White Paper

Transforming

the performance of existing windows

Improving the thermal performance of existing windows by installing replacement ultra-thin glass triple-glazing units.

regencyglass

the difference is clear

Executive Summary

Improving the energy efficiency of the UK's existing building stock is a critical priority for the public sector, particularly in addressing fuel poverty, reducing carbon emissions, and enhancing occupant wellbeing. Windows represent a significant source of heat loss in many properties, especially those fitted with older glazing systems.

Recent advancements in glazing technology now allow for the installation of high-performance triple-glazed units within existing window frames. These thin glass triple-glazed units, designed to match the thickness of standard double glazing, offer a practical and cost-effective route to upgrading window performance without the need for full window replacement.

This paper outlines the case for adopting this approach across social housing, education, and public buildings, highlighting its benefits in terms of cost, disruption, sustainability, and energy performance.

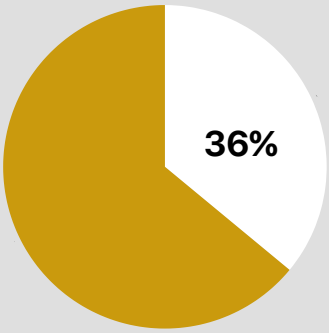
The Challenge:

Energy Inefficiency & Fuel Poverty

The UK has the least thermally efficient housing stock in Western Europe. Energy costs continue to place a disproportionate burden on lower-income households with millions of homes classified as being in fuel poverty.

According to the Office for National Statistics[1]:

UK households typically spend around 6.2% to 10% of their income on energy bills, with lower-income households often hit the hardest, spending up to 7% more.



As of early 2025, approximately 36% of UK households (nearly 9 million) were estimated to spend more than 10% of their income on energy, a metric often used to define fuel poverty.

Older housing stock, particularly in the social housing sector, is often characterised by poor thermal performance.

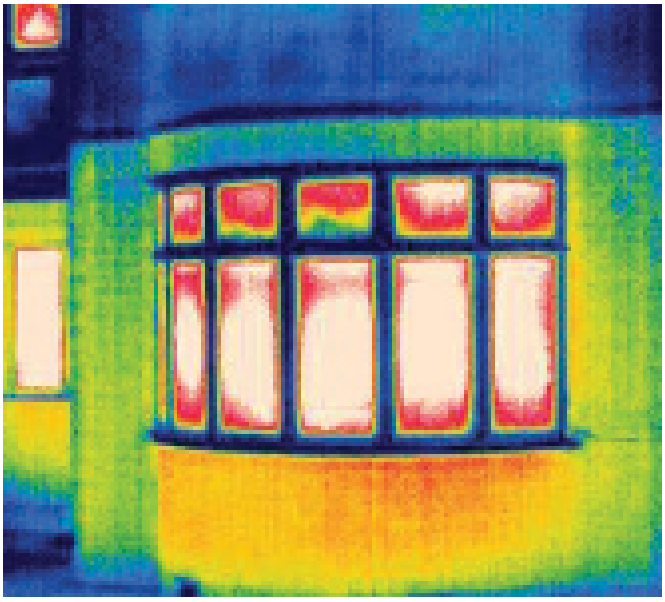
Reducing heat loss from buildings is a key strategy in lowering energy demand and improving affordability for occupants.

A Fabric-First Approach

The 'fabric-first' principle focuses on improving the thermal efficiency of a building's envelope - walls, roofs, floors, and windows - using low energy solutions such as insulation, airtightness and solar gain - before introducing mechanical or renewable systems.

High-performance windows play a critical role in this approach:

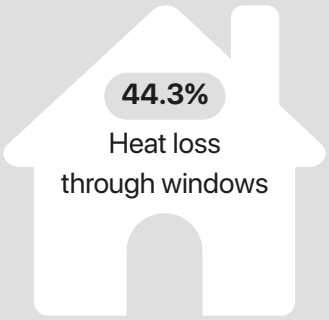
- According to the Energy Saving Trust, a typical house loses up to 25% of its total heat through its windows[2].
- Poorly performing glazing can undermine other energy efficiency measures. Once insulation improvements are made in a property, poorly performing windows often become the weakest point in the building fabric.



Upgrading window performance is therefore essential to achieving meaningful energy reductions

- Upgrading windows in an already improved property reduces the heat lost through the glazing by half.
- Upgrading older windows that do not comply with current performance regulations to those that do can reduce overall heat loss through the glazing from 44.3% to 22% (A Window of Opportunity, GGF and BG3).

An improved property



When other energy loss prevention measures are taken. Glazing is now the point of least resistance.

** Loft/floor/wall insulation, draught proofing, low-energy lighting, solar water heating.*

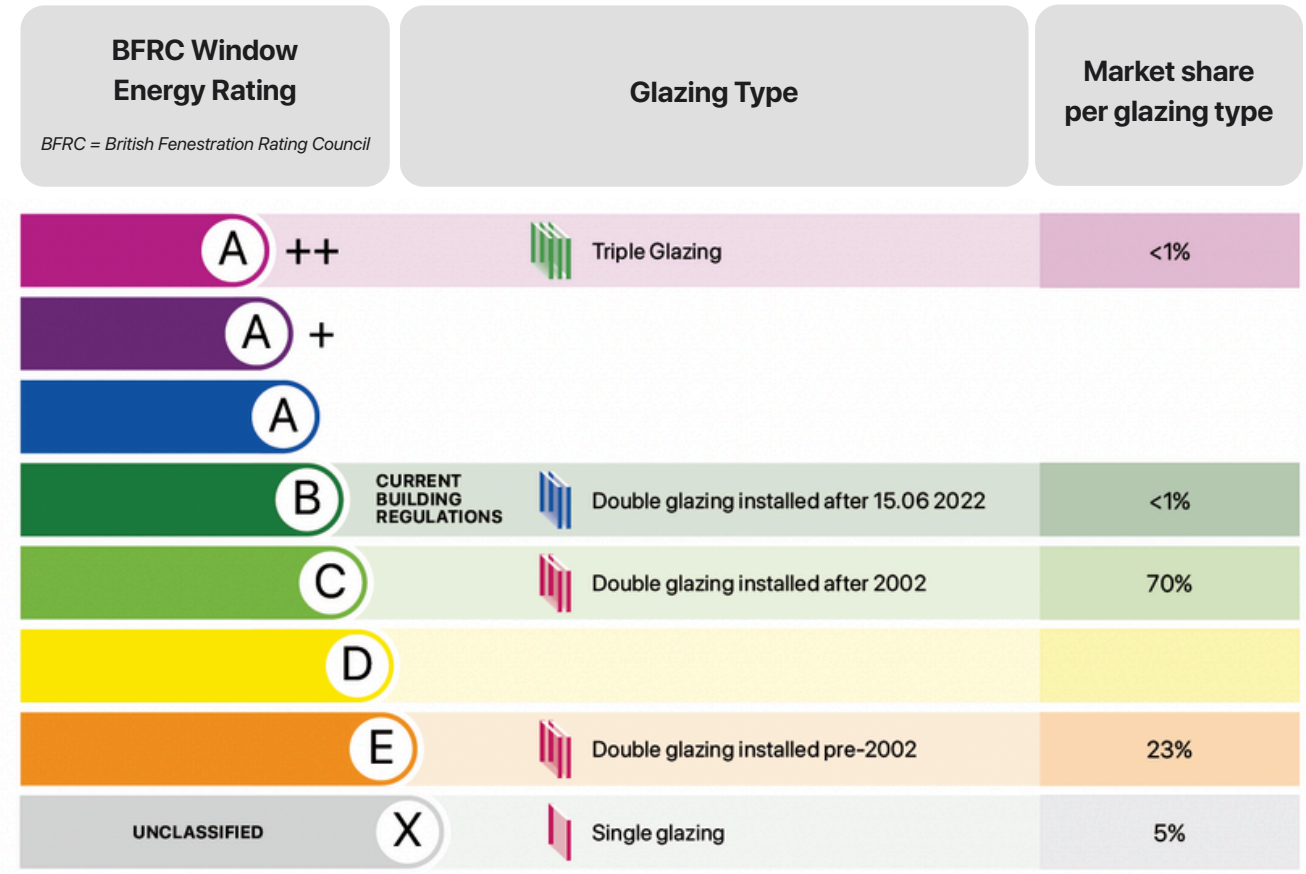
Same property further improved with glazing to current standards

This shows how double-glazing has progressed, and the impact upgrading windows has on the average household.

The Role of Glazing in Window Performance

The thermal efficiency of a window is largely determined by it's glazing

- **Pre-2002 windows** typically achieve an 'E-Band' Window Energy Rating (WER) - and an indicative 2.9 W/m^2.K whole window U-value (Uw).
- **Modern double-glazed windows** typically achieve at least an 'A-Band' Window Energy Rating and between 1.2 and 1.4 W/m^2.K whole window U-value (Uw).
- A typical **triple-glazed window** can achieve an 'A++ Band' Window Energy Rating, with a whole window U-value below 1.0 W/m^2.K and can achieve U-values as low as 0.8 W/m^2.K, depending on the specification.



BFRC ratings vary according to the glazing specification and window components. The Building Regulations prescribe the minimum U-values that can be installed and does not mean that windows with lower U-values and which are more energy-efficient are not being installed.

The performance of the glass is the primary factor in the thermal efficiency of a window. Modern window glass now comes with high-performance microscopic metallic coatings to minimise heat loss and reflect heat into a room.

This means that today's windows are many times more thermally efficient than those of 15 to 20 years ago. However, much of the UK's housing stock still relies on outdated glazing installed during earlier refurbishment programmes.

Extending Window Lifespan

Window frames often outlast their glazing: According to the BRE (Building Research Establishment), PVC-U windows should have a service life of at least 35 years under normal urban and non-aggressive conditions. The actual lifespan depends on material, maintenance, location and installation quality.

The lifespan of a double-glazed unit can range from approximately 10 to 25 years, although actual performance depends on the specific conditions the unit is exposed to throughout its service life. This means that the insulating glass units often need to be replaced before the window frame, creating a clear opportunity to upgrade the glazing performance without replacing otherwise serviceable frames. Doing so maximises asset value and avoids unnecessary waste.

Innovation:

Thin glass triple-glazed units for existing windows.

The growth in triple-glazing that the UK's window industry is now experiencing is largely driven by the improved thermal insulation they provide. However, a key barrier to upgrading to triple glazing has traditionally been the need to replace entire window frames to accommodate thicker units. New innovations now remove this constraint.

Regency Triple® from Regency Glass is an example of this innovation, transforming the opportunity to cost-effectively upgrade existing windows by simply removing old, double-glazed units and replacing them with new triple-glazed units.

A typical 28mm double-glazed glass unit can be replaced with a 28mm thin glass triple-glazed insulating glass unit, using the existing PVC window frame and glazing beads.

This is made possible by incorporating a layer of ultra-thin, 0.5mm Boro-Aluminosilicate architectural glass as the central pane of the triple-glazed unit.

Older E-rated windows can be upgraded to A+ or A++ performance levels, depending on condition and specification.

Retention of existing frames

Only the old, double-glazed glass unit is replaced with a new higher performance triple-glazed unit of the same dimensions. The existing PVC-U or other window frames remain in place, reducing material use and installation complexity.

Improved thermal performance

Older E-rated (WER) windows can be upgraded to an A+ or A++ Band window (depending on window age, original specification and frame condition).

Minimal disruption

The process is quick, low-risk, reliable and cost effective – the original window frame is retained and therefore no damage is caused to the reveal plasterwork of walls and no need for further remedials in the home.

Structural integrity is maintained

Regency Triple has a weight typically within 5% of the original doubleglazed glass unit, so there are no concerns over the durability or structural integrity of the window frame.

Comfort upgrades

Laminated glass can be incorporated into the Regency Triple to offer upgrades to security and safety performance, along with improvements to noise-control and reduction of ultraviolet rays (Furniture Fade Protection).

Regency Triple®
featuring Corning® Enlighten™ Glass

Regency Triple is a next-generation triple-glazed unit that uses Corning® Enlighten™ Glass, an ultra-thin 0.5mm Boro-aluminosilicate glass middle pane to deliver the thermal performance of traditional triple glazing at the weight and thickness of double glazing.

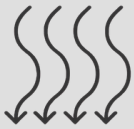
This innovation significantly boosts performance - reducing typical UPVC window frame U-values from 1.6 W/m.K to 1.0 W/m.K - without the bulk and weight penalties associated with conventional triple glazing. Older window systems stand to benefit even more. Regency Triple enables widespread, low-cost insulation upgrades without the need to replace most window frames, avoiding the disruption usually caused by major window works.

In short: superior insulation, seamless integration with existing frames, and an affordable path to better-performing homes.

Only 5% heavier than a standard double-glazed unit.

Fully compatible with the UK's existing 28mm glazing pocket window frame systems.

No need to replace existing window frames.



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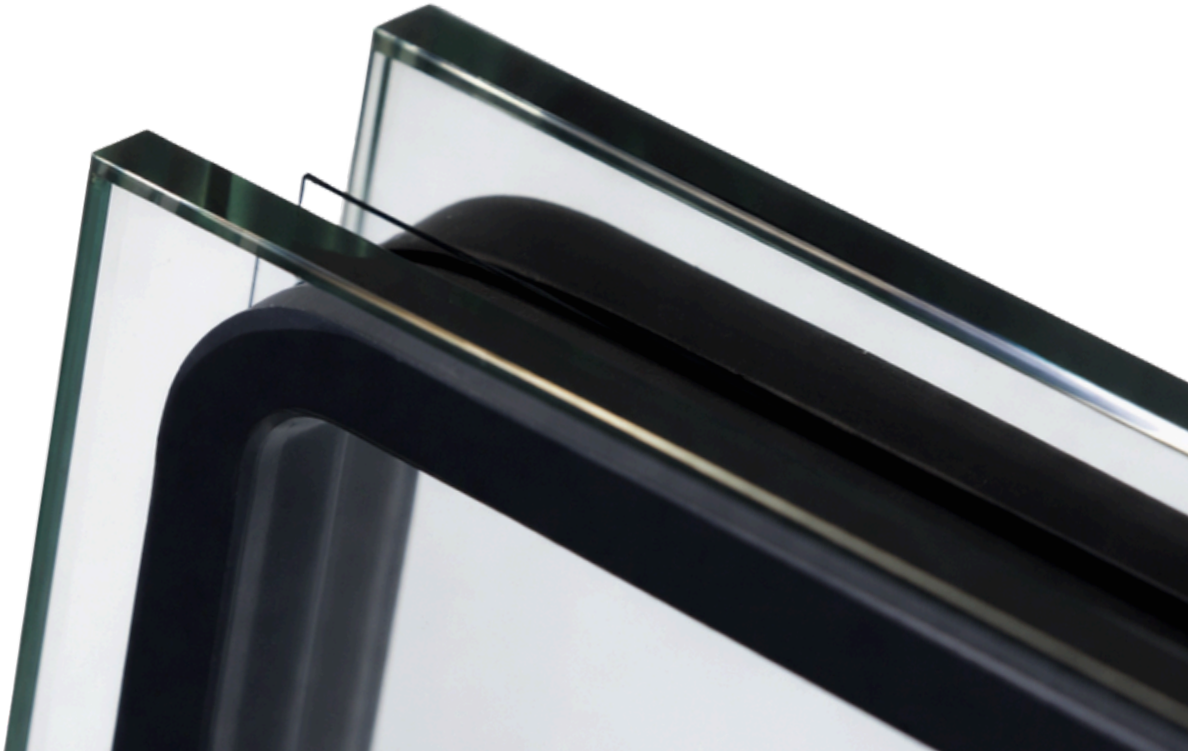
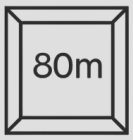


The Scale of the Opportunity

The potential impact of upgrading glazing across the UK is substantial:



80 million windows in the UK's housing stock are rated E or unclassified in terms of Window Energy Ratings. These windows are typically over 20 years old and would benefit from immediate replacement or upgrade as they are energy inefficient (A Window of Opportunity, GGF and BG3).

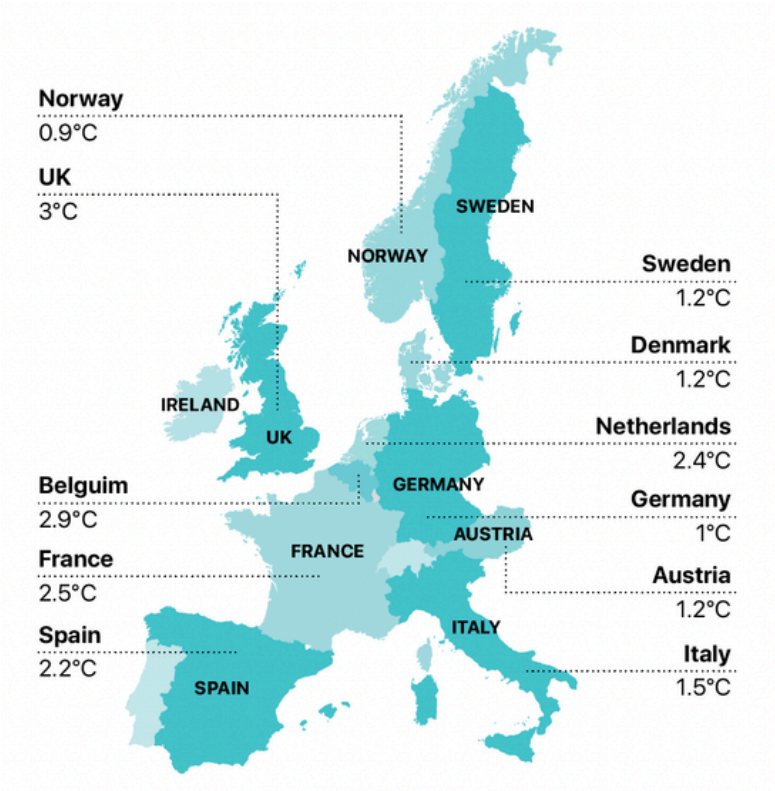
98% of windows in the UK's housing stock do not comply with the energy performance levels of the current Building Regulations - minimum Band B WER, 1.4 W/m^2.K Uw.

Approximately **288 million windows** could benefit from performance improvements.

A significant proportion of these windows will be in good serviceable condition and suitable for upgrade by replacement of the double-glazed glass units with high-performance, ultra-thin glass triple-glazed units alone.

The UK has some of the worst-performing housing stock in Europe, which has implications for families living in those homes in terms of health, well-being, and financial pressures. If the UK tackles the challenge of poorly performing windows in the existing housing stock, heating bills and emissions can be reduced, leading to more positive outcomes for occupants.

Source: UK homes losing heat up to three times faster than European neighbours, tado°, 2020: https://www.tado.com/gb-en/press/uk-homes-losing-heat-up-tothree-times-faster-than-european-neighbours



Supporting National Policy: The Warm Homes Plan

Announced in January 2026, the Warm Homes Plan is backed by a £15 billion public budget and aims to upgrade up to 5 million homes over five years. It primarily focuses on solar energy, heat pump heating systems, and some insulation measures to cut bills and reduce fuel poverty.

The plan intends to lift up to one million families out of fuel poverty by 2030, increase heat pump installations to over 450,000 annually, and support the Net Zero 2050 target.

High-performance windows are critical when installing an electric air-source heat pump into a home because they dramatically reduce heat loss, allowing the heat pump to operate at peak efficiency and maintain a consistent, comfortable temperature without overloading the system.

Because heat pumps typically operate at lower flow temperatures than traditional gas boilers, a well-insulated, airtight "building envelope" - of which windows are a major component - is essential to prevent the generated heat from escaping.

Heat pumps are most efficient when they do not have to work hard to compensate for rapid heat loss. High-performance windows minimise heat loss, which allows the heat pump to maintain high Coefficients of Performance (COP).

Upgrading glazing aligns directly with the fabric-first approach underpinning the Warm Homes Plan.

Reducing Condensation and Improving Health

Condensation is a common issue in poorly insulated homes and can contribute to mould growth and associated health risks.

Condensation can form on the inner pane of window and door glass when the surface temperature of the glass drops below the 'dew point', or the temperature at which air becomes saturated with water vapour, and the vapour condenses on the surface.

The dew point is influenced by the moisture content in the air, and the moisture content directly affects the 'relative humidity' (RH).

The ventilation in a room, the occupants' room usage patterns, and room temperature (including that from heating systems) all affect the RH value.

In colder temperatures, Low-Emissivity glass reduces overall heat transfer from inside the room to the outside of the building. The lower the U-Value of the glass (lower U-values measured in $W/m^2.K$ equate to higher levels of thermal insulation), the slower the rate of heat transfer. This results in the temperature of the dwelling retaining the internal temperature for longer, reducing the risk of condensation forming on the inside of windows and doors.

Triple-glazed windows and doors, therefore, typically reduce the risk of condensation due to their lower U-values (higher thermal insulation).

Whilst there are many factors that influence condensation risk, when specifying a 28mm ultra-thin glass triple-glazed unit incorporating high performance Low-Emissivity coated glass in typical UK winter temperatures of between 10°C and -5°C, the inner pane of glass in the window will be between 0.6°C and 1.3°C warmer than a conventional double-glazed unit. This therefore reduces the risk of condensation forming on the inner pane.

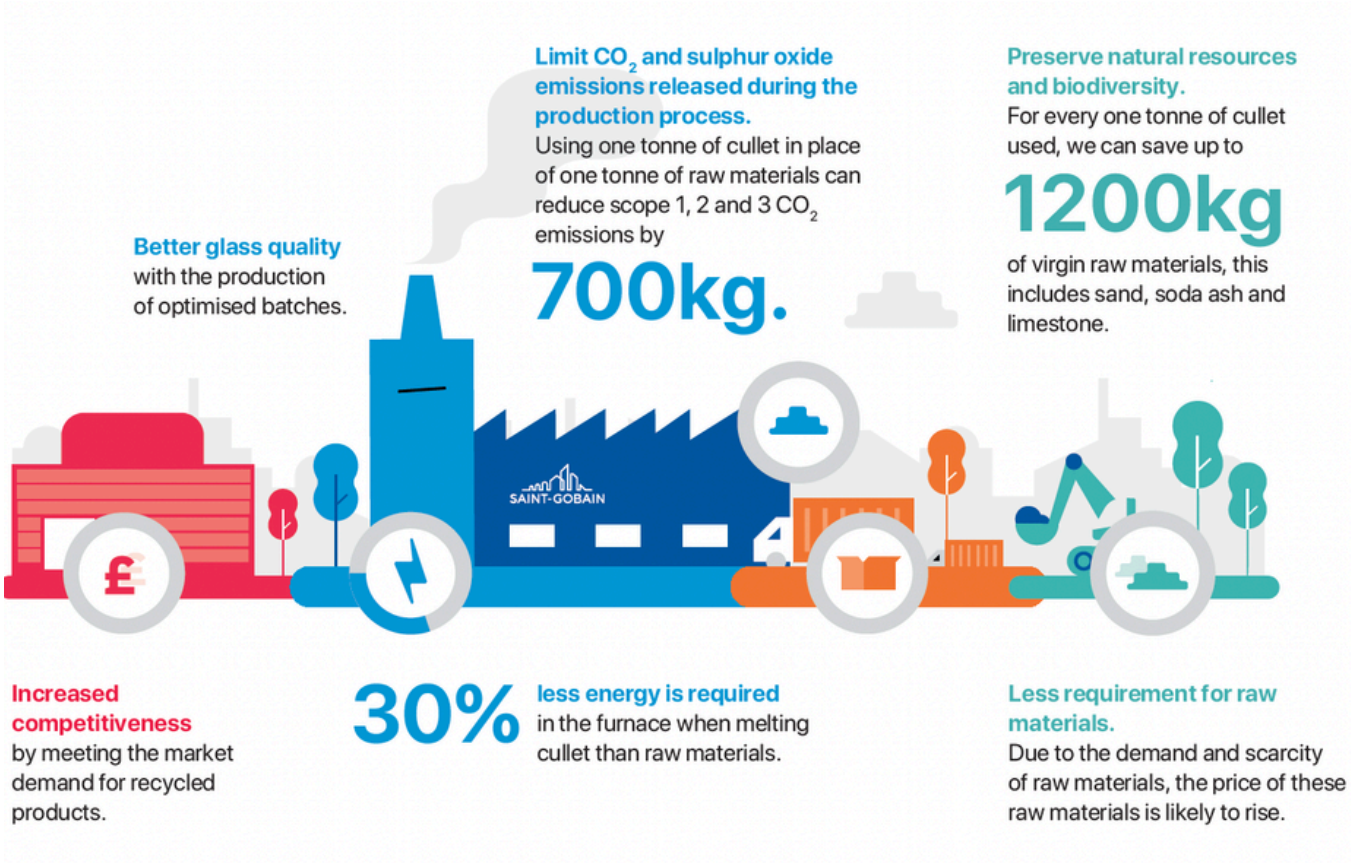
Condensation that forms on any surface in a dwelling over time is a risk factor for persistent mould growth. All building design measures that reduce the risk of condensation will reduce the risk of mould growth and support healthy, safe dwellings and occupant wellbeing.

Sustainability and Circularity

Glazing upgrades also offer strong environmental benefits:

- All glass is **recyclable**, with no impact on product quality or performance.
- Post-consumer window glass is now being routinely recovered and remanufactured into new high-performance window glass, reducing emissions and avoiding unnecessary raw material extraction.
- Retaining window frames **reduces material consumption and waste**.

This supports circular economy principles and reduces the carbon impact of refurbishment programmes.



Beyond Residential Buildings

While much of the focus on energy efficiency improvements is directed towards housing, the opportunity to upgrade glazing extends equally to non-residential building across the public sector.

Many schools, hospitals, offices, and other public buildings constructed or refurbished over the past 20-30 years utilise PVC-U or aluminium window systems fitted with double-glazed units. In a significant number of cases, these window frames remain structurally sound and fully serviceable, despite the glazing no longer meeting current thermal expectations.

The introduction of thin glass triple-glazed units enables these buildings to benefit from the same upgrade approach as residential properties.

Key Benefits:

Retention of existing window systems: Both PVC-U and aluminium frames can typically accommodate replacement units of the same thickness, avoiding the need for full window replacements.

Minimal disruption to operations: Installation can be carried out with limited impact on building occupants, which is particularly important in environments such as schools and healthcare settings.

Cost-effective, estate-wide improvements: Large public-sector estates can implement phased upgrades without the significant capital expenditure associated with full window-replacement programmes.

Improved internal comfort: Enhanced thermal performance supports more stable indoor temperatures, benefiting learning environments, patient recovery spaces, and workplace productivity.

Alignment with public-sector sustainability targets: Upgrading glazing contributes to carbon-reduction goals and supports compliance with evolving energy-performance standards across public buildings.

Given the scale and diversity of the UK's non-residential building stock, the ability to upgrade glazing in situ offers a practical, scalable solution to improve energy performance across entire estates.

Conclusion

Upgrading existing windows with ultra-thin-glass triple-glazed units is a practical, scalable, and cost-effective solution to improve building performance across the public sector.

By focusing on glazing replacement rather than full window renewal, organisations can:

- Deliver immediate energy efficiency improvements.
- Reduce costs and disruption.
- Extend the lifespan of existing assets.
- Support national decarbonisation and fuel poverty objectives.

As the UK continues to address the challenges of an inefficient housing stock, this approach offers a compelling pathway to achieving meaningful, measurable outcomes.

Appendix

What is a window U-value?

U-values are a measure of heat transfer used to assess how building components conduct heat.

A U-value is calculated from the rate of energy transfer through one square meter of the structure divided by the difference in temperature at either side of the structure.

The value is quoted as watts per square meter per Kelvin (1°C =1K) - $W/m^2.K$.

For a double-glazed window with a U-value of 1.4, this means that 1.4 watts will be transmitted per square meter for every degree of temperature difference between the inside and outside of the window.

A higher U-value indicates more heat transfer, and a lower U-value indicates less heat transfer, which means a more insulated structure. When applied to building components such as windows, a lower U-value indicates greater energy efficiency.

What is a Window Energy Rating (WER)?

Window Energy Ratings (WERs) show how energy-efficient a window is by taking into account thermal heat loss, solar gain, and air leakage.

Windows are rated on an A++ to E scale to symbolise their overall energy efficiency. The higher the rating, the better the performance. Windows with an energy rating of A to A++ are considered to be energy positive.

References

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01942 262 162 | sales@regencyglass.co.uk | www.regencyglass.co.uk
4 Thunderbolt Drive, Great Sankey, Warrington, WA5 3PW