Smart Cities – Good Practice

Buildings

Code for Sustainable Homes in Essex

Wimbish, Saffron Walden, Essex, UK

Wimbish PassivHaus for Social Housing Development

The Code for Sustainable Homes plays a key role in building a future housing stock which both meets citizens' needs and protects the environment. It represents the basis for future developments of the Building Regulations in UK in relation to carbon emissions and energy use in homes [1]. The Code is the national standard for the sustainable design and construction of new homes. It is intended to help promote higher standards of sustainable design above current building regulations. A specific case of its application is the development of fourteen homes in Wimbish, near Saffron Walden (Essex), in south-east England: the project is certified by the PassivHaus Standard, as well as the UK Code for Sustainable Homes. It represents a pioneering development of social housing through the application of the PassivHaus scheme. The project represents also good practice example for achieving sustainability and energy efficiency in the peripheral urban areas. The requirements were met using a "fabric first" approach, combined with mechanical ventilation with heat recovery [2].

Country/ City Profile

Country		City	
Population (2014)	64,510,376 [3]	Population (2011)	1,629 [5]
Land area (km²)	243,610 [3]	Land area (km²)	(Essex) 3,465
GDP per capita (2014, current international $, at purchasing power parity)	39,136 [4]	GDP per capita / GDP per capita at purchasing power parity	n/a
Region	Europe	Region	south-east side, rural

City's physical geography		
	Location	✓ Situated in a hilly, rural landscape ✓ Essex county is an important agricultural region with farmland accounting for more than half of the counties low-lying land ✓ Latitude 51°59'38.21''N; longitude 0°18'19.16''E ✓ Very low altitude (approximately 20 m above sea level)
	Climate	✓ Temperate maritime (i.e. mild with temperatures not much lower than 0°C in winter and not much higher than 32°C in summer) ✓ Less than 700 mm/year annual rainfall in eastern England **(this area includes some of the driest areas in the country)**

Initiating context and background

The Code for Sustainable Homes was introduced in England in April 2007 as a voluntary national standard to improve the overall sustainability of new homes by setting a single framework within which the home building industry can design and construct homes to higher environmental standards. It is incorporated into the Building Regulations. Where it is used, the Code also gives new homebuyers information about the environmental impact of their new home and its potential running costs. The Code measures the sustainability of a home against nine design categories, rating the 'whole home' as a complete package.

The design categories are: *Energy and CO2 Emissions*, *Water*, *Materials*, *Surface Water Run-off*, *Waste*, *Pollution*, *Heath and Wellbeing*, *Management*, and *Ecology*. It uses a rating system to communicate the overall sustainability performance of a home. A home can achieve a sustainability rating from one to six stars depending on the extent to

which it has achieved Code standards. One star is the entry level – above the level of the Building Regulations, and six stars is the highest level – reflecting exemplar development in sustainability terms [2].

Project description

The design scheme was largely driven by a consideration of the context of the site and an appreciation of the typical local style. The neighboring communities largely comprise plain fronted houses under simple natural slate roofs, and this context led the Housing Association Hastoe to consider a rendered finish under plain simple roofs. The economic solution of externally applied insulation was therefore compatible with the local style. Strong colours are also a feature of this part of Essex and were used to place the properties.Colours were chosen with a similar tonal balance so as allow the properties to settle into the landscape without competing with each other. Internal layouts were designed to place the primary living rooms on the south side, and limit north facing areas to less important spaces such as bathrooms and entrance halls.

The plans comply with the UK design standards for dwellings funded by the Homes & Communities Agency, and the following standards [6]:

- *Secure By Design*
- *Lifetime Homes*
- *Housing Quality Indicators*
- *Code for Sustainable Homes - Level 4*
- *Hastoe Housing's Design Brief*

Project details [2]	
WALLS	- External walls: 190mm lightweight aerated concrete blocks, 285mm external EPS insulation panels, external 8mm modified silicone resin render - Party walls: 300mm cavity walls of lightweight aerated concrete blocks, consisting of two layers of 100mm blocks with 100mm filled cavity in between
GROUND FLOORS	- Ground floor slabs: 300mm reinforced concrete raft, on 50mm concrete blinding, on eco-membrane, on 400mm Styrofoam structural insulation, on 25mm 'fines' blinding, on compacted type 1 sub-base - Ground floors: 65mm thick sand & cement screed, with fabric reinforcement, on 30mm thick EPS insulation
WINDOWS	Triple glazed composite (timber and aluminium)
DOORS	Boarded external composite (timber and aluminium) with triple glazing
ROOFS	Plain grey concrete tiles; timber trusses; 500mm glass fibre insulation to loft spaces
LAYOUT AND ORIENTATION	Layout and oreintation of buildings – east west - are designed to maximize solar gain: - the glazed areas on the north side are minimized - larger glazed areas are incorporated on the south elevation, comined with brise soleil to ground floor and blinds to first floor with eaves overhang to reduce overheating in summer
VENTILATION	- Mechanical ventilation heat recovery units (MVHR), which recover almost 87% of the outgoing heat - Internal air circulation is facilitated through internal vents and 3cm ventilation gaps at the bottom of internal doors
WATER	- Small gas boilers (gas is not used for any other purpose) - Solar thermal panels (the MVHR unit has a heating coil within the air duct, connected to the hot water system, which can be switched on to provide additional warming of the incoming air when needed)

Implementation process

Hastoe Housing Association is a social landlord, with a growing stock in excess of 4,000 rented, shared ownership and leasehold homes across the south, east and west of England. Hastoe focuses on rural and peripheral urban areas schemes, of which Wimbish is one. Hastoe east region has a history of building to sustainable standards, for example having over 200 properties at Code for Sustainable Homes – level 4.

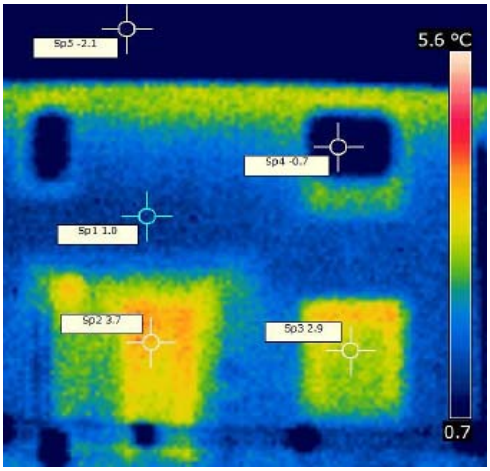
Hastoe is committed both to ensure that their tenants do not fall into fuel poverty as energy prices rise, and also that tenants remain able to afford their rents. These considerations led Hastoe to explore ways of ensuring minimal fuel bills while maintaining comfort levels. PassivHaus construction is the paramount way of achieving this aim. With support from the local authority for the project, the Uttlesford District Council, the architects Parsons+Whittley were employed to work with Hastoe to create the Wimbish PassivHaus development [6].

During the implementation of the project, the residents have received considerable information about living in a PassivHaus home, including a home user booklet and briefings before and during their move-in. In this sense, they are been involved during the whole process of buildings construction because advice and support for residents before and after they move in is essential if they are to maximize the benefits of living in a low energy home.

Source: [11]

Results

Performance data [2, 7]	
EXTERNAL WALLS	U-value (W/m^{2}K) = 0,09
ROOFS	U-value (W/m^{2}K) = 0,08
FLOORS	U-value (W/m^{2}K) = 0,07
EXTERNAL DOORS	U-value (W/m^{2}K) = 0,80
WINDOWS	U-value (W/m^{2}K) = 0,77
CO2	Peaks are no more than 1,200 ppm
PRIMARY ENERGY DEMAND	104÷111 kWh/m^{2}a (< 120 kWh/m^{2}a PassivHaus)
HEAT DEMAND	- South facing = 12 kWh/m^{2}a (< 15 kWh/m^{2}a PassivHaus) - North facing = 19 kWh/m^{2}a
AIR CHANGES PER HOUR	*average*: 0.45 (< 0.6 air changes per hour PassivHaus)



Source: [11]

Sustainable features from the application of the Code – level 4 [2, 8]	
WATER USAGE	< 105 l/person/day Flow restrictors were fitted to baths and showers, and rainwater butts were provided for each property. The soil was unsuitable for soakaways, so surface water drainage works included gabions and holding tanks under the road, linked to a holding ditch behind the houses
MATERIALS	Materials met at a 'A' grade (hoghest level) in the Building Research Establishment's Green Guide UK
WASTE	Recycling bins and composting bins were provided for each property. The contractor was required to develop and implement a site waste management plan, to minimise construction waste and its impacts.
POLLUTION	GWP < 5
HEALTH AND WELL BEING	Daylighting was considered early in the design process, as were Lifetime Homes requirements.
ECOLOGY	The site was assessed as having low ecological value, since a major part of it was previously agricultural land. Whilst the surrounding trees and hedgerows do have some ecological value, including potentially great crested newts, these areas were protected during construction. The ecological value of the site was enhanced through ecological planting
ENERGY	PassiveHaus Standard + Eco-labelled products

Lessons learned

This fourteen dwelling development follows classic PassivHaus principles of design, specification and construction that have been adapted for the UK to allow simultaneous compliance with the Code for Sustainable Homes. The built form is simple without unnecessary steps and staggers which add to the heat loss area and complicate the design and construction process.

The Wimbish PassivHaus development is the subject of a Building Performance Evaluation study supported by the Technology Strategy Board. All 14 units have been equipped with sensors to log energy consumption, thermal comfort, and air quality. Three of the units are more extensively monitored - both in more rooms, and in detail of the performance of the mechanical and electrical systems. The study includes a University of East Anglia PhD Researcher investigating occupant practices; in particular, how they influence energy consumption, and how they may be modified to reduce consumption [9].

The continuous evaluations demonstrate the benefits of sustainable design, and identifies those aspects of design, construction, occupation and maintenance that can be improved in future projects. The benefits are substantial in terms of occupant outgoings, health and well-being, and almost certainly in terms of housing association long-term rental income and asset valuations [6].

This project shows that it is extremely important that UK house builders have paradigms for successful low energy homes, as accelerated effort is needed to comply with the EU "nearly zero-energy buildings" requirement in the *Energy Performance of Buildings Directive* ("*all new buildings must be nearly zero energy buildings by 31 December 2020*" [10]).

References

[1] Code for Sustainable Homes. A step-change in Sustainable Home building Practice: http://www.planningportal.gov.uk/buildingregulations/greenerbuildings/sustainablehomes/technicalguide

[2] Code for Sustainable Homes Case Studies - volume 4: https://www.gov.uk/government/publications/

[3] World Bank: Data UK: http://data.worldbank.org/country/united-kingdom

[4] World Bank: GDP per capita, PPP: http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

[5] Data UK (2011): http://www.neighbourhood.statistics.gov.uk/

[6] Wimbish PassivHaus web page: Building Performance Evaluation Second Interim Report: http://www.wimbishpassivhaus.com/

[7] InBuilt: Towards Zero Carbon: http://www.wimbishpassivhaus.com/

[8] The UK Passive House Organization: Wimbish Housing – Residential new building – UK PassiveHaus Awards 2012: http://www.passivhaustrust.org.uk/

[9] The UK Passive House Organization: http://www.passivhaustrust.org.uk/projects/

[10] European Commission: Energy Performance of Buildings Directive (2010): https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings

[11] Photos and images: https://www.gov.uk/government/publications/ ; http://www.wimbishpassivhaus.com/

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