Module 2

EU & National Drive

Energy Efficiency for Construction

24 partners

12 countries

Date of Event

*Author/ **Institute***

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EU and National Drive | Summary

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To equip the learner with the relevant knowledge required to understand the key policy and legislative drivers relevant to construction and the workers

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EU and National Drive | Objectives

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1. Identify and outline the **acronyms and definitions** associated with energy efficient construction
2. Explain the **impact of EU climate change** and energy efficiency policy for building energy performance
3. List the actions in **National action plans** for energy efficiency and renewable energy deployment in buildings
4. Define and describe the **key energy principles** and requirements for NZEB as they pertain to new and retrofitted buildings.
5. List the **key units** used to define the energy efficiency of buildings including kWh/m^2.year and $kgCO_2/m^2$.year
6. Describe the main **changes to National Building Regulations** over the last 10 years specifically directed to the conservation of fuel and energy.
7. Understand how to **keep up-to-date with changes** and amendments to relevant national regulations and national policies.

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EU and National Drive | Contents

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1. Climate Change and Policies

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Climate Change

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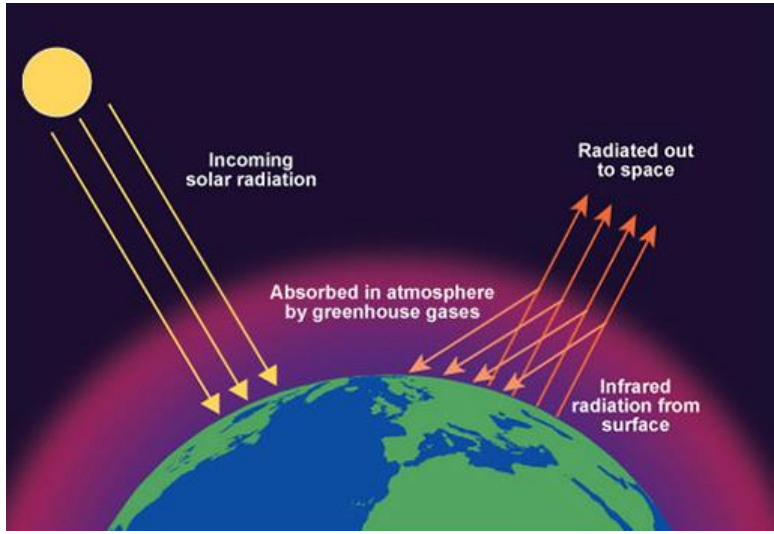
Climate change is defined as a variation in the state of the Earth's climate system that lasts for sufficiently long periods of time (decades or longer) until a new equilibrium is reached.

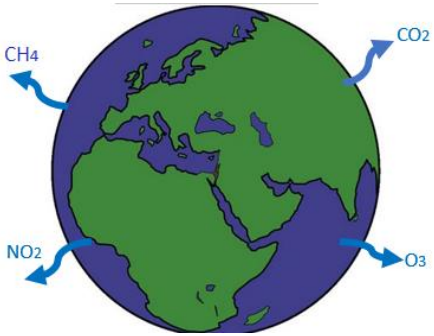
The one we are living now is the first one originated by humankind so it is our responsibility to amend it.

It is mainly related to the intensification of the greenhouse effect due to industrial emissions from the burning of fossil fuels.

This leads to an increase in the global average temperature of 0.85ºC.

International community has recognized the need to keep warming below 2ºC in order to avoid the risk of catastrophic changes in the world environment.





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Climate Change

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GLOBAL WARMING CONSEQUENCES

- Weather:
  - Intense storms
  - Heat waves
  - Floods
  - Wildfires
  - Avalanches
- Food:
  - Food shortage
  - Food prices
- Health:
  - Spread of certain diseases
- Ecosystem

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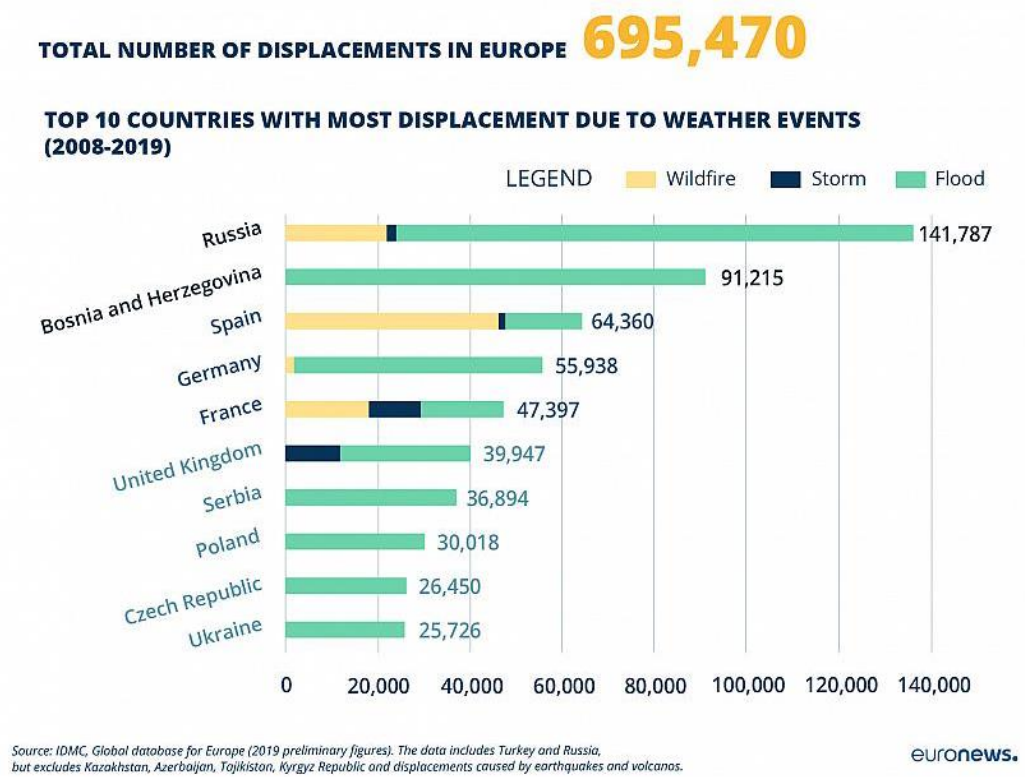
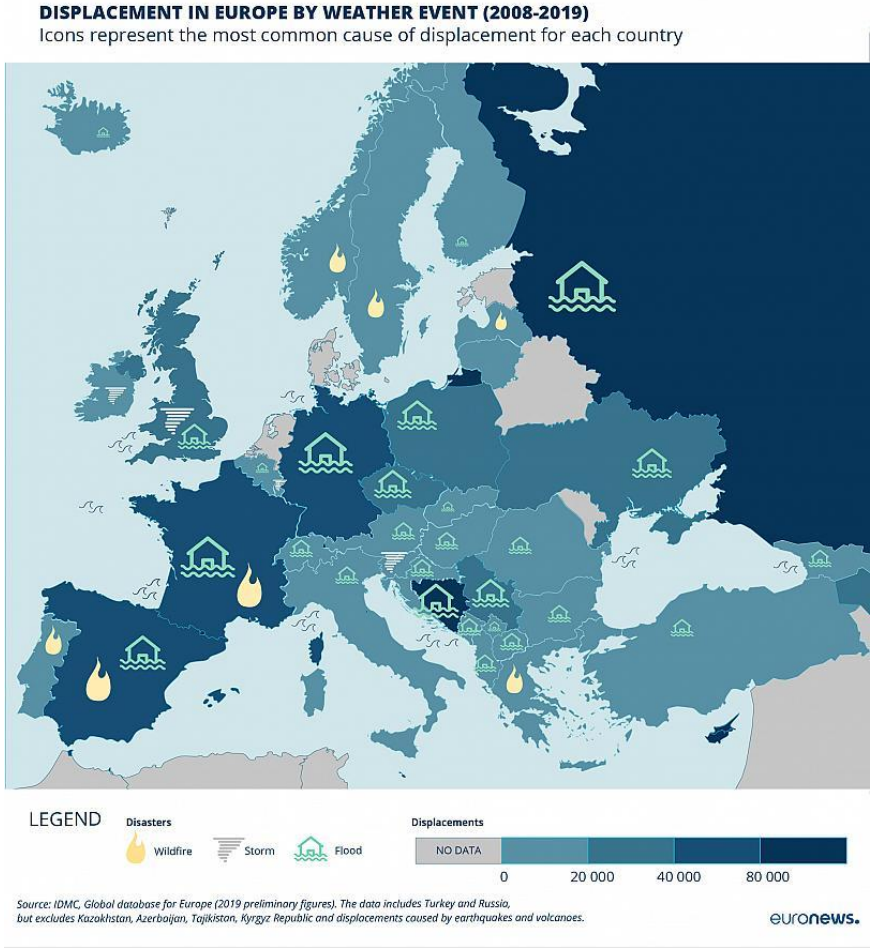
GLOBAL WARMING CONSEQUENCES IN EUROPE

VIDEO: CLIMATE CHANGE IMPACTS EUROPE





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Climate change on our doorstep

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THE IRISH TIMES

NEWS | SPORT | BUSINESS | OPINION | LIFE & STYLE

Recent storms have cost billions and severely tested Ireland, says EPA

Expect extreme weather more frequently in the future, warns agency director general

Thu, Oct 4, 2018, 11:39

Kevin O'Sullivan Environment & Science Editor

A file image from March 2018 showing the frozen sculpture fountain at the Irish Life Building in Dublin. Photograph: Alan Betson/The Irish Times

Ireland's hosepipe ban: Everything you need to know

Hosepipe ban Q&A: Can I water my plants? Should I flush the toilet every time?

Mon, Jul 2, 2018, 09:08 | Updated: Fri, Jul 6, 2018, 07:47

Jack Power

Irish Water has introduced a hosepipe ban across the country that will last until at least July 31st. Photograph: Gareth Fuller/PA Wire

Images Source: The Irish Times

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Frequency and Severity of Weather Conditions

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From Ophelia to Ali: Five notable Irish storms in recent years

Hurricane Lorenzo will be latest storm to hit country should it arrive on Thursday

Tue, Oct 1, 2019, 12:26

Sarah Burns

Storm Ophelia: Gardaí clearing the road near Enniskerry from a fallen tree. Photograph: Cyril Byrne

"Ireland is set to experience a less stable climate, with more extreme weather events as a result of global warming"

Eoin Moran,
Head of Met Eireann

Image Source: The Irish Times

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EU Policies & Legislation

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1997 – Kyoto Agreement

EU Directive to improve energy efficiency and reduce GHG emissions

2002 – Energy Performance of Buildings Directive (EPBD)

Improve energy performance for new and existing buildings

2010 – EPBD Recast

To achieve nearly zero energy buildings NZEB, mainly using renewable energies by 2020.

2012 – Energy Efficiency Directive (EED)

To use energy more efficiently at all stages of the energy chain from its production to its final consumption

National Building Codes

2018 – EPBD Recast

Decarbonise building stock by 2050, smart technologies and the mobilisation of investments

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<u>It all started with the Kyoto agreement (1997)</u>,
then

<u>Kyoto 2nd commitment period (2013–2020)</u>

All EU countries (together with Iceland) agreed to set a 20% reduction target compared to 1990 (in line with the EU's own target of 20% by 2020).

- 20% energy to come from Renewables
- 20 % reduction in GHG emissions
- 20% increase in Energy Efficiency

EPBD- Energy Performance of Buildings Directive

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EPBD - Energy Performance of Buildings Directive (2010/31/EU)

To boost energy performance of buildings and improve the existing building stock.

EU Countries MUST:

- Establish strong **long-term renovation strategies**, aiming at decarbonizing the national building stocks by 2050, with indicative milestones for 2030, 2040 and 2050.
- Need to establish a 10-year integrated **national energy and climate plan** (NECP) for the period from 2021 to 2030.
- Set **cost-optimal minimum energy performance** requirements for new buildings, for existing buildings undergoing major renovation, and for the replacement or retrofit of building elements such as heating and cooling systems, roofs and walls.
- Regulate that all new buildings are to be **nearly zero-energy buildings (NZEB)** from 31 December 2020. Since 31st December 2018, all new public buildings are to be NZEB compliant.
- Issue **Energy Performance Certificates (EPC)** when a building is advertised to sell, sold or rented/leased.
- Support **electro-mobility** by introducing minimum requirements for car parks.
- Promote **smart technologies** and building control systems.
- Set out lists of national **financial measures** to improve the energy efficiency of buildings.

EED - Energy Efficiency Directive

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EED - Energy Efficiency Directive (2012/27/EU)

To improve energy efficiency.

The EU Countries :

- Must take **energy renovations** to at least 3% of the total floor area of buildings owned and occupied by central governments.
- Are recommended to only **purchase buildings that are highly energy efficient** for national governments/Public Authorities.
- Large companies conducting **energy audits** at least every four years.
- Achieve an annual reduction of 1.5% in national energy sales.
- Use minimum **energy efficiency standards and labelling** for a variety of products such as boilers, household appliances, lighting and televisions (energy label and eco-design)
- Have the **obligation schemes for energy companies** to achieve yearly energy savings of 1.5% of annual sales to final consumers
- Protecting the rights of consumers to receive **easy and free access to data** on real-time and historical energy consumption

Why Target Buildings?

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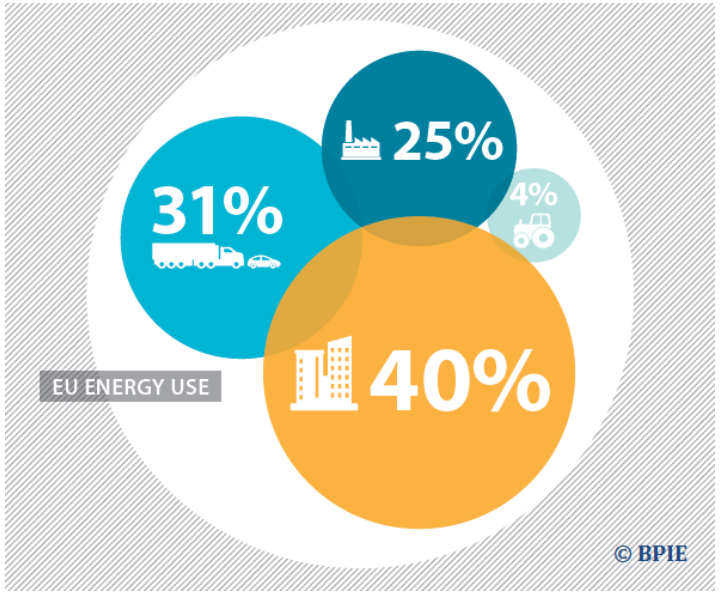
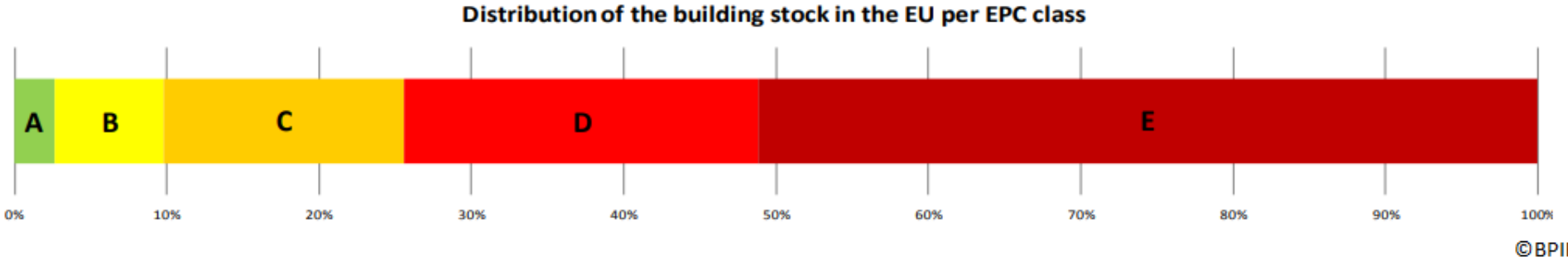
- Buildings are the single largest energy consumer in Europe.
- Currently, about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient
- Renovation of existing buildings can lead to significant energy savings, as it could reduce the EU's total energy consumption by 5-6% and lower CO2 emissions by about 5%.





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Why Buildings?

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OTHER BENEFITS BY IMPROVING BUILDING ENERGY PERFORMANCE

- Fuel poverty
- Job creation
- Energy security
- Health & Air Quality
- Comfort
- Energy Savings

Increasing buildings' energy performance is one of the most cost-effective ways to reach the EU climate goals and to stimulate sustainable growth. It will lead to important social and environmental benefits and give a boost to Europe's economy.

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2. NZEB Principles

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NZEB Principles

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What is NZEB?

EPBD - Energy Performance of Buildings Directive (2010/31/EU)

"Definition – Nearly Zero Energy Building (NZEB)"

"Nearly Zero Energy Buildings (NZEB) means a building that has a very high energy performance, Annex 1 of the Directive and in which "the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby".

NZEB Principles

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1 – High energy performance building-
A building which produces more or less the same amount of energy per year as it uses.

2 – Building energy from renewable sources –
including energy from renewable sources produced on-site or nearby.
The building can generate this renewable energy on site or feed-back to the electricity grid.

3 – Cost Optimisation
The approach where possible should be selected based on maximising long term cost optimality and return on investment

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NZEB Principles

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Overall Aim of NZEB:

1. Reduce Energy Demand of buildings
2. Reduce Carbon Emissions
3. Employ Renewable Energy Production

First NZEB principle	Second NZEB principle	Third NZEB principle	Fourth NZEB principle
Reduce energy demand	Improve indoor environmental quality	Provide renewable energy share	Reduce primary energy and carbon emissions
Reduce internal loads Reduce building envelope loads Reduce HVAC equipment energy consumption	Set up minimum fresh air per person Enable Natural Lighting Set up a maximum occupant density	Produce energy from renewable sources on-site Introduce renewable energy delivered from nearby or offsite Avoid double counting	Reduce the primary energy demand Reduce the carbon emissions related to delivered energy

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NZEB Principles

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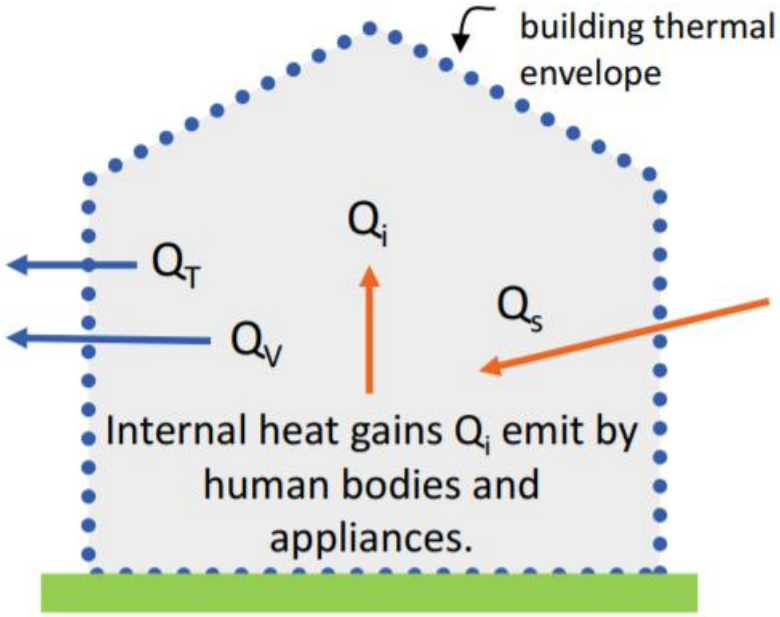
1- High energy performance building.

Building envelope.

Transmission heat losses Q_T due to heat transfer through the opaque and transparent elements of building envelope.

Ventilation heat losses Q_V due to the infiltration of air through the leakages in building envelope and due to the ventilation as process of dedicated supply of fresh air to maintain indoor air quality.



Solar heat gains Qs due to transmission of solar radiation through the transparent envelope elements (window glazing) and heat flux that passes through the sunlit surface of opaque building envelope. In case of well thermal insulated buildings and use of monthly calculation method, these heat gains are normally neglected, meanwhile they are taking into account in hourly calculation methods.

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Energy Fundamentals

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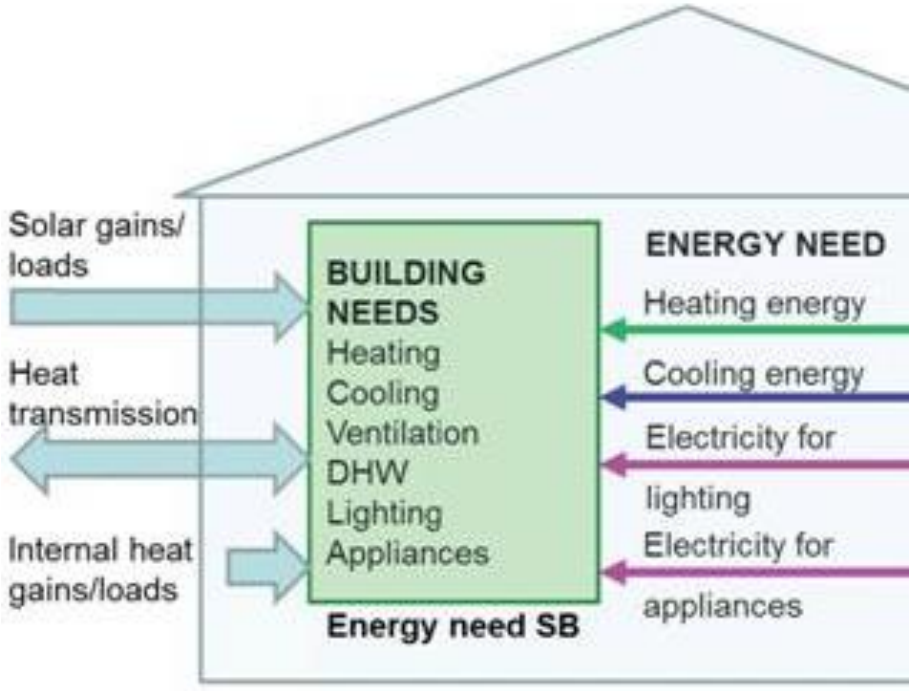
1- High energy performance building.

Achieving maximum productivity with minimum wasted effort or energy.
To achieve maximum productivity with minimum expense, you need to improve the efficiency of our building in order to:

- Minimize heat loss through the building envelope and provide air tightness.

- Reduce the energy demand through architectural design with bio-climatic criteria and passive energy measures.
- This will minimize the negative effect on the building environment (for example use shading elements, to reduce excessive solar gains in summertime) or maximize the environment positive effects (by using cross ventilation strategies during summer to prevent overheating).



NZEB Fundamentals

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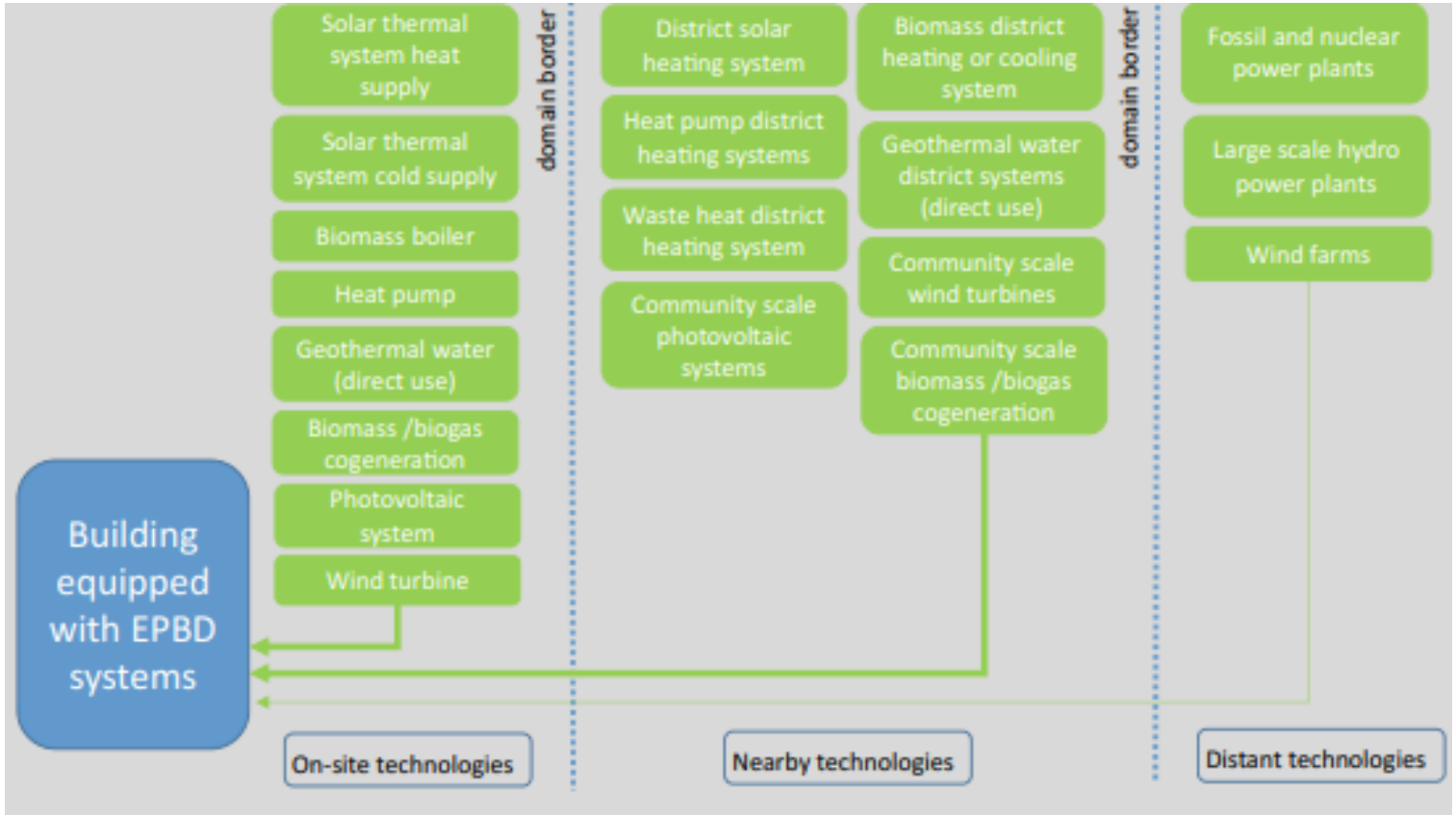
***2* - Energy from renewable sources**

including energy from renewable sources produced on-site or nearby.



Source: Sustainable Technologies for Nearly Zero Energy Buildings, Design and Evaluation methods

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3. National Regulations

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Building Regulations

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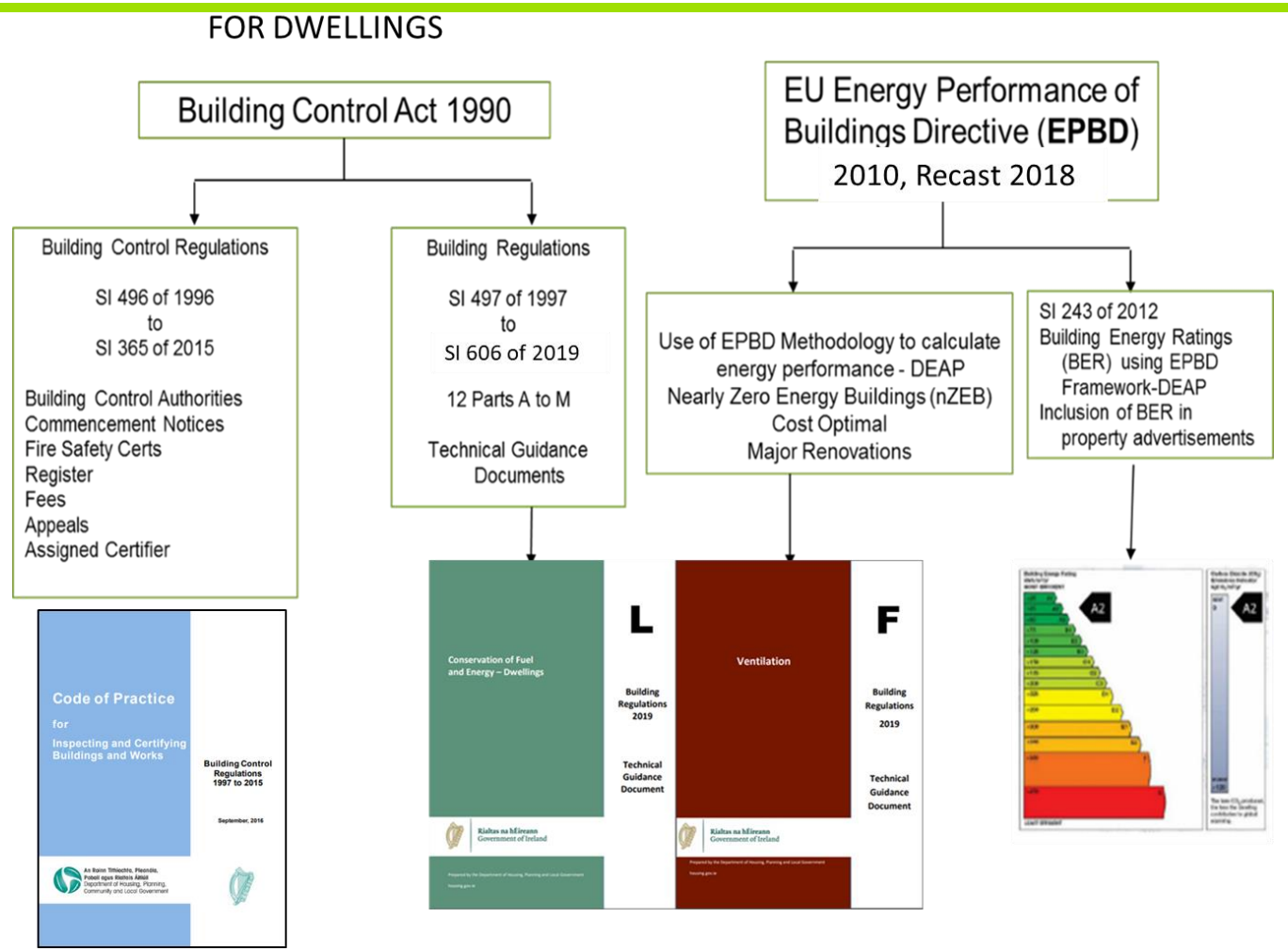
NZEB and TGD Part L Dwellings 2019

All **new Dwellings** and **Dwellings with deep renovation or major renovation** from 1st November 2019.



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Suite of Technical Guidance Documents (TGDs)

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https://www.housing.gov.ie/housing/building-standards/tgd-part-d-materials-and-workmanship/technical-guidance-documents

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Irish Building Regulations

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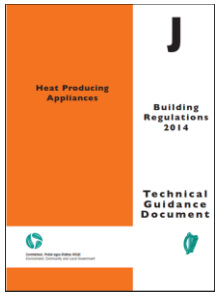
The most important Documents:



For the fabric of buildings:

- lower U-values
- improving air tightness
- reducing thermal bridging

For ventilation within buildings:

- Stricter levels and controls of ventilation

For the installed systems for heating/cooling and lighting:

- High efficiency gas and oil boilers
- Improved insulation of pipes carrying hot water
- Improved insulation of hot water storage tanks
- Zoning and automatic control of heating
- Replacement of inefficient light bulbs with low energy alternatives
- The provision of renewable energy sources for heating and/or electricity

Conservation of Fuel and Energy – Dwellings 2019

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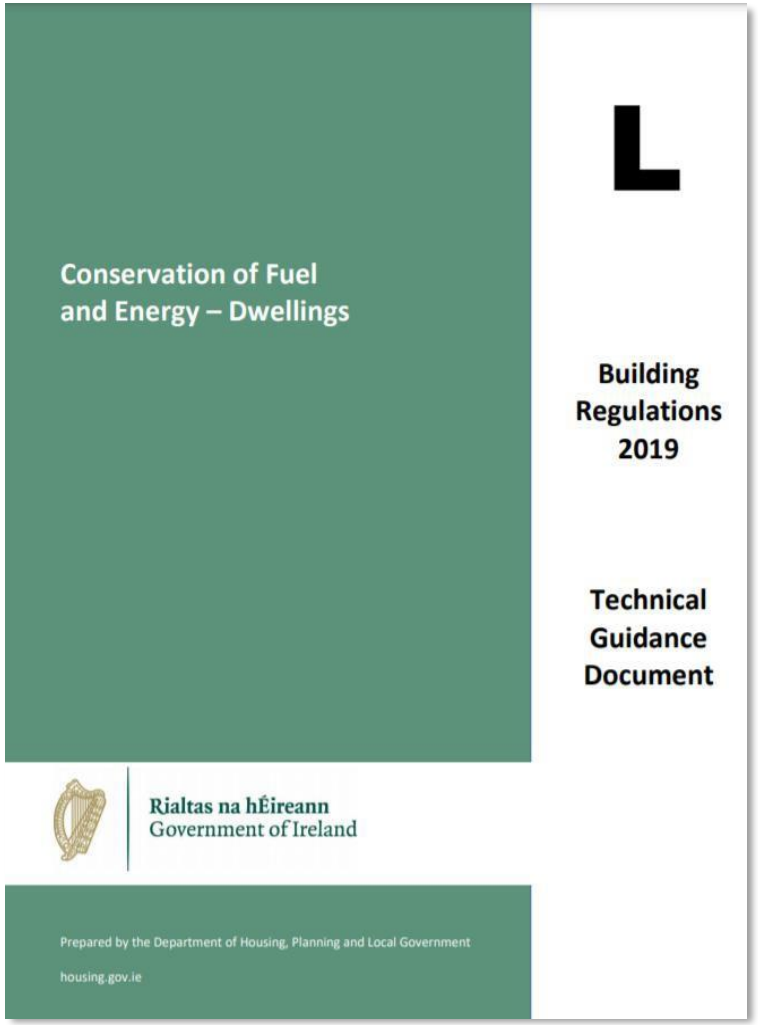

Key Guidance:

EPC, CPC, RER

Insulation

Air permeability

Thermal Bridging

Acceptable Construction Details (ACDs)

Image Source: Department of Housing, Planning and Local Government

Ventilation 2019

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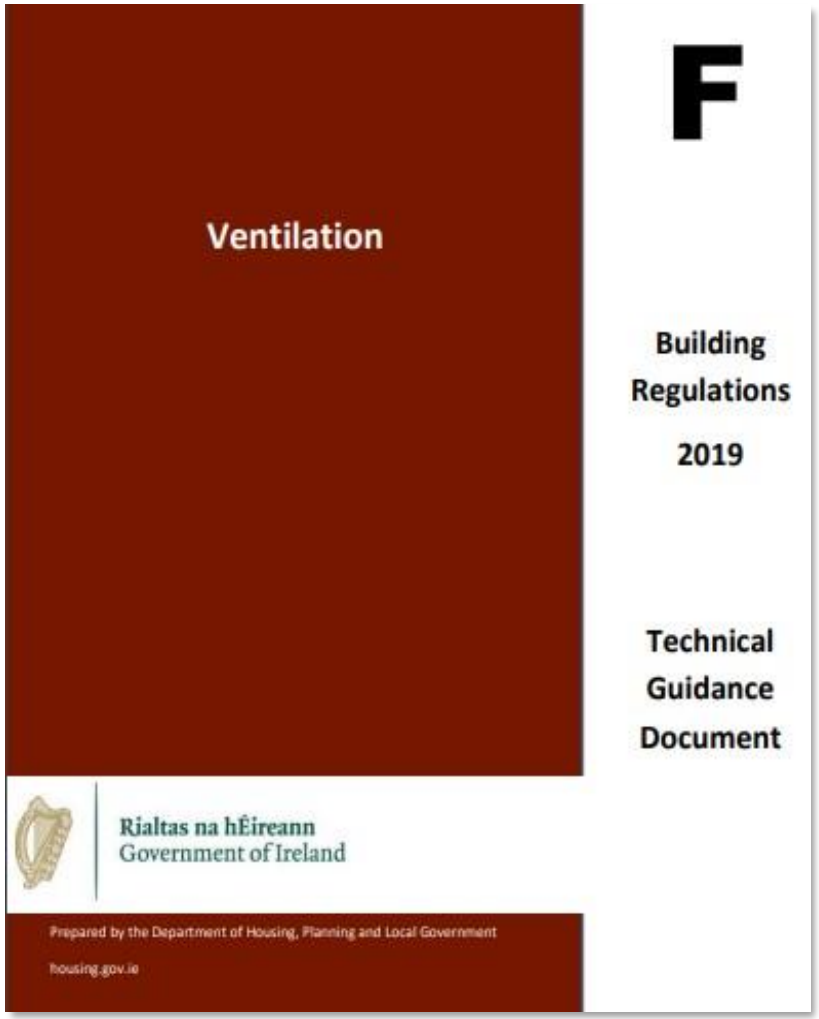

Key Guidance:

Ventilation strategies

Air flow rates for supply and extract

Quality assurance pertaining to design, installation and commissioning.

Image Source: Department of Housing, Planning and Local Government

New Dwellings

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A typical dwelling, with a Building Energy Rating **(BER) of A2** with a **primary energy value of 45 kWh/m²/annum** with a significant proportion of the energy demand being covered by renewable resources produced on-site or nearby. This takes account of the energy needed for space heating, water heating, fixed lighting and ventilation.

Not only is the compliance of the energy consumption required but to demonstrate NZEB compliance as calculated in the SEAI DEAP BER software, all new dwellings in Ireland must not exceed a maximum permitted energy performance co-efficient **(MPEPC) of 0.30** and not exceed a maximum permitted carbon performance co-efficient **(MPCPC) of 0.35.**

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Major Renovation Might require Whole Dwelling Upgrade

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Image Source: MosArt

Where a dwelling undergoes "**major renovation**", the energy performance of the whole dwelling should be improved to **Cost Optimal** level insofar as this is technically, functionally and economically feasible.

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What is a ‘Major Renovation’?

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Where more than **25%** of the surface area of a dwelling undergoes renovation.
The cost optimal performance level to be achieved is **125 kWh/m2.yr** with a Building Energy Rating (BER) of B2

Image Source: MosArt

Surface area of “thermal envelope”
= surface area through which it can lose heat to the external environment or the ground, including walls, windows, floors and roof

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Buildings Exempt from NZEB – Outlined in TGD Part L

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"TGD Part L Regulations do not apply to works (including extensions) to an existing building which is a **"protected structure"** or a "proposed protected structure" within the meaning of the Planning and Development Act 2000 (No. 30 of 2000)".

Where buildings are not protected structures, or proposed protected structures, but are of **architectural or historical interest**, including buildings of **traditional construction**, the aim should be to improve the energy efficiency as far as is reasonably practicable.

The work should not prejudice the **character of the building** or increase the **risk of long term deterioration** of the building fabric.

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Sample Acceptable Construction Detail (ACD)

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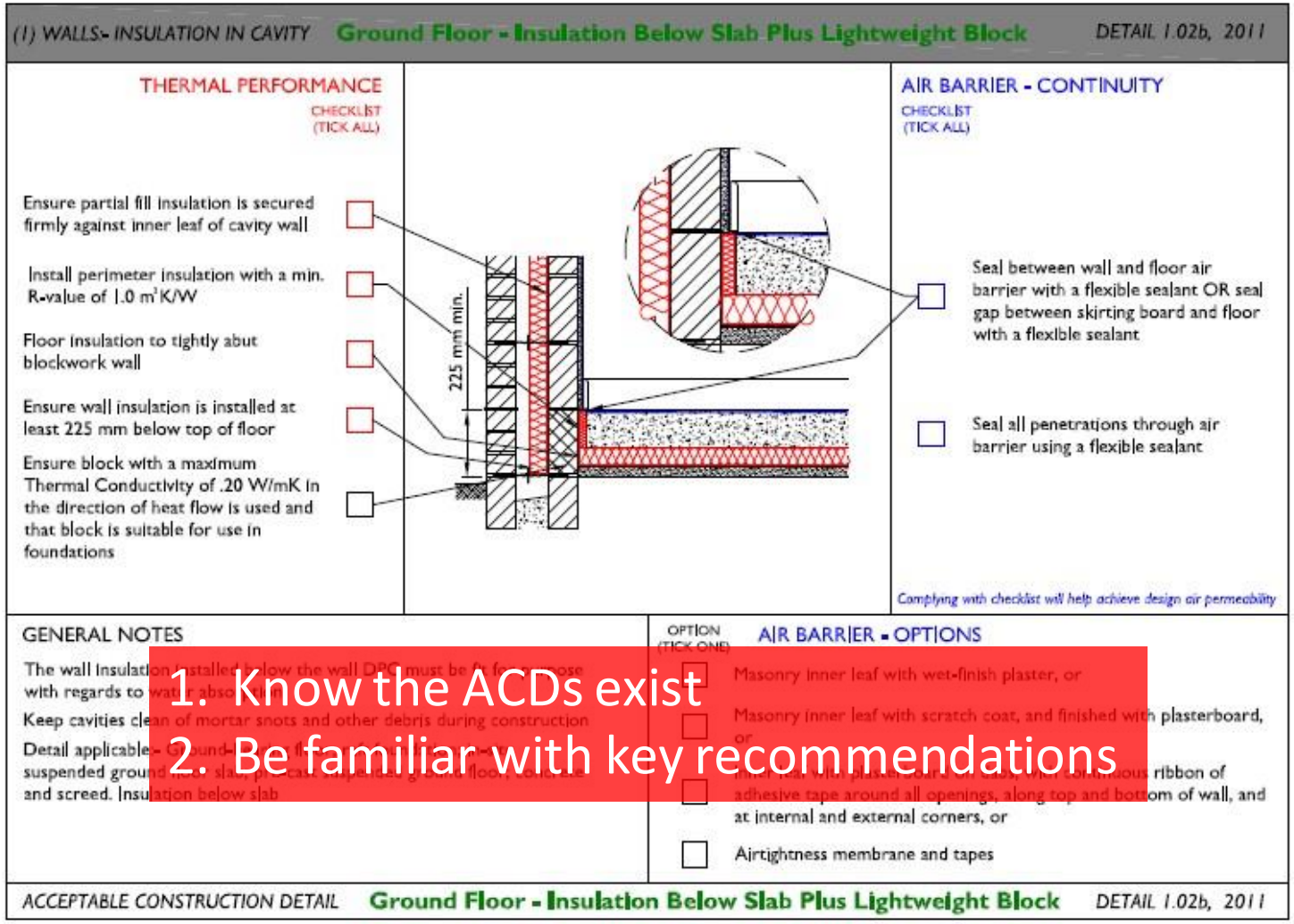

1. Know the ACDs exist
2. Be familiar with key recommendations

Image Source: Department of Housing, Planning and Local Government

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Comparison to 2005 ‘Reference Dwelling’

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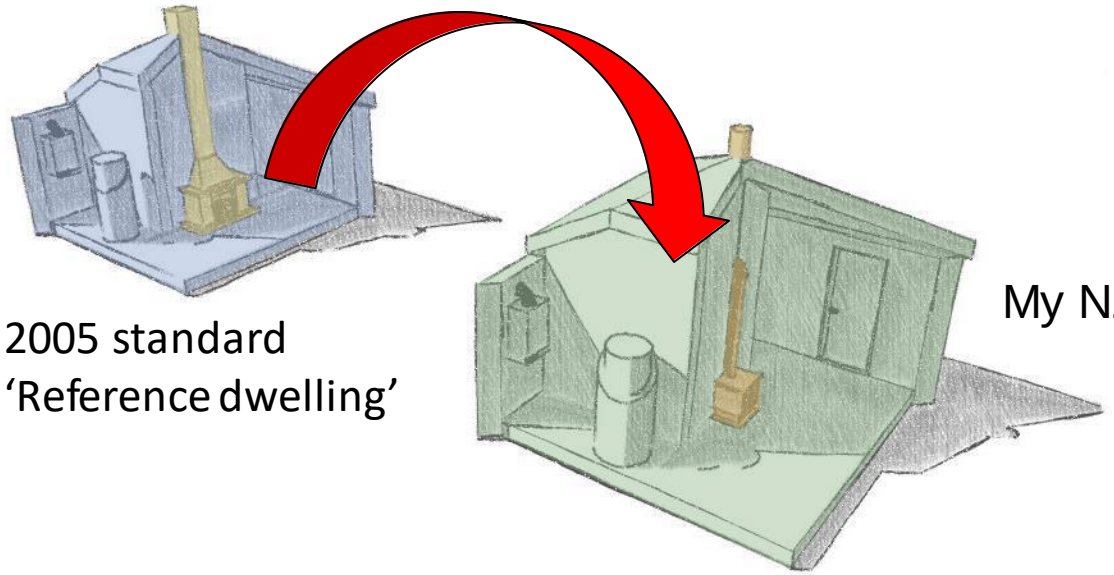
DEAP compares the performance of your proposed NZEB dwelling to a so-called ‘Reference Dwelling’ (2005 energy efficiency standard)



2005 standard ‘Reference dwelling’

My NZEB dwelling

My dwelling **must out-perform** the energy efficiency of the reference dwelling by a minimum amount to comply with NZEB

Image Source: MosArt

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TGD Part L 2019 - Primary Energy Use and “EPC”

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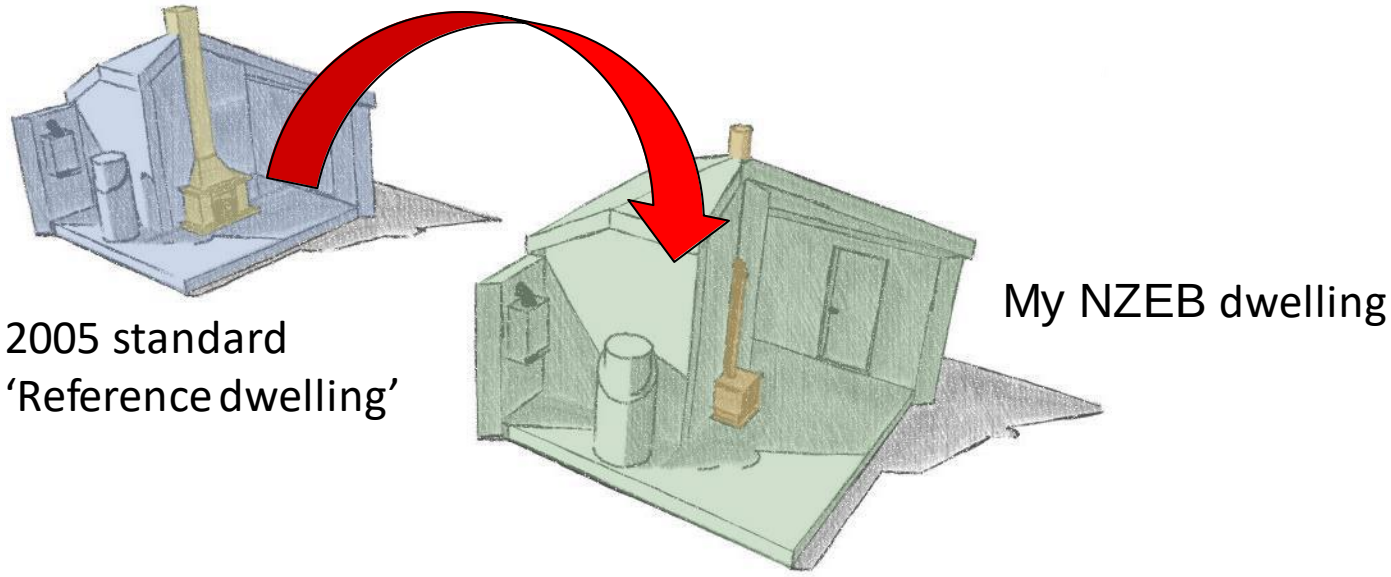

Primary Energy Use must be **< 30%** of 2005 standard

Max energy performance coefficient

“EPC” = 0.30

33% improvement on previous Part L regulation

Image Source: MosArt

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TGD Part L 2019 - CO_2 Emissions and "CPC"

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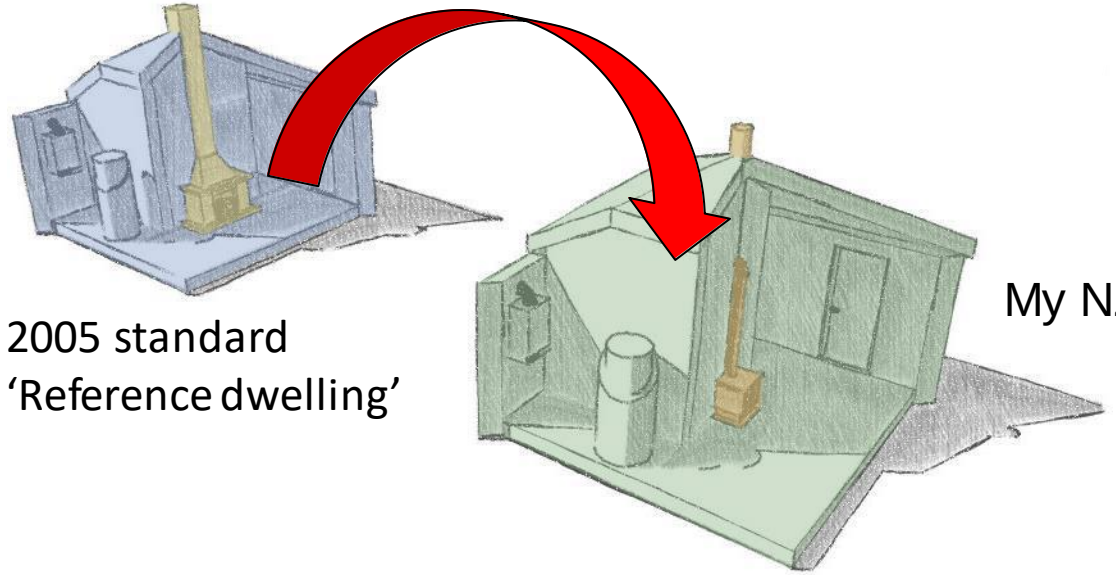

2005 standard
'Reference dwelling'

My NZEB dwelling

CO_2 emissions must be **< 35%** of 2005 standard

Max carbon performance coefficient

"CPC" = 0.35

31% improvement on previous Part L regulation

Image Source: MosArt

Minimum Renewable Energy Ratio (RER) Requirement for NZEB

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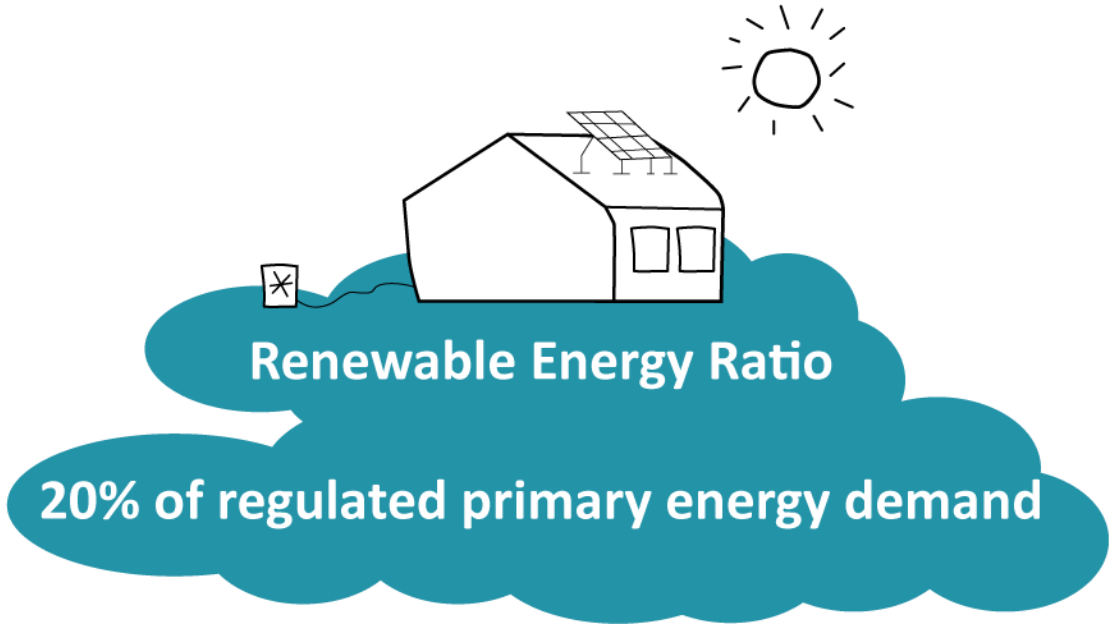

- Regulated energy demand includes heating, cooling, domestic hot water, ventilation and lighting
- It does not include household appliances

Image Source: MosArt

What is the Regulated Load of an NZEB Dwelling?

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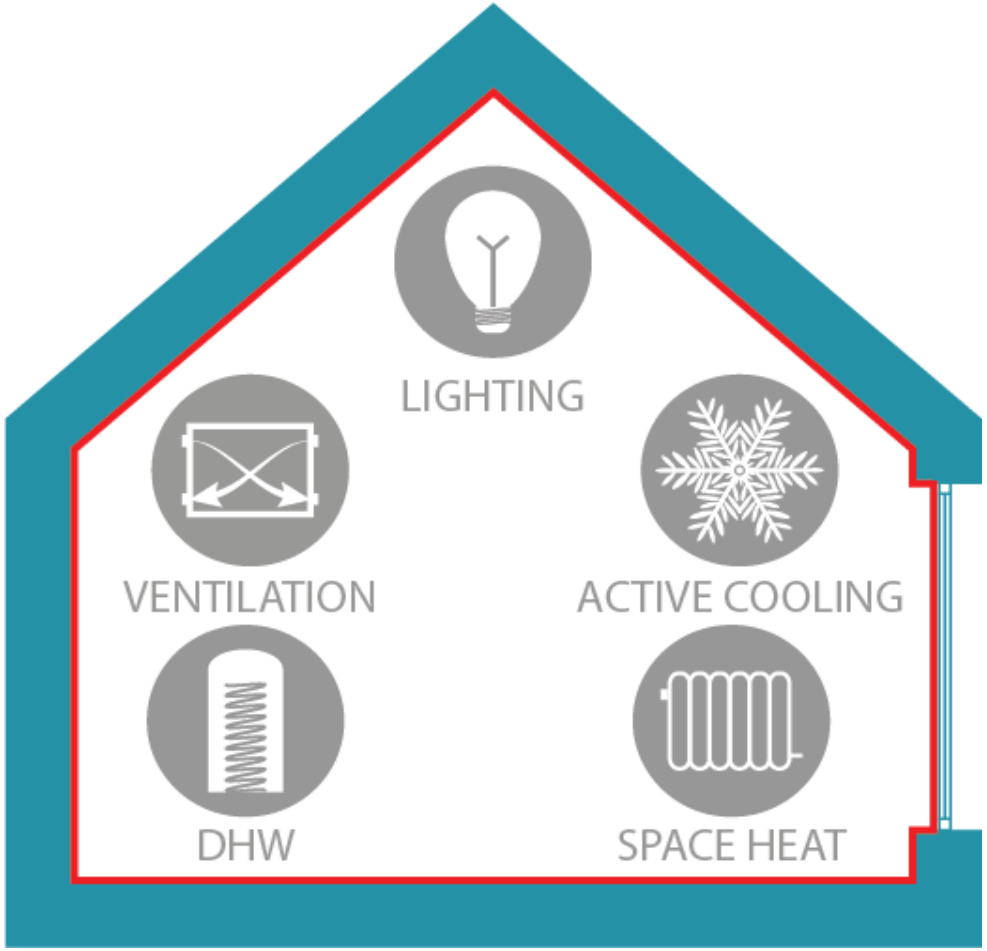

Image Source: MosArt

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What is Primary Energy?

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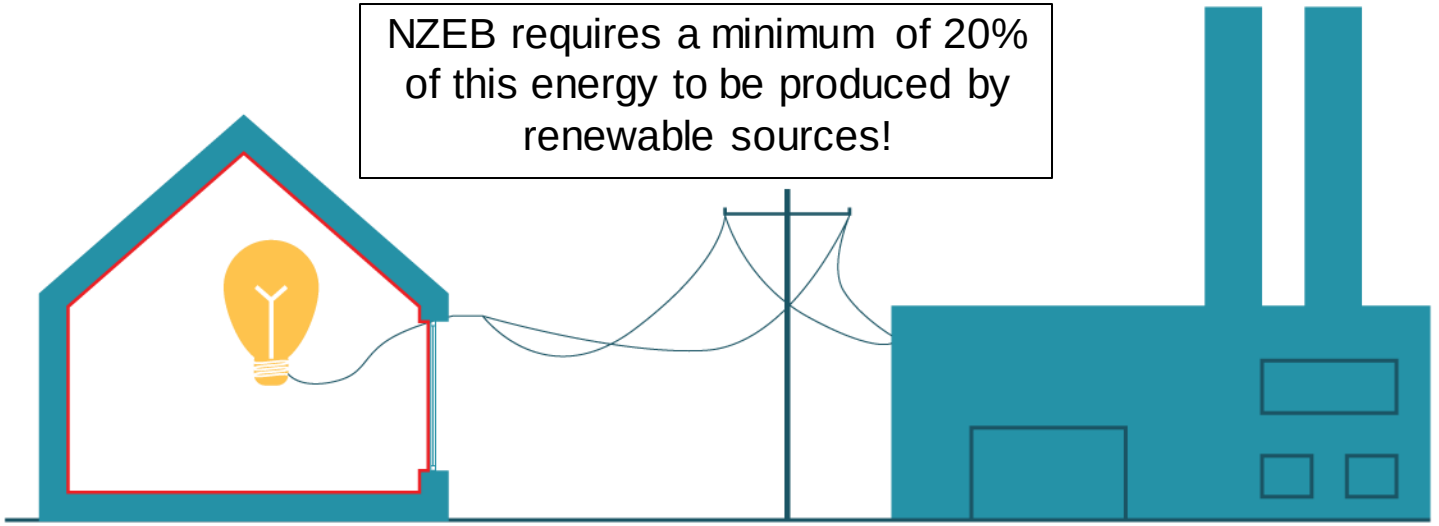
NZEB requires a minimum of 20% of this energy to be produced by renewable sources!



GENERATION LOSSES AT POWER PLANT

Delivered Energy ← Losses via National Grid → **Primary Energy**

1 Watt ← Losses via National Grid → **2.08 Watts**

Image Source: MosArt

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Improvements in energy Performance Since 2005

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Year	2005	2008	2011	2019
Energy Improvement	Baseline	40%	60%	70%
Primary Energy Consumption	150	90	60	45
CO2 Emission Rate ($kgCO_2/m^2/yr$)	30	18	12	10
Renewable Energy Contribution	n/a	10 $kWh/m^2/yr$ thermal or 4 $kWh/m^2/yr$ electric	10 $kWh/m^2/yr$ thermal or 4 $kWh/m^2/yr$ electric	20%
Maximum Permitted Energy Performance Co-Efficient (MPEPC)	n/a	0.6	0.4	0.3
Maximum Permitted Carbon Performance Co-Efficient (MPCPC)	n/a	0.69	0.46	0.35
BER	B3	B1	A3	A2

Remember, it is only the EPC, CPC and renewable energy contribution that determines whether a building is NZEB or not, the other figures above are only indicators!

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What is Energy Assessment Procedure - DEAP?

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DEAP stands for the **Dwelling Energy Assessment Procedure**, which is the methodology for demonstrating compliance with specific aspects of Part L for Dwellings of the Building Regulations.

DEAP is also used to generate the Building Energy Rating (BER) and advisory report for new and existing dwellings. DEAP calculates the energy consumption and CO_2 emissions associated with a standardised use of the dwelling.

The DEAP software has been developed by SEAI, who are also responsible for auditing DEAP assessors. The use of DEAP is strictly outlined in the DEAP manual.

DEAP is the only tool that can be used to prove NZEB compliance

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What is DEAP?

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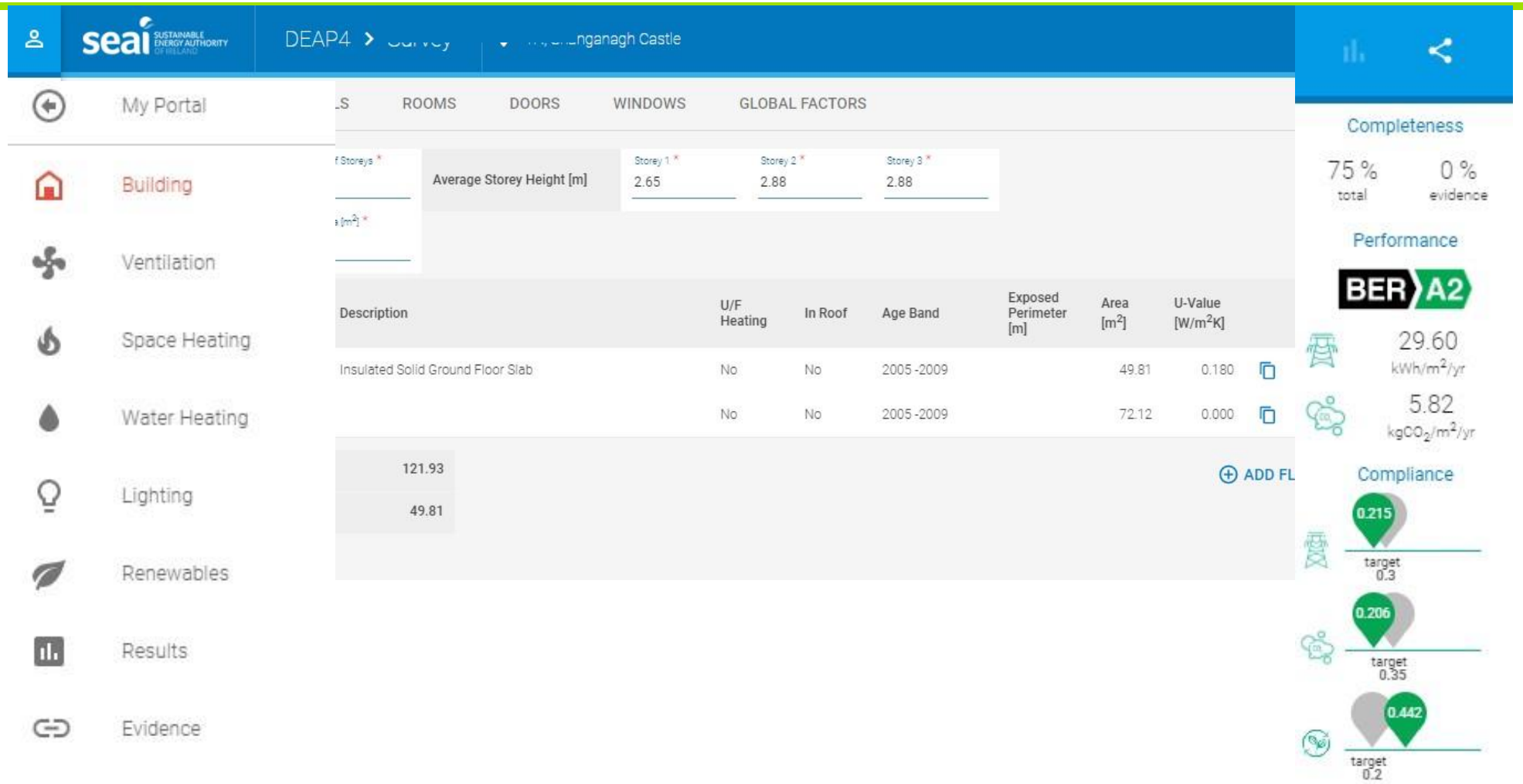

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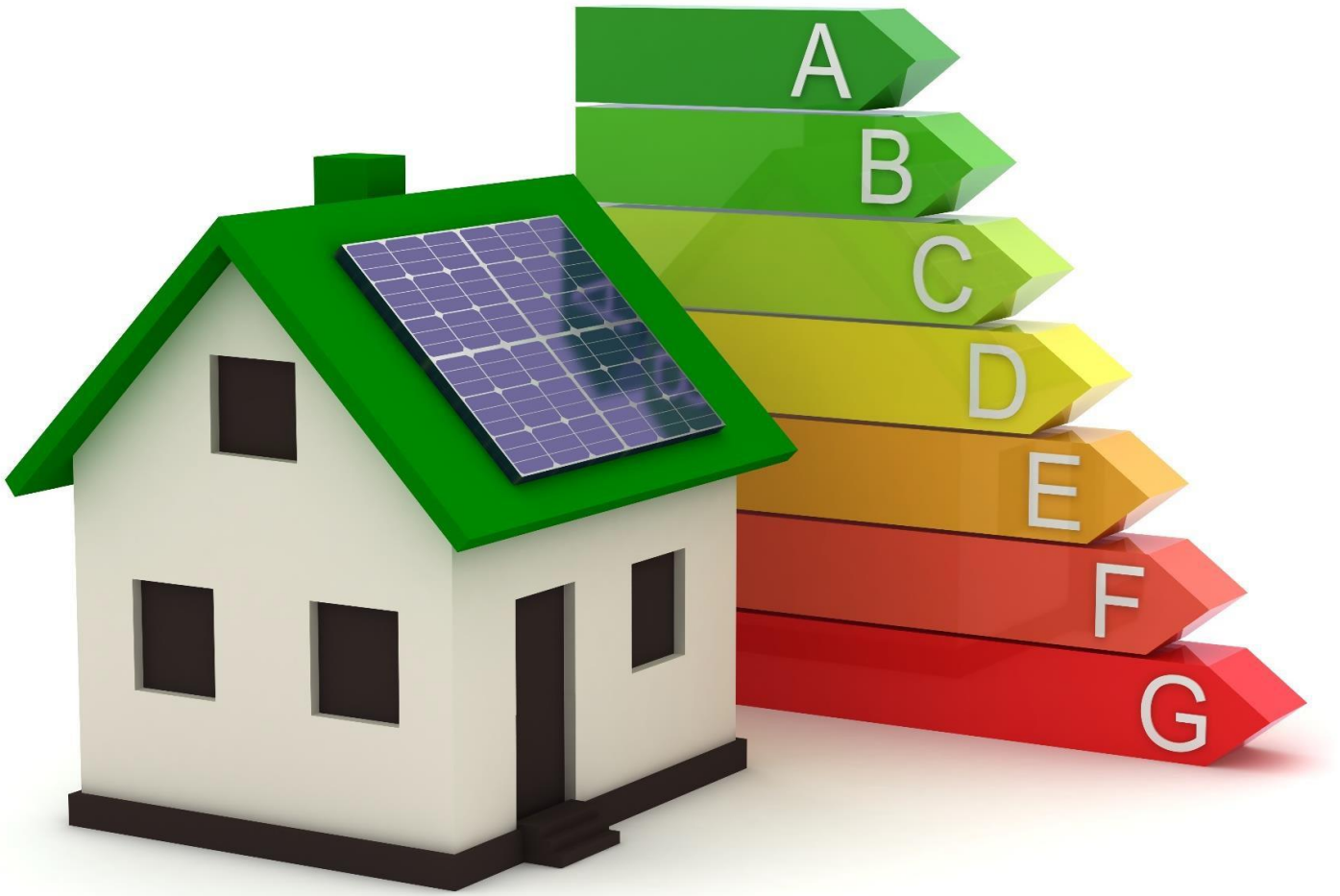

Image source: Purchased by MosArt from iStock (157615946)

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BER's Across Ireland

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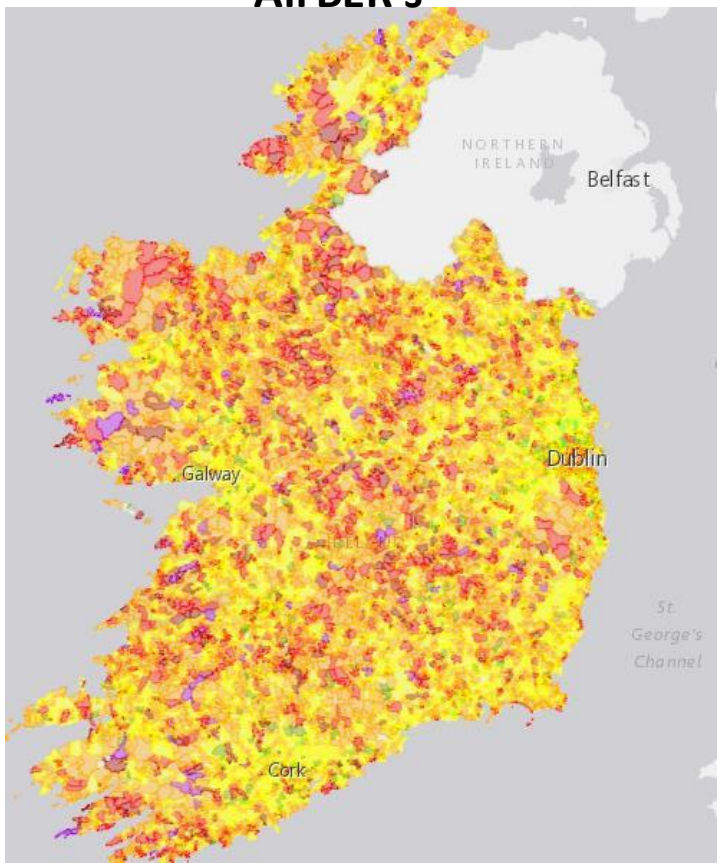
All BER's



A rated BER's

Median BER - A | Median BER - B | Median BER - C | Median BER - D | Median BER - E | Median BER - F | Median BER - G

Image source: SEAI -BER Map – Last update before above images 04/2020

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Major Improvement in Energy Efficiency of New Homes

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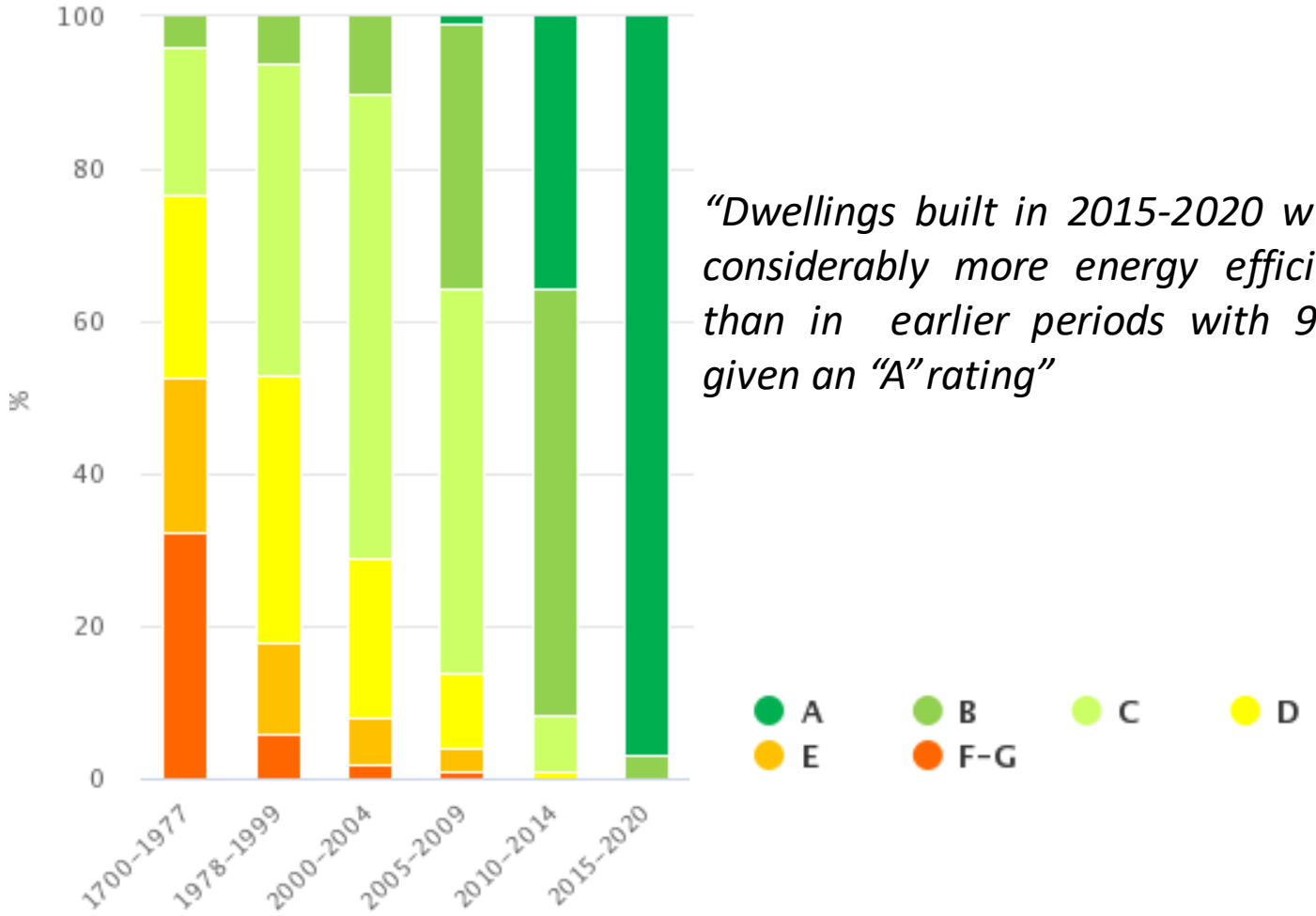

Image source: CSO Ireland

"Dwellings built in 2015-2020 were considerably more energy efficient than in earlier periods with 97% given an "A" rating"

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CE European Conformity Marking

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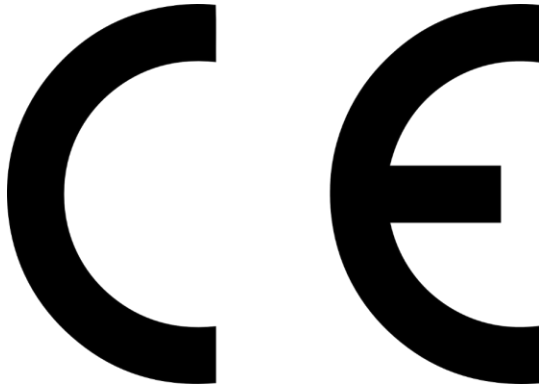
CE Marking on a product is a manufacturer's declaration that the product complies with the essential requirements of the European technical regulations ("Directives"), related to European health, safety and environmental protection legislation, and that the product compliance has been established using the appropriate conformity assessment procedure(s).



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NSAI's 'Construction Products Regulation' (CPR)

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Before a product can be certified, it must first undergo a process of inspection and testing to ensure it meets **Minimum quality assurance standards & Any relevant legal requirements.**

The product certification services can be divided into two broad categories:

- **CE marking:** legal requirement for many products sold in the European Union
- **Irish Standards Mark (ISM):** A system of quality control supervised by NSAI.

Be Aware of **Standards** related to Construction

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- NSAI's 'Construction Products Regulation' (CPR)
- "CE European Conformity Marking"
- SR 325 – design of masonry structures
- 'Woodspec – A Guide to Designing, Detailing and Specifying Timber in Ireland'
- I.S. 127 and I.S. EN 14081 relating to timber strength grading
- I.S. 193 and I.S. EN 14250 relating to roof truss manufacturing standards

Image Source: Armaflex

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SR 325 – design of masonry structures

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SR 325

This Standard Recommendation contains non-contradictory complementary information as guidance material for the use in Ireland of the following EN Eurocode 6 series of standards

Topics covered

- Scope
- Normative references
- Terms and definitions
- Materials and components
- Design
- Workmanship

Woodspec – A Guide to Designing, Detailing and Specifying Timber in Ireland

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WOODSPEC is a guide to designing, detailing and specifying timber in Ireland. It covers the following topics:

- Design guidance
- Detailed drawings
- Sample timber specifications
- Timber building specifications
- Reference materials

I.S. 127 and I.S. EN 14081 relating to timber strength grading

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I.S. 127

Specifies a method of visually strength grading structural softwood timber of rectangular cross-sections shaped by sawing, planing or other methods.

Topics covered:

- Scope
- Normative references
- Terms and definitions
- Requirements for strength grading of timber
- Measurement of characteristics
- Strength grade requirements
- Marking

I.S. EN 14081

Defines requirements for visual and machine strength graded structural timber of rectangular cross-section shaped by sawing, planning or other methods and of minimum cross sectional dimensions complying with EN 336.

Topics covered:

- Scope
- Normative references
- Terms and definitions
- Symbols
- Requirements for structural timber
- Assessment and verification of constancy of performance AVCP
- Marking
- Environmental issues

Reference Source: NSAI

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I.S. 193 and I.S. EN 14250 relating to roof truss manufacturing standards

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I.S. 193:

Describes the requirement for material, fabrication and the use of trusses using punched metal plate fasteners for roofs in service class conditions 1 and 2.

- **Topics covered:**
- Materials
- Assessment of structural adequacy
- Design requirements
- Roof truss design
- Limitation for roof truss span and sizes
- Fabrication
- Information for design and fabrication
- Handling and storage
- Erection and site work

I.S. EN 14250:

Describes material, product and documentation requirements for prefabricated structural members (e.g. trusses for roofs, walls and floors, frames, composite beams and girders) for use in buildings made from solid structural timber according to EN 14081-1 with or without finger joints assembled with punched metal plate fasteners.

- **Topics covered:**
- Scope
- Normative references
- Terms and definitions
- Material requirements
- Prefabricated member requirements
- Product documents
- Evaluation of conformity
- Marking

Reference Source: NSAI

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Assessment

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Thank You

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