The A-Rated Energy-Efficient Concrete Home

IRISH CONCRETE FEDERATION

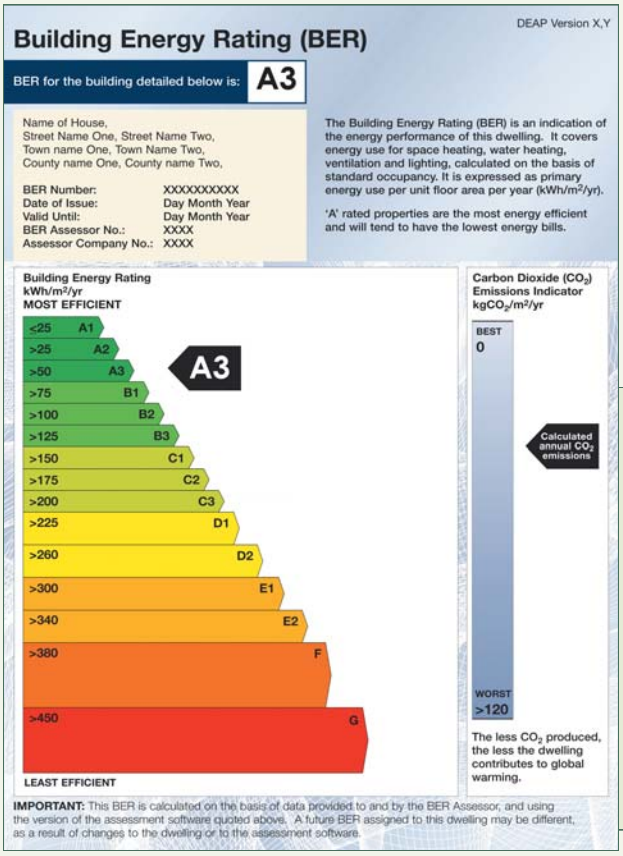
Set for life

www.irishconcrete.ie

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.



DEAP Version X,Y

Building Energy Rating (BER)

BER for the building detailed below is: **A3**

Name of House,
Street Name One, Street Name Two,
Town name One, Town Name Two,
County name One, County name Two,

BER Number:	XXXXXXXXXX
Date of Issue:	Day Month Year
Valid Until:	Day Month Year
BER Assessor No.:	XXXX
Assessor Company No.:	XXXX

The Building Energy Rating (BER) is an indication of the energy performance of this dwelling. It covers energy use for space heating, water heating, ventilation and lighting, calculated on the basis of standard occupancy. It is expressed as primary energy use per unit floor area per year (kWh/m²/yr).

'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

Building Energy Rating
kWh/m²/yr
MOST EFFICIENT

<25	A1
>25	A2
>50	A3
>75	B1
>100	B2
>125	B3
>150	C1
>175	C2
>200	C3
>225	D1
>260	D2
>300	E1
>340	E2
>380	F
>450	G

LEAST EFFICIENT

A3

Carbon Dioxide (CO_2) Emissions Indicator
$kgCO_2/m^2/yr$

BEST
0

Calculated annual CO_2 emissions

WORST
>120

The less CO_2 produced, the less the dwelling contributes to global warming.

IMPORTANT: This BER is calculated on the basis of data provided to and by the BER Assessor, and using the version of the assessment software quoted above. A future BER assigned to this dwelling may be different, as a result of changes to the dwelling or to the assessment software.

The EU now hopes to achieve similar outcomes in respect of buildings. The **Energy Performance of Buildings Directive** requires **calculation of energy performance** for most buildings, and that when a building is constructed, sold or rented, a Building Energy Rating (BER) Certificate is made available.

The BER rating is an estimate based on a standardised assessment procedure, which makes many assumptions regarding how the dwelling will be used. It's 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

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.

A BER certificate is required since January 1, 2007 for all new dwellings, unless it's a dwelling for which planning permission was applied or a planning notice published on or before December 31, 2006 and where substantial work is completed by June 30, 2008.

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

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

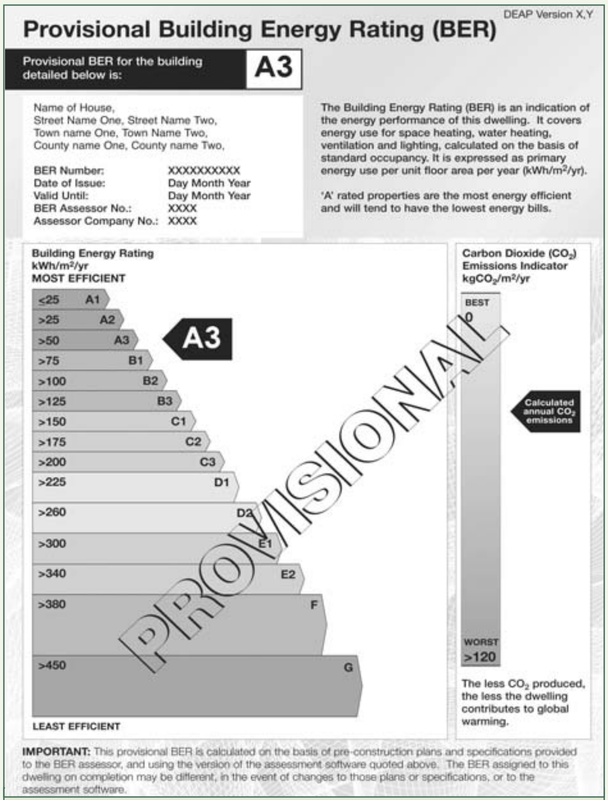
THE DWELLINGS ENERGY ASSESSMENT PROCEDURE

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**. 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, with their insulation;
- The thermal mass of the construction: heavyweight, lightweight, or in between;
- Windows, roof lights and external doors;
- Ventilation;
- The type of fuel used;
- Boilers, radiators, fans, lights, etc., and their efficiency.

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.



DEAP Version X,Y

Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is: A3

Name of House,
Street Name One, Street Name Two,
Town name One, Town Name Two,
County name One, County name Two,

BER Number: XXXXXXXXXX
Date of Issue: Day Month Year
Valid Until: Day Month Year
BER Assessor No.: XXXX
Assessor Company No.: XXXX

The Building Energy Rating (BER) is an indication of the energy performance of this dwelling. It covers energy use for space heating, water heating, ventilation and lighting, calculated on the basis of standard occupancy. It is expressed as primary energy use per unit floor area per year (kWh/m²/yr).

'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

Building Energy Rating
kWh/m²/yr
MOST EFFICIENT

LEAST EFFICIENT

Carbon Dioxide (CO2) Emissions Indicator
kgCO2/m²/yr

The less CO2 produced, the less the dwelling contributes to global warming.

IMPORTANT: This provisional BER is calculated on the basis of pre-construction plans and specifications provided to the BER assessor, and using the version of the assessment software quoted above. The BER assigned to this dwelling on completion may be different, in the event of changes to those plans or specifications, or to the assessment software.

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 no dwelling built just to comply with the 2005 building regulations will achieve an A-rating without some changes.

No single change will turn a current building regulation compliant home (which can often achieve a B3 rating) into an A-rated one. 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's always room for futuristic design, many A-rated homes need not look very different from what's being built right now.

The **first steps to an A-rating are simple**. The 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.

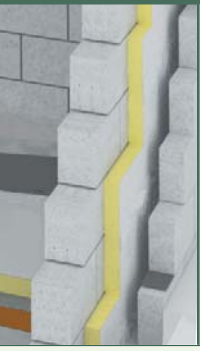
With the high levels of thermal insulation in an A-rated home, overheating in summer months will be an important consideration. Heavy buildings absorb solar gains better, and can stay at comfortable temperatures for longer than thermally light buildings. Concrete homes can benefit from having **medium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

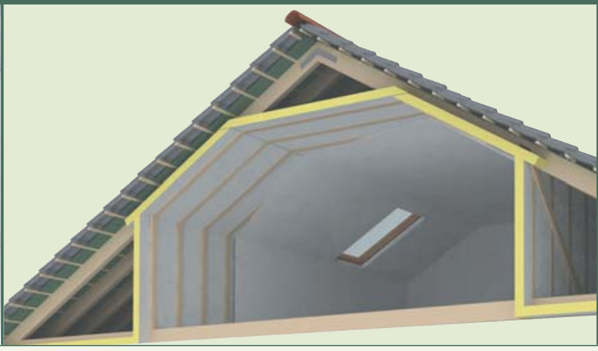
STEPS TO THE A-RATED CONCRETE HOME

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

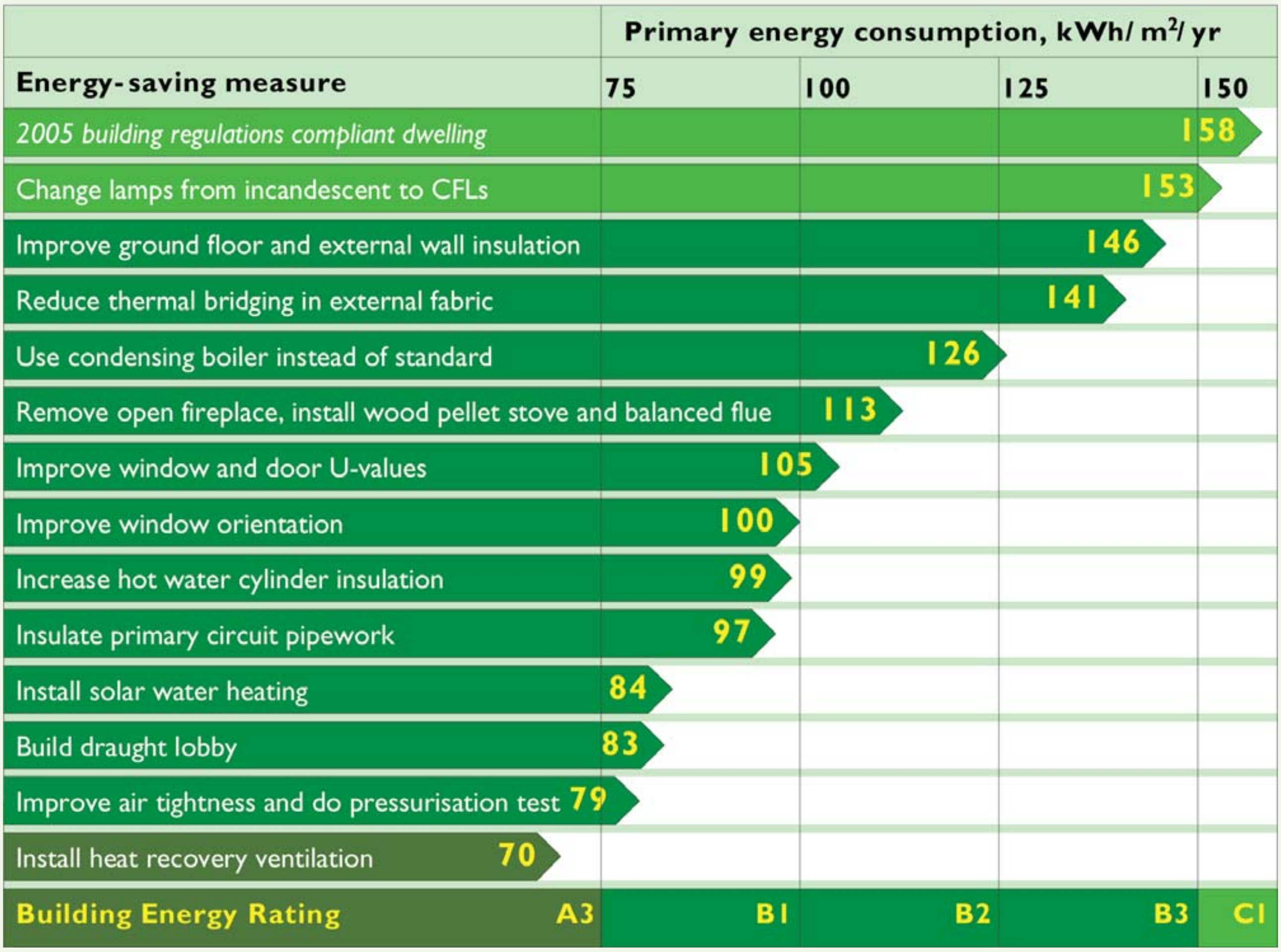
Independent studies for the Irish Concrete Federation show a cumulative **improvement in energy performance of over 50%** for an A-Rated house over a typical 2005 building regulations dwelling. Improving a building regulation compliant dwelling to an A-rating will typically reduce primary energy consumption from around 160 kWh to less than 75 kWh per square metre of building space per year.

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 upgrades 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 now.





Cost varies widely between, say, a small apartment and a large detached house. With grants available, the package for an average home costs an estimated typical net extra € 15-20,000 over today's standard construction. This results in lower running cost, better environmental protection, and with many measures, such as heat recovery ventilation, dramatically 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 according as energy-saving measures are introduced

06

DESIGNING AND BUILDING

IMPROVE THE THERMAL PERFORMANCE OF WINDOWS AND EXTERNAL DOORS

Improving the U value for windows and external doors from 2.20 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.

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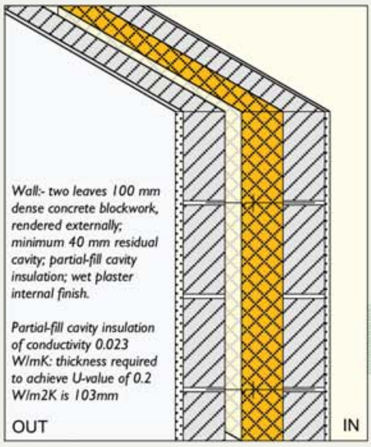
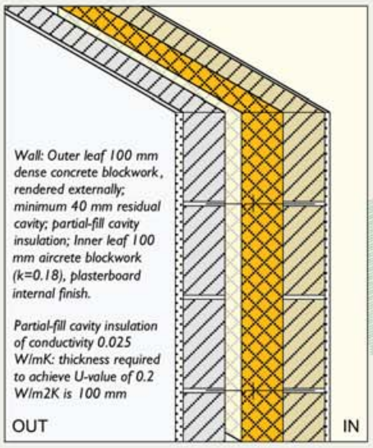
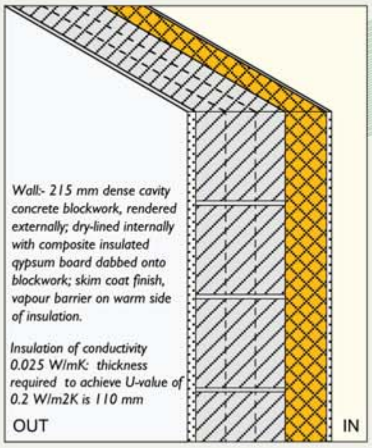
for more advice.


Wall:- two leaves 100 mm dense concrete blockwork, rendered externally; minimum 40 mm residual cavity; partial-fill cavity insulation; wet plaster internal finish.

Partial-fill cavity insulation of conductivity 0.023 W/mK: thickness required to achieve U-value of 0.2 W/m2K is 103mm


Wall: Outer leaf 100 mm dense concrete blockwork, rendered externally; minimum 40 mm residual cavity; partial-fill cavity insulation; Inner leaf 100 mm aircrete blockwork (k=0.18), plasterboard internal finish.

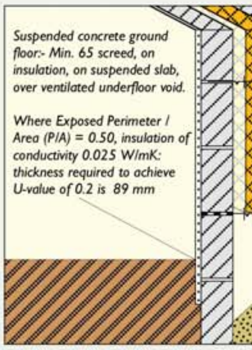
Partial-fill cavity insulation of conductivity 0.025 W/mK: thickness required to achieve U-value of 0.2 W/m2K is 100 mm


Wall:- 215 mm dense cavity concrete blockwork, rendered externally; dry-lined internally with composite insulated gypsum board dabbed onto blockwork; skim coat finish, vapour barrier on warm side of insulation.

Insulation of conductivity 0.025 W/mK: thickness required to achieve U-value of 0.2 W/m2K is 110 mm

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. If the Overall Heat Loss Method is used, ground floors and external walls may have a maximum U value of 0.37, and roofs, 0.25. A floor and walls U value of 0.20 and a roof U value of 0.16 will typically improve energy efficiency by 4% for about € 500


Suspended concrete ground floor:- Min. 65 screed, on insulation, on suspended slab, over ventilated underfloor void.

Where Exposed Perimeter / Area (P/A) = 0.50, insulation of conductivity 0.025 W/mK: thickness required to achieve U-value of 0.2 is 89 mm

AN A-RATED HOME

RMAL MASS

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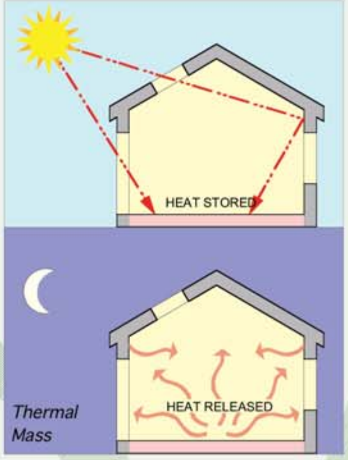
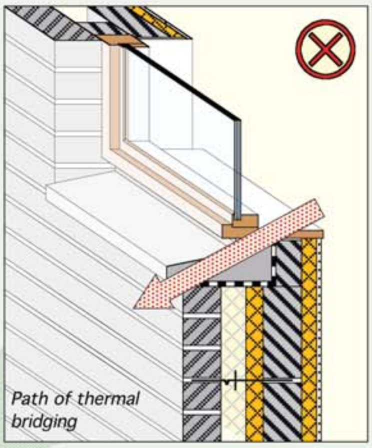
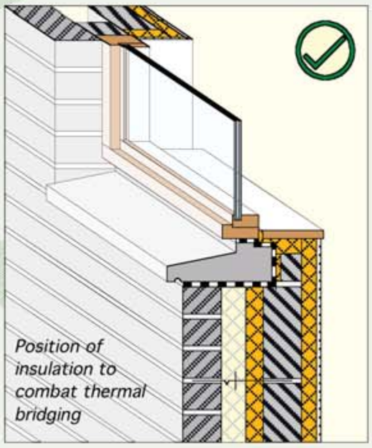


REDUCE THERMAL BRIDGING IN THE EXTERNAL FABRIC

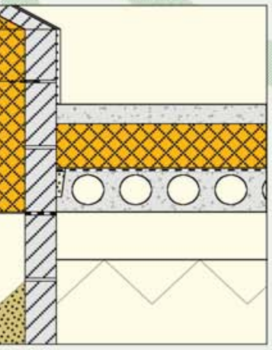
Thermal bridging around openings in the external fabric increases heat loss. Reducing the proportion of thermal bridging in the external fabric from 0.11 to 0.08 will deliver a 3% improvement in energy efficiency. Typical cost: € 1000

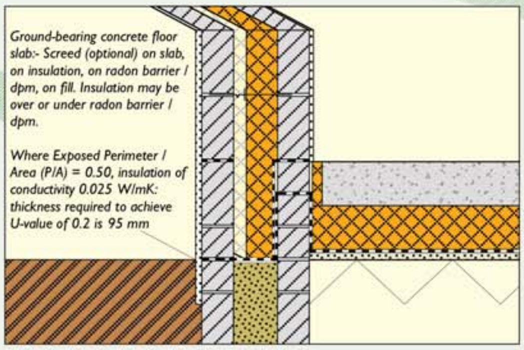




PROVIDE A DRAUGHT LOBBY AT THE FRONT ENTRANCE

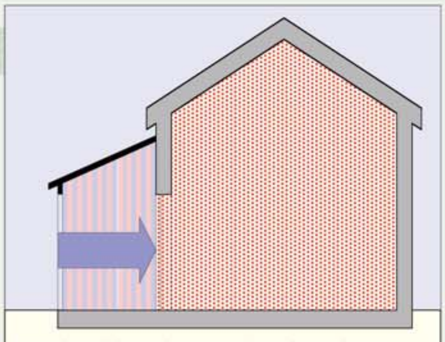
A draught lobby at the front door will reduce unplanned ventilation at low extra cost, and typically give a 1% improvement in efficiency.





Ground-bearing concrete floor slab:- Screed (optional) on slab, on insulation, on radon barrier / dpm, on fill. Insulation may be over or under radon barrier / dpm.

Where Exposed Perimeter / Area (P/A) = 0.50, insulation of conductivity 0.025 W/mK: thickness required to achieve U-value of 0.2 is 95 mm



Draught Lobby reduces unplanned ventilation

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.

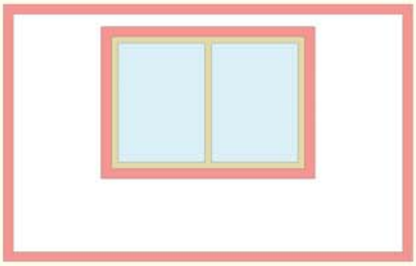
INSTALL A WOOD PELLET BOILER

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.

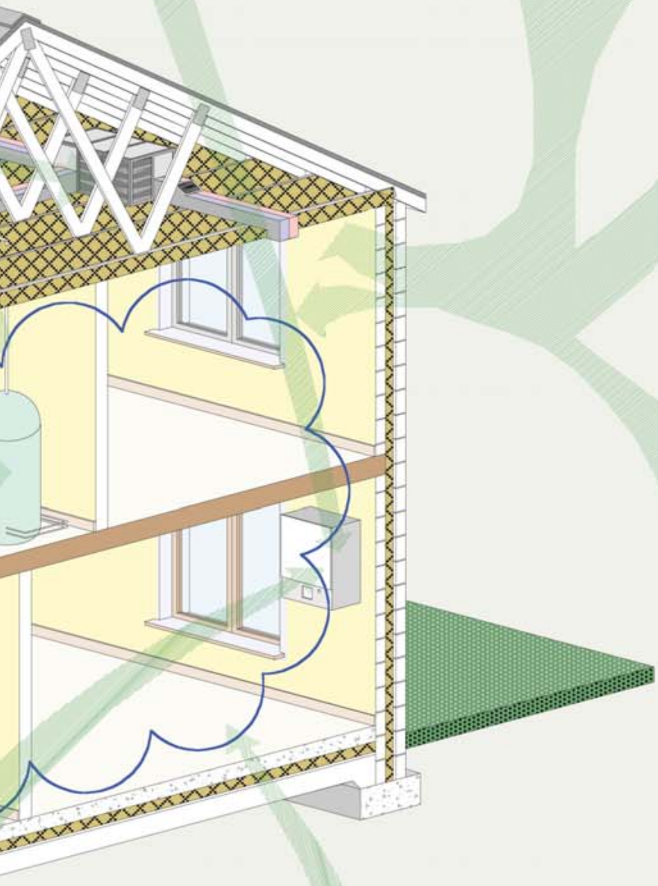
AN A-RATED HOME

USE A CONDENSING BOILER INSTEAD OF A STANDARD ONE

Today's balanced flue gas fired boiler is about 80% efficient. Condensing boilers achieve 90% efficiency, and are as easily installed as conventional boilers, giving a 10% improvement in overall building efficiency.



Continuous sealing bands around perimeters and junctions to improve air-tightness



IMPROVE AIR TIGHTNESS AND DO A PRESSURIZATION TEST

In the absence of a pressurization test, the DEAP assumes a casual infiltration rate of 0.50 air changes per hour. Effective sealing around components such as windows and external door frames, electrical terminals and drainage pipes will lower rates significantly. A typical 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 become operative 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 has been completed by June 30, 2008.

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

The Building Regulations 2005 require 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 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.

Prepared by 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

Publications by Homebond, Construction House, Canal Road, Dublin 6:

"Right On The Site" leaflet issue no. 28,
Updated January 2007,
Building Regulations 2005,
Conservation of Fuel and Energy

"Right On The Site" leaflet issue 39,
January 2007,
Building Energy Rating (BER)

Irish Concrete Federation publication:
"Thermal Mass and Sustainable Buildings"

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
- House of Tomorrow 5 Year brochure

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.

Technical Guidance Document to Part L of the Building Regulations, 2005, Department of the Environment, Heritage and Local Government, downloadable from 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.

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Disclaimer

This publication by the Irish Concrete Federation will assist Federation Members and there staff ,as well as architects,builders, developers ,engineers and home owners in understanding how to design and build an A-Rated Energy Efficient Concrete Home.

Every care has been taken to ensure that the information contained herein is correct and accurate at the date of publication. However, the Irish Concrete Federation Ltd and/or its Associates cannot accept any responsibility or liability for any errors, inaccuracies or omissions which may have occurred inadvertently.

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Concrete Built is Better Built

Concrete is present in almost every home in Ireland. Its strength, durability, fire resistance, sound insulation and water resistant qualities make it indispensable in foundations, ground 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 50 km of the place of their final use. They are manufactured without environmentally damaging preservatives, and at the end of a very 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, lintols and cills, concrete roof tiles and fibre-cement slates, concrete paving and cement-based external and internal plasters make up the essence of Ireland's homes today.

Concrete's **FIRMNESS** means that walls of concrete or concrete blocks remain firm for decades, unaffected by timber-eating insects or weather

Concrete's **ADAPTABILITY** copes easily with the alterations which many home owners wish to make to rooms and spaces during a lifetime's occupancy

Concrete's **FIRE RESISTANCE** means that semi detached or terraced house walls, or apartment blocks built with concrete floors and walls can readily resist fire for two hours or more, a far higher standard than available with almost any other structural material

Concrete's **WATER RESISTANCE** means that leaking roofs or water pipes need not turn into an owner's nightmare of rotting joists or floors

Concrete's **SOUND RESISTANCE** means that walls and floors separating houses or apartments can provide the highest levels of acoustic comfort, not only in the walls between semi-detached or terraced houses, but also in apartment block floors

Concrete's **DURABILITY** means that today's houses and apartments can stand for centuries to come, requiring less care over the years than systems requiring regular inspection, maintenance and repair

Concrete's **ROBUSTNESS** delivers peace of mind to home owners absent at work or on holiday, providing a secure external envelope and party walls and floors

Concrete's **BEAUTY** is seen in the colours of West Cork housing and in urban apartments alike, in the bridges spanning the new motorways, and the robust, elegant school, university and hospital buildings around Ireland

For more information and advice on how concrete sustains Irish homes and infrastructure and Ireland's environment, visit www.irishconcrete.ie

IRISH CONCRETE FEDERATION
Set for life

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