



# Timber frame passive house, Co Cork

A new house in rural Cork mixes the best of traditional Irish rural design with the cutting edge combination of closed-panel timber frame and the German passive house standard

Words: Lenny Antonelli

There was a time when featuring a passive house was a rare thing for Construct Ireland — lately it's rare for an issue to go by without one.

For those who aren't familiar with it, the German standard requires that homes be so well

insulated and airtight that they don't need conventional heating systems. The theory is that by making your building retain as much heat as possible and orientating it to make the most of passive solar gains, the heat generated by occupancy will suffice.<sup>1</sup>

Designed by Irish passive house pioneers MosArt, this two-storey home near Macroom in Co Cork offers a contemporary take on the best elements of Irish rural house design with its clean lines, simple shape, white walls and black slate roof.



MosArt architect Art McCormack designed the house for clients Emmanuelle and Aodh Quinlivan. Art's MosArt partner Tomás O'Leary built Ireland's first certified passive house — called 'Out of the Blue' — in Wicklow in 2004.

"We did show respect for the vernacular and yet we didn't compromise in terms of it being contemporary, so we held a delicate balance there," Art says of the Cork house. Though it's a two-storey house, the roof slopes down to the front to create a bungalow-like facade.

Emmanuelle had a lot of design input. "She wanted something contemporary and clean, not only in terms of appearance — simple clean lines — but in terms of organisation," Art says.

She also wanted to keep the shape of the building simple — perfect for a passive house, where a simple shape means less exposed surface area through which heat can escape.

Art had little choice but to orientate the house 30 degrees off the ideal south axis in order to avoid a rocky patch of earth that would have required major groundworks. But he kept his eye on the Passive House Planning Package — the software used to design passive house buildings — and said changing the orientation had little effect on space heating demand in the calculations.

Emmanuelle and Aodh were keen on timber frame building, and the Green Build Centre (GBC) built the house's closed-panel timber frames in their Cork factory.

"It's factory fitted, the panels come out pre-insulated and airtight," says GBC's Kevin Murphy, a veteran of timber frame for two decades in the US and Ireland.

He said that while GBC have built six or seven homes to a similar spec, this was the first that included a specific brief to hit the passive house standard — including a space heating demand of 15kWh/m<sup>2</sup>/yr, maximum heat load of 10 W/m<sup>2</sup>, airtightness of 0.6 air changes per hour and maximum U-value of 0.15 for walls, roof and floor.

Kevin found the requirement to hit the standard focused the mind: "It made sure everything was up to the mark. It was both challenging and interesting," he says.

"And you're working with MosArt who are one of the most preeminent [architecture firms] on the island for passive house. It was challenging at the beginning, and it was quite rewarding at the end of the day."

GBC did more than just assemble the timber frame though — they did everything down to fitting the windows and the landscaping too.

They insulated the roof sections and block-clad timber frame walls with mineral wool and insulation, while the sloped roof and walls are also beefed up with an extra 50mm of rigid PIR insulation. The windows are triple-glazed Vrogum-Svarre units made with Scandinavian pine, and Siga airtightness tapes and membranes were used throughout the build too.

The house's final airtightness result was 0.4 air changes per hour at 50 pascals — well inside the passive house standard. Art recommends that as many of the building team as possible — including window installers — are on site during the airtightness test so they can clearly see where any leaks occur.

The ground floor features a Supergrund foundation system with 300mm of Aerobord insulation.

An 11kW air-to-water heat pump is the main ►

source of heat, feeding underfloor heating pipes downstairs and towel radiators in the bathrooms. Three flat plate solar panels contribute to hot water demand, while a heat recovery ventilation system supplies fresh air to the house.

The house also boasts some ecological touches in its use of materials — there's Fermacell dry lining board (made from gypsum, cellulose and water — all of it recycled), clay based paints, timber furniture certified as sustainable by the Programme for the Endorsement of Forest Certification, and the use of Ecocem low carbon cement.

The house meets all the criteria of the passive house standard, but Emmanuelle and Aodh may not go to the expense of getting it certified — a fairly common move among homeowners who are more interested in the comfort and energy benefits of living in a passive house than in having the certificate on their wall.

There's a strong case that you can't really call it a passive house unless it's certified — but within the green building sector the term has slipped into more general use to mean any house designed with PHPP that meets all of the main technical standards.

Granted, the house lacks the independent oversight that comes with certification. But Emmanuelle and Aodh's house hit all the key standards, as assessed by the most experienced passive house architectural practice in Ireland — and it should thus perform with the comfort and energy savings of a passive house. Which matters more than any cert.

<sup>1</sup>Some of these free gains include heat loss from lighting, white goods, body heat and — with the aid of heat recovery ventilation — cooking and washing. That said, even certified passive houses often feature small heating systems such as biomass stoves or compact units that combine heat recovery ventilation with a small heat pump.

#### Selected project details

**Clients:** Emmanuelle & Aodh Quinlivan

**Architects:** MosArt Ltd

**Contractor:** The Green Build Centre Ltd

**Civil / structural engineer:**

Foundation & Design Consulting Engineers

**Airtightness tester:** Permagreen Ltd

**Timber frame:** The Green Build Centre Ltd

**Windows & doors:** Vrogum-Svarre Ireland Ltd

**Roof lights:** Fakro

**Airtightness products:** Siga

**Solar thermal:** Kingspan Renewables

**Heat recovery ventilation:** O'Leary Ventilation Ltd ►

(top to bottom) though the house has limited glazing on north facing aspects to minimise heat loss, a clever design combining roof lights with glass balustrades ensures that natural light reaches as far as possible

(p69) most of the building's glazing is oriented to the south, where three roof integrated flat plate solar panels help to meet hot water demand





**PROJECT OVERVIEW:**

**Building type:** 262 sq m detached two-storey timber frame house

**Location:** Kilmurry, Co Cork

**Completion date:** May 2012

**Budget:** €340,000

**Space heating demand (PHPP):** 15 kWh/m<sup>2</sup>/yr

**Heat load (PHPP):** 10 w/m<sup>2</sup>

**Airtightness:** 0.4 ACH at 50 Pa

**BER:** A2 (47.5 kWh/m<sup>2</sup>/yr)

**Thermal bridging:** first course of lightweight blocks, low thermal conductivity cavity wall ties, thermally broken window frames, insulated reveals. Y-value (based on ACDs and numerical simulations): 0.08 W/mK

**Ground floor:** Aerobord Supergrund foundation with 300mm Aerobord insulation. U-value: 0.1 W/m<sup>2</sup>K

**Walls:** 100 mm lightweight block work externally, followed inside by 50mm cavity, 220mm factory-built timber frame insulated with high performance quilt insulation, 9mm OSB taped and sealed as airtight layer, 50mm PIR insulation, uninsulated 50mm service cavity and 12.5mm plasterboard inside. U-value: 0.12 W/m<sup>2</sup>K

**Flat roof:** Lagan Group clay tile externally on 50 x 35mm battens on breathable roofing membrane on prefabricated roof trusses filled with 400mm fibreglass insulation, Siga airtight membrane taped and sealed, 50mm service cavity and 12.5mm plasterboard. U-value: 0.12 W/m<sup>2</sup>K

**Sloped roof:** Lagan Group clay tile externally on 50 x 35 mm battens on breathable roofing membrane on 220mm rafter filled with 220mm high performance quilt insulation, Siga airtight membrane taped and sealed, 50mm PIR insulation, 50mm uninsulated service cavity and 12.5mm plasterboard. U-value: 0.12 W/m<sup>2</sup>K

**Windows:** Vrogum-Svarre triple-glazed laminated hardwood. U-value: 0.8 W/m<sup>2</sup>K

**Heating system:** 11 kW air-to-water heat pump, under floor heating to ground floor towel radiators to ensuite & bathrooms, three panel integrated Thermomax flat plate solar array. 300 L dual coil solar cylinder.

**Ventilation:** up to 92% efficient Vent-Axia Lo Carbon Sentinel Kinetic heat recovery ventilation unit. Efficiency based on Sap Appendix Q data, but a 12% penalty is applied in PHPP in accordance with Passive House Institute certification criteria for non PHI certified units.

**Green materials:** Fermacell dry lining board, recycled slate, cellulose insulation, clay based paint, all timber furniture from PEFC certified sources, 50% GGBS cement



**Comparison with Part L requirements**

