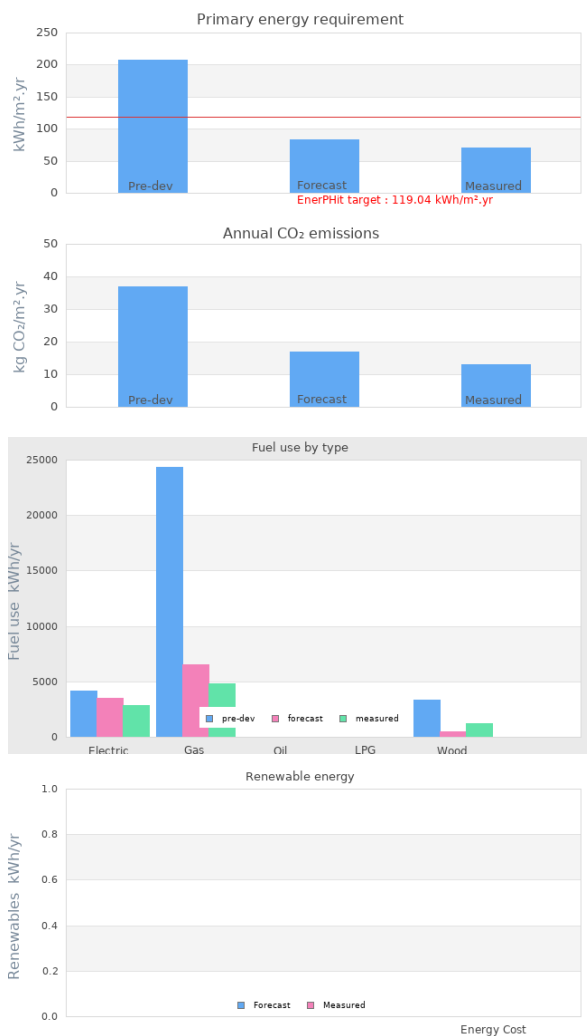


Project name Bristol Retrofit

Project summary A full thermal retrofit of a mid-century, three-storey property built into a hill and located within a Conservation Area in Bristol. The project included an extension, designed and built to a very energy efficient specification. The extension was needed, both to accommodate home based business facilities, and to improve access to the lower floor, which is now the kitchen/dining area. A key challenge for this project was to address the amount of thermal bridges created by the excess amount of concrete used during the period of the original construction. Concrete gutters and a balcony have been removed. External wall insulation has been used throughout (U



Project Description

Projected build start date	10 Sep 2012
Projected date of occupation	03 May 2013
Project stage	Occupied
Project location	Bristol, Bristol, England
Energy target	EnerPHit
Build type	Refurbishment
Building sector	Private Residential
Property type	Detached

Existing external wall construction	Masonry Cavity
Existing external wall additional information	60mm cavity brick-brick
Existing party wall construction	
Floor area	201.9 m ²
Floor area calculation method	SAP

Project team

Organisation	Four Walls Consultants
Project lead	Ian Mawditt
Client	Ian Mawditt
Architect	Taylor Kay
Mechanical & electrical consultant(s)	Four Walls Consultants
Energy consultant(s)	Four Walls Consultants
Structural engineer	
Quantity surveyor	
Other consultant	
Contractor	Greenheart Sustainable Construction

Design strategies

Planned occupancy	Two people with occasional guests. Both occupants work full time from home.
Space heating strategy	Re-use existing (A rated) boiler with new 3 zone distribution using panel radiators. 4kW installed capacity + 5kW wood burner to living room.
Water heating strategy	New 250 litre mains-pressure, indirect coil hot water cylinder. Primary source is system boiler.
Fuel strategy	Mains gas for heating and cooking; mains electricity
Renewable energy generation strategy	None present
Passive solar strategy	Large amount of glazing (70%) to rear (east) allowing good winter solar gain.
Space cooling strategy	New glazing using high quality triple glazed units. These have a double low-e coating and offer a good degree of solar control. Light colour render and ventilated timber facades help to reduce solar insolation. Lower ground floor (new kitchen) will have approximately 1 metre overhang from balcony above, with planting. Exposed internal thermal mass wherever possible. Live/work from home window management is key in summer.

Daylighting strategy	House is very well day-lit as many mid century homes tended to be. Glazed area has reduced slightly with the extension/renovation, but occupied rooms have a daylight factor >4, which means that do not need electric lighting during the day.
Ventilation strategy	Whole house heat recovery ventilation system using Paul Novus 300 with frost coil. Ducting is rigid steel with double seals at each connection. System provides 220 m ³ .h ⁻¹ in normal mode and 270 m ³ .h ⁻¹ in boost. Have the option of automatic summer bypass, but in reality system is switched off and windows are permanently open (secure) on ground (rear) and upper floors (all).
Airtightness strategy	Wet plaster coating to interior walls. Render under-/slurry-coat applied to outer brick layer prior to applying EWI. Airtightness detail around window and door openings and junctions between floors, walls and roofs, by use of airtightness membranes and tapes. Around openings, an adhesive backed airtightness tape will be fitted to surrounding structure. Existing intermediate floor joists (penetrating the cavity) will be individually sealed using proprietary air barrier sealant and/or membranes and parging
Strategy for minimising thermal bridges	In general, wrapping the house in 120mm of external wall insulation will eliminate many of the existing thermal bridges. Extending insulation in the extension to foundation level reduces psi-values to negligible levels.
Modelling strategy	Therm modelling for thermal bridges only. Although a full retrofit, the entire strategy is based upon an elemental approach (e.g. all elements U=
Insulation strategy	120mm external wall render insulation system to extension and majority of existing house. South elevation has external concrete stairs and EWI will not be possible. Internal wall insulation (100mm) fitted to this elevation at ground/lower ground. Roof (cold loft) has between 400mm and 600mm Warmcell (excessive, but was also to envelop MVHR ducts). Extension roof, tapered PIR, min 100mm. Extension floor 100mm PIR; existing floor 100mm batts between joists

Other relevant retrofit strategies

For more information go to www.fourwalls.uk.com/blog

Other information (constraints or opportunities influencing project design or outcomes)

The house is in a Conservation Area

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric	4155	3500	2866
Gas	24367	6500	4871
Oil			
LPG			
Wood	3350	500	1203

Primary energy requirement & CO2 emissions

	previous	forecast	measured
Annual CO2 emissions (kg CO2/m ² .yr)	37	17	13
Primary energy requirement (kWh/m ² .yr)	208	83	70

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
-		
-		
Energy consumed by generation		

Airtightness (m³/m².hr @ 50 Pascals)

	Date of test	Test result
Pre-development airtightness	01 May 2012	18.4
Final airtightness	20 Oct 2013	1.85

Annual space heat demand (kWh/m².yr)

	Pre-development	forecast	measured
Space heat demand	140.3	16.93	14.2

Whole house energy calculation method

SAP Extension for Whole House

Other energy calculation method

Predicted annual heating load

-

Other energy target(s)

Building services

Occupancy	See design strategy
Space heating	See design strategy
Hot water	See design strategy
Ventilation	See design strategy
Controls	Three zone heating controls: one thermostat and programmer per floor. Ventilation central controller in study with boost buttons in kitchen and outside bathroom. Controls are programmable: 4 different speed settings, set according to occupancy and time of day. Hot water programmer set for one hour per day.
Cooking	Mains gas hob - daily use; electric Oven - approx. twice-weekly; microwave - approx. once weekly
Lighting	70% LED; 30% CFL/T5
Appliances	A rated electric oven; A+ rated fridge freezer; A+ rated dishwasher; A++ rated washing machine; A+++ rated tumble drier (heat pump)
Renewables	None fitted yet - fabric first approach followed by a period of monitoring and refining. Then consider options for micro-generation.
Strategy for minimising thermal bridges	See design strategy

Building construction

Storeys	3
Volume	581.5m ³
Thermal fabric area	470m ²
Roof description	Original roof: cold loft; timber with concrete tiles. Insulated using Warmcel blow in to a depth of 300mm, with a further 300mm ontop/around MVHR ducting, resulting in A.W U=0.1. New roof to extension: flat, warm roof construction made up with 150mm Kingspan Thermaroof TR26 and Cefil single ply membrane. Sedum layer dressing. (U=0.14)
Roof U-value	0.10W/m ² K
Walls description	Existing masonry CW: Infilled with Ecobead+ (nominal 60mm depth). Cavities edge-sealed at top. EWI applied using 2x60mm layers of Kingspan K5 over a sand/cement slurry coat (air barrier). Finished in render or ventilated timber cladding. (U=0.12) Extension walls: solid AAC using 190mm 7.3n/sq.mm blocks. insulation/air barrier/finishes as per existing walls. (U=0.14). Timber infil sections (U=0.1). Internal insulation areas on south elevation at ground and lower ground using 100mm Pavadentro (U=0.17)
Walls U-value	0.12W/m ² K

Party walls description	N/A
Party walls U-value	0.00W/m ² K
Floor description	Original LGF slab removed and floor lowered. New slab to existing and extension LGF built up using 100mm Kingspan Kooltherm K3 with a 30mm liquid flow screed over
Floor U-value	0.13W/m ² K
Glazed doors description	Two x TG tilt/slide units and one TG bi-fold door set by Green Building Store EcoContract+ range
Glazed doors U-value	0.90W/m ² K installed
Opaque doors description	Two opaque doors by Green Building Store EcoContract+ range
Opaque doors U-value	1.00W/m ² K installed
Windows description	All timber frame triple glaze with 2xlow-e coatings. All by Green Building Store EcoContract+ range
Windows U-value	0.90W/m ² K installed
Windows energy transmittance (G-value)	0.49%
Windows light transmittance	
Rooflights description	3 x Velux GGU-62 units in extension roof
Rooflights light transmittance	0.69%
Rooflights U-value	0.81W/m ² K installed

Project images







