

EnerPHit Assessment

RETROFIT COORDINATION AND MANAGEMENT

BY AARON GRIFFITHS (2223674) MODULE: ACBA5026 DATE: 13/5/25

Contents

Introduction 2

Current Performance 2

Performance Gaps Relative to EnerPHit 10

Proposed Upgrades to the Property 12

Impacts of Upgrade and Carbon Reduction 27

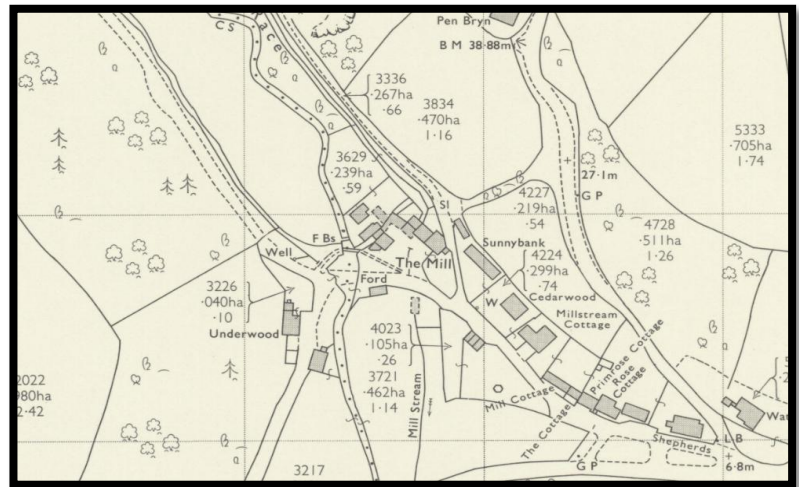
References 28

Introduction

I have been tasked to critically assess the property. In which the Property is located at Underwood, Gower, Swansea. With an aim goal of reducing energy consumption and carbon dioxide (CO₂) emissions in the building. Which retro fitting this building would provide a crucial role to transition this building by offering opportunities to modern energy performance expectations. The suggestions which will be made on the property will be in accordance with “The EnerPHit standard provides requirements for retrofit projects designed to maximize the thermal efficiency of the building and drastically reduce its energy consumption and heating requirements.” - www.norrskan.co.uk. (n.d.). *The EnerPHit Standard*. [online] Available at: <https://www.norrskan.co.uk/passive-house/enerphit>. EnerPHit allows for some flexibility while still ensuring that retrofitting buildings achieve significant reductions in heating and cooling demand, improved indoor comfort, and lower operational emissions. Attaining EnerPHit certification is widely regarded as the benchmark for high-performance retro fit projects. To conclude, this report will be assessing the retrofit scenarios which could be applied to the property, in the context of EnerPHit. Which will be guided by the Passive House Planning Package (PHPP), which gives detailed assessment of a building’s energy performance.

Current Performance

The building fabric of the property currently is a typical stone build cottage, with an extension which was built onto the property in more recent years. The extension is built with blockwork and cavity which is built in accordance with building regulations at the time. The property has had double glazed windows installed in 1980, along with new composite doors. The age of the building based on Scottish maps, the information which I have gathered that the property was built around 1971, and it may be even older. The location of the property can be seen on the map image provided. The double storey extension was built in 1977 and the rear utility was built in 1990 according to the homeowner of the property.



Maps.nls.uk. (2025). *View map: Ordnance Survey, SS5489-SS5589 - AA - Ordnance Survey 1:2500 scale map - Ordnance Survey National Grid Maps, 1940s-1970s*. [online] Available at: <https://maps.nls.uk/view/188694537> [Accessed 12 May 2025].

Due to the age of the building and the extent of the works which would be taking place a full Asbestos Survey would need to be carried out prior to works commencing. The asbestos which could be within the building:

- Crocidolite
- Tremolite
- Amosite
- Anthophyllite
- Chrysotile
- Actinolite

“The properties of asbestos made it an ideal material for use in several products, including insulation material for buildings, boilers and pipes; car brakes and floor tiles, insulating board to protect buildings and ships against fire; asbestos cement for roofing sheets and pipes. Due to the risks to health following inhalation exposure to asbestos the importation of blue and brown asbestos has been banned in the UK since 1985. This ban was extended to include white asbestos in 1999. Breathing in high concentrations of asbestos for a long period of time mainly affects the lungs, causing a disease called asbestosis where breathing becomes difficult and the heart enlarges. Asbestosis may take decades to develop. Asbestosis sufferers are at an increased risk of cancer. Exposure to lower concentrations of asbestos over time may result in a general (diffuse pleural thickening) or localized (pleural plaques) thickening of the lung lining.”

- Public Health England (2017). *Asbestos: general information*. [online] GOV.UK. Available at: <https://www.gov.uk/government/publications/asbestos-properties-incident-management-and-toxicology/asbestos-general-information>.

Therefore, when I'm assessing this building going to consider asbestos could be present and use the The Control of Asbestos Regulations 2012 (CAR 2012) which outlines the specific duties and responsibilities for managing asbestos in the workplace, including requirements for surveys, risk assessments, and control measures.

More information found at: Reuters, T. (n.d.). The Control of Asbestos Regulations 2012. [online] 15(1), p.14. Available at: https://assets.publishing.service.gov.uk/media/65fd6fa2a6cof7001aef927f/CD1.F_Control_of_Asbestos_Regulations_2012_CAR_2012_.pdf.

Other possible threats which could occur are:

Japanese Knotweed - can damage buildings, though the extent and type of damage are often debated. It's primarily known for exploiting existing weaknesses, like cracks in foundations or walls, rather than directly causing major structural damage. To remove Japanese Knotweed, you must follow the following:

“Chemical Treatment

- Spraying or injecting stems with approved herbicides can control spread but usually requires repeated applications over at least 3 years.
- Knotweed rhizomes can stay dormant and regrow if the soil is disturbed.
- Chemical use may require certified personnel, a health and safety assessment, and permissions if near water or protected sites.
- Disposal of chemicals must be done via registered waste carriers and may need permits or exemptions.

Burying Knotweed

- Notify the Environment Agency one month in advance.
- Bury only on the original site, including soil or ash containing knotweed.
- Bury at least 5 metres deep, or 2 metres if using a durable geotextile membrane that lasts 50 years.
- Ensure membranes are UV-resistant, undamaged, and properly sealed.

Burning Knotweed

- Businesses must inform the Environment Agency and local council, obtain a D7 exemption, and comply with regulations.
- Individuals should check with the council before burning.
- Burning may not kill all plant material; follow up with burial or proper off-site disposal.”

Environment Agency (2016). *Prevent Japanese knotweed from spreading*. [online] GOV.UK. Available at: <https://www.gov.uk/guidance/prevent-japanese-knotweed-from-spreading>.

Legislation to follow the Wildlife and Countryside Act 1981 and the Environmental Protection Act 1990 address Japanese knotweed.

However, this property which I am assessing does not have Japanese knotweed on site or in the area.

The heating system for the property is an LPG with a combi boiler with double convector rads located in each room of the property

Provided By Homeowner from Bosh Worcester

Product Details	
Product Name	Greenstar 30i LPG
Product Serial Number	55701390001187733600032

Installer Details	
Installer Company:	S M K Plumbing & Heating
Installer Name:	Shaun Kissick
Installer Address:	8 Glan yr Afon Road, Swansea, SA2 9JE

<https://mail.google.com/mail/u/0/?ik=60850646&view=pt&search=all&permthid=thread-f180666623689160066&siml=msg-f1806666236891...>

07/08/2024, 11:03	Gmail - Guarantee Registration
Installer Telephone:	07917177113

Where product is installed	
Installation Date:	25-04-2022
Installation Address:	Underwood, Parkmill, Parkmill, Abertawe, SA3 2EH

Gas Safe Notification Details	
Certificate Number	28664119
Engineer License Card Number	5609908
Is Subcontracted	No
Local Authority	W06000011
Is New Build	No

Underwood, Parkmill, SA3 2EH

LPG Usage Dec 23 - March 25

Fitted with 1410L tank (only allowed 85% fill)

05/12/2023	1132	0.549	£621.47	0.05	£31.07	£652.54
13/02/2024	1132	0.549	£621.47	0.05	£31.07	£652.54
09/05/2024	1089	0.549	£597.86	0.05	£29.89	£627.75
15/10/2024	830	0.549	£455.67	0.05	£22.78	£478.45
12/12/2024	1034	0.549	£567.67	0.05	£28.38	£596.05
14/02/2025	94	0.599	£56.31	0.05	£2.82	£59.12
17/03/2025	1158	0.599	£693.64	0.05	£34.68	£728.32

Total costs £3,794.79
Monthly spend (/16months) £237.17

Total Litres 6469 4851.75 Litre per annum
kWh conversion rate 1 litre 7.08
convert LPG into kWh 34350.39 kWh per annum
square meters 90 381.671 kWh/m2a

This data shows the cost of LPG usage which is occurring in the property each month.

Underwood, Parkmill, SA3 2EH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
------------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

The data above displays the property's energy costs from December 2024 to March 2025

[Home](#)
[Usage](#)
[Meter readings](#)
[Billing history](#)
[Payments](#)
[Plan](#)
[Energy insights](#)
[Offers](#)
[Power Move](#)
[Moving home](#)
[Renew your plan](#)

Tell us about your home

Answer 8 quick questions to personalise your insights and offers.

Get started

Year

Month

Day

<

Your 2024 energy use

>

Total Electricity cost

£1,288.07

Total Electricity kWh

5029.56

Want to know

[where your energy's going?](#)

Unit

kWh

Cost

Compare

No comparison

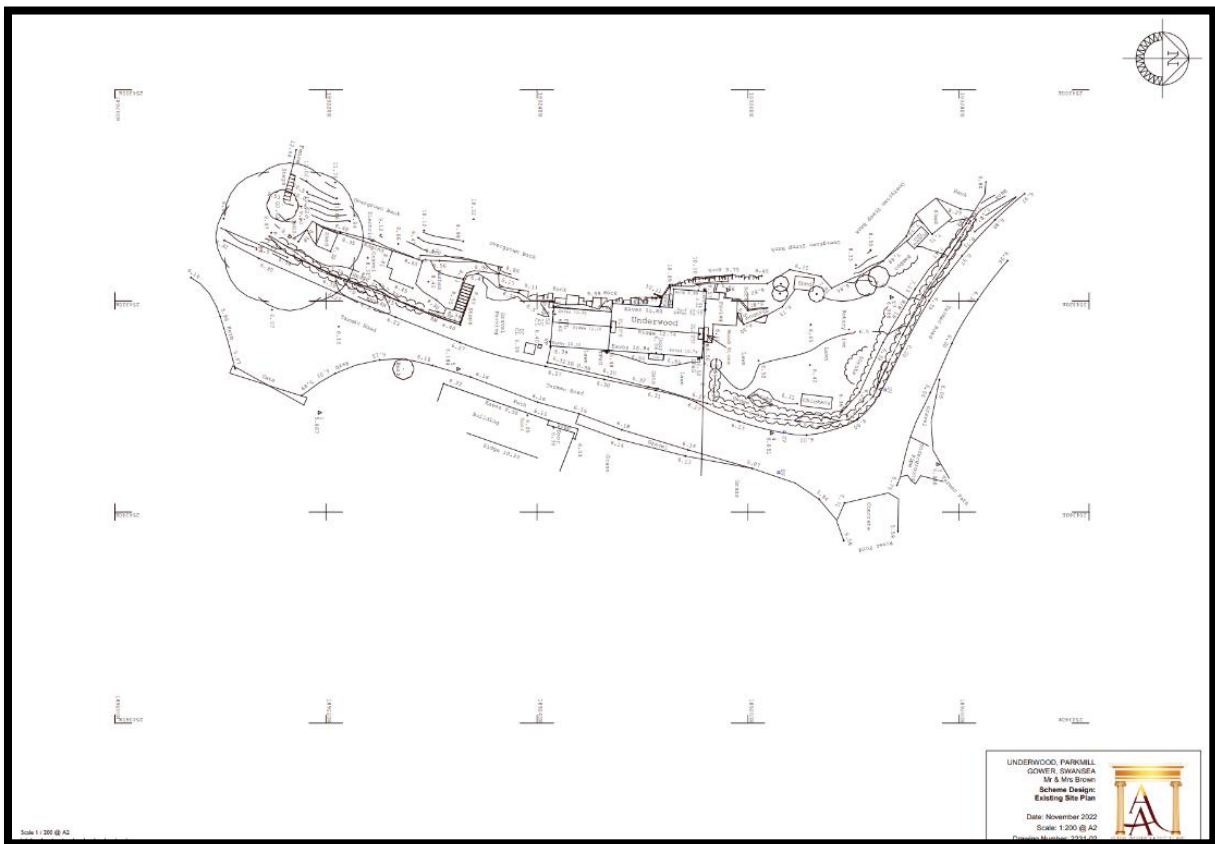
▼

[See how we calculate your usage](#) 

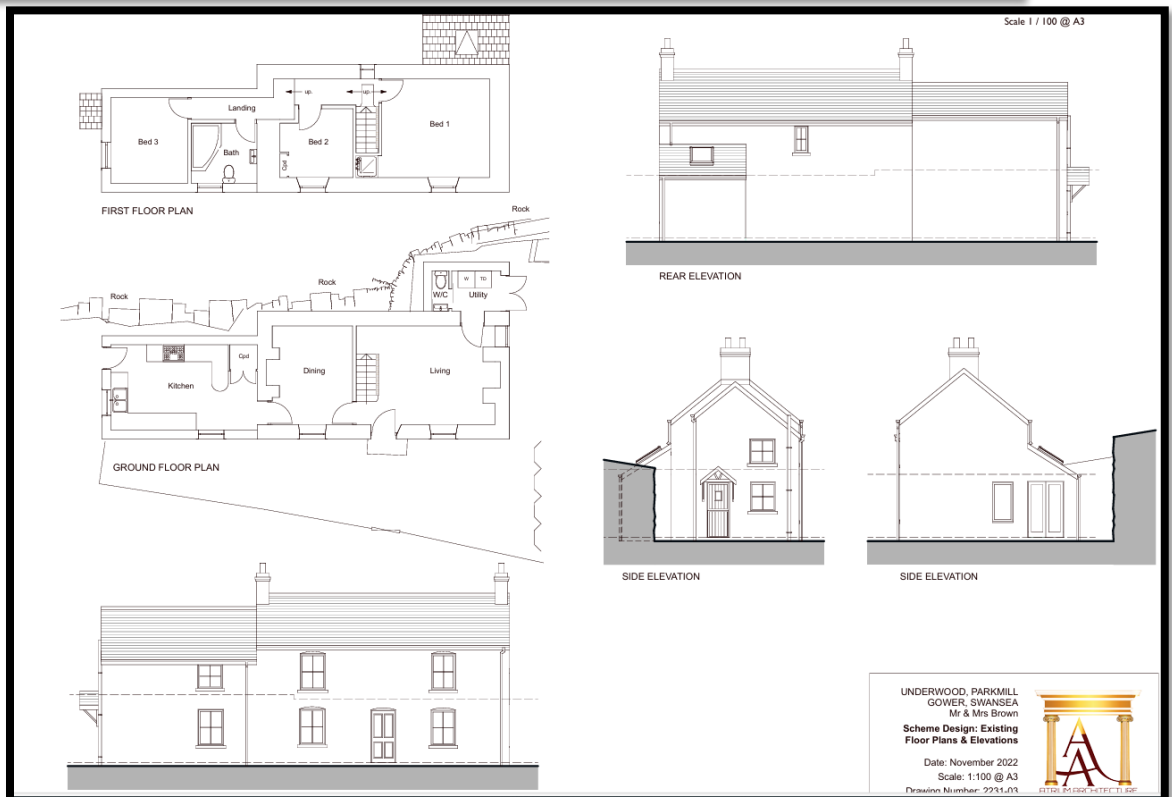
Month	Usage
Jan 2024	693.42 kWh
Feb 2024	670.32 kWh
Mar 2024	505.27 kWh
Apr 2024	347.95 kWh
May 2024	299.09 kWh
Jun 2024	277.81 kWh
Jul 2024	289.85 kWh
Aug 2024	347.56 kWh
Sep 2024	342.86 kWh
Oct 2024	405.71 kWh
Nov 2024	429.88 kWh
Dec 2024	419.84 kWh

The data above shows the nenergy usage throughout the year of 2024 and the Kwh for the property with 4 people living in the household. This data was shared via the homeowner.

Site plan of the property:



Floor Plan of the property:





Floor Plan of property produced by Visual AI

Performance Gaps Relative to EnerPHit

Due to the age and building fabric makeup. Therefore, the property is currently experiencing significant heat loss through various elements of the building envelope, including walls, roof, floors, and window junctions. This is primarily due to insufficient insulation, aged construction materials, and thermal bridging. As a result, the building requires more energy to maintain comfortable indoor temperatures, leading to higher heating costs and reduced energy efficiency. As the property a stone-built cottage with no insulation finished with lime mortar. The use of stone and lime mortar in traditional construction results in substantial heat loss due to the high thermal conductivity of the materials, lack of insulation, and poor airtightness. Also, for moisture management, this building method is thermally inefficient by modern building regulation. Therefore, the best opportunity is the retrofit method in accordance with PHPP and EnerPHit for suggestions. This property as a traditional building has no insulation on the floor, which results in significantly poor thermal performance. This poses a challenge in meeting modern energy efficiency standards, such as those required by EnerPHit or national building regulations.

Key issues with a poor insulated floor:

- Continuous downward heat flow resulting in higher space heating demand.
- Cold floor surfaces contribute to reduced thermal comfort.
- Thermal bridging at floor-to-wall junctions, which increases heat loss and condensation risk.
- Increased operational costs due to inefficiencies in retaining heat within the building.

This property has a gable roof. However, without proper insulation, the gable roof can contribute significantly to heat loss, which impacts the overall energy efficiency of the building. As part of this retrofit assessment, addressing the insulation and airtightness of the gable roof is essential to improve thermal performance and reduce heating costs.

The gable roof contributing to heat loss:

- Insufficient or poorly installed insulation in the loft space, particularly between the rafters or at ceiling level.
- Thermal bridging at structural junctions, such as the intersection of the roof slope with the gable wall, ridge, and eaves.
- Air leakage points around the roof space, including gaps in insulation, poorly sealed loft hatches, and unsealed penetrations around chimneys, flues, and electrical fittings.

- Cold spots in the upper sections of the property, especially in rooms under the gable roof, due to inefficient insulation or gaps in the roofing structure.

Upgrading this building to EnerPHit standard in the UK delivers numerous benefits. These include significant energy savings up to 75% compared to non-refurbished homes—as well as improved comfort through enhanced insulation and airtightness. This will allow the homeowner to enjoy lower long-term energy costs and a healthier indoor environment, with better air quality and a reduced risk of condensation and mold. Moreover, EnerPHit certification offers a high level of quality assurance, ensuring that the retrofit meets design and performance standards.

“Key retrofitting measures in EnerPhit

- **Enhanced Insulation:** Adding or improving insulation in walls, roofs, and floors to reduce heat loss, while being mindful of the building’s existing architecture.
- **Upgrading Windows and Doors:** Replacing or upgrading to high-performance windows and doors to improve thermal performance without compromising the building’s character.
- **Addressing Thermal Bridges:** Identifying and mitigating thermal bridges to prevent heat loss and condensation issues.
- **Improving Airtightness:** Sealing gaps and leaks to create a more airtight building envelope, which is crucial for maintaining a stable indoor climate.
- **Ventilation Systems:** Incorporating efficient ventilation systems, often with heat recovery features, to ensure good indoor air quality without significant heat loss.

Passivhaus is specifically designed for new constructions, with a focus on achieving maximum energy efficiency from the ground up. This approach allows for the integration of energy-efficient features into the building’s design right from the start, ensuring an optimal performance in terms of energy conservation and sustainability.

However, EnerPhit is tailored for existing buildings. It aims to upgrade these structures to standards that closely align with those of Passivhaus. This involves adapting and retrofitting older buildings, a task that often comes with its own set of challenges. EnerPhit recognises these unique difficulties and provides a more achievable pathway for bringing existing buildings up to par with modern energy efficiency standards.”

Hlobil, A. (2024). *How Does EnerPhit Differ From Passivhaus?* [online] EWI Pro. Available at: <https://ewipro.com/2024/01/06/how-does-enerphit-differ-from-passivhaus/> [Accessed 13 May 2025].

With using Passivhaus legislation to help guide the proposed retro fit upgrades. I am aiming to have low U-values in the property. Which represent thermal transmittance, are significantly lower than in standard buildings to minimize heat loss. Typically, U-values for walls, roofs, and floors in a Passivhaus range from 0.10 to 0.15 W/(m²K). Windows and doors in Passivhaus construction should have a U-value below 0.8 W/(m²K).

U-values in Passivhaus Construction:

- Walls:

U-values are typically between 0.10 and 0.15 W/(m²K), requiring thicker insulation than standard building practices.

- Roofs:

U-values are typically between 0.10 and 0.15 W/(m²K), requiring thicker insulation than standard building practices.

- Floors:

U-values are typically between 0.10 and 0.15 W/(m²K), requiring thicker insulation than standard building practices.

- Windows and Doors:

U-values should be below 0.8 W/(m²K). This is achieved through triple glazing and insulated frames.

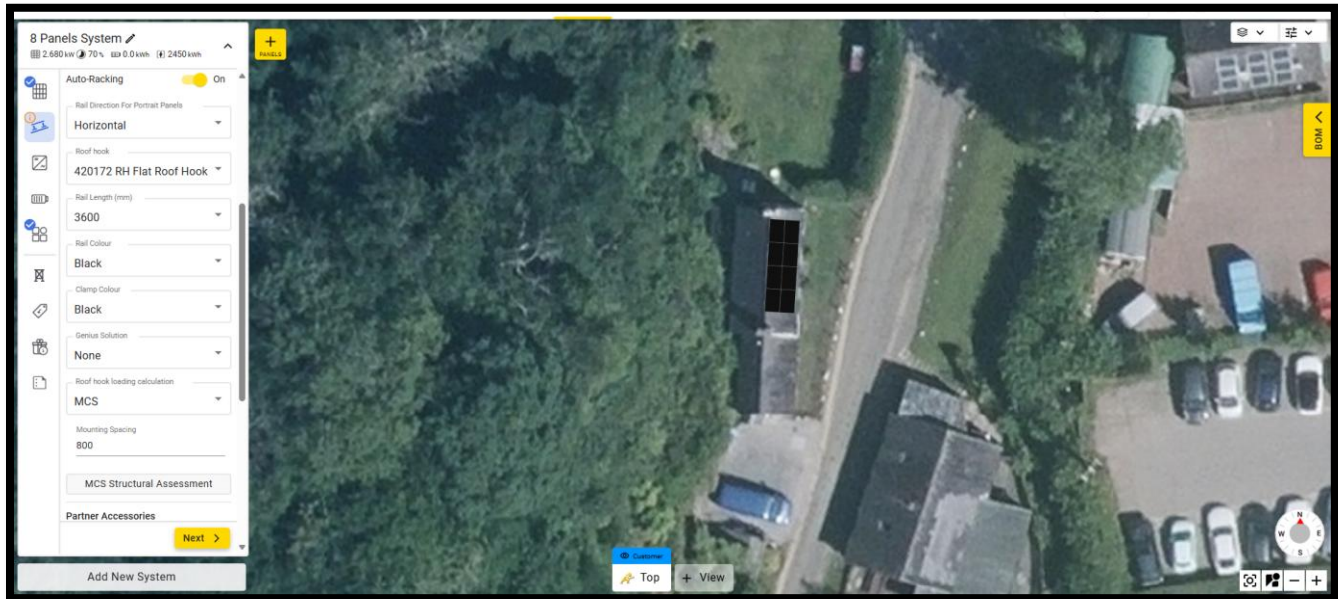
Passipedia.org. (2019). *Thermal insulation* []. [online] Available at: https://passipedia.org/planning/thermal_protection/integrated_thermal_protection.

Proposed Upgrades to the Property

From the evaluation of this property, there is no budget cost which I must consider. Due to the age of the property, the owner will have to carry out minor repairs to the chimney and repoint the brickwork with lime mortar, by also removing the overgrowth to the stack. To ensure all slated roof tiles are in good condition and make repairs if needed. Ensure that the rafter, battens and trusses are not suffering with any dry rot and wet rot. This will need to check throughout the property with any timber structures such as partitions walls etc. "Dry rot refers to brown rot decay caused by fungi that damage timber in buildings and wooden structures, often without visible moisture. Despite the name, it's misleading, as all wood-decaying fungi require some level of moisture to start decaying the wood" Wikipedia. (2021). *Dry rot*. [online] Available at: https://en.wikipedia.org/wiki/Dry_rot. The stages of dry rot are:

- Mycelium growth

- Fruiting body
- Affected wood
- Dry rot smell

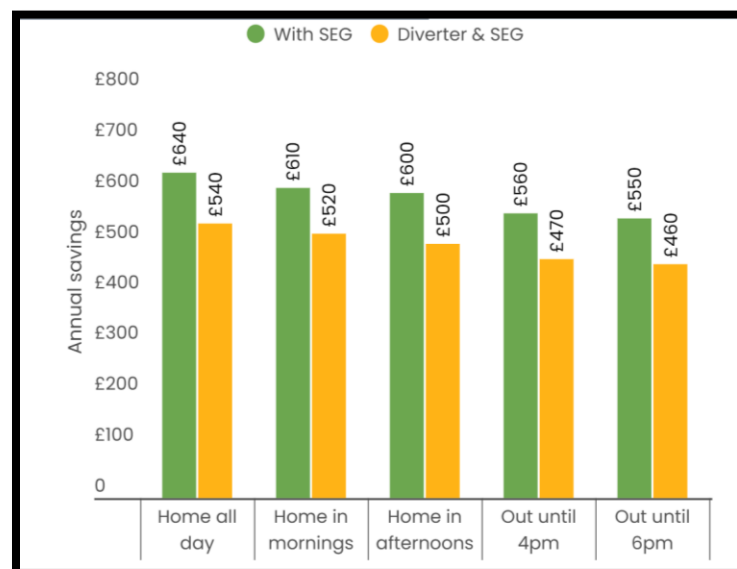


Once all the roof repairs are carried out and scaffold is erected on the property. I suggest the installation of PV panels on the property. There are going to be 8 solar panels installed on the main roof of the property, this due to the overgrowth to the rear of the property will affect the sunlight which would be produced. This system will generate 2600Kwh of energy. This will help reduce energy bills over the years, and the cost of the panels with these saving will be made back.

Savings in Great Britain are based on an electricity price of 24.5 p/kWh and a gas price of 6.29 p/kWh, calculated from a weighted average of projected, current and recent energy price caps. Savings in Northern Ireland are based on fuel prices as of November 2024

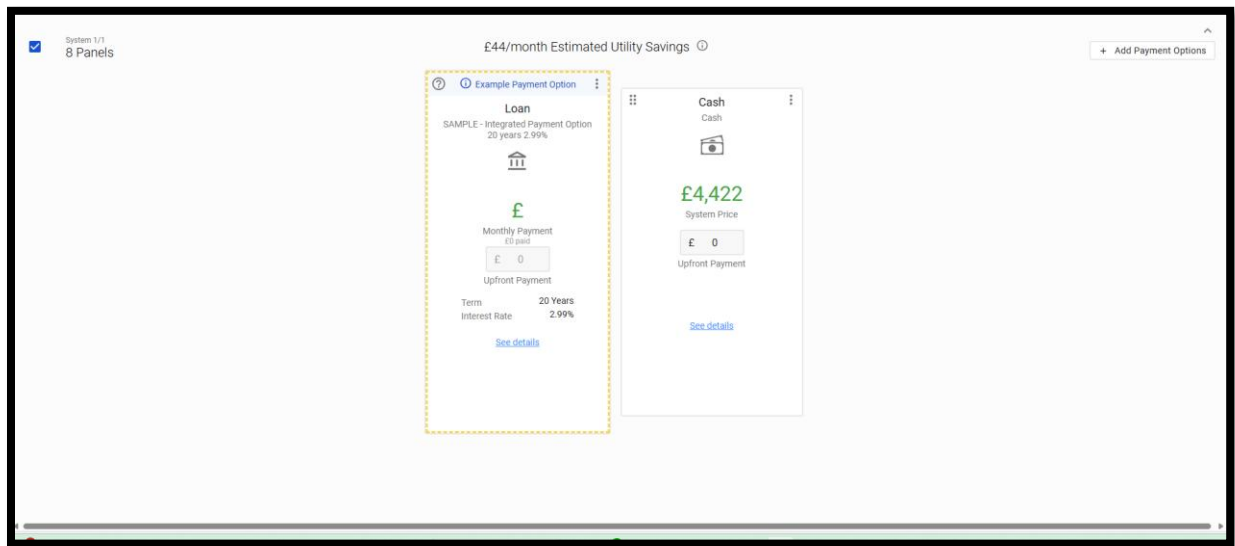
Energy Saving Trust (2022). *Solar panels*. [online] Energy Saving Trust. Available at: <https://energysavingtrust.org.uk/advice/solar-panels/>.

The price of the system which I have chosen and designed on the Open Solar website will cost around £4500 for the 8 solar panels and converters. For best practice a shed will be built in the garden to store the battery pack for solar panels for safety reasons. Which then will



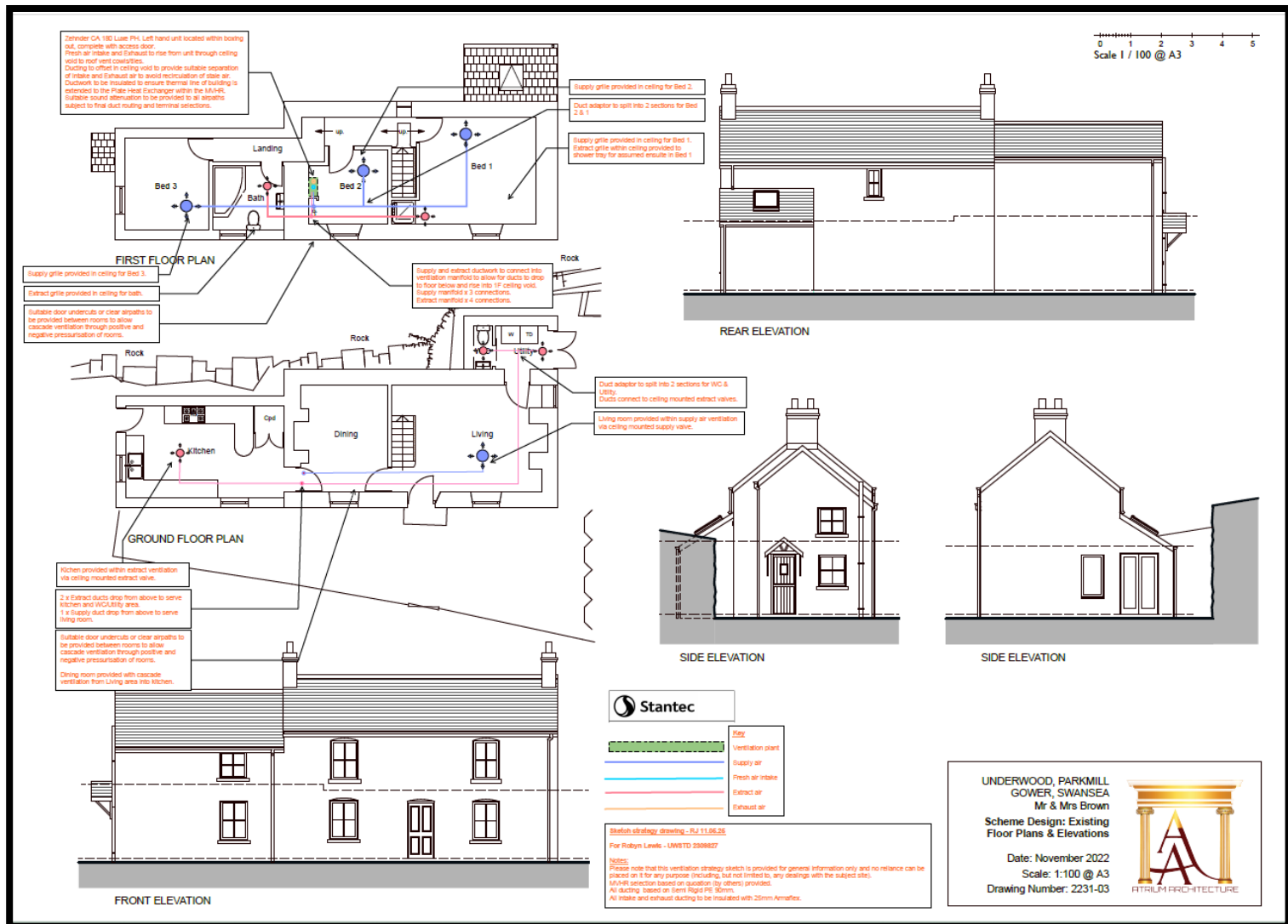
help provide electricity for the property. By storing a solar battery in a garden shed is considered best practice for several important reasons. Which it enhances safety by reducing the fire risk associated with lithium-ion batteries and ensuring proper ventilation away from the main property. It also offers practical benefits, such as saving indoor space, reducing noise, and keeping the system out of sight for a cleaner appearance.

Moreover, a shed can provide a controlled environment that protects the battery from weather extremes and helps maintain optimal operating temperatures, thereby extending its lifespan and efficiency. For this approach to be effective, the shed must meet manufacturer guidelines, including weatherproofing, ventilation, and safety standards.



OpenSolar. (2024). *Accurate 3D design*. [online] Available at: <https://www.opensolar.com/3ddesign/>.

Another suggestion is to remove the Comi boiler and LPG gas system from the property and looking at the PHHP to guide this retrofit, is to install an MVHR unit on the property. I have gone to a well-known supplier for plans of the MVHR unit and sects required to heat this property efficiency and ensure all ducting is not protruding in the habitable living spaces. MVHR systems recover up to 95% of the heat from the waste air stream, significantly reducing the energy needed for heating. This makes MVHR a crucial component in achieving the high energy efficiency demanded by Passivhaus standards. However, need to ensure that the building is airtight then the MVHR systems is particularly effective in achieving Passivhaus energy efficiency, as MVHR is most effective when the building is not airtight.



MVHR system

Ventilation requirements: usable floor area: 87 m² x 3 Bedr 112 m³/h Regulations applied: ADF plus Passivhaus
1.08 /h = 94 m³/h

Extract requirements (boost): Kitchen: 47 m³/h x 1 Ventilation rates:
Bathroom, Shower: 29 m³/h x 1 Away: 40 m³/h
Utility: 29 m³/h x 1 Level 1: 84 m³/h
Drying Area: 29 m³/h x 0 Level 2: 120 m³/h
WC: 22 m³/h x 1 = 127 m³/h Level 3: 151 m³/h

Commissioned on level 2

Distribution of the airflow volumes: commissioning values no less than below

Floor	Room	Area	Clear Height	Room Volume	Nominal (normal)			Boost		Nomin. Air Changes	Boost Air Changes	Comments (1) = single plenum (2) = double plenum
		m ²	m	m ³	Supply	Extr.	Through	Supply	Extr.			
		m ²	m	m ³	m ³ /h	m ³ /h	m ³ /h	m ³ /h	m ³ /h	1/h	1/h	
GF	Kitchen	15.81	2.40	37.9		48			60	1.26	1.58	1x (2) Cpd included
GF	Dining	9.18	2.40	22.0								Cascade ventilation
GF	Living	14.96	2.40	35.9	40			50		1.11	1.40	1x (2)
GF	Utility	3.07	2.40	7.4		23			29	3.13	3.94	1x (1)
GF	WC	0.84	2.40	2.0		17			22	8.67	10.91	1x (1)
1F	Bedroom 1	15.64	2.40	37.5	40			50		1.07	1.34	1x (2) Shower Tray?
1F	Bedroom 2	6.42	2.40	15.4	20			25		1.30	1.63	1x (1)
1F	Landing	7.51	2.40	18.0								Cascade ventilation
1F	Bathroom	4.88	2.40	11.7		32			40	2.71	3.42	1x (1)
1F	Bedroom 3	8.44	2.40	20.3	20			25		0.99	1.24	1x (1)
		86.8	max3m	208	120	120		151	151	0.58	0.73	

Zehnder ComfoAir 155 WMe

The Zehnder ComfoAir 155 WMe is a heat recovery unit designed to enable better and easier specification of ventilation in new properties. It contains features such as its automatic true summer by-pass, high heat recovery efficiency and integrated humidity sensor to provide a comfortable, healthy and energy-efficient indoor climate.



ZGRC1 Speed controller



ZGS2 Switch



ZGS1 Switch

Key Features

- Left or right hand configuration through software alone, no mechanical alteration required.
- 100% full and filtered summer bypass.
- Modern, discreet design.
- Easy installation to wall, cupboard or kitchen cupboard.
- Light to handle.
- BMS capability.
- Tool free filter access.
- Volt free contact boost capability.
- CommissionSMART is a commissioning wizard that enable a quick and simple set-up process.
- SummerSMART ensures automatic full by-pass activation providing filtered supply air 365 days a year.
- TimerSMART eliminates nuisance noise and over-ventilation by determining the duration of occupancy and allocating a suitable overrun time.
- HumidiSMART continuously monitors the humidity level within the home and looks for a man-made spike before boosting the unit, irrespective of distance or dilution.
- 100% variable AUX speed for use as away mode, medium speed or purge boost.
- Independently tested sound data.

SAP PCDB Test Results

	SFP (W/l/s)		Efficiency (%)	
	2009	2012	2009	2012
K+1	0.45	0.5	92%	90%
K+2	0.47	0.62	90%	88%
K+3	0.56	0.8	88%	86%
K+4	0.7	1.05	87%	85%
K+5	0.85	1.31	86%	84%
K+6	1.03		85%	
K+7	1.26		84%	

SEC Class



Based on average climate with local demand control

Article Numbers

Description	Product Code
Zehnder ComfoAir 155 WMe for wall or cupboard mounting with SMART technology	CA155WMe-GB
Controls, two position switch for ComfoAir 155/185 and Centair range	ZGS2
Controls, three position switch for ComfoAir 155/185 and Centair range	ZGS1
Controls, dual speed controller for ComfoAir 155/185 range with operational and service indicators	ZGRC1
Controls, remote air quality sensor	AQR
Controls, remote humidity sensor	HHRW
Controls, remote passive infra-red movement sensor	PIRR
Controls, remote temperature sensor	THR

Article Numbers

Description

Filter for Zehnder ComfoAir 155 WMe, ISO Coarse >45% (G3), 2 Pieces
Heat exchanger for Zehnder ComfoAir 155 WMe

Product Code

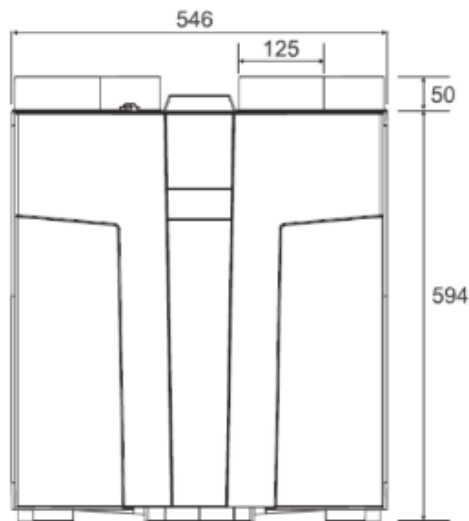
CA155FIL
CA155HFEX

Technical Specification

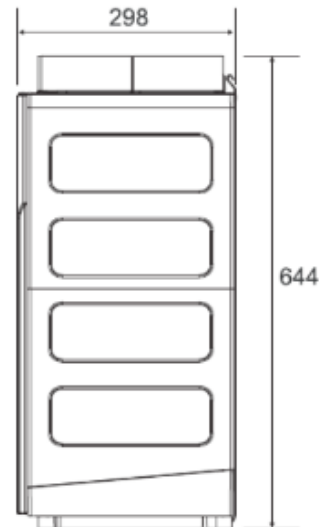
Weight	18 Kg
Ducting ø	125 mm
Condensate connection ø	21.5 mm
Filter grade	ISO Coarse >45% (G3)
Materials	Internal PP/EPS External ABS
Supply voltage	230V / single-phase / 50Hz
Maximum power consumption	165 W
Current draw	1.1 amp
Fuse	3 amp
Specific Fan Power	0.45 W/l/s
Heat Recovery Efficiency	92%

Dimensions

Height	644 mm
Width	546 mm
Depth	298 mm

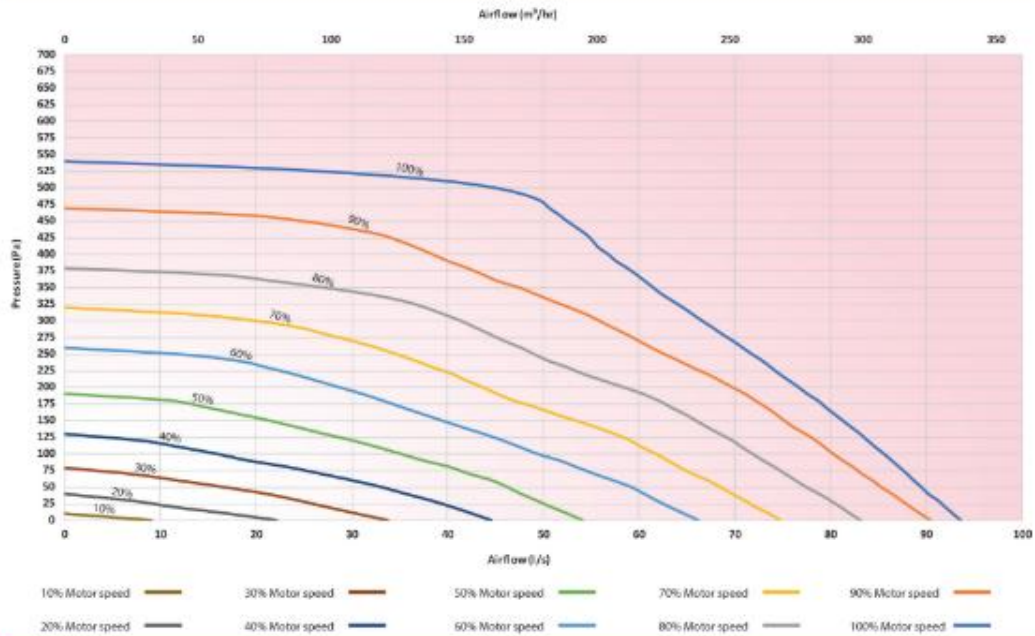


Front View



Side View

Pressure Curve



Sound Data

Speed	Test area	Octave Band (Hz) Sound Power Level, dB								Overall LwA, dB	dB(A) @ 3m
		63	125	250	500	1000	2000	4000	8000		
20%	Casing	26.6	25.5	23.4	26.1	20.8	15.1	17.9	22.6	27.9	10.4
	Supply/Exhaust	47.8	40.9	33.9	33.1	26.6	16.6	17.8	22.7	33.9	
	Extract/Intake	47	38.6	30.7	25.6	19.7	14.2	17.7	22.6	29.7	
40%	Casing	33.6	44	41	43.2	40.4	34.6	28.8	24.4	44.5	27.0
	Supply/Exhaust	63.4	60.2	53.7	52.5	53.9	46.8	38.5	35.3	56.8	
	Extract/Intake	55.8	51.4	45.2	41	40.9	32.9	23.1	23.3	44.8	
60%	Casing	37.6	50.2	47.1	49.3	45	42.4	36.8	31.4	50.4	32.9
	Supply/Exhaust	67.6	66.4	60.1	59.8	58.9	56	46.6	45.9	63.2	
	Extract/Intake	54.3	57	51.5	46.6	45.2	39.7	29.8	27.3	50	
80%	Casing	40.5	53.2	49	51.2	46.5	44.8	39.7	34.8	52.5	35.0
	Supply/Exhaust	69.6	69.3	62	60.9	60.2	58.6	49.4	49.4	65.1	
	Extract/Intake	57.9	59.1	53.8	48.9	46.5	42	32.7	30.1	52	
100%	Casing	41.5	55.9	53.2	55.3	50.9	49.4	44.3	40	56.8	39.3
	Supply/Exhaust	71.9	72.7	65.3	64	62.4	61.9	53.7	54	68.1	
	Extract/Intake	59	61.5	57.8	52.4	49.1	45.9	37.2	34.9	55.3	

Tested according to BS EN 13141-7:2010. Supply and Extract showing induct sound power level. Casing dBA @ 3m given as hemispherical.

Declaration of Performance Heat Recovery Unit Zehnder ComfoAir 155 WMe

Supplier's Name or Trade Mark	Zehnder Group			Zehnder Group			Zehnder Group			Zehnder Group		
Supplier Model Identifier	CA155WMe-GB			CA155WMe-GB			CA155WMe-GB			CA155WMe-GB		
Control Typology	Manual Control (via manual switch)			Clock Control (via 7 day timer control)			Central Demand Control (with 1 sensor)			Local Demand Control (with 2 or more sensors)		
SEC in [kWh/(m ² a)] for Each Climate (Cold, Average, Warm)	-76.6	-40.0	-16.4	-77.5	-40.6	-16.9	-79.1	-41.7	-17.7	-82.1	-43.8	-19.2
SEC Class (Cold, Average, Warm)	A+	A	E	A+	A	E	A+	A	E	A+	A	E
Type of Ventilation Unit	Bidirectional RVU			Bidirectional RVU			Bidirectional RVU			Bidirectional RVU		
Type of Drive Installed	Variable Speed			Variable Speed			Variable Speed			Variable Speed		
Type of Heat Recovery System	Recuperative			Recuperative			Recuperative			Recuperative		
Thermal Efficiency	84%			84%			84%			84%		
Maximum Flow Rate in [m ³ /h] / [l/s]	307 / 85			307 / 85			307 / 85			307 / 85		
Electric Power Input [W]	157			157			157			157		
Sound Power Level [dB(A)]	51			51			51			51		
Reference Flow Rate in [m ³ /h] / [l/s]	215 / 60			215 / 60			215 / 60			215 / 60		
Reference Pressure Difference	50			50			50			50		
SPI [W/(m ³ /h)]	0.27			0.27			0.27			0.27		
Control Factor and Typology	1			0.95			0.85			0.65		
Declared Maximum Internal and External Leakage [%]	Internal: 0.8% External: 1.0%			Internal: 0.8% External: 1.0%			Internal: 0.8% External: 1.0%			Internal: 0.8% External: 1.0%		
Mixing Rate	-			-			-			-		
Position and Description of Visual Filter Warning	Details within Homeowner Guide			Details within Homeowner Guide			Details within Homeowner Guide			Details within Homeowner Guide		
Internet Address for Preassembly / Disassembly Instructions	www.zehnder.co.uk			www.zehnder.co.uk			www.zehnder.co.uk			www.zehnder.co.uk		
Airflow Sensitivity to Pressure Variations [%]	-			-			-			-		
Indoor / Outdoor Air Tightness [m ³ /h]	-			-			-			-		
AEC (kWh electricity/a) for Each Climate (Cold, Average, Warm)	9.3	3.9	3.4	8.9	3.6	3.1	8.3	2.9	2.5	7.3	1.9	1.5
AHS (in kWh primary energy/a) for Each Climate (Cold, Average, Warm)	85.9	43.9	19.9	86.4	44.2	20.0	87.4	44.7	20.2	89.4	45.7	20.7

Application:	Zehnder Economy MVHR		Passive House MVHR	
Heat Recovery Ventilation Unit (no. of units)	1x	Zehnder CA 155Wme	1x	Zehnder CA 180 LuxePH
	 Economy MVHR Wall or ceiling mounting		 Wall mounted, e.g. in kitchen cabinets	
click link for more information:	mvhr-units/economy-mvhr-zehnder-comfoair-155		mvhr-units/zehnder-comfoair-160-180-and-200	
MVHR unit: type of heat exchanger frost protection	heat recovery frost pr. disbalancing £1,530.21 20.0% £1,224.17		high perform. heat recovery in-built modulating pre-h. £2,550.37 20.0% £2,040.30	
Controller	integrated controller £56.04 20.0% £44.83		CCS controller £114.95 20.0% £91.96	
Ducting type Insulation of intake + exhaust Noise attenuation	Semi-rigid PE 90mm 15mm EPP best performing metal attenuator £3,193.77 20.0% £2,555.01		Semi-rigid PE 90mm 25mm Armaflex best performing metal attenuator £3,193.77 20.0% £2,555.01	
Terminals (internal) (external)	Zehnder Luna, V-F for kitchen Metal combi grille £520.85 20.0% £416.68		Lindab Airy, VI25-FB for kitchen Metal combi grille £968.08 20.0% £774.46	
Material Estimate (excl. VAT):	Retail Price	Your Price	Retail Price	Your Price
	£5,300.87	£4,240.69	£6,827.17	£5,461.73
Please note that the price for ducting material is an estimate and may change dependant on the design layout and price fluctuations. If you would like to receive an accurate price, we are happy to re-quote after the system has been designed. All Retro fits are subject to site visit				

Design, consultancy & project support	£605.00	£605.00
	all prices excl. VAT	all prices excl. VAT
TOTAL design & supply only estimate	£4,845.69	£6,066.73

For more information, click here: [heatrecovery.co.uk/information-on-domestic-ventilation-and-mvhr/quotation-specification-design-installation](#)

All data received from Paul Heat recovery. "Opting for an MVHR system in a domestic property could save 25%-50% on energy bills, due to the reduced heating demand. While MVHR systems do take a small amount of electricity to run, this amounts to a matter of pence a day and usually no more than £30 a year.

The potential for long-term savings makes MVHR an attractive choice for homeowners looking to reduce their energy expenses while enjoying a more energy-efficient and comfortable living environment."

Sales Account (2023). *How MVHR Systems Reduce Energy Bills - Filters Direct*. [online] Filters Direct. Available at: <https://filtersdirect.uk/how-mvhr-systems-reduce-energy-bills/>.

The MVHR unit will be installed in bedroom 2 with a built-in cupboard and covered with sound proofing which there will be supply and extract through the existing chimney. I am opting for the Passivhaus rated MVHR system as it will be efficient and help reduce bills cost for the future.

Alongside this I am going to upgrade the boiler and wet goods. The reason for the new combi boiler and radiators aims to upgrade the existing heating system to meet current regulatory standards and improve overall energy efficiency, safety, and performance within the property.

Building legislation which need to be compliant with:

- Part L – Conservation of fuel and power, ensuring energy-efficient heating systems.
- Gas Safety (Installation and Use) Regulations 1998, requiring all gas appliances and installations to be carried out by a Gas Safe registered engineer.
- Benchmark Commissioning Checklist – Ensuring the boiler is correctly commissioned for optimal performance and warranty validation.

New combi boilers are typically over 90% efficient, significantly reducing gas consumption and lowering utility bills. Radiators will be correctly sized and placed for optimal heat distribution and improved thermal comfort.

To ensure airtightness and reduce thermal loss, I suggest that triple glazing windows and doors to be installed on the property. Tripple glazing significantly reduces heat loss through windows, which are typically a major source of energy loss in buildings. It helps achieve the very low U-values ($\leq 0.85 \text{ W/m}^2\text{K}$) required by EnerPHit, contributing to the overall energy efficiency target.

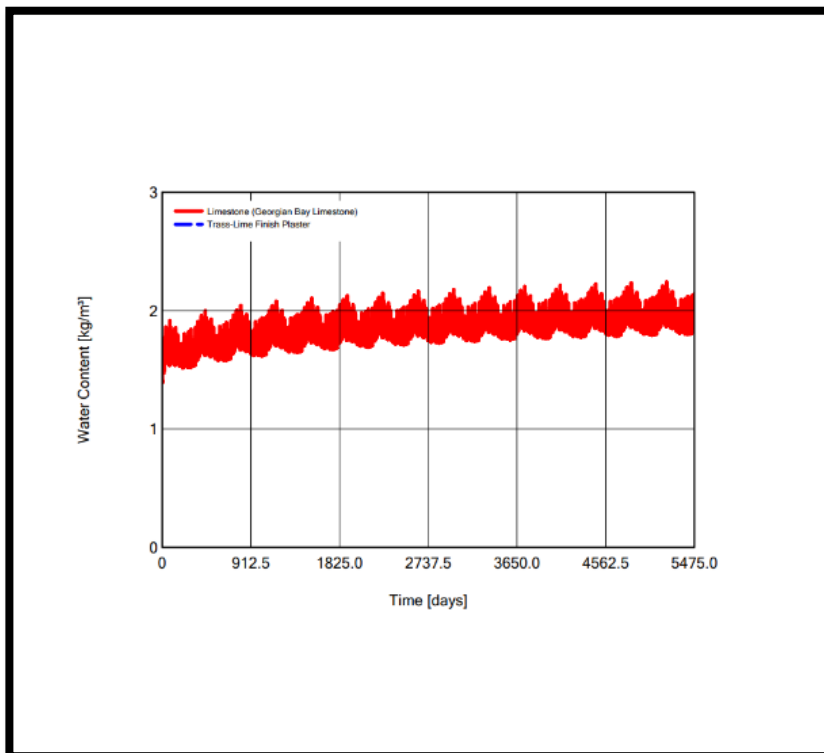
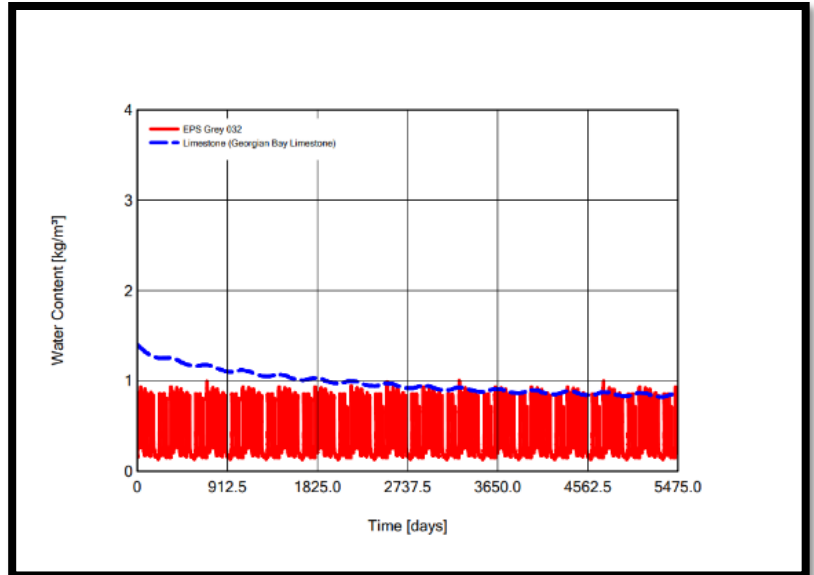
www.norrsken.co.uk. (n.d.). *The EnerPHit Standard*. [online] Available at: <https://www.norrsken.co.uk/passive-house/enerphit>.

Ensure that the suppliers are installing the windows and doors. “FENSA ensures that installers meet specific standards for product quality, installation techniques, and compliance with building regulations. This includes ensuring that triple glazed windows meet the required energy efficiency ratings. “

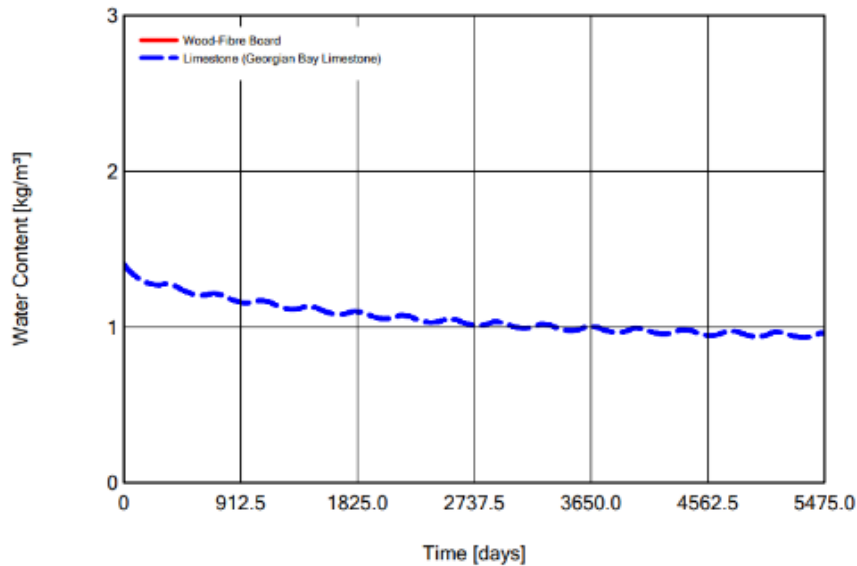
Fensa.org.uk. (2025). *Solar Windows & Doors Limited*. [online] Available at: <https://www.fensa.org.uk/installers/solar-windows-doors-limited> [Accessed 13 May 2025].

Regarding the wall buildup of the property a WUFI assessment was carried out of different materials which could be used on the property. Which “WUFI (Wärme Und Feuchte Instationär, meaning "Heat and Moisture Transient") analysis is a software-based method used to simulate heat and moisture transfer within building components. It helps predict how materials will behave under various climate conditions, including condensation, moisture accumulation, and drying over time”. - Wufi.de. (2019). *What is WUFI®? | WUFI (en)*. [online] Available at: <https://wufi.de/en/software/what-is-wufi/>.

Figure 1 Exiting wall build up with limestone plaster



EWI Install with limestone plaster



EWI with wood fiber insulation

By completing this survey, the option for this property is EWI wood fiber with limestone render. The original limestone render from the property will need to be removed and re applied to ensure that the building is reached. Hacking off existing render before installing External Wall Insulation (EWI) is essential to ensure a stable, even, and moisture-free surface for the insulation system. It prevents issues like poor adhesion, damp build-up, and thermal bridging. Removing old render also allows for inspection and repair or defects. This step is crucial for the long-term durability and performance of the EWI system. When installing the EWI system we will need to ensure the insulation goes to ground level, and the eaves of the property will need to be extended. Adjustment to pipework such as vents, waste pipe and flues will need to be extended. Also, ensure the manufacturer's details are followed for window/door reveals, using appropriate trims at openings, corners, angles, and interfaces. “An INCA (Industry Association for External Wall Insulation) best practice guide for external wall insulation (EWI) provides comprehensive guidance on the installation, maintenance, and materials used in EWI system. “

INCA EWI Trade Association. (2016). EWI Technical Guidance & Research and Resources | INCA. [online] Available at: <https://www.inca-ltd.org.uk/knowledge-hub/guidance/> [Accessed 13 May 2025].

Attic insulation will need to be topped up and insulation the rake in the ceiling with Celotex to ensure there is no heat loss occurring, or cold spots. "For a building to meet Passive House requirements (PHPP), attic insulation needs to achieve a very low U-value, typically between 0.10 and 0.15 W/m²K. This requires a high level of insulation, often referred to as "super insulation," with thicknesses ranging from 200-300mm, depending on the insulation's lambda value. In addition to insulation, minimizing thermal bridges and ensuring airtightness are also crucial aspects of meeting the PHPP standards."

Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard Structure of the criteria. (n.d.). Available at: https://passiv.de/downloads/03_building_criteria_en.pdf.

Moreover, I am going to suggest digging up the floor of the ground floor if the property and installing insulation this will help with heat loss reduction. This will help to maintain a consistent indoor temperature and lower heating costs. Also, looking at the levels of the property the ground level will need to be reduced as it's protruding over the DPC level. Which I would also suggest installing an unsullied DPC due to the extent of works which is occurring.

2 timber I-beam wall							
Assembly No. Building Assembly Description							
Heat Transfer Resistance [m ² K/W]			interior R _{si}	0.13			
			exterior R _{se}	0.04			
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
1. plaster board	0.250					15	
2. non ventilated air gap	0.136	timber	0.130			25	
3. osb	0.130					20	
4. insulation	0.039	timber	0.130	timber	0.130	40	
5. insulation	0.039			timber	0.130	240	
6. insulation	0.039	timber	0.130	timber	0.130	40	
7. fibre board	0.049					50	
8.							
			Percentage of Sec. 2	6.7%		Percentage of Sec. 3	1.7%
			U-Value:		0.107		W/(m ² K)
					Total		43.0 cm

For the internal wall going to use the materials used above due to the low u value achieved

3		Pitched Roof				
Assembly No.		Building Assembly Description				
Heat Transfer Resistance [m ² K/W]		interior R _{si} :		0.10		
		exterior R _{se} :		0.24		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1. plaster board	0.250					15
2. non ventilated air gap	0.153	timber	0.130			25
3. osb	0.130					15
4. insulation	0.039	timber	0.130			100
5. insulation	0.039					300
6.						
7.						
8.						
		Percentage of Sec. 2		Percentage of Sec. 3		Total
		10.0%				45.5 cm
U-Value:		0.094		W/(m ² K)		

U Value calculation for the pitched roof makeup

4		floor slab on grade				
Assembly No.		Building Assembly Description				
Heat Transfer Resistance [m ² K/W]		interior R _{si} :		0.17		
		exterior R _{se} :		0.00		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1. floor finish	0.930					20
2. screed	1.300					50
3. cork insulation	0.045					250
4. lime concrete	1.700					180
5.						
6.						
7.						
8.						
		Percentage of Sec. 2		Percentage of Sec. 3		Total
						50.0 cm
U-Value:		0.170		W/(m ² K)		

U value calculation using PHPP calculations for the new suggested floor slab makeup on the property.

When carrying out work on-site, make sure that building control is overseeing the process. This ensures that the work is done correctly and that the appropriate materials are used.

Impacts of Upgrade and Carbon Reduction

The suggestion in accordance with Passivhaus regulation and EnerPHit will allow the Welsh government to reach their goal of becoming carbon neutral by 2030. As buildings are responsible for a significant portion of greenhouse gas emissions, upgrading existing building stock is essential. The EnerPHit standard, developed by the Passive House Institute, provides an effective approach to retrofitting existing buildings for energy efficiency and sustainability. As resulted from the suggestion made, this will allow us to contribute towards the Welsh government's goal of becoming carbon neutral

Planning Policy Wales is one of the many documents implemented by Welsh government to reduce carbon footprints the document to summarize talks about reducing energy demand in an affordable manner. By focusing on energy efficiency and the strategic location and design of new developments, they aim to meet energy needs with renewable and low-carbon sources

GOV.WALES. (n.d.). *Planning policy Wales*. [online] Available at: <https://www.gov.wales/planning-policy-wales>.

References

www.norrskan.co.uk. (n.d.). *The EnerPHit Standard*. [online] Available at:

<https://www.norrskan.co.uk/passive-house/enerphit>.

Maps.nls.uk. (2025). *View map: Ordnance Survey, SS5489-SS5589 - AA - Ordnance Survey 1:2500 scale map - Ordnance Survey National Grid Maps, 1940s-1970s*. [online] Available at: <https://maps.nls.uk/view/188694537> [Accessed 12 May 2025].

Public Health England (2017). *Asbestos: general information*. [online] GOV.UK. Available at: <https://www.gov.uk/government/publications/asbestos-properties-incident-management-and-toxicology/asbestos-general-information>.

Reuters, T. (n.d.). *The Control of Asbestos Regulations 2012*. [online] 15(1), p.14. Available at: https://assets.publishing.service.gov.uk/media/65fd6fa2a6cof7001aef927f/CD1.F_Control_of_Asbestos_Regulations_2012__CAR_2012_.pdf.

Environment Agency (2016). *Prevent Japanese knotweed from spreading*. [online] GOV.UK. Available at: <https://www.gov.uk/guidance/prevent-japanese-knotweed-from-spreading>.

Hlobil, A. (2024). *How Does EnerPhit Differ From Passivhaus?* [online] EWI Pro. Available at: <https://ewipro.com/2024/01/06/how-does-enerphit-differ-from-passivhaus/> [Accessed 13 May 2025].

Passipedia.org. (2019). *Thermal insulation []*. [online] Available at: https://passipedia.org/planning/thermal_protection/integrated_thermal_protection.

Wikipedia. (2021). *Dry rot*. [online] Available at: https://en.wikipedia.org/wiki/Dry_rot.

Energy Saving Trust (2022). *Solar panels*. [online] Energy Saving Trust. Available at: <https://energysavingtrust.org.uk/advice/solar-panels/>.

OpenSolar. (2024). *Accurate 3D design*. [online] Available at: <https://www.opensolar.com/3ddesign/>.

Paul Heat recovery

Fensa.org.uk. (2025). *Solar Windows & Doors Limited*. [online] Available at: <https://www.fensa.org.uk/installers/solar-windows-doors-limited> [Accessed 13 May 2025].

INCA EWI Trade Association. (2016). *EWI Technical Guidance & Research and Resources | INCA*. [online] Available at: <https://www.inca-ltd.org.uk/knowledge-hub/guidance/> [Accessed 13 May 2025].

Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard Structure of the criteria. (n.d.). Available at:

https://passiv.de/downloads/o3_building_criteria_en.pdf.

GOV.WALES. (n.d.). *Planning policy Wales*. [online] Available at:

<https://www.gov.wales/planning-policy-wales>.

Lecture notes and PowerPoints