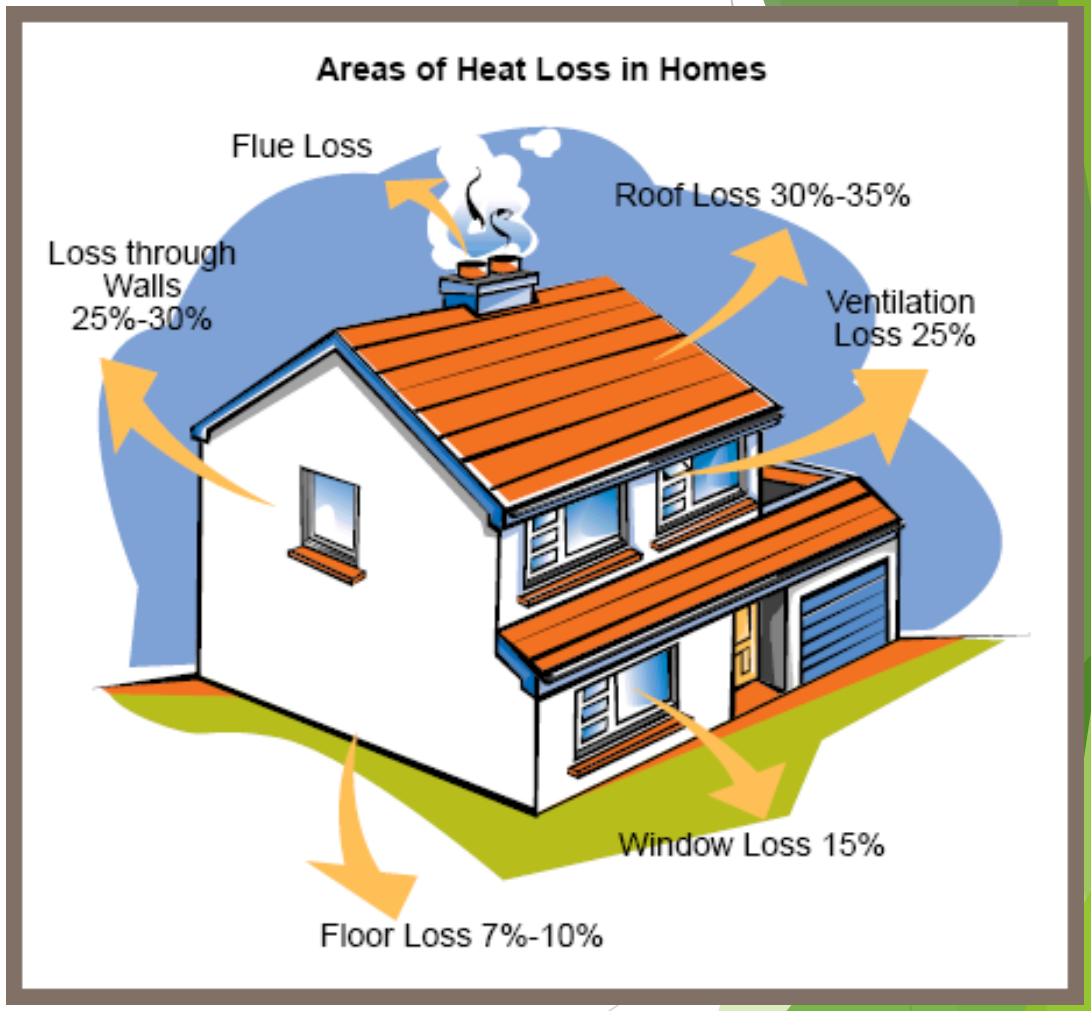
Building Efficiency

Week 2

Fabric First - Insulation

- For domestic users the first money to be spent is on insulation
- Attic
- Windows
- Doors
- Floors
- Draughts



Improving Insulation in older buildings

Walls:

Must consider the wall type and then select the appropriate insulation type for the wall:

Wall Types:

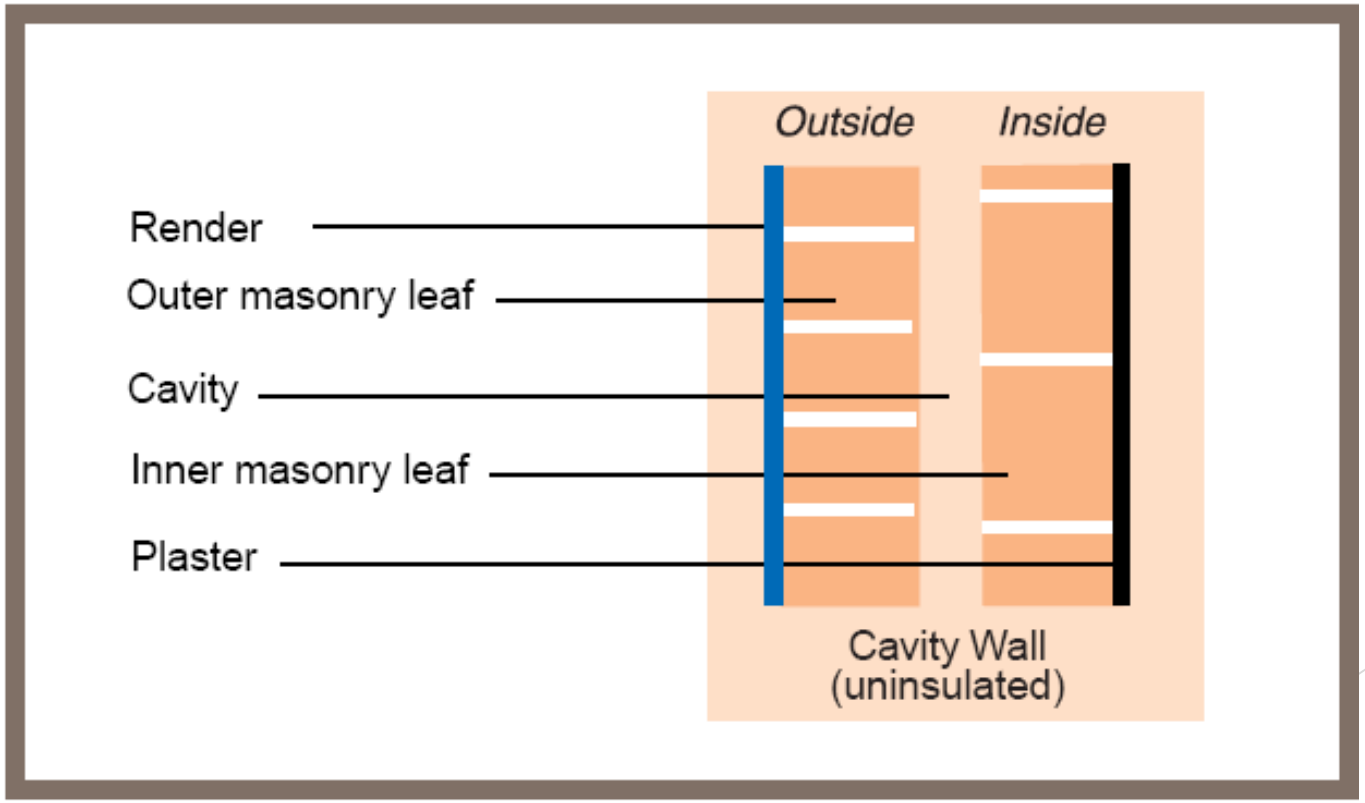
- Cavity wall
- Solid masonry wall
- 9 inch hollow block
- Timber frame

Insulation Types:

- Cavity insulation
- Internal wall insulation
- External wall insulation

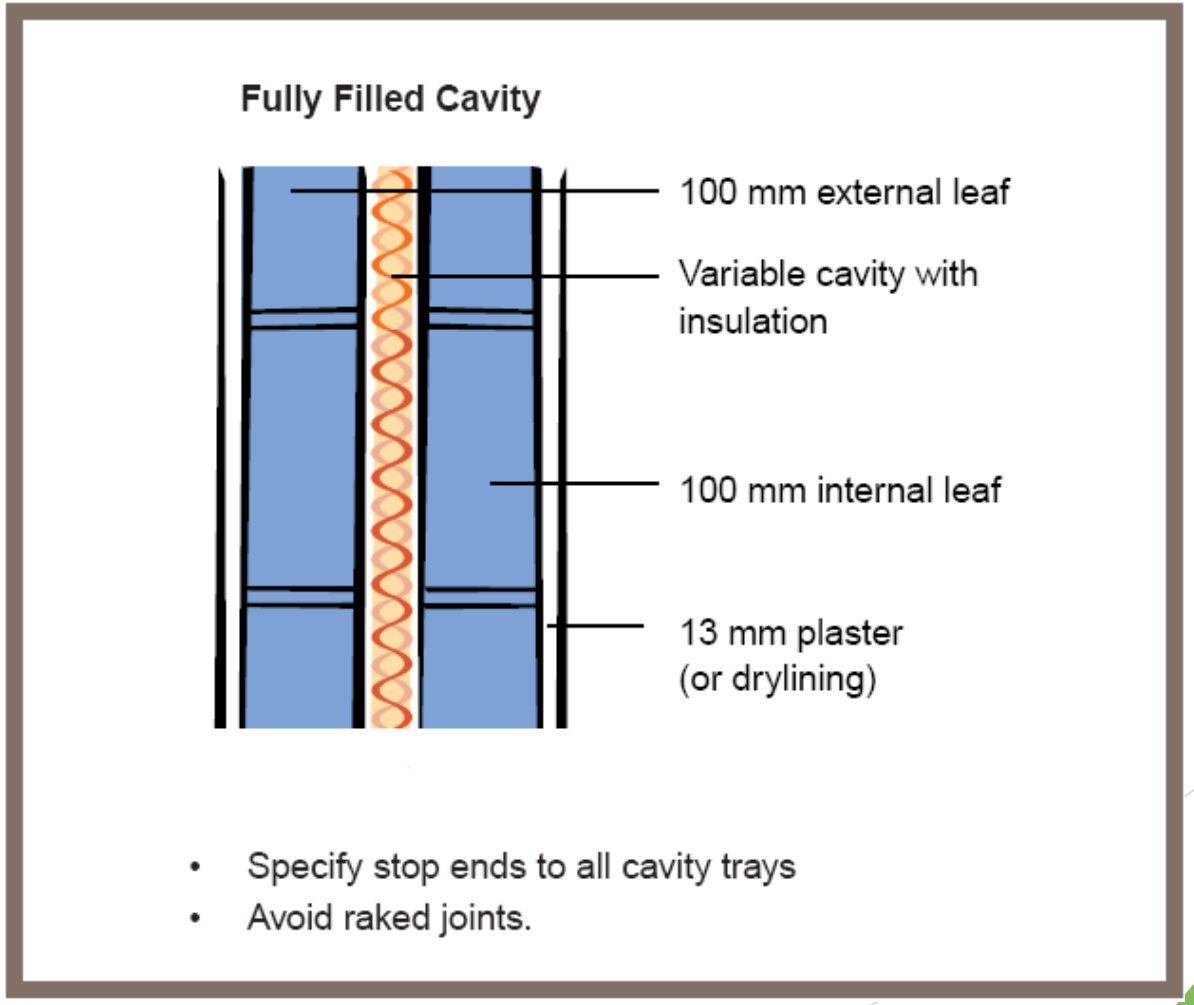
Improving Insulation in older buildings

Walls: e.g. Cavity wall with no insulation



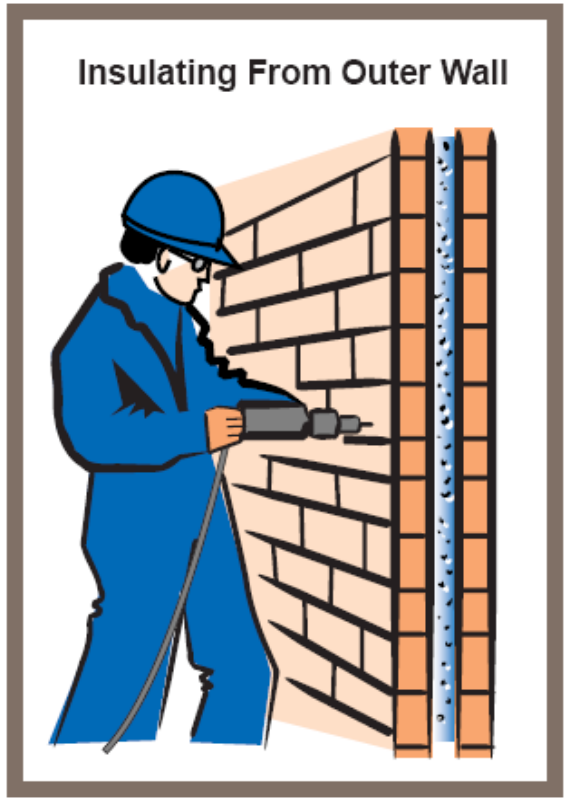
Improving Insulation in older buildings

Walls: e.g. Cavity wall full-fill insulation



Improving Insulation in older buildings

Walls: e.g. Cavity wall full-fill insulation



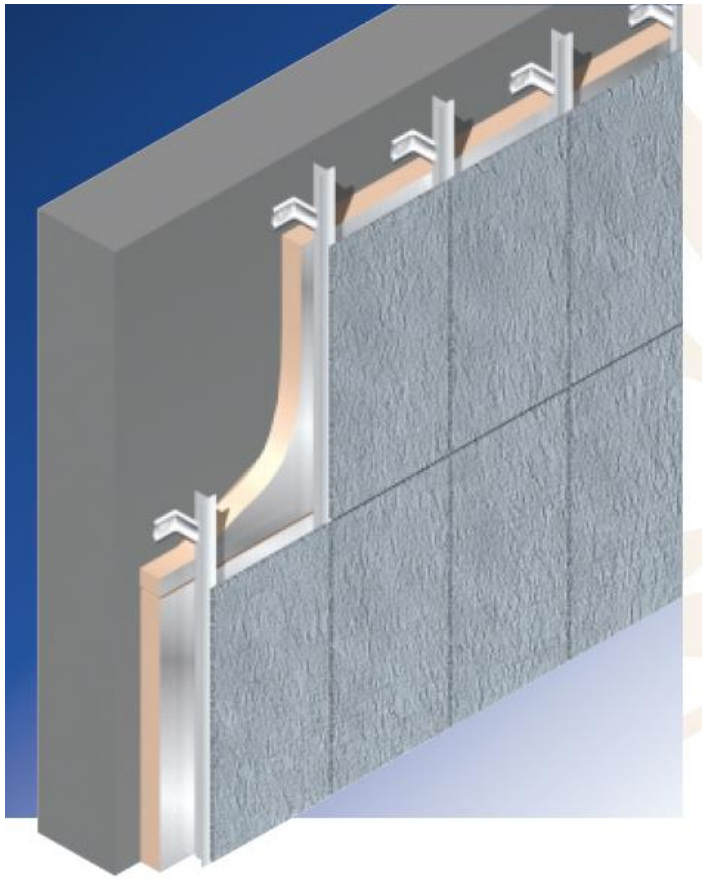
- This type of insulation can be injected or blown into wall from outside through drilled holes ~ 1 inch diameter placed 1 meter apart

- Condition of wall must be inspected before this type of insulation is used. Factors such as rain penetration, general condition of wall and ventilation openings are taken into account

- Grants available

Improving Insulation in older buildings

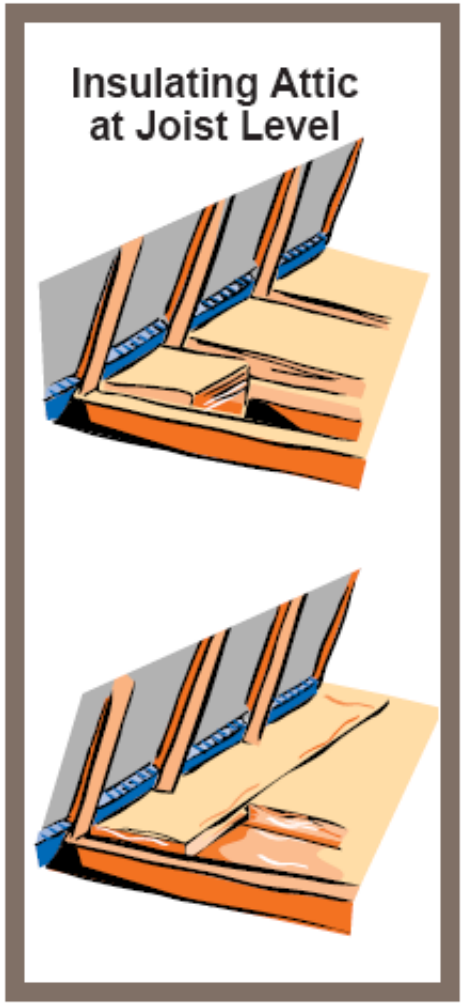
Walls: e.g. External insulation



- Insulations is fixed to outer surface wall and covered with a cement-based render for weather resistance
- A steel or fibre glass mesh is embedded into this render to provided strength
- Window sills and pipes may need to be moved
- Can solve rain penetration issues
- Cost ~ €50/m^2 => €15,000 for a typical semi detached house
- Grant available

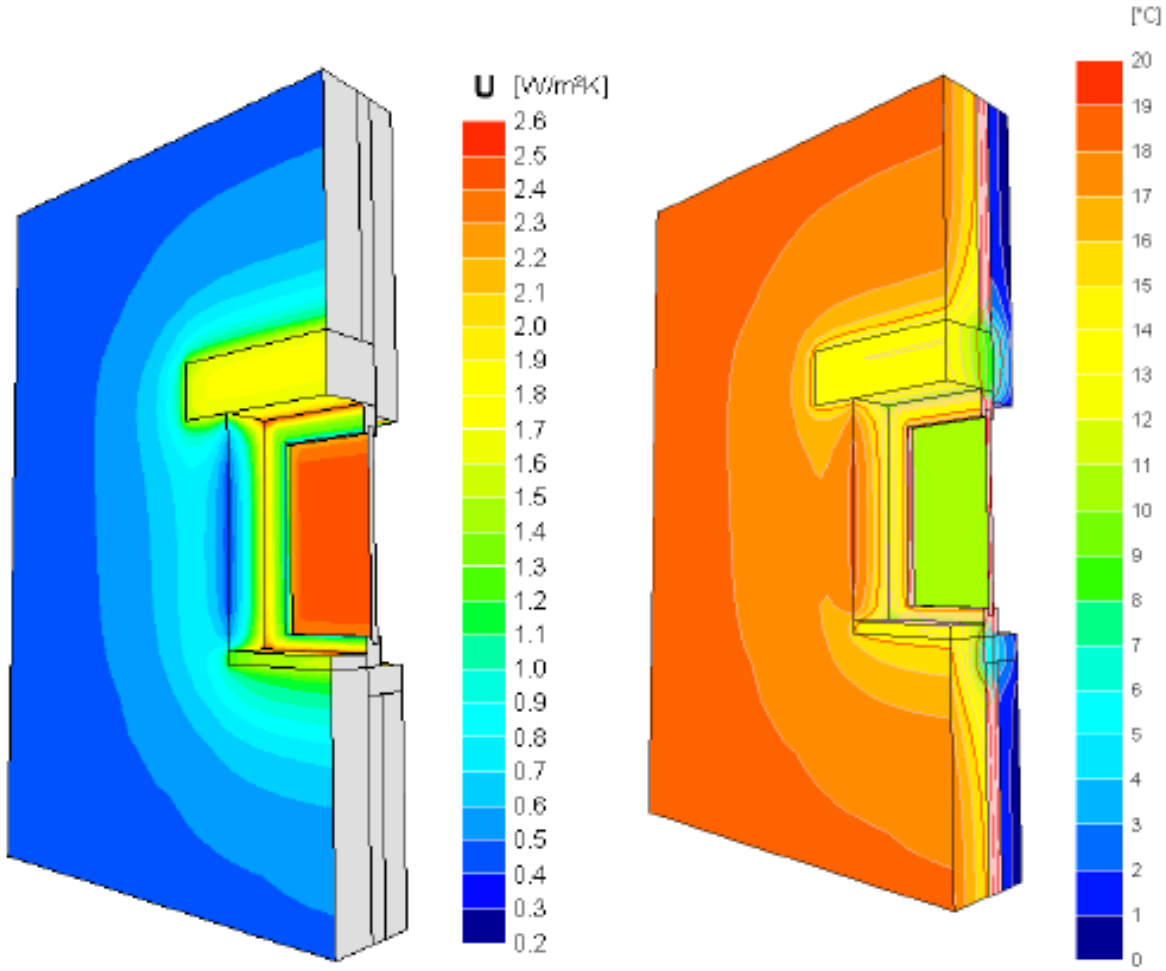
Improving Insulation in older buildings

Roof: Attic Insulation



- Lay glass fibre or mineral fibre in rolls between ceiling joists and a second layer over joists in opposite direction. Min 300mm thick total
- Attic space will become cooler so important to insulate any hot water pipes
- 1m^2 costs ~ €20

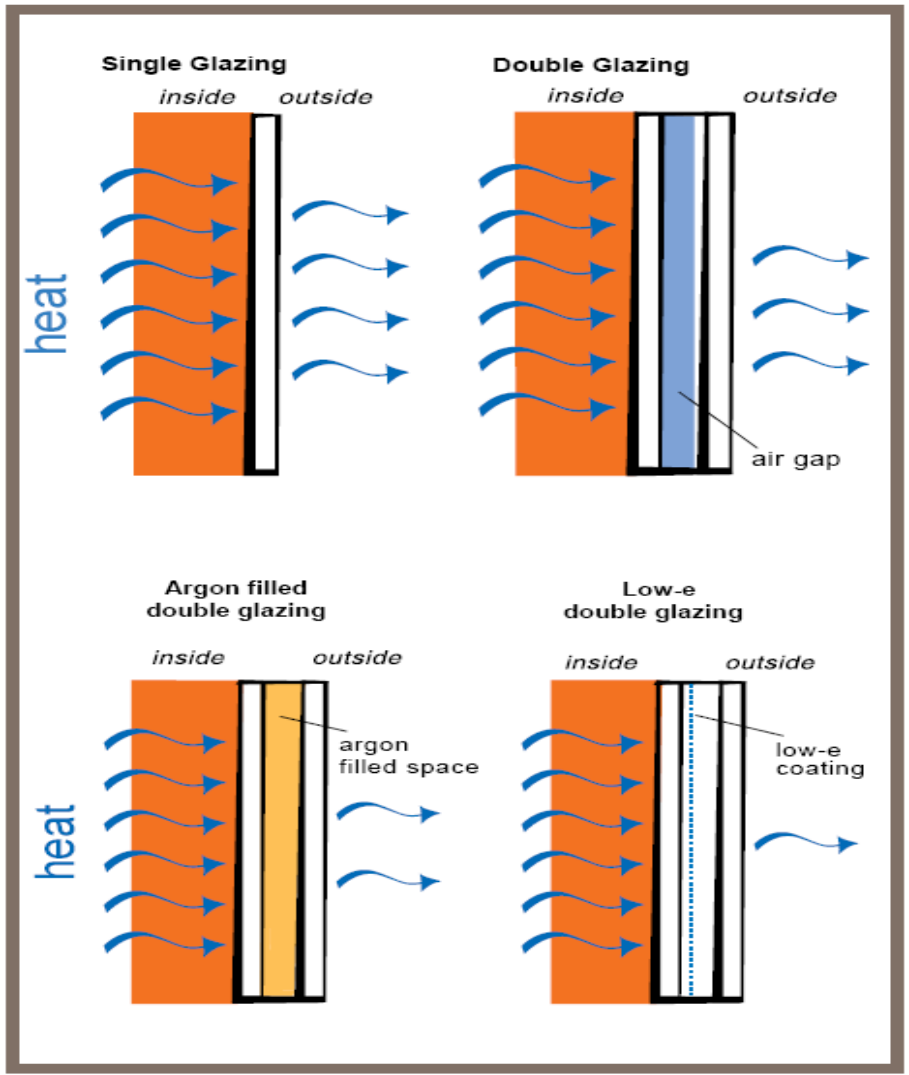
Thermal Bridging



The left-hand diagram shows the high heat flow caused by the lintel, the frame of the window and the single glazing. On the right-hand simulation you can see the consequences in terms of temperature.

Improving Insulation in older buildings

Windows:



Heat Loss Comparison:

Single glaze (reference)

Double glaze: 50%

Double glaze argon filled: 45%

Double glaze low-e: 0.35%

Double low-e argon filled : 27%

Ratings based on energy loss “U value” and Solar Gain “G value”

Improving Insulation in older buildings

Windows:

- Low E double glazing – the outside face of inner pane is coated with a special layer of material which is transparent to light but has high resistance to heat flow

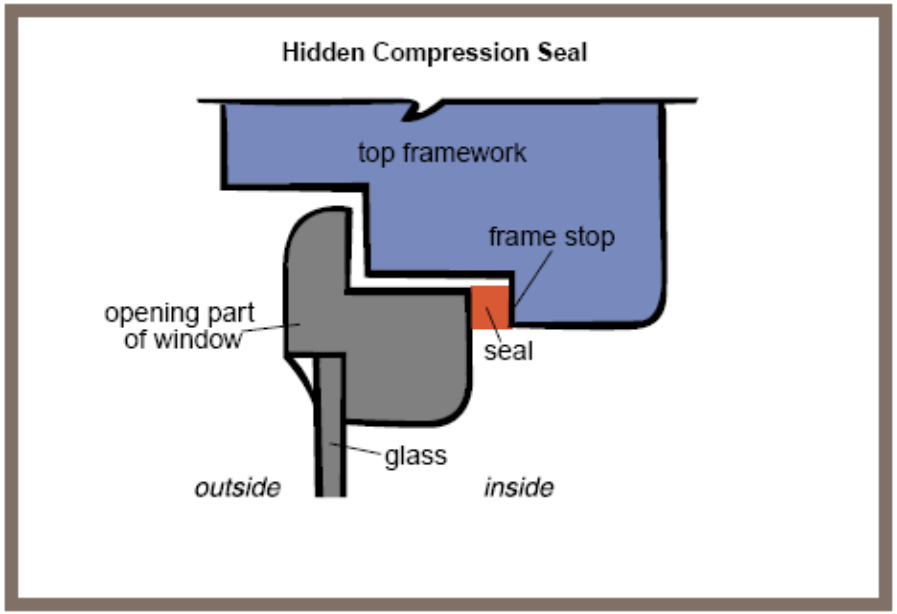
Cost 15% more than regular double glazing and is a requirement in new buildings to meet building regulations.

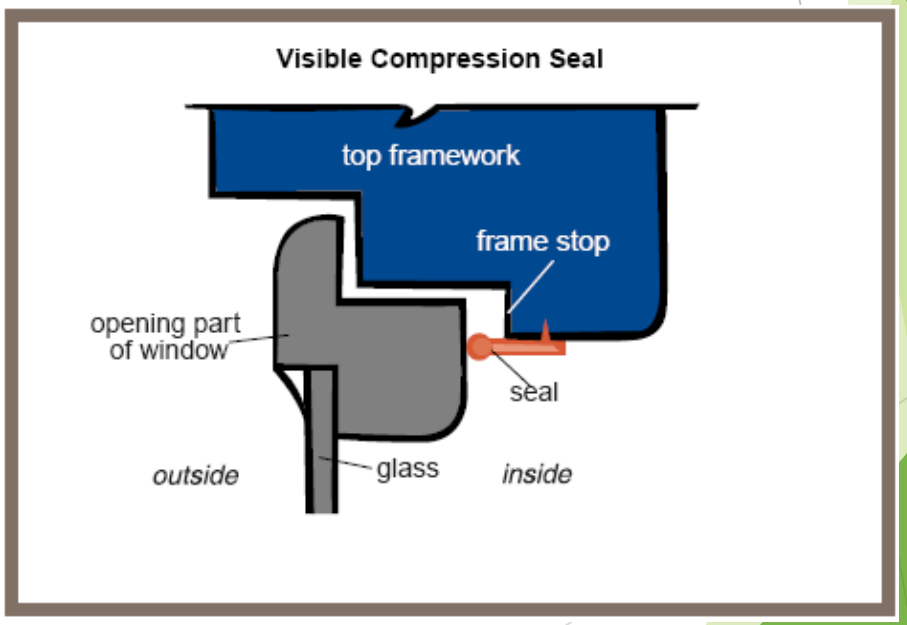
- Can have argon filled low e double glazing and triple glazing

- Triple glazing is normally 10-15% more expensive again

Improving Insulation in older buildings
Simple solutions

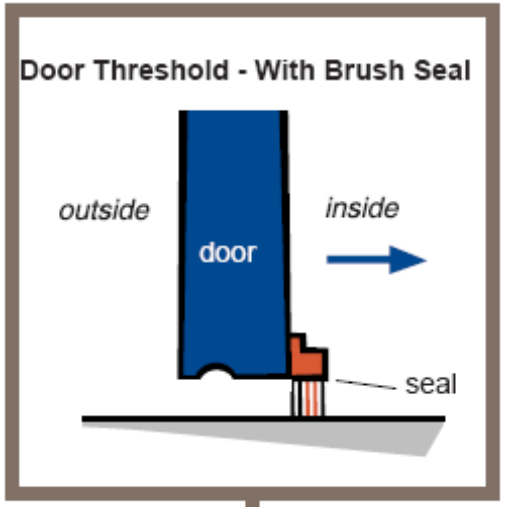
Draught Proofing: Windows

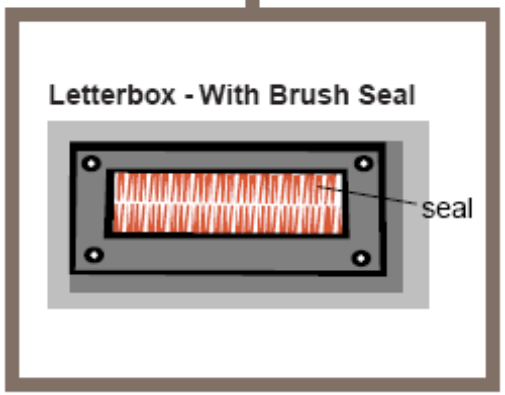


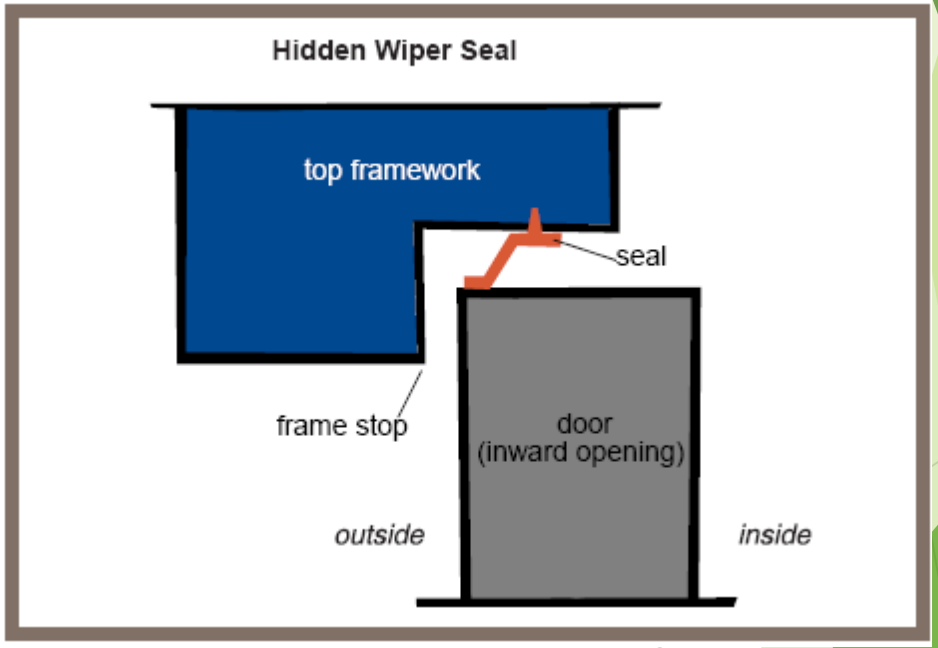


Improving Insulation in older buildings

Draught Proofing: Doors







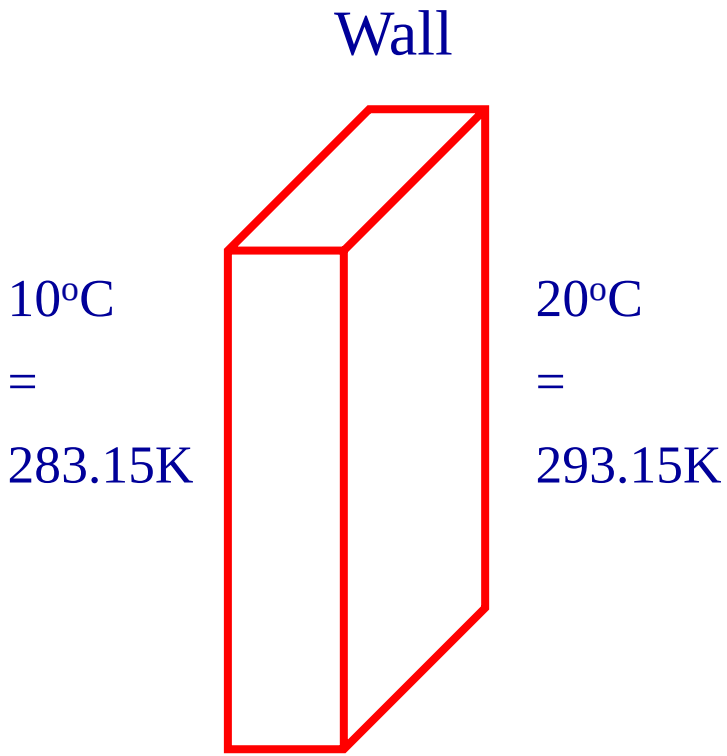
Temperature Units – the science bit

Celsius (C)

Kelvin (K)=> 1°C + 273.15 = Temperature in Kelvin

Worked example:

The temperature on one side of a wall is 10C and 20C on the other wall



Temp difference

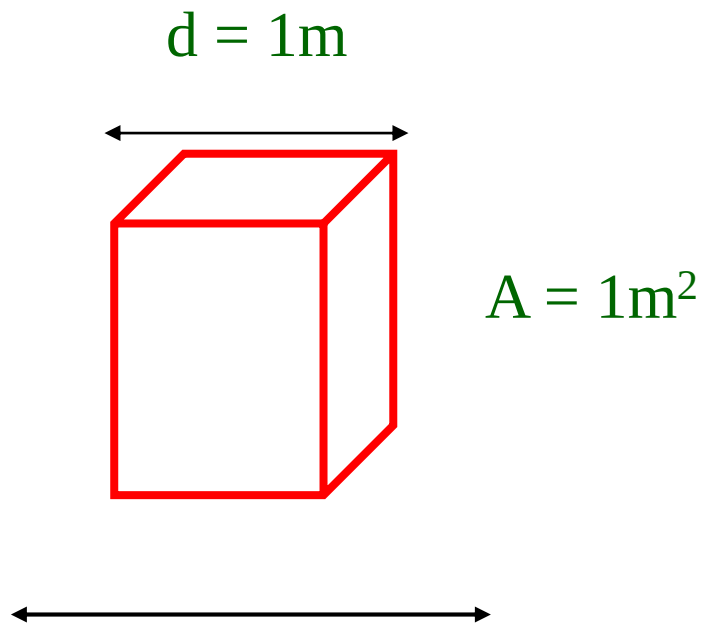
20°C – 10°C = 10°C

290.15K –280.15K = 10K

i.e temp *difference* is same value for either scale

Thermal conductivity (k)

k = heat flow per second through $1m^2$ of a material that is 1m thick for a 1 degree temperature difference of 1^oC (or 1 K) across the material - intrinsic property



If A increases more heat flows

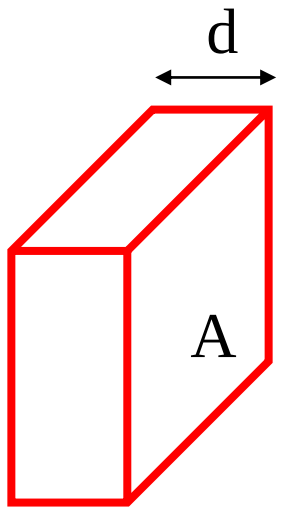
If d increases less heat flows

k= thermal conductivity W/mK

(*manufacturer's data sheet)*

U values!

U values are a measure of heat loss through
1m^2 of a material per degree C (or Kelvin = Celsius)
Units are W/m^{2}K



$$U = \frac{k}{d}$$

Thermal Resistance R of fabric = 1/U

$$R = \frac{d}{k}$$

2019 Building regulations Part L

Existing dwellings

L1 A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.

L2 For existing dwellings, the requirements of L1 shall be met by:

(a) limiting heat loss and, where appropriate, maximising heat gain through the fabric of the building;

(b) controlling, as appropriate, the output of the space heating and hot water systems;

(c) limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air;

(d) providing that all oil and gas fired boilers installed as replacements in existing dwellings shall meet a minimum seasonal efficiency of 90 % where practicable.

Regulation 7

When a dwelling undergoes major renovation, the minimum energy performance requirement of the dwelling or the renovated part thereof is upgraded in order to meet the cost optimal level of energy performance in so far as this is technically, functionally and economically feasible.

- Housing.gov.ie
- New builds can not receive any grant assistance from SEAI
- Older buildings can receive grant assistance
- Home retrofits by SEAI aim to achieve a B2 energy rating

BER ratings for domestic premises

- A Building Energy Rating (BER) certificate indicates your home's energy performance. The certificate rates the energy performance of your home on a scale of A-G.
- A-rated homes are the most energy efficient and will tend to have the lowest energy bills. G-rated are the least energy efficient. – SEAI
- Rating is also given in kWh/m^2/year

Sample BER

Building Energy Rating (BER)

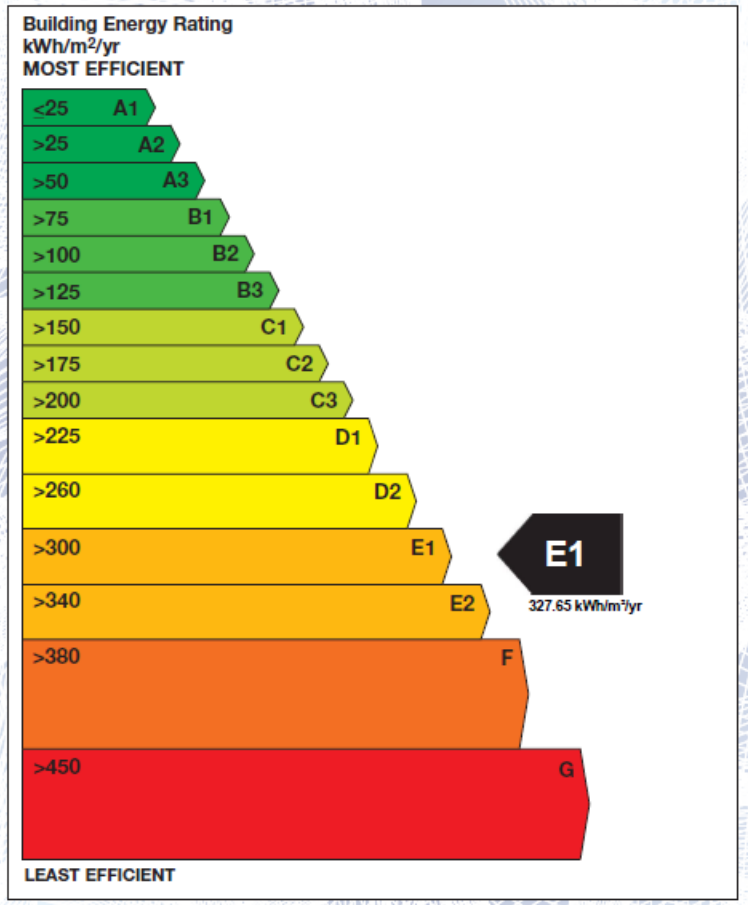
BER for the building detailed below is: E1

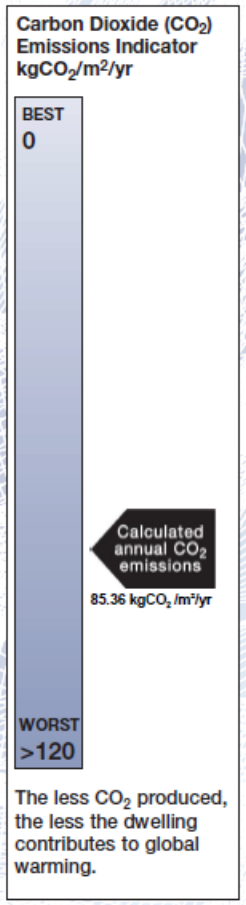
Address
DUNDALK
CO. LOUTH

BER Number
Date of Issue 22/07/2016
Valid Until 22/07/2026
Assessor Number 103103
Assessor Company No 103102

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.





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 below. A future BER assigned to this dwelling may be different, as a result of changes to the dwelling or to the assessment software.

DEAP Version: 3.2.1

Advisory Report

- Gives options which the homeowner can pursue depending on their budget and motivation
- Fabric first
  - Upgrade doors, windows, attic, wall (internal and external), draught proofing
- DON'T REPLACE THE HEATING WITHOUT FIRST CHANGING THE INSULATION
- Then upgrade the heating systems
  - Domestic Hot Water – DHW
  - Space Heating
  - Electricity requirement
  - Transport

To Do:

- Get your bills for energy for as long as you can
- Calculate your energy use in kWh for
  - Electricity
  - Heat
  - Transport
- Which is the highest Energy use?
- Which is the highest Cost?
- Which is the highest Carbon?
- Which one do you think you need to address most?