OVERVIEW

Since our formation in 2008, the Zero Carbon Hub continues to work with Government and industry to identify risks, remove barriers to innovation and help demonstrate that energy efficient, healthy new homes can be delivered by the mainstream house building industry.

This series of building profiles gives examples of manufacturers, developers and clients who have embraced the challenge and are developing practical, commercially viable ways of delivering the next generation of homes in preparation for the nationwide introduction of Nearly Zero Energy Homes from 2020.

SUMMARY

Killynure Green forms part of PDP London’s phased masterplan (for 65 homes), which won an international design competition in 2010. The masterplan proposes a journey of spatial events through the site around which a series of housing clusters layer into the landscape creating a variety of private, semi-private and public open spaces. The competition was organised by the Royal Society of Ulster Architects (RSUA) and the Northern Ireland Housing Executive (NIHE), and funded by the Department for Social Development. Phase 1 completed in October 2015.

SPECIAL FEATURES

The developments was designed to meet minimum Code 5 of The Code for Sustainable Homes, utilising Modern Methods of Construction. It was to be the first Code Level 5 scheme in Northern Ireland and one of the largest in the U.K.
PROJECT STRATEGY

SITE TOPOGRAPHY
During early analysis it became apparent that the site’s dramatic topography was the main driver behind the generation of the masterplan, with the site sloping steeply; an approximate 10m drop across the whole site. The buildings are carefully positioned to follow the natural undulations of the site, with short housing terraces tiered across the existing site levels and contours to reduce the impact on the natural topography and to create a series of linked external landscaped spaces that add character to the site.

The design sought to take advantage of the sloping site by spacing the dwellings to maximise daylight and solar collection. Dwellings are generally arranged to be south facing with wintergardens located to the southern façade of the dwelling to benefit from solar gains. The dwellings were designed to be highly insulated with a high level of air tightness to minimise energy usage.

CREATION OF AN ‘EXEMPLARY SUSTAINABLE COMMUNITY’
The creation of a sense of place was also an overall focus for the development as it is slotting into an already established community with a nearby school and both social and private housing estates in close proximity. Much attention was paid, therefore, to the external spaces and the spaces between the houses, as to the dwellings themselves.

In addition to utilising the site orientation to benefit from solar gains, a fabric first initiative was adopted to reduce energy consumption and a prefabricated structural system was utilised to achieve high levels of thermal insulation and airtightness.

It was important to the design team that these standards could be easily ‘managed’ throughout the construction process and an ‘offsite’ factory finish approach meant that details could be more readily achieved in standard width wall build ups. Although the final system was a contractors design element (CDP) within the NEC ‘Works information’.

Enhanced accredited construction details were used to achieve Y values of 0.04 W/m²K that minimised thermal bridging. Where details differed to standard enhanced details, thermal modelling was undertaken to test junctions: such as window heads. This was required as part of the Contractors design responsibility.

Air tightness tests were carried out at an early stage as a quality check, i.e. once the SIP frames and external doors and windows were installed, to ensure that targets for airtightness could be met even without final linings complete, and indeed all targets were surpassed on completion. The development also makes use of photovoltaics and MVHR to reduce energy demand within properties.

Timber framed wintergardens have been designed in and are used as a passive solution for each house. They act as an ‘insulated’ buffer for the residents from the external conditions, reliant on the build-up of solar gain in the winter months to reduce heating load and have designed in purge and shading components to act as a solar buffer in summer. The wintergardens were modelled in IES at design stage (original design by PHA Consult) to ensure optimum solar gain, whilst also providing the required solar shading during the warmer months.

EXTERNAL WALLS
Kingspan Ultima Timber Frame System (originally designed as a SIP panel, but redesigned by contractor to meet a performance specification)
Timber prefabricated panels with 40mm Kooltherm K12, 120mm Kooltherm K12, 50mm cavity with rendered masonry external leaf.

ROOF & INTERMEDIATE FLOORS
Kingspan prefabricated cassette panels.
Pitched roof incorporating; 120mm Kooltherm K12 between rafters, 50mm Kooltherm K12 to underside of rafters.

FLOOR
Screed over 175mm insulation on concrete slab

WINDOWS
Triple glazed throughout to achieve a minimum complete window U-value of 0.9W/m²K.

WINTERGARDENS
Single glazed timber framed for passive heat gains, note the winter gardens are not part of the thermal envelope.

AIRTIGHTNESS
Between 2 -3 m³/m²h

BUILDING SERVICES
MVHR system with a summer bypass facility
Gas combination boiler for space heating and hot water
Rainwater harvesting
The project was assessed under the Building Regulations 2006 (Northern Ireland) and therefore energy efficiency was measured based on the ‘Heat Loss Parameter’ (HLP) rather than the ‘Fabric Energy Efficiency’ (FEE). The HLP achieved for the project ranges from 0.69 W/m²K to 1.13 W/m²K. To gain Code Level 5 credits the HLP must be less than or equal to 1.13 W/m²K, with some houses performing almost 40% more efficiently than the target value.

The total Carbon Emissions for the houses ranges from 3.38 to 10.11 kg/m²/yr. To achieve Code Level 5 the target emissions rate needs to be a minimum 100% reduction in Carbon Emissions. All of the houses easily achieve this and some of the houses are close to the zero carbon emissions target for a Code Level 6 dwelling.

**Space and Domestic Hot Water (DHW)**

The radiators are supplied by a highly efficient gas combi boiler system. Hot water supply is also from the gas combi boilers.

**Airtightness and Ventilation**

The airtightness target of 3 m³/h/m²@50pa is achieved in all the houses. The most airtight house is as low as 1.6 m³/h/m² @ 50pa of pressure.

**Ventilation**

A highly efficient MVHR system is in use in all the houses, which includes a summer bypass facility to supply fresh air to the building without any heat being recovered when not required.

The MVHR ventilation system was commissioned in accordance with the approved BPEC code of practice.

**Others – Overheating Strategy, Renewables, etc**

The homes are designed to maximise natural daylight and although the smaller punched openings were designed to the south, a high-level dormer window facing north is designed in to afford light into each dwelling. The dwellings have been arranged on the site to allow light into the external spaces, gardens and terraces between the houses as well as allowing positive solar gain into the houses during the winter. The passive design strategy hinged round the use of enclosed, external, south facing wintergardens designed with hard surfaces for thermal mass and tenant controlled ventilation.

Each house is designed with a water butt integrated into the roof canopy to collect rainwater utilising a simple ‘chain drain’ detail along with rainwater harvesting for reuse in WCs. Dedicated bicycle storage has been designed to suit the location of each specific house and to maximise amenity.
From the outset of the project, the client wanted the scheme to take a low carbon, energy efficient approach to meet Code 5 of the Code for Sustainable Homes targets. It is clear that the success of the project has been helped by a client who is committed to generating awareness of reducing carbon emissions, and willing to embrace creative design solutions to achieve this.

Although, technically, the wintergardens could not be assessed via SAP/building regulations the client’s vision realised the passive benefits of the wintergardens and as social landlords understood the potential savings in energy use terms would have long term tenant benefits. Delivering these as enclosed external spaces meant that they could provide flexibility at different times of year and extended the potential use of a garden space all year round.

The project uses innovative products and systems to achieve high levels of thermal insulation and airtightness, but the commercial constraints of delivering social housing can often preclude the quality. Generating key components such as the structural system as a CDP was a key consideration as the off-site manufacturing meant that programme and cost benefits could be achieved whilst maintaining accuracy of the factory designed components. That meant airtightness and continuity of insulation could be managed. Careful coordination between the technical and construction teams was required at an early stage to ensure the required performance was achieved, whilst maintaining ease of buildability on site.

As part of the handover process Choice Housing provided an information session for every tenant and also followed this up with visits to homes. During these visits a number of tenants commented on how quickly homes heated up and reduced need for heating. The scheme has only been occupied for a few months (October 2015) and so there is limited information available on performance at this stage, however energy consumption will be reviewed after six months and twelve months from handover to compare performance against the target design expectations.