



PART 10

CONSTRUCTION AND ENERGY

10.1 LEARNING OUTCOMES IN PRACTICE

Since our inception in 2008 with the pioneering Crossway Passive House project featured on Grand Designs, Hawkes Architecture has continually explored and refined innovative techniques in sustainable environmental design.

This chapter offers an insight into the strategies and technologies we’ve developed over more than a decade across PPS7, para 55/79/80, and now para 84 projects. It illustrates our commitment to learning from each project and applying those insights to future work.

At Hawkes Architecture, we apply a rigorous, holistic mindset—questioning and refining every decision from inception to completion. Barkham will embody this same joined-up thinking and meticulous attention to detail that defines all our work.



KEY POINTS

Our approach to the proposed Barkham development draws on these lessons to create a design that is “truly outstanding,” meets the “highest standards in architecture,” and helps “raise the standards of design in rural areas.”

CONSTRUCTION AND ENERGY PRINCIPLES



REDUCING EMBODIED ENERGY

- Transport
- Accuracy and Coordination
- Detailing and Airtightness
- Innovative Engineering



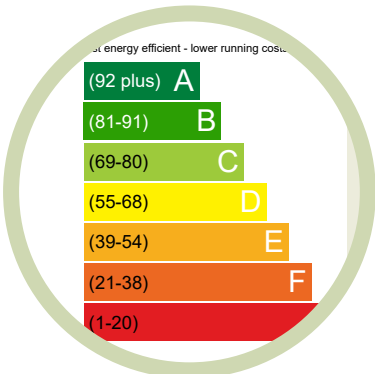
BUILDING HEALTH AND WELL-BEING

- Relative humidity control
- Vapour transfer
- Hygroscopic



REDUCING OPERATIONAL ENERGY USE

- Seasonal Dynamic
- Energy Consumption
- Fabric First
- Passive Solar Gains
- Integrated Renewables



EMBODIED CARBON

- Embodied Carbon
- Zero Carbon Future
- Cradle to Cradle Study
- SAP Ambitions



ENVIRONMENTAL STUDIES

- Disseminating knowledge
- Academic Engagement
- Testing construction methods and technologies
- Post Occupancy Evaluation (POE)

10.2 PROJECT DELIVERABLES

MEETING THE TESTS OF PARAGRAPH 84e

This proposal for a Paragraph 84e Dwelling at Land North of Barkham Road is put forward by Hawkes Architecture, PAD Studio and Axiom Planning.

The thorough and considered design process employed thus far has been informed by research and analysis of the site and local area around Barkham.

The location of the proposed dwelling has been guided by analysis of the spacial constraints of the site and the core principle of enhancing the woodland block character of the site.

The proposal for a building on the creates an opportunity to implement a woodland management strategy to enhance habitats across the site and improve biodiversity.

A key strategy is for the building to have a 'light touch' on the site, raised on piles to cause minimal disturbance to the trees and ground flora and fauna.

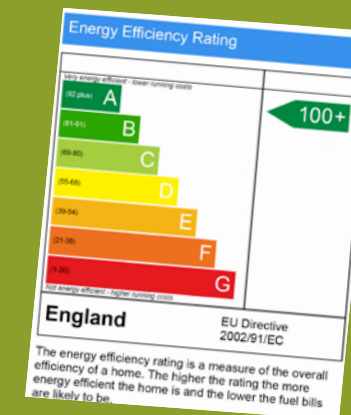
The form and arrangement of the dwelling respond to the site and the woodland to enhance and curate the experience of the setting. The proposed material pallet draws from analysis of the tonal qualities of the site and the patternation of views experienced through trees to compliment the woodland setting.

The rigorous approach of the design team and the strong foundation of analysis on which the proposals are based reflects the highest standards of design. The proposal puts forward a scheme of exceptional quality which will help to raise the standards of design more generally in rural areas in accordance to Paragraph 84e of the NPPF.

FOR PLANNING

Deliverable 1 : SAP / EPC SCORE

As standard, projects by Hawkes Architecture have a design stage SAP calculation as well as an as-built SAP calculation. The houses Hawkes' design and build are consistently achieving A ratings. Far above the average standard achieved by comparable projects by others.



This project has achieved a design stage SAP of 99, far above the A rating threshold of 92.

FOR PLANNING

Deliverable 2 : EMBODIED CARBON CALCULATION

Designing with cradle to cradle principles

Furthering existing Hawkes research into circular economy principles, we have evaluated our choices of materials using a cradle to cradle approach.

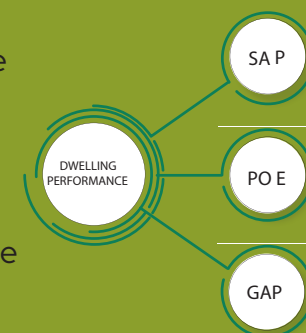


This project will be aiming to meet or exceed the requirements of the RIBA 2030 climate challenge.

AFTER PLANNING

Deliverable 3: POST OCCUPANCY EVALUATION REPORT

Hawkes Architecture has studied and developed a POE methodology with the University of Nottingham and Build Test Solutions to create a repeatable and non-invasive POE methodology. The outcome of POE reports is used to reflect on design choices and inform future projects.

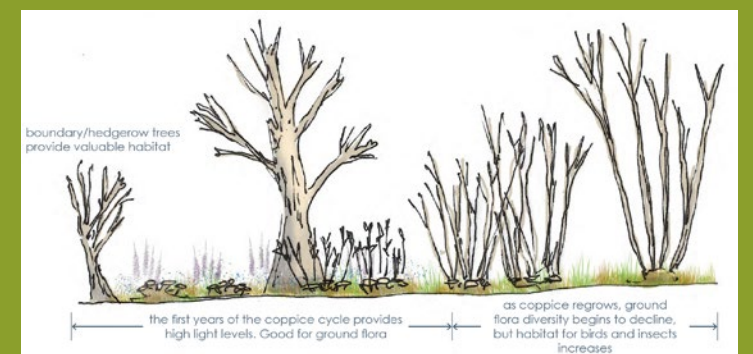


This project will undergo a post-occupancy evaluation which will show how it compares to the predicted SAP performance.

AFTER PLANNING

Deliverable 4 : WOODLAND MANAGEMENT & ECOLOGY ENHANCEMENTS

PAD Studio have put forward a strategy for woodland management to **'significantly enhance its immediate setting'**. Management of the woodland will enhance habitat and improve biodiversity across the site.



10.3 REDUCING EMBODIED ENERGY

TRANSPORT



This timber frame from Echo Barn 2016 was fully engineered in 3D, which enabled us to coordinate MVHR ductwork cut outs.

Every beam, nogging, sole plate & wall plate came pre-cut & ready for installation. MVHR ductwork had been coordinated so holes were pre-cut which further improved quality & speed of frame erection, reducing time & transport.

THE HOUSE OF THE WOODS

Transfer timber frame to site in minimal lorry loads. Components should be packaged into frame sections with all components for a section packaged together.

KEY POINTS

Transport makes a significant contribution to the embodied energy footprint of a building. **Reducing transport journeys to & from site can contribute significantly to reducing embodied energy.** Insights gained from Echo Barn highlighted the significant impact of the transport energy footprint compared to the materials used in construction. These learnings will be integrated into the construction of the Barkham project to enhance sustainability and efficiency.

ACCURACY AND CO-ORDINATION



The engineered beams from Crossway 2008 were able to accommodate MVHR ductwork within the structural depth, but holes weren't pre-cut so flexible ducting had to be used in various places, which is noisier and less efficient than rigid ducting and takes longer to install.

THE HOUSE OF THE WOODS

In terms of applying this to Barkham Rd, using 3D models along with VR technology, we will be able to fully coordinate MVHR ductwork, steelwork & other services to improve speed & efficiency of on-site activities and deliver a higher quality end product. The benefits are multi-faceted.

KEY POINTS

Accuracy and coordination can make a significant impact upon embodied energy, and furthermore it can reduce cost and improve performance. Insights learnt early in the company's lifetime from Crossway in 2008 has meant progressive education about how to maximise accuracy and coordination as much as possible.

DETAILING AND AIRTIGHTNESS



We have recognised the importance of air tightness in reducing heat leakage from the building envelope and so we have been adapting and innovating various construction details to make building airtight easier and more attainable to contractors less familiar with airtight passive construction techniques. .

THE HOUSE OF THE WOODS

- *Utilise construction techniques and phasing to create a continuous thermal line preventing cold bridging and ensuring thermal efficiency is achieved.*
- *External breather membrane will be of high quality to encourage vapour transparency but airtight. The product can also reflect radiant heat, keeping building cool in the summer months.*
- *Tescon tape utilised on sheathing board to ensure uninterrupted airtightness and vapour check line. Battened service void integrated into the wall design for M&E.*
- *Achieve high standards of airtightness*

KEY POINTS

We have continuously been developing innovative construction techniques to refine the technical detail of our buildings. We can also insure that Barkham has the maximum level of airtightness.

INNOVATIVE ENGINEERING



Hawkes is collaborating with Rubner Haus, specialists in customised, pre-fabricated timber systems made from engineered wood grown and processed entirely in their Northern Italy facilities. Building on experience from multiple Para 84e projects, Hawkes has refined prefabrication techniques using engineered timber frames designed with specialist consultants. Each numbered component is factory-produced, coordinated with the building information model, and pre-drilled to accommodate MVHR ductwork—streamlining on-site installation and improving efficiency.

THE HOUSE OF THE WOODS

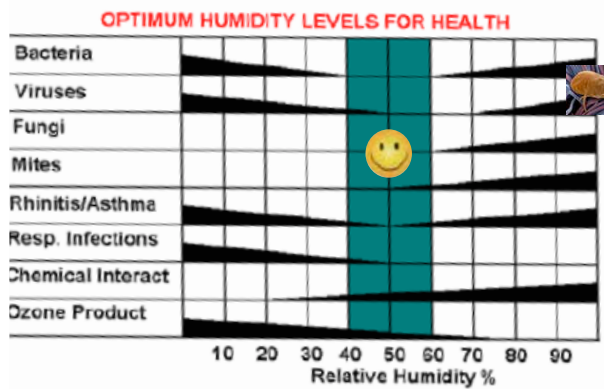
At Barkham Rd, screw piles will be considered for their speed, efficiency, and minimal environmental impact. A ground survey will be undertaken post planning to confirm their suitability for the site.

KEY POINTS

Hawkes is working with timber frame specialists including Rubner Haus to deliver a prefabricated timber system refined through previous projects for precision and efficiency.

10.4 BUILDING HEALTH AND WELLBEING

HUMIDITY



Dust mites thrive in high humidity and they carry various bacteria & viruses we associated with Sick Building Syndrome. Conversely they cannot survive in less than 60% R.H. if atmospheric moisture can be regulated to between 40 & 60% then maximum human health can be obtained. This can be achieved through use of hygroscopic buffering materials.

THE HOUSE OF THE WOODS

The House of The Woods will specify sheep wool as sound insulation within our internal wall partitions. With an excellent ability to slowly absorb and release moisture this helps the house passively regulate internal relative humidity.

KEY POINTS

Dust mites linked to Sick Building Syndrome thrive in high humidity but die below 60% relative humidity. Keeping indoor moisture between 40–60% supports health, and at Barkham, sheep’s wool insulation will help passively regulate humidity through its natural moisture-absorbing properties.

VAPOUR TRANSFER



New buildings & renovated buildings need to be built from low energy, minimally processed bulk natural materials. Materials such as timber, earth, stone, straw and other natural fibres are not only the best materials from an environment point of view. They are also the best materials from a performance point of view.

THE HOUSE OF THE WOODS

The House of The Woods will adopt blown in fibre insulation techniques or similar for all walls.. These ensure high density full fill coverage that is maintained in every cavity.

KEY POINTS

Across a series of built projects we have employed various types of insulation depending on the nature of the building, familiarity of the products with the workforce and comparative cost to performance dynamics.

HYGROSCOPICITY



Sometimes we have used an hygroscopic wood fibre insulation to fully fill the wall cavities. This is installed as a series of friction fitted bats to ensure a tight fit & full cavity coverage. This provides excellent thermal performance, piece of mind during installation, thermal mass and the ability of the structure to naturally absorb & release moisture to help regulate Relative Humidity.

THE HOUSE OF THE WOODS

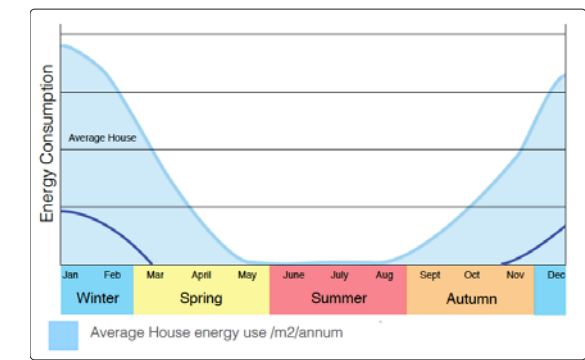
In terms of applying this to Barkham, we aim to Avoid cold bridging, reduce embodied energy, avoid penetrating thermal envelope, maintain high airtightness

KEY POINTS

Across a series of PPS 7, paragraph 55, paragraph 79, paragraph 80, and paragraph 84 build projects we have employed various types of insulation depending on the nature of the building, familiarity of the products with the workforce and comparative cost to performance dynamics.

10.5 REDUCING OPERATIONAL ENERGY USE

- SEASONAL DYNAMIC
- ENERGY CONSUMPTION
- FABRIC FIRST
- PASSIVE SOLAR GAINS
- INTEGRATED RENEWABLES



Generating lots of energy in the summer is easy: lots of sun, long days, no heating requirement, high ambient temperature. The tricky bit is finding a way of remaining ‘off grid’ for heating during the Winter months. Solving this represents the ‘Holy grail’ for sustainable renewable energy technologies.

THE SEASONAL PROBLEM - WHY DO WE USE SO MUCH ENERGY IN WINTER?

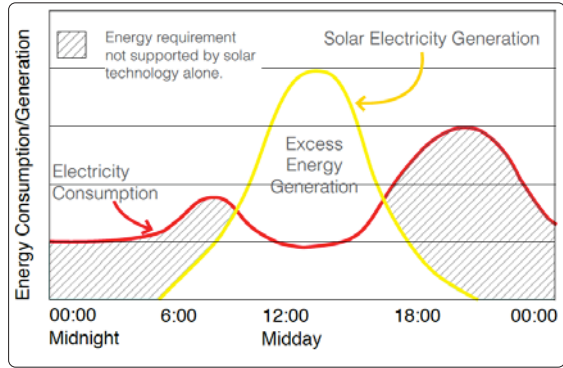
- The average UK house;
- Does not have much insulation (building regulations set a low benchmark standard)
 - Has poor performing windows
 - Leaks air and heat

THE HOUSE OF THE WOODS

- We aim to adopt a seasonal solution by:
- Using fabric first principles to focus investment on building envelope efficiency.
 - Maximise opportunities for Passive Solar Gains.

KEY POINTS

Generating renewable energy in summer is relatively easy due to abundant sunlight, long days, and minimal heating needs, but remaining off-grid in winter presents a major challenge for sustainable energy systems. To address this, a seasonal approach is proposed—focusing on “fabric first” principles to improve building envelope efficiency and maximizing passive solar gains.



The daily issued faced is that the average UK new build uses the most electricity when the sun is not out.

A typical summers day in the Uk has electricity consumption peak in the morning and evening, while solar generation follows a bell-shaped curve, peaking midday. This mismatch creates excess daytime solar energy, which can be fed into the grid, stored in batteries, or used by shifting consumption to midday. While battery storage helps balance supply and demand, it is most effective when charged during off-peak grid hours—especially in winter, when solar generation is low—to reduce reliance on external energy sources during peak times.

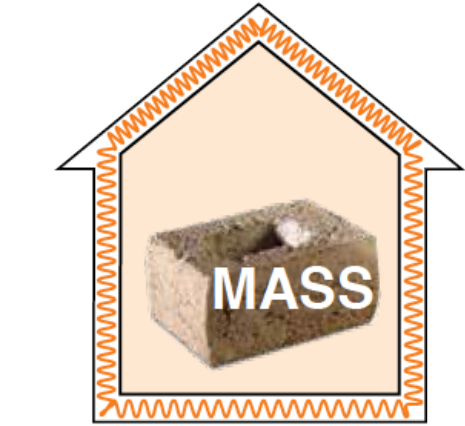
A typical winter day in the UK has a higher electricity consumption due to increased use of lighting, heating, and appliances like circulation pumps and hot water systems. However, solar generation is at its lowest in winter due to shorter days and frequent cloud cover, making it insufficient on its own to meet a household’s energy demand.

THE HOUSE OF THE WOODS

- Integrating renewable technologies to offset energy requirement
- Potential for excess energy generation stored on site or exported to grid for later

KEY POINTS

As a daily solution our proposals seek to reduce electricity consumption whenever possible and reduce its embodied CO² footprint.



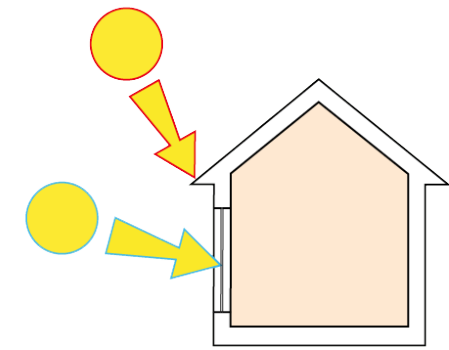
- Focus investment on building envelope efficiency:
- High levels of insulation = less heat required
 - High airtightness = less heat loss = less heat required
 - High performance triple glazed windows = less heat loss
 - Mechanical Ventilation Heat Recovery (MVHR) = less heat loss

THE HOUSE OF THE WOODS

The Barkham building will feature triple-glazed, triple-sealed, argon-filled timber-framed windows with insulated aluminium cladding, Passivhaus certified. The walls will have use 300 mm engineered timber panels with recycled newspaper insulation and the warm roof will feature 250mm of high performance insulation.

KEY POINTS

Reduce the building’s energy demand through a high-performance envelope with high amounts of insulation, airtight construction, and triple glazing. An MVHR system recovers over 90% of waste heat, while prefabrication improves quality and lowers construction and transport costs.



Orientate building to optimise harnessing of passive solar gains

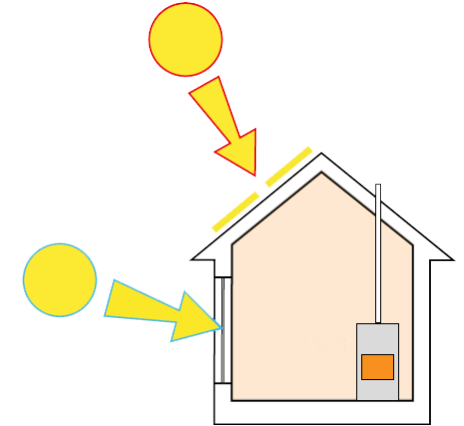
- Maximise south facing glazing to harness low Winter sun
- Shade high Summer sun through use of overhangs to reduce gains
- Maximise thermal mass = Resilience to outside temperature fluctuations

THE HOUSE OF THE WOODS

- Continuous uninterrupted insulation.
- Heat kept in, cold kept out.
- Minimise cold bridging.
- Maximised thermal mass inside the sleeping maximises opportunities to store free passive solar energy for heating.

KEY POINTS

Conventional homes don’t have a thick enough insulation layer to maintain warmth during cold winter months. This means they use up more energy to keep warm in winter. This can be avoided by using a thicker, uninterrupted line of insulation.



Wind, hydro, geothermal, biomass, solar, heat pumps and anaerobic digestion each have their pros and cons (see Renewable Energy Source Assessment). Other factors are based on availability on site and their visual impact. This will determine which renewable technology or technologies are most appropriate. The amount of renewable technology required will be dependent on the size of dwelling.

THE HOUSE OF THE WOODS

- Heat sources currently being considered include ground and air source heat pumps due to the high coefficient of performance.
- This project is set to use a Roofit solar roof on the garage
- Both Mechanical Ventilation Heat Recovery (MVHR) and Battery Storage would provide effective support systems in this project.

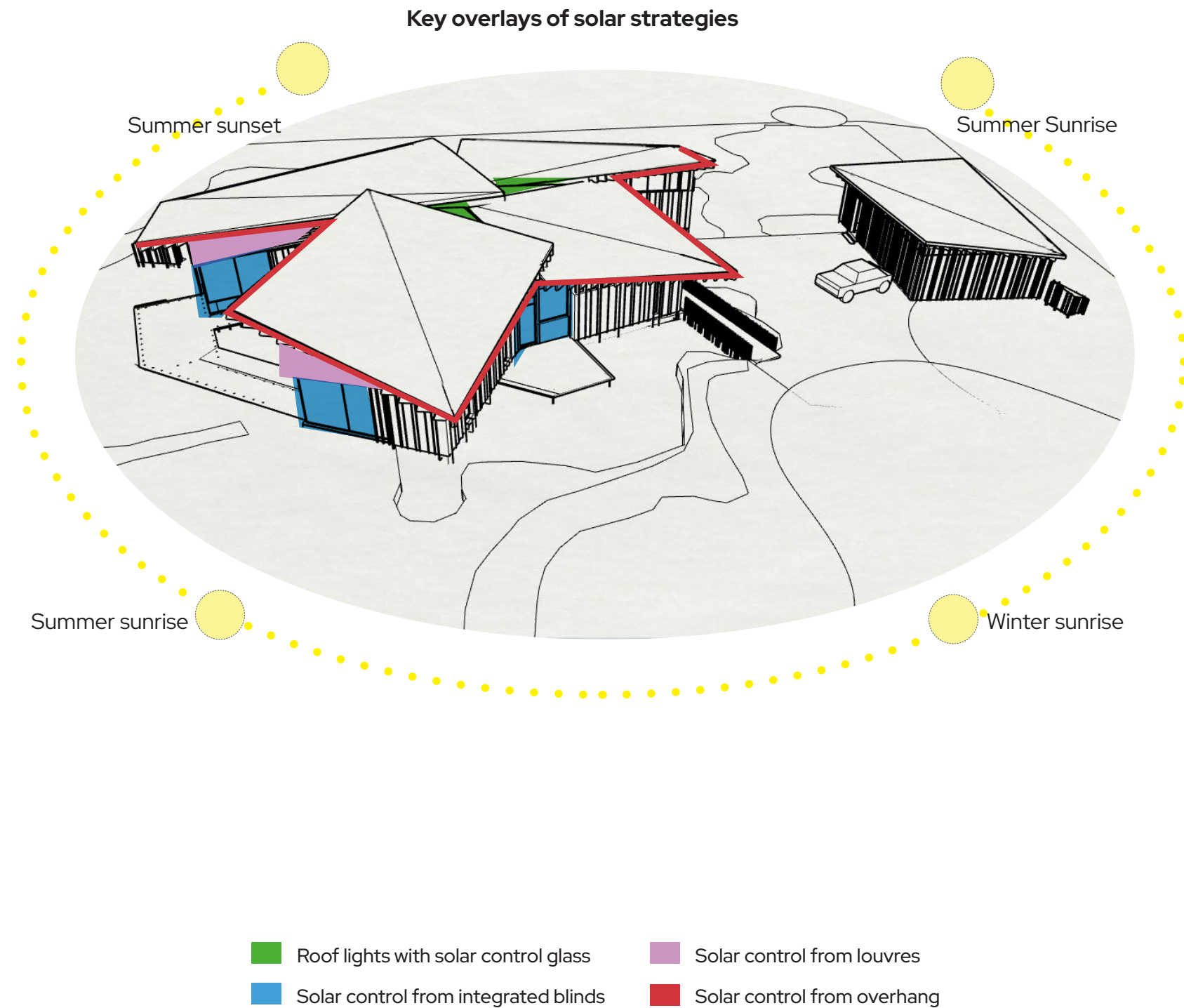
KEY POINTS

To enable us to ascertain the most appropriate renewable technology for each individual project we create a spreadsheet which scores technologies on their inherent characteristics and their application to each site.

10.6 LIGHT MITIGATION STRATEGY

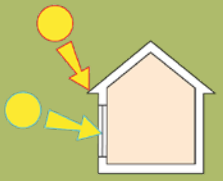
HOUSE OF THE WOODS SOLAR GAINS & LIGHT MITIGATION

Maximise opportunities for passive solar gains & considerations for evening light spill mitigation.



HOUSE OF THE WOODS

Additional light spill mitigation strategies



BLIND PROPOSAL:

- Incorporate internal roller blackout blinds on most southerly glazing and within roof lights to mitigate light spill.
- Mitigation also includes tinting of the glazing to effectively reduce the visibility of light at night from the interior lighting.
- Electronically Dusk till dawn timed blinds in sensitive locations, linked either through a photocell, time clock or Smart Home system will ensure any spill light from the glazing is kept to a minimum.
- Dusk till Dawn, Automated blinds have been used where possible where there is no external door and the internal room use is one where manual blinds could perhaps not be closed.



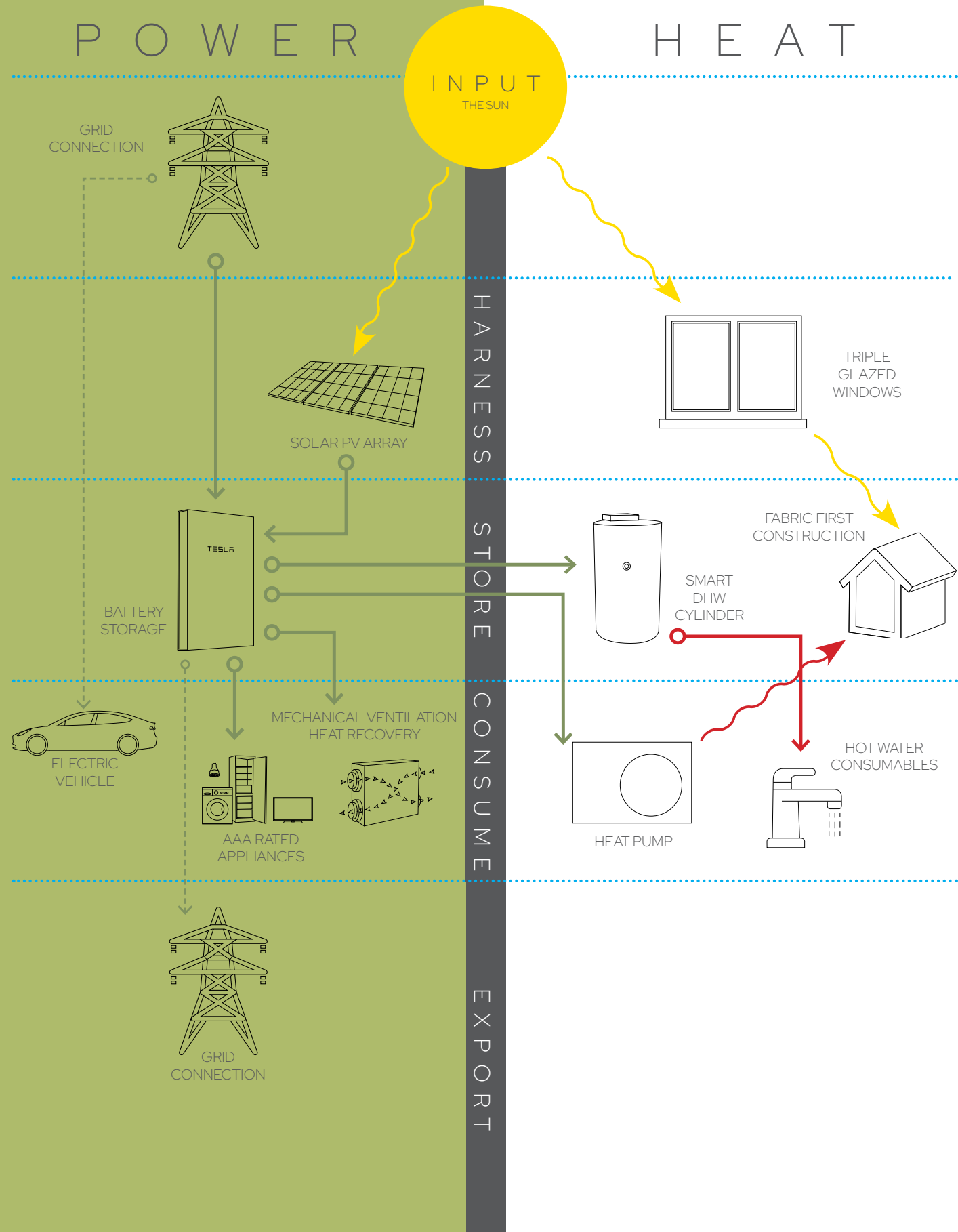
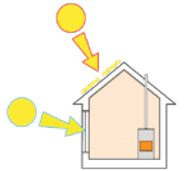
SOLAR CONTROL GLASS:

- Lower light transmission levels are preferred, we have specified that a 70% light transmission value should be used.
- Using a control coating of 70/35 from IQ glass maintains the unit's light transmission at 70% for a natural appearance whilst reducing the G factor of the glass unit to 35%.
- This will reduce the light spill from the dwelling whilst also not affecting the interior brightness.

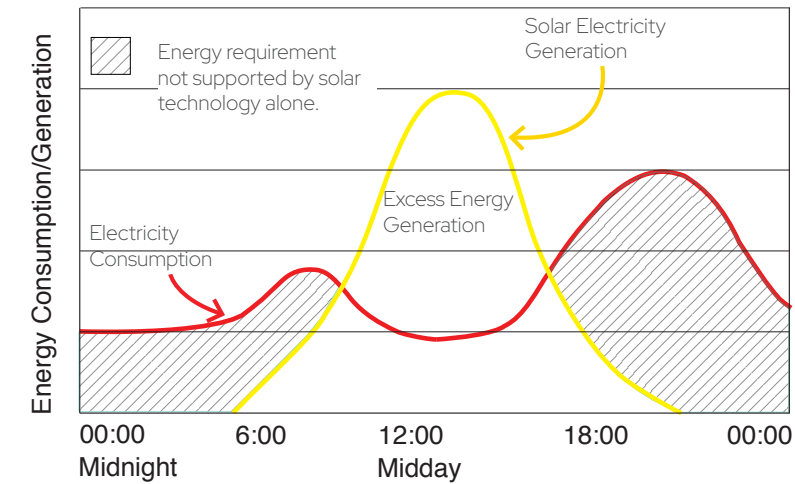
OVERHANG:

- A shaded overhang allows passive solar control. It provides shade from the sun in hot summer months, meaning overheating is reduced.
- In winter, the lower angled sunlight enters below overhangs meaning natural warmth and daylight reaches the interior.
- The thermal comfort is therefore improved, preventing heat build up in summer, and ensuring daylight and indoor comfort in winter.

10.7 RENEWABLE TECHNOLOGY: POWER AND HEAT TECHNOLOGY

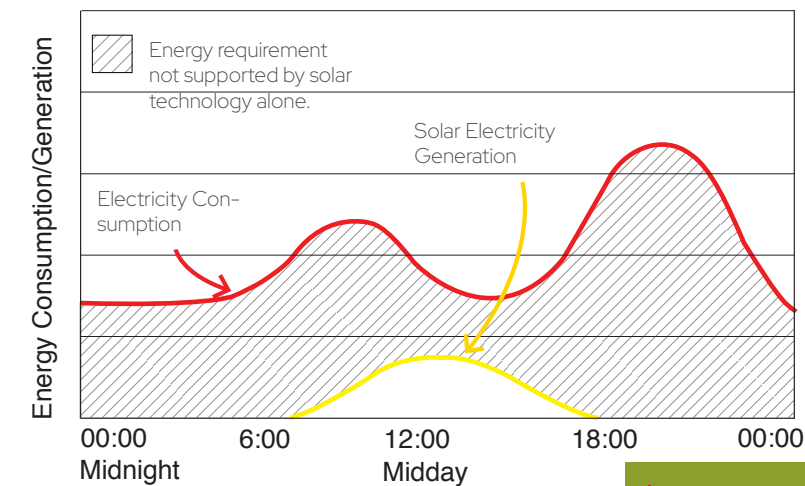


A TYPICAL U.K. SUMMER DAY



- Electricity consumption is generally characterised by a morning & evening peak.
- Electricity generation (solar) is characterised by a bell shaped curve, with peak generation occurring between the two consumption peaks.
- An excess of daytime generated PV energy means that either excess electricity is sent to the grid, stored on site in batteries or consumption patterns adopt suit these dynamics (for example setting washing machine, dishwasher to come on during the middle of the day).
- Battery storage can help but given the low generation capacity during winter, batteries are more likely best used to charge during off peak periods from the grid to mitigate any need for external energy resources at peak consumption periods.

A TYPICAL U.K. WINTER DAY

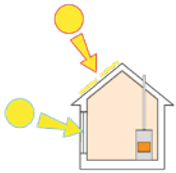


- Winter electricity consumption is higher due to lights being on heater, circulation pumps, hot water immersion use etc.
- Electricity generation (solar) is lowest during winter due to short days and variable cloud cover.
- Solar technology alone is to be able to support the electricity demand of a dwelling during the winter months.

KEY CONSIDERATIONS

Electricity use typically peaks in the morning and evening, while solar generation peaks midday, creating a mismatch between supply and demand. Excess daytime solar energy can be exported, stored in batteries, or used by shifting appliance use to midday. Battery storage helps balance demand but is limited in winter, when shorter days and higher energy use reduce solar output—meaning solar alone cannot fully meet winter electricity needs.

10.8 RENEWABLE TECHNOLOGY: INTEGRATED TECHNOLOGY



POWER

TESLA POWERWALL

Powerwall stores energy efficiently, detects outages and can become a households energy source when the grid goes down.

Solar panels can be connected and recharge the powerwall to upkeep household appliances. Preferences can be set to optimise the energy output, for the households consumption, through your smartphone.



ZAPPI

Zappi is an eco-smart charging station for electric vehicles. it operates as an electric vehicle charger, but it has charging modes to harness energy generated from Solar PV generation.

Compatibility with smartphones allows you to find the most optimal time for energy output.



EDDI POWER DIVERTER

The Eddi power diverter includes a grid current sensor, which monitors the households power generation. The excess energy is diverted to the household heating devices. The Eddi is capable of logging data to save the homeowner ongoing savings by optimal energy usage.



HEAT

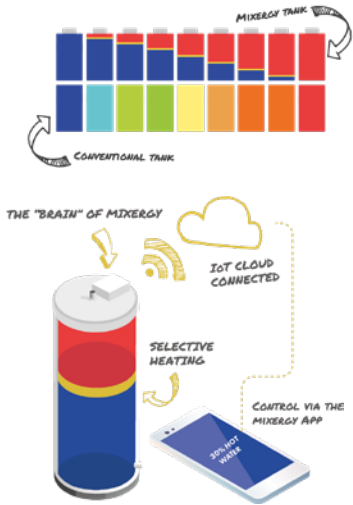
MIXERGY

How do Mixergy Tanks Work?

Conventional hot water tanks heat all of the water, irrespective to how much hot water is desired by the consumer. This wastes energy heating water that isn't desired by the consumer and can result in long heating times.

The Mixergy tank differs to conventional tanks in three fundamental ways:

- Mixergy allows you to head the water by volume, instead of time
- Sensors monitor the temperature and make hot water volumes measurable.
- Ability to remote control the Mixergy tank from a smartphone.

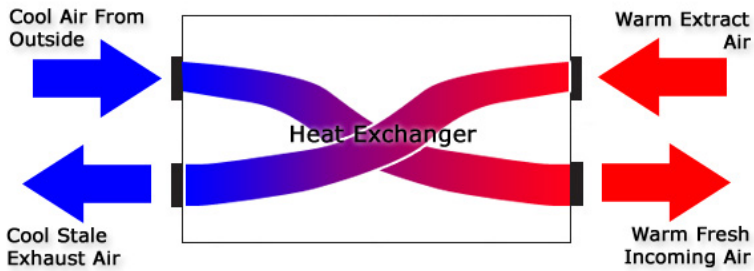


MECHANICAL VENTILATION HEAT RECOVERY

MVHR is an essential element of low energy buildings. The houses are built to be highly airtight so mechanical ventilation is required.

MVHR employs a counter-flow heat exchanger (counter-current heat exchange) between the inbound and outbound air flow. Thus providing fresh air and improved climate control, while also saving energy by reducing heating (and cooling) requirements.

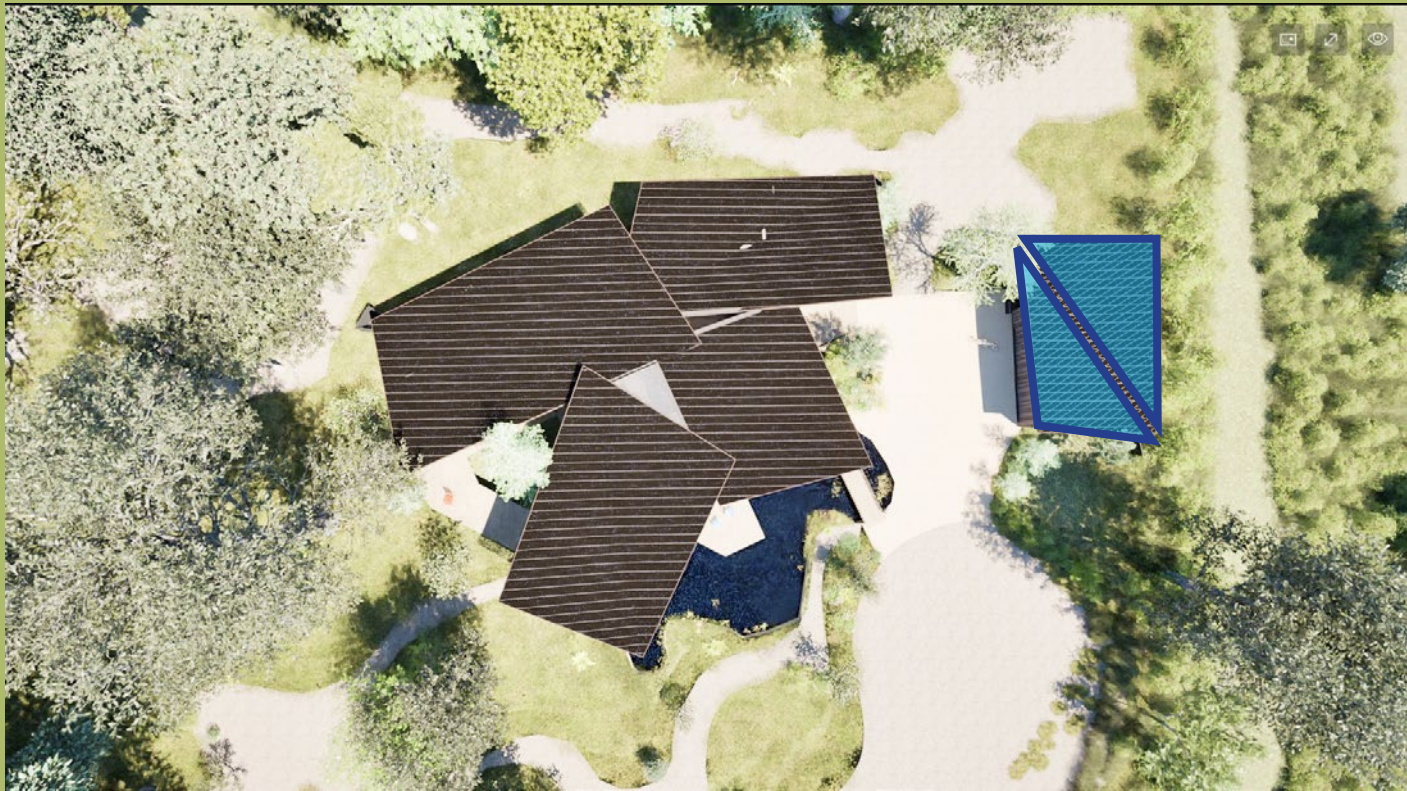
Heat from the PCM Heat Stores is transferred to the air through a In-line duct heater and this warm air is circulated through the building via the MVHR system.



GROUND SOURCE HEAT PUMP

A Ground Source Heat Pump (GSHP) is a highly efficient heating and cooling system that transfers heat between a building and the ground, leveraging the stable temperature of the earth. It acts like a refrigerator in reverse, moving heat rather than creating it through combustion.

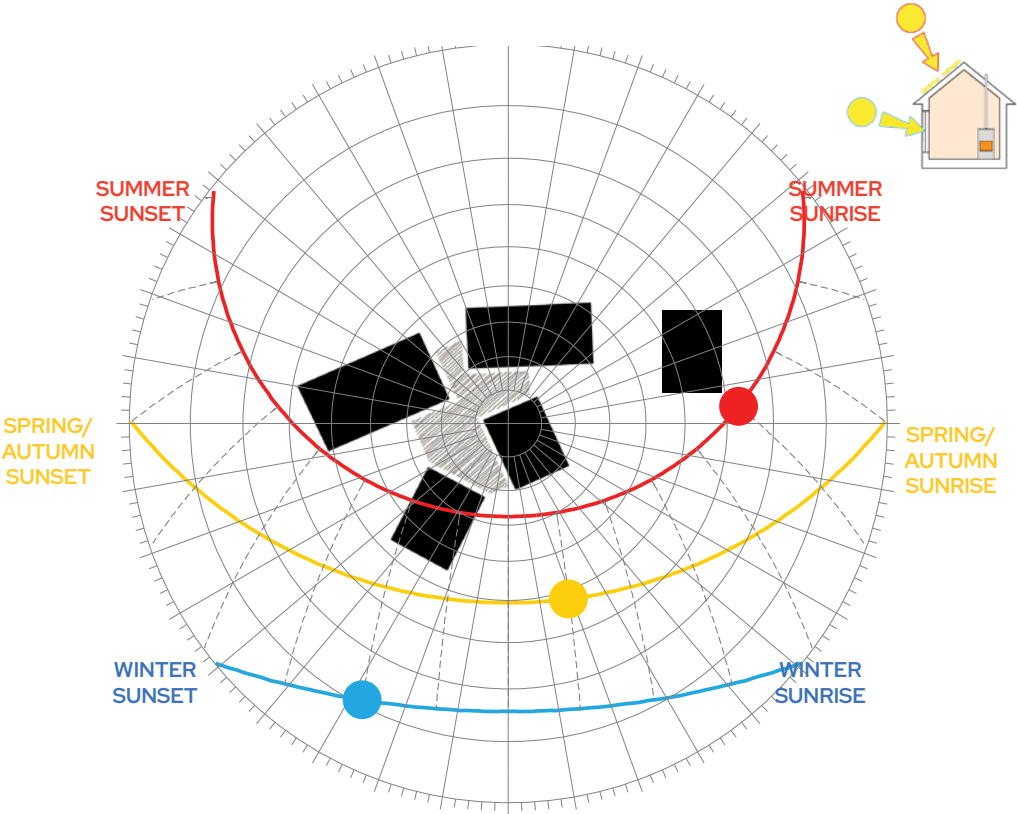
10.9 PV ENERGY GENERATION STRATEGY



'Roofit' integrated solar at Hawkes project Shurlock Row Barns, a low energy barn conversion near the site.



HOUSE OF THE WOODS



UK Solar Orientation Chart (orientation and tilt)

Orientation Chart showing output for different orientation and tilt angles (% of maximum)																				
Tilt (°)	West								South				East							
	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	
0	87	88	90	91	92	92	93	93	93	93	93	93	92	92	91	90	89	87	86	
10	84	87	90	92	94	95	95	96	96	97	97	96	95	94	93	91	89	87	84	
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70	59	63	66	70	72	75	78	79	79	79	79	79	78	75	72	68	64	61	56	
80	50	56	60	64	66	68	69	70	71	72	72	71	70	67	66	60	57	54	50	
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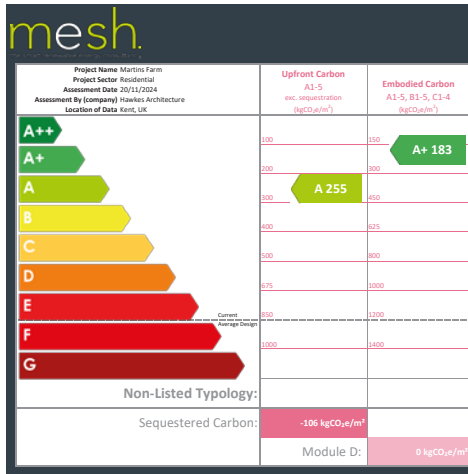
Source: PVNI.org.uk

KEY CONSIDERATIONS

Given the shaded nature of most of the Barkham site, the design team acknowledge that harvesting solar energy will be limited. However, the current proposal is that integrated solar will be used to allow the garage building to discreetly capture as much energy as possible. This will be coupled with battery storage to allow energy to be stored for later.

10.10 CARBON OVERVIEW

EMBODIED CARBON



The Mesh Energy Embodied Carbon Calculator (V6) provides predictions on embodied carbon during RIBA stages 2/3. Hawkes Architecture have been involved in the development and testing of this calculator since version 1.

‘Developments should also consider whole-life performance and costs and take a ‘fabric first’ approach – that is maximising the performance of the components and materials that make up the building fabric itself’

HOUSE OF THE WOODS

- We aim to adopt a seasonal solution by:
- Using fabric first principles to focus investment on building envelope efficiency.
 - Maximise opportunities for Passive Solar Gains.
 - Meeting the RIBA 2030 Climate Challenge

KEY POINTS

Using mesh energy’s embodied carbon calculator we expect that the embodied carbon will be well under the RIBA 2030 Climate Challenge of 300kgCO₂e/m² and also the LETI 2030 goals.

A full calculation will be made before the planning submission.

ZERO CARBON FUTURE



- LETI Climate Emergency Design Guide
- RIBA Embodied And Whole Life Carbon Assessment For Architects
- RICS Whole Life Carbon Assessment For The Built Environment
- RIBA 2030 Climate Challenge

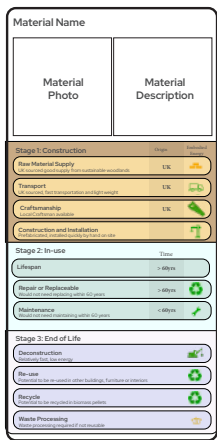
HOUSE OF THE WOODS

Each of the documents above defines a set of good, realistic and achievable targets to help reduce carbon emissions and embodied energy throughout the building’s life cycle. All new buildings must operate at net zero carbon by 2030 and all buildings must operate at net zero carbon by 2050. Each document sets out targets and provides advice as to how new buildings can meet UK climate change targets.

KEY POINTS

Hawkes Architecture has used the **Leti Climate Emergency Design Guide**, **RIBA Embodied and Whole Life Carbon Assessment for Architects** and **RICS Whole Life Carbon Assessment for the Built Environment** to further develop our understanding towards a net zero carbon future. These documents helped us to develop a Hawkes Cradle to Cradle study. Our study aims to quantify the embodied carbon used in construction, in-use and end of life while providing a better justification for the use for materials proposed and the afterlife or reuse of the building.

CRADLE TO CRADLE



Cradle to Cradle is a design philosophy which states that raw materials are not thrown away (cradle to grave). Instead, the raw materials are recycled, reused or re-purposed and therefore each material should be able to be disassembled easily.

We have considered craftsmanship and construction, in-use operation, and end of life.

HOUSE OF THE WOODS

- We aim to adopt a seasonal solution by:
- Using fabric first principles to focus investment on building envelope efficiency.
 - Maximise opportunities for Passive Solar Gains.

KEY POINTS

This approach considers every stage of a building’s life—construction, operation, and end-of-life—by using locally sourced and prefabricated materials, promoting local craftsmanship, and minimizing energy use. Materials are chosen for durability, easy maintenance, and simple disassembly, allowing components to be repaired, reused, or recycled to reduce waste and embodied energy.

SAP SCORE

Walls: 0.12 W/m²K
Roof: 0.11 W/m²K
Floors: 0.13 W/m²K
Triple Glazing: 0.80 W/m²K

MVHR system with an efficiency of 93%

Lighting with an average of 90Lm/W

Solar PV system
13 – 15kW peak.
Tesla Power-wall: 13kWh
3 phase grid connection

HOUSE OF THE WOODS

The predicted performance is very good at 99, especially considering the shaded nature of the site and is, close to the Hawkes Architectures average SAP rating of 102.

KEY POINTS

From SAP ratings taken from a portion of Hawkes projects built since 2008, the Hawkes SAP average rating is 102. This is classed as very energy efficient, and Barkham will follow the same pattern.

10.11 CRADLE TO CRADLE STUDY

What is Cradle to Cradle?

Cradle to Cradle is a design philosophy which states that raw materials are not thrown away (cradle to grave). Instead, the raw materials are recycled, reused or re-purposed and therefore each material should be able to be disassembled easily.

Stage 1: Craftsmanship and Construction

To improve the environmental performance of the building and the embodied energy through the construction phase, we have considered:



Raw Material Supply

- Raw materials should be sourced locally or UK based where possible
- EU based products should only be specified if they enhance the building performance over UK based products
- Incorporate prefabricated elements where possible to decrease construction and installation times
- Materials should be as lightweight as possible to reduce transportation and embodied energy



Transport

- Ideally locally or UK sourced to reduce transport



Craftsmanship

- Incorporating local craftsmanship should be sourced where possible which would help boost the local economy
- Craftsmanship methods should utilise minimal heavy machinery to reduce energy demand



Construction and Installation

- The utilization of prefabricated components results in a construction process with lower embodied energy due to reduced waste and faster construction times
- Often, less workers are needed for the construction of prefabricated elements resulting in fewer traffic movement to and from site
- Forms of low energy installation methods should be used

Material Name

Material Photo

Material Description

Stage 1: Construction

	Origin	Embodied Energy
Raw Material Supply UK sourced good supply from sustainable woodlands	UK	
Transport UK sourced, fast transportation and light weight	UK	
Craftsmanship Local Craftsman available	UK	
Construction and Installation Prefabricated, installed quickly by hand on site		

Stage 2: In-use

	Time	
Lifespan	> 60yrs	
Repair or Replaceable Would not need replacing within 60 years	> 60yrs	
Maintenance Would not need maintaining within 60 years	< 60yrs	

Stage 3: End of Life

Deconstruction Relatively fast, low energy	
Re-use Potential to be re-used in other buildings, furniture or interiors	
Recycle Potential to be recycled in biomass pellets	
Waste Processing Waste processing required if not reusable	

Key

Origin		Embodied Energy (Based on distance from site, weight, construction and installation time, energy consumption)
Site	0 miles	
Local	1-50 miles	
UK	50-500 miles	
EU (European)	500 miles >	
In-use Longevity		
> 0yrs	More than	
< 0yrs	Less than	

Low
 Medium
 High

Stage 2: In-use Operation

To improve the environmental performance and lower the embodied energy of the building while in-use, we have considered:

Lifespan

- Each material will have an expected lifespan which refers to the time of installation to the time the material needs replacing.
- Materials should be chosen carefully that consider longevity to minimise the need for regular replacement



Repair or Replacement

- The majority of materials and components should be chosen to be repaired where possible. If materials and components of the building do need replacing, where possible, the use of Reduce, Reuse, Recycle will be followed to prevent landfill waste.



Maintenance

- Components of the building have been designed to be easily maintained rather than replaced resulting in minimal waste and lower embodied energy

Stage 3: End of Life

To improve the environmental performance and lower the embodied energy of the building after use, we have considered:



Deconstruction

- Where possible, the building has been designed as a series of components to make for easy deconstruction with low embodied energy



Re-use

- Where possible, the material could be re-used in other projects. Depending on the material or component, this could be in the form of a replacement, interior fittings, landscaping.



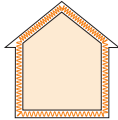
Recycle

- Where possible, the material should be able to be recycled and made into other products such as:
 - Untreated timbers could be recycled in the form of fuel such as biomass pellets
 - Glazing elements can be broken down into separate components and recycled
 - Metal can be recycled into other products



Waste processing

- Minimal waste
- Waste processing should be local and considered



10.12 HOUSE OF THE WOODS: CRADLE TO CRADLE (1 OF 2)

* NOTE: These are the desired approaches for each material and building component which will be adhered to where possible during the construction stage, subject to supply demand

In-situ Concrete Foundations



The concrete foundations achieve the highest embodied energy within the build. To counteract some of the embodied energy, we propose to use an eco concrete that is created from recycled aggregates.

Hawkes will work with engineers to produce foundations using as little concrete as possible.

Stage 1: Construction	Origin	Embodied Energy
Raw Material Supply High embodied energy	UK	
Transport UK sourced, heavy transportation	UK	
Craftsmanship Local Craftsman available	UK	
Construction and Installation In-situ, high embodied energy		

Stage 2: In-use	Time	
Lifespan Should last beyond 80 years	> 80yrs	
Replaceable Not Replaceable	N/A	N/A
Maintenance Will not require maintenance	N/A	

Stage 3: End of Life	
Deconstruction Very high energy required to de-construct, heavy weight	
Re-use Foundations can not be re-used	N/A
Recycle Can be recycled as aggregates or hardcore, requires high energy	
Waste Processing High energy waste processing required	

Engineered Timber Frame



The construction of the house uses an engineered timber frame. All components are designed on CAD within a 3D model and once finalised the design is CNC cut in the factory before being delivered to site resulting in a fast manufacturing process and limited waste. All junctions have been pre-designed before the frame is delivered to site. All of these factors result in a fast construction time of the frame that results in less workforce required and therefore reduces the total embodied energy of construction.

Stage 1: Construction	Origin	Embodied Energy
Raw Material Supply EU sourced good supply from sustainable woodlands	EU	
Transport EU sourced, fast transportation and light weight	EU	
Craftsmanship Local Craftsman available	UK	
Construction and Installation Prefabricated, Low energy required to install		

Stage 2: In-use	Time	
Lifespan Should last beyond 60 years	> 60yrs	
Repair or Replaceable Would not need replacing within 60 years	> 60yrs	
Maintenance Maintenance maybe required beyond 60 years	> 60yrs	

Stage 3: End of Life	
Deconstruction Low energy required to de-construct, light weight	
Re-use Potential to be re-used in other buildings, furniture or interiors	
Recycle Potential to be recycled in biomass pellets	
Waste Processing Waste processing required if not reusable	

Internorm Triple Glazing



Despite the triple glazed units being sourced from Austria, they are sourced due to their unrivaled performance benefits that aligns with our fabric first principles. The triple glazed elements could be re-used in other projects. If recycled, the glazing unit would be broken down into elements. The aluminum frame and glass could be recycled. The timber elements could be used as wood chip and the insulation would be disposed of.

Stage 1: Construction	Origin	Embodied Energy
Raw Material Supply Sourced and supplied locally within Austria	EU	
Transport Manufactured in Austria requires long transport distances	UK	
Craftsmanship Local Craftsman available		
Construction and Installation Low energy required to install	Time	

Stage 2: In-use	Time	
Lifespan Should last in excess over 60 years	> 60yrs	
Repair or Replaceable Unlikely to need repairing or replacing unless damaged	< 25yrs	
Maintenance Limited maintenance required	< 25yrs	

Stage 3: End of Life	
Deconstruction Low energy required to de-construct, medium weight	
Re-use Can be reused in other buildings dependent on age and condition	
Recycle Glazing unit can be broken down into elements for recycling	
Waste Processing Many components makes waste processing complex	

10.13 HOUSE OF THE WOODS: CRADLE TO CRADLE (2 OF 2)

* NOTE: These are the desired approaches for each material and building component which will be adhered to where possible during the construction stage, subject to supply demand

Dark stained timber cladding



Clad in a combination of dark stained timber with dark timber fins, the façade highlights the material's sense of place in it's woodland setting. Natural timber cladding offers a renewable, carbon-sequestering solution that supports cradle-to-cradle thinking. Its biodegradability, renewability, and ability to age gracefully make it both environmentally responsible and visually timeless.

Stage 1: Construction		Origin	Embodied Energy
Raw Material Supply	UK Sourced and good supply	Local	
Transport	UK, fast transportation and light weight	Local	
Craftsmanship	Local Craftsman available	Local	
Construction and Installation	Low energy required to install		
Stage 2: In-use		Time	
Lifespan	Should last between 50-100 years with correct treatment	< 100yrs	
Repair or Replaceable	May need repairing but unlikely to need replacing	< 50yrs	
Maintenance	Limited maintenance required. May need re-coating	> 10yrs	
Stage 3: End of Life			
Deconstruction	Low energy required to de-construct, light weight		
Re-use	Potential to be re-used dependant on age and condition		
Recycle	Can not be recycled	N/A	
Waste Processing	Local waste processing		

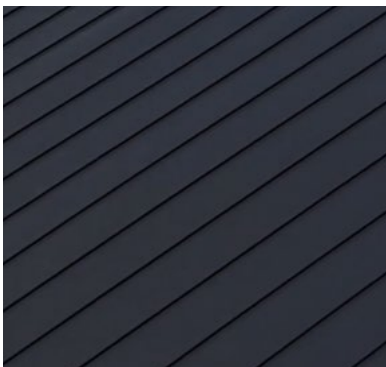
Natural Timber cladding



Clad in a combination of natural timber with dark timber fins, the façade highlights the material's sense of place in it's woodland setting. Natural timber cladding offers a renewable, carbon-sequestering solution that supports cradle-to-cradle thinking. Its biodegradability, renewability, and ability to age gracefully make it both environmentally responsible and visually timeless.

Stage 1: Construction		Origin	Embodied Energy
Raw Material Supply	Sourced locally	Local	
Transport	Local, short journey	Local	
Craftsmanship	Local Craftsman available	Local	
Construction and Installation	Low energy required to install		
Stage 2: In-use		Time	
Lifespan	Should last 80-100 years	> 100yrs	
Repair or Replaceable	May need repairing and replacing	< 50yrs	
Maintenance	Maintenance required every decade	< 50yrs	
Stage 3: End of Life			
Deconstruction	Low energy required to de-construct, light weight		
Re-use	Potential to be re-used dependant on condition		
Recycle	Clay tiles can be recycled		
Waste Processing	Non toxic		

Dark seamed metalwork



The overlapping roof forms will use a dark seamed metalwork. This will provide a highly durable, weathertight building envelope. This will also offer longevity, minimal maintenance, and full material recoverability at the end of its life.

Stage 1: Construction		Origin	Embodied Energy
Raw Material Supply	Sourced Locally, extraction means quarrying	EU	
Transport	Local, heavy weight	EU	
Craftsmanship	Local Craftsman available	UK	
Construction and Installation	Low / moderate energy required to install		
Stage 2: In-use		Time	
Lifespan	can last over 200 years	80-120+ yrs	
Repair or Replaceable	Easy to repair or replace	< 60yrs	
Maintenance	Low maintenance	< 60yrs	
Stage 3: End of Life			
Deconstruction	Low energy required to de-construct		
Re-use	Can be re-used, dependant on age and condition		
Recycle	Can be recycled for aggregate or fill		
Waste Processing	Non toxic		

10.14 DESIGN STAGE SAP

The outlined construction methodology allows for the below U-Values to be achieved:

- Walls: 0.12 W/m²K
- Roof: 0.11 W/m²K
- Floors: 0.13 W/m²K
- Triple Glazing: 0.80 W/m²K

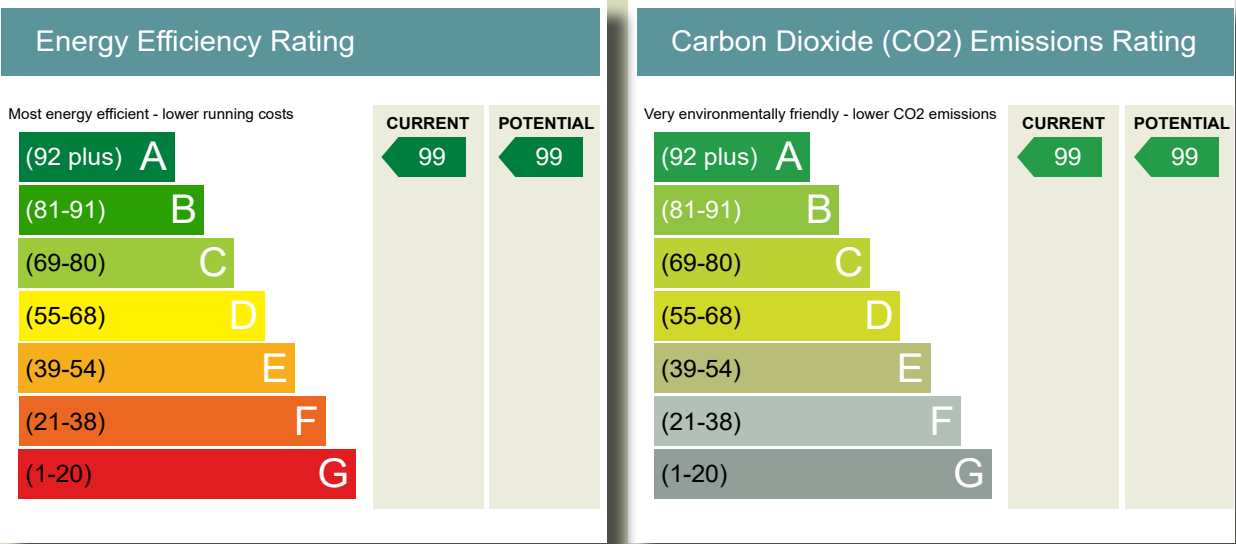
MVHR system with an efficiency of 93%

Lighting with an average of 90Lm/W

Solar PV system

- 13 – 15kW peak.
- Tesla Power-wall: 13kWh
- 3 phase grid connection

PREDICTED DESIGN STAGE SAP:



Average UK Building Performance is a D (55 – 68)



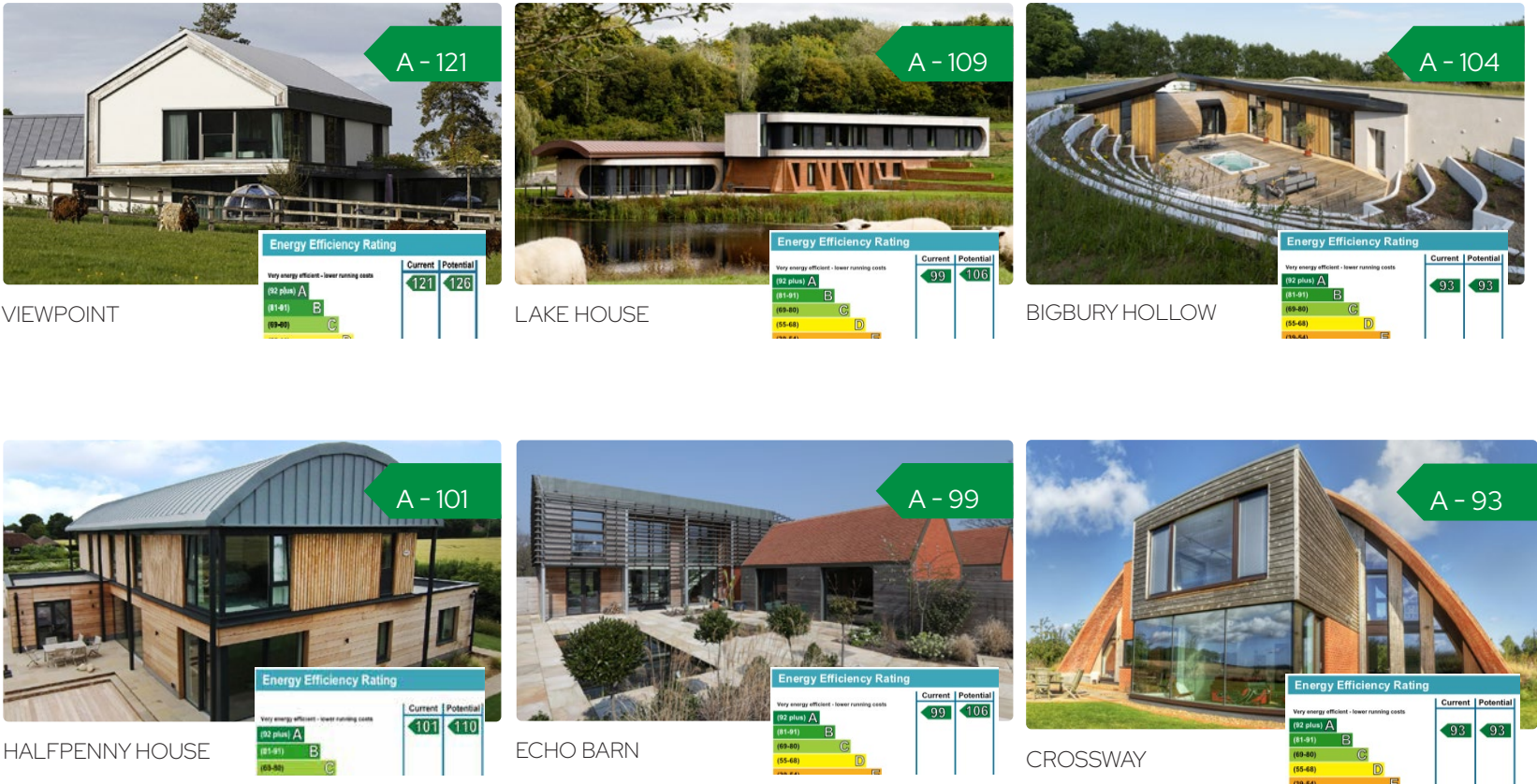
Through the application of the principles outlined in Part 9 of this document, the predicted performance is A 99.

HOUSE OF THE WOODS

HAWKES AVERAGE SAP RATING

A - 102

out of 10 built projects



HAWKES PROJECTS BUILT SINCE 2008

UKMoHo ref. no.		Architect	Project name	Project Postcode	Year built	EPC			Thermal Envelope Performance (U-values per m ² - lower value better)			Total Floor Area / m ²	TER (heating emissions) kWh/m ² /yr	DER (heating emissions) kWh/m ² /yr	BER (heating emissions) kWh/m ² /yr	% REDUCTION in DER compared to the TER as required under Part L1A (2013)	
						Energy Efficiency Rating (EER) A - G	EPC Score Average house = D - 60	CO2 emissions tonnes / year (whole house) kgCO2/m ² /yr	Airtightness m ³ /m ² /hr @ 0.05Pa (whole house)	Walls	Roof	Floor					
8662		HAWKES Architecture Ltd	Crossway Passive House	TN12 9JA	2009	A	93	-0.6	0.7	0.12	0.12	0.11	249	\	-0.60	-0.002	
17040		HAWKES Architecture Ltd	Echo Barn	TN27 8JG	2017	A	99	-0.4	2.1	0.14	0.14	0.09	320	\	\	-0.001	1
20426		HAWKES Architecture Ltd	Weald Meadows (YTL)	TN6 3QP	2021	A	109	-5.7	1.9	0.11	0.12	0.09	430	22.75	-4.27	-0.013	119
20427		HAWKES Architecture Ltd	Meadow View	TN17 2AP		A	93	-0.7	0.4	0.14	0.14	0.13	232	\	11.24	-0.003	
20428		HAWKES Architecture Ltd	Bigbury Hollow	CT2 9BJ	2022	A	104	-2.6	2	0.14	0.14	0.09	312	18.28	-8.31	-0.008	145
19954		HAWKES Architecture Ltd	Vision (The Leas)	CT14 8ER	2022	A	98	0.4	2	0.15	0.14	0.17	269	25.82	1.82	0.001	93
20429		HAWKES Architecture Ltd	Halfpenny House	TN27 8PU	2016	A	101	-3.3	2.5	0.12	0.12	0.09	346	\	\	-0.010	
20430		HAWKES Architecture Ltd	Viewpoint	RH17 6PD	2018	A	121	-12.5	2.4	0.1	0.1	0.1	558	14.84	-20.05	-0.022	235
20431		HAWKES Architecture Ltd	Dunnet (Brooks Barn)	RH13 9JN	2019	A	110	-12.22	1.8	0.12	0.11	0.11	593	17.49	-11.98	-0.021	168
17039		HAWKES Architecture Ltd	Headlands	GL52 3NL	2018	A	95	1.2	1.94	0.14	0.12	0.12	292	22.15	4.65	0.004	79
Hawkes Average EPC Rating 10 Projects						A	102.3	-3.6	1.8	0.13	0.12	0.11	AVERAGE % REDUCTION in DER compared to the TER as required under Part L1A (2013)				124

KEY CONSIDERATIONS

From SAP ratings taken from a portion of Hawkes projects built since 2008, the Hawkes SAP average rating is 102. This is classed as very energy efficient, and therefore it can be projected that Barkham will follow the same pattern.

10.15 ENVIRONMENTAL STUDIES

DISSEMINATING KNOWLEDGE



- Inviting members of the local community, planning department etc. to open houses.
- Active & engaged audience on LinkedIn, Facebook, Instagram & Youtube following projects under development, on site & performance on completion.
- Regular keynote speaking at events for the public such as the Homebuilding & Renovating and Grand Designs Live shows.
- Contributing to articles and podcasts for multiple publications
- Undertaking 'ask the expert' sessions at events to assist the general public

KEY POINTS
The practice engages the community and industry through open houses, active social media presence, and public events. It shares project updates online, speaks at major shows like Homebuilding & Renovating and Grand Designs Live, and contributes to articles, podcasts, and "Ask the Expert" sessions.

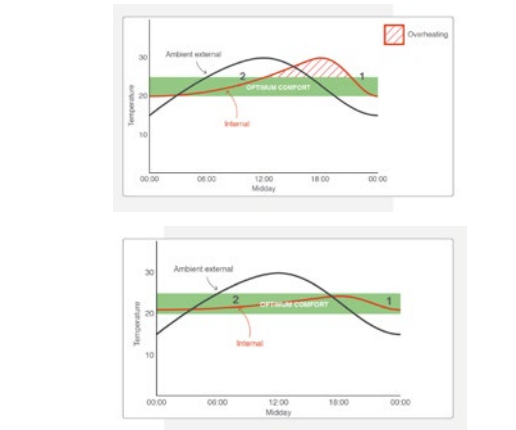
ACADEMIC ENGAGEMENT



- Hawkes Architecture have had ongoing contact with Cambridge University Engineering Department and De Monfort University for over a decade
- Involvement with academic intuitions for example University of Kent demonstrating how various aspects of environmental aspects are incorporated into our work
- Supplying data gathered from the monitoring of the project to students & researchers.
- A member of the Hawkes Team enrolled on an apprenticeship course with Nottingham University. Learning Outcomes from testing and research projects helped both Hawkes and Nottingham University to improve and understand the highest standards of design

KEY POINTS
Hawkes Architecture collaborates with universities including Cambridge, De Montfort, Kent, and Nottingham, sharing project data and environmental design insights. A team member's apprenticeship with Nottingham University supports shared learning and advances in sustainable design.

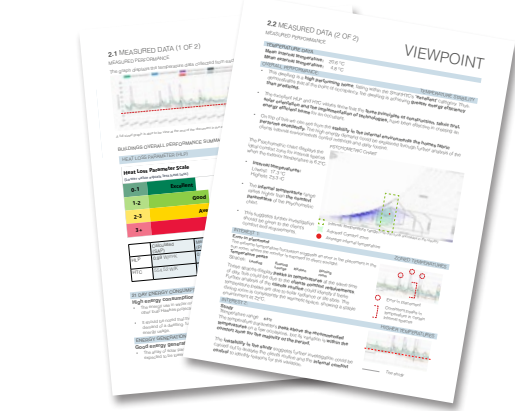
TESTING



- Hawkes Architecture have been involved and have implemented the development of earth energy bank
- Crossway was a test-bed for several sustainable technologies such as heat stores, batteries, PV-T panels.
- The practice is actively involved in the reviewing of Para84 and Para139 projects around the country which enables the implanting of knowledge and up-skilling of the wider design community
- Our constant strive to adapt and improve all processes involved with the formation of a robust Para84 case have led to us developing various tools which can help to assist the wider design community.

KEY POINTS
Hawkes Architecture has developed and implemented earth energy bank technology, with Crossway serving as a testbed for innovations such as heat stores, batteries, and PV-T panels. The practice actively reviews Para 84 and Para 139 projects nationwide, sharing knowledge and upskilling the design community while continually refining tools and processes to strengthen future Para 80 cases.

POE



- Hawkes Architecture's work on EPC research and POE has helped contribute to the national discussion on heating and energy.
- Hawkes Architecture undertook an extensive study on the energy performance of notable and award winning dwellings, contributing to articles on Dezeen and in the AJ.
- Our built houses are being carefully monitored to see what we can learn from them.
- The team has worked with Build Test Solutions to utilise the latest monitoring technology.

KEY POINTS
Hawkes Architecture's EPC research and post-occupancy evaluations have contributed to the national discussion on energy and heating. The team has studied the performance of award-winning homes, featured in publications such as Dezeen and The Architects' Journal, and continues to monitor built projects using advanced technology in collaboration with Build Test Solutions.

10.16 HAWKES POST OCCUPANCY EVALUATION (POE) STUDIES

POE Definition (RIBA)

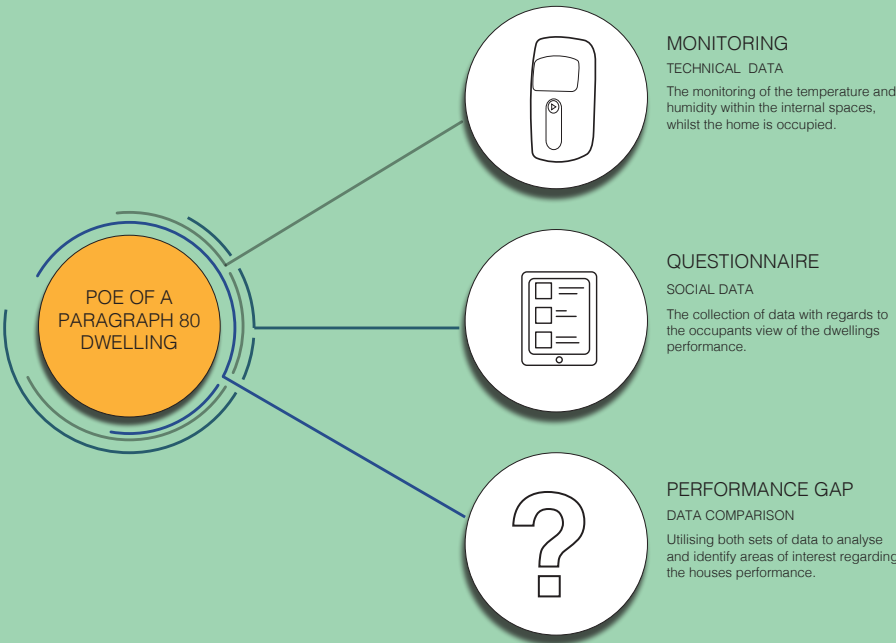
The process of obtaining feedback on a buildings performance in use after it has been built and occupied

Hawkes Architecture’s POE

Hawkes Architecture have studied and developed a POE methodology with the University of Nottingham and Build Test Solutions to create a repeatable and non-invasive POE methodology. It summarises both the energy performance and the clients satisfaction to create an overall evaluation of the architectures performance, socially and environmentally.

We then compare the predicted SAP performance of the building to the actual measured performance of the dwelling to provide the percentage performance gap of the building.

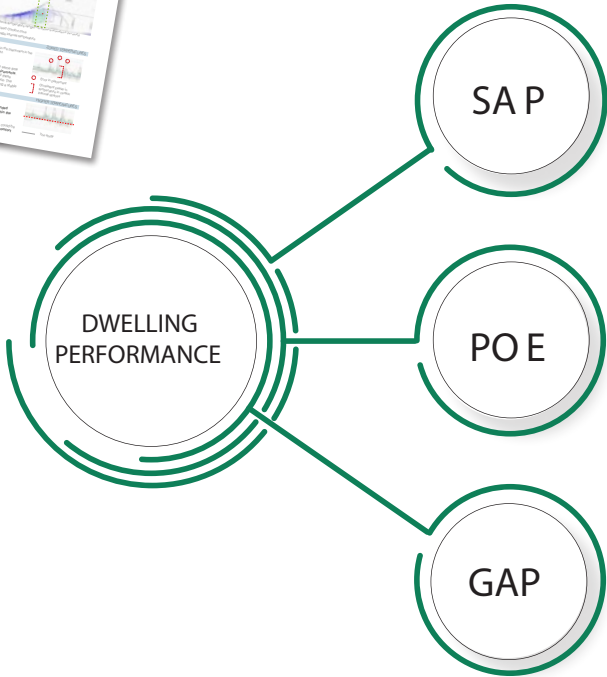
The methodology is based off research conducted by Hawkes Architectures and The University of Nottingham. Utilising technology from Build Test Solutions.



HOUSE OF THE WOODS



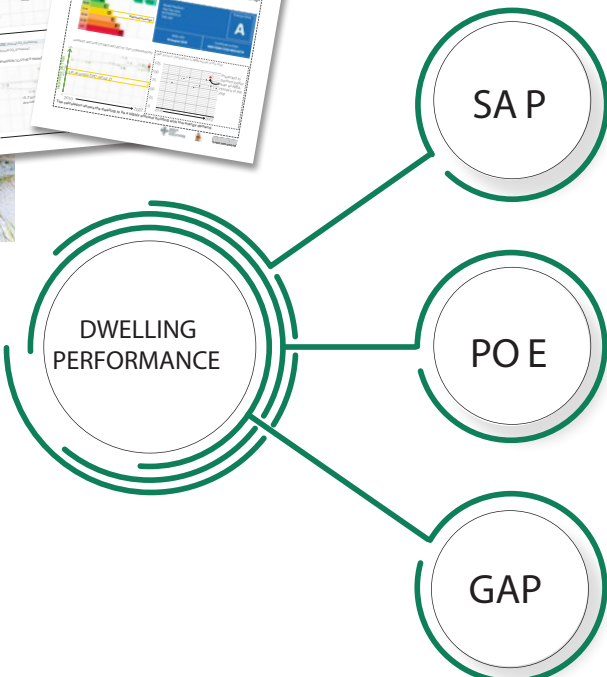
VIEWPOINT, HAWKES POE REPORT - SUMMARY



121
Energy Rating A
The average UK energy rating is D (55-68)
The design stage SAP predicts the building to be high performing.
0.9 W/m2K
Excellent HLP Performance
An excellent HLP is 0 to 1
A very poor HLP is 3+
The measured data collected whilst the occupant lived in the house displays an extremely high performing home.
11% ↑
BETTER
In the two largest POE studies the performance gap was 60 to 20% worse than predicted.
Viewpoint performs Better than what was predicted.

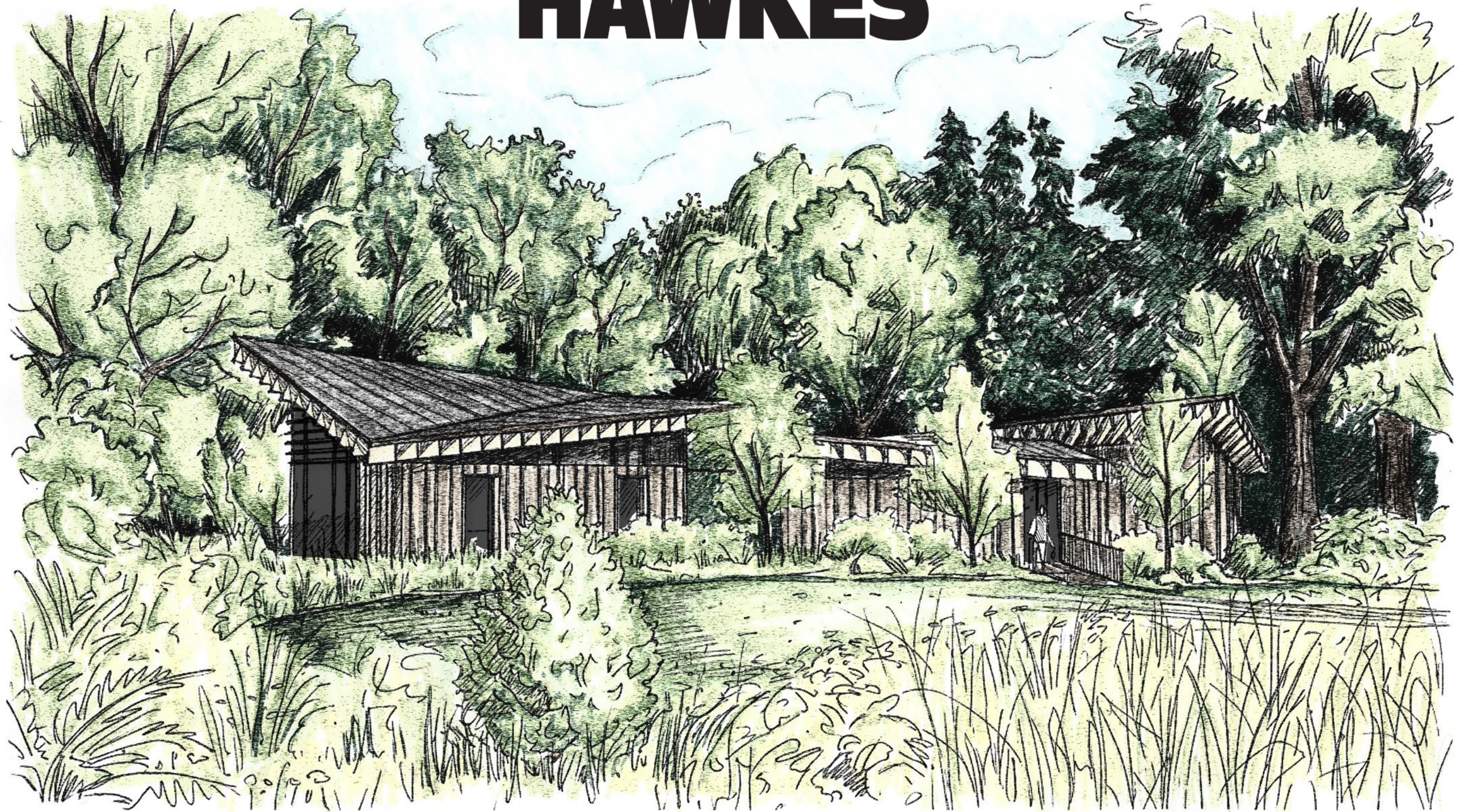


YEW TREE LAKES, HAWKES POE REPORT - SUMMARY



109
Energy Rating A
The average UK energy rating is D (55-68)
The design stage SAP predicts the building to be high performing.
0.8 W/m²K
Excellent HLP Performance
An excellent HLP is 0 to 1
A very poor HLP is 3+
The measured data collected whilst the occupant lived in the house displays an extremely high performing home.
11% ↑
BETTER
In the two largest POE studies the performance gap was 60 to 20% worse than predicted.
Viewpoint performs Better than what was predicted.

HAWKES



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