1 Description	-				
Energy produced or saved		2.08	0.409	91	
Energy consumed		0.00	0.000	0	
Type 2 Description	-				
Energy produced or saved		2.08	0.409	231	
Energy consumed		0.00	0.000	0	
Type 3 Description	-				
Energy produced or saved		0.00	0.000	0	
Energy consumed		0.00	0.000	0	

Results

		Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kg/y]
Space heating - main		1,442	1,485	281
Space heating - secondary		0	0	0
Water heating - main		2,457	2,531	479
Water heating - supplementary		0	0	0
Pumps, fans, etc.		181	377	74
Energy for lighting		262	544	107
CHP input (individual heating systems only)		0	0	0
CHP electrical output (individual heating sys		0	0	0
Photovoltaic/ Wind Turbine		0	0	0
Type 1	-	-91	-189	-37
Type 2	-	-231	-480	-94
Type 3	-	0	0	0
Total		4,020	4,267	810
per m^2 floor area		37.6	39.95	7.58
			[kWh/m^2 y]	
Building Energy Rating			40	A2



Check conformity with MPEPC, MPCPC and RER requirements in TGD L

Relevant for new-build.

	Primary energy [kWh/y]	CO2 emissions [kg/y]	Renewable Energy Ratio
Totals for reference dwelling	16,128	3,294	
	EPC	CPC	RER
Performance coefficients	0.265	0.246	0.26
Maximum permitted	0.300	0.350	0.20
	Complies	Complies	Complies

DEAP Report

DEAP Workbook: Aligned to DEAP software version 3.2 (plus draft changes for NZEB part L)
Inputs and results, with selected intermediate results shown in *italics*
Details not applicable for this dwelling are grayed out.
Print out 'Proj' worksheet separately if required.

Dwelling dimensions — **TGD L version** 2018

	Area [m²]	Height [m]
Ground floor	107	2.6
First floor	0	0.0
Second floor	0	0.0
Third and other floors	0	0.0
Total floor area [m²]	107	
Dwelling volume [m³]	278	
Living area [m²]	49.2	

Ventilation

Number of chimneys	0	
Number of open flues	0	
Number of intermittent fans and passive vents	1	
Number of flueless gas fires	0	
Is there a draught lobby on main entrance?	Yes	
Number of storeys in the dwelling	1	
Has an air permeability test been carried out?	Yes	1
If no Not applicable		
If yes :		
Air permeability [m3/h.m2 at 50 Pa]		0.1
End if		
Number of sides sheltered	3	
Ventilation method	Balanced whole-house mechanical ventilation with heat recovery	6
Effective air change rate [ac/h]	0.15	
Ventilation heat loss [W/K]	13	
Permeability test carried out and meets guidelines in TGD L?		
For mechanical ventilation, other than positive input ventilation from loft:	:	
Is measured "Appendix Q" data available?	Yes	
Manufacturer and model	Vent Axia Sentinel Kinetic Advance	
Specific fan power [W/(l/s)]	0.42	
Heat exchanger efficiency [%]	92	

Windows

Orientation	North	East/West	North	SE/SW	South	North	North	North	Horizontal
Orientation ID	1	3	1	4	5	1	1	1	6
Area [m²]	11.4	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U-value [W/m² K]	1.30	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Is U-value a manufacturer's certified value?	Yes	Yes	-	-	-	-	-	-	-
If yes:									
Manufacturer and model	-	-	-	-	-	-	-	-	-
Solar energy transmittance	0.4	0.4	-	-	-	-	-	-	-
End if									
Correction for roof window and/or metal frame if applicable (Table 6a, notes 1 and 2).									
	0	0	0	0	0	0	0	0	0
Overshading ID	3	3	0	0	0	0	0	0	0
Frame factor (Table 6c) [-]	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Window type ID	4	4	0	0	0	0	0	0	0

Fabric

Exposed element type	Area [m²]	U-value [W/m² K]	*AU [W/K]*	Comment (optional)	Element type (for assessing TGD L conformity)
Windows/rooflights	20.0	1.24	24.7	-	
Doors	0.0	0.00	0.0	-	
Floor	0.0	0.00	0.0	-	No underfloor heating
Floor (type 2)	0.0	0.00	0.0	-	-
Floor (type 3)	0.0	0.00	0.0	-	-
Walls	33.8	0.18	6.1	Wall Type 1	Wall relevant for TGD L fabric compliance check
Walls (type 2)	6.8	0.23	1.6	Wall Type 2	Wall not relevant for TGD L fabric compliance check
Walls (type 3)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 4)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 5)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Roof	0.0	0.00	0.0	-	-
Roof (type 2)	0.0	0.00	0.0	-	-
Roof (type 3)	0.0	0.00	0.0	-	-
Roof (type 4)	0.0	0.00	0.0	-	-
Roof (type 5)	0.0	0.00	0.0	-	-
Total area of elements [m²]	60.58				
Heat loss via plane elements [W/K]			32		
Factor for thermal bridging [W/m² K]			0.08		
Fabric heat loss [W/K]			37		
Dwelling heat loss coefficient [W/K]			51		
Heat loss parameter, HLP [W/K m²]			0.47		

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Water heating										
Are there distribution losses?				Yes						
Distribution loss [kWh/y]				301						
Are there storage losses?				Yes	1					
If yes	:									
	Water storage volume [litres]						3.4			
	Is manufacturer's declared loss factor available?						Yes	1		
	If yes	:								
		Manufacturer and model name				Heatrae Sadia Hi Max Instant 5/80				
		Manufacturer's declared loss factor [kWh/day]					0.364			
	If no	Not applicable								
	End if									
	Temperature factor unadjusted (Table 2)					1				
	Temperature factor multiplier (from Table 2 notes)					1				
End if										
Is there a solar water heating system?						No	0			
If yes	Not applicable									
							Solar fraction [%]			0
End if										
Primary circuit loss [kWh/y] (Table 3)								360		
Additional loss for combi boiler [kWh/y] (Table 3a)								0		
Electricity consumption of electric keep-hot facility of combi boiler [kWh/y] (Table 4f)								0		
Is supplementary electric immersion heating is used in summer?								No		
Output from main water heater [kWh/y]						2457				
Output from supplementary heater [kWh/y]						0				
Heat gains from water heating system [W]						109				
Is hot water storage indoors or in group heating scheme?						Yes				
Lighting										
Proportion of fixed lighting outlets that are low-energy [-]						#REF!				
Annual energy used for lighting, EL [kWh/y]						268				
Internal gains										
Net internal gains [W]						489				
Heat use										
Living area fraction [-]				0.461086						
Thermal mass category of dwelling				Medium						
Heat use [kWh/y]				435						
Space heating										
Control and responsiveness										
Temperature adjustment (Table 4e), where appropriate [C]						0				
Heating system control category (Table 4e)						3				
Heating system responsiveness category (Table 4a or 4d)						1				
Pumps/fans							Enter	If present,		If present,
							number	is boiler controlled		inside
							present	by room thermostat?		dwelling?
Central heating pump (supplying hot water to radiators or underfloor system)							0		Yes	
Oil boiler - pump (supplying oil to boiler and flue fan)							0		-	-
Gas boiler - flue fan (if fan assisted flue)							0			
Is there a warm air heating system present?						No				
Emission efficiency										
Is main heat emission system within an envelope element? (e.g. underfloor heating in ground floor)									No	0
	If yes, U-value of envelope element [W/m^2 K]								0.15	
Type of main heating system				Group / community heating scheme				2		

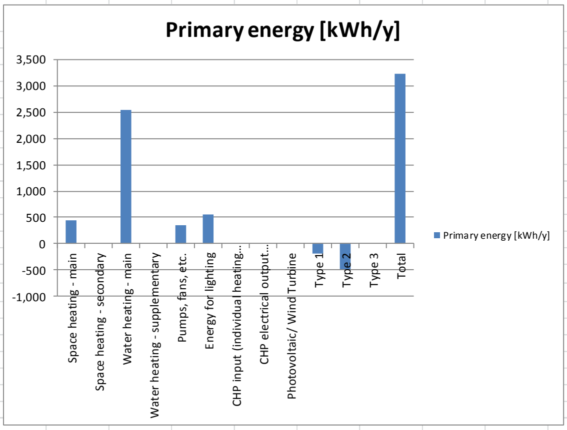
Energy requirements - group/community heating scheme :

Secondary space heating					
Fraction of heat use from secondary / supplementary system (use value from Table 7, Table 10 or Appendix F)					0
Generation efficiency of secondary / supplementary heating system [%] (use value from Table 4a or Appendix E)					0
Main (group heating) system					
Is charging based on heat consumed?		Yes			
Distribution loss factor [-] (Table 9)		1.05			
Fraction of heat from CHP unit or fraction of heat recoverd from power station		0			
Boilers					
(If the fraction of heat from boilers is zero, this section is irrelevant).					
Heat source type	Fuel	Efficiency [%]	Percent of heat [%]		
Boiler type 1	mains gas	91	49		
Boiler type 2	-	0	0		
Heat pump	electricity	273	51		
Solar heating system			0		
CHP or waste heat from power stations					
(If the fraction of heat from CHP/waste heat is zero, this section is irrelevant).					
System type	-			2	
If CHP					
Electrical efficiency of CHP unit (e.g. 0.3) from operational records or the CHP design specification [					0.28
Heat efficiency of CHP unit (e.g. 0.5) from operational records or the CHP design specification [-]					0.57
Fuel type	mains gas				
Fuel data	Fuel				
Space heating - secondary	-				

Renewable and energy-saving technologies			Primary energy factor [-]	CO2 factor [kg/kWh]	Delivered energy [kWh/y]
Type 1	Description	-			
	Energy produced or saved		2.08	0.409	91
	Energy consumed		0.00	0.000	0
Type 2	Description	-			
	Energy produced or saved		2.08	0.409	231
	Energy consumed		0.00	0.000	0
Type 3	Description	-			
	Energy produced or saved		0.00	0.000	0
	Energy consumed		0.00	0.000	0

Results

		Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kg/y]
Space heating - main		435	448	85
Space heating - secondary		0	0	0
Water heating - main		2,457	2,531	479
Water heating - supplementary		0	0	0
Pumps, fans, etc.		171	356	70
Energy for lighting		268	558	110
CHP input (individual heating systems only)		0	0	0
CHP electrical output (individual heating sys		0	0	0
Photovoltaic/ Wind Turbine		0	0	0
Type 1	-	-91	-189	-37
Type 2	-	-231	-480	-94
Type 3	-	0	0	0
Total		3,009	3,223	612
per m^2 floor area		28.2	30.17	5.73
			[kWh/m^2 y]	
Building Energy Rating			30	A2



Check conformity with MPEPC, MPCPC and RER requirements in TGD L

Relevant for new-build.

	Primary energy [kWh/y]	CO2 emissions [kg/y]	Renewable Energy Ratio
Totals for reference dwelling	13,218	2,659	
	EPC	CPC	RER
Performance coefficients	0.244	0.230	0.26
Maximum permitted	0.300	0.350	0.20
	Complies	Complies	Complies

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DEAP Report

DEAP Workbook: Aligned to DEAP software version 3.2 (plus draft changes for NZEB part L)
Inputs and results, with selected intermediate results shown in *italics*
Details not applicable for this dwelling are grayed out.
Print out 'Proj' worksheet separately if required.

Dwelling dimensions **TGD L version** 2018

	Area [m²]	Height [m]
Ground floor	110	2.6
First floor	0	0.0
Second floor	0	0.0
Third and other floors	0	0.0
Total floor area [m²]	110	
Dwelling volume [m³]	286	
Living area [m²]	52.0	

Ventilation

Number of chimneys	0	
Number of open flues	0	
Number of intermittent fans and passive vents	1	
Number of flueless gas fires	0	
Is there a draught lobby on main entrance?	Yes	
Number of storeys in the dwelling	1	
Has an air permeability test been carried out?	Yes	1
If no Not applicable		
If yes :		
Air permeability [m3/h.m2 at 50 Pa]		0.1
End if		
Number of sides sheltered	1	
Ventilation method	Balanced whole-house mechanical ventilation with heat recovery	6
Effective air change rate [ac/h]	0.16	
Ventilation heat loss [W/K]	16	

Permeability test carried out and meets guidelines in TGD L?
For mechanical ventilation, other than positive input ventilation from loft: :

Is measured "Appendix Q" data available?	Yes
Manufacturer and model	Vent Axia Sentinel Kinetic Advance
Specific fan power [W/(l/s)]	0.42
Heat exchanger efficiency [%]	92

Windows

Orientation	North	East/West	North	SE/SW	South	North	North	North	Horizontal
Orientation ID	1	3	1	4	5	1	1	1	6
Area [m²]	11.4	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U-value [W/m² K]	1.30	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Is U-value a manufacturer's certified value?	Yes	Yes	-	-	-	-	-	-	-
If yes:									
Manufacturer and model	-	-	-	-	-	-	-	-	-
Solar energy transmittance	0.4	0.4	-	-	-	-	-	-	-
End if									
Correction for roof window and/or metal frame if applicable (Table 6a, notes 1 and 2).									
	0	0	0	0	0	0	0	0	0
Overshading ID	2	3	0	0	0	0	0	0	0
Frame factor (Table 6c) [-]	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Window type ID	4	4	0	0	0	0	0	0	0

Fabric

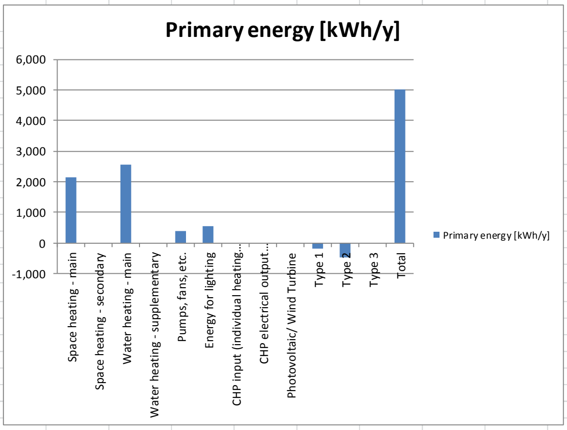
Exposed element type	Area [m²]	U-value [W/m² K]	*AU [W/K]*	Comment (optional)	Element type (for assessing TGD L conformity)
Windows/rooflights	20.0	1.24	24.7	-	
Doors	0.0	0.00	0.0	-	
Floor	0.0	0.00	0.0	-	No underfloor heating
Floor (type 2)	0.0	0.00	0.0	-	-
Floor (type 3)	0.0	0.00	0.0	-	-
Walls	63.0	0.18	11.3	Wall Type 1	Wall relevant for TGD L fabric compliance check
Walls (type 2)	6.8	0.23	1.6	Wall semi exposed	Wall not relevant for TGD L fabric compliance check
Walls (type 3)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 4)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Walls (type 5)	0.0	0.00	0.0	-	Wall relevant for TGD L fabric compliance check
Roof	110.1	0.15	16.5	Roof	Flat roof
Roof (type 2)	0.0	0.00	0.0	-	-
Roof (type 3)	0.0	0.00	0.0	-	-
Roof (type 4)	0.0	0.00	0.0	-	-
Roof (type 5)	0.0	0.00	0.0	-	-
Total area of elements [m²]	199.80				
Heat loss via plane elements [W/K]			54		
Factor for thermal bridging [W/m² K]			0.08		
Fabric heat loss [W/K]			70		
Dwelling heat loss coefficient [W/K]			86		
Heat loss parameter, HLP [W/K m²]			0.78		

Water heating														
Are there distribution losses?				Yes										
Distribution loss [kWh/y]				306										
Are there storage losses?				Yes	1									
If yes	:													
	Water storage volume [litres]						3.4							
	Is manufacturer's declared loss factor available?						Yes	1						
	If yes	:												
		Manufacturer and model name				Heatrae Sadia Hi Max Instant 5/80								
		Manufacturer's declared loss factor [kWh/day]					0.364							
	If no	Not applicable												
	End if													
	Temperature factor unadjusted (Table 2)					1								
	Temperature factor multiplier (from Table 2 notes)					1								
End if														
Is there a solar water heating system?						No	0							
If yes	Not applicable													
								Solar fraction [%]		0				
End if														
Primary circuit loss [kWh/y] (Table 3)								360						
Additional loss for combi boiler [kWh/y] (Table 3a)								0						
Electricity consumption of electric keep-hot facility of combi boiler [kWh/y] (Table 4f)								0						
Is supplementary electric immersion heating is used in summer?								No						
Output from main water heater [kWh/y]						2497								
Output from supplementary heater [kWh/y]						0								
Heat gains from water heating system [W]						111								
Is hot water storage indoors or in group heating scheme?						Yes								
Lighting														
Proportion of fixed lighting outlets that are low-energy [-]						#REF!								
Annual energy used for lighting, EL [kWh/y]						270								
Internal gains														
Net internal gains [W]						500								
Heat use														
Living area fraction [-]				0.472298										
Thermal mass category of dwelling				Medium										
Heat use [kWh/y]				2081										
Space heating														
Control and responsiveness														
Temperature adjustment (Table 4e), where appropriate [C]						0								
Heating system control category (Table 4e)						3								
Heating system responsiveness category (Table 4a or 4d)						1								
Pumps/fans							Enter	If present,		If present,				
							number	is boiler controlled		inside				
							present	by room thermostat?		dwelling?				
Central heating pump (supplying hot water to radiators or underfloor system)							0		Yes					
Oil boiler - pump (supplying oil to boiler and flue fan)							0		-	-				
Gas boiler - flue fan (if fan assisted flue)							0							
Is there a warm air heating system present?						No								
Emission efficiency														
Is main heat emission system within an envelope element? (e.g. underfloor heating in ground floor)									No	0				
	If yes, U-value of envelope element [W/m^2 K]								0.15					
Type of main heating system				Group / community heating scheme				2						

Energy requirements - group/community heating scheme			:				
Secondary space heating							
Fraction of heat use from secondary / supplementary system (use value from Table 7, Table 10 or Appendix F)							0
Generation efficiency of secondary / supplementary heating system [%] (use value from Table 4a or Appendix E)							0
Main (group heating) system							
Is charging based on heat consumed?				Yes			
Distribution loss factor [-] (Table 9)				1.05			
Fraction of heat from CHP unit or fraction of heat recoverd from power station				0			
Boilers							
	(If the fraction of heat from boilers is zero, this section is irrelevant).						
	Heat source type	Fuel		Efficiency	Percent of		
				[%]	heat [%]		
	Boiler type 1	mains gas		91	49		
	Boiler type 2	-		0	0		
	Heat pump	electricity		273	51		
	Solar heating system				0		
CHP or waste heat from power stations							
	(If the fraction of heat from CHP/waste heat is zero, this section is irrelevant).						
	System type		-			2	
	If CHP						
		Electrical efficiency of CHP unit (e.g. 0.3) from operational records or the CHP design specification [					0.28
		Heat efficiency of CHP unit (e.g. 0.5) from operational records or the CHP design specification [-]					0.57
		Fuel type	mains gas				
Fuel data		Fuel					
Space heating - secondary		-					
				Primary	CO2	Delivered	
Renewable and energy-saving technologies				energy	factor	energy	
Type 1	Description	-		factor [-]	[kg/kWh]	[kWh/y]	
	Energy produced or saved			2.08	0.409	91	
	Energy consumed			0.00	0.000	0	
Type 2	Description	-					
	Energy produced or saved			2.08	0.409	231	
	Energy consumed			0.00	0.000	0	
Type 3	Description	-					
	Energy produced or saved			0.00	0.000	0	
	Energy consumed			0.00	0.000	0	

Results

	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emissions [kg/y]
Space heating - main	2,081	2,143	406
Space heating - secondary	0	0	0
Water heating - main	2,497	2,572	487
Water heating - supplementary	0	0	0
Pumps, fans, etc.	192	400	79
Energy for lighting	270	562	111
CHP input (individual heating systems only)	0	0	0
CHP electrical output (individual heating sys	0	0	0
Photovoltaic/ Wind Turbine	0	0	0
Type 1 -	-91	-189	-37
Type 2 -	-231	-480	-94
Type 3 -	0	0	0
Total	4,719	5,008	950
per m^2 floor area	42.9	45.49	8.63
		[kWh/m^2 y]	
Building Energy Rating		45	A2



Check conformity with MPEPC, MPCPC and RER requirements in TGD L
Relevant for new-build.

	Primary energy [kWh/y]	CO2 emissions [kg/y]	Renewable Energy Ratio
Totals for reference dwelling	16,803	3,438	
	EPC	CPC	RER
Performance coefficients	0.298	0.276	0.25
Maximum permitted	0.300	0.350	0.20
	Complies	Complies	Complies

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