Low energy, low carbon and passive houses: A Consumer Guide

Over the last decade we have seen a significant change in the way we view energy use in buildings. We are much more aware now that reducing energy demand is the very first step in creating an energy efficient dwelling, whether it is already built, or yet to be built.

During the period of dramatic construction growth in the mid-2000's, the emphasis was very much on volume, as the demand for property was so high. However, following the implementation of the EPBD directive from Europe, the introduction of new building regulations and a growing appetite for low energy, low carbon and passive houses, the emphasis is now on quality, rather than quantity. It can still, however, be difficult for a consumer to decide which route to choose.

So, to explain first of all the differences between the different terms you might encounter :

- *Building regulations Part L : New houses must comply with the new regulations.*
- *An A-rated house is a low energy house (which has received an A rating using the BER methodology)*
- *A "passive" house is a house designed to have a heat demand which is as low as is practically achievable*
- *A low carbon or zero carbon house is a house that is responsible for little or no carbon emissions.*

What are the benefits of an energy efficient house?

Overview

Energy for heating accounts for around seventy five percent of the energy used in a "typical" dwelling. Simply by decreasing the amount of heating energy required and by making use of free solar and internal heat gains, it is possible to build a house that needs much less energy to run. Furthermore, as the energy demand of a house decreases, so do the carbon emissions, and renewable energy can then be generated on site (heat and electricity) to provide the tiny amount of energy required for heating and hot water, and feasibly achieve zero carbon emissions.

Note: the greater the amount of energy a house needs for heating, hot water, ventilation, lighting and appliances, the greater the carbon emissions the house is responsible for. Therefore, it is important when designing a low or zero carbon house, to first of all reduce the heat demand as far as is practically achievable, and then examine renewable and energy efficient heat options.

The Passivhaus standard (often written as "passive house")

The passivhaus standard originated in Germany, and has become increasingly popular in Ireland and indeed all over the world.

The main focus of the standard is to reduce the heat demand to such a level that conventional heating with radiators or underfloor heating is not required. In a passivhaus, all the heat required can be supplied through a mechanical ventilation system.

The other main feature of passivhaus dwellings is the use of solar energy. Large areas of highly efficient windows are installed on the south facing side of the dwelling in order to capture the free heating energy from the sun. In a passivhaus, the heating demand is so small that the free "passive" solar gains make up a huge proportion of the overall energy demand! Solar collectors are also used to provide "active" solar hot water and heat for the dwelling's remaining heat and hot water needs.

BER, The A-rated house and building regulations Part L

If you build a new house in Ireland, a Building Energy Rating certificate (BER certificate) is compulsory. In order to design an A-rated house, the BER method will be used during the design stage also, to ensure the dwelling design meets the desired rating.

A new dwelling must also comply with all parts of the building regulations, including the part of the regulations relating to energy use, Part L. In 2013, building regulations will require that all new houses are built to a carbon zero, or nearly carbon zero standard.

Keep the following point in mind when comparing an A-rated house with a passive house :

- *Because the method for verifying a house is "passive" differs from the BER method, the assumption cannot be made that a passive house is automatically an A-rated house. The BER method assesses heating, hot water, lighting and ventilation, whereas the passive design method includes all appliances in it's calculations as well as those covered by the BER method, but accounts for them differently.*

  In summary : When you design a new passive house, you still need to verify it's energy performance using the BER method.

However, the overall aim is to build an energy efficient house, with low associated energy costs and low carbon emissions.
Whether you are aiming for an A-rated, a passive, or a low-carbon house, the following features should be a priority.
In no particular order :

- High levels of insulation - *In the walls, floors and roof*
- Avoid thermal bridges – *When insulation is interrupted by a material with a lower insulating ability , e.g. where an internal wall intersects with an external wall, and the insulation is discontinued as a result, an easy path for loss of heat to the outside can occur, this is known as a thermal bridge, and should be avoided.*
- High levels of airtightness – *A major portion of a dwellings' heat is lost through air infiltration. As well as sealing the building during construction, it is important to also remember vents, electrical outlets etc. as air can leak through these areas.*
- Ventilation with heat recovery – *A well insulated, airtight house has a low heat demand, but occupants still need good indoor air quality. Mechanical ventilation is therefore necessary in such a house. A "heat-recovery" exchanger can also be added to the system to capture the waste heat from kitchens, bathrooms etc. that would otherwise be lost to outside.*
- High performing windows and doors – *Minimise glazing on northern side of dwelling, maximise southerly glazing to capture free solar gains available. Doors and windows should be well sealed and have a low U-value (note : low U-value = high insulating ability)*
- No open-fire chimneys – *Chimneys are a significant source of heat loss. "Room-sealed" stoves are available (i.e. with a dedicated air supply and flue directly to outdoor), so that the airtightness of the dwelling is not compromised. (See consumer guide on wood-stoves).*
- Low energy lighting – *Electricity from the grid is produced from a variety of sources, including fossil fuels. When we use one unit of electricity, approximately two and a half times that amount of energy is needed in order to produce this unit, and this unit is also responsible for over half a kilogram of CO_2 emissions! The overall energy required is known as "primary energy". Using low energy lighting will reduce the primary energy use and reduce the resulting CO_2 emissions.*
- Efficient DHW system with solar thermal – *In a low-energy dwelling, because the heat demand is so low, energy required to produce hot water makes up a large proportion of the overall energy requirement. It is important, therefore, to install an efficient hot water system , and if suitable, use solar thermal collectors to provide a renewable contribution to hot water production. In a fully passive house, where the heat demand is negligible, a solar collector installation can contribute significantly to the heating of the dwelling, which, as mentioned earlier, is provided entirely through the mechanical ventilation system.*

Some Questions

In a self-build situation, decisions can make or break the project. You will certainly need professional guidance, and it is strongly suggested that you engage the services of an architect or suitably qualified building professional. The RIAI keep a list of Irish architectural practices who specialise in low-energy and passive house design. This is a good place to start. www.riai.ie
The BER registered assessors list is also a useful resource when searching for suitable professional guidance : www.seai.ie/BER

The following questions (and many more) commonly arise, and need to be discussed with a suitable building professional :

- What insulation material should I use, and how much insulation will I need? *When designing a low-energy dwelling, there is an array of options to choose from. A building professional will advise on a suitable insulation value (U-value) to get you to your target (e.g. A-rated, or "passive") and then will specify the most appropriate insulation material to provide this level of insulation..*
- How airtight should my dwelling be? *In older houses, no mechanical ventilation was required, as airtightness levels were low. If you intend building a low-energy house, airtightness levels must be high. If not,, then as well as having unacceptable heat loss through air leakage / infiltration, a mechanical ventilation system with heat recovery will not be of any benefit.*
- Should I use double or triple-glazed windows ? *A suitable balance between U-value (insulation value of the window) and heat gain (as windows also allow free solar heat gains in to the dwelling) is required. This needs to be specifically calculated for every dwelling.*

N.B. The SEAI guides on designing to the passive house standard are recommended reading: www.seai.ie/Renewables/REIO_Library/
For more information on low energy and low carbon buildings , email : renewables@reio.ie or call 023-8842193
Visit www.environ.ie/en/TGD for all technical guidance on the building regulations, visit www.seai.ie/ber for information on the BER. Visit www.nsai.ie for : Window Energy Performance database, airtightness testers database, insulation database

Sustainable Energy Authority of Ireland, Renewable Energy Information Office, West Cork Technology Park, Clonakilty, Co. Cork.