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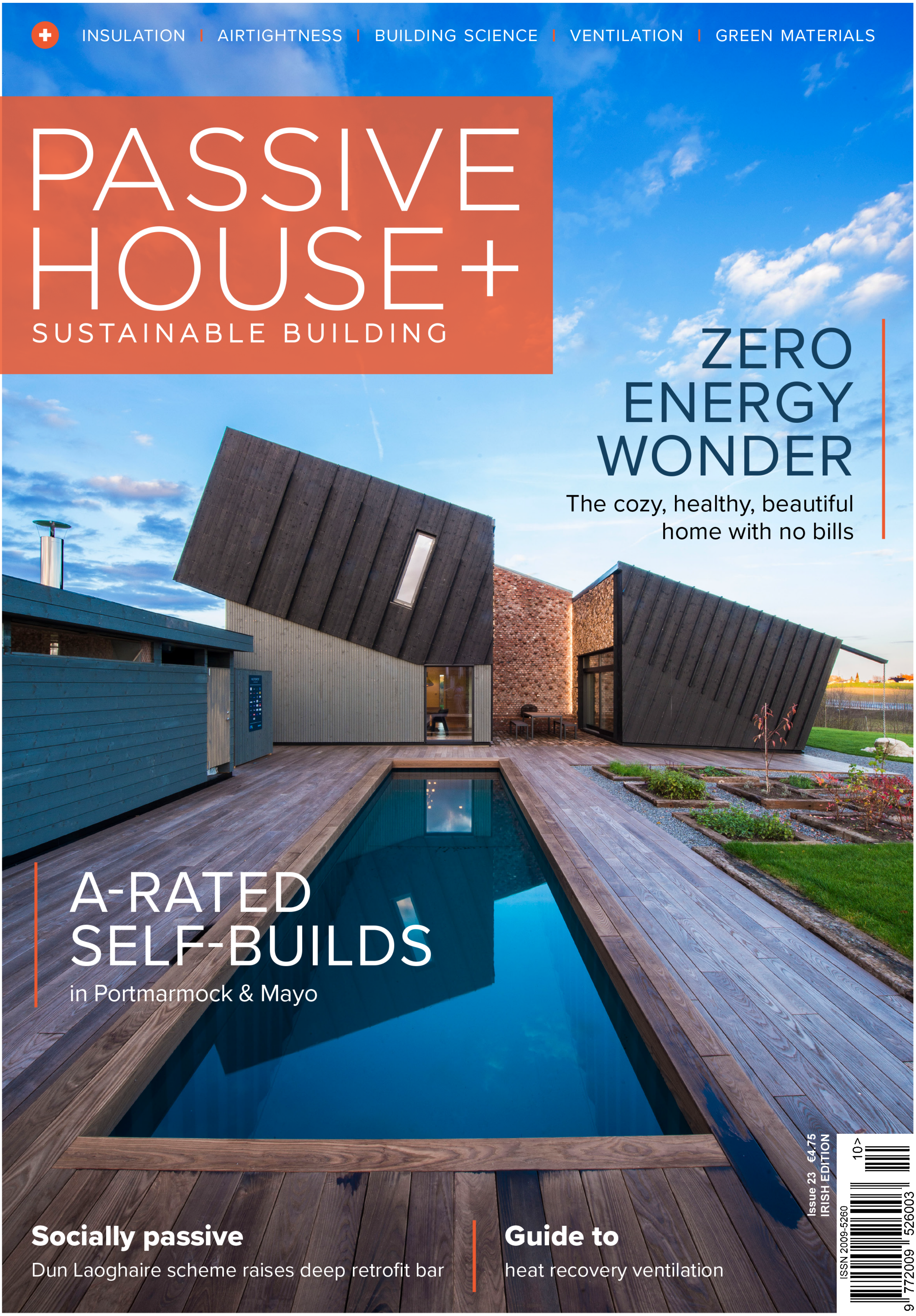
PASSIVE HOUSE+

SUSTAINABLE BUILDING



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THE RISE OF PASSIVE ARCHITECTURE:

The dawn of solar energy

In this coming series of articles, Dr Marc Ó'Riain will examine the history of sustainable, low energy and passive architecture during the 20th century and before, and take a look at some classic eco-buildings.

The body of knowledge that we draw on today in passive architecture comes from some ancient, and some more relatively recent precedents.

For example, the Roman architect, engineer and author, Vitruvius, recognised, as far back as 27BC, the way the ancient Greeks orientated their buildings to avoid overheating in summer and to capture solar gain from the low winter sun. Writing in the 5th book of 'De Architectura' (27BC), he recommended that designers should take "especial precaution that it be not exposed to the south; for when the sun fills the cavity of the theatre, the air confined in that compass being incapable of circulation, then is heated, and diminishes the moisture of the body". This clearly demonstrates an informed understanding of building physics and environment.

The Romans also used glass panes to accumulate heat inside a building from the low winter sun. So ubiquitous was this understanding of passive solar gain and orientation that the Romans passed laws to make "it a civil offense to block one's access to the south" Perlin (2000), perhaps the basis for England's 'ancient lights law' and the more recent Prescription Act of 1832.

The amassed knowledge of the Romans was passed down through master stonemasons and revived by the translation of Vitruvius' Ten Books on Architecture (De Architectura) by Cesariano in Italian in 1521, into French by Perrault (1673) and eventually into English by Shute in 1692.

These translations informed both a revival in classical orders and the education of the first academically qualified architects at l'École des Beaux Arts (1819). The lineage of environmental understanding in the discipline of architecture can be traced in an unbroken line to the Arts & Crafts movement.

Seminal exemplars like Broad Leys House (1898) embraced optimal orientation, with double height bay windows for light, a cantilevered balcony creating shading, the use of building fabric as thermal mass, placing service areas in the east of the house and having window sizes environmentally appropriate to room function. However, a disruptive paradigm shift in architectural practice in the 1920s would see the rejection of much of the amassed knowledge of building performance as architects embraced formal and compositional concerns.

Gropius & Meyer's Fagus Werks building (1911-13) broke with tradition with large unshaded thin curtain glazing, and brick and concrete fabrics acting as façade planes rather than supporting structures. The international movement and modernism would result in many environmentally dysfunctional buildings, many of them the exemplars of the paradigm.

The seed of a new interest in building energy performance can be traced to the contraction of Solar 1 at MIT in 1938/39. It would become the first building to be entirely heated year-round from solar energy. Boston businessman, Godfrey Cabot (1938), sponsored 50 years of research to convert "the energy of the sun to the use of man by mechanical, electrical, or chemical means". His proposal involved the use of flat plate sun collectors, with flat black metallic surfaces which would be covered by transparent insulators and heated by absorbing the sun's energy.

"To heat the building, a sun heat trap tilted at a 30-degree angle was placed on the roof under three layers of glass. The bottom of the box was fitted with a sheet of copper painted black, under which tubes ran. Water circulated through these tubes and then ran down into a metal tank located in the basement" (MIT 2017). "By the time Solar 1 was torn down in 1941... it had become clear that its heating system was effective but impractically expensive" (Levy 2017).

Over a sequence of test buildings, the engineers tested solar collectors on the roof, on the walls, in stacked black painted tin cans, using heat pumps, air circulating fans and various water storage configurations. Storage systems sometimes failed and once went on fire, and the second building lost heat dramatically through its fabric at night. Much like many active renewable energy systems research projects later in the 20th century, this project was solely focused on active solar energy as a solution, ignoring the ramifications of passive interventions for energy conservation in the building's design.

Oil prices fell after 1945, further undermining the economics of solar renewable research, but a small cohort of architects and engineers would continue to experiment with it through the 1950s and 60s. My next article will focus in more detail on the Dover Sun House of 1948. ■


The Tech

Today Deadline For Physical Exam

CAMBRIDGE, MASS., FRIDAY, NOVEMBER 5, 1946

PRICE FIVE CENTS

Oscar, Geiger Split On Outcome

Dormitory Board Votes Permanent Open House

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Flying Club Gets Another Cessna For Night Flying

Open Ground School To Show Action Films On Radio Navigation

More 'Shmoos' Demand Obeyed

J. P. Committee Plans Additional Ticket Sale

60 College Co-eds Will Give Show On Latest Fashions

Occupants Of Unusual House To Be Warmed By Sun's Heat

Nomination Forms Will Be Due Nov. 10

FIELD DAY SCHEDULE

(above) MIT student newspaper The Tech ran a story on Solar House II on 5 November 1946. Boston businessman Godfrey Cabot sponsored 50 years of research into solar power at the university.

Dr Marc Ó Riain is the president emeritus of the Institute of Designers in Ireland, a founding editor of Iterations design research journal and practice review, a former director of Irish Design 2015, a board member of the new Design Enterprise Skillsnet and has completed a PhD in low energy building retrofit, realising Ireland's first commercial NZEB retrofit in 2013.