

## Case study: Abbey Walk, Storrington, West Sussex SECBE Low Carbon Homes Project

### Built-in long life

Forget preconceptions of drab social housing schemes. 'Greenhomes' combine high building performance and low environmental impact with thoughtful design and generous living space. Designed to Level 4 of the Code for Sustainable Homes (CSH), Abbey Walk follows three tiers of decisions. First, ensure the envelope is thermally efficient and air-tight, and then apply passive design principles to harmonise with the environment. Finally, and only as a last resort, introduce technologies for renewable energy.

Greenoak Housing Association, with just 400 units in Surrey and Sussex, is a minnow among social housing providers. Yet it has earned The Housing Corporation's Gold Award for environmental sustainability for its new house model – Greenhomes – as well as its work on existing homes. Abbey Walk is the third Greenhomes development which aims to improve environmental performance and design out obsolescence.

Full **Lifetime Homes** standard means flexibility of use in the future and more living space now. Greenhomes have pitched timber roof and timber floors spanning between cross walls. The absence of internal load-bearing walls will make future alterations easier. This is typical of how Greenhomes' simplicity builds in long life.

#### Planning permission

The brownfield site is adjacent to the South Downs Area of Outstanding Natural Beauty and the project replaces

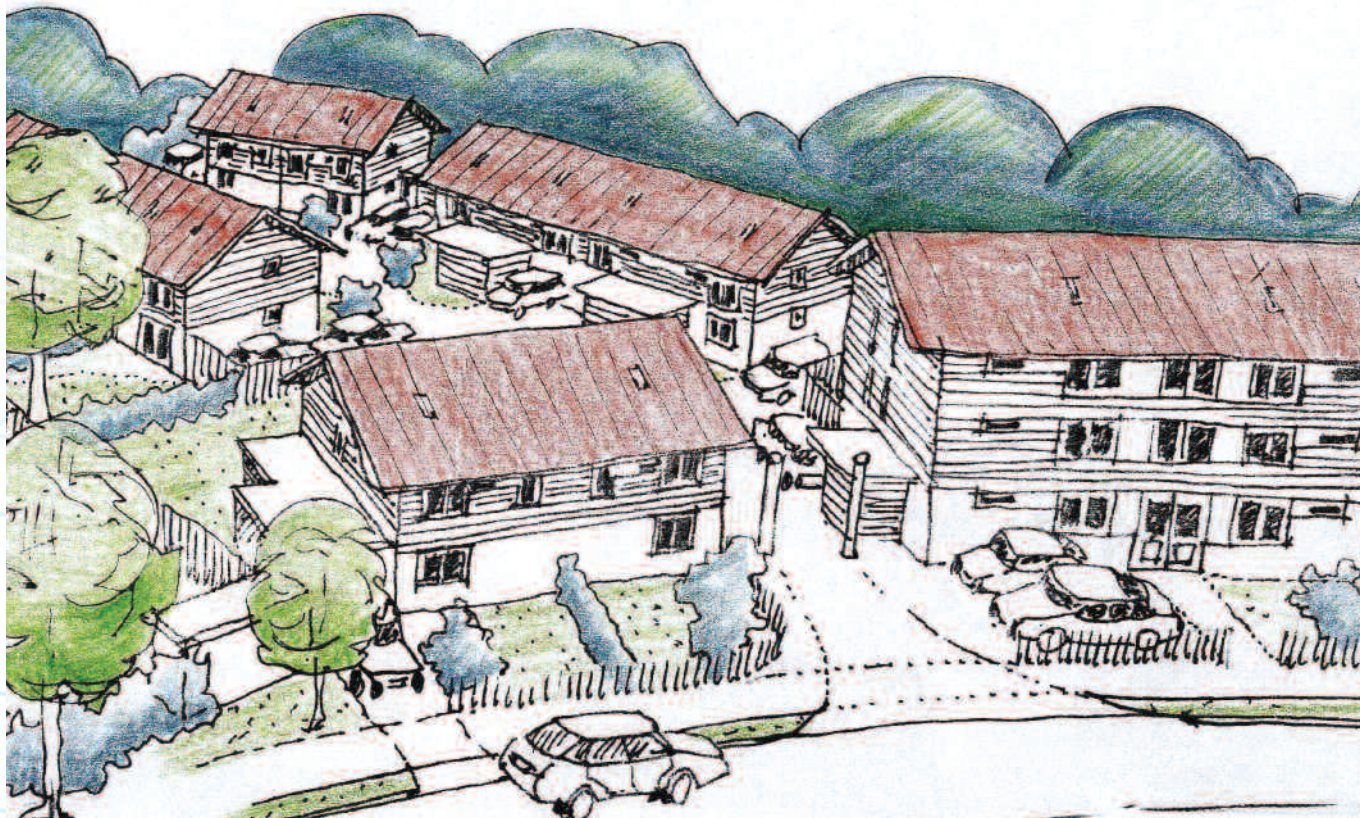
a redundant local authority scheme. Diverting a footpath has caused a 12-month delay. The main design hurdles were minimising impact on the existing drainage system and working at the limit of density allowed in this edge-of-village setting.

#### Key outcomes

- This Code Level 4 design yields CO<sub>2</sub> emissions approximately 46% less than a 2006 Building Regulations compliant house.\*
- Estimated energy bills will be nearly half of a 2006 Building Regulations compliant house.\*
- Residents are so pleased with the Greenhomes design that turnover is lower than in Greenoak's traditional properties.

\* Based on NHER SAP 2005 calculations

This project has been defined by:



## Cost

The upgrade to Code Level 4 added about 12% to the build cost over an equivalent scheme built to the 2006 Building Regulations. The most significant increases are for windows and solar water heating.

## Design summary

Key to U-values: achieved (required under 2006 Building Regulations) W/m<sup>2</sup>.K

**Build form:** Twelve 2, 3 and 4 bed terraced/semi-detached houses, to be built 2008, typical floor area 82m<sup>2</sup>

**Roof:** 300mm of Rockwool insulation in between I-beam rafters  
U-value: 0.15 (0.15)

**Floor:** Suspended timber cassettes on piles with 250mm of Rockwool insulation in between I-beam joists, insulating wood fibre board  
U-value: 0.15 (0.20)

**Walls:** 205mm Rockwool insulation within cross-battened timber panels, 22mm Bitroc board, lime render  
U-value: 0.13 (0.28)

**Windows:** Argon-filled, triple-glazed with low E coating  
U-value: 0.8 (1.8)

**Doors:** Composite timber  
U-value: 1.8 (2.1)

**Air permeability:** 1.5m<sup>3</sup>/(h.m<sup>2</sup>) at 50 Pa

**Ventilation:** Whole house mechanical ventilation with 90% efficient heat recovery

**Primary heating:** Sedbuk 'A' rated gas boiler linked to thermal store

**Secondary heating:** None

**Renewable energy source:** Solar thermal flat plate 3m<sup>2</sup>

**Thermal bridging:** Accredited construction details  
y-value = 0.06

## Performance scores (typical)

**Target Energy Emission Rate**  
(TER) = 22.35

**Dwelling Emission Rate**  
(DER) = 11.91

**Heat Loss Parameter**  
(HLP) = 0.81

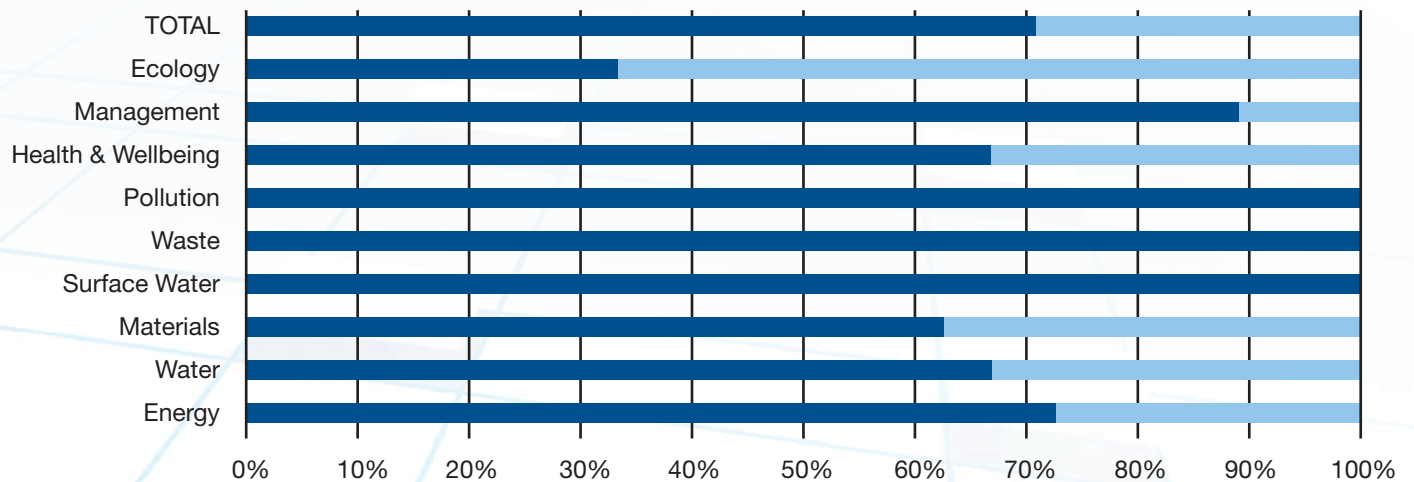
**Standard Assessment Procedure**  
(SAP) = 89, Band B

**National Home Energy Rating**  
(NHER) = 11.4 (3 bed), 11.7 (2 bed)

**Code for Sustainable Homes**  
(CSH) Level = 4 (provisional)

## Actions and outcomes (by CSH category)

The chart below compares the predicted and achievable scores for each of the nine CSH categories.



Code for Sustainable Homes: Predicted and Achievable Scores

### Category 1: Energy/CO<sub>2</sub>

The main upgrades were:

- Closed panel, airtight timber frame shell with high levels of insulation to ground floor, walls and roof
- Triple-glazed timber windows
- Solar hotwater system
- 100% low-energy lights
- 'A' rated boiler with thermal store to run with solar system.

The structure sits on piles without any masonry or concrete in the ground. This reduces time and cost, and minimises spoil.

Cross-wall construction with clear-span I-beams and web joists provides complete flexibility for internal layout.

Services are entirely accommodated in ducts and voids to permit easy access for upgrading and renewal. This also helps to achieve an airtight construction by avoiding the penetrations in the vapour control layers.

Mezzanine platforms exploit space below the warm roof panels that form raked bedroom ceilings.

Airtightness tests in earlier schemes show the timber system achieves around 1.5m<sup>3</sup>/m<sup>2</sup>/hr, which is vastly better than the Building Regulations standard of 10m<sup>3</sup>/m<sup>2</sup>/hr. However, considerable training of operatives is needed to achieve this.

The thickness of brick saved by using timber cladding and lime-based render gives more room for insulation.

Bearing in mind the uncertain future, the designers made provision for upgrading to new technologies and energy sources. For example, individual condensing boilers could be replaced by shared heating systems.

The SAP calculations show a 46% improvement over TER, satisfying the key qualification for Code Level 4.

Abbey Walk also scores well with its 100% energy-efficient lighting, 'A' rated appliances, cycle storage and accommodation for a home office.

### Category 2: Water

Metered water use in existing Greenhomes is only 79 l/p/day – nearly half the southeast average and well below the Code Level 4 target of 105 l/p/d.

Greenhomes focus on reducing demand before using recycling systems. This, together with short pipe runs, has the knock-on benefit of wasting less energy in hot water.

Simple measures include low flush toilets, reduced flow shower heads and taps, and accurate pipe sizing.

Rainwater butts are used to collect water for external use.

### Category 3: Materials

Greenoak chooses materials that minimise environmental impact as far as possible. This includes avoidance of PVC

and use of steel rainwater goods, clay pipes, non-PVC pipes and wiring, linoleum floor-coverings and organic paints.

Sustainable timber and the absence of Portland cement contribute to significant carbon reduction.

## Category 4: Surface water run-off

Abbey Walk earns full marks for easing run-off with a sustainable urban drainage system (SUDS). Roof drainage is to soakaways and roads have porous block paving.

Flood risk is low.

## Category 5: Waste

Careful design, specification and site waste management minimise construction waste. The amount of landfill residents produce is reduced by recycling and composting facilities.

## Category 6: Pollution

Pollution is reduced by using zero global warming potential of insulants and the lowest NOx emission boilers.

## Category 7: Health and well-being

Day lighting is exceptionally good throughout and windows maximise views.

The development earns top marks for sound insulation and outdoor privacy. Sound testing in earlier schemes shows performance up to 10dB better than the Building Regulations standard.

Residents in previous Greenhomes schemes have praised air quality improved by the continuous ventilation system and report fewer respiratory illnesses.

Although not explicitly required by CSH, Greenhomes avoid PVC products. Substitutions include timber windows, low-smoke zero-halogen cable insulation, clay drains in the ground and polyethylene in the building, steel gutters and downpipes, linoleum floor covering and organic paints and finishes. Only formaldehyde-free boards are used.

## Category 8: Management

Greenoak provides a detailed scheme-specific user guide and training.

Greenhomes contractors follow the **Considerate Constructor Scheme**. They also monitor energy and water use, air and water pollution, and they obtain site timbers from sustainable sources.

**Secured by Design** is a basic requirement of Greenoak.

## Category 9: Ecology

Although the site has little ecological value and limited scope for improvement, Greenoak engaged a qualified ecologist to advise on protecting important features. A bat licence was needed for demolition of existing buildings.

It was not possible to achieve higher plot ratios due to the rural edge nature of the site.

### Lessons

- Take control of procurement including the development risk.
- Seek technical advice, set high standards and test for compliance.
- Selecting a main contractor conscious of low environmental impact is one thing; ensuring all sub-contractors comply is another.
- Sourcing timber frame suppliers and sustainable materials remain problematic.
- With so many standards and tick boxes it is easy to overlook the basic principles of good design.
- Strive for the simplest solutions.
- Low energy features can give residents the false impression that they don't need to bother conserving energy. Developers need to work with residents to avoid this.
- Concerns about summer overheating can be addressed by solar shading, night-venting and helping residents reduce excess heat from electrical appliances.
- Greenoak's generous layouts are uncommon but will be required by proposed Lifetime Homes, Lifetime Neighbourhoods policy requiring such standards by 2013, and 2011 for social housing.

## Credits



**Developer:** Greenoak Housing Association

**Architect:** Jon Broome Architects

**Quantity Surveyor:** Dobson White Boulcott

**Energy Strategy:** John Willoughby

**Structural Engineer:** Ellis & Moore

**M&E Engineer:** ndesign

**Ecology:** Faber Maunsell

**Constructor:** Westridge