The A-Rated Energy Efficient Concrete Home

Set for life

www.irishconcrete.ie

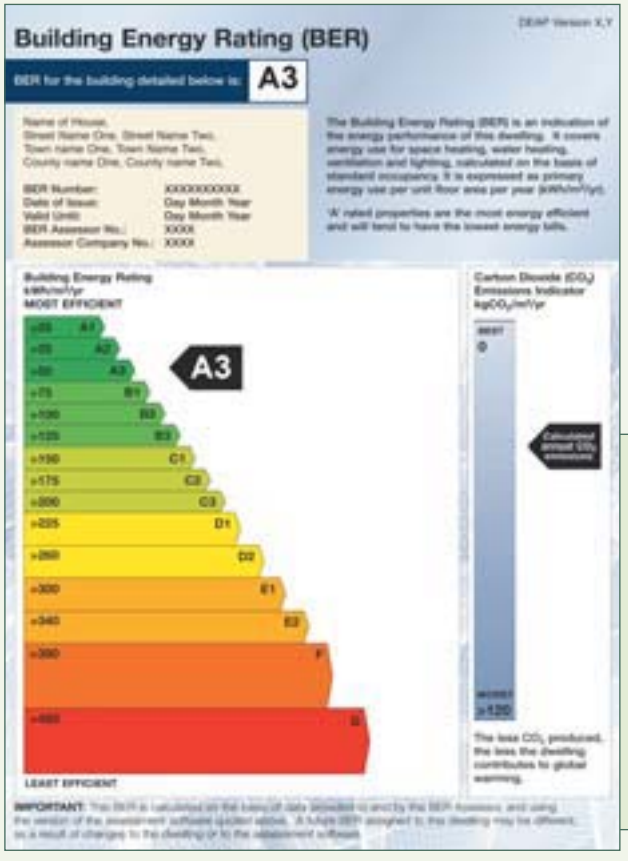
April 2009

02

Building Energy Rating and Certificates

In the European Union, the introduction of labels showing the energy ratings of domestic appliances has made people more aware of energy consumption in use.

Many people will pay more at the outset in order to reduce running costs and improve environmental performance over the appliance lifetime. This has resulted in improved energy performance of household appliances, as manufacturers respond to market demand.



The EU now hopes to achieve similar outcomes in respect of buildings. The **Energy Performance of Buildings Directive** requires **calculation of energy performance** for all buildings, and when a building is constructed, sold or rented, it is obligatory to provide a Building Energy Rating (BER) Certificate as part of the content documents.

The BER rating is an estimate based on a standardised assessment procedure, which makes many assumptions regarding how the dwelling will be used. It is expressed in kilowatt hours of primary energy used for space and water heating, ventilation and lighting, per square metre of the building, per year. An estimate of the carbon dioxide emitted, in kilograms of carbon dioxide per square metre of the building per year, is also made. Provisional ratings may be issued for buildings at the design stage, which are amended after construction is complete. Building Energy Rating is a theoretical exercise. In reality, people use widely varying amounts of energy in identically designed dwellings.

Primary energy is made up of not only the energy used in the building for light, heat and other purposes, but also the energy consumed in generating and distributing the electricity, gas, oil or other fuel. In Ireland, BER performance bands range from A1 (the most efficient level) to G (the least efficient). An A1 rating is achieved where the primary energy used is between 0 and 25 kilowatt hours per square

The increasing cost of energy, and growing concerns about carbon dioxide (CO_2) emissions from fuels burned for heating, cooling, lighting and other services, have prompted stricter regulation of the energy performance of buildings in many countries.

From 1st January 2009 all Buildings (dwellings and other buildings) when offered for sale or letting require a BER Certificate.

The illustration shows a "Master Version" of the Building Energy Rating Certificate.




metre per year. This is a very high standard. A2 and A3 ratings are where the dwelling has a primary energy consumption of 25 - 50 and 50 - 75 kWh per square metre per year respectively.

The 2008 revisions to Part L of the Building Regulations has amongst other measures, required that new dwellings achieve B1 or better. It is envisaged that proposals for further amendments in 2010 will increase this requirement to A3.

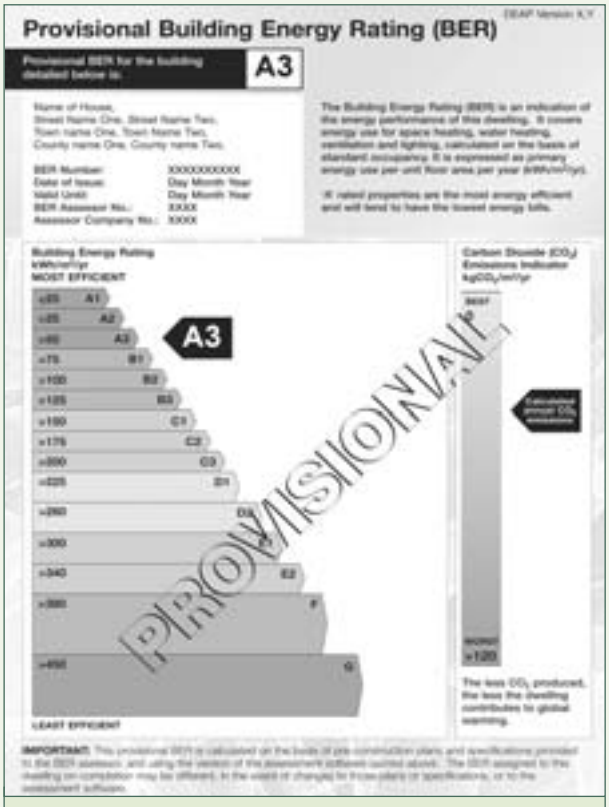
THE DWELLINGS ENERGY ASSESSMENT PROCEDURE

The energy which a building uses derives from its performance in a number of areas. These include not only design and construction but also the energy source, living habits and dwelling occupancy. Sustainable Energy Ireland has developed a **Dwellings Energy Assessment Procedure** (DEAP) in connection with energy labelling regulations and also Building Regulations.

The calculations are based on a **standardised use of a new dwelling** in order to enable sensible comparisons, people are assumed to live in a standardised way. The calculations consider:

- Heat loss as a function of dwelling shape and size;
- Heat loss through floors, walls and roof, taking insulation into account;
- The thermal mass of the construction: heavyweight, lightweight, or in between;
- Windows, roof lights and external doors;
- Ventilation;
- The type of fuel used for both space and water heating;
- Boilers, radiators, fans, lights, etc., and their respective efficiencies.

The calculations give two results. The first, in **kilowatt hours of primary energy per square metre of building per year**, gives the building energy rating (BER). The second, in **kilograms of carbon dioxide per square metre of building per year**, is shown on the BER Certificate and is also used for Building Regulations calculations. (For advice on energy and the Building Regulations, see p.10.) The two results are related, but are not proportionately connected. Renewable energy sources such as wind generators and solar water heaters can significantly reduce carbon dioxide emissions while delivering energy.



Where a new dwelling is for sale or letting on the basis of plans and specifications, a provisional BER certificate and related report is produced. After construction is completed, this provisional certificate is replaced with a BER certificate, which takes account of any changes implemented in relation to the design. The illustration shows a model of a Provisional Building Energy Rating Certificate.

04

Designing and Building an A-Rated Home

Many people will want an A-rated home, even though it's a voluntary measure. Whether buying or renting, and whether for comfort, financial saving or environmental well-being, the advantages are clear - a home is a lifetime investment!

Dwellings, whether detached bungalows, terraced houses or apartment blocks, are built from many different materials and systems. Concrete is used in all of them; from the foundations to the ground floor, the external and internal walls, concrete suspended floors, up to the roof tiles. But dwellings built just to comply with the 2008 Building Regulations will not achieve an A-rating without some additional measures.

Starting with a house built to comply with the 2005 Regulations (likely to be a C1 or B3), several improvements are required to meet the B1 Rating (2008 standard) and several more to achieve A3 (likely 2010 standard). This is true of all construction, whether precast or in situ concrete, standard or autoclaved concrete block, timber or steel.

In achieving an A-rating, energy performance will improve in many areas. BER assesses not only insulation and U-values, but also thermal mass, air tightness, window glazing and size, boiler performance, fuel type, light bulbs, and more. Taken together, small changes in many of these make a big impact. While there is always room for futuristic design, many A-rated homes need not look very different from what's being built currently.

The **first steps to an A-rating are simple**. Their order of priority is not absolute. Different designs respond better to different changes. However the list includes many straightforward and inexpensive measures, which will not impact on lifestyle.

With the high levels of thermal insulation in an A-rated home, heating in summer months will be an important consideration. Heavy buildings absorb solar gains better, and can stay at comfortable temperatures for longer than lightweight buildings. Concrete homes can uniquely benefit from having **medium or heavy thermal mass**.

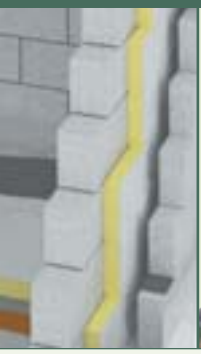
Apart from improving summer comfort, they can reduce the need for cooling, thus improving energy performance. Alternatively, if rapid heat build-up is desired, insulated dry lining to the inside face of concrete block walls can be highly effective.

STEPS TO ACHIEVING AN A-RATED CONCRETE HOME

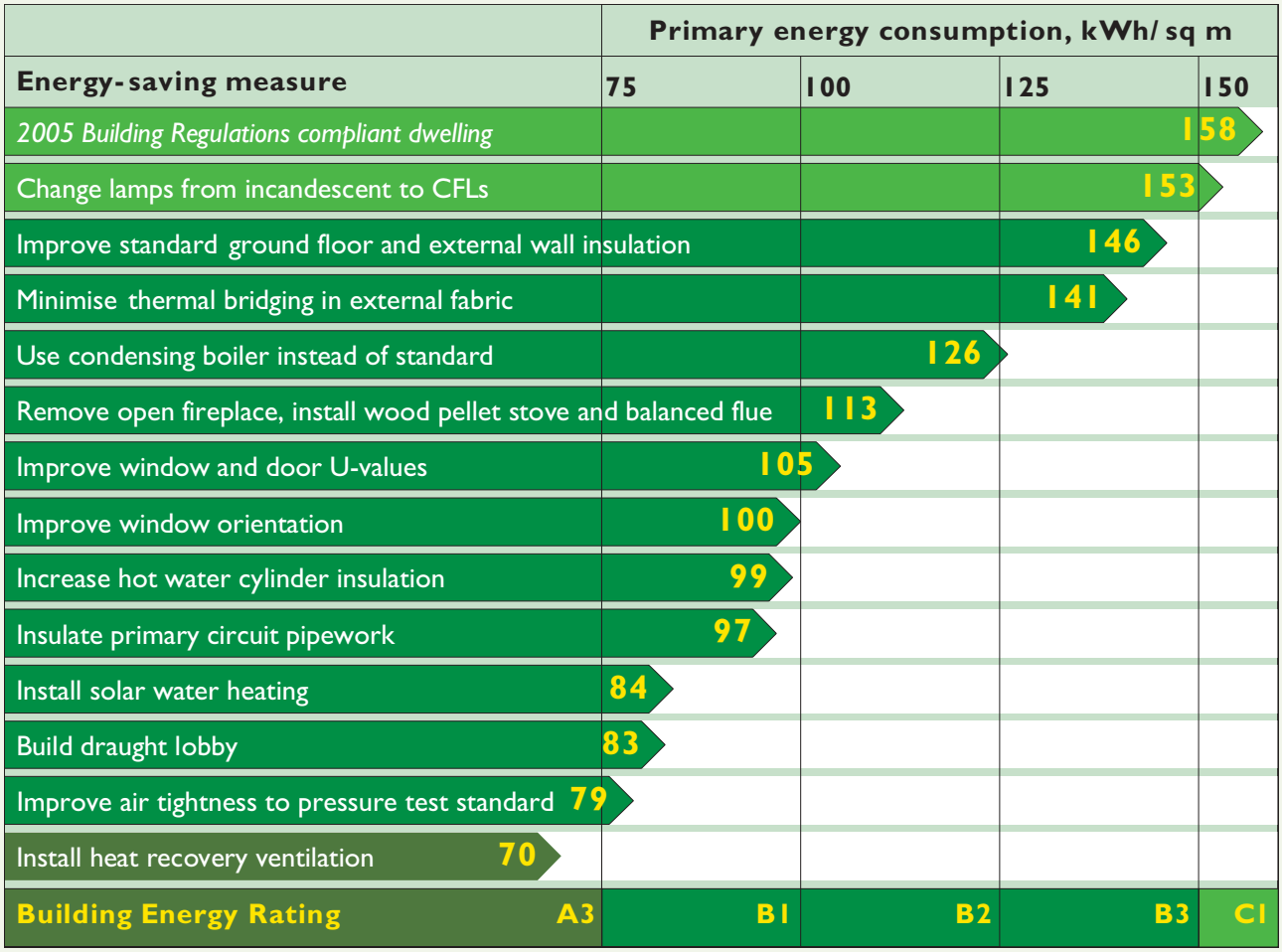
The energy savings from different conservation measures vary, depending on the dwelling type - bungalow, terraced house or apartment; size - large or small; design - compact or open plan, heavy or medium thermal mass. Furthermore, the savings from any given measure vary depending on the exact set of measures implemented (see pages 6 to 9).

Independent[1] study for the Irish Concrete Federation, shows a cumulative **improvement in energy performance of over 50%** for an A-Rated house over a typical 2005 Building Regulations dwelling. Improving a Building Regulation compliant dwelling to an A-rating will typically reduce primary energy consumption from around 150 kWh/m^2/yr to less than 75 kWh/m^2/yr.

Some improvements are more cost effective than others. Energy efficient light bulbs always win. However, planning a layout for good passive solar performance must be done at initial design, and many construction improvements must be incorporated during initial build. It pays to get it right at the beginning. From an environmental viewpoint, the time to reduce carbon dioxide emissions is at design stage.



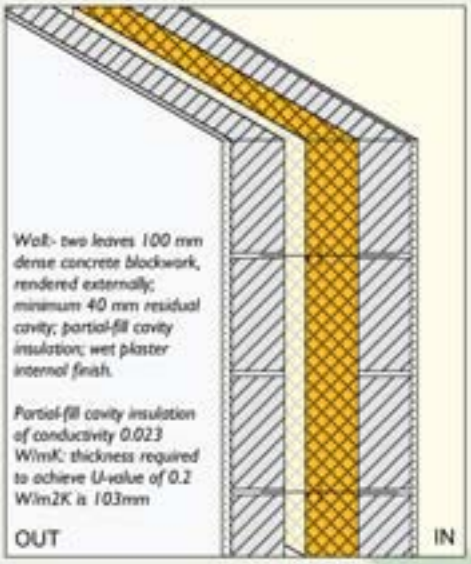

Cost varies widely between, say, a small apartment and a large detached house. With grants available, the package of measures required for a semi-detached home costs an estimated extra €10,000 over today's standard construction costs to revise a B1 to an A3 rating. However the result is lower running costs, better environmental protection and improved home owner comfort!

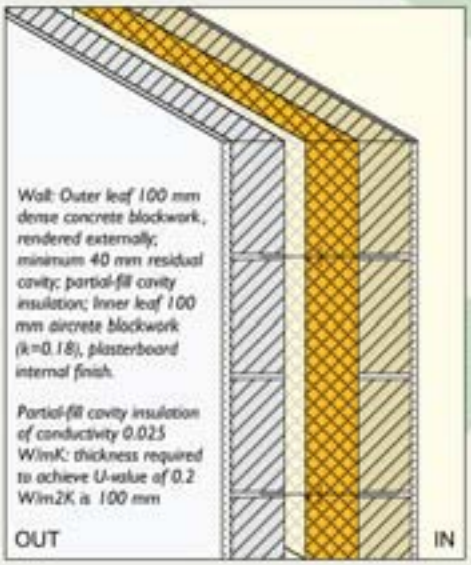


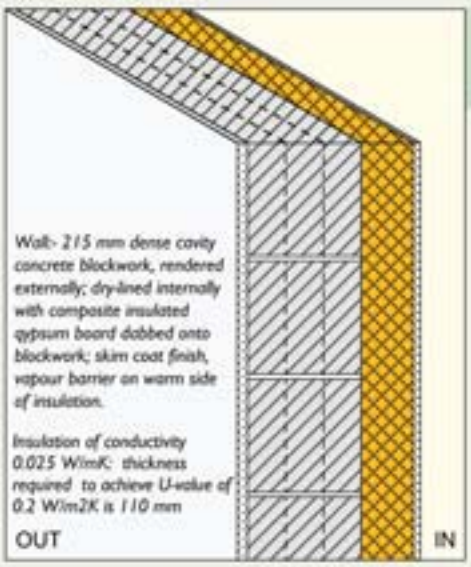
DEAP calculations for a typical 96 sq metres semi-detached house, medium-high thermal mass, showing progressive reduction in energy consumption as energy-saving measures are introduced

[1] Independent Study by Emerald Energy

06 DESIGNING AND BUILDING







IMPROVE THE THERMAL PERFORMANCE OF WINDOWS AND EXTERNAL DOORS

Improving the U-value for windows and external doors from 2.00 to 1.50 with, for example, triple glazing, argon filled cavity and soft low-E glass improves efficiency and is done easily when installing or renewing windows. Typical cost: € 2500.

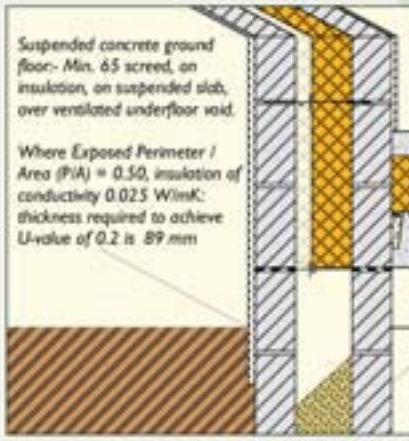
IMPROVE WINDOW ORIENTATION

Favouring of south-facing windows is usually possible, and can improve efficiency by 4%. Concrete homes of medium thermal mass can benefit particularly well, where the design promotes good passive solar gains. The additional cost can be minimal.

These constructions reflect compliance with the Buildings Regulations in place at April 2009. Modifications to reflect different values may be required for compliance with 2010 Regulations.

INCREASE INSULATION IN THE EXTERNAL FABRIC

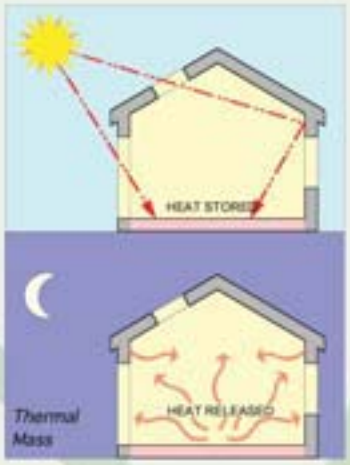
Using the Elemental Heat Loss Calculation Method given in the technical guidance to the current Building Regulations, ground floors may have a maximum U-value of 0.25, external walls a maximum 0.27, and roofs, a maximum of between 0.16 and 0.22 depending on construction method. A floor and walls U-value of 0.20 and a roof U-value of 0.16 will typically improve energy efficiency by 4%. Typical cost: € 500.



AN A-RATED HOME

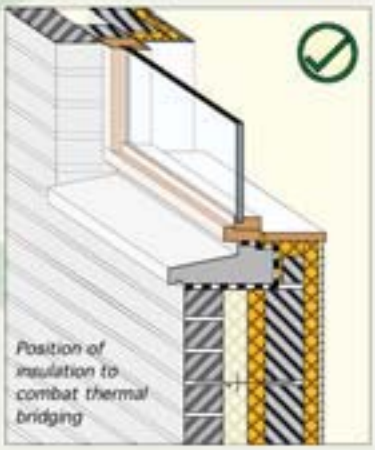
UTILISE THERMAL MASS

With an efficient heating system, medium or heavy thermal mass buildings can give good summer comfort and improve overall energy efficiency. See the Irish Concrete Federation's booklet "Thermal Mass and Sustainable Buildings" for more advice.



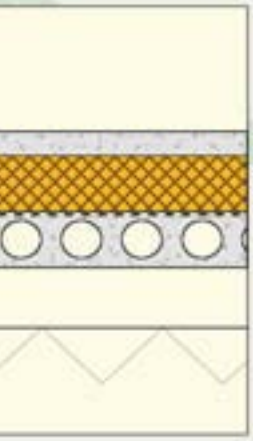
REDUCE THERMAL BRIDGING IN THE EXTERNAL FABRIC

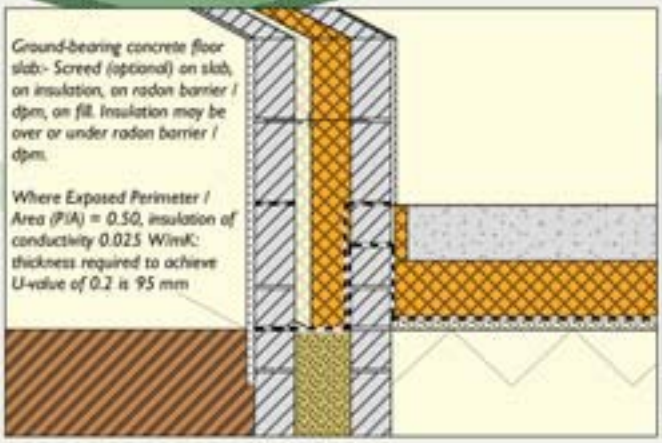
Thermal bridging around openings in the external fabric increases heat loss. Reducing the proportion of thermal bridging in the external fabric from 0.11 to 0.08 will deliver a 3% improvement in energy efficiency. Typical cost: € 1000.

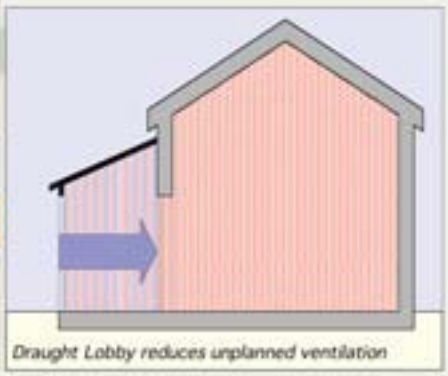


PROVIDE A DRAUGHT LOBBY AT THE FRONT ENTRANCE

A draught lobby at the front door will reduce unplanned ventilation at low extra cost, and typically give a 1% improvement in efficiency.







08 DESIGNING AND BUILDING

INSTALL A HEAT RECOVERY VENTILATION SYSTEM

Where the dwelling has a high level of air tightness, contemporary whole building heat recovery ventilation systems deliver up to a 9% increase in energy efficiency. Choose a system which requires only minimal energy to operate fans.

REPLACE THE OPEN FIREPLACE WITH A BALANCED FLUE ENCLOSED STOVE

A balanced flue enclosed stove is far more energy efficient than an open fire. Removing the open fireplace will typically result in a 11% improvement in efficiency. When the enclosed stove is fired by a renewable fuel source, it also reduces net carbon dioxide emissions.

INSTALL A SOLAR WATER HEATING SYSTEM

Solar water heaters will deliver hot water all year round, but can be particularly advantageous in summer, to replace electricity (which is assumed in DEAP to be the primary heat source).

INSULATE PRIMARY CIRCUIT PIPEWORK

Insulating the primary circuit pipework between boiler and cylinder will typically deliver a 1% improvement in energy efficiency.

INCREASE THE HOT WATER CYLINDER INSULATION THICKNESS

Increasing the normal 35 mm of cylinder insulating foam to 60 mm will typically deliver a 1% improvement in energy efficiency.

CHANGE THE LIGHT BULBS TO ENERGY EFFICIENT TYPE

Energy efficient bulbs are now available for almost every application. Making all lights energy efficient is easy and typically gives a 3% improvement in energy efficiency.

INSTALL A GROUND-SOURCE HEAT PUMP

If a renewable fuel source is not used, geothermal heating with a heat pump along with under-floor heating will significantly improve energy efficiency.

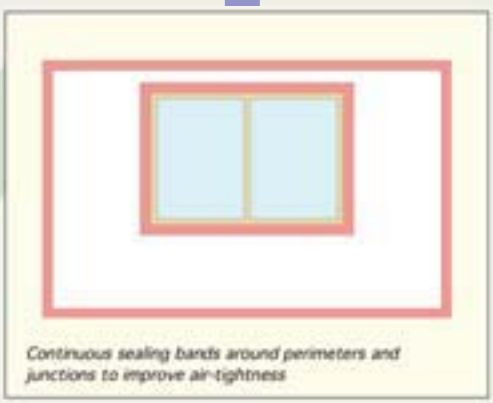
INSTALL A WOOD PELLET BOILER

Some house owners may have the space for a wood pellet burning boiler and fuel storage. Depending on the fuel substituted, the efficiency improvement may be slight, but carbon dioxide emissions will be reduced significantly.

AN A-RATED HOME

USE A CONDENSING BOILER INSTEAD OF A STANDARD ONE

Today's balanced flue gas fired boiler is about 80% efficient. Condensing boilers can achieve up to 95% efficiency, and are as easily installed as conventional boilers, giving a 10% improvement in overall energy efficiency. Boiler efficiency ≥ 86% is obligatory under the 2008 Part L Amendment Regulations.



IMPROVE AIR TIGHTNESS AND DO A PRESSURE TEST

Effective sealing around components such as windows and external door frames, electrical terminals and drainage pipes will lower rates of air infiltration significantly. A typical pressure test and supervision costs between € 500 and € 1000 and can achieve improved efficiency calculations of 5%.

Energy and the Building Regulations

Building Energy Ratings were introduced by the Government under the European Communities (Energy Performance of Buildings) Regulations 2006 (S.I. No. 666 of 2006). Those regulations transposed articles 5 and 7 of the EU Energy Performance of Buildings Directive - EPBD - (2002/91/EC of 16 December 2002). They come into operation at various dates up to 30 June 2010.

The Building Regulations (Amendment) Regulations 2005 (S.I. No. 873 of 2005), which provides for the introduction of a building energy performance assessment methodology for new dwellings, and which sets higher thermal performance and insulation standards for non-domestic buildings, came into operation on July 1, 2006, except where planning permission or approval was applied for on or before June 30, 2006, provided substantial work was been completed by June 30, 2008. Since January 1st 2009, these Regulations apply to all dwellings.

As well as its use for Building Energy Ratings, the **Dwellings Energy Assessment Procedure** (DEAP) has been introduced under the Building Regulations, together with new requirements to calculate and to limit carbon dioxide emissions.

The Building Regulations 2005 required initially the calculation of the **Carbon Dioxide Emission Rate (CDER)** for space and water heating, ventilation and lighting, under standardised temperature and use conditions. The CDER depends on the energy sources used in the dwelling - electricity, gas, oil, wood, geothermal, solar, wind or others. Secondly, you calculate a theoretical **Maximum Permitted CO_2 Emission Rate** for the same dwelling. These calculations are carried out using the DEAP.

The actual design must perform at least as well as the theoretical one. These rates represent the amount of carbon dioxide emitted over a year. If **renewable energy sources** such as wood pellets or solar water heaters are used, the calculations will reflect the lower carbon dioxide emissions from the building and make it easier to comply with the requirements of the regulations.

The Building Regulations 2008, which apply to new dwellings, include requirements for a 40% improvement in energy efficiency and a 40% reduction in CO_2 emissions compared to 2005 standards. In addition, there is a mandatory minimum renewable energy requirement in all new homes. The Regulations also provide for acknowledgments of improvements in limiting heat loss and availing of heat gain through the fabric of the building. Air pressure tests are also a requirement of the new regulations.

The Building Regulations set standards in relation to buildings, not only as regards energy performance but also as regards access for people with disabilities, structural and fire safety, ventilation and many other matters. In parallel with the introduction of Building Energy Ratings and Building Energy Performance Certificates, the Regulations on energy were revised in 2005 to take account of the EPBD Directive. The Regulations were further revised in 2008.




ACCEPTABLE CONSTRUCTION DETAILS

In 2008, the Department of the Environment, Heritage and Local Government issued guidance on Limiting Thermal Bridging Heat Loss, in the form of the Acceptable Construction Details with a full set of details for the six most common methods of construction. These details suggest ways to reduce thermal bridging "y" values to 0.08, a considerable saving on the revised 2008 Regulations "do nothing" default value of 0.15. Achieving air tightness is also dealt with in that publication.

ACKNOWLEDGMENTS

Originally prepared by Eoin O'Cofaigh of Mc Hugh O'Cofaigh architects for and on behalf of the Irish Concrete Federation. DEAP calculations by Emerald Energy.

Grateful acknowledgement is made to Sustainable Energy Ireland for permission to use the diagrams of the Building Energy Rating Certificate and Provisional Certificate.

USEFUL PUBLICATIONS AND CONTACTS

"Right on the Site" Issue No. 28, Building Regulations Part L, Conservation of Fuel and Energy.
Updated January 2007, Building Regulations 2007,
Updated March 2008, Publication by Homebond,
Construction House, Canal Road, Dublin 6

"Right on the Site" Issue No. 39, Building Energy Rating (BER), updated January 2007, Publication by Homebond,
Construction House, Canal Road, Dublin 6

Sustainable Energy Ireland publications, downloadable from the SEI website, www.sei.ie, including:

- Building an Energy Efficient Home
- Detailed Guide to Home Heating Systems
- How to Make Your Home Energy Efficient

The SEI website also provides information on the Energy Performance of Buildings Directive, the Dwellings Energy Assessment Procedure, a Home-heating Appliance Register of Performance, and on Building Energy Rating generally.

"Thermal Mass and Sustainable Buildings"
Publication by Irish Concrete Federation, date 2006, available on www.irishconcrete.ie

Technical Guidance Document to Part L of the Building Regulations, 2005 and Building Regulations 2008, as well as the Acceptable Construction Details, Department of the Environment, Heritage and Local Government, available on www.environ.ie

This publication is non-technical. It is a general introduction only to the concepts involved. It should not be relied upon as being specifically applicable to a particular project. It cannot and does not substitute for a thorough reading of the actual EU and Irish documents referred to. Cost estimates and energy savings are indicative only. Competent professional advice should be obtained in all circumstances.

Published by the Irish Concrete Federation:

Concrete Built is Better Built

Concrete is present in almost every home in Ireland. It's strength, durability, fire resistance, sound insulation and water resistant qualities make it ideal for foundations, floors, external walls, party walls between houses, internal partitions, roof tiles and more. Building components and materials made with concrete can be environmentally sustainable, made from materials sourced and worked locally - most frequently within 30km of the place of their final use. They are manufactured without environmentally damaging preservatives, and at the end of a long life can be recycled as inert filling material under floor slabs, roads and around underground services.

Poured concrete, precast concrete wall panels, precast concrete floor slabs, concrete blocks and aerated concrete blocks, lintels and sills, concrete roof tiles and fibre -cement slates, concrete paving and cement-based external and internal plasters are the essential components of Ireland's homes not just for today but for the future also.

Some of the key advantages of concrete homes are as follows:

- Concrete's **STRENGTH** and **DURABILITY** means that today's houses and apartments can stand for centuries to come, with minimum maintenance.
- Concrete's ability to absorb and store heat produces a comfortable environment avoiding unwanted temperature swings. Modern, well insulated concrete homes are highly **ENERGY EFFICIENT**, making a positive contribution to the challenge of climate change and minimising the effects on the built environment.
- Concrete homes are easily **ADAPTABLE**. The internal layout can be easily changed to accommodate any design.
- Concrete is **FIRE RESISTANT** and **NON-COMBUSTIBLE**. In the event of fire, concrete built homes retain their structural stability and will be less costly to repair.
- Concrete is **WATER RESISTANT** and will not warp, rust or rot. Concrete homes are less affected by flooding or by leaks from tanks or water pipes.
- Concrete has excellent **SOUND INSULATION** properties. Concrete walls and floors absorb sound and vibration.
- Concrete walls between adjoining properties offer high levels of **SECURITY** and peace of mind to property owners.
- Concrete is both **FUNCTIONAL** and **AESTHETIC**. It can be used to build homes that are functional or grand designs which are complex and elegant.

Discovering too late that you have made the wrong choices with your home is a huge disappointment. So, make sure to ask the builder or selling agent - is this a concrete home?

For more information on Energy-Efficient Concrete Homes, visit our website at www.irishconcrete.ie

www.irishconcrete.ie

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