

CASE STUDY

# The Sigma Home 2007

In 2007 Stewart Milne Group built The Sigma Home, the first home in the UK designed to Level 5 of the Code for Sustainable Homes.

## A Model for Green Homes.

### UK's first near zero carbon home – CSHL5.

In 2007 Stewart Milne Group built the award winning Sigma Home, the first home in the UK, designed and built to Level 5 of the Code for Sustainable Homes.

Constructed at the BRE Innovation Park Watford in eight weeks and comprising a pair of semi-detached homes, one complete and one left unfinished to demonstrate the innovations, the Sigma Home benefited from modern methods of construction using the award winning Sigma® II closed-panel timber building system, with a fabric first highly energy efficient building envelope at its heart.

The Home focused on Offsite Construction assemblies using a prefabricated foundation system, of pre-cast piles and beams, and the construction consisted of highly insulated Sigma® II closed panel timber frame system, with pre-fitted windows and doors, three different pre-fabricated timber floor cassettes, and pre-insulated roof cassettes. Bathroom pods were also pre-fabricated and installed during the construction process. The building was clad with a non-masonry, render and timber feature façade system.

The pair of homes were very innovative in their design utilising a small footprint to maximise urban space, split level design to create internal feature spaces, roof terraces to maximise high level views and provided external space, whilst flooded with natural daylight. The homes each had passive stack natural ventilation through the staircase, to assist the dissipation of heat and draw in cool fresh external air.

One side was suitable for simple conversion from a 3 bed terrace to a 4 bed terrace home. The other side was designed with a live/work unit on the ground floor, with a triplex home above, each with a separate entrance. The design allowed for these spaces to be converted in the future to one full home or a granny/disabled annex to the ground floor, subject to lifestyle changes.

The home underwent extensive design -v- as-built testing, including whole house co-heating testing to determine its actual heat loss performance. In addition, the home was



occupied by a local family who lived in it for two weeks each season over the course of a year, to determine its thermal comfort and occupancy responses. Findings from the project were used to inform industry and evolve future home designs and MMC building systems.

In 2011, Rexel Energy Solutions and the Stewart Milne Group formed a partnership to refurbish the Sigma Home. Rexel refitted it to showcase and test the most innovative low energy products and technologies.

This was an evolving project which was constantly updated to incorporate the latest advances in the marketplace. The decision to create this five-star accredited house as a reality gave Stewart Milne Group the opportunity to explore the challenges, identify practical solutions and assist key influencers in the housing sector in the feasibility of building near zero carbon homes in an affordable fashion.

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## Materials & Technologies

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- **Building Envelope** – High levels of building fabric insulation, thermal detailing, and air tightness, provided by prefabricated closed panel wall, floor and roof elements coupled with pre-fitted high-performance triple glazed timber windows.
- **Renewable Energy** – Heating and hot water provided by solar thermal, wastewater heat recovery, mechanical ventilation and heat recovery, photovoltaic solar panels, and a roof mounted wind turbine.
- **Thermal Comfort** – Regulated through passive stack heat dissipation, natural passive cooling ventilation, couple with MVHR and innovative use of phase change wall board to regulate indoor temperature.
- **Offsite Construction** – Prefabricated foundations, Sigma® II Award winning closed panel timber building system, pre-fitted windows and doors, pre-insulated closed panel roof cassettes, prefabricated bathroom and en-suite pods and lightweight timber and render building façade system. Pre-Manufactured Value was estimated at around 66%.



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## Achieving Level 5 near zero carbon compliance – key features

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### Carbon Neutral

The house was designed to be carbon neutral in terms of space heating, hot water, lighting, and ventilation fans. High performance building fabric, with triple glazed windows/doors made it a highly energy efficient design. The building fabric used award winning Sigma® II timber building system, offering a very low embodied carbon solution, along with added benefits of carbon sequestration, not recognised in regulations.

The house also included other carbon reducing measures such as low energy appliances, high efficiency condensing gas boiler, mechanical ventilation and heat recovery, photovoltaic solar power generation, solar thermal hot water, wastewater heat recovery from showers, and wind turbine power generation, along with car charging, cycle storage and grey water recycled water systems.

### Low Water Use

Water saving devices were used throughout – washbasin, bath and shower water was collected for flushing the toilets. Water usage was intended to be kept below 80 litres per person per day. Water butts were provided to collect rainwater from the roof for watering the garden.

### Flexible Design

The house was designed with an open-plan layout to suit modern lifestyles. A central core contained bathrooms and other highly serviced areas along with the stairway, which provided vertical circulation. Floor plates were connected onto this core, allowing a flexibility of sizes and uses of space. This also allowed the home to change over time along the principles of Lifetime Homes. The adjoining house was built to show how it could be easily converted to a one bedroom flat or work unit on the ground floor and a 3-bed house above. The house was

split-level, which gave interest to the spaces and high ceilings on the ground floor; this also kept the circulation to a minimum, which was required on this tight site. The open plan design also allowed views, daylight, and ventilation across the levels. Safety and security were enhanced by using a domestic sprinkler system combined with fire and security alarms.

### High Density

Maximising family living in city centres is essential for true sustainability and we believed that this four-storey family home uses significantly less land than a traditional four bed home, making the proposal more affordable and in line with Government's current thinking on increasing housing density.

### Solar Chimney

On the roof of each house was a solar chimney positioned above the staircase.

### Energy

The Sigma Homes utilised renewable energy by way of heating hot water from solar thermal and photovoltaic roof panels,

roof mounted wind turbines and solar gain. A solar stack and 'whole house' mechanical ventilation and heat recovery system-controlled temperature in a passive system.

The high levels of insulation provided by the wall, floor and roof elements coupled with high performance timber windows gave excellent thermal performance of the external envelope. The technical performance included air tightness 1.00 m3(h.m2) at 50Pa, thermal bridging 0.04, walls 0.15 u-value, triple glazing 0.68 triple windows, roof 0.15 u-value and floor 0.18 u-value. All timber and timber products were from sustainable sources.

### Collaboration

This innovative project involved experts at many different levels within the Group, research partners, and the supply chain creating a team approach in which skills and experience across all departments, interests and businesses worked together to produce an award winning result.



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