

Arch 464  
ECS  
Spring 2023

Name \_\_\_\_\_

Quiz #3

## "How Sustainable is a Nest House?"

Read and look at everything before you write!



All photos and drawings: Jim Stephenson, Andy Billman, and Studio Bark.

*Viewed from the southwest, the Nest House 'nestles' into the landscape and its rural context.*

For this quiz you get to investigate Nest House with an eye on evaluating its performance as an eco-friendly, perhaps regenerative, building and site.



## NEST HOUSE

Through consideration of context and astute material choices, Nest House, in the picturesque Wye Valley, challenges preconceptions about sustainability while embedding itself into its scenic milieu. The designer, Studio Bark, was founded in 2014 with the express purpose of delivering eco-friendly buildings.

As you approach the site, you're met with a breathtaking view of Herefordshire hills. It is a view so engaging you could be forgiven for not noticing the small single-storey timber-clad house embedded into the hillside. The east elevation, which you encounter first, is, if anything, understated. Maroon-coloured window frames, though not out of place, are the only standout features. As you enter the house, you're reacquainted with that view, this time framed dramatically by large, west-facing windows.

The house's rectilinear doughnut plan is organised into two complementary 'L' shapes wrapped around a central courtyard. Upon entering, you find yourself in the 'L' that includes the kitchen, dining and living rooms. This assembly of spaces looks onto the adjacent fields, a reminder of the site's agricultural past. The rooms throughout are clad in spruce plywood and, except for some of the furniture, which has been moved in from the clients' previous home, the utilitarianism of the materials at work here would make Bentham proud. The second 'L' shape houses the bedrooms and bathrooms; the master bedroom at one end also overlooks the fields to the west.

U-Build parts are CNC-cut from sustainably sourced plywood. They fit together to make modules for walls, floor, and roof that are fixed manually, with nothing but a drill and a mallet. The external walls are wrapped in a breather membrane, insulated with sheep's wool and, in this case, clad with timber slats of varying widths, in step with the rhythm of the windows. Sourcing locally considerably lowered the building's embodied carbon. The project is free of concrete foundations or structural steel. The Douglas fir used for cladding and decking came from the nearby Whitney Sawmills. Groundworks and retaining walls are made from reclaimed railway sleepers from Ross-on-Wye. The structure is raised on jack pads made from recycled plastic.

The house's operational energy is also very low, owing to key moves such as orientation to benefit from solar gain; use of second-hand photovoltaic panels, which also serve as awnings; and user-responsive infrared heating, which dispenses with any need for radiators and pipework. A green roof and extensive planting strategy support biodiversity, which was important to the clients, who are keepers of rare native breeds. Choices of materials such as the zero-carbon linoleum floor and butyl for the roofing help the project's eco-credentials further. Sarah Broadstock, associate at Bark Studio, speaks of 'environmental rigor' or being 'forward-thinking in environmental terms'. But a building's sustainability is only as good as its client's..

Nest House's orthogonal simplicity was the perfect test-bed for NBAU and U-Build. The clients concede the result is 'not for everyone' but, with a construction cost of £280,000, it does call into question the argument often put up against sustainable construction—that it is prohibitively expensive.

However, for all that there is something poetic about people coming together to build with materials from the land to which the structure is ultimately destined to return, this project is not the golden ticket to sustainable construction at scale. Architecture will not find redemption through a series of single-occupancy rural homes. But it is a start. Nest House poses important questions, the most important of which is: which parts of this methodology, framework and outlook could be the start of something bigger?

With Nest House, Studio Bark challenges us to go further. The generosity with which they offer up their processes dares us to do better, if we're brave enough.

—Ewa Effiom, *Architects's Journal*, 24 Feb 2023

### ***M&E consultant's view***

Nest House is an all-electric building. This includes the heating system, which uses infrared (IR) heaters integrated with the fabric of the building. This provides thermal comfort in a different way than traditional convective heating systems and allows the room temperature to be slightly lower, reducing the building's energy requirements. This strategy is made possible by good levels of insulation and airtightness in the building envelope. The heaters are controlled by occupancy and temperature readings, reducing the amount of time energy is used for heating and so reducing the overall demand.

Ventilation is provided by a demand-control system that only ventilates spaces when CO<sub>2</sub>, humidity and VOC levels drift out of range, which reduces the amount of energy needed to run the house. Fresh air is provided to the habitable rooms such as bedrooms and living rooms by automated trickle vents in the façade. Air is extracted from the dwelling by a fan integral to an exhaust air heat pump. This provides mechanical extract ventilation via a ducted system from wet rooms such as bathrooms and kitchens and discharges air to the façade. This unit also generates and stores hot water by performing a heat pump cycle on the extracted warm air stream and ensures that heat is recovered all year round, and hot water is generated at a high coefficient of performance.

—Josh Shimmin, *consultant, Atamate Building Intelligence*

## SUSTAINABILITY STATEMENT

The plan is arranged around a small courtyard space to enhance accessibility by minimizing distances between key spaces. The courtyard also offers shelter from the strong south-westerly winds, fantastic cross-ventilation, and daylight throughout the plan.

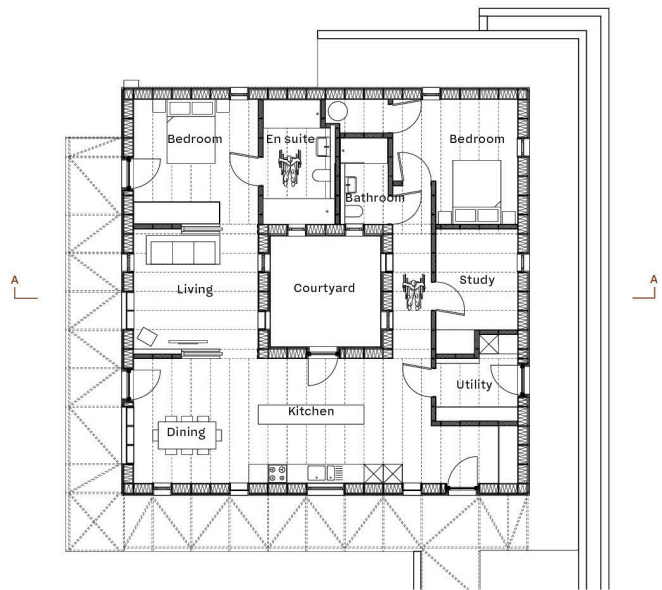
Resource efficiency was a key driver for the project, with the aim of keeping things affordable both financially and environmentally. Concrete was banned from the site, replaced by an innovative jack pad foundation system, coupled with a series of raised decks to provide level access. In order for the building to 'nestle' in the landscape, significant groundworks were required to get to foundation level. An innovative reclaimed railway sleeper retaining wall and planter system was developed in collaboration with the groundworker and engineer, saving huge amounts of concrete and steel.

The project's embodied and operational carbon counts are notably low due to fabric-first principles, local and natural materials, high levels of natural insulation, good airtightness, on-site renewables, and a 'smart' infrared heating system. It was built using the following pallet of materials with environmental impact at the front of mind:

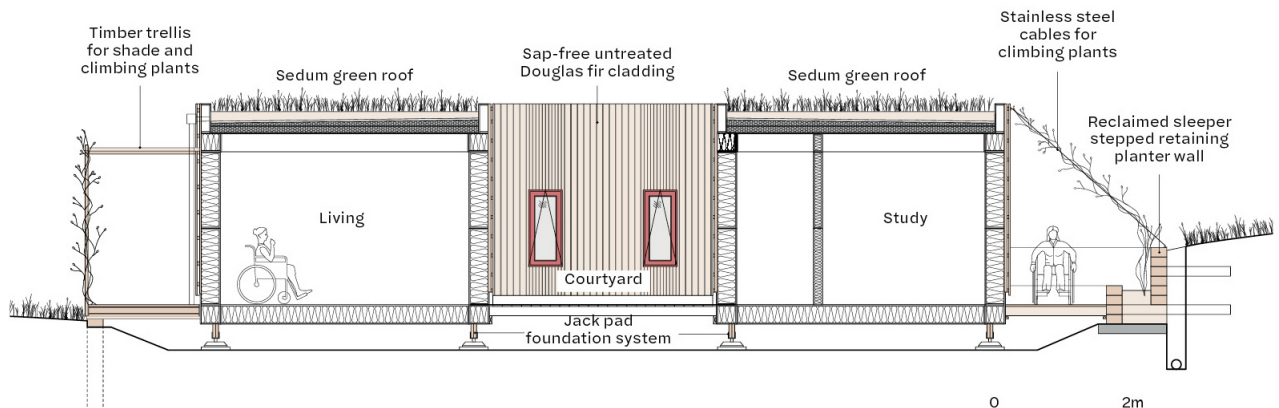
- Reclaimed railway sleeper retaining walls
- Very local recycled hardcore, compacted to accept the foundations
- Re-usable, recycled rubber and steel jack pad foundations
- Modular U-Build construction system, made from sustainable spruce plywood
- KJAR triple-glazed timber/aluminium-clad windows
- Thermafleece sheep's wool insulation (pre-cut to size)
- Illbruck airtight breather membrane
- Sky Garden sedum roof system on butyl one-piece membrane
- Forbo Marmoleum natural flooring system
- Locally sourced ash timber sills and worktop
- Battens, cladding, decking joists and decking were sourced locally from Whitney Sawmills.

—Sarah Broadstock, associate architect,

Studio Bark



### Section A-A



## Site Energy

1. The building makes use of a photovoltaic array and battery system to generate and store electricity, which allows a proportion of the building's energy demand to be offset. **Make a case** for or against supplementing the photovoltaics with wind turbines or with more photovoltaics. **Discuss** the merits, placement, and drawbacks of PV and wind turbine placement. Use diagrams to **illustrate** your ideas.

4 points

## PVs



Roof view showing sedum roof and PV array that provides 22% of the electricity required.

## Wind



Site plan showing Nest in red and its neighbors. North is up.

### Regeneration-Based Checklist for Design and Construction

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Project: \_\_\_\_\_

degeneration      sustainability      regeneration

*Rate the building for each of the checklist items and give a total score.*

	-100 always	-75 usually	-50 sometimes	-25 a bit	0 balances	25 a bit	50 sometimes	75 usually	100 always	
the site	pollutes air									cleans air
	pollutes water									cleans water
	wastes rainwater									stores rainwater
	consumes food									produces food
	destroys rich soil									creates rich soil
	dumps wastes unused									consumes wastes
	destroys wildlife habitat									provides wildlife habitat
	imports energy									exports energy
	requires fuel-powered transportation									requires human-powered transportation
	intensifies local weather									moderates local weather
the building	excludes daylight									uses daylight
	uses mechanical heating									uses passive heating
	uses mechanical cooling									uses passive cooling
	needs cleaning and repair									maintains itself
	produces human discomfort									provides human comfort
	uses fuel-powered circulation									uses human-powered circulation
	pollutes indoor air									creates pure indoor air
	is built of virgin materials									is built of recycled materials
	cannot be recycled									can be recycled
	serves as an icon for the apocalypse									serves as an icon for regeneration
is a bad neighbor									is a good neighbor	
is ugly									is beautiful	

negative score 2200 possible		positive score 2200 possible
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final score:

### Regeneration Rating

2. a) Explain what your final rating score of the building means in terms of regeneration and eco-friendliness.

2 points

b) Explain your rating for "serves an icon for the apocalypse vs. serves as an icon for regeneration."

## Building Scale Regeneration

3. Given the building plans and orientation **point out and discuss three** features of the **building design** to which you awarded high regeneration points on the SBSE checklist (page 4) and **one** feature of the **building design** to which you awarded low degeneration points on the SBSE checklist.

8 points

1(+)

2(+)

3(+)

1(-)

## Site Scale Regeneration

4. Given the building plans and orientation **point out and discuss two** features of the **site design** to which you awarded high regeneration points on the SBSE checklist (page 4) and **one** feature of the **site design** to which you awarded low degeneration points on the SBSE checklist.

6 points

1 (+)

2 (+)

3 (-)