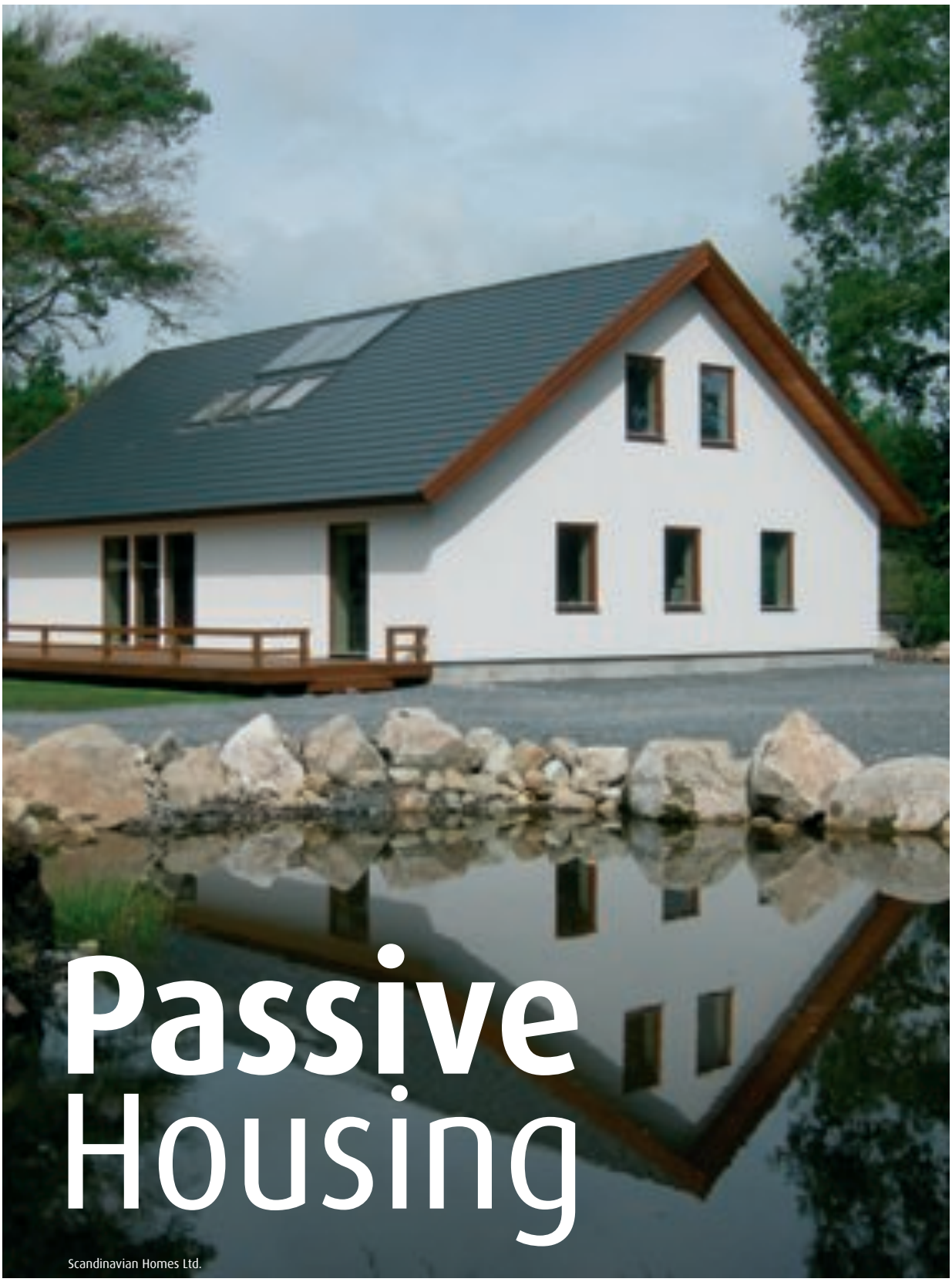

Passive Housing

Scandinavian Homes Ltd.

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A wide bodied house works well with a passive specification.

Near passive house with stove & large windows to South. Protected from high summer sun by proper roof detail.

Low-energy houses.

Low-energy houses have been around in Ireland for more than 15 years. In the early days, these types of houses were considered very radical and in general people were quite sceptical. The emphasis is for energy-efficiency in both fabric and systems; high levels of insulation and an airtight building envelope in conjunction with ventilation heat-recovery systems and triple glazed low-emission-argon filled glass are important factors. A cost efficient approach to building a low-energy house is also one of simplicity. The designer must be aware of the negative implications of complex architectural shapes. Some features might be culturally correct and fashionable - but be aware of their energy consequences. Dormers, roof-windows, bay windows, long and narrow extensions to the main body, split-levels are all examples of features that cost energy in practice.

The necessary components of a building should be optimized for low energy losses.

- The building envelope: shape and orientation.
- The windows and doors: performance and orientation
- The ventilation-system: performance ▶

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Dormer windows, bay windows and irregular shapes are not suitable for passive or any energy efficient house

IJM

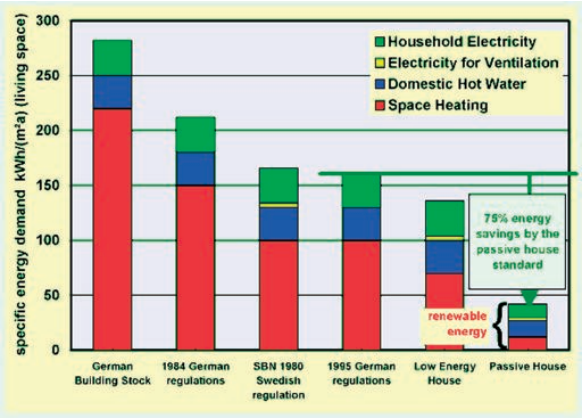

Diagram - Energy Demand

Many standard houses can be described as "low-energy" because they have lower energy consumption than the norm, but this is not passive housing. By optimizing these components further to the point where space heating is no longer required, as in a passive house, yields savings throughout its lifetime that help finance the extra costs of the improvement in the energy performance.

What is a Passive house?

A passive house is "a house in which the space heat requirement is reduced by means of passive measures to the point at which there is no longer any need for a conventional heating system; the air supply system essentially suffices to distribute the remaining heat requirement" *(The Passive House Institute)*. Super-insulation, absolute air-tightness, elimination of all cold bridging combined with a heat-recovery ventilation system, are the key elements.

The U-values of the exterior building components generally range between 0.1 and 0.15 W/m2C, with the fabric acting as a 'thermal store'. When these elements are combined to the point where their efficiencies remove the need for a conventional heating system, then you have a passive house. The standard has been named "Passive House" because the passive heat inputs – delivered externally by solar irradiation through the windows and provided internally by the heat emissions of appliances and occupants, coupled with the components outlined above – are sufficient to keep the building at comfortable interior temperatures throughout the year. It is a part of the Passive House philosophy that efficient technologies are also used to minimize the other sources of energy consumption in the building, notably electricity for household appliances and lightning. The extra costs of these are covered by the capital saved from buying, installing, fuelling and maintaining a heating system.

61-73.indd 64 5/10/06 17:10:42

Jotul Wood Burning Stove Sean Murphy heating

Passive house is the term mostly used and originally coined by the German Passive House Institute, but this type of house can also be called: Zero-energy house, Body-heat house, House without Heating. *A passive house is a building in which a comfortable interior climate can be maintained without active heating and cooling systems. (Adamson 1987 and Feist 1988)*

The criteria for a Passive House per m2 living area are:

- Max. 10 W/m2 constant heating-load
- Max. 15 kWh/m2yr annual space-heat requirement
- Max. 42 kWh/m2yr annual total amount of energy input

Apart from the building envelope being particularly efficient, passive houses are also solar houses with high performance windows. They must provide the necessary daylight, but also approximately one third of the heat demand. Triple glazed and super insulated because these allow in more solar radiation than they lose, the majority of the glazing should be south, east or west with only a minimal amount to North.

In addition to space heating, solar energy is also used to provide hot water.

What this adds up to in practice is a marked improvement in comfort level and a dramatic reduction in energy bills. ▶

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A few large fixed windows in direction SSW for optimized passive solar gain.

Get everyone on board

Amazing reductions in energy demand and the economic advantage of extremely low running costs are the obvious plus-factors for the passive house concept. There are ecological benefits as well. At the initial planning stage careful consideration must be given to every detail, no matter how small, of the building. Additionally, the physical performance, as well as the environmental impact, of all the materials used is analysed. Thus the passive house represents the most consistent approach to sustainable building today. During construction, the passive house concept requires quality workmanship resulting from a good understanding of the passive principles by everyone involved. Although sometimes doubting at first, this inclusive approach is usually appreciated by the workmen and tends to increase their motivation and work satisfaction as a result.

Will the number of passive and low-energy houses rise dramatically in the coming years? In Germany, experts predict a substantial development in the passive and low-energy house market. In a survey done in 2004 among 180 architects, engineers and house-manufacturers, it was estimated that on average, nearly every fifth new building will be a passive house, and every third, a low energy house by the year 2010. In Sweden all houses built since 1985 are "low-energy" houses; Ireland is slowly starting to move in a similar direction.

Drawbacks?

With low or virtually no heating costs, increased comfort levels and no longer caught on the bandwagon of regular increases in the price of fossil fuels, there are few reasons not to build all new houses to the Passive house standard, provided that the building costs are manageable. ▶

61-73.indd 66 5/10/06 17:12:55

A frame with extra glass can be added to standard roof windows to reduce heat loss.

No windows in northern gable to minimize heat-losses.

61-73.indd 67 5/10/06 17:13:16

Well insulated fabric

The identified drawbacks are few. External condensation occurring on the triple glazed super energy glazing in the morning. Some people will miss the traditional fireplace, and some people do not like the complete silence in Winter; no noise from the wind or birds singing can penetrate the layers of insulation. ▶

In a passive house the efficiency of the heat recovery unit must be over 80%. Be aware of the quality

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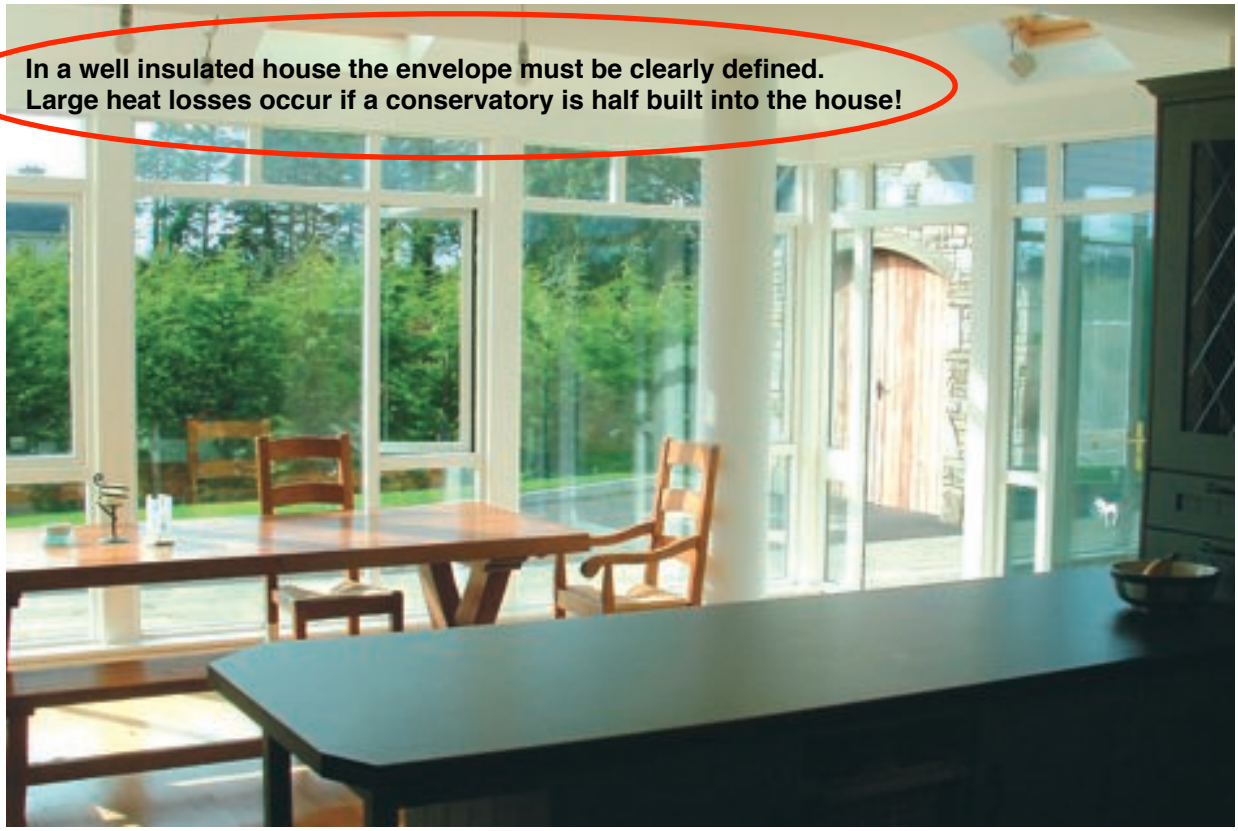

Robert Scott Architect

Wood Burning Stove Charnwood Compton

Because of the need for solar gain, this is a factor in the design process, one that can and should be used to advantage.

Almost, but not quite

If you just cannot live without a stove in the house a lower specification for the roof insulation and a lower ambition level for the air-tightness is allowed, these houses are termed "near-passive".

Then there are many houses that make use of solar gain and are well insulated with heat recovery ventilation, but these are not 'true' passive houses.

It's easy to become confused because there are so many terms to keep track of. How many people know the difference between: 'U' and 'K' values, kW and kWh, heat energy rating and primary energy requirement? Passive-house concept and Minergie concept? The term "passive house" could easily be hi-jacked into a catch- phrase to promote all sorts of products, just like the phrase "fat free" is used to sell sugar coated breakfast cereals! If you really want to live a sustainable lifestyle, start the way you mean to continue and think seriously about building a passive house.

Prepared in association with Lars Pettersson of Scandinavian Homes Ltd., Moycullen, Co Galway www.scanhome.ie
Passive House Institute (some pages in English) www.passiv.de

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SBER

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