DECERNA

Delivering, unlocking & advancing the low-carbon economy

Insulation Improvements

CASE STUDY	
Business Type:	Retail shop
Location:	Middlesbrough
Existing building fabric:	Suspended ceiling tiles
Proposed building fabric:	Suspended ceiling insulation
Installed cost:	£3,250
Simple payback period:	2.0 years

ANNUAL SAVINGS	
Gas:	16,625 kWh
Cost:	£1,663
Carbon:	3.6 tCO_2e

WHAT IS INSULATION?

Thermal insulation prevents unwanted heat transfer in and out of buildings, and is important in order to achieve thermal comfort. Heat flows naturally from warmer spaces to cooler ones, with insulation acting as a barrier between areas of temperature difference.

Many buildings in the UK struggle to retain heat, which frequently leads to energy being wasted as heat escapes through roofs, walls and floors.

Large savings can also be made by insulating heating pipework and water storage tanks.

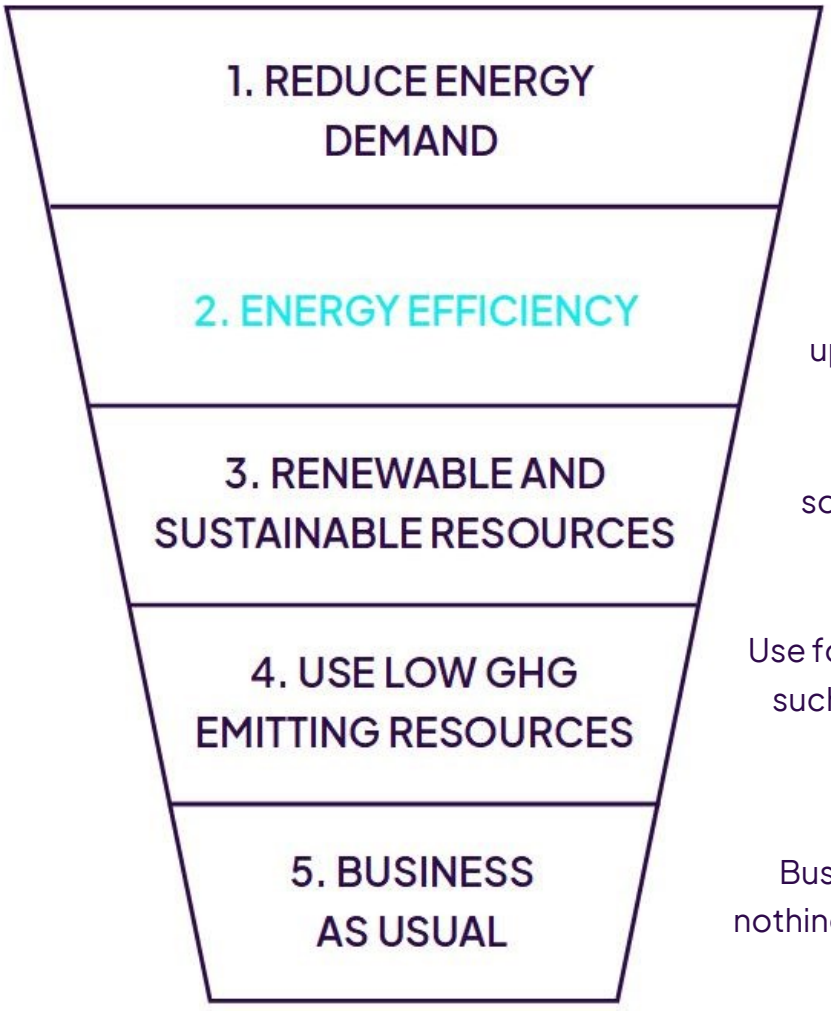
Thermal comfort	Insulation provides better thermal comfort and wellbeing for employees or other building users, and allows increased control over the temperature of the premises. Buildings take less time to heat up and remain warm for longer once heating has been turned off.
Lower energy bills and reduce energy waste	Insulation keeps you building warmer in the winter and cooler in the summer. By ensuring that a building is well insulated, you can reduce the energy requirement and cost of heating and cooling the premises.
Lower carbon emissions	Using less energy to heat or cool a building leads to a lower consumption of fossil fuels, resulting in lower carbon emissions given out by your business.
Improved EPC rating	Insulating your business will have a positive impact on the building's energy performance certificate (EPC). This is beneficial when selling or renting out a property, as better energy efficiency is appealing to potential clients.
Soundproofing	Insulation absorbs sound waves, reducing sound transmission throughout a building. This leads to a quieter environment and a more comfortable workspace.
Heat pump suitability	If you are considering upgrading your heating system to a heat pump, you need to ensure that the building is properly insulated. Information about heat pumps can be found in our other factsheets.

ENERGY HIERARCHY

The Energy Hierarchy considers the actions we need to take to reduce our energy usage, before looking to meet remaining demand in the cleanest possible way. Improving a building's insulation is high up in the hierarchy framework, as it reduces the energy demand of the building.

The energy hierarchy should be seen as a top-down approach, with priorities from 1 down to 5. Insulation improvements fall under priority 2, highlighted in green.

It makes a lot of sense to take a 'fabric-first' approach; improving insulation and reducing ventilation heat losses by draught-proofing, before a more expensive intervention such as a heat pump is considered. This again aligns well with the energy hierarchy, and prevents excessive energy waste.



Conserve energy by reducing demand. This includes behavioural change campaigns.

Reduce energy consumption by improving efficiency, such as upgrading building fabric or controls.

Utilise renewable and sustainable sources such as heat pumps and solar PV.

Use fossil fuels in a more sustainable way, such as transitioning from coal usage to natural gas.

Business-as-usual approach, changing nothing and continuing to burn fossil fuels.

WHERE SHOULD I INSULATE?

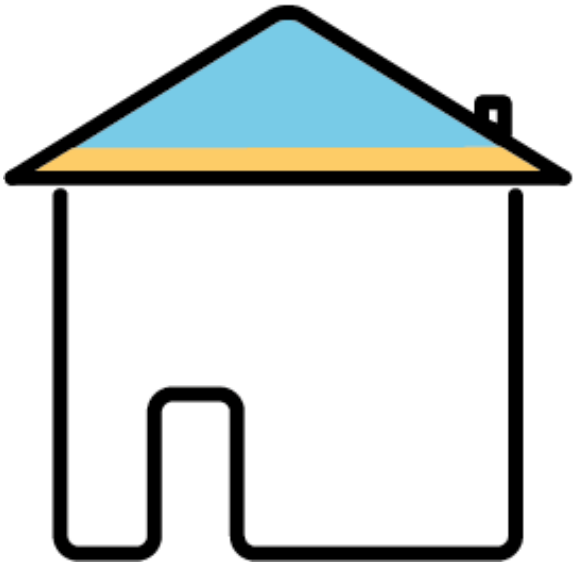
When looking at where to insulate, it's useful to consider a building's thermal envelope. This is everything which prevents the heat from escaping through areas including walls, doors, windows, floors and roofs.

Buildings should have a continuous layer of insulation, or a thermal barrier. Breaks in insulation are called thermal bridges, and lead to areas of high heat loss, which can then cause condensation and mould problems. Thermal bridges are most likely to occur at connecting junctions of a building, such as wall and floor junctions, and window reveals.

When considering where to install or improve insulation, you should first check that the current insulation is continuous. For example, checking that the layers of roof insulation are not interrupted, and fix any breaks which may have occurred.

The areas of highest heat loss should then be prioritised for improvement, as this will make the biggest difference to energy wastage, and therefore has the highest potential for cost and carbon savings.

The main areas to insulate are the roof/roof space, walls and floors. When talking about insulating roofs, there are two main ways in which this can be done:



Cold roof space

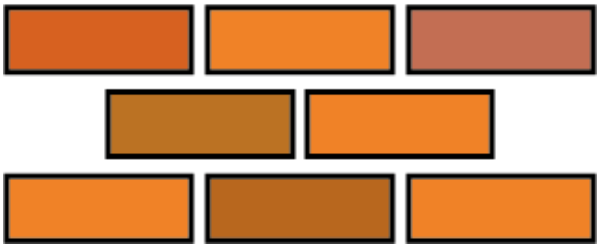
Insulation is installed below or inside the roof structure, between and over joists. The temperature of the roof space will be close to that of outside. Water tanks and pipework above the insulation layer will require insulating or lagging to protect them from frost.

Warm roof space

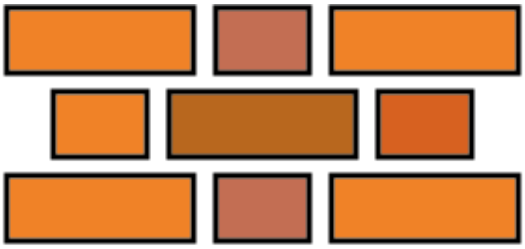
Roof insulation is installed between the tiles and rafters on the roof, creating a thermal barrier between your roof and the external air. Roof insulation prevents heat from escaping through the roof, while still maintaining a warm roof void.

CAVITY AND SOLID WALLS

Walls in old buildings tend to be made in a solid, double brick configuration. The construction industry began building cavity walled properties in about 1920. These cavities were uninsulated until the Building Regulations changed in the mid 1980s. Buildings which still have uninsulated cavity walls can be insulated by drilling a series of holes in the outer leaf of the wall and injecting insulation materials using special equipment. Once this process is complete, the holes are sealed up with mortar.



Cavity walls appear to have the same sized bricks, all facing in the same direction.



Solid walls have the bricks facing in different directions.

SOLID WALL INSULATION

Traditional solid walls allow some vapour to move freely through the bricks and stone. High levels of ventilation and draughts are also common, and help to prevent dampness in the building. Insulating an older building affects the way water vapour behaves and can lead to damage to the building fabric. Problems with moisture movement and ventilation may occur due to:

- The added insulation creating a barrier to vapour movement
- Insulation decreasing the level of draughts around windows and through walls
- Internal insulation making the inside of a wall colder, and leading to vapour condensing in the wall
- Shifting thermal bridging points to new locations in the building structure

The ventilation and breathability of the insulation should always be considered. Breathable insulation products, membranes, plaster and paint can be selected to allow moisture to move through walls. Moisture movement is compatible with the way that traditional buildings are built to work. This helps reduce the risk of mould and wet rot.

There are two main ways to insulate solid walled buildings—internal and external insulation.

EXTERNAL WALL INSULATION

Installing external wall insulation is less disruptive to a business and means that no internal room space is lost. Considerations include:

- Can restore the existing façade of a building and therefore extend the life of the building
- Can improve the appearance of a building
- Does not reduce the internal space available to your business
- It is lightweight and relatively simple to install
- Scaffolding is likely to be required

INTERNAL WALL INSULATION

Installing internal wall insulation requires a substantial refit of the premises. Pipework, light switches, door and skirting boards will need to be moved to accommodate insulation. Once the installation is complete, newly insulated walls and adjacent surfaces will need to be redecorated. Considerations include:

- Installation is very disruptive
- Loss of internal room area
- No impact on the external property appearance
- No scaffolding required
- Noise insulation will be improved

THERMAL MASS

Thermal mass describes a material's capacity to absorb, store and release heat energy. Dense and dark surfaces are ideal for absorbing and storing heat. During the day, thermal mass will absorb heat from sunlight. As the outdoor temperature drops at night, heat stored in the thermal mass of the building's fabric will be slowly released into the building, which helps to keep the internal temperature stable. Choosing to insulate a building internally or externally will have a very different result on how the thermal mass of a building behaves.

External insulation is much more effective at preserving the value of thermal mass in walls, helping to regulate the internal temperature. In comparison, internal insulation causes the heat storage value of walls to be lost, meaning that heat will leave quickly with external air.

SELECTING INSULATION PRODUCTS

Lambda Value

The lambda value is also known as the k-value. This measures the thermal conductivity of an insulation material, and is independent of the materials thickness. A low lambda value indicates a good insulation material, as the heat loss through it is low.

R-Value

Insulation can be rated be an R-value. This is a measure of the thermal resistance of the material and indicates how resistant it is to heat flow. This can be thought of as the opposite to the lambda value, and takes into account the thickness of the insulating material. The higher the R-value, the more effective the insulation. If there are multiple layers of insulation, the R-values can be added together to achieve the total R-value.

U-Value

U-Values are used to describe the thermal performance of elements of a building, such as cavity walls, or windows. U-values are calculated for the building element as a whole. For example, a cavity wall U-value would take into account the thermal properties of the bricks, the insulation in the cavity, and any other materials such as internal plasterboard. The lower the u-value is, the less heat is transmitted through the fabric element. This measures the quantity of heat that flows through a square meter of the fabric element, for every degree different in temperature between inside and outside.

Material	Description
Blanket/roll insulation	This type of insulation comes in rolls and is commonly made of glass wool, or natural, breathable materials, such as hemp, jute, or sheep's wool. The insulating air pockets within the material work best when not compressed.
Rigid boards	Pre-formed, rigid panels of insulation. These can be made from PIR/PUR (polyisocyanurate/polyurethane) or natural, breathable materials such as wood fibre.
Loose fill	Light material consisting of small particles, which can be installed into awkward spaces . Common materials include cellulose and fibreglass.
Insulated panels	Prefabricated panels that can be used in the floors, walls, or roof of a building. Foam is sandwiched between two rigid boards. These are not often used for retrofit work.
Sprayed foam	Liquid foam poured or injected into cavities where it expands and hardens. This is a versatile form of insulation.
Vacuum insulated panels	Rigid, thin cores of material which are encased in an airtight foil lining. The air is evacuated from these panels, giving excellent thermal properties. Best for use in areas where space is at a premium, but are expensive and cannot be penetrated.

OTHER CONSIDERATIONS

Moisture

Adding or improving insulation can reduce the ventilation or air movement in an area. This can lead to moisture build up. Because cold air cannot hold as much moisture as warm air, condensation is more likely to form in newly insulated spaces which were previously warmer.

Condensation can create a damp problem, so it is important to ensure that air vents remain uncovered during installation, and that insulation is not packed too tightly around external walls and eaves. It is advised that areas around insulation are regularly checked, to ensure there are no condensation issues.

Building regulations and planning restrictions

Some works may be subject to planning restrictions, so check with your local planning department before commissioning works, particularly for listed buildings, or within conservation areas.

Insulation upgrades need to comply with Building Regulations Part L—Conservation of Fuel and Power. The requirement will vary depending on the building usage type and the area in question being insulated. Your local planning department or qualified installer will be able to advise on this.

Maintenance

Maintenance requirements will differ depending on the area of building, and the type of insulation material installed.

- Floor insulation generally requires no maintenance and can last a lifetime, unless damaged by flooding
- Cavity wall insulation should last a lifetime, and if installed by a Cavity Insulation Guarantee Agency (CAGI) member, will be guaranteed for 25 years
- Roof insulation may compress over time. This makes the insulation less effective and may require topping up or replacement.

DECERNA

Delivering, unlocking & advancing the low-carbon economy

ABOUT US

Decerna provides a wide range of consultancy and development services, to ensure that the right decisions are made, to support our customers in the whole journey, from initial concept through to implementation of low carbon systems and infrastructure. Please get in touch to find out how we can help your organisation to de-carbonise.

www.decerna.co.uk

info@decerna.co.uk

+44 (0)1670 613 270

January 2023