

Sustainability Statement

5 Ashley Road,
Reading, RG1 6HT
2835 C003P1 - 4th July 2022

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RG1 6HT



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INTRODUCTION

This document is prepared on behalf of our client Mr P Grabinar, resident at the application address. We have been appointed by the client to ensure that the building is designed and constructed sustainably with low energy impact.

The design has been developed using the Passivhaus Planning Package (PHPP) energy modelling software which shows that the building as designed would be capable of achieving very low energy usage. It should be noted that further detailed design is subject to technical and financial considerations, but the client's intention is to create a low energy building, which would perform significantly better than the existing house.

Thanks to the detailed assessments undertaken it is hoped that a highly sustainable building can be achieved. Even though this proposal would extend an existing building, it could potentially perform better than a new build conforming to current building regulations.

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www.hivesarchitects.co.uk Hives Architects is a Limited Liability Partnership, registered in England and Wales No. OC356830 at the above address. Partners: Henk Wieringa MSc (Delft) RIBA. Alistair Cruickshank BA(hons) Dip Arch Certified Passivhaus Consultant.

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Planning Policy Response

This report demonstrates how the proposed design addresses and positively contributes to the following areas of planning policy.

CC2: Sustainable Design and Construction. We have developed the passive low energy design of the project in line with the council's sustainable design checklist.

We have used the PHPP energy modelling software which shows that the proposal has the potential to reach either the AECB or Enerphit standard, subject to financial and technical project constraints, further thermal modelling, detailed design and certification. Should either of these standards be adopted it would result in a considerable improvement over building regulation energy standards for refurbished dwellings.

The specification of new build elements are based on a timber frame Passivhaus certified building system called PH15 which has very low embodied carbon when compared to alternative construction methods such as steel frame or masonry construction.

CC3: Adaptation to Climate Change. The design has been carefully considered in relation to its form and solar orientation. Useful solar gains and passive heating are maximised by the south facing façade and roof design. Protection against overheating and mitigating against the effects of climate change are achieved through careful shading design and an external solar louvre system to the west facing windows.

CC4: Decentralised Energy. In reducing energy demand to a minimum through Passive low energy design, a relatively small intervention of renewable energy solutions can go a long way to meet a building's energy demand. We have proposed a heating system driven by an air-source heat pump as a simple and cost-effective means of providing renewable micro-generation.

CC5: Waste Minimisation and Storage. The proposal retains a large percentage of the existing structure to help reduce waste and reduce the embodied energy of the overall project. The proposed PH15 system for the new build elements are factory built which results in very low levels of site waste.

5 Ashley Road Sustainability Statement - Planning Application Stage.

1.0 Introduction

The purpose of this report is to outline the sustainability and low energy design development of the 5 Ashley Road project.

1.1 The target of the project in energy terms has been to develop the design so it has the potential to meet either the Enerphit or AECB low energy design standard. At this stage the focus has been on achieving a potential energy balance for the overall building so that the energy required for heating is between 25kWh/m²yr and 40kWh/m²yr, as required by the aforementioned standards.

The precise level of energy use will be dependent on technical and budgetary constraints to be ascertained at the detailed design stage. The planning stage PHPP model shows the proposed design has the potential to meet these targets should either standard be a client requirement. It should be noted that the PHPP model will need to be updated as the design develops in detail to formally assess the building's energy performance.

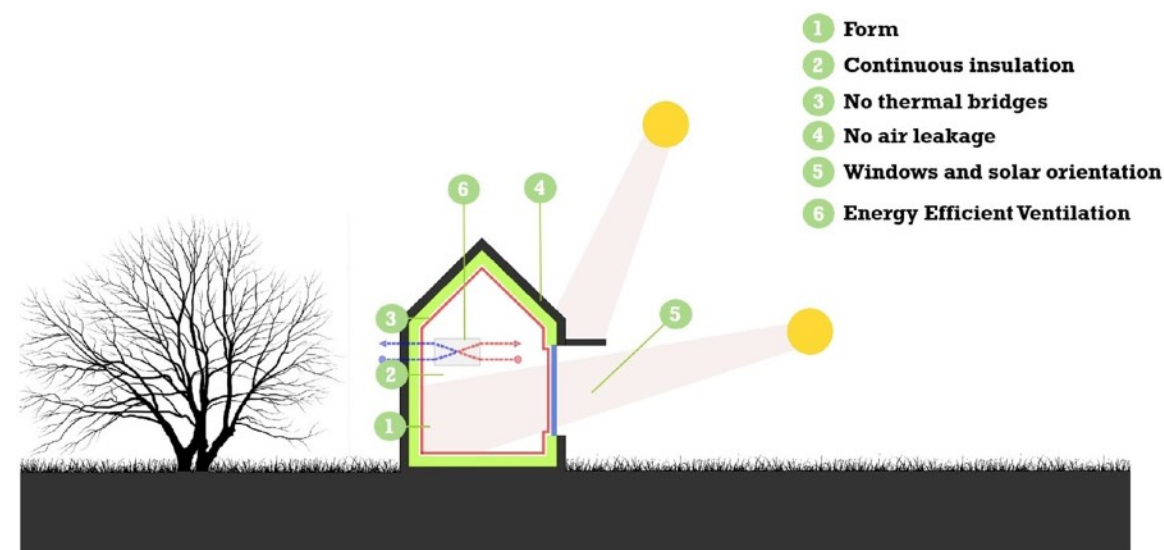
The heating energy target has been chosen for this stage as the form, fabric and fenestration design are mostly fixed by planning approval. We are also proposing micro-generation of energy via renewable sources with the use of an air source heat pump.

1.2 The Enerphit/AECB route has been chosen as they are both proven 'fabric first' standards, minimising energy demand and achieving significant energy savings over and above building regulation requirements. Passivhaus/Enerphit have been the subject of wide-ranging post-occupancy energy use studies.

The actual energy use in Passivhaus and Enerphit buildings is shown to very closely match the use predicted by the design, closing the energy performance gap. In the UK, the performance gap between designed heat loss and in use heat loss has been shown to be between 10% and 125%. The AECB standard uses the same principles and energy modelling techniques as Passivhaus. Further detail on this can be found in the Passivhaus Trust's report 'Passivhaus : the route to zero carbon?'

1.3 The design has been developed based on the six principles of low energy passive design as follows:

Summary of **Passive** principles



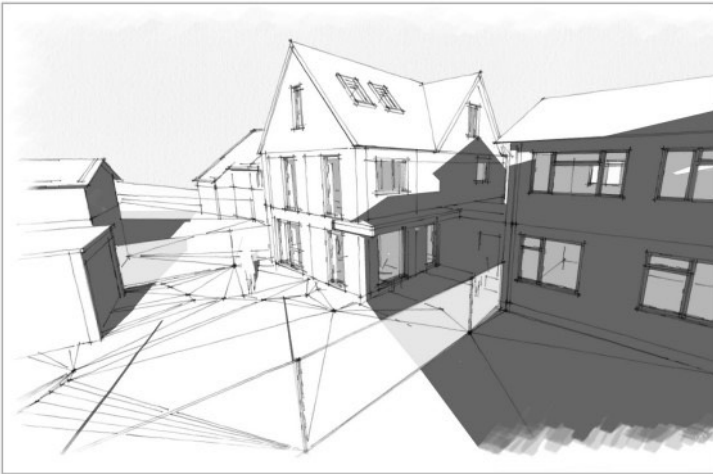
2.0 Design Development

2.1 Site Analysis. The site has a mix of opportunities and constraints when considering low energy design. The orientation of the site is roughly 10 degrees from the north/south axis. This allows solar access for the majority of windows on the south facing elevation and any south facing rooflights. The neighbouring buildings act as shading elements, particularly 7 Ashley Road. As such the solar receipts to the South elevation are higher on the upper floors and at roof level.

2.2 As the design has been developed, several fenestration options have been considered before settling on the submitted design. The proposal utilises several of the key concepts of passive low energy design as follows:

- The building has a relative simple and compact form. This helps reduce the area of the thermal envelope, in turn reducing its heating energy requirement.
- The design is split over three floors, improving the heat loss form factor and reducing energy loss per square metre of usable floor space.
- The fenestration design maximises south facing glazing whilst minimising it on the north face. This helps to exploit useful solar gains whilst allowing for a straightforward shading strategy to avoid overheating in the summer months. Due to the ten-degree inclination to the south, the west facing windows are likely to be close to energy neutral as they will receive useful afternoon solar gains in the heating season.
- The summer condition is more challenging, as west facing windows are subject to heat gains from the low level setting sun in the summer. This will be managed by the use of sliding external timber louvres. The benefit of these is to provide full protection from overheating due to solar gain in the summer whilst cutting out none of the useful winter solar gains.

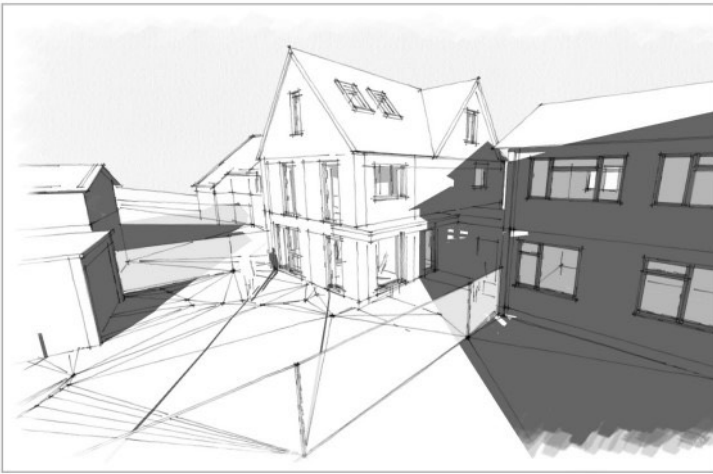
2.3 We have used shadow studies to help develop a design that maximises the use of the winter sun to passively heat the house.



December 21 Midday

This study demonstrates the high levels of direct winter sun on the South and West facades. Consideration should be given to increasing the area of the rooflights and first floor glazing on the south elevation to maximise passive solar heating.

The neighbouring property is a shading object to the ground floor window on the south elevation until roughly 1pm.

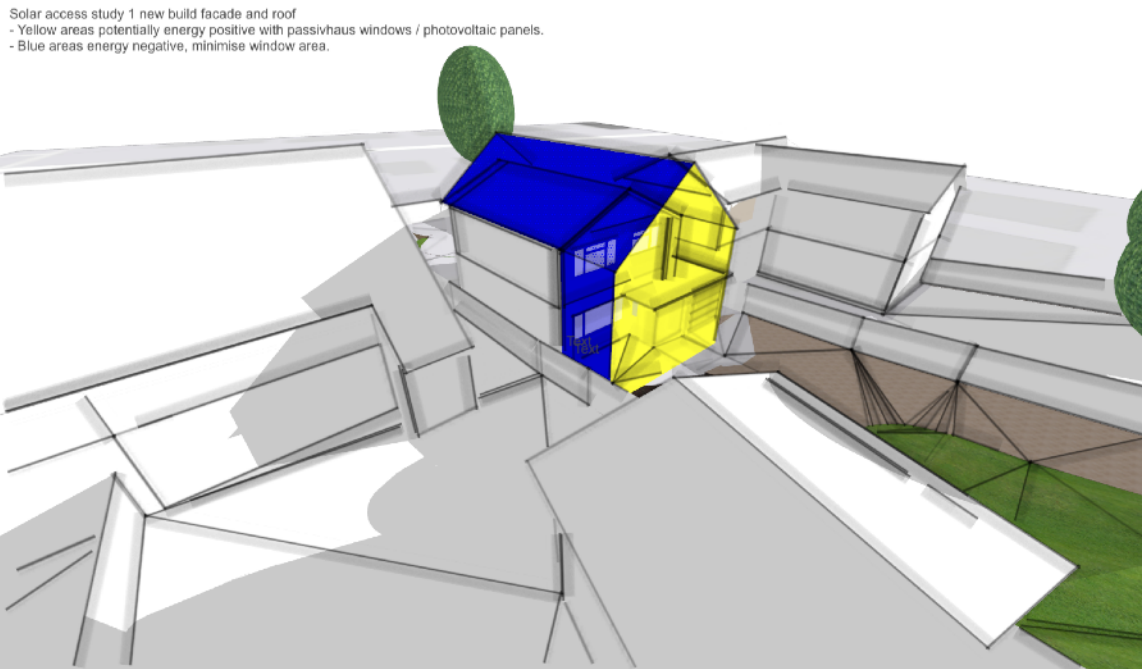
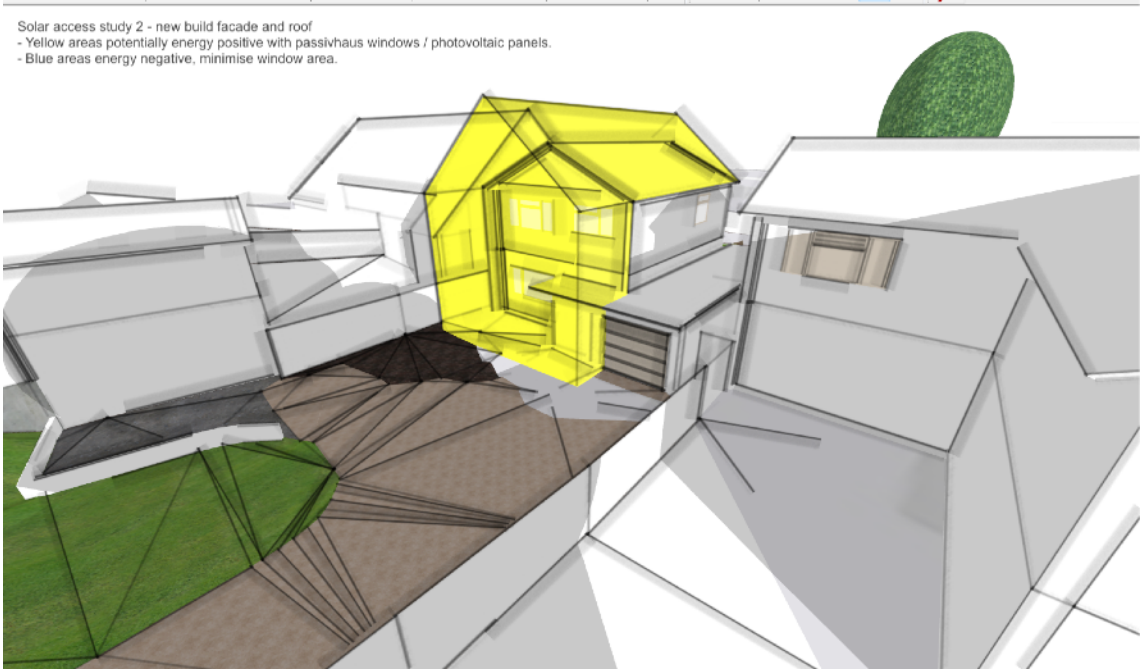


December 21 2pm

From 2pm the vast majority of the proposed glazing is in full sun.

There will be some shading from the large tree in the neighbouring garden. This has been omitted for clarity. Due to the deciduous nature of the tree its shading will be limited.

The conifer hedge on the boundary has the potential for high levels of overshadowing. To maximise the passive solar benefits of the proposal the height of this hedge should be managed and maintained.



3.0 Building Specification and Energy Performance

The design has been tested using the PHPP software. The building is thermally modelled based on the following specification.

3.1 Retained External Walls. Full fill insulation to the existing cavity and 250mm external insulation generally with 150mm external insulation to the North elevation.

Assembly no.	11ud				Wall type 2 - Blown Insulation plus 250 EWI				Interior insulation?
Orientation of building element				2-Wall				Heat transmission resistance (m ² K/W)	
Adjacent to				1-Outdoor air				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]			
Interior plaster	0.350					15			
Concrete block	1.330					100			
Mineral Fibre Insulation	0.036					100			
Brickwork	1.000					100			
Mineral Fibre board	0.036					250			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
100%								56.5 cm	
U-value supplement				0.02 W/(m ² K)				U-value: 0.119 W/(m ² K)	

Assembly no.	12ud				Wall type 3 - Blown Insulation plus 150 EWI				Interior insulation?
Orientation of building element				2-Wall				Heat transmission resistance (m ² K/W)	
Adjacent to				1-Outdoor air				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]			
Interior plaster	0.350					15			
Concrete block	1.330					100			
Mineral Fibre Insulation	0.036					100			
Brickwork	1.000					100			
Mineral Fibre board	0.036					150			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
100%								46.5 cm	
U-value supplement				0.02 W/(m ² K)				U-value: 0.156 W/(m ² K)	

3.2 New External Walls. Based on the PH15 timber frame system (300mm I-joist).

Assembly no.	04ud				1C PH15 WALL, 300 I-JOIST, LIME or SILICATE RENDERED FINISH				Interior insulation?
Orientation of building element				2-Wall				Heat transmission resistance (m ² K/W)	
Adjacent to				1-Outdoor air				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]			
Interior plaster	0.250					15			
Service void	0.270					25			
Airtightness Board	0.130					12			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
Blown Insulation	0.039	Blown Insulation	0.039	Web	0.180	210			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
External Wood Board (Steico Protect M)	0.049					60			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
82%						15.0%	3.0%	41.2 cm	
U-value supplement				W/(m ² K)				U-value: 0.119 W/(m ² K)	

3.3 Retained and New Ground Floor. Based on providing a new floor slab with 200mm rigid insulation above.

Assembly no.	01ud				CONCRETE FLOOR SLAB UPH				Interior insulation?
Orientation of building element				3-Floor				Heat transmission resistance (m ² K/W)	
Adjacent to				2-Ground				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]			
Concrete Slab	2.100					150			
Cellotex or similar	0.022	Perinsul	0.058			200			
Screed	1.400					60			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
99%						1.0%		41.0 cm	
U-value supplement				W/(m ² K)				U-value: 0.108 W/(m ² K)	

3.4 Pitched Roof. Based on the PH15 timber frame system (300mm I-joist).

Assembly no.	07ud				2B PH15 PITCHED ROOF 300 I-JOIST				Interior insulation?
Orientation of building element				1-Roof				Heat transmission resistance (m ² K/W)	
Adjacent to				1-Outdoor air				interior R _{si} 0.10 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]			
Interior plaster	0.250					15			
Service void	0.270					25			
Airtightness board	0.130					12			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
Blown Insulation	0.039	Blown Insulation	0.039	Web	0.180	210			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
Steico Special Dry	0.041					60			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
82%						15.0%	3.0%	41.2 cm	
U-value supplement				W/(m ² K)				U-value: 0.116 W/(m ² K)	

3.5 Flat Roof. Based on the PH15 timber frame system (360mm I-joist).

Assembly no.	10ud				2E PH15 FLAT ROOF 360mm I-JOIST (VENTILATED min 50mm, roof finishes over)				Interior insulation?
Orientation of building element				1-Roof				Heat transmission resistance (m ² K/W)	
Adjacent to				3-Ventilated				interior R _{si} 0.10 exterior R _{se} 0.10	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]			
Interior plaster	0.250					15			
Service void	0.270					25			
Airtightness membrane	2.300					1			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
Blown Insulation	0.039	Blown Insulation	0.039	Web	0.180	270			
Blown Insulation	0.039	Flange	0.130	Flange	0.130	45			
Special Dry	0.041					60			
Breather membrane	2.300					1			
Percentage of sec. 1						Percentage of sec. 2	Percentage of sec. 3	Total	
86%						12.0%	3.0%	46.1 cm	
U-value supplement				W/(m ² K)				U-value: 0.100 W/(m ² K)	

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3.6 Windows(fixed and opening).

Based on a high thermal performance Passivhaus certified triple glazed system such as the Design Plus model from Katzbeck.

3.7 Rooflights (all opening).

Based on a high thermal performance Passivhaus certified triple glazed system such as the FTT U6 model from Fakro.

3.8 External Glazed Doors.

Based on a high thermal performance Passivhaus certified triple glazed system such as the Design Plus model from Katzbeck.

3.9 Shading. The windows on the West Elevation have sliding timber Louvre shading. Any changes to the form of these shading elements will impact the energy performance and summer overheating results.

3.10 Air-tightness requirement. 1.0ach at 50Pa (air-changes per hour n50 not q50).

3.11 Thermal Bridges. Thermal bridge free construction to all new elements. Detailed reduction strategy required for existing built fabric elements and junctions at detailed design stage.

3.12 Ventilation. Passivhaus Certified MVHR system to each dwelling with a minimum efficiency of 75%. Recommended efficiency 90%.

3.13 Summer Overheating. Frequency of overheating. Percentage of the time over 25 degrees Celcius. The Passivhaus maximum figure is 10%, however 2% or below will help future proofing for increasing temperatures due to climate change. This must be tested using PHPP software at detailed design stage if the Enerphit standard is a requirement. The proposed external blind solution coupled with opening windows for purge ventilation in the summer is an effective strategy.

3.14 Primary Energy Demand. To be developed at detailed design stage. To meet the Enerphit standard if required.

3.15 Heating/Hot Water/Electrical. To be developed at detailed design stage.

3.16 Adherence to the performance specification.

If the Enerphit or AECB standard is to be met, any future amendment to the design, specification or performance should be equal to or better, in energy terms, than those described, unless it can be proved using the PHPP energy modelling software.

The thermal model is based on the new build elements using the PH15 building system which is designed to be thermal bridge free.

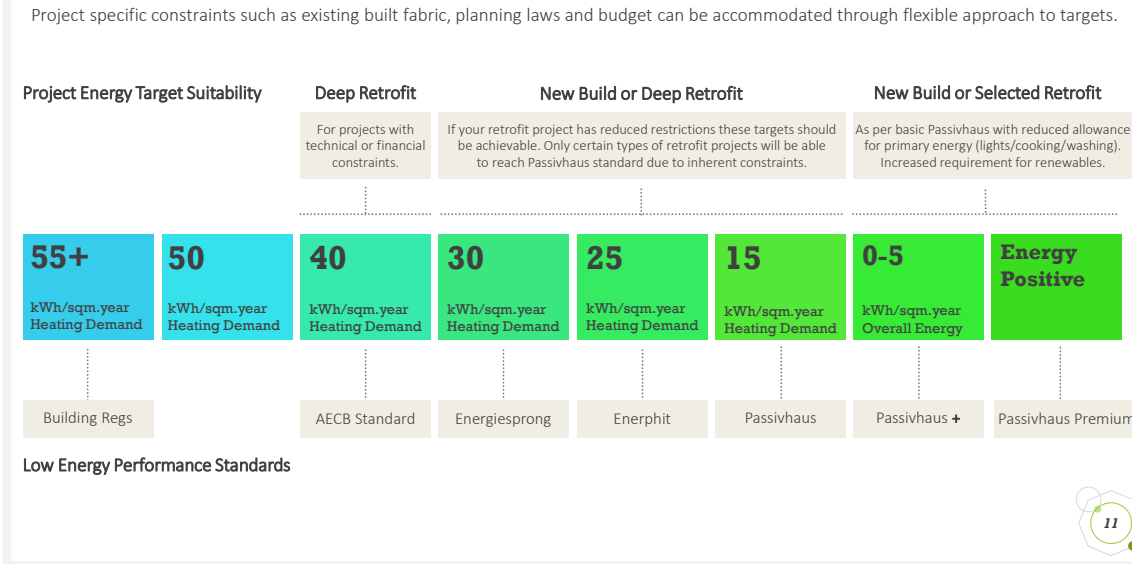
If a different building system is chosen, it will also be required to be thermal bridge free to maintain the energy performance.

The PH15 system also has the benefit of utilising responsibly sourced, natural, and low embodied-carbon materials, offering significantly lower production and construction related carbon emissions than steel framed or masonry alternatives.

4.0 Energy Targets and Results

The graphic on the right shows examples of different energy standards that can be applied to construction projects. The most suitable targets for domestic retrofit to achieve lower energy use than building regulations are the the AECB standard, Energiesprong and Enerphit. The Passivhaus standard is more difficult to achieve and would be technically difficult and financially prohibitive in this case.

Project Specific Energy Targets



The first iteration of the PHPP model demonstrates that the current design has the potential to meet the Enerphit standard.

Specific building characteristics with reference to the treated floor area						
	Treated floor area m²			Criteria	Alternative criteria	Fulfilled?²
Space heating	Heating demand kWh/(m²a)	146.7	≤	25	-	yes
	Heating load W/m²	17	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	1	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n₅₀ 1/h	1.0	≤	1.0		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)		≤	#N/A		#N/A
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	1	≤	-	-	
	Generation of renewable energy (in relation to projected kWh/(m²a) building footprint area)	0	≥	-	-	-

² Empty field: Data missing; - : No requirement

The second iteration of the PHPP model uses mechanical extract ventilation as opposed to MVHR which is a more economical and technically simple solution. The lack of heat recovery in this system means the heating demand target of 25kWh/sqm.a is not achieved. This option does however meet the AECB standard of 40kWh/sqm.a.

Specific building characteristics with reference to the treated floor area						
	Treated floor area m²			Criteria	Alternative criteria	Fulfilled?²
Space heating	Heating demand kWh/(m²a)	38	≤	25	-	no
	Heating load W/m²	21	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	1	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n₅₀ 1/h	1.0	≤	1.0		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)		≤	#N/A		#N/A
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	1	≤	-	-	
	Generation of renewable energy (in relation to projected kWh/(m²a) building footprint area)	0	≥	-	-	-

² Empty field: Data missing; - : No requirement

5.0 Conclusion.

The PHPP model shows that at this stage of design development, that the proposed building design has the potential to meet the Enerphit or AECB standard.

In order for Certification to be achieved, the design will need to be developed in detail using the PHPP modelling software and Certified via the required methodology by a qualified Passivhaus Certifier or AECB Certifier.

As the design is developed in more detail it is possible that the projected annual heating demand may increase, particularly as the majority of the existing structure is retained and detailed investigations of the existing structure are still to be undertaken. If this is the case and further measures are required to meet the Passivhaus standard, the following changes would help to improve the building's energy performance.

- Increased depth of floor slab insulation.
- Increased thickness of wall/roof insulation.
- Increased window area on the south elevation in areas where windows provide a positive energy balance.
- Removal of north facing roof light.