



A Guide to Passive House Design.

Guidance Leaflet no. 06



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A Guide to Passive House design

This leaflet is a guide to Passive House design. It explains the 7 key ideas that make up the passive house approach to building. I also outline the benefits and point to some on-line resources for calculating cost benefit.

Greg Jackson is a certified Passive House designer with the Passive house Institute in Germany.

For further information, please contact us. We are more than happy to visit your site and discuss design options and our services.

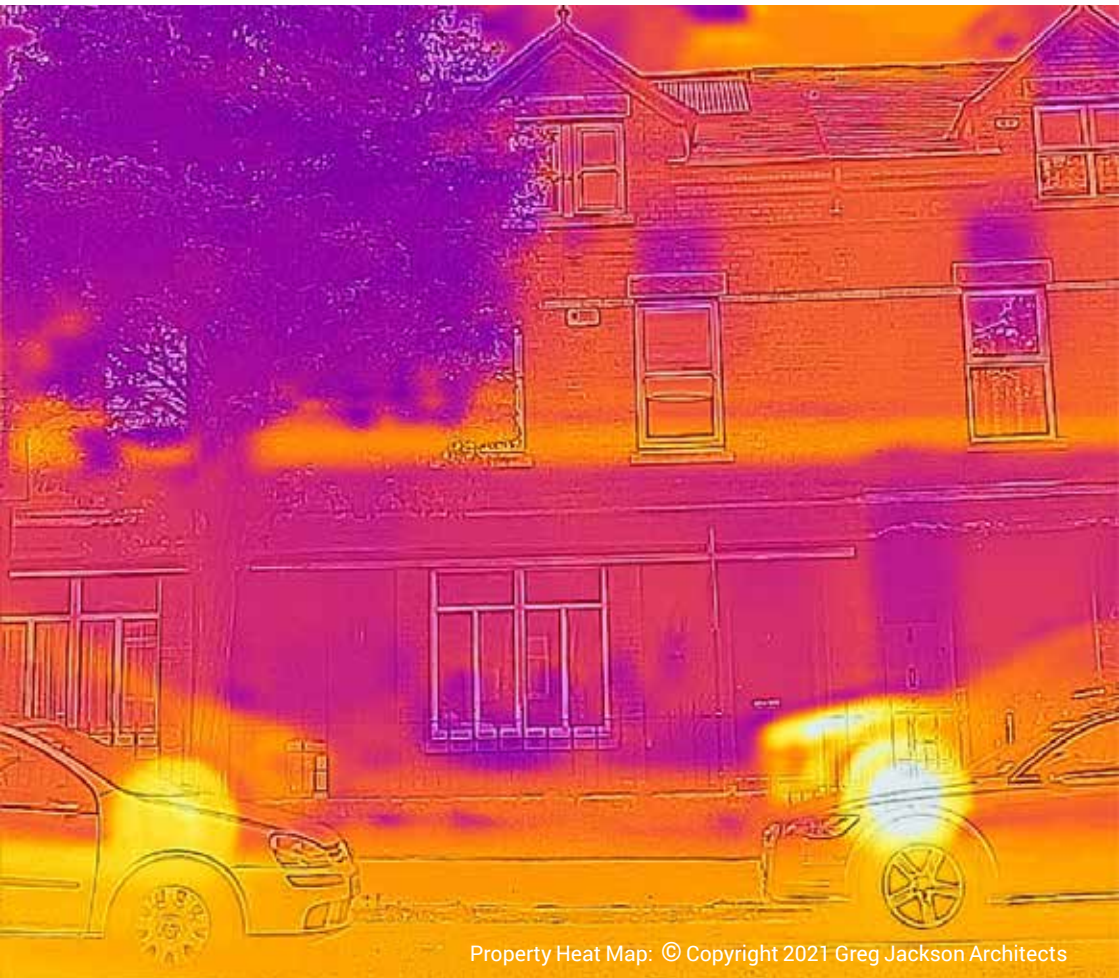
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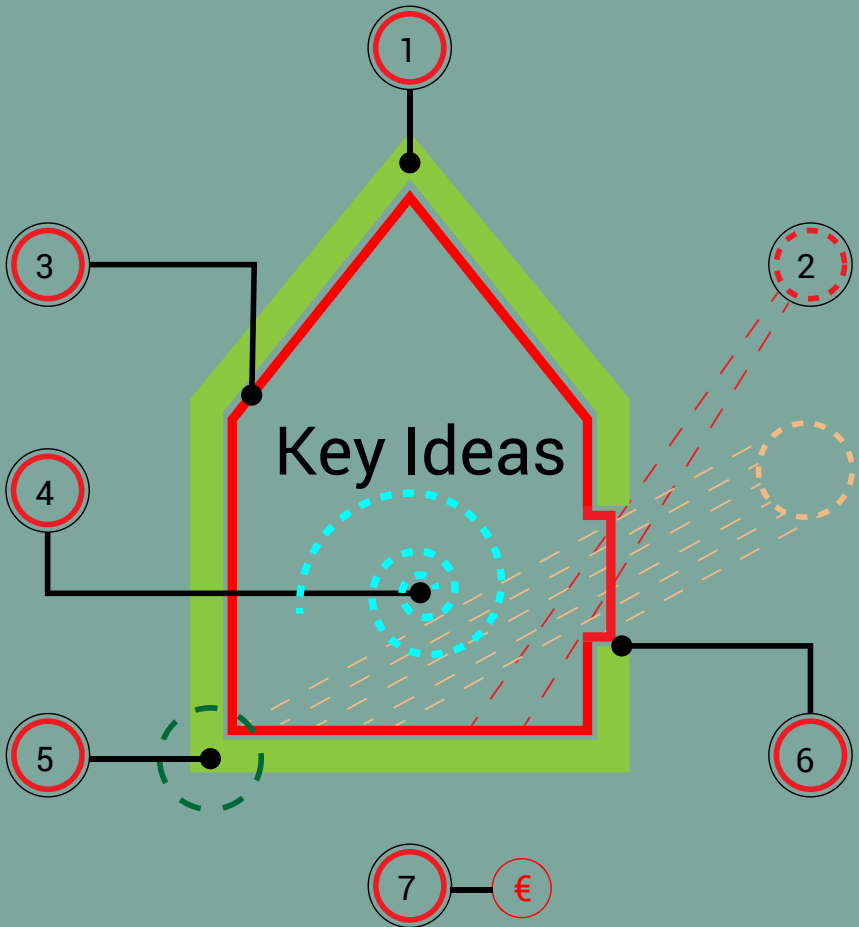


What is Passive House?

The International Passive House Association, based in Germany, describes a Passive House as a highly energy efficient building, which requires minimal heat energy to maintain a comfortable indoor temperature all year round. To achieve this, Passive house buildings use predominantly passive heat sources such as the sun's rays, the occupant's body heat and the energy generated by household devices. Thanks to the quality insulation, ventilation and passive solar gain design, Passive House homes remain comfortably warm on cold days and cool on warmer days.



7 Key Ideas that explain Passive House design



The 7 Key Ideas.

The following 7 ideas are at the heart of every Passive House

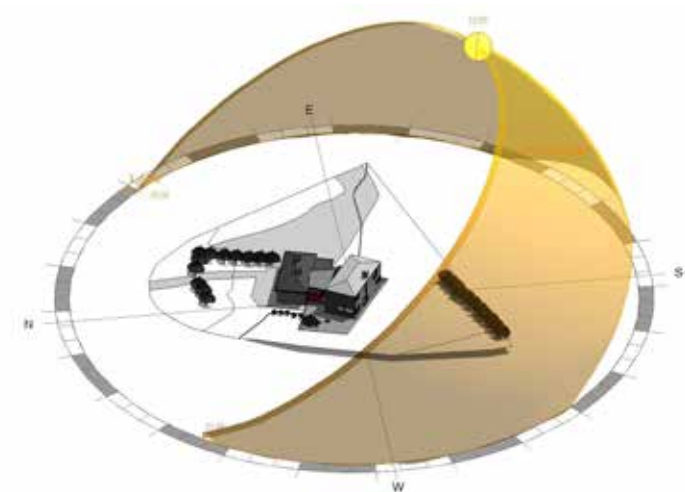
1. Super Insulated Envelope
2. Solar Orientation
3. Air-Tight Construction
4. Mechanical Heat Recovery & Ventilation (MHRV)
5. Technical Details to Eliminate Cold Bridges
6. High Quality Doors & Windows
7. Affordability

1 Super Insulated Envelope

A well insulated building envelope keeps warmth in during cold months and heat out during warmer months. Passive house walls have U-Values as low as $0.11 \text{ W/m}^2\text{K}$ while the 2019 NZEB national standard requires only $0.18 \text{ W/m}^2\text{K}$.

2 Solar Orientation

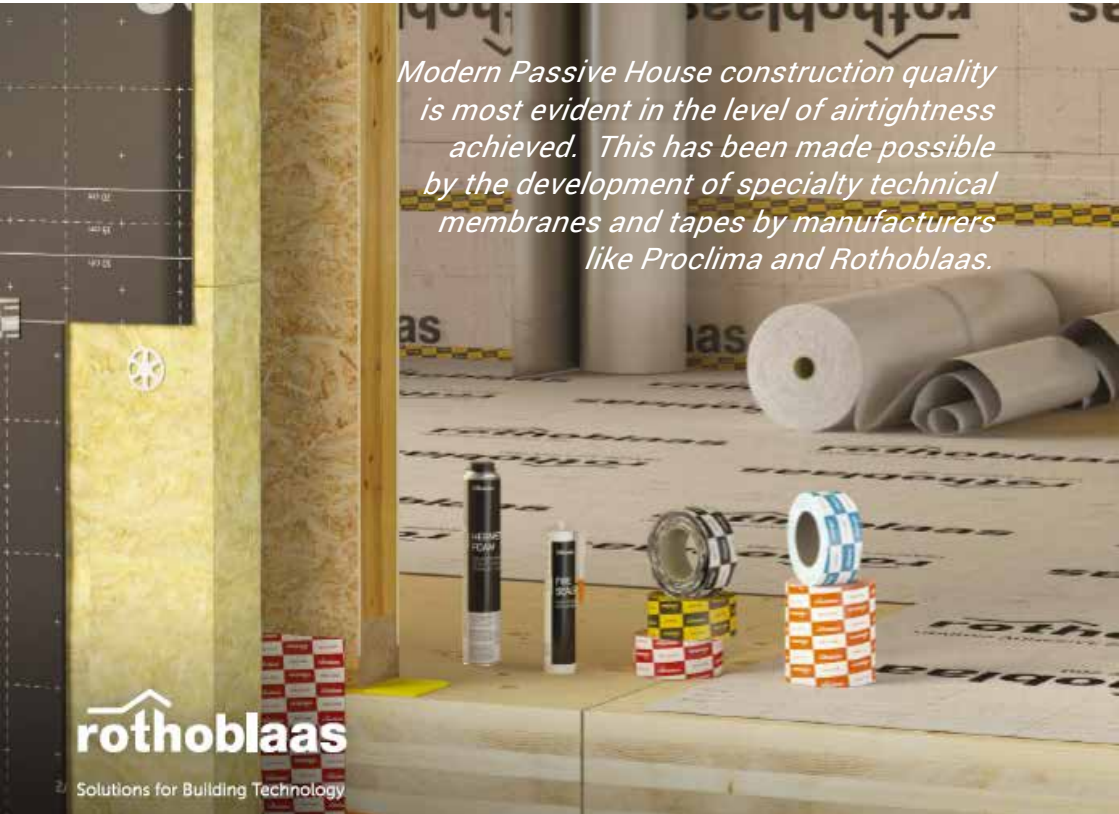
Passive Houses are designed to maximise energy gains from the sun. After all this is free heat. But the approach has to be nuanced to avoid solar overheating. A balanced is achieved through architectural layout, window size and layout decisions and shading strategies.



3 Air-Tight Construction

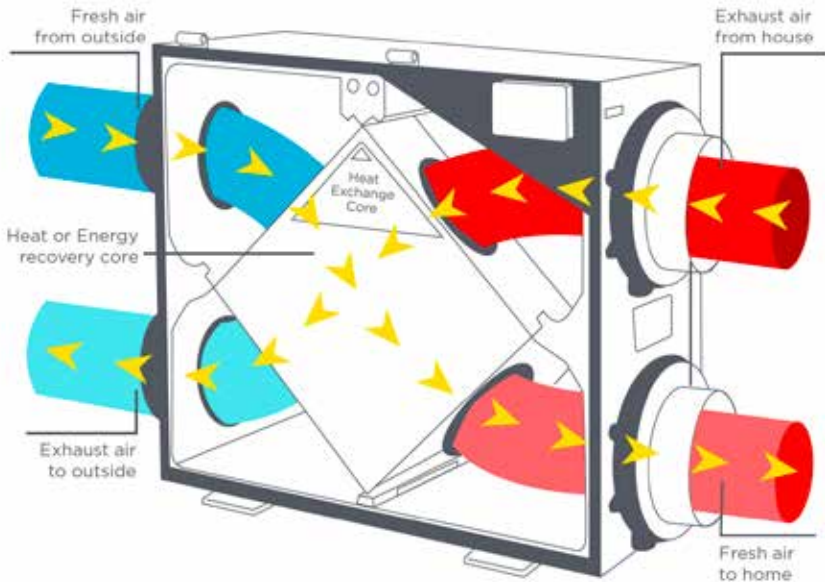
Passive Houses are designed to avoid leakages in the building envelope which boosts energy efficiency and eliminates draughts and moisture damage. When tested under pressure using a blow tester @ 50pa, a Passive House must barely exceed 1/5 air change per hour and will typically fare much better. The 2019 Irish regulations allows 1.39 ACH which is over twice that of a Passive House. At the same time Passive Houses are designed to exceed the 30m³/hr/person recommended threshold ventilation for a healthy indoor environment and meet or exceed the national standard for ventilation. But airtightness and ventilation should not be confused: Airtightness is a measure of build quality while ventilation depends on the mechanical or other system being used. A useful way to think about this is Airtightness removes unintended infiltration of air and moisture (draughts, cold etc) while ventilation then controls the amount of air permitted. Regrettably most houses are ventilated through the unintended infiltration caused by poor construction. This simply cannot happen with Passive House because the airtightness is tested through the construction stage.

Modern Passive House construction quality is most evident in the level of airtightness achieved. This has been made possible by the development of specialty technical membranes and tapes by manufacturers like Proclima and Rothoblaas.



4 Mechanical Heat Recovery & Ventilation (MHRV)

Why let all the heat vent from your house when you can reuse it. Mechanical Heat recover in Passive House ventilation systems removes the heat from the stale air being expelled from the house and transfers it to the incoming fresh air without any cross contamination. This provides plentiful fresh, pollen free air with maximum efficiency through heat recovery. Heat recovery efficiency can exceed 90% for Passive House certified systems. There are associated benefits for asthmatics and general benefits like reduced noise and pollution through not having open windows or vents. These mechanical ventilation systems have also become a trending topic in the fight against airborne virus' like Covid.



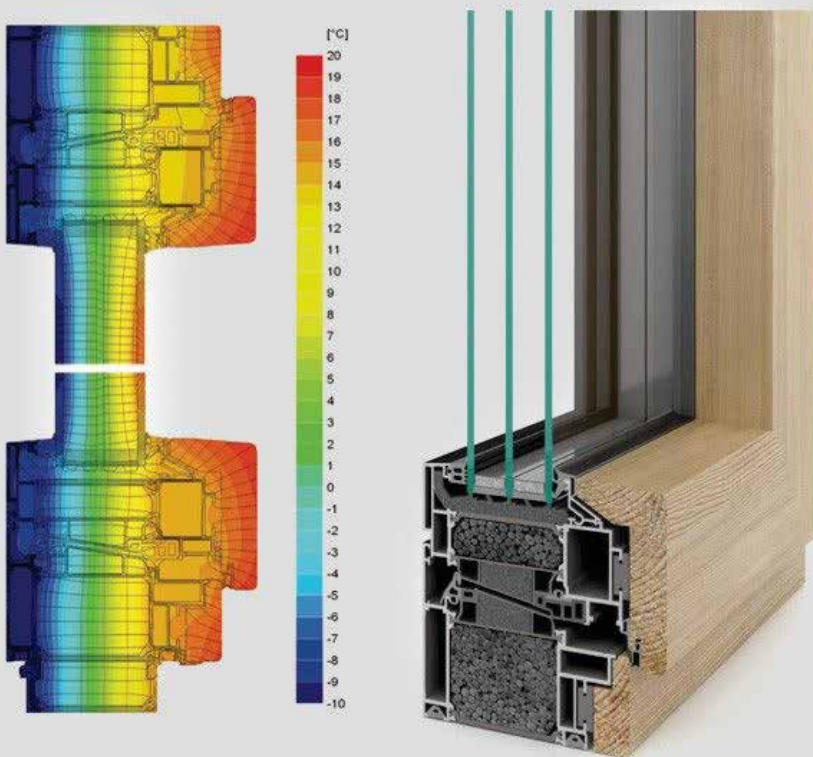
5 Technical Details to Eliminate Cold Bridges

Thermal bridges are weak points in the building envelope that allow heat transfer. The loss of heat is something obvious to avoid but less obvious is the problems they present through causing condensation both within the building and, more

critically, within the structure where it cannot be seen but can cause significant structural damage. Most of us have seen the bark patches on paintwork or peeling wallpaper internally around windows and doors. This is caused by cold bridges in the location where they are most common. When cold bridges are combined with poor airtightness it can cause considerable indoor discomfort and unseen damage. It is the job of the Passive house designer to design technical details that prevent this happening so as to create pleasant, even indoor temperatures with no cold spots.

6 High Quality Doors & Windows

Highly insulated windows play a part in the optimal use of the sun's energy. The window design in a passive house requires careful balancing of size, location and consideration of sun aspect and shading. Ireland has many Passive House window suppliers.



7 Affordability

At the centre of the Passive House ethos is affordability. We are looking for the most economically efficient way to achieve consistently high comfort. This has to be calculated both in build cost and running cost terms.

Passive House trades better insulation, airtightness and windows against considerably lower mechanical costs (there are no radiators, underfloor heating or gas boilers to install) while maintaining a minimum 21°C all year round. Uniquely these claims are backed by rigorous building physics post occupancy data as one would expect from a German standard.

To help you calculate some of the more complex cost-benefits we have developed some on-line calculators.

Our On-line Calculators

Calculating the benefits of Passive house is not easy. There are many variables. Some banks offer lower mortgage rates for high efficiency homes. Some benefits are gained in running costs rather than up front. How do you compare the options. We have developed a calculator that thinks of costs in terms of your monthly outlay. You pay a mortgage for the up front cost of your house and you pay monthly running costs. If you combine these you get a clearer picture for comparison purpose. You will find our calculator at www.gregjackson.ie/phcalc. I hope you find it useful but don't hesitate to contact me if you have any specific queries.

Greg Jackson. Architect and Passive House Designer.



Passive House Calculator

Passive House Comparison Calculator

www.gregjackson.ie/phcalc

For more information and further guides on planning, design, construction and architecture, visit our website at

www.gregjackson.ie/




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Greg Jackson Architects are a 'Housing First' design studio. We bring our expertise as registered architects, registered Passive House designers and certified Conservation Architects to provide housing, restoration and extension design, planning, certification and supervision services.

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