

# SUBURBAN HEARTLANDS

The suburban districts which characterise the commuter belts of the region's Major Urban Areas largely consist of detached and semi-detached homes. These districts contain the majority of the regions homes, and some of the oldest housing stock with the greatest heating demand and the lowest SAP ratings.

They are also likely to contain households with the most interest in investing and adding value to their properties. Heritage concerns may, in some cases, limit the potential for solutions that could affect the external appearance of properties – such as external insulation.

Because of the low net densities of the suburbs 'micro-generation' technologies are likely to be the most appropriate energy supply technologies for deployment. This creates a challenge because much of the existing housing stock falls outside of the remit of the planning system.

Novel market mechanisms will be required in order to increase the deployment of both improvements to the building fabric of suburban homes, and micro-generation technologies – with the need to focus on achieving a critical mass of home improvement works in each neighbourhood in order to improve the economies of scale and bring down the unit costs.

#### New-build

| Scheme                     | Developer                        | Units | Completion | Description   |
|----------------------------|----------------------------------|-------|------------|---|
| Reepham Beck, Lincolnshire | Gusto Homes                      | 15    | 2007       | High standards of energy efficiency with solar thermal collectors. Reduction in CO <sub>2</sub> emissions (TER) of up to 70 per cent on 1995 Building Regulations.  |
| Upton Green                | Cornhill Estates<br>Miller Homes | 123   | 2006       | A direct response to English Partnership's requirements set out in the design codes for the scheme, with improvements to building fabric, together with solar thermal and solar photovoltaic installations. |
| Great Bow Yard, Langport   | Ecos Homes                       | 12    | 2005       | Homes designed to passive and low energy design principles, with integrated solar thermal collectors, low energy lighting and appliances.   |
| Lincoln Grove, Oxfordshire | Kingerlee Homes                  | 9     | 2007       | Homes designed with a focus on super insulation and air tightness, with integration of solar thermal collectors and efficient underfloor heating systems.   |

#### Refurbishment

|  |               |   |      |   |
|--|---------------|---|------|---|
| Late Victorian semi-detached villa, Nottingham | '40% pioneer' | 1 | 2000 | Comprehensive building fabric improvements, including internal and external insulation, together with a new biomass heating system, solar thermal collectors, low energy lights and appliances. |
|--|---------------|---|------|---|

# SUBURBAN HEARTLANDS

Reepham Beck, Lincolnshire

Developer: Gusto Homes

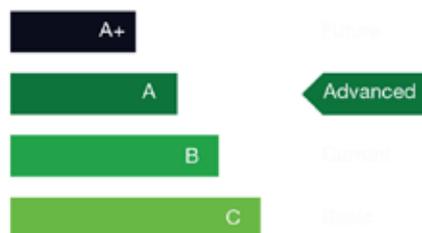
Completion: 2007

Number of units: 15

Urban form: Semi-detached houses

Tenure: Private owner occupier

Building Regulations: Part L 2002



## Background

Gusto Homes, a small house-builder operating in Lincolnshire and Nottinghamshire, are currently developing their own brand of housing. There are several precursors to this development. Gusto's first green development was the Millennium Green development, built in 1999 in Collingham, Nottinghamshire.

The outcome was the incorporation of many 'green' building techniques and technologies into buildings which are architecturally acceptable to the average house-buyer. Since the success of Millennium Green, Gusto has carried out green developments on 4 other sites in Lincolnshire, of which Reepham Beck is the latest.

## Drivers for change

Gusto's aim is to be identified within the market as a brand that delivers higher quality and specification. Their homes have higher energy efficiency than average housing developments and use materials which have a lower lifetime impact on the environment. The performance of the homes is used by Gusto as a "unique selling point".

## Energy strategy

All homes, a mixture of terrace and semi-detached, were built to a very high thermal specification, with high levels of insulation and high quality finishing to increase air tightness. The high quality windows, imported from Sweden and achieving U-values of 1.1, also contributed to reducing the heat loss to at least half that specified under the 2002 building regulations. Gas condensing boilers with intelligent heating controls, as well as solar thermal collectors

and low energy lighting systems, were fitted as standard. Together this gave an overall SAP rating of 80.

Through their experience with previous developments Gusto decided to install heat recovery ventilation systems. In addition, all homes were fitted with rainwater harvesting technology, reducing mains water consumption by 50%. While this does not affect the carbon emissions of the home directly there are significant upstream benefits.

Gusto stresses the importance of engaging with its customers. Residents are provided with an induction into training in the novel features of the dwellings when they move in. This is important in order to maximise the potential benefits of these systems by ensuring the residents understand how they work. It also fosters a greater awareness amongst the residents of the environmental benefits of the dwellings.

## Whole Life Costs

The houses cost 10% more than standard houses to build and this was passed on through the purchase price. This premium is balanced by cheaper running costs - they cost 50% less to run - although this would have to be capitalised to pay for the additional build cost through a mortgage. All the additional costs were met by the developer without external subsidies.

## Market response

With Reepham Beck being based on Gusto's evolving model, post occupancy surveys were

### Key design features

- Super-insulated timber frame
- High performance double-glazing
- Evacuated tube solar thermal collectors
- Mechanical ventilation with heat-recovery
- Underfloor heating

### Technical specifications

SAP 80

Building fabric U-Values (W/m<sup>2</sup>K)

External walls: 0.2      Roof: 0.15

Glazing: 1.6              Floors: 0.15

Air tightness: 3 ac/hr at 50 Pascal



expected to produce very similar results to previous studies and were not carried out. Pre-sale and post-occupancy surveys have been carried out by Gusto on previous developments with an independent researcher finding that the sustainability features of the homes were important in encouraging residents to purchase their houses.

Around half of the purchasers had bought specifically because of the sustainable features, whilst the remainder had principally been concerned with location and quality. There were some concerns about the new technologies, but to some extent this was overcome as they became more familiar with them, and Gusto provided a high level of after sales care. It has been found that under-floor heating, combined with appropriate under floor insulation is a feature that purchasers like.

### Monitoring and performance

Due to the long-term relationships that Gusto has developed they encountered no significant issues with the procurement or installation of any of the energy-saving technologies on the development. There were some issues of cost over-run due to the

initial design brief, which specified costly detailing on e.g. basements and large expensive glazing details.

Gusto is keen to learn from each development and Reepham Beck highlighted the importance of well-designed insulation details, and the necessity of quality control on site to reduce air leakage to a minimum. Glazing details can be simplified, and costs reduced, while still maintaining the passive solar benefits required.

### Capacity building and supply chain

Gusto's investment in staff training and development has increased retention and reduced snagging during the development stage, producing more efficient problem resolution and maintenance once the buildings are occupied and in use.

Gusto views the new methods of construction, and their approach to training and development, as an opportunity to give people in the industry a renewed sense of satisfaction and pride which they feel is lacking in the UK when compared to countries such as Germany or Holland.

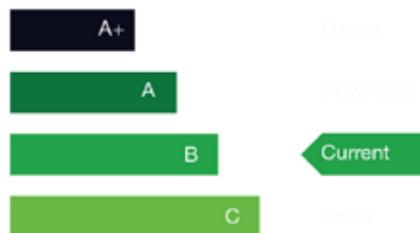
### Key learning points

- Well-designed details and quality control on-site are essential in order to deliver super-insulated, airtight properties.
- High quality, energy efficient homes can command added value, which they are able to sustain over time. However, location and overall quality are still primary concerns.
- Induction for purchasers is important in order to familiarise them with the building and energy technologies, and to ensure they maximise the benefits.
- The development of modern, low carbon homes can create a driver for training and upskilling.

# SUBURBAN HEARTLANDS

Upton Green, Northampton

Developer: Miller Homes and Cornhill Estates  
 Installer: Ecofirst  
 Completion: 2006  
 Number of units: 123  
 Urban form: Townhouses and semi-detached homes  
 Tenure: Private owner occupier/shared ownership  
 Building Regulations: Part L 2002



## Background

Upton is a flagship masterplan for a major site in Northampton. The development is a joint initiative between English Partnerships and Northampton Borough Council. The overall plan includes outline consent for approximately 1,100 properties, and includes a school and other community buildings.

The masterplan is being developed in a number of distinct phases with associated design codes and performance requirements. English Partnerships formally put 'site B' out to tender in late 2004, and a joint bid by Miller Homes and Cornhill Estates to build 123 units, including 38 units of 'affordable' housing, was accepted.

## Drivers for change

English Partnerships provided all of the major infrastructure to the site, including a SUDS (Sustainable Urban Drainage System), and has stipulated the number of dwellings within each parcel of land which have to include specific energy technologies (see Table below).

| Mandatory across whole site | Demonstration projects |
|-----------------------------|------------------------|
| Site A                      | None                   |
| BREEAM/EcoHomes Excellent   |                        |
| NHER rating 10              |                        |
| Site B                      | Photovoltaic (PV)      |
| BREEAM/EcoHomes Excellent   | systems: 25 units      |
| NHER rating 10              | Green roofs: 25 units  |
| Passive solar design        |                        |
| Solar water heating         |                        |
| Rainwater harvesting        |                        |

## Energy strategy

All of the site B homes have had to achieve an EcoHomes rating of Excellent. 54 incorporate solar thermal collectors and 15 incorporate solar photovoltaic cells in the form of modules or roof tiles. One block of apartments has a green roof in which the vegetation layer improves the thermal performance of the building.

Whilst the development partners considered these requirements to be relatively onerous, they have had to accept them as the additional cost of developing the site, offset against the reduced infrastructure costs, which were met by English Partnerships.

## Whole Life Costs

The additional costs associated with the renewable energy technologies have been absorbed into the build cost. This cost was not passed onto the consumer, but instead reflected in an adjusted bid and pre-sale valuation for the site. The consumer will benefit from reduced heating and electricity bills over the life span of the technology.

## Residence response

The developer was not able to cite evidence of the ability to achieve higher values for more sustainable homes, with the overall quality of the development being seen as more likely to drive values.

## Monitoring and performance

At present no post-occupancy monitoring has been carried out or planned.

### Key design features

- Passive heating and ventilation
- Super-insulation coupled with thermal mass
- High specification doors and glazing
- Low energy lighting and appliances
- Communal biomass heating



### Capacity building and supply chain

Based on the knowledge and expertise gained during the construction of Upton, Cornhill Estates formed a sister company Ecofirst. Ecofirst now

source and install all of Cornhill Estates renewable energy technologies as well as working with other parties such as the Co-operative Bank.

### Key learning points

- The bidding rounds for the sites revealed that the environmental standards required are more efficient to achieve on a larger, higher density development opportunity - indicating an efficiency of scale.
- The additional technologies have been bolted onto standard housetypes by the housebuilder.

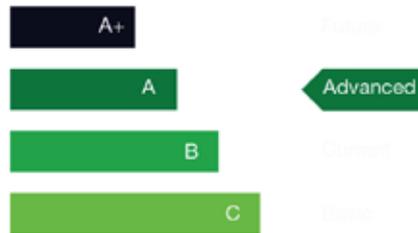
This resulted in problems finding space to integrate the new technology into the buildings. Redesign to take into account of new technologies and services is therefore required.

- The technologies and skills required to integrate renewable energy technologies create the opportunity to set up new enterprises.

# SUBURBAN HEARTLANDS

Great Bow Yard, Langport (Somerset)

Developer: Ecos Homes  
Architects: Stride Treglown  
Completion: 2007  
Number of units: 12  
Urban form: Townhouses  
Tenure: Private owner occupier  
Building Regulations: Part L 2002



## Background

Great Bow Yard is a mixed-use development of 12 eco-homes, together with offices and workshops. The development has been built by Ecos Homes, a social enterprise spun-out from the former Somerset Trust for Sustainable Development.

## Drivers for change

Ecos covenants its profits back to new Ecos Trust, a charity managed by a Board of Trustees. Their vision is to “Show sustainable design and construction in practice, persuade planners, builders, developers and estate agents of its practicality, and prove that it meets a real, and as yet unsatisfied, demand from house buyers.”

## Energy strategy

The development consists two distinctive wings comprising five 2 storey houses with integral sunspaces, three 3 storey townhouses and four apartments (1 and 2 bed). All the properties have been built using sustainably sourced materials, insulated far above normal standards for UK construction and incorporate renewable energy technologies and low energy devices. They aim to provide a high quality of living space with natural daylight, sunspaces, balconies and green spaces.

The scheme has been developed as two distinct wings. The north wing uses conventional masonry construction with external rendered insulation. The east wing was constructed using a composite timber frame with cellulose insulation which achieves very low U-Values approaching 0.10 W/m<sup>2</sup>.

High efficiency double-glazed, argon-filled timber frame windows have been specified throughout. Integral flat plate collectors supplement the heating provided by condensing gas boilers.

## Whole Life Costs

Nigel Griffiths, in the book ‘Great Bow Yard: Anatomy of an Eco build’, assessed that the additional costs associated with developing a one-off sustainable property scheme. In his assessment the additional costs were 5%, of which 3% was recovered through a premium on sales price. It is important to note that the properties also sold quickly, three quarters of them of plan. The development delivered a return of 10.5%.

## Residence response

As the majority of the dwellings were pre-sold, and some of purchasers were involved prior to detailed planning was completed there were a number of specific requests. Residents have offered a very positive response to living at Great Bow Yard.

## Monitoring and performance

Underway with no results currently available.

## Capacity building and supply chain

Medium size local contractors were appointed, with experience of sustainable building. Experienced architects, engineers and quantity surveyors were also appointed.

### Key design features

- Super-insulated timber frame
- High performance double glazing
- Low energy appliances and light fittings,
- Condensing gas boilers
- Solar thermal collectors

### Technical specifications

SAP 83 - 85

TER 9.0 kg/m<sup>2</sup>

Building fabric U-Values (W/m<sup>2</sup>K)

External walls: 0.13

Glazing: x1.6

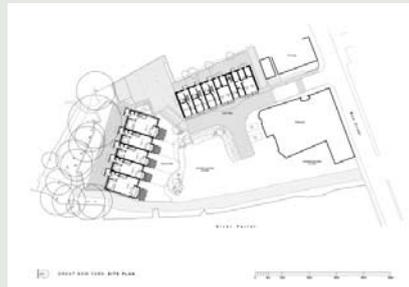
Roof: 0.11

Floors: 0.16

### Cost and value

Build cost: £3.7m (£1,050/m<sup>2</sup>)

Unit sales price: Averaging £2350/m<sup>2</sup>



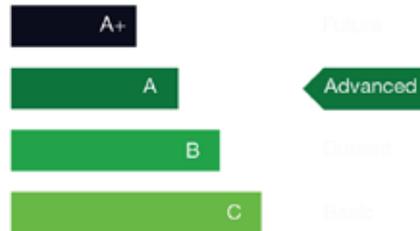
### Key learning points

- Clear set of environmental aims and objectives, complemented by the financing arrangements
- Solar thermal and rainwater harvesting presented difficulties using conventional contractual frameworks.
- The sustainability of whole scheme was a great advantage for from a marketing perspective.

# SUBURBAN HEARTLANDS

Lincoln Grove, Bladon (Oxfordshire)

Developer: Kingerlee Homes  
Completion: 2007-08 (on site)  
Number of units: 9  
Urban form: Semi-detached homes  
Tenure: Owner occupier  
Building Regulations: Part L 2006



## Background

The development comprises of two rows of terraced houses, and is sited on a brownfield site (a former quarry), at the edge of the Blenheim Estate in the Oxfordshire village of Bladon. Kingerlee Homes works with Lifehaus, an ethical investment fund specialising in sustainable development. The scheme is being built by the Kingerlee Group's contracting arm, Kingerlee Limited.

## Drivers for change

Kingerlee Homes is a Founder Member of the Good Homes Alliance, the members of which are committed to working towards substantially reducing the negative impacts of housing and renovation, and to substantially increasing the factors that contribute towards the wellbeing of the occupants of their properties.

Members of the Good Homes Alliance commit to build a significant proportion of their new homes to EcoHomes Excellent standard, to substantially reduce carbon emissions arising from the use of their new homes, and to monitor the performance of those properties for up to two years.

## Energy strategy

The scheme is designed to deliver a 30% reduction in CO<sub>2</sub> compared to similar homes built to the current Building Regulations, with a calculated saving of approximately 0.8 tonnes per annum. When the buildings were designed, using U values from the SAP worksheets for the worst case, the percentage improvement for the whole site was

44% better than the 2002 Building Regulation and 25% better than 2006 Building Regulations.

The properties are innovative in their construction using a European form of a fired clay block in a single skin external walling construction. Robust detailing and air tightness have been important design considerations. Building the homes in terraces also reduces the external wall area.

The roof insulation comprises 250mm of Warmcell insulation blown into the voids between the I-beam rafters. Ground floor insulation is by means of 150mm of expanded polystyrene. High performance timber framed low emissivity double glazed windows and insulated external doors are used throughout.

All of the homes have a SEDBUK A rated gas boiler linked to a twin coil immersion tank. Solar thermal panels are installed in all dwellings for water heating supplying the immersion tanks. Wood burning stoves are fitted providing carbon neutral back up heating. Low energy A rated appliances and lighting have been specified for all properties.

## Market response

Building to Code for Sustainable Homes 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.

### Key design features

- Air tight SAP 80+ building fabric
- High performance double glazing
- Condensing boilers
- Solar thermal collectors
- Low energy appliances and light fittings

### Technical specifications

SAP 87

TER 21 - 22 kg/m<sup>2</sup>

Building fabric U-Values (W/m<sup>2</sup>K)

External walls: 0.26

Glazing: 1.4

Roof: 0.11

Floors: 0.12

Air tightness: Target of 4m<sup>3</sup>/(h.m<sup>2</sup>) at 50 Pa

### Cost and value

Build cost: £1.5m (£1,500/m<sup>2</sup>)

Floor area: Average 109 m<sup>2</sup>

Additional cost: 15-20%



### Monitoring and performance

Kingerlee have committed to the post-occupancy monitoring of energy use to compare design versus actual performance and to enable occupants to understand and reduce their energy use.

### Key learning points

- As a member of the Good Homes Alliance the developer has committed to high environmental standards, quality practices and monitoring
- The quality and specification of construction is a key factor in improving the energy efficiency of the new homes.
- Although the quality of build and higher performance requires higher values the scheme has been able to sustain good sales even when the market has weakened.

# SUBURBAN HEARTLANDS

## '40% Pioneer', Victoria Semi (Nottingham)

Developer: Private household

Architects: MS Architects

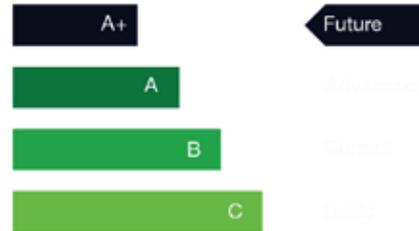
Completion: 2000

Number of units: 1

Urban form: Victorian semi-detached home

Tenure: Private owner occupier

Building Regulations: Not applicable



### Background

Penney Poyzer and Gill Schalom purchased a run-down 1898 three-storey five-bedroom semi detached villa in Nottingham for £84,500 with the intention of demonstrating how it could be comprehensively improved to reduce CO<sub>2</sub> emissions.

### Drivers for change

After living in the experimental new-build Hockerton Housing Project in Newark, Penney Poyzer and Gill Schalom wanted to demonstrate how the energy performance of the existing housing stock could be improved.

### Energy strategy

The couple have comprehensively tackled every aspect of the homes performance. Their first concern was to improve the building fabric and reduce heat loss. They installed a combination of internal drylining on the elevations of the building onto the street, to retain the visual appearance, and external rendered insulation onto side and back walls where this was less of a consideration.

A combination of double and triple glazing were used including advanced Velux rooflights and triple glazed units with krypton filled 'I-Plus' low emissivity coated windows were installed with a U-Value of 0.6 W/m<sup>2</sup>. 300-400mm of loft insulation was installed in order to achieve a U-Value of 0.1 W/m<sup>2</sup>.

The electric heating system was replaced with a biomass boiler, flat plate solar thermal collectors

and a 1,400 litre thermal storage tank. The biomass boiler is flexible in its fuel, enabling logs, pellets or chips to be used. The couple decided not to spend additional money on evacuated tube solar collectors because the efficiency gain was not enough to pay for itself.

Other features include mechanical ventilation with heat recovery, the addition of a draught lobby on the porch and energy efficient lighting and appliances.

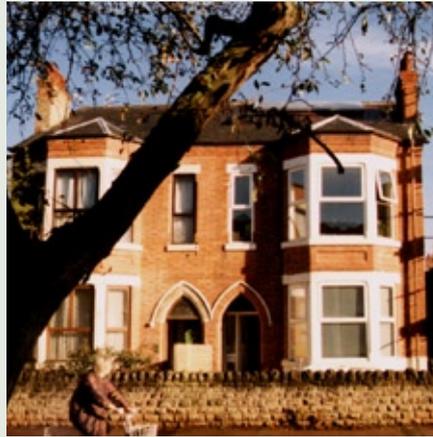
### Resident response

The couple found that their local authority (Ruchcliffe Borough Council) was 'very supportive'. However, they encountered problems with the government's Clear Skies programme, now the Low Carbon Buildings Programme. The registered installer imposed by the scheme as a condition of funding recommended a boiler that was not an approved appliance under the Clean Air Act.

The couple found themselves fighting a test case. They won because the local authority, which implements the clean air legislation, approved the wood burner on the basis of being able to demonstrate its very low emissions. The Clear Skies programme had clearly not thought through the process for implementing biomass heating and had recommended an installer that was inexperienced with domestic installations of this kind.

### Key design features

- Dry lined insulation
- External rendered insulation
- Loft insulation
- Low-emissivity double and triple glazing
- Flexible biomass boiler
- Thermal storage tank (1,400 litres)
- Flat plate solar thermal collector
- Low energy appliances and lighting



### Technical specifications

SAP xx

TER xx kg/m<sup>2</sup>

Building fabric U-Values (W/m<sup>2</sup>K)

Glazing: 0.6 - 1.1

Roof: 0.1

### Cost and value

Market valuation: £350,000 (based on similar properties in the local area)

Elemental cost of design features:

- Biomass boiler: £5,000



## Monitoring and performance

The couple have estimated based on energy bills that they have reduced their CO<sub>2</sub> emissions from around 19 tonnes to 2.9 tonnes CO<sub>2</sub>/year, an 85% reduction.

## Key learning points

- The main barrier was upfront funding for the project. The couple had to implement their plans in installments as they saved the money to pay for it, and had to live in a semi-finished house for several years.
- The uplift in the value of the house has more than paid for the cost of the improvement works, although the property was in a relatively poor state when they purchased it.
- Researching and carrying out the works took a great deal of time, which could be prohibitive to a less committed household. The learning from the project could reduce the learning curve needed for future refurbishments.

# RURAL VILLAGES AND MARKET TOWNS

An aerial photograph of a rural village and market town. The town is built along a river, with a mix of residential buildings, some larger commercial or public buildings, and open spaces. The surrounding area consists of fields and some scattered trees. The overall scene is a typical rural settlement in the Midlands of England.

Rural villages and market towns of the kind that can be found in Shropshire, Herefordshire, Worcestershire and Warwickshire create opportunities for small pockets of new housing development on the edges of existing settlements.

Market towns such as Hereford have assembled larger town centre sites, for which higher density 'housing market renewal' or 'urban renaissance' type housing is likely to be more appropriate.

The existing stock of towns, villages and hamlets largely consists of detached and semi-detached property, with trends including the need to provide new affordable housing and, increasingly, farm building conversions for homes and workspace.

Like the suburbs these areas contain some of the region's oldest housing stock, with the greatest heating demand and the lowest SAP ratings, as well as households with the most interest in investing and adding value to their properties.

Heritage concerns may, in some cases, limit the potential for solutions that could affect the external appearance of properties – such as external insulation.

In many locations properties and sites are likely to be off the natural gas grid, requiring the delivery of alternative fuels such as oil and, potentially, biomass.

## New-build

| Scheme                       | Developer                            | Units    | Completion    | Description  |
|------------------------------|--------------------------------------|----------|---------------|--|
| The Wintles, Shropshire      | Living Villages                      | 40 units | 2005-ongoing  | Bespoke rural house types by a new specialist developer. The homes have a highly insulated timber framed building fabric with heat recovery and integrated solar collectors. |
| Jubilee Wharf, Cornwall      | Andrew Marston                       | 6 units  | 2006          | Mixed use scheme that achieves close to net zero carbon. The design incorporates passive design, super insulation, biomass heating and on-site wind turbines.                |
| Station Crescent, Shropshire | South Shropshire Housing Association | 20 units | 2005          | Social rented terraces designed to maximise passive solar gain, constructed using a super insulated timber frame system and with integrated solar thermal collectors.        |
| Rocks Green, Shropshire      | South Shropshire Housing Association | 91 units | Expected 2008 | Highly insulated properties for social renting supplied with underfloor space heating and hot water by a biomass fuelled district heating network.                           |

# RURAL VILLAGES AND MARKET TOWNS

## The Wintles, Bishops Castle (Shropshire)

Developer: Living Villages

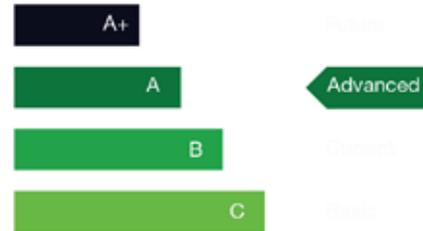
Completion: 2005 – ongoing (three phases)

Number of units: 40

Urban form: Detached homes

Tenure: Private owner occupier

Building Regulations: Part L 2002



### Background

The Wintles is a small new-build development in a rural setting on the edge of the historic town of Bishops Castle. The first phase was completed in 2005, and the fourteen houses set around the village green are now all occupied. A further two phases are underway and will see a total of 40 properties, ranging from two-bedroom bungalows to three-storey, six-bedroom houses.

### Drivers for change

The Wintles is the first scheme for specialist developer Living Villages, who were established by Bob Tomlinson to ‘design and build energy efficient, environmentally friendly and socially sustainable new communities’.

Living Villages are now looking to scale up the approach successfully demonstrated at the Wintles in order to develop further new communities and add value to sites in partnership with landowners and developers. They are currently working on a number of development opportunities in London and the South West which could see them developing schemes of more than 250 units.

### Energy strategy

The homes have been designed to minimise energy use from the outset. They are manufactured off-site using timber panel systems to ensure quality and airtightness. The heavy beams of the structural walls are made from either Douglas fir, oak or larch (all locally sourced). To maximise insulation a second stud wall is added made from locally sawn softwood.

All windows are triple glazed as standard, specified to meet Scandinavian standards of thermal efficiency. Highly efficient condensing boilers provide under-floor heating to ground floor and bathrooms only, with thermal stack effect used to transfer heat upwards to bedrooms, and the hot water supply is supplemented by solar thermal collectors as standard. Low energy appliances and lighting are provided to all properties.

### Market response

The development has proved popular, providing people with the opportunity to ‘put their money where their mouth is’, and has consistently achieved values some 15-25% above other local new-build completions. It is seen by estate agents very much as a niche product, and people are buying into a lifestyle as much as a home.

### Key learning points

- The house types are unique and have enabled the environmental performance to be designed in from the outset.
- The quality and distinctiveness of the scheme, together with the ecological specifications and community focus have enabled higher values to be achieved.
- The scheme appears to have appealed to a niche market of people wanting to ‘put their money where their mouth is’.

### Key design features

- Super-insulated timber frame construction
- High performance double glazing
- Mechanical ventilation with heat recovery
- Solar thermal collectors
- Low energy light fittings
- Condensing boilers

### Cost and value

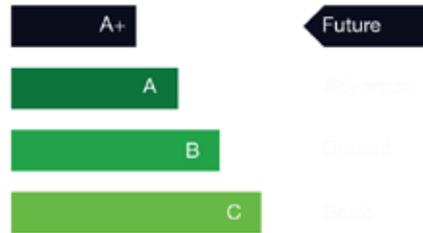
Unit sales price: £465,000 - £585,000



# RURAL VILLAGES AND MARKET TOWNS

## Jubilee Wharf, Prestyn (Cornwall)

Developer: Robotmother (Andrew Marston)  
Architect: ZED Factory  
Completion: 2007  
Number of units: 8  
Urban form: Townhouses and apartments  
Tenure: Private rental workspace, community uses and apartments  
Building Regulations: Part L 2002



### Background

Jubilee Wharf is a mixed use scheme consisting of a café/bar, community hall, nursery, retail outlets, commercial office space, 12 rented workspaces and 6 private rented maisonettes.

It has been developed by the specialist property investor Andrew Marston and is the first commercial scheme designed by Bill Dunster's ZED Factory. Andrew Marston's development company Robotmother develops residential and commercial buildings and manages its lettings without agents.

### Drivers for change

The client is committed to environmental sustainability and the long-term management of the whole life costs for developments.

### Energy strategy

The maisonette designs are an evolution of those at BedZED. The main focus is on airtightness and super-insulation with 300mm Rockwool cavity insulation (giving a U-Value as low as 0.1 W/m<sup>2</sup>) and high-performance windows, as well as high-thermal-inertia concrete floor slabs and inner leaf. Both floors are fronted by a glazed sunspace, part of it double height, that helps warm the units in winter.

The building fabric is made airtight (tested to 1.5 air changes per hour at 50 Pascals) by the use of wet plaster being applied directly to the block walls, care is taken to make sure that the plaster meets the screed floor at the bottom of each wall. With high standards of airtightness achieved the

ventilation of the building can be controlled via a heat exchanger to further minimise heat loss.

Wind cowls ventilate without the need for electric fans - heat exchangers recover up to 70% heat loss. The specification of the bearings for the wind cowls has been improved from BedZED based on car technology.

Zero net carbon performance has been achieved through a combination of energy supply technologies:

- Solar thermal collectors – in the form of evacuated tubes - provide 60% of the hot water demand.
- Biomass boilers provide additional hot water and the minimal space heating required for the whole scheme from a 75kW wood pellet boiler. The boiler is mainly used to provide hot water and heat the workspaces in winter, but can also supply underfloor heating in the maisonettes.
- Four 6 kWe Proven wind turbines generate the majority of the electricity demand for the site, utilising the clean wind resource of the estuary location.

### Whole Life Costs

ZED Factory were selected because of the developer's focus on whole life costs, with the energy and maintenance costs having been projected over the planned period of ownership. The expected energy demand is extremely low, in the order of 50kWh/m<sup>2</sup>. This provided a robust

### Key design features

- Passive solar design with sunspaces
- Passive ventilation with heat recovery
- Super-insulated building fabric
- Solar thermal collectors
- Low energy light fittings
- Communal biomass boiler
- Small wind power

### Technical specifications

Building fabric U-Values (W/m<sup>2</sup>K)

External walls: 0.1

Roof: 0.1

Floor: 0.1

Air tightness: 2 ac/hr at 50 Pascal

### Cost and value

Build cost: £3.6m (£1,700/m<sup>2</sup>)

Unit sales price: Private rental only

Elemental cost of design features:

- Biomass heating system, solar thermal collectors and small wind turbines  
£242/m<sup>2</sup>



business case, in spite of the initial capital premium, for investing in the low carbon specification provided by the consultant architect.

### Capacity building and supply chain

The scheme has benefited from an experienced design team which has previously delivered all of the technologies, thereby minimising design time. Risk was managed through by using only design aspects thoroughly tested by the same team on previous projects, by specifying specialist suppliers

who have a proven design capability (as opposed to choosing them based on lowest cost) and by having an architect with sufficient experience of the technical aspects to act as the team's eyes and ears on site.

### Key learning points

- The scheme has benefited from the experience of the design team, and their knowledge and access to the supply chain required to deliver the high performance and specifications.
- The scheme design represents an evolution of ZED Factory approach, enabling the learning from previous projects to be applied to the project.
- The long-term approach taken by the client, including taking account of the lower running costs, offset the higher initial build costs of the scheme.
- The scheme achieves near zero carbon through the use of on-site electricity generation based on a technology appropriate for the site.

# RURAL VILLAGES AND MARKET TOWNS

## Station Crescent, Craven Arms (Shropshire)

Developer: South Shropshire Housing Association

Contractor: Thomas Vale Construction

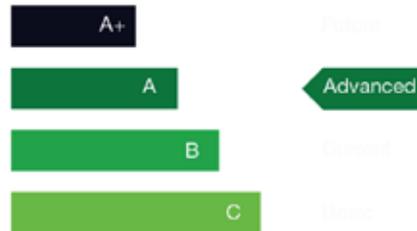
Completion: 2005

Number of units: 20

Urban form: Terraced houses

Tenure: Social rental

Building Regulations: Part L 2002



### Background

Station Crescent is a development of 20 terraced homes at Craven Arms, in South Shropshire. The development is a mix of 2 and 3 bed houses and 2 bed flats. All the units are for social renting.

### Drivers for change

In 2002 the board of South Shropshire Housing Association approved a sustainable build strategy and it has recently made a strategic commitment to develop carbon neutral housing. The Housing Association aims to minimise the energy bills of both current and future tenants and owners.

The use of off-site construction has been driven by the need to manage because of reduced Housing Corporation grants. This has led to a close working relationship with local timber frame contractors.

### Energy strategy

The Housing Association's main aim has been to deliver a 50% improvement on the performance required by the 2002 Building Regulations. In order to achieve this, a strong emphasis was placed on super-insulation standards and build quality, and a prefabricated timber frame system was specified from manufacturers Taylor Lane in Hereford. Timber frame provides a higher standard of air tightness and reduces the potential for cold bridging.

Passive solar design was also a priority. The properties are orientated south and a notable feature of the properties are the two storey conservatories or 'solariums'. These are designed to collect passive solar warmth from October

to April, and are shaded to avoid overheating in summer. The heated air is then drawn through the property by a ventilation system in order to supplement the space heating. During summer the system works in reverse, drawing cool air from the north side of each property

In addition to super-insulation 67.9 m<sup>2</sup> of flat plate solar thermal collectors were installed in total in order to further reduce heating bills. The collectors supplement the heat provided by gas condensing boilers in each property during the period May to September, with a storage cylinder used to regulate the two sources of heat.

### Whole Life Costs

The overall performance of the building fabric will minimise tenants gas bills. The higher upfront capital cost will to some extent have been offset by the faster build time for the timber frame system.

Solar thermal collectors come with manufacturer guarantee. There is good evidence from the EU that this technology has the potential to last longer than this.

The hot water supplied by the thermal collectors has been estimated to meet 60% of each units annual hot water demand. The benefit of this will accrue to the tenants, who will have reduced gas bills, and so the upfront cost had to be met by the Housing Association, with the assistance of a government grant.

### Key design features

- Passive solar heating using 'solarium' sun spaces
- Super-insulation and good build quality provided by timber frame
- Individual condensing gas boilers paired with solar thermal collectors

### Technical specifications

Building fabric U-Values (W/m<sup>2</sup>K)

External walls: 0.18

Glazing: 2.0

Roof: 0.17

Floors: 0.25



### Cost and value

Build cost: £1,791,445m

Elemental cost of design features:

- Flat plate solar thermal collectors: £64,408 including a Clear Skies grant of £32,204



Regular gas safety checks are still required for each property because individual gas boilers are still required in order to meet demand during winter. The typical lifespan of a gas boiler is 10 years.

### Resident response

A post-occupancy survey was initiated during 2007.

### Key learning points

- Off-site construction based on a timber frame system can deliver greater thermal efficiencies and deliver cost effective housing for social landlords. It can also create the opportunity to work with local contractors.
- Lower running costs from higher specifications enable current and future tenants to minimise their energy bills.
- The experience gained from the project led to the establishment of the Carbon Forum, which is sponsored by Shropshire County Council, and aims to share knowledge and experience between rural social landlords in the Marches area.

# RURAL VILLAGES AND MARKET TOWNS

## Rocks Green, Ludlow (Shropshire)

Developer: South Shropshire Housing Association

Contractor: Thomas Vale Construction

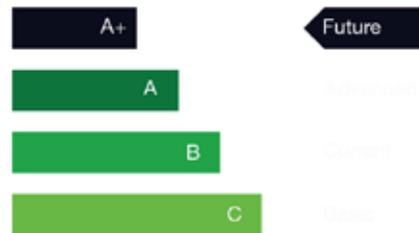
Completion: Expected 2008

Number of units: 91

Urban form: Semi-detached houses

Tenure: Social rental

Building Regulations: Part L 2006



### Background

Rocks Green is a development of 91 new semi-detached homes in Ludlow, South Shropshire. The development is a mix of 1,2,3 and 4 bed properties. The units are for social renting and shared ownership.

### Drivers for change

In 2002 the board of South Shropshire Housing Association approved a sustainable build strategy and it has recently made a strategic commitment to develop carbon neutral housing. The Housing Association aims to minimise the energy bills of both current and future tenants and owners.

The use of off-site construction has been driven by the need to manage because of reduced Housing Corporation grants. This has led to a close working relationship with local timber frame contractors.

Many rural sites in Shropshire are located off the natural gas grid, which necessitates expensive fuel oil for heating. The biomass heating element of the project has been supported by a Rural Regeneration Zone grant of £100,000 awarded by Advantage West Midlands.

### Energy strategy

The new homes are constructed using a prefabricated timber frame system to ensure air tightness and incorporating high levels of insulation. Underfloor heating has been specified in order to provide a more efficient heating system for tenants, with an estimated saving of 10% compared to conventional panel radiators.

All of the homes are supplied with their space heating and hot water from communal wood chip boilers, with heat distributed to each property via 1,200 metres of pre-insulated heating mains. The district heating main circulates hot water, and the heat is transferred to each home by a small heat exchanger which is installed in each home instead of a gas boiler. Heat use is metered and billed for like any other utility, with the Housing Association having chosen to manage the billing and revenue recovery.

The boiler house contains two 150 kW Austrian KWB boilers together with a 200 kW oil-fired standby boiler and a thermal storage tank. The storage tank is required in order to match the supply and demand for heating. This is because biomass boilers are less efficient if they are modulated to meet fluctuating loads, so instead they are run at a steady load and used to charge the thermal storage tank which can be used to meet peak loads.

The development has been estimated to require 200 tonnes of wood chips per year. The fuel is to be supplied under a contract with Midlands Wood Fuel, which was established by Marches Energy Agency. The contract is based on the heat output delivered by the fuel.

### Whole Life Costs

The approach taken by Aberdeen requires a long-term commitment to management and maintenance. The boilers are high quality products sourced by installer Econergy from Austria. They do,

### Key design features

- Super-insulated timber frame system
- High specification doors and glazing
- Biomass district heating



however, require more active maintenance than a conventional gas boiler. District heating networks generally have a design life of at least 25 years.

Because the heating network is communal it can be maintained without requiring access to resident's properties, in contrast to the need to carry out individual gas safety checks each year for typical

properties – which are time consuming and costly for social landlords.

### Resident response

The scheme is due for completion later in 2008.

### Monitoring and performance

The scheme is due for completion later in 2008.

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### Key learning points

- Biomass heating can provide a viable alternative to fuel oil for space heating and hot water for rural sites that are off the natural gas grid.
- This form of communal heating system is required in order to deliver zero carbon heating and the Code for Sustainable Homes level 5.
- Although the market for biomass heating is not yet mature in the UK the client has been able to benefit from the experience of a contractor with a track record and access to best practice technology.
- The client has also been able to ensure access to a local supply chain for biomass fuel by working with a regional initiative that was specifically established to support the market.
- Thermal storage and standby boilers are required for biomass heating in order to help meet peak loads and to cover downtime.

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Bob Tomlinson, Living Villages  
Serena Webber, Blue Ice Communications  
Susan Venner, ZED Factory  
Paul Sutton, South Shropshire Housing Association



Sustainability West Midlands  
Regional Partnership Centre  
Albert House  
Quay Place  
92-93 Edward St  
Birmingham B1 2RA

Tel. 0121 449 4406  
Email [admin@smw.org.uk](mailto:admin@smw.org.uk)