

# Building Services 2

## CASE STUDY ANALYSIS - LOW ENERGY DESIGN

By Aaron Griffiths (2223674) | ACBA5017 | 06/05/25

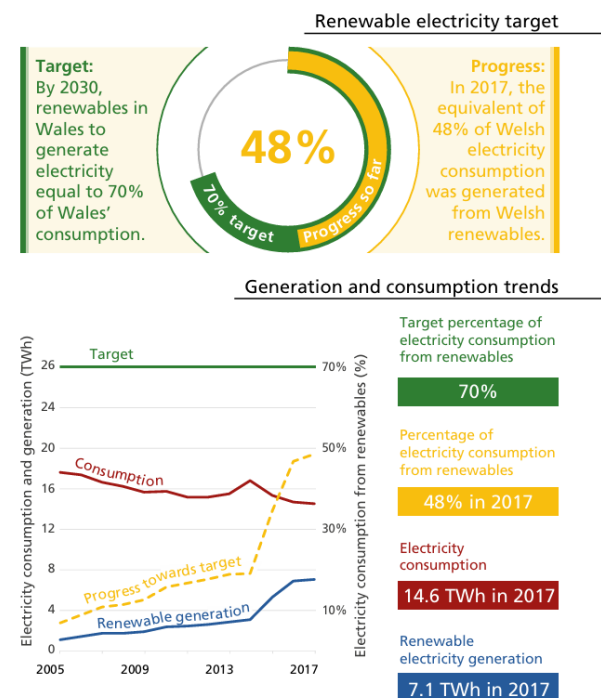
This report critically evaluates the case study provided by Spring Design in the context of scenario building and proposes strategic changes to mechanical, electrical, and ventilation systems. The revised design aims to align with low energy building standards, Nett Zero targets, low embodied and operational carbon, and significant lifecycle cost reductions. The report includes recommendations, equipment justification, and annotated sketches to support sustainable construction and operational practices. The case study is to evaluate the different methods we use in the construction industry to today's date and further my opinion on why we should be building new development to Leti building standard or also known as Passivhaus standard. Also to implement the transition to low-energy, low-carbon building standards, renewable integration, Passivhaus strategies and how to create a pathway to Nett zero. By also, involving a financially sustainable and a resilient building.

The suggestions I propose for the design will be aligned with global sustainability targets and enhance both environmental and occupant well-being. The reason why we need to act now is because global warming is impacting our planet. "Global warming is the long-term heating of Earth's surface observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. This term is not interchangeable with the term climate change. Since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius (1.8 degrees Fahrenheit), a number that is currently increasing by more than 0.2 degrees Celsius (0.36 degrees Fahrenheit) per decade. The current warming trend is unequivocally the result of human activity since the 1950s and is proceeding at an unprecedented rate over millennia." - NASA (2024). *What Is Climate Change?* [online] science.nasa.gov. Available at: <https://science.nasa.gov/climate-change/what-is-climate-change/>.

## PATHWAY TO NETT ZERO LEGISLATIONS

The construction industry has a significant influence on the environment. It contributes to a range of environmental concerns, including the generation of waste, depletion of natural resources, pollution of air and water bodies, noise disturbances, and the degradation of natural habitats. Moreover, is a main source of greenhouse gas emissions. The processes involved in the extraction, production, and utilisation of construction materials place considerable strain on the Earth's ecosystems and resource reserves.

The Welsh government implemented legislation such as Energy Generation Wales Doc 2017. "The Energy Generation in Wales 2017 report sets out the current energy generation capacity of Wales, and analyses how it has changed over time. The document summarizes: Progress towards renewable energy targets, renewable



energy generation in Wales, local authority area progress and local ownership stories. Since 2005, energy consumption has fallen 17%. Electricity generation from nuclear and coal has reduced, whereas natural gas and renewable generation has increased. (TWh)



Renewables Gas and Nuclear Wales' annual electricity consumption. The Welsh Government has set a supportive policy, regulatory and support framework in Wales, which continues to be successful in bringing forward energy projects both at the local, and the large scale - Energy Generation in Wales 2017 in 5 minutes. (n.d.). Available at:

<https://www.gov.wales/sites/default/files/publications/2019-06/energy-generation-2017-graphical-summary.pdf> [Accessed 5 May 2025].

Another legislation which the Welsh government has introduced to push development/retro fitting is the Future Wales National Plan 2040 Doc. To summarize the Future Wales – The National Plan 2040 is a comprehensive 20-year national development framework prepared by the Welsh Government, covering the entire territory of Wales up to the year 2040. The plan sets out a strategic vision for shaping the future of the nation through the planning system, providing a clear direction for addressing national priorities such as climate change, sustainable development, economic resilience, and placemaking. Its core objectives include supporting the transition to a low-carbon economy, promoting renewable energy generation, enhancing biodiversity, and encouraging sustainable transport and infrastructure investment. The plan also aims to strengthen regional collaboration, support thriving urban and rural communities, and ensure that future development contributes positively to the well-being of current and future generations in line with the principles of the well-being of Future Generations (Wales) Act 2015.

Wales is trying Net zero within the country by 2050. So, a legislation which guide industries and worker. Within the construction industry the legislation Net Zero Skills in Wales refers to the specialized skills and knowledge. To allow for supporting the construction industry's transition to a net-zero carbon economy by 2050. In this context, it involves developing the technical competencies and sustainable practices required to reduce carbon emissions across the built environment. This includes skills in low-carbon construction methods, energy-efficient building design, the use of sustainable materials, and the integration of renewable technologies. The aim is to equip construction professionals ranging from



GOV. WALES. (2024). Net zero skills Wales | GOV. WALES. [online] Available at: <https://www.gov.wales/net-zero-skills-wales>.

architects and engineers to site operatives and project managers. With the capabilities to deliver buildings and infrastructure that meet net-zero standards. The workers will be prepared to adapt to the changing demands of industry and contribute to long-term environmental and economic resilience in Wales.

Moreover, another document which the Welsh government has made to try to reach Net Zero and Low Carbon Wales represents the Welsh Government's strategic approach to reducing greenhouse gas emissions and facilitating the transition to a low-carbon economy. The strategy encompasses a wide range of policies and initiatives designed to decrease dependence on fossil fuels, accelerate the deployment of renewable energy



sources, enhance energy efficiency, and promote low-carbon technologies across key sectors such as transport, heating, construction, and industry. This integrated approach supports Wales' commitment to achieving net-zero emissions by 2050, in line with broader climate and sustainability goals. "There is a national milestone for greenhouse gases which is for Wales to achieve net-zero greenhouse gas emissions by 2050. In 2021, it was estimated that greenhouse gas emissions released into the atmosphere directly from within Wales totaled 36.3 million tons of carbon dioxide equivalent" - [www.gov.wales](https://www.gov.wales). (n.d.). *Wellbeing of Wales, 2023: a globally responsible Wales [HTML]* | GOV.WALES. [online] Available at: <https://www.gov.wales/wellbeing-wales-2023-globally-responsible-wales-html>.

The Royal Institution of Chartered Surveyors (RICS) plays a key role in advancing energy modelling and sustainability within the built environment. Through its promotion of Building Information Modelling (BIM) and the development of the Whole Life Carbon Assessment (WLCA) standard, RICS supports more accurate and data-driven approaches to evaluating and improving building performance. BIM is utilized to simulate energy use, enabling the optimization of design decisions to enhance efficiency and reduce environmental impact. The WLCA methodology, established by RICS, provides a comprehensive framework for measuring both embodied and operational carbon emissions over a building's entire lifecycle. In addition, RICS advocates for the enhancement of Energy Performance Certificates (EPCs) to ensure they more accurately reflect actual energy performance, thereby supporting industry-wide decarbonization efforts and the transition to net zero.

#### Carbon Assessment within RICS analysis:

- WLCA is a standard developed by RICS for measuring carbon emissions throughout a building's lifespan, including embodied carbon (from materials and construction) and operational carbon (from energy use).
- The standard ensures consistent and accurate carbon measurements, allowing for better decision-making about sustainability.
- RICS provides guidance and training to members on implementing WLCA, including how to record any deviations from the standard.
- WLCA helps organizations understand and reduce their carbon footprint across the built environment.

RICS also uses software such as BIM. Which Building Information Modelling (BIM) is a collaborative digital process that provides an integrated representation of a building's physical and functional characteristics throughout its lifecycle from design and construction to operation and maintenance. BIM enables architects, engineers, surveyors, and other stakeholders to work within a shared 3D environment, enhancing coordination, reducing errors, and improving decision-making.

Within the context of sustainable construction and energy-efficient design, BIM plays a critical role in modelling and simulating building performance. It supports the integration of Building Energy Modelling (BEM), allowing for detailed analysis of thermal performance, natural and artificial lighting, ventilation strategies, insulation, and material properties. These simulations help identify opportunities to reduce energy consumption, minimise carbon emissions, and enhance occupant comfort.

The Royal Institution of Chartered Surveyors (RICS) advocates the use of BIM as a vital tool in achieving low-carbon design standards, particularly when combined with Whole Life Carbon Assessments (WLCA). This approach ensures that energy efficiency and sustainability are embedded at every stage of the project lifecycle, enabling better compliance with environmental regulations and more informed, responsible construction practices.

Referenced from - Rics.org. (2025). Available at: <https://www.rics.org/news-insights/reforming-energy-performance-across-england-and-wales> [Accessed 5 May 2025].

## ENERGY PERFORMANCE

To compare the costs and performance on new developments within Wales you must follow the four legislation which are commonly used in Building regulation Part L Wales 2025, AECB Carbon Lite, B&NES and Leti also known as Passivhaus.

Each legislation:

**Building Regulations Part L** – was revised in 2025 and is a key legislation measure aimed at significantly reducing the carbon emissions associated with new homes and buildings. The updated regulations set ambitious performance standards, targeting a 75–80% reduction in carbon dioxide emissions from new dwellings compared to those built to previous standards. This forms a critical component of Wales’s broader strategy to achieve net zero carbon emissions by 2050, promoting new technologies, improved energy efficiency, and sustainable construction practices across the built environment.

**AECB Carbon Lite** - a framework for creating low-carbon, energy-efficient buildings, focusing on both new builds and retrofits. They aim to reduce overall carbon emissions by using readily available technologies and emphasizing best practices in construction and renovation. AECB CarbonLite Certified buildings are eligible for discounted mortgages, and the standards are supported by training courses and resources for professionals. - Anon, (2023). *The AECB CarbonLite™ Standards - an intro - AECB*. [online] Available at: <https://aecb.net/the-aecb-carbonlite-standards/>.

**B&NES** - Bath and North East Somerset Council has declared a climate emergency and has committed to providing the leadership for the district to be carbon neutral by 2030.

This will contribute to the UK’s legally binding target of net zero carbon by 2050. There are three key priorities to achieve this:

- energy efficiency improvement of most existing buildings (domestic and non-domestic) and zero carbon new build
- a major shift to mass transport, walking, and cycling to reduce transport emissions
- a rapid and large-scale increase in local renewable energy generation

Aims:

- provide simple, practical guidance on retrofit and sustainable construction for all building types whilst having regard to statutory legislation
- facilitate all householders and developers to approach build projects more sustainably
- support the uptake of retrofitting measures
- support planning, housing, building control and conservation officers to provide consistent and quality advice
- enable our goal of achieving 65,000 retrofits in B&NES by 2030
- enable affordable warmth for all

Bathnes.gov.uk. (2025). *Introduction* | Bath and North East Somerset Council. [online] Available at: <https://www.bathnes.gov.uk/energy-efficiency-retrofitting-and-sustainable-construction-supplementary-planning-document-5> [Accessed 5 May 2025].

**LETI** - LETI standards, primarily focused on Net Zero Carbon for buildings, are a set of guidelines and recommendations developed by the London Energy Transformation Initiative (LETI). These standards aim to help the built environment achieve net zero carbon emissions by addressing both operational and embodied carbon, with a focus on energy efficiency, renewable energy, and demand management.

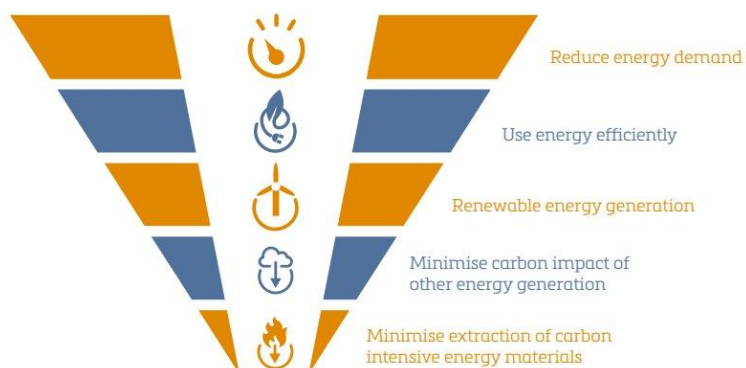
- LETI's standards are designed to help buildings achieve net zero carbon emissions, meaning that the total carbon emissions from the building lifecycle (both operational and embodied) are offset or reduced to a minimum.
- The standards align with the UK's 1.5°C carbon reduction pathway.

LETI (2020). *Climate Emergency Design Guide*. [online] LETI. Available at: <https://www.leti.uk/cedg>.



When planning to build your next development plan need to look at the hierarchy energy use plan The Welsh Government places the highest priority on reducing energy demand wherever it is feasible and economically viable. Enhancing energy efficiency and minimising demand through the strategic location and sustainable design of new

Figure 10: The Energy Hierarchy for Planning



developments. Which will play a vital role in enabling energy needs to be met through renewable and low-carbon sources, thereby supporting the transition to a more sustainable energy system.

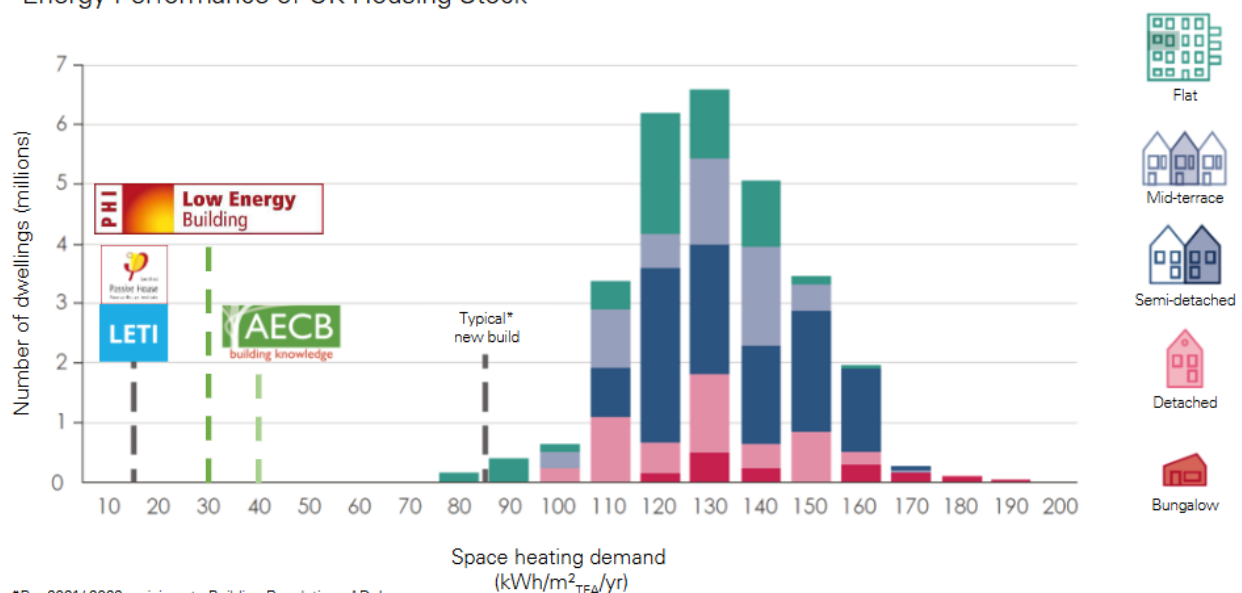
To calculate the heating demand in a property you use the calculation below:

Heating demand = Amount of energy required to heat a space annually

energy / area (TFA) / annum

kWh / m<sup>2</sup>TFA / yr

### Energy Performance of UK Housing Stock



\*Pre-2021/ 2022 revisions to Building Regulations AD: L

The table above presents the number of dwellings within the UK housing stock and compares the potential heat saving achieved by constructing homes in accordance with various building standards. Which, it highlights the reductions in heating demand that can be realized when building to LETI (Low Energy Transformation Initiative) when compared to typical new development built to Part L building regulations.

The calculation to calculate the energy usage in a property for this analysis. The reason why we would exclude EV chargers is because Part L of the Building Regulations in the UK evaluates building energy efficiency. As transport energy is considered outside the building's core operational use, excluding EV charging.

$$\begin{aligned} \text{Energy Use Intensity} &= \text{All energy consumed by a building annually*} \\ \text{(EUI)} & \text{energy / area (GIA) / annum} \\ & \text{kWh / m}^2\text{GIA / yr} \end{aligned}$$

*\*Excludes EV chargers*

This calculation refers to a building or development where the total annual energy consumption is balanced by on-site renewable energy generation. This means that over the course of a year, the energy used for heating, cooling, lighting, and ventilation, is offset by clean energy produced on-site, resulting in net-zero operational carbon emissions:

Net Zero = Balancing annual consumption with on-site generation

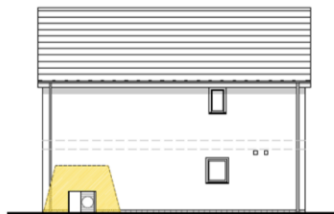
Referred to Spring Design PowerPoint presentation

## DESIGN ANALYSIS

HT 641



Ground & First Floor Plans



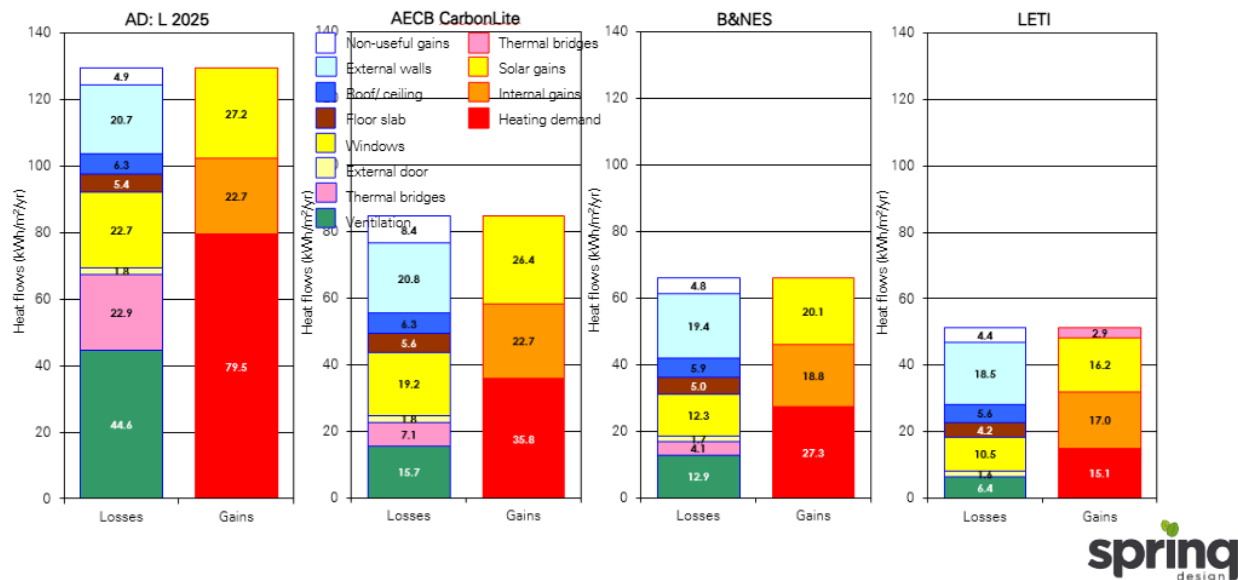
Elevations



**spring**  
design

*Site layout and location*

## HT 641 - Operational Energy



The design for the 641 development, produced by Spring Design, showcases the use of Passivhaus calculation methodologies to optimise energy efficiency through a high-performance building fabric. The model focuses on minimising heat loss, ensuring airtightness, and maximising thermal comfort under realistic occupancy scenarios. Key elements include enhanced insulation, triple glazing, thermal bridge-free detailing, and a high level of airtightness (targeting  $\leq 0.6$  ACH @50Pa), all of which contribute to significantly reduced space heating demand typically below 15 kWh/m²/year, as required by Passivhaus standards.

The graph above illustrates how using LETI (Low Energy Transformation Initiative) legislation can further guide the development towards low-energy housing. LETI benchmarks recommend space heating demand of  $\leq 20$  kWh/m²/year and overall operational energy use (regulated and unregulated) of  $\leq 35$  kWh/m²/year, supporting the transition to Net Zero Carbon.

By aligning with both LETI principles, the 641 developments not only achieve substantial reductions in operational energy demand and carbon emissions, but also meets emerging expectations for sustainable, future-ready residential design.

Referenced from [passipedia.org](https://passipedia.org). (n.d.). *PHPP – Passive House Planning Package* []. [online] Available at:

[https://passipedia.org/planning/calculating\\_energy\\_efficiency/phpp - the passive house planning package.](https://passipedia.org/planning/calculating_energy_efficiency/phpp_-_the_passive_house_planning_package)

RIBA (2019). *2030 Climate Challenge*. [online] Architecture.com. Available at: <https://www.architecture.com/about/policy/climate-action/2030-climate-challenge>.

LETI (2020). *Climate Emergency Design Guide*. [online] LETI. Available at: <https://www.leti.uk/cedg>.

#### Residential Typologies- Embodied Specifications

| Embodied           | Masonry                                               | Framed                                                                              | Timber                                                                                                                           | Timber Optimised                                                                                                                 |
|--------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Foundations        | Trench fill                                           | Trench fill                                                                         | N/A                                                                                                                              | Trench fill                                                                                                                      |
| Ground Floor       | Screed, PIR, slab on grade                            | Screed, XPS, beam & block                                                           | Raft on Jackson XPS formwork                                                                                                     | Steel joist w/ Warmcel                                                                                                           |
| External Walls     | Brickwork finish externally                           | Plasterboard on dabs, masonry cavity w/ PIR                                         | Plasterboard w/ service zone, SMARTPLY OSB, 140mm stud w/ woodfibre                                                              | Plasterboard w/ service zone, SMARTPLY OSB, 292mm twin stud w/ Warmcel                                                           |
| Party Walls        | All to Robust Details                                 | Wet plaster, blockwork, ROCKWOOL filled cavity, blockwork, wet plaster              | Plasterboard, stud w/ ISOVER, SMARTPLY OSB, cavity w/ ISOVER, stud w/ ISOVER, plasterboard                                       | Plasterboard, SMARTPLY OSB, timber w/ Warmcel, cavity w/ Warmcel, stud w/ Warmcel, SMARTPLY OSB, plasterboard                    |
| Internal Walls     | Wet plaster, blockwork, wet plaster                   | Plasterboard, stud w/ ISOVER, plasterboard                                          | Plasterboard, stud w/ woodfibre, plasterboard                                                                                    | Plasterboard, stud w/ Warmcel, plasterboard                                                                                      |
| Intermediate Floor | Chipboard, Posi-joist w/ ROCKWOOL, plasterboard       | Chipboard, Posi-joist w/ ROCKWOOL, plasterboard                                     | Chipboard, Posi-joist w/ woodfibre, plasterboard                                                                                 | Chipboard, Posi-joist w/ Warmcel, plasterboard                                                                                   |
| Separating Floor   | All to Robust Details                                 | Screed, resilient layer, beam & block, suspended ceiling w/ ROCKWOOL & plasterboard | Screedboard, OSB deck, resilient layer, Posi-joist w/ ROCKWOOL, resilient bar w/ plasterboard, suspended ceiling w/ plasterboard | Screedboard, OSB deck, resilient layer, Posi-joist w/ ROCKWOOL, resilient bar w/ plasterboard, suspended ceiling w/ plasterboard |
| Roof               | Plasterboard, polythene VCL, ROCKWOOL, concrete tiles | Plasterboard, polythene VCL, EARTHWOOL, clay tiles                                  | Plasterboard, SMARTPLY OSB, hemp insulation, Spanish slate                                                                       | Plasterboard, SMARTPLY OSB, Warmcel, Welsh slate                                                                                 |

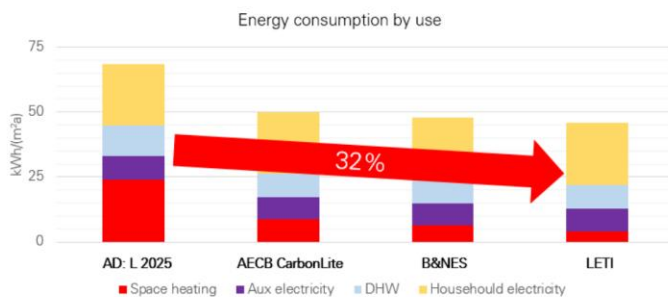
#### Referenced Spring Design PowerPoint

The external wall makeup of the property under Part L of the building regulations, which would be a typical masonry wall for a new house build. The wall construction is typically plasterboard on adhesive (dabs), a masonry cavity wall, and PIR (polyisocyanurate) insulation within the cavity. Which the typical is  $0.18-0.22 \text{ W/m}^2\cdot\text{K}$ , meeting current Part L 2021 requirements for thermal performance in new dwellings. In which PIR and brick have a high embodied carbon so will not help the Welsh government reach Nett Zero. To Compare with Optimized Timber LETI standard. The LETI wall build-up is typically plasterboard with a service void, a continuous airtightness layer using Smartply OSB, and a 292 mm twin stud timber frame densely filled with Warmcel (a recycled cellulose insulation). This construction achieves very low U-values (typically  $\leq 0.15 \text{ W/m}^2\cdot\text{K}$ ), excellent airtightness ( $\leq 1.0 \text{ ACH@50Pa}$ ), and reduced embodied carbon.

Therefore, the optimized timber wall in coronation with LETI stand is a better thermal and airtightness performance but also aligns more closely with net zero and low-embodied carbon objectives, making it more suitable for a sustainable construction method.

By achieving better airtightness and thermal efficiency the operational cost of the building will decrease. As you require less energy to heat the building, the thermal efficiency of the building will be increased by achieving the LETI standard.

#### HT 641 - Operational Energy



| AD L (Wales) 2025 upgrade to LETI |                                  |                 |   | B&NES     |   | LETI      |  |
|-----------------------------------|----------------------------------|-----------------|---|-----------|---|-----------|--|
| Building Element                  |                                  |                 |   |           |   |           |  |
| Fabric                            | Double glazing to triple glazing | additional cost | + | £623.63   | + | £623.63   |  |
|                                   | ASHP reducing in size            | cost saving     | - | £6,000.00 | - | £6,000.00 |  |
|                                   | MVHR addition                    | additional cost | + | £4,000.00 | + | £4,000.00 |  |
|                                   | MEV omission                     | cost saving     | - | £900.00   | - | £900.00   |  |
| Generation                        | PV array decreasing in size      |                 | - | £1,200.00 | - | £1,200.00 |  |
|                                   | TOTAL                            |                 | - | £3,476.37 | - | £3,476.37 |  |
| Cost per unit                     |                                  |                 | - | £3,476.37 | - | £3,476.37 |  |
| Cost per m² of GIA                |                                  |                 | - | £31.49    | - | £31.49    |  |

#### Projected annual electricity bills

- AD:L (Wales) 2025 £1,774.29
- AECB CarbonLite £1,309.04
- B&NES £1,252.44
- LETI £1,203.69

*excludes standing charge & PV offsets*

#### Headlines

- EUI & CO<sub>2</sub>e reductions of 32% in upgrading **AD: L (Wales) 2025** to **LETI**
- ASHP reduce from 7 kW to 3.5 kW due to reduced space heating demand
- PV provision reduces 32% to achieve Net Zero with reduced EUI
- PV provisions for **AD: L (Wales) 2025** do not fit on a single roof slope



Based on the information provided, investing in higher-performance building fabrics to meet LETI standards which include significantly lower U-values. Which the optimized timer would offer. This may involve increased upfront costs compared to a standard Part L build. However, this additional investment is a substantial long-term benefit. Which indicates a 32% improvement in return on investment (ROI) overtime when compared to Part L construction. This is due to reduced operational energy consumption, lower running costs, and improved thermal comfort, all of which contribute to long-term financial and environmental gains.

An important element supporting the methodology is the specification of a Mechanical Ventilation with Heat Recovery (MVHR) system, which aligns with the performance requirements of a LETI-standard building. To assess feasibility and costs, I have contacted Birds Hill Renewables, a specialist MVHR supplier, to obtain a quotation

## MVHR installation and material

| Description                               | Quantity | Unit Cost | Price            |
|-------------------------------------------|----------|-----------|------------------|
| MVHR material kit and design              | 1        | £4,725.00 | £4,725.00        |
| Installation Work <b>Provisional cost</b> | 6        | £360.00   | £2,160.00        |
| Electrical work                           | 1        | £1,050.00 | £1,050.00        |
| <b>SUB TOTAL</b>                          |          |           | <b>£7,935.00</b> |
| VAT @ 0%                                  | 0%       |           | 0                |
| <b>TOTAL</b>                              |          |           | <b>£7,935.00</b> |

### Provisional Cost Items

These items are based on our assumptions made during the survey and may be subject to change (up or down) according to the actual work/ materials required. Every effort is made to avoid any unnecessary costs.

### Commissioning and Handover

The installation will be commissioned according to MCS installation standards to ensure that the system is safe, has been installed in accordance with the documented procedures and manufacturer requirements and is operating correctly in accordance with the system design. Following the testing and commissioning of the system there will be a full handover including documentation, product training and warranty documents etc.

## ASHP Costs - Itemised

| Description                                                                | Quantity | Unit Cost | Price             |
|----------------------------------------------------------------------------|----------|-----------|-------------------|
| Vaillant Arotherm Plus 5Kw Heat Pump                                       | 1        | £3,950.00 | £3,950.00         |
| Vaillant Installation Kit                                                  | 1        | £1,106.75 | £1,106.75         |
| Vaillant Unistor Heat Pump Standard Cylinder 200 Litre 20235273 And buffer | 1        | £1,980.00 | £1,980.00         |
| Vaillant Controls VR92 SensoHome                                           | 1        | £200.00   | £200.00           |
| Installation Work <b>Provisional cost</b>                                  | 7        | £360.00   | £2,520.00         |
| Materials Required                                                         | 1        | £1,200.00 | £1,200.00         |
| Electrical Installation Materials - Provisional Cost                       | 1        | £1,450.00 | £1,450.00         |
| Documentation (MCS paperwork, Insurances, HLC's and application support)   | 1        | £140.00   | £140.00           |
| Delivery                                                                   | 1        | £210.00   | £210.00           |
| <b>SUB TOTAL</b>                                                           |          |           | <b>£12,756.75</b> |
| VAT @ 0%                                                                   | 0%       |           | 0                 |
| <b>TOTAL</b>                                                               |          |           | <b>£12,756.75</b> |

## Birds' Hill renewables Quote MVHR



Why install MVHR? "Using an MVHR heat recovery system can recover up to 90%+ of otherwise wasted heat energy. This recovered energy can reduce your heating requirements by up to ~25% with a well-installed system.

Depending on where you buy, your initial investment could pay for itself within 5 years. Factors like air tightness do however come into the equation, causing this efficiency to drop. The leakier the property the less efficient.

A building using a heat exchanger above 80% efficiency can save around 30% on heating bills. The cost of running a heat recovery system is usually less than 10p per day."

Referenced from bjorn@orisel.co.uk (2023). *Are MVHR Systems Worth It?* [online] Ventilation Megastore. Available at: [https://ventilationmegastore.co.uk/mvhr-blog/are-mvhr-systems-worth-it/?srsltid=AfmBOoppzVRlbe44wgwwbSoa9\\_mo57zTHyyXhYoe-73RfszX98sToMM\\_](https://ventilationmegastore.co.uk/mvhr-blog/are-mvhr-systems-worth-it/?srsltid=AfmBOoppzVRlbe44wgwwbSoa9_mo57zTHyyXhYoe-73RfszX98sToMM_) [Accessed 6 May 2025].

## Quotation Acceptance Form

| Type of ASHP                                                | Price      | VAT   | Cost              |
|-------------------------------------------------------------|------------|-------|-------------------|
| Vaillant AroTherm 5kW ASHP -200 unistor and associated bits | £12,756.75 | £0.00 | £12,756.75        |
| <b>Boiler Upgrade Scheme Voucher</b>                        |            |       | <b>-£7,500.00</b> |
| <b>Total</b>                                                |            |       | <b>£5,256.75</b>  |
| <b>MVHR material and installation</b>                       |            |       | <b>£7,935.00</b>  |
| <b>Total</b>                                                |            |       | <b>£13,191.75</b> |

Because the building is going to be airtight and reduced thermal bridging by building to the LETI Standard. “An ATTMA (Air Tightness Testing & Measurement Association) plays a crucial role in ensuring good indoor air quality, primarily through its focus on air tightness testing and its connection to ventilation strategies. By measuring and reducing air leakage, ATTMA helps minimize the spread of pollutants and contaminants within a building, contributing to a healthier indoor environment”

The Air Tightness Testing & Measurement Association. (2019). *ATTMA | How Air Tightness Fixes Air Quality, Even Mould*. [online] Available at: <https://www.bcta.group/attma/2019/how-air-tightness-fixes-air-quality-even-mould/> [Accessed 6 May 2025].

In line with LETI design principles, solar systems considered to ensure that on-site renewable generation aligns with the building’s actual operational energy demand, without being unnecessarily oversized. This approach supports LETI’s commitment to Net Zero Operational Carbon while also addressing wider objectives around embodied carbon reduction and cost-effectiveness.

LETI-compliant homes are designed to operate at exceptionally low energy levels typically. As a result, the overall electricity demand is significantly lower than in conventional houses. A smaller PV system can therefore generate sufficient renewable energy to meet this reduced load, effectively balancing the building’s annual consumption without surplus generation.

Oversizing PV systems in this context may lead to:

- Excess electricity exported to the grid, which is often subject to reduced financial returns under export tariffs.
- Higher embodied carbon, due to the additional materials and manufacturing impacts associated with surplus panels and inverters.
- Unnecessary capital expenditure, which reduces the overall return on investment and may limit affordability.

LETI encourages right-sizing systems to meet demand efficiently, rather than over specifying the system. This ensures a more sustainable and resource-efficient design, while still achieving compliance with Net Zero Operational Carbon targets.

Energy Saving Trust (2024). Save energy at home. [online] Energy Saving Trust. Available at: <https://energysavingtrust.org.uk/>.

## HT 641 - Embodied Scenario Costs

| Cost Analysis to LETI |                    |                    |                    |                    |
|-----------------------|--------------------|--------------------|--------------------|--------------------|
| Construction          | 1 Masonry          | 2 Framed           | 3 Timber           | 4 Timber Opt.      |
| Foundations           | £8,750.00          | £8,750.00          | £25,550.00         | £8,750.00          |
| Ground floor          | £19,345.00         | £16,790.00         | £25,550.00         | £8,030.00          |
| External walls        | £54,230.00         | £58,990.00         | £59,960.00         | £60,960.00         |
| Party walls           | N/A                |                    |                    |                    |
| Internal walls        | £9,435.00          | £13,875.00         | £13,875.00         | £16,095.00         |
| Inter. floor          | £5,225.00          | £5,775.00          | £5,775.00          | £6,600.00          |
| Separating floor      | N/A                |                    |                    |                    |
| Roof                  | £15,958.00         | £18,148.00         | £23,258.00         | £34,208.00         |
| Doors / windows       | £7,642.39          | £7,642.39          | £7,642.39          | £7,642.39          |
| M&E                   | £26,800.00         | £26,800.00         | £26,800.00         | £26,800.00         |
| <b>TOTAL</b>          | <b>£147,385.39</b> | <b>£156,770.39</b> | <b>£162,860.39</b> | <b>£169,085.39</b> |
| Cost per unit         | £147,385.39        | £156,770.39        | £162,860.39        | £169,085.39        |
| Cost per m²           | £1,335.01          | £1,420.02          | £1,475.18          | £1,531.57          |

|                    |        |                         |                                                         |
|--------------------|--------|-------------------------|---------------------------------------------------------|
| Project Name       | HT 641 | Project Sector          | Residential                                             |
| Assessment Date    |        | Assessment By (company) |                                                         |
| Location of Data   |        | Upfront Carbon A1-5     | Embodied Carbon A1-5, B1-5, C1-4 kgCO <sub>2</sub> e/m² |
|                    |        |                         |                                                         |
| Sequestered Carbon |        |                         |                                                         |
| Module D           |        |                         |                                                         |



The graph illustrates the cost and performance differences between a typical new build construction and a LETI-standard building. Cost estimates are based on data from the Spon's Architects and Builders Price Book which have been provided by Spring Design. It highlights how the use of optimized timber construction, in alignment with LETI principles, results in minimal additional cost while delivering significant improvements in energy performance and carbon reduction.

This graph shows the embodied carbon across various construction methods. The optimized timber solution has the lowest levels of embodied and upfront carbon, making it the most sustainable option for this development. It supports low-carbon construction goals while aligning with long-term environmental performance.

## HT 641 - Embodied Carbon

| Embodied outputs |                                           |                            |                                  |                            |
|------------------|-------------------------------------------|----------------------------|----------------------------------|----------------------------|
| Scenario         | RIBA/ RIAI 2030 targets (cradle to grave) | LETI 2030                  |                                  |                            |
|                  |                                           | Upfront carbon A1-5        | Embodied carbon A1-5, B1-5, C1-4 | Sequestered carbon         |
| 1 Masonry        | 748 kgCO <sub>2</sub> e/m²                | 422 kgCO <sub>2</sub> e/m² | 589 kgCO <sub>2</sub> e/m²       | 107 kgCO <sub>2</sub> e/m² |
| 2 Framed         | 580 kgCO <sub>2</sub> e/m²                | 327 kgCO <sub>2</sub> e/m² | 420 kgCO <sub>2</sub> e/m²       | 185 kgCO <sub>2</sub> e/m² |
| 3 Timber         | 593 kgCO <sub>2</sub> e/m²                | 326 kgCO <sub>2</sub> e/m² | 433 kgCO <sub>2</sub> e/m²       | 293 kgCO <sub>2</sub> e/m² |
| 4 Timber Opt.    | 560 kgCO <sub>2</sub> e/m²                | 305 kgCO <sub>2</sub> e/m² | 400 kgCO <sub>2</sub> e/m²       | 303 kgCO <sub>2</sub> e/m² |

|                    |        |                         |                                                         |
|--------------------|--------|-------------------------|---------------------------------------------------------|
| Project Name       | HT 641 | Project Sector          | Residential                                             |
| Assessment Date    |        | Assessment By (company) |                                                         |
| Location of Data   |        | Upfront Carbon A1-5     | Embodied Carbon A1-5, B1-5, C1-4 kgCO <sub>2</sub> e/m² |
|                    |        |                         |                                                         |
| Sequestered Carbon |        |                         |                                                         |
| Module D           |        |                         |                                                         |



This method also has the highest value of sequestered carbon, which Carbon sequestration is the practice of removing carbon dioxide (CO<sub>2</sub>) from the atmosphere and storing it is one of the many approaches being taken to tackle climate change. Which optimized timber will help this process.

National Grid (2024). *What is carbon sequestration?* | National Grid Group. [online] [www.nationalgrid.com](https://www.nationalgrid.com/stories/energy-explained/what-carbon-sequestration). Available at: <https://www.nationalgrid.com/stories/energy-explained/what-carbon-sequestration>.

Moreover, I would suggest installing triple glazing throughout the property reasoning behind this is:

- **“Noise reduction:** Triple glazing thickness ensures that it can deflect sound waves trying to invade the home, making it ideal for noisy regions.
- **Better temperature control:** The temperature coefficient of resistance for triple glazing is higher than that of double glazing or single-paned windows. Compared to double glazing, heat conservation increases by about 20%.
- **Increased efficiency:** The extra windowpane offers more durability, insulation, and toughness than other types of windows.
- **Better security:** This extra-thick glass will last for years without any damage. It is also capable of withstanding strong winds and harsh weather.”

| Window Type    | Potential U-value | Possible Difference in Temperature Near Window |
|----------------|-------------------|------------------------------------------------|
| Double Glazing | 2.8               | 16°C                                           |
| Triple Glazing | 0.8 to 0.6        | 18°C                                           |

Due to the lower  $U$  value of triple glazing windows being lower is has a better insulation and reduces thermal bridging. Triple glazing provides significantly better insulation compared to standard double glazing, reducing heat loss in winter and heat gain in summer. This can lead to lower energy bills and a more comfortable living environment.

Ahmed, R. (2024). *Triple Glazing: Pros, Cons & Costs*. [online] GreenMatch.co.uk. Available at: <https://www.greenmatch.co.uk/windows/triple-glazing>.

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