40 Varndean Gardens, Brighton BN1 6WL

OVERVIEW

Age: 1958

Type: Detached

Residents: 2 adults

Beds: 4

Floors: 2

Walls: Insulated cavity plus external insulation

Area: 161m²

FEATURES

+ Cavity wall insulation (poly bead fill)
+ Condensing boiler
+ External wall insulation
+ High performance double glazing
+ LED lighting
+ Low energy appliances
+ Low water goods
+ Natural materials (locally sourced)
+ Passive solar gain
+ Rainwater harvesting
+ Solar PV (4kWp)
+ Solar thermal
+ Underfloor insulation
+ Woodburning stove

Introduction and approach

The house was designed and built in the 1950s by Nigel's parents to be modern, efficient, and comfortable. Unusually for that period, the living rooms & bedrooms were deliberately positioned on the south side of the house and had large areas of glazing to benefit from passive solar gain. The hall, stairs, landing, bathroom and cloakroom were on the north and east elevations. The north facing windows were non-opening to cut down on draughts.

Nigel is a surveyor and with his knowledge of the house he worked with architects BBM Sustainable Design to enhance the best of the original structure to create an impressive retrofit.

Their approach has been to wrap the whole of the house in high levels of external insulation and fit high performance windows, so that the original brick structure operates as a thermal store inside its insulated blanket, to keep the temperature comfortable all year.

They have made maximum use of the south facing roof with an extensive photovoltaic array and solar thermal panels to produce electricity and heat water. Combined with highly efficient appliances throughout, including condensing boiler, wood- burner, A rated appliances and LED lighting, the whole house feels comfortable and is designed to function at low cost to Nigel and Sally and the environment.

This approach was enhanced by the use of natural materials, ideally locally sourced, for internal and external finishes; recycled materials were adopted where possible.

One year on from completion, consumption figures bear out the design intention; energy use and carbon emissions are more than 80% lower than an average UK house. Monthly energy bills are very low and more than paid for by income from solar generated electricity.

Energy efficiency measures

Heating and hot water

A Worcester condensing boiler provides space heating and hot water, although over half the hot water is heated by solar thermal panels. This is backed up by a woodburning stove, which helps to reduce gas consumption and large south facing windows which collect passive solar warmth in the winter.

The downstairs has very efficient underfloor heating.

Insulation

The central storage area of the attic has 100mm Earthwool between the joists, over which has been laid 200mm of PIR foam, boarded to create a storage area. Around the edges and toward the eaves, the rest of the loft has 270mm of Earthwool insulation, a glasswool material made from recycled bottles.

The walls were insulated with poly bead cavity wall insulation. This measure alone cut wall heat losses by two thirds. This is augmented by external wall insulation; 100mm PIR foam boards fixed to walls, finished in chestnut cladding This has created a wall with losses less than 20% of the original construction.

The suspended ground floor was lifted and the void beneath used to dispose of rubble from the garage conversion. Over this was created a new solid floor incorporating 100mm of PIR foam insulation, with underfloor heating above, to complete the highly insulated living shell.

Windows are high performance double glazing, made by Velfac, clad with powder coated aluminium externally, but with an underlying timber frame. These have an excellent u value of around 1.5 W/m²K.

Unusually, the garage has also been insulated to create a warm space.

The building was renovated to very high standards of airtightness, as it was intended to fit MVHR heat recovery ventilation. This was dropped to trim costs.

Renewables and Low carbon technology

Solar thermal hot water is provided by a Kingspan flat panel array. Solar PV electricity is generated by a substantial 16 panel Sanyo/ Panasonic installation, with a peak output of 4kW. A Morso woodburning stove, fed by a direct external air vent, provides virtually carbon neutral space heating to top up the boiler.

Electricity

Low energy LED lighting has been installed throughout, augmented by excellent natural lighting. The house has A+ or A+++ low energy appliances throughout.

Other sustainable measures

Natural materials

Timber is used extensively for cladding, flooring as well as the central oak staircase. Clay tiles were used on the roof and recyclable galvanised steel rainwater goods replaced the old cast iron. Where possible materials were sourced locally.

Bathroom mosaic tiles were made from recycled glass, as were the kitchen worktops, and much of the flooring is natural Marmoleum.

Water conservation

Low flow taps, aerated shower heads and low water use appliances help to minimise water demand, whilst rainwater harvested from the roof is stored in a 235 litre tank and used for garden watering.

Lessons learned

Prior to this refurbishment, Sally and Nigel had volunteered to help in a variety of Eco open houses and gained experience of what worked best before beginning their project.

The new first floor bedroom on the first floor tends to be slightly colder than the other upper rooms as it faces north. With hindsight it would have been better to have zoned this room separately from the rest of the first floor as it needs more heat.

Sally and Nigel have tried to adopt low maintenance, future-proof solutions and go for a design that will last the test of time.

Professionals

Architects BBM Sustainable Design Ltd: www.bbm-architects.co.uk

Energy strategy Robinson Associates: www.robinsonengineers.co.uk

Structural engineer BBP Consulting Engineers: www.bbpengineers.com

Main contractor Chalmers & Co: www.chalmersandco.co.uk

Electrical sub-contractor Chris Syms Ltd: www.chrissyms.co.uk

Plumbing sub-contractor Steve Wells

Underfloor heating sub-contractor Kestrin Ltd: www.kestrin.co.uk

Timber flooring EC Forest Products Ltd: www.ecforestproducts.com

Staircase, oak stairs AA Taylor Ltd: www.aataylor.co.uk

Stair, steel strings & glass Iron Designs Ltd: www.irondesigns.co.uk

Solar thermal and Solar PV Suntrader Solar Energy: www.suntrader.co.uk

Woodburner installer Bolney Stoves: www.bolneystoves.co.uk

Kitchen Harvey Jones: www.harveyjones.com

Kitchen worktops Resilica, Newhaven: www.resilica.com

Solar photovoltaic panels Sanyo HIT H250E01 (now Panasonic VBH H250E01) https://eu-solar.panasonic.net/en/

Roof Tiles Hawkins Blue Smooth clay tiles: www.marleyeternit: co.uk/ Roofing/Clay-Tiles/Hawkins-Clay-Plain-Tile.aspx

Guttering Lindlab Rainline Galvanised: www.lindlab.co.uk

Windows Velfac 200: www.velfac.co.uk

Bi-fold doors Sunflex SF70: www.sunflex.co.uk

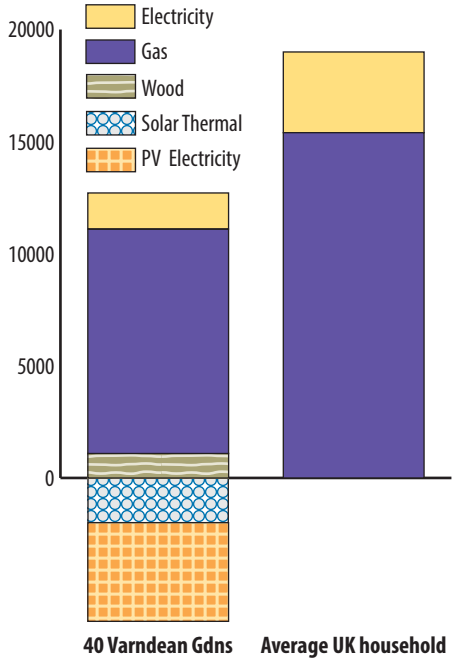
Garage door Hormann LPU40, L-ribbed: www.hormann.co.uk

Wood burner Morso: www.morso.co.uk

Paint Farrow and Ball: www.farrow-ball.com

Energy and CO_2 performance

Energy performance kWh



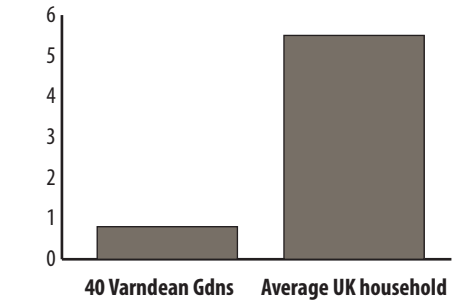
Energy use (generation) kWh

	40 Varndean Gardens	Average UK household[1]
Gas	10000	15400
Electricity	1100	0
Wood	1600	3600
PV Electricity[2]	-4400	0
Solar Thermal	-2000	0
Totals	**6300**	**19000**

[1] 15400 kWh average gas use (DECC Energy Trends March 2013), 3600 kWh average electricity use (EST 'Powering the Future' 2012)

[2] Total generation figure, of which 500 kWh is assumed used by household

CO_2 performance Tonnes CO2



CO_2 emissions (tonnes)[3]

40 Varndean Gdns	Average UK household[4]
0.8	5.5

86% below average

[3] CO_2 fuel emissions factors from SAP 2009

[4] Average fuel emissions 0.233kg CO_2/kWh (from EHS 2009 fuel split)

Eco Open Houses is an annual collaborative project between Low Carbon Trust, Brighton Permaculture Trust and Brighton & Hove City Council. This year the event is run as part of the ECOFab 2 project and has been selected within the scope of the INTERREG IV A France (Channel): England cross-border European cooperation programme and is co-financed by the ERDF. The Green Deal strand of the project has been funded by the Department of Energy and Climate Change through the Local Authority Fund