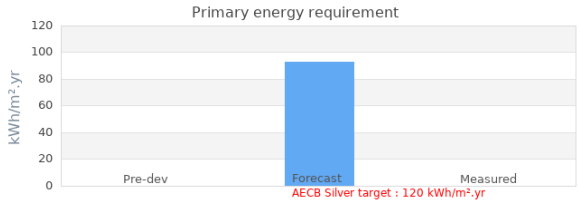
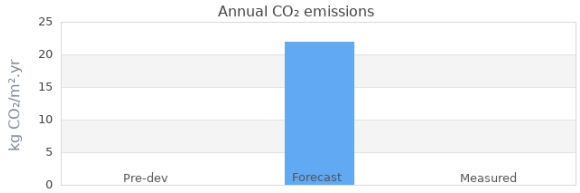
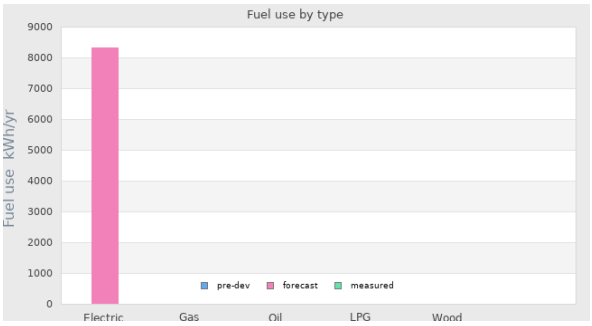
https://www.lowenergybuildings.org.uk/

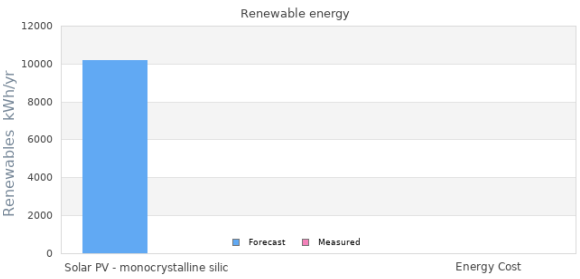
Project name Hornbeams

Project summary New build house









Project Description

Projected build start date	17 May 2023
Projected date of occupation	18 Sep 2024
Project stage	Occupied
Project location	Lavenham, Suffolk, England
Energy target	AECB Silver
Build type	New build
Building sector	Private Residential
Property type	Detached
Existing external wall construction	Softwood frame
Existing external wall additional information	timber frame, part steel, brick & render external
Existing party wall construction	n/a
Floor area	224 m²
Floor area calculation method	PHPP

Project team

Organisation	Cayford - AECB Certifier
Project lead	Project Orange
Client	Private client
Architect	Project Orange
Mechanical & electrical consultant(s)	Total Home Environment
Energy consultant(s)	Total Home Environment + Cayford
Structural engineer	Superstructures
Quantity surveyor	Marstan BDB LLP
Other consultant	
Contractor	Moore & Stone

Design strategies

Planned occupancy	Two people, mostly at home.
Space heating strategy	Heat Pump Ventilation (HPV) - air to air heat pump, for most of the heating demand, and some comfort cooling. Residual heat demand (in exceptionally cold weather) from built-in infra-red radiant panels.
Water heating strategy	Hot water is produced by a direct phase change Sunamp thermal storage (heat battery) unit. There are Solar PV panels with battery to help power the hot water unit.
Fuel strategy	All electric no fossil fuel - heat-pump with Solar PV
Renewable energy generation strategy	Solar PV
Passive solar strategy	Solar PV
Space cooling strategy	High thermal mass, eaves shading, fully opening windows on all four elevations. Mechanical air-supplied cooling is available from Heat Pump Ventilation unit.
Daylighting strategy	Windows and rooflights.
Ventilation strategy	Mechanical air-supplied fresh air ventilation with heat recovery from Heat Pump Ventilation unit. Fully opening windows on all four elevations
Airtightness strategy	Considerable care was taken for airtightness. The ground insulation is below the slab so the concrete slab is used for the floor air tightness. SIGA membranes and tapes are used on the inner lining of the insulation to walls and roofs.

Strategy for minimising thermal bridges	Continuous thermal insulation to minimise thermal bridging was a key part of the design. Thermal bridges were modelled for the floor-wall and wall-eaves junctions, and values recorded in PHPP. Where steel structural beams extend out of the thermal envelope armourflex structural thermal breaks are installed to separate inside from outside, and external steel beams are wrapped with insulation. Ancon thermal resisting cavity ties are used where required.
Modelling strategy	The energy has been modelled with PHPP v10.4. We believe all elements have been completed accurately in the model, providing compliance with the AECB Carbonlight Legacy Standard. The project started at the end of 2022. The airtest result is n50 of 1.36 ACH.
Insulation strategy	Glapor recycled foam glass (RFG) gravel is laid to the thickness of 500 to 600 mm below the floor concrete floor slab. XPS foam provides thermal continuity at the slab edge to meet the walls. The walls and roofs are of timber frame construction. The joists are fully filled with a hemp-based quilt insulation, and Gutex wood-fibre batts are installed over the joists on the inside and the outside to eliminate the thermal bridge of the timber construction. (Similar construction for the roof). This also allows windows and doors to be installed with minimal thermal bridging.
Other relevant retrofit strategies	
Other information (constraints or opportunities influencing project design or outcomes)	Indoor air quality is managed by the filtered supply air from the HPV unit. There are no combustion appliances in the property, which helps external air quality. The house is set in the Suffolk countryside, and is locally surrounded by a verdant garden.

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric		8323	
Gas			
Oil			
LPG			
Wood			

Primary energy requirement & CO2 emissions

	previous	forecast	measured
Annual CO2 emissions (kg CO2/m².yr)	-	22	-
Primary energy requirement (kWh/m².yr)	-	93	-

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
Solar PV - monocrystalline silic	10184	
-		
Energy consumed by generation		

Airtightness (m³/m².hr @ 50 Pascals)

	Date of test	**Test result**
Pre-development airtightness	-	-
Final airtightness	03 Dec 2024	1.36

Annual space heat demand (kWh/m².yr)

	Pre-development	forecast	measured
Space heat demand	-	38	-

Whole house energy calculation method	PHPP
Other energy calculation method	
Predicted heating load	17 W/m² (demand)
Other energy target(s)	

Building services

Occupancy	3.1 modelled in PHPP. Likely occupancy is 2.
Space heating	HPV2 (Heat Pump Ventilation) air-to-air unit by Total Home Environments provides the majority of space heating requirement, distributed by insulated air-ducts. There are infrared panels in the sloping ceilings to provide back-up in exceptionally cold conditions.
Hot water	Hot water is produced by a direct phase-change Sunamp thermal storage (heat battery) unit. There are Solar PV panels with battery to help power the hot water unit.
Ventilation	HPV2 (Heat Pump Ventilation) unit by Total Home Environments provides fresh filtered air with heat recovery. Opening windows provide users with further choice.

Controls	Central touch-screen control panel, which is located within the main living area of the house. The panel allows the user to adjust all the important functions such as selection of the operating mode (e.g. ECO Summer which, during very warm periods, can reduce fan speeds during the day and facilitate greater and simultaneous use with the heat exchange bypass during the night to provide passive night-time cooling). The main control panel will allow the user to control the target room temperature for the main living area and for rooms with localised ceiling mounted heater terminals, time settings and the 24 hr 7-day timer programme for specific temps and airflow rates throughout the week; display only of general system information, measured readings and reported errors; ventilation rates (essentially vacation, setback, standard and boost); domestic hot water heating settings; and system configuration settings for the administrators within the household.
Cooking	Induction electric
Lighting	LED
Appliances	Low energy appliances
Renewables	Solar PV
Strategy for minimising thermal bridges	Continuous insulation was part of the design. Thermal bridges were modelled for the floor-wall and wall-eaves junctions. Where steel structural beams extend out of the thermal envelope armourflex structural thermal-breaks are installed to separate inside from outside, and external steel is wrapped in insulation. Ancon thermal resisting cavity ties are used where required.

Building construction

Storeys	2
Volume	942m³
Thermal fabric area	814m²
Roof description	The main roof is pitched, with additional flat roofs. a) Pitched roof: Timber rafter structure (with additional steelwork), joists filled with hemp-flax quilt, Gutex wood fibre batts on top, with slate roof on battens & counter battens. Wood-wool boards with plaster ceilings.b) Flat roofs: Timber joist structure, joists filled with hemp-flax quilt, Gutex wood-fibre batts on top. Various ceiling finishes.
Roof U-value	0.10W/m² K

Walls description	Timber stud construction, fully filled with hemp-flax quilt. Inside - vapour membrane, Gutex wood-fibre batts, finished with self coloured lime plaster. Outside, breathable P5 particle board, Gutex wood-fibre batts, breathable membrane and cavity. Either render finish on woodwool board, or brick with insulating cavity ties.
Walls U-value	0.10W/m² K
Party walls description	n/a
Party walls U-value	
Floor description	Reinforced concrete slab on 500-600mm Glapor recycled foam-glass (RFG). Isolating underlay with solid timber floor.
Floor U-value	0.13W/m² K
Glazed doors description	Aura triple-glazed, timber windows
Glazed doors U-value	0.82W/m² K uninstalled
Opaque doors description	Aura thermal solid front door
Opaque doors U-value	1.80W/m² K installed
Windows description	Aura triple-glazed, timber windows
Windows U-value	0.78W/m² K
Windows energy transmittance (G-value)	53%
Windows light transmittance	74%
Rooflights description	Skyway triple-glazed
Rooflights light transmittance	54%
Rooflights U-value	0.80W/m² K uninstalled

Project images