Heat Loss from School Buildings

Improving building fabric saves energy by reducing heat loss and makes the learning environment more comfortable and can improve the appearance of the school. The fabric may be improved with increased amounts of insulation, and by making the building less draughty.

Top tips

- If your attic has little or no insulation, have it topped up. 300 mm is recommended.
- Have cavity walls filled fully with suitable insulation. Make sure the system has an Irish Agrément Certificate from the National Standards Authority of Ireland.
- Ensure that windows can be latched firmly closed and that automatic door closers work properly.
- Replace broken panes of glass.
- Ensure the building fabric is checked regularly for signs of damage from moisture, weather or rodents/pests

Did you know?

Attic insulation
Insulating any attic spaces in a building could reduce heat loss by 25%, providing a payback as short as 3-5 years, and is most beneficial if your school has no attic insulation.

Cavity wall insulation
10% or more of heat lost in a building is through the fabric of the walls. Improving insulation here is particularly cost-effective in cavity walls, and could produce a payback in 4-6 years.

Gaps and cracks
About 30% of a building's heat is lost through infiltration. Infiltration is the unintentional or accidental introduction of outside air into a building, typically through cracks in the building envelope.

Floor insulation
Floors are often overlooked as an area for energy saving. However, it is rarely economic to insulate an existing floor as it usually requires the floor to be taken up at great expense.

Part L requirements - Building Regulations
Where more than 25% of the surface area of the school building envelope undergoes renovation the energy performance of the whole building should be improved to cost optimum level in so far as is technically, functionally and economically feasible. Guidance is given in Part L of the Building Regulations and Professional advice is advised to be sought with regard this area.

Energy efficient retrofits of schools
The Department of Education and the Sustainable Energy Authority of Ireland are involved in an energy efficient retrofit pilot scheme for schools since 2017.

The pilot programme focused initially on medium to deep retrofit measures to improve the energy efficiency of existing schools which represent a variety of challenges including different building ages, archetypes, and retrofit requirements. The energy efficiency upgrade measures undertaken in the pilot are considered medium to deep, and include fabric, electrical and mechanical upgrades.

The longer-term outcome of the pilot will be to create an accurate and scalable model for energy efficient retrofits of schools across Ireland. This will lead to the "deep energy retrofit of schools built prior to 2008" as identified in the National Development Plan.

Therefore, this pilot scheme is now paving the way for, and informing, a much larger national schools energy retrofit programme based on a range of typical retrofit options, which will have been tried and tested during the pilot.

External wall insulation
This is an alternative method of insulating walls; it is not suitable for all walls. Professional advice is required and payback periods will vary. External wall insulation may also require planning permission.

Double glazing
The very best double glazing can be more than twice as efficient as the double glazing installed 20 years ago. It is important to note that payback periods can be 50 years or more.

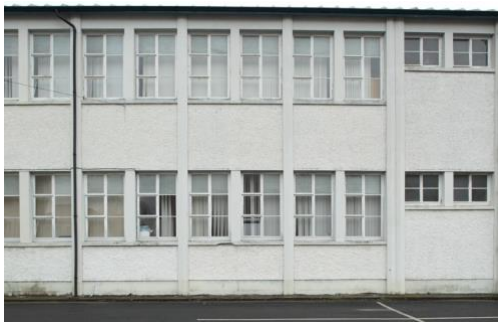
Weather stripping
Weather stripping is inexpensive to install and should have a short payback period.

Windows

Windows are made up of two components, the frame and the glazing that sits inside in the frame. Used effectively, windows can reduce requirements for lighting and heating. However, they can account for over a quarter of a building's heat loss, depending upon how leaky they are. Glazing lets in solar heat, and whilst this can be beneficial in reducing heating requirements in colder weather, it can make buildings uncomfortably warm in warm weather, particularly for occupants placed next to windows.


Single glazed timber window

If your school still has single glazed windows, consider having them replaced with high efficiency double glazed units. The Department of Education Technical Guidance Documents call for windows with U-values of 1.2 W/m^{2}K or better in new schools and on refurbishment projects. U-values describe how well a building element conducts heat. The higher the value, the more heat is being lost from the building. High performance glass has a coating applied to it to improve insulation properties. This coating helps to keep the heat inside. High performance glazing also uses special inert gas in the gap between the inner and outer pane.

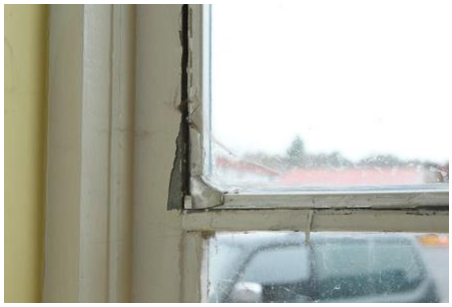

Single glazed windows

Improving glazing can be expensive (50 years+ payback) and may only be cost effective in energy saving terms as part of a refurbishment project. In very highly glazed spaces, it may be more effective to replace some of the glazing with highly insulated opaque panels. This will reduce the amount of light entering the space, but provide better insulation and reduce spring and autumn overheating. This usually only applies to highly glazed south facing classrooms. A “daylight factor” of between 4.5% to 5.5% must be maintained in classrooms.

When installing a new window system, the system should comply with the Departments TGD with regard to overall window performance and also the amount and location of opening sections. Do not just match the existing opening sections as these may not provide adequate ventilation to reduce overheat in the newly insulated school.

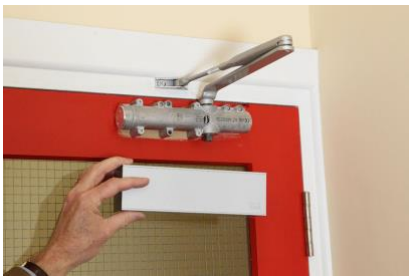
Your design team should ensure these TGD requirements are maintained.

A lot of older windows allow in a lot of infiltration and in some cases the infiltration may be the main source of heat loss. Consider weather-stripping old leaky windows. However, openable windows must not be caulked permanently closed, as good ventilation is essential in schools during occupied hours. If a 50 cent coin or credit card can slide between a window and its frame, draught-proofing can be of benefit by reducing heating costs and increasing comfort.


Deterioration of internal window frame

Professional advice is advised to be sought with regard this area and the Part L Building Regulations.

Doors



Ensure doors close properly. Fit adjustable door closers

Ease of access to any building is essential, but open doors can allow uncontrolled quantities of air into a building, reducing comfort and wasting energy. There are a number of opportunities to reduce heat loss through doors, and most are low cost and can be implemented immediately.

- **Keep doors closed.** All external doors should be kept closed when the heating system is in operation.
- **Door warden.** Appoint door wardens to open and close doors at the beginning and end of break periods.

Maintenance opportunities for Windows and Doors

- **Keep doors closed**. Consider fitting automatic door closers if not already fitted to all external and internal doors. This is a relatively simple and inexpensive measure for reducing heat lost from the building and can be carried out by a caretaker. If you already have door closers, make sure they are adjusted correctly so that it is not possible to push the outside door fully open

and have it stay in the open position. Instruction manuals for door closers can often be downloaded from the internet.

- **Window hardware**. Make sure window hardware is in good working order, and that windows can be latched firmly closed outside school hours. If handles are broken or missing, have them replaced with good quality handles to hold the window closed when necessary. This will help prevent air infiltration, reduce heat loss and save energy.

Broken window latch

- **External door seals**. Regular checks and maintenance of draught proofing on doors will continue to ensure that they work properly and help provide savings. Check all seals and draught stripping and replace if required. Add weather stripping to doors which do not have weather stripping.

- **Internal corridor fire doors.** Internal fire doors along corridors should never be propped open and should always be closed outside school opening hours. This will help reduce infiltration and keep the school warmer when the school is unoccupied. If doors must be open during the day, have an electrician install magnetic hold open devices. Hold open devices are integrated into fire alarm systems and allow the door to close once the fire alarm is activated. This will help prevent the spread of fire and smoke. The hold-open device control circuit can include a 7-day time clock so that the doors close automatically outside school hours.

Magnetic door closer

- **Refurbishment opportunities.** Installing a draught lobby at frequently used entrances can reduce heating costs and draughts. Lobbies should be large enough to provide unrestricted access and enable one set of doors to be closed before the other is opened. Modern, well-insulated doors help to improve comfort levels through preventing draughts and retaining heat. Never install a radiator in a draught lobby, and if you have one already, turn it off. If pipes might freeze, have the radiator removed and the pipes capped inside a heated adjacent room, if practical.

It is important to ensure that any interventions do not contradict the fire certificate for the school.

External walls

10% or more of heat lost in schools is through the fabric of the walls. Improving insulation is particularly cost-effective in cavity walls.

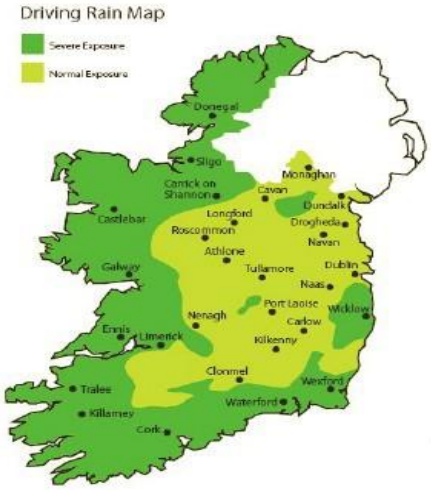
Cavity wall installation

The installation of cavity wall insulation is simple with little disruption to the school. Cavity wall insulation could offer payback in about 4-6 years. The installer will visit the site to determine whether or not the building is suited for full fill cavity wall insulation. Not all schools are suitable. The professional installer will check to see:

- Whether the wall's cavity is suitable to be filled and doesn't show signs of water getting in.

- Whether the school is within an area identified as having high driving rain (see sample driving rain map below, your installer will advise on your school's location with respect to driving rain).

- What finish the external wall has e.g. render (plaster) or brick. Cavity wall insulation may not be appropriate if the school has a brick finish, as brick can be very porous.



Sample Driving Rain Map, Source: Irish Agrèment Board

All cavity wall insulation products and installers must have NSAI Agrèment certification and must be installed to the standards set out under the certification. This means that installers of the insulation must follow strict guidelines on installation of the insulation.

Cavity wall 'beads' and post installation finishing

Expanded polystyrene beads or mineral wool are the most commonly used materials for existing buildings. Filling cavities provides a more comfortable environment for occupants and reduces the risk of condensation. Different filling materials have different thermal conductivities. Ask your insulation contractor. A lower conductivity gives a lower "U-value" which lowers heating costs.

By regularly checking for dampness in the school you can help maintain the lifespan of the wall insulation. Damp causes significant damage to the building structure and reduces its insulating properties. Check for signs of damp and condensation at least once a year, preferably prior to the winter months. Check walls for draughts on a cold windy day, especially around skirting and where the top floor ceiling meets the wall, as well as around window and door frames. To reduce heating costs and improve comfort seal any gaps where draughts can be felt. Why not involve the students in detecting any problem areas in your classroom.

If the school does not have cavity walls, the only options are internal drylining insulation or external insulation. Both have longer payback periods than cavity wall insulation with external insulation typically being more expensive. Internal drylining will require anything running along external walls such as heating pipes and radiators to be removed and replaced or reinstated, which will increase the cost, and the insulation will reduce the dimensions of the room slightly. Independent condensation risk analysis must be conducted on any new wall make up to ensure that the new wall does not trap moisture within it make up. This will only lead to problems in the future and negate the advantages of the wall upgrade.

External insulation may require temporary removal of rainwater pipes, any wall mounted external light fittings, PA Speakers, Alarm Units, CCTV etc. and other measures to be taken, particularly at the eaves and at gullies, and may or may not be practical. It is important that the existing electrical systems have sufficient cabling to reach the new extended location of the external wall mounted fittings when re-fixed to the deeper wall. It may also require planning permission in certain circumstances. However, it has the advantage that walls are insulated passed first floor slabs and internal partition walls i.e. the whole wall is insulated. Installation also results in minimum disruption to the school's interior.

Internal or external insulation should only be done if most other energy saving measures have been implemented already, such as new boiler, better lighting, attic insulation, etc.

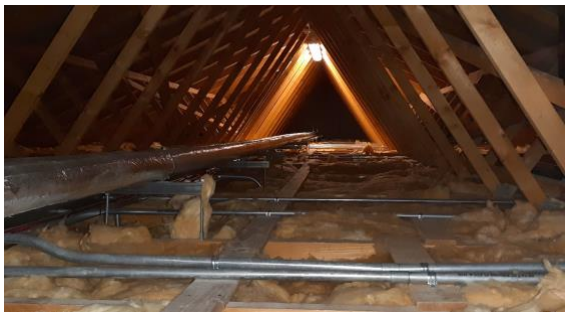
It is important to ensure that professional advice is sought from a Registered Architect or Chartered Structural Engineer when considering or before proceeding with wall and roof insulation projects.

Roofs & attic spaces

Over 20% of heat in a building may be lost through the roof. Improving insulation levels in this area can often be cost effective, particularly with pitched roofs. Installing attic insulation in an un-insulated attic is likely to be the single most cost-effective way to improve the efficiency in the building, offering paybacks as short as 3-5 years. It is also possible to upgrade existing insulation in the majority of attics by adding to what is already there, providing it is in good condition and not damp.

If there is less than 150mm (6 inches) of insulation, it is always worth adding more. Mineral wool quilting is often the easiest option as it retains its blanket shape and can be rolled out of the way and put back should access be required to wiring below. Blown insulation should not be used, because it cannot be easily rolled aside and reinstated. If insulation is added, heavier electrical cables should be lifted above the insulation, not embedded in it, as cables can overheat.

The recommended total thickness is 300mm, and the less you have now, the more worthwhile it is to add more. While in the attic space, why not check to see if pipe work is insulated? If not, insulate any pipe work running through the roof space to reduce the risk of freezing or bursting as repair work can be costly. This is particularly important if you are adding substantially to attic insulation depth, because the attic will be colder in winter than it used to be and pipes may be more prone to freezing.



Attic Insulation

It is best for a professional insulation company to insulate attics. It is important that ventilation is maintained through

the attic, and that safe access to water tanks etc is maintained.

It is always important to ensure your roof is in good condition. This is particularly pertinent for flat roofs. Keep an eye out for signs of damp, or puddles of surface water. Energy saving options may depend on the type of roof your building has and the associated space available. For example, flat roofs can be difficult and more costly to insulate than pitched roofs. Always seek professional advice before carrying out any major work.

If upgrading a flat roof consider extending the roof at the edges over the external walls to future proof the school as a suitable candidate for future external wall insulation.

Floors

It is not really to be economic to insulate a solid concrete floor next to the ground unless the floor is to be replaced anyway (e.g. major renovation of ground floors might be the result of damp or radon remedial works).

If your school has areas where there are suspended timber floors it may be possible to insulate these. Adding insulation between joists, where there is access to the underside of suspended timber floors, may be a cost-effective measure. In areas where there is no access, insulating between the joists can only be carried out from above. To do this the flooring boards must be lifted, so any floor coverings that already exist would probably need to be replaced. This would increase the cost of insulating the floors and will not be an attractive investment.

If insulating the floors, it is also worthwhile to eliminate unwanted draughts coming from the floor space. Seal gaps at skirting boards with a suitable sealant. It would also be worth installing a “breather” membrane below the floorboards, unless the floor is to be covered in an air-tight floor covering.

It is important to maintain, through ventilation of the floor, a void below the floor to remove damp and stale air and try to keep timbers in good condition. Therefore, perimeter ventilation grilles, visible on the outside of the school below floor level, should never be blocked up.

Maintenance Considerations

- Clean windows, including skylights, at regular intervals to maintain good daylighting.
- Weather strip windows in areas where air escapes. Use your hand or a lit incense stick to find where cracks are located. Windy weather may help detect draughts entering the room. Don’t permanently caulk around openable sections.
- Check windows for maintenance before the end of each term.
- Install door closers or have them adjusted to close doors tight against the door frame.
- Appoint a specific staff member to conduct regular walk-arounds using a checklist. The checklist should include checking of windowpanes and frames, skylights, roofs, skirting and eaves outside.
- Check that insulation, including pipe insulation, remains dry and undamaged. Replace as necessary.
- Check for signs of damp in classrooms. Check for puddles of surface water on the roof as these can result in water getting in and causing significant and expensive damage to the building.
- Repair rainwater downpipes, faulty gutters and leaky roof tiles immediately to prevent further water damage. Check for signs of damp and condensation at least once a year.
- Download instruction manuals for door closers and follow instructions to adjust them properly. The closer may have a make and model number stamped on it.
- Ensure that external ventilation grilles are not covered over or sealed.

Helpful hints

Do - If replacing windows ensure that proprietary airtightness tapes and membranes are used to help eliminate air leakage through external windows & doors between the frame and masonry and refer to the Departments Technical Guidance Document for windows at https://www.gov.ie/en/publication/7e515-technical-guidance-documents/

Do – Check that all windows are closed at the end of the school day.

Do - Draw curtains and lower blinds at the end of each day to help keep warmth in during winter months, particularly on north facings windows.

Do - Check that where roof lights are ducted down to ceiling level, the light shaft should be insulated.

Don’t - Leave insulation in place if damaged. Have it replaced immediately.

Don’t - Prop exterior doors open. Let them close automatically.

Don’t - Fully close blinds and switch on lights. Angle blinds so to maximise daylight into the room or open the blinds if practical.