

Case study: Lincoln Grove, Bladon, Oxfordshire SECBE Low Carbon Homes Project

Emphasis on envelope not add-ons

Designed to achieve EcoHomes Excellent rating, Lincoln Grove has been reassessed to the Code for Sustainable Homes (CSH) and achieves Code Level 3. While some developers pin their hopes on micro technologies to boost renewable energy production, Kingerlee and Lifehaus prefer to build a thermally efficient, heavy weight structure that is less reliant on skilled labour.

Lincoln Grove is a joint venture between Kingerlee Homes and Lifehaus, an ethical investment fund specialising in sustainable development.

It comprises two rows of two and three-bedroom terraced houses on a former quarry, at the edge of the Blenheim Estate in the Oxfordshire village of Bladon, where Sir Winston Churchill was laid to rest.

The properties are innovative in their construction using European fired clay block in single-skin stone-faced or rendered external walls.

The roof is slated over low timber content I-beam rafters supported by timber trusses. I-beam joists also form the first floor. Concrete planks are used in the ground floor. High performance timber framed double glazed windows and insulated external doors are used. All houses have individually fenced rear gardens.

Planning permission

The initial scheme, which planning officers recommended to the Planning Committee, was a modern rendered design that conveyed a strong 'eco' message. But councillors were unhappy with the visual impact, arguing that "it didn't look like Bladon". The approved scheme reverts to traditional stone-faced 'Oxfordshire village'.

Key outcomes

- This Code Level 3 design yields CO2 emissions approximately 30% less than a 2006 Building Regulations compliant house.*
- The estimated saving in energy bills is about 20% compared to a 2006 Regulations compliant house.*

* Based on NHER SAP 2005 calculations

This project has been defined by:



Cost

Building to Code Level 3 costs about 15-20% more than to the 2006 Building Regulations. Despite the higher asking price, Kingerlee reports good sales at Lincoln Grove while demand elsewhere has flattened.

Design summary

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

Build form: Nine 2 & 3 bed semi-detached houses, built 2007, typical floor area $109m^2$

Roof: 300mm of Warmcell insulation blown in between I-beam rafters with 35mm wood fibre insulating sarking board
U-value: 0.11 (0.15)

Floor: Excavated down and laid damp proof membrane horizontally and vertically to above ground level; 150mm urethane with 50mm edge upstands; 100mm concrete slab
U-value: 0.12 (0.20)

Walls: 365mm single skin cellular insulation monolithic clay blocks with stone or render facing
U-value: 0.26 (0.28)

Windows: Argon-filled, double-glazed with low E coating
U-value: 1.4 (1.8)

Doors: Glazed door including frame factor
U-value: 2.1 (2.1)

Air permeability: target of $4m^3/(h.m^2)$ at 50 Pa

Ventilation: Passive stack ventilation

Primary heating: Sedbuk 'A' rated gas boiler linked to twin-coil immersion tank, efficiency = 91%

Secondary heating: Wood burning stove

Renewable energy source: Solar thermal flat plate $2.4m^2$

Thermal bridging: Construction details using ThermoPlan were calculated to an exceptionally low y -value = 0.024

Performance scores

Target Energy Emission Rate
(TER) = 22.2 (3 bed), 21.1 (2 bed)

Dwelling Emission Rate
(DER) = 15.5 (3 bed), 14.8 (2 bed)

Heat Loss Parameter
(HLP) = 1.11 (3 bed), 0.97 (2 bed)

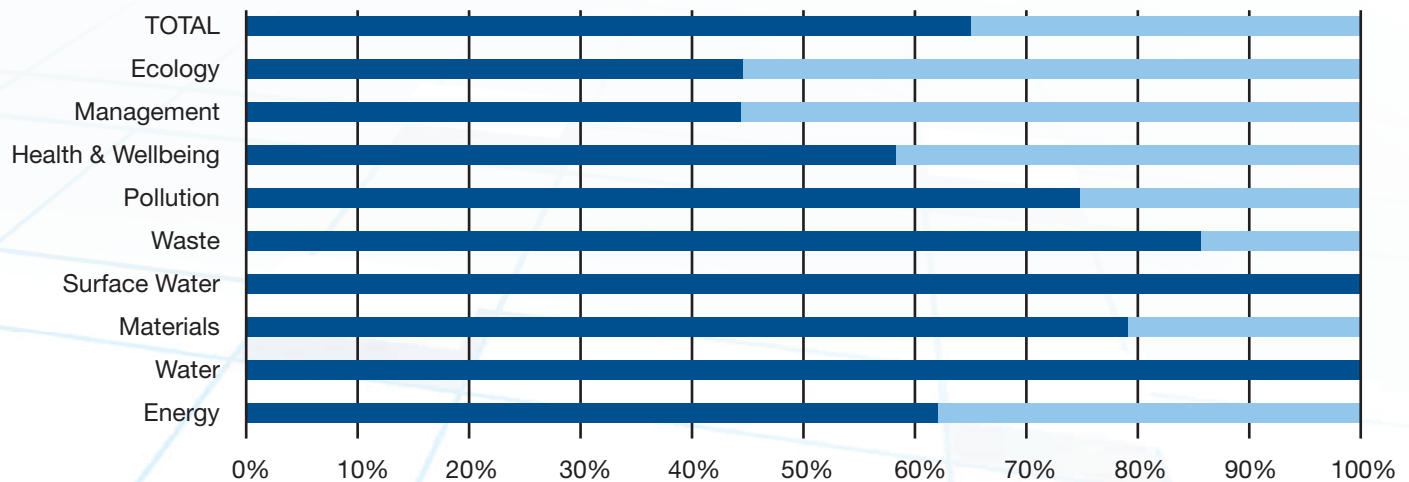
Standard Assessment Procedure
(SAP) = 87, Band B

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

Code for Sustainable Homes
(CSH) Level = 3

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/CO₂

The main upgrades were:

- Extra insulation in the roof and floor
- Change from cavity brick to a single skin fired clay Ziegel block system with passive stack ventilation throughout
- Improved windows
- Solar hotwater system
- 100% low-energy lights
- 'A' rated boiler with twin coil tank to run with solar system.

The **NBT ThermoPlan® System** external walls at Lincoln Grove are unusual for Britain but commonplace in Germany where they are known as Zeigel blocks. These clay blocks are extruded with vertical perforations. The clay contains fine particles of sawdust and polystyrene, which are burnt off when the block is fired to produce a micro-porous structure. The blocks are planed top and bottom enabling them to be stuck to each other when laid to produce a single skin, robust, weather and air-tight structural wall, which is vapour permeable (air-tight and breathable). They have very low embodied energy and environmental impact compared to conventional masonry building methods, which is recognised in their 'A' rating in the BREEAM Green Guide.

The wall, whose insulation value is entirely due to the block, is simply constructed without cavities, membranes or additional insulation, thereby ensuring a robust and high performance building. Combined with

the other improvements, this system delivers CO₂ emissions typically 30% better than equivalent houses built to the 2006 Building Regulations.

These houses have lime-based render to the rear walls and natural limestone facings to the street-side elevations. Internally the walls are plastered with a vapour-permeable plaster.

The SAP calculations at Lincoln Grove show an average 30% improvement over TER, satisfying the key qualification of 25% for Code Level 3.

When examining the feasibility of the various options Peter Warm, the sustainability adviser, found that good insulation values and airtightness were the most cost-effective options, followed by using the most efficient boiler and controls.

The development also scores well with its low heat loss, energy-efficient lighting, 'A' rated fridges, freezer and washer dryer, energy-efficient security lighting, solar pre-heating of water, cycle storage and accommodation for a home office.

Category 2: Water

Lincoln Grove's exceptional 80l/p/d water consumption would earn Code Level 5/6. This is achieved by low flush toilets, smaller baths, reduced flow shower heads and taps. The fitted kitchens and laundries are equipped with 'A+' rated appliances.

Outside there are rainwater butts to collect water for irrigation.

Category 3: Materials

All structural and finishing timber was substantially sourced from FSC or PEFC certified forests. Masonite I-beam rafters and joists, and the girder trusses minimise the volume of timber used.

Roofs have natural slate, woodfibre insulation board, and Warmcell (recycled paper) insulation.

Category 4: Surface water run-off

Lincoln Grove earns full marks for easing run-off with a sustainable urban drainage system (SUDS) that reduces surface run-off and feeds into a pond.

Flood risk is low.

Category 5: Waste

Domestic recycling is encouraged by providing dedicated bins within kitchens and by drawing the purchaser's attention to the District Council's recycling policy. (West Oxfordshire District Council provides a weekly kerbside collection scheme and provides free recycling boxes and a wheelie bin.) A full score was just missed by the omission of composting facilities.

Category 6: Pollution

All insulating materials have the highest rating global warming potential (GWP<5). The class 5 boiler emits less than 70 mg/kWh, not quite reaching the <40 mg/kWh goal.

Internal decorations use non-toxic, zero-solvent, chlorine-free, highly vapour-permeable paints that have minimum health and environmental impact.

Category 7: Health and well-being

Day lighting is good throughout except that not all rooms have a view of the sky.

The development earns top marks for sound insulation and outdoor privacy. Kingerlee was particularly impressed by the good sound reduction offered by the Zeigel block wall (achieved 60 dB, better than the 45 dB in the 2006 Building Regulations).

The Lifetime Homes criteria were not addressed.

Category 8: Management

Kingerlee's comprehensive resident's pack gives information about operations, site and surroundings. There is scope for the constructor to improve CSH performance by documenting achievements under the Considerate Constructors Scheme, energy and water consumed during construction, and controlling dust and water pollution.

Category 9: Ecology

The site is of low ecological value and the development will have a neutral impact. No credit is sought for achieving a high ratio of floor area to footprint because the structure is only two storeys.

The developer has retained the trees, as recommended in the ecological report, and protected the original quarry face and its plant growth. The addition of a pond enhances the site and will encourage wildlife.

Lessons

In the design of this and other developments, Kingerlee has encountered some hitches with the Code for Sustainable Homes:

- It is difficult to achieve some of the flow rates using water appliances currently available.
- In new dwellings it is easier to achieve Code Levels 3 and 4 by using off-peak electric heating than the more efficient gas system, leading to a more carbon-intensive solution. This is on account of an advantageous fuel factor for electric heating where gas is either unavailable or not the preferred choice in blocks of flats.
- It is easier to achieve Building Regulations standards and Code Levels 1 to 4 if the building is bigger and the form is less efficient.

Kingerlee is negotiating with the Code's authors, via The Good Homes Alliance, to address these apparent anomalies.

Credits



Developer: Kingerlee Homes, a member of the Good Homes Alliance, in partnership with Lifehaus plc

Architect: Richard Ladenburg, ALP Architects

Sustainability Consultant: Peter Warm, NBT Consult

Employer's Agent: Tony Woodward, Kingerlee Homes

Contractor: Kingerlee Limited