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Case Study 10

St. Athan Affordable Housing Development

Owner/Developer:
Wales & West Housing Association

Architect:
Powell Dobson Architects, Welsh School of Architecture (design research unit)

Location:
St Athan, The Vale of Glamorgan

Building Types:
Residential

Project Description

The Wales & West Housing Association (WWHA) developed 16 affordable housing units on the site of a former church to help meet the strong demand for affordable homes for local people in the area of St Athan. The project was one of the Welsh Government's first Code for Sustainable Homes Pilot Projects, requiring the new homes to achieve Code for Sustainable Homes (CSH) level 4. This standard entailed a 44% reduction in CO_2 emissions over 2006 Building Regulations Part L guidance.

Key Drivers

The core driver was for the WWHA to build a community of CSH level 4 dwellings to be utilised as affordable rented accommodation. This was a pilot scheme where sharing learning experiences and knowledge gained through the entire process were particularly important.

The scheme presented an opportunity to experiment and learn about offsite construction technologies to discover their specific advantages and disadvantages. Other learning opportunities were gained through the use of renewable and low carbon technologies, in addition to the requirements and challenges of meeting the CSH Level 4. Residents' experiences of utilising the low carbon technologies were monitored by WWHA in order to accumulate knowledge and experience for future projects.

Key features

- Air Source Heat Pump (ASHP);
- Mechanical Ventilation with Heat Recovery (MVHR);
- High energy efficiency systems; and
- Underfloor heating.

Standard affordable housing units in St Athan housing development.
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Renewable & Low Carbon Technologies

- Air Source Heat Pumps

"We are very proud of this scheme which reflects innovative design and construction methods and a willingness to look beyond the usual concepts to help the Welsh Government achieve its target of reducing carbon dioxide emissions."
Anne Hinchley
WWHA

Procurement

The WWHA chose to develop the scheme under a negotiated Design & Build contract with contractor Lovell, who is on the WWHA's framework. The project Architects, Powell Dobson Architects, worked in collaboration with the Welsh School of Architecture (WSA), who were undertaking a Knowledge Exploitation Fund project investigating Modern Methods of Construction (MMC) from a Welsh perspective. The WSA assisted in providing a basis for design principles of the properties and knowledge of MMC applications for the St Athan development.

One of WWHA's preferred suppliers of heating systems are Worcester Bosch from whom it was possible to source an Air Source Heat Pump (ASHP) that was appropriate in terms of long term maintenance and performance specification. Other factors that made Worcester Bosch suitable for this project included their post installation support and participation in the Design Stage and post handover stages.

Scheme Costs and Finance:

Excluding land purchase and demolition, the total build (contract) cost of the scheme was £2.25m, equating to £1,228/m^2.

The total cost of the ASHP (including capital, installation and commissioning) was approximately £9,100 per unit. This included the cost of underfloor heating which was used on the ground floor of the houses in conjunction with the ASHPs had at £1,350 per dwelling.

Funding for part of the project was partially sourced from a Social Housing Grant obtained from the Welsh Government for the scheme, worth £1.9m. The remainder of the total scheme cost was funded by WWHA.

Technology selection process

Before any renewable or low carbon technologies were considered, the design team used an energy hierarchy approach of 'fabric first' to make each building type as thermally efficient as possible. For instance, triple glazed windows were selected, which improved the thermal performance of the building and provided an extra noise reduction benefit to residents.

Following implementation of an energy efficiency building fabric, the most suitable renewable and low carbon technology was chosen through numerous refined SAP calculations.

Standard Assessment Procedure (SAP)

SAP provides a simple means of reliably estimating the energy efficiency performance of dwellings. SAP ratings are expressed on a scale of 1 to 100, where better ratings equate to higher numbers. SAP is calculated by predicting heating, and hot water costs, which depend on the insulation and air tightness of the house and the efficiency and control of the heating system. The calculation uses the Building Research Establishment's Domestic Energy Model (BREDEM).

The SAP calculations also allowed combinations of renewable and low carbon technologies, including PV and solar thermal, to be investigated for the St Athan development. However, due to the capital cost and carbon saving target necessary to achieve the ENE1 part of the CSH

for CO_2 reduction, the SAP process eventually indicated that an ASHP was the most suitable and cost effective low carbon technology.

ASHPs work well in conjunction with underfloor heating, due to the lower output heating temperatures compared to those associated with a traditional radiator system. Installation of underfloor heating at the St Athan development improved the ASHP coefficient of performance (COP), which is the ratio of the energy transferred for heating to the input electric energy used.

The development utilised an advanced construction method comprising of a pre–fabricated structurally insulated panel (SIPs) system. This enabled a much higher level of airtightness to be achieved compared to Building Regulation standards, at $3m^3/m^2.hr$ at 50 Pa compared to $10m^3/m^2.h$.

Airtight dwellings require mechanical ventilation to maintain adequate indoor air quality. As part of a number of low energy, high efficiency systems, the St Athan development utilised mechanical ventilation with heat recovery (MVHR). MVHR warms fresh incoming air using 'waste' heat extracted from outgoing warm air via a heat exchanger e.g. from kitchens and bathrooms.

Part L1A 2006 of the Building Regulations stipulated a Target Emission Rate (TER), measured in kWh/m^2, which describes the maximum allowable CO_2 emissions for a Part L compliant dwelling. In order to achieve CSH Level 4, the CO_2 emissions of a dwelling (the Dwelling Emission Rate (DER) had to make a 25% improvement on the TER. When compared against the benchmark for CSH Level 4 the DER for the St Athan development made, on average, a 47% improvement on the Part L1A 2006 TER.

Monitoring and operation

Following completion, the WWHA adapted its handover process to ensure housing managers and tenants were comfortable with the systems and technologies used in their homes. This included contractors demonstrating to the tenants how the ASHPs and MVHR systems worked.

The tenants were provided with energy meters to help them understand their energy costs. A dedicated Environmental Officer was available to act as a point of contact to assist residents in reducing their energy bills.

Part of the energy monitoring system involved a survey of residents at regular intervals; after six months, one year, two years and three years, to obtain longer–term feedback on the performance of their homes. To date the results have been positive, with residents generally happy with their properties and WWHA continue to work with them to ensure they are getting the most from them.

Following the first set of monitoring, the resulting actual electricity bills were actually somewhat higher than expected by the residents, although still considered reasonable. The ASHPs did not perform as well as indicated by the original SAP calculations due to differences in occupant behaviour between the theoretical design calculation and the actual inhabitants, in addition to an abnormally cold winter during the first year of operation.

"This development is just one example of a whole range of initiatives which we are undertaking organisation–wide in order to reduce our carbon footprint, make all our homes and the communities in which we operate greener and more cost–effective, and make the most of the opportunities which new technologies afford."
Anne Hinchley
WWHA

Lessons learnt

Technological Issues

- The Code of Sustainable Homes assessor has a crucial role to play and needs to work closely with the design team, guiding and advising where appropriate.

Financial Lessons

- Early involvement of the contractor within the design team prior to planning stage enhanced the value engineering potential; and
- Contractor knowledge of products and willingness to provide solutions (in particular relation to the Code for Sustainable Homes) can be an important benefit. An example was the Euro clad roofing system which ensured a long term maintenance free solution and integrated well within the scheme.

Occupant Involvement

- Allowing members of the project team to 'Buy in' to the scheme gave many people a personnel commitment and involvement to the project;
- Positive support from locals for the scheme was a benefit in the context of this project; and
- Housing managers and tenants were trained in the use of the 'new' systems within the homes, reducing problems when occupants moved in.

Awards and Achievements

- Awarded Exemplar status by the Building Research Establishment and Constructing Excellence Wales;
- Code for Sustainable Homes Level 4;
- Silver Considerate Constructors National Award; and
- Short listed by Constructing Excellence Wales Awards (in the 2009 Innovation category and in the 2010 Integration and Collaborative Working category).

References and Acknowledgements

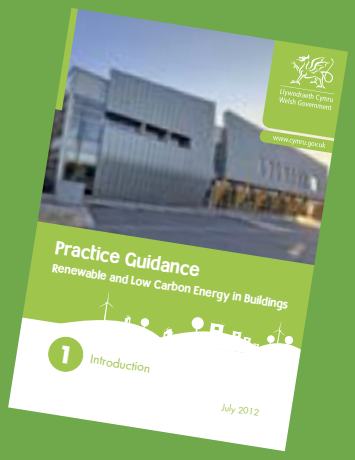
Paul Wyatt
Wales and West Housing Association

Further Information

Social Housing Grant,
Welsh Government
www.wales.gov.uk

BRE & CEW Award descriptions
www.cewales.org.uk/cew/wp–content/uploads/St–Athan–case–study–web.pdf

These case studies are presented to show examples of how buildings can be designed and built to be low carbon and incorporate renewable and low carbon technologies. This case study is part of a series of case studies supporting a separate practice guidance document on low carbon buildings.
For further information see www.wales.gov.uk/planning



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