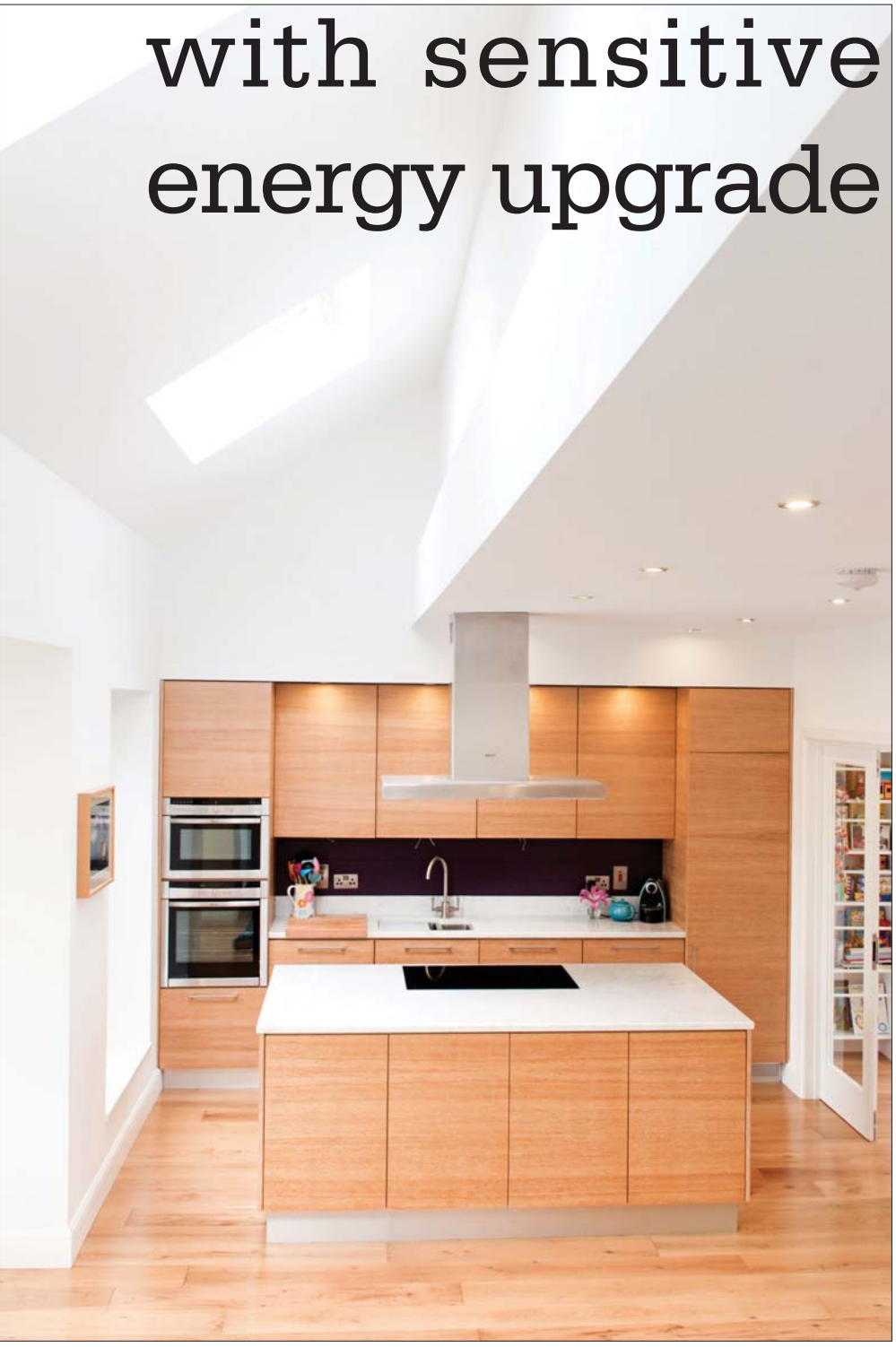
Victorian home given new life with sensitive energy upgrade



The renovation and extension of a Victorian home in south county Dublin proves that with care and attention, bringing delicate historic buildings up to modern standards of comfort and energy efficiency is very much possible.

Words: Lenny Antonelli

Historic buildings pose a tricky challenge for green building enthusiasts: how to insulate them without damaging their historic fabric. The renovation of an 1850s house in Sandycove, Dublin shows how, treading a fine line between architectural and energy conservation.

Though the house sits in the middle of a Victorian terrace, it isn't a listed building, so there were "no tough restrictions," says homeowner Henrietta Senkowsky. Nonetheless, preserving the historic facade was essential.

Henrietta and her husband Conor bought the house in 2010 with the intention of renovating before moving in. The building was suffering from dampness and mould growth, while there was structural damage to the walls, roof and floors. Its internal layout was cramped, with dark rooms and tight passageways.

Henrietta's brief to Cooney Architects was clear: she wanted a house that was warm, comfortable and energy efficient.

Treading lightly

Cooney Architects got to work insulating the old building, creating bright open-plan living spaces with clear connection to the back garden and designing a modern, low energy extension.

The architects chose to insulate the existing stone walls internally. This was a potentially tricky task, as insulating internally to onerous U-values can create a temperature drop where the insulation meets the wall, and this can encourage water vapour to condense (at the 'dew point'), potentially causing dampness and mould. So the architects just insulated the walls to a U-value of 0.31 W/m^{2}K with Isover Optima, a thermally-broken metal-framed internal insulation system. It features 100mm of Isover fiberglass insulation and an Isover Vario membrane. Vario is an 'intelligent' vapour and airtightness membrane that adjusts its structure depending on relative humidity. It becomes more porous to let moisture escape as the building structure gets warmer in summer, but closes in winter to prevent vapour from the warm interior of the house entering the timber frame.

The build-up was finished inside with plasterboard, but without foil backing — important for allowing moisture to escape through the build-up, as foil isn't vapour permeable.

Cooney Architects had first modelled the proposed wall design using condensation analysis software Wufi to make sure it wouldn't cause condensation, and it passed the test.

Since finishing the project at Sandycove, architect Frank Cooney's been studying different options for insulating historic single-layer walls as he prepares to take on the similar retrofit of a 1930s house.

'We've found the brickwork performance when we assessed the U-values was much better than we had projected," he says. "Now what we're looking at is super-insulating the floors, roofs and windows, but not insulating the walls." He says this would still bring the BER up "quite a way".

At Henrietta's house the original roof had de-

Photos: Bríd Ní Luasaigh

(above) Preserving the historic front facade was essential as the house sits in the middle of a Victorian terrace, and the new double-glazed sash windows replicate the historical look; (opposite) a void above the new kitchen brings plenty of light into the building

teriorated, and the structural engineer advised the damaged rafters wouldn't be able to support new slate tiles, so the builders constructed a new roof that includes 175mm of cellulose insulation.

The original ground floor was insulated with 100mm of EPS insulation and waterproofed, as the area is prone to flooding. The builders wrapped it in a Platon tanking membrane, designed for waterproofing structures below ground level, and dug a network of land drains to ease water pressure.

Henrietta was impressed with the result, pointing that while there was serious flooding outside last year, only a few centimetres got in through the shower drain.

The original single-glazed windows at the front were replaced with new double-glazed sash windows from Callaghan O'Brien that replicate the historic look.

"From the front it does look like an old house," Henrietta says, "but when you come around the back or walk into the house it's very different."

Modern extension

Indeed it does. In the back garden sits an ultra modern zinc clad extension. Builders Butler Contractors Ltd built the extension's ground floor from a double-skin blockwork wall with the 150mm cavity full insulted with KOREFill bonded bead insulation, while the upstairs is a timber frame structure insulated with 200mm of cellulose. The roof of the extension includes 120mm of wood fibreboard insulation and 175mm of cellulose.

The extension features large triple-glazed timber alu-clad units, facing out on to the garden. "We were concerned about having those two big windows but it's just wonderful, that triple glazing works really well," Henrietta says. "You can sit next to the window and don't feel cold or a chill."

The finished house boasts airtightness of 1.5 air changes per hour. In theory a high efficiency condensing gas boiler is the main source of heat, but Henrietta doesn't use it that much.

"I know it's been a mild winter, but we only heat really maybe an hour a day to get hot water, and that's mainly because we haven't put the solar panels on yet," she says.

Instead Henrietta says a wood burning stove is her main heat source, even though it isn't connected to central heating and just heats the surrounding air.

"We don't heat the bedrooms anyway, they don't seem to need heating. Our main source is still the little wood burning stove," she says.

The house also features a Vortice heat recovery ventilation system, and solar thermal panels are set to be installed shortly.

Henrietta and Conor moved in last summer, and Henrietta says she's really impressed with the house so far. "It's excellent, it's really, really good. It seems to conserve whatever heat is generated very well." It's cheap to run too, she says.

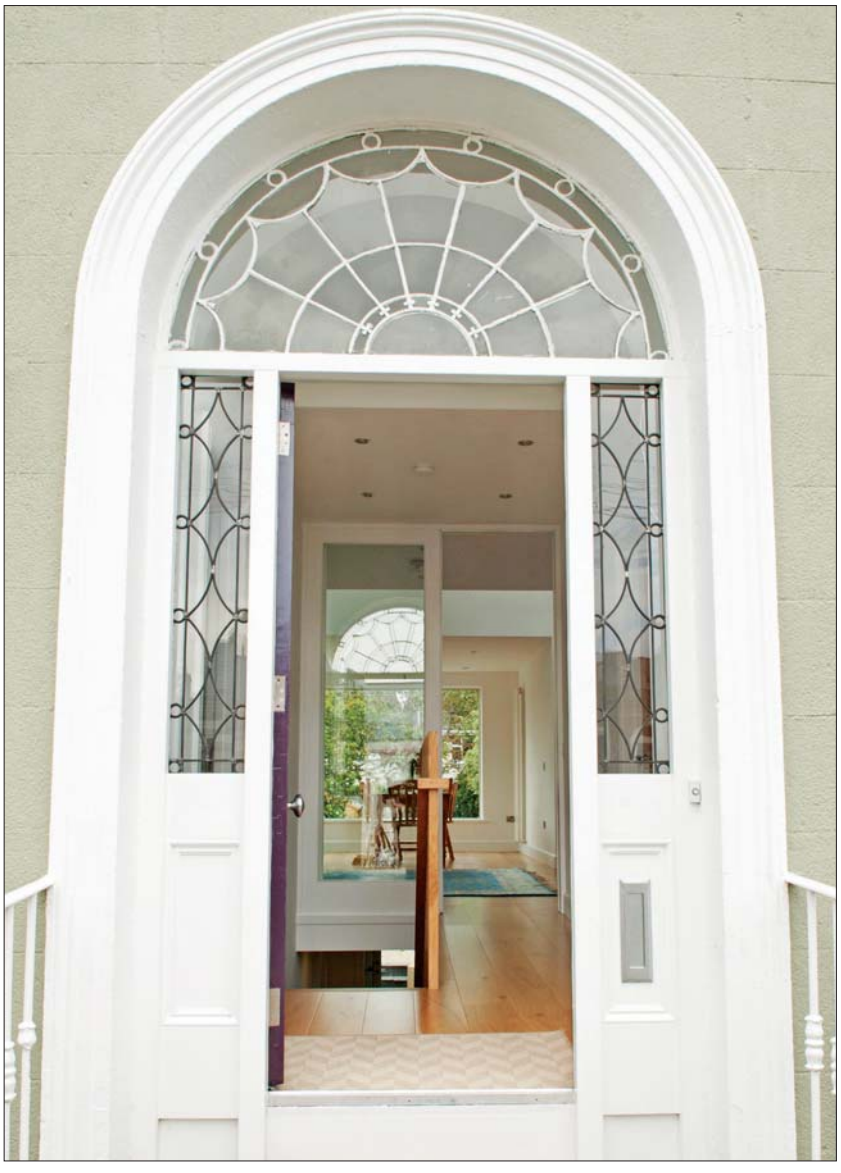
The house now boasts a B1 BER — impressive for a Victorian house, and quite the jump from the original F. But Henrietta's keen to point out they didn't have to make design sacrifices to achieve that rating.

"We didn't get that B1 through comprising on things we wanted," she says. "We have the big windows. We didn't have to build a house with tiny windows and tiny rooms. We've got a really good balance between good looks, a good floor plan and a very efficient building."

Architect's statement, Frank Cooney, Frank Cooney Architects

Description of the property as it existed

This late Victorian house of character is mid-terrace and retained some surviving period features, however it was in poor condition overall. The front entrance is located at upper ground floor level, accessed by a half flight of external steps. The rear garden could only be accessed at lower ground floor level, and awkward circulation through constricted passageways meant there was no clear connection to it. The lower ground floor was dark with low ceilings, while the upper floor had high ceilings ▶



but as mentioned lacked connection to the back garden. The building fabric was in poor condition, with dampness, rotting timbers, delaminating plaster, a poor thermal performance and draughts. The BER score for the house at the time was a lowly F.

The client's brief

The clients were looking to create a family home. They wanted to achieve a functional layout that would suit the needs of their young family. Not only should it function socially as a family home, from the outset the clients wanted an energy efficient home that would take advantage of passive energy through natural light and some passive solar gain. Crucially, the most important thing for the client was good connectivity with the garden at the rear.

Response to the brief

A systematic analysis of the project was carried out. The existing fabric was opened up and surveyed; a study of the local micro-climate was carried out so as to establish orientation, opportunities for passive solar gain, natural lighting, stack effect ventilation, and shading. A series of sketch options was prepared, along with computer and physical models. An energy audit was carried out at the design stage, whereby a detailed study of the performance of building fabric was undertaken.

It was agreed that any new extension to the rear should be of contemporary design, exempt from planning permission, and have a high level of sustainability. It was also agreed that substantial interventions to the fabric of the existing building were appropriate given its condition, however any such interventions should be appropriate and should not compromise the long-term performance of the historic fabric.

Design

It was quickly agreed that the family day living spaces would be located principally on the upper ground floor level, with a connection to the garden via a south-west facing terrace at that level. The south-west facing garden was identified as the most important element, thus the living spaces were orientated to address the garden which is immediately apparent on entry via an unobstructed view through the house.

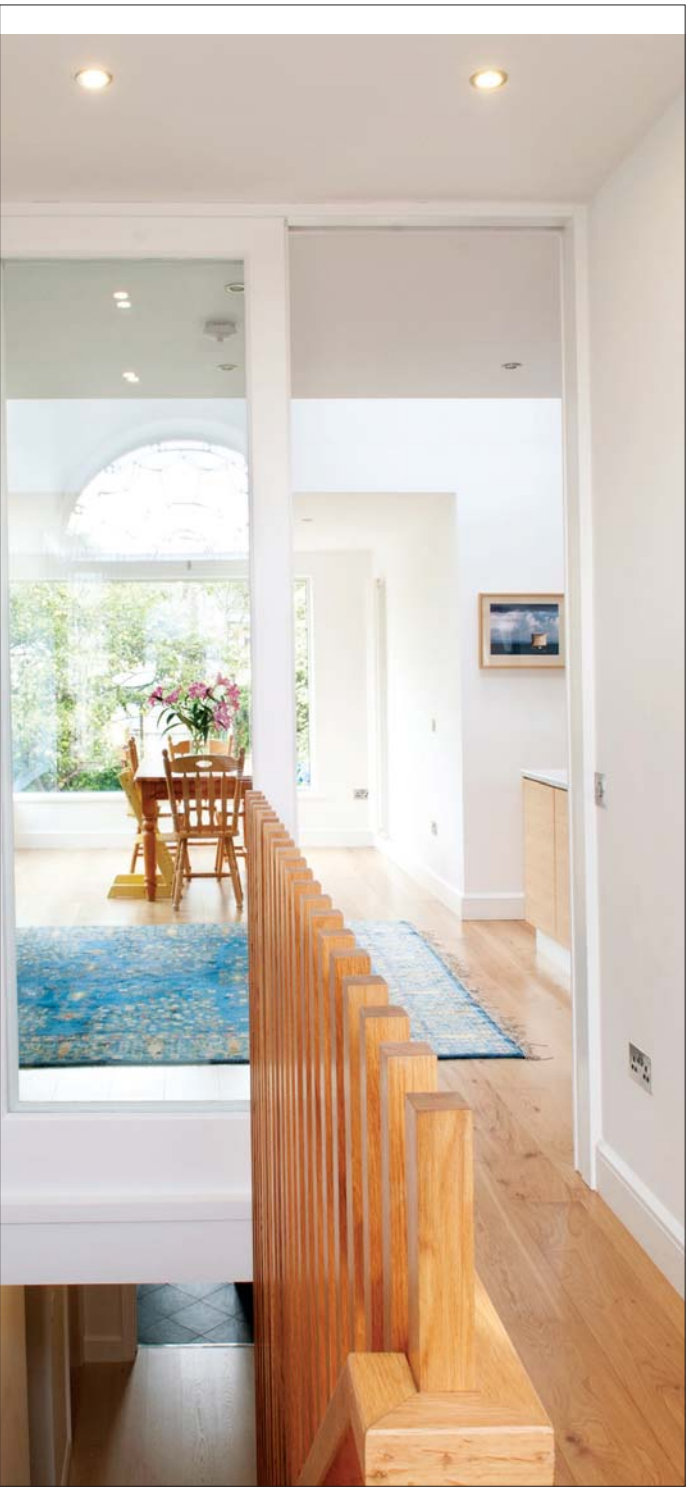
The agreed design response consists of a two storey contemporary, highly energy efficient extension in the form of two interlinking pavilions clad in black zinc with a plaster 'plinth' at the rear of a sensitively restored and upgraded existing building.

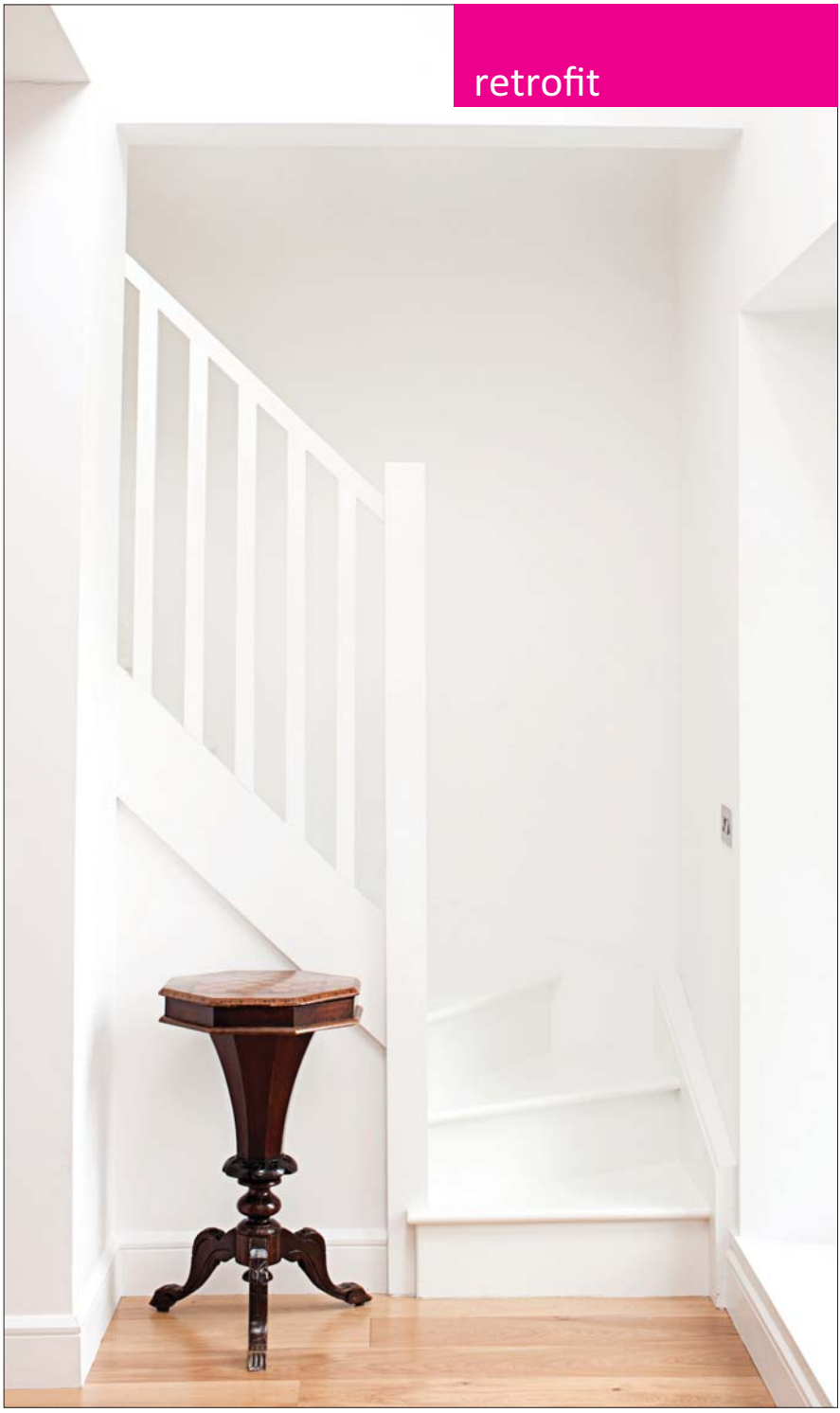
In the old part of the house, a void above the kitchen to the rear brings light deep within the plan of the building.

The new extension has a highly insulated, breathable external envelope. The repositioning of the internal stairs creates direct views of the garden from the front of the house.

The treatment of the new extension and the existing building

The approach to sustainability was to optimise passive measures by using appropriate levels of insulation and airtightness. It was only when these were optimised that we looked at active





(above) The inside of the house now has much brighter open-plan living spaces, and the white walls further help to reflect the light; (p78) the south-west facing garden was crucial to the new design and the internal layout was altered so that there is an unobstructed view of the garden from front to back

systems including solar hot water and heat recovery ventilation – passive measures were explored first. The new extension is therefore lightweight, contemporary construction – highly insulated and airtight using intelligent membranes to allow for breathability – with large glazed openings, optimising natural light and solar gain.

External insulation was not an option for the existing house. Passive interventions included internally fixed insulation to a carefully selected U-value so that it would not contribute to the deterioration of the building fabric in the future. We used natural quilt insulation materials, intelligent membrane and a breathable build-up. Great care was taken with detailing to avoid cold bridges, to achieve continuity of airtightness membranes, and to improve airtightness at the edges of existing windows. To the front, the sliding sash windows, fanlight and lime render walls of the external façade were restored with due sensitivity and care.

Selection of contractor

The selection of the contractor was critically important. A shortlist was prepared of contractors familiar with realising highly insulated and airtight new build and conservation projects. A set of comprehensive drawings, details and specifications was provided for complete clarity. A number of contractors were interviewed so as to establish their attitude and approach to sustainability and workmanship in regard to old structures.

Detailed pre-contract reviews with the lowest tenderer were undertaken to ensure that he was fully familiar with the design intent and standards required. This six month project was completed in May 2011.

Summary of completed building

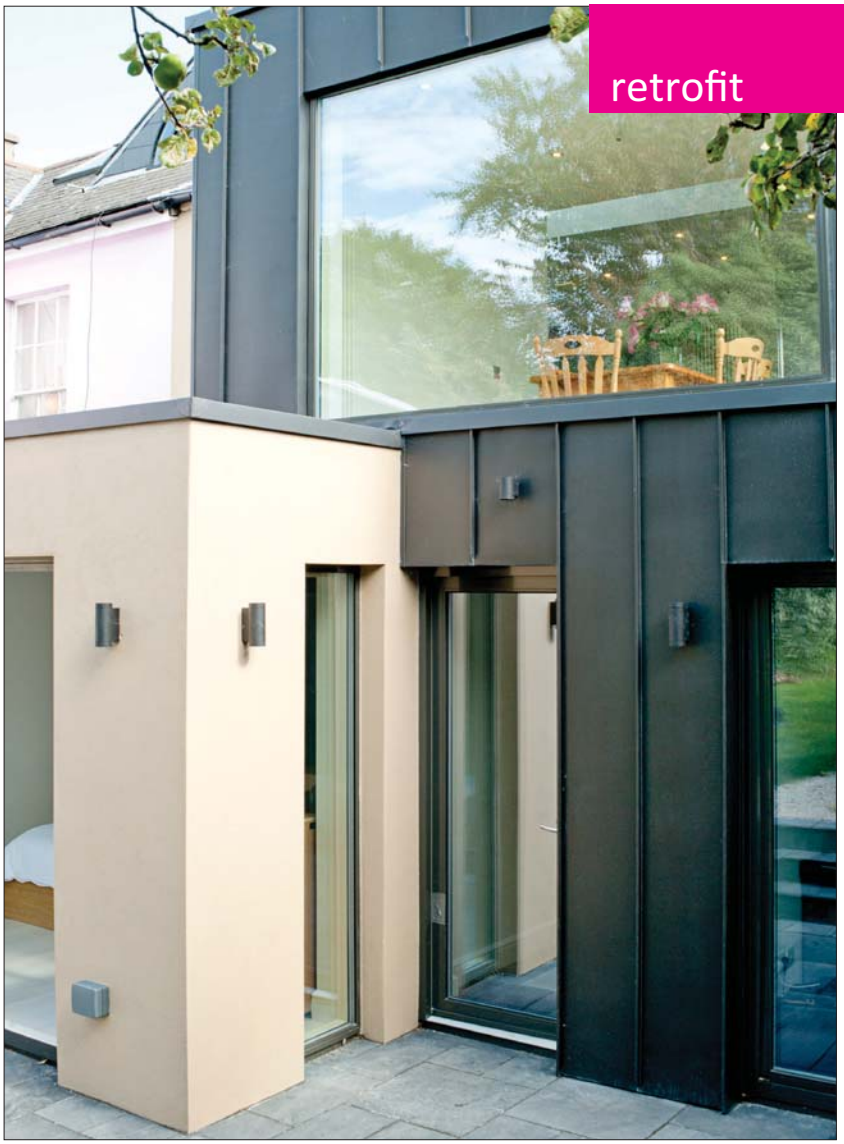
The building was brought from the lowly F-rating to a B1 energy rating, while the future addition of small area of solar panels will achieve an A3 rating. The completed family home is a healthy building, it is extremely well insulated and ventilated and has inherently low running costs.

There is a clear distinction between the old and new elements, with the new extension to the rear being distinctly contemporary. It sits well in its juxtaposition with the original house. The delicacy of that lightweight modern struc- ▶

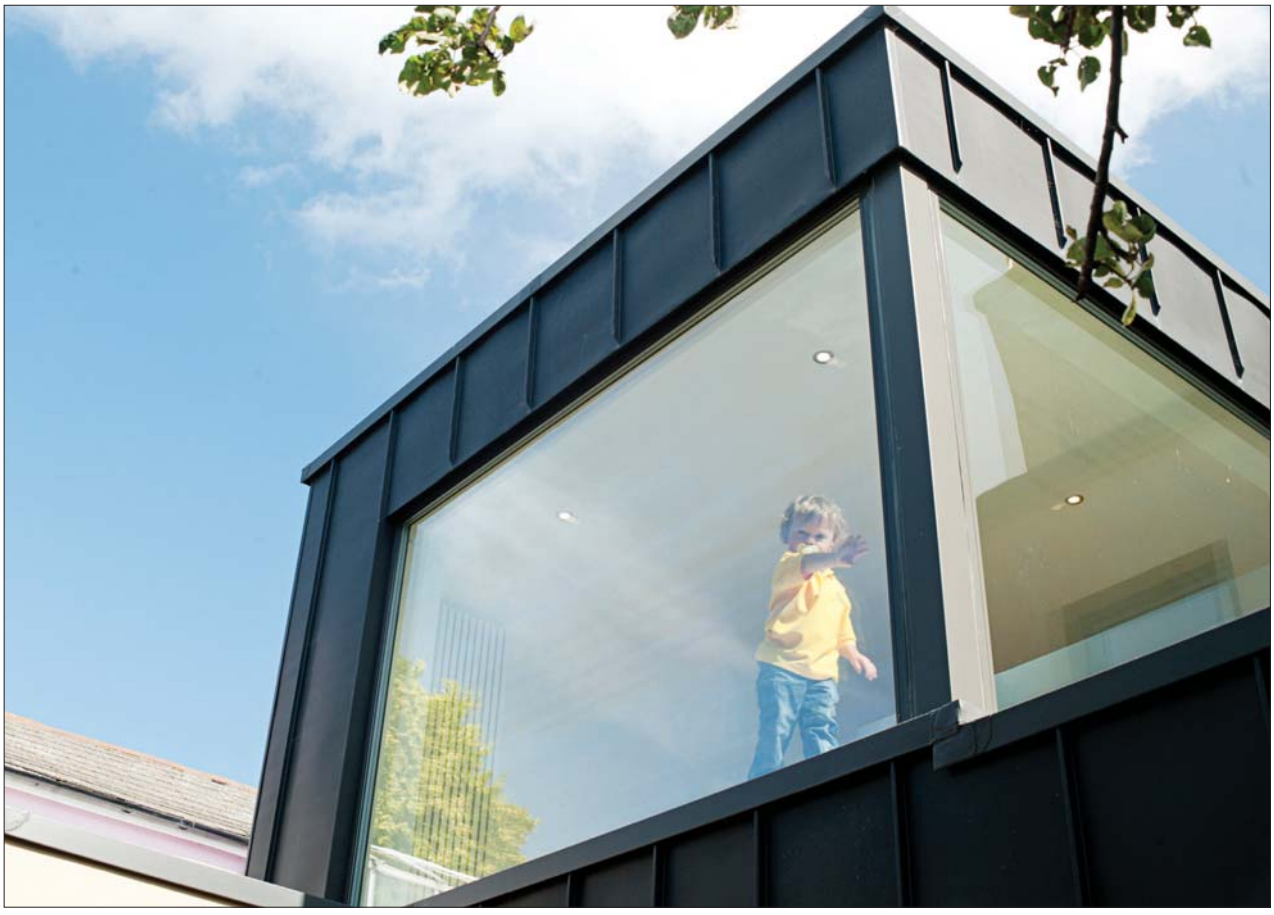
ture subtly counterbalances with the heavy masonry of the existing Victorian House. Toward the front of the house, the primary concerns were to do with conservation of the period elements that survived, and retaining the character of the street. There was a contrast in the rear where the work was ultramodern and about using the latest technologies to create a future-proof house. ▶▶

Selected project details

Clients: Conor O'Regan & Henrietta Senkowsky
Architect: Cooney Architects
Contractor: Butler Contractors Ltd
AnTherm/WUFI analysis: Integrated Energy
BER assessment: IHER Energy Services Ltd
Bonded bead insulation: KORE
Blown cellulose insulation: Ecocel
Insulated foundation system: Supergrund
Double-glazed sash windows: Callaghan O'Brien
Triple-glazing: Scandun
Airtightness products & insulation: Isover Ireland
Additional airtightness products: Ecological Building Systems
Heat recovery ventilation: ATC Electrical & Mechanical
Solar evacuated tubes & buffer tank: to be fitted



(right) The new zinc clad extension has an insulated, highly breathable external envelope and features large triple-glazed timber windows (below) which optimise solar gains



PROJECT OVERVIEW:

Building type: Victorian (circa1850) mid house, not a protected structure.
Location: Sandycove, Dublin

Budget: approx. €250,000

BER before: F (419 kWh/m²/yr)
BER after: B1 (86.5 kWh/m²/yr)
Energy performance coefficient: 0.695
Carbon performance coefficient: 0.606

Airtightness (after): 1.5 air changes per hour at 50 pascals pressure

EXISTING HOUSE

Original wall-type 1: 20mm external lime based plaster, 450mm stone/rubble walls, 20mm sand and cement internal plaster . U-value: 1.33 W/m²K

Original wall-type 2: 20mm external lime based plaster, 450mm stone/rubble walls, timber battens; Visqueen sheeting and plasterboard in very poor condition. U-value: 1.33 W/m²K

Upgraded walls with internal insulation. 20mm external lime based plaster, existing external type stone/rubble wall approximately 450mm thick, thermally broken metal walling system with 100mm quilt insulation laid in-between; intelligent airtightness membrane, 12.5mm non-foil-backed plasterboard, with all joints taped, sealed and skimmed. U-value: 0.31 W/m²K.

Original sloped roof over existing dwelling. Fibre cement slates externally, followed underneath by non-breathable felt, existing deteriorated timber rafters, plasterboard ceiling

Replacement roof with cellulose insulation. Natural slate system externally, on treated 25x50mm timber battens/counter battens, on breather membrane, on new 175mm timber roofing rafters with 175mm cellulose insulation, on 'intelligent' membrane taped and sealed for airtightness using Tescon tape, counter-battened services cavity with plasterboard skim finish internally. U-value: 0.16 W/m²K

Original single-glazed windows and doors. Overall approximate U-value: 3.5 W/m²K

New sliding sash windows (conserved): Slim line double glazing fitted with airtightness beading and striping. Overall U-value: 1.8 W/m²K

150mm concrete floor insulated with 100mm EPS insulation, on Platon tanking membrane

EXTENSION

Timber frame extension wall (first floor): external FlatLock zinc panel rainscreen, on two layers of 25x50mm treated timber battens (cross battened), on 9.2mm Panelvent sheathing board, on 200mm timber structure studwork with 200mm full fill cellulose insulation, on Isover Vario membrane taped and sealed for airtightness using Tescon tape, on 50mm services with Isover Metac insulation, on internal plaster finish. U-value: 0.13 W/m²K

Extension cavity wall (ground floor): external plaster finish, 100mm masonry blockwork outerleaf, 150mm cavity with full fill KOREFIll bonded bead thermal insulation, 100mm masonry blockwork inner leaf, internal plaster finish. U-value: 0.18 W/m²K

Roof over new extension with cellulose insulation: Trocal finish on underlay to Trocal specification by Reid Roofing, on 120mm fibreboard insulation, on 18 WBP plywood, on timber roof joist with 175mm cellulose insulation between joists, on 'intelligent' membrane taped and sealed for airtightness using Tescon tape, on counter battened services cavity with plasterboard skim finish internally. U-value: 0.14 W/m²K

New triple-glazed windows and doors with argon filling: timber with aluminium cladding. Overall U-value: 0.80 W/m²K

Supergrund insulated foundation system with radon membrane, 250mm EPS insulation, cast in situ concrete raft foundation, tiled floor finish. U-value: 0.15 W/m²K

HEATING

Original heating system: 40 year old oil boiler & radiators throughout entire building, with four open fires and chimneys.

New 95% efficient condensing gas boiler

Biomass stove: Chesney's 4kW Barrington wood burning only space heating stove

Ventilation: Vortice HR 400 heat recovery ventilation system. Heat recovery efficiency of up to 90% according to independent Sap Appendix Q database

Green materials used: recycled slate, fibreboard insulation, cellulose insulation, optima dry-lining system with Agrément certificate (WUFI and AnTherm analysis carried out), timber furniture from PEFC certified sources, Ecocem cement, Solitex breather membrane, Vario airtightness/intelligent membrane