

# 57 Grantham Road, Brighton BN1 6EF



## OVERVIEW

Address: 57 Grantham Road,  
Brighton BN1 6EF

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Owners: Malcolm and Linda Kemp

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Type: Detached

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Age: New build

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Beds: 3

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Walls: Block (LGF) and timber frame  
(GF)

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Area: 120m<sup>2</sup>

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Residents: 2

## FEATURES

- + Air source heat pump

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- + Double glazing (high performance)

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- + Low energy lighting

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- + Low energy appliances

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- + Natural materials

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- + Solar PV

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- + Solar thermal

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- + Rainwater harvesting

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- + Underfloor heating

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- + Underfloor insulation

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- + Woodburning stove (back boiler)

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- + Zero Carbon

## Introduction and approach

This building is a rare example of an eco house built to the very demanding Level 5 of the Code for Sustainable Homes (CSH). It was designed by Deacon and Richardson Architects and built by R&R Building Services. This embraces not only energy efficiency and low emissions, but every aspect of sustainability, including natural materials, treatment of waste and rainwater harvesting. The house design, build process and performance are in every sense sustainable.

This project evolved over six years and the finished result is an example of brilliant simplicity, with a cleverly integrated renewable heating system, chiefly fuelled by a woodburning stove, and backed up by solar thermal panels and an air source heat pump. Electricity for the heat pump is balanced by a solar PV array.

The overall look and feel is beautiful, with natural timber and stone finishes, heavily influenced by input from the owners, designers Malcolm and Linda.

## Energy efficiency measures

### Heating and hot water

The hybrid heating system calls on a number of sources. In summer and autumn, the main heat comes from 6m<sup>2</sup> of solar thermal panels, which feed a customised Akvaterm heat store. The store is separated into two chambers by a baffle. Using a solar pump and two solar coils (one in each compartment), the effective size of the tank can be controlled in response to the varied output of the solar array. Separated tappings from the heat pump and back boiler also input into the tank. In winter, a 13kW Apollo woodburning stove with a back boiler is designed to supply most of the heat, both directly to the living space and also via the back boiler, from which hot water is pumped to the heat store as soon as it reaches operating temperature.

In addition, a 9kW air source heat pump has been installed as a backup, to provide hot water and heat if the stove is not lit or the panels are not delivering. Heat is distributed via underfloor heating, which delivers it where it is needed and is far more efficient than conventional radiators. Nathan

Williams of Crofton Design was responsible for planning the integration of these systems via the heat store.

### Insulation

Levels of insulation go far beyond those required by building regulations.

**Walls** – Lower ground floor is part buried and has cavity block walls with 100mm Celotex infill to give a u value 0.21. The ground floor has an outer rendered block skin around a timber frame with 150mm Celotex infill to give a u value of 0.15.

**Windows** – High performance double glazed Velfac units have timber frames for attractive appearance and excellent insulation values.

**Roof** - There is 120mm Celotex between rafters and 65mm over, with a battened service zone, chiefly for the sprinkler system. The u value is 0.12. Sprinklers were a requirement as the house is more than 45m from the road and hence limited access for firefighters.

**Floor** - The slab was covered with staggered layers of Celotex, with an overall thickness of 165mm, to give a u value of 0.11. This high

level of floor insulation is important because of the underfloor heating.

**Airtightness** – Particular attention was paid to sealing around windows and taping joints and pressure testing registered an airtightness level of 3.3 m<sup>3</sup>/hr/m<sup>2</sup>.

**Shading** – The eaves give good shading in summer to prevent overheating, yet allow the low winter sun to flood in and benefit from solar gain. Solar blinds were also added as an extra measure and to control light levels internally.

### Renewables and low carbon technology

One Eco was responsible for specifying and installing the solar thermal, PV, air source heat pump and thermal store.

**Solar thermal** – The solar thermal array is particularly large at 6m<sup>2</sup> and comprises attractive Viridian Solar panels, which match the PV from the same manufacturer.

**Solar photovoltaics** – Viridian Solar PV panels deliver 3.5 kWp, which is intended to offset the electricity required by the ASHP.

#### Air Source Heat Pump (ASHP)

– A Panasonic 9 kW heat pump is installed, chiefly for back up heating, on the lower ground floor. This is sited in an external store with louvred walls and it will be interesting to see how it performs in this unusual configuration with a heat pump housed in a store.

**Woodburning stove** – The 13kW Apollo stove was supplied and fitted by Energy Wake Up.

### Electricity

Low energy lighting – All lights are energy saving, mostly LED.

Appliances – appliances are the most energy efficient available.

### Carbon emissions

As the building has only been occupied since May 2015, energy use figures are not yet available, but it is designed to be zero carbon for central heating, cooling and fixed lighting.

### Other sustainable measures

**Rainwater harvesting** – Rainwater is collected in an underground tank for use in the WCs and washing machine.

**Wildlife** – There is a wildlife pond and nesting boxes in the rear garden.

#### Requirements of Code for Sustainable Homes (CSH) Level 5

- The building has been designed to meet the requirements of the Code for Sustainable Homes - a national building design standard that since 2007 has offered developers, planning authorities and householders a means of evaluating the sustainability of newly built dwellings. The government announced in March 2015 that the Code would be withdrawn. Level 5 of the Code is the second highest standard that can be achieved, and defines a building with very high standards of sustainability in many areas, and especially in water efficiency and energy performance (zero carbon).

The CSH required that Grantham Road achieve the security standard, 'Secured By Design' to be achieved, with all accessible doors and windows having laminated glass and SBD certification. It also satisfies the 'Lifetime Homes' standard; required by the local authority and under the CSH. This in part resulted in the building's upside down arrangement with bedrooms downstairs, which allows it to be easily adapted for a wheelchair user. This works well from an energy efficiency point of view, as the most-used rooms of the house receive the most light and solar gain, and heat for the living area stays where it is needed rather than escaping up stairs to a less used space. A large majority of construction elements have an environmental impact rating of A, when assessed under the BRE Green Guide, and materials have been responsibly sourced under the relevant accreditations;

PEFC, FSC, BES (excellent or very good), or have been reclaimed or recycled. The contractor employed their own checks on site management throughout the build including water consumption and site waste management. All timbers for shuttering and temporary works were responsibly sourced and were reused in the building fabric where possible. An oversized soak-away and attenuation crates were installed under the patio to reduce and delay the risk of surface water run-off from the site. Daylighting studies were carried out to ensure that the minimum average daylight factor was better than 1.5%. An ecologist was appointed to assess the ecological value of the site and to ensure that this would only be enhanced as a consequence of the works. The existing pond was repaired and replenished with new species of plants and bird boxes were introduced.

### Lessons learnt

Achieving level 5 of CSH proved very challenging and required very high levels of insulation and a big commitment to renewable energy. Pumping concrete so far from the road proved a major problem. Ideally the central floor would have been concrete instead of timber frame, to act as a heat store, but this proved impossible. Similarly, a wood pellet stove was rejected because of the restricted access for delivery. There was also concern that wood pellet fuel would have been too expensive. Much of the systems remain to be tested under a full winter and it will be interesting to see how the planned energy performance for the hybrid heating system matches actual performance. Using recycled timber is a labour of love, as the time spent sorting and grading greatly increases the build time. Tom believes this is very much a self-build priority, rather than for commercial projects.

## Professionals

**Architect** – Deacon and Richardson, Brighton.  
[www.deaconandrichardson.co.uk](http://www.deaconandrichardson.co.uk)

**Builder** – R&R Building Services Ltd, Brighton. [www.randrbuildingservices.co.uk](http://www.randrbuildingservices.co.uk)

**CSH Assessor and SAP Assessor** – Therm Energy  
[www.thermenergy.co.uk](http://www.thermenergy.co.uk)

**Heating system design** – Crofton Design Ltd.  
[www.crofton-design.co.uk](http://www.crofton-design.co.uk)

**Renewables design and installation** - One Eco Ltd, Surrey.  
[www.oneeco.ltd.uk](http://www.oneeco.ltd.uk)

**Solar PV** – Viridian Solar, Cambridge. [www.viridiansolar.co.uk](http://www.viridiansolar.co.uk)

**Solar Thermal** – Viridian Solar, Cambridge. [www.viridiansolar.co.uk](http://www.viridiansolar.co.uk)

**Structural Engineering and Below Ground Drainage** – Ings Engineering

**Woodburning stove** – Apollo stove supplied and installed by EnergyWakeUp, Brighton.  
[www.energywakeup.co.uk/](http://www.energywakeup.co.uk/)

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Eco Open Houses is an annual collaborative project between Low Carbon Trust, Brighton Permaculture Trust and Brighton & Hove City Council. Eco Open Houses 2015 is being run as part of the national Green Open Homes network established with funding from the Department of Energy and Climate Change (DECC) and is now maintained and managed by the Centre for Sustainable Energy (CSE). This year's event is part funded by Brighton & Hove City Council.