

Recycling of end-of-life building glass

A powerful tool to reduce CO₂ emissions

Recycling flat glass is the most beneficial end-of-life option for building glass and glazing¹. In addition to its environmental benefits, **recycling² is one of the most prominent ways to reduce energy consumption and CO₂ emissions** from glass manufacturing. The use of recycled broken or waste glass – known as cullet – allows for less energy required to heat furnaces and a reduction in the use of virgin raw material. The increased use of recycled glass therefore helps delivering CO₂ emissions reduction, with decarbonised furnaces and products with lower embedded carbon, to contribute to the EU climate-neutrality objective.

Successful industry execution of company schemes implemented at local level led to an increase of the average share of cullet used to produce flat glass in Europe from 20 to 26% between 2010 and 2018³. Despite this substantial increase, there are remaining **sources of cullet that could be returned to flat glass furnaces**, in particular from construction and demolition projects, of which only 5% is recycled today⁴.

Flat glass manufacturers are eager to use more recycled glass into their manufacturing process. To tap into the remaining flat glass recycling potential, **Glass for Europe is calling for a closed-loop model whereby flat glass is used to manufacture new flat glass.** Such a model is necessary to ensure high quality recycled content is made available in an economically viable manner.

The industry strongly believes in the importance of preventing waste generated by demolition and renovation from being landfilled or downcycled. Flat glass manufacturers seek to **promote the dismantling, collection and recycling of all end-of-life building glass** (from windows, glazing and other products) to ensure that end-of-life flat glass is effectively returned to flat glass furnaces. Doing so requires overcoming existing regulatory bottlenecks but could present numerous benefits for both the environment and the industry. In addition to the environmental effects, cullet as recycled raw material can help limit the impact of high energy costs on the sector while strengthening the competitiveness of EU-based industries.

Glass for Europe is the trade association for Europe's flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire building glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG-Group and Saint-Gobain Glass Industry, and works in association with national partners gathering thousands of building glass processors and transformers all over Europe.

¹ See Glass for Europe paper on [‘Reuse, remanufacturing, recycling: the case of glass for buildings’](#)

² In this document, the term recycling must be understood as flat glass broken glass, a.k.a. cullet, being reintroduced into a glass furnace to produce new glass, be it flat glass, container glass, insulation glass wool. In this paper, the use of broken glass as aggregates is not considered as “recycling”, unlike the definition of the Waste Framework Directive. Closed-loop recycling refers to the flat glass cullet being reintroduced into a flat glass furnace. This vocabulary does not refer to any specific standard or ‘recycled content’ definition.

³ European Commission, 2012, Glass BREF; Glass for Europe, 2019, Statistics on cullet use and recycled content.

⁴ Deloitte, 2016, Economic study on recycling of building glass in Europe

Three main sources of “cullet” to increase recycling

There are essentially three sources of flat glass cullet which can be recycled, each with their own specificities.

- **Internal float cullet generated on flat glass production sites:** cullet of high quality, that is already fully recovered and directly remelted on-site.
- **Pre-consumer cullet: off-cuts generated on glass processors’ transformation sites;** cullet partly recovered and recycled thanks to take-back systems organised between processors and flat glass manufacturers themselves and/or collection by glass recycling firms. Cullet quality can be controlled by protocols.
- **Post-consumer construction and demolition waste:** glass from old windows, facades, internal partitions, etc. From previous studies, it is estimated that 1.5 million tonnes of such waste is generated annually in the EU. The Renovate Wave and the new Energy Performance of Buildings Directive (EPBD) is meant to further increase this number by accelerating the rate of renovations. Most of this waste is never valorised and therefore lost when in a vast majority of cases, it is used either as aggregate or sent to landfilling⁵. Construction and demolition waste glass represents the **biggest untapped source of cullet nowadays**. It also represents most quality control issues.

A framework not conducive enough for the recycling of end-of-life glass

Despite its recyclability and the potential, it is estimated that today **only 5% of end-of-life glass is effectively recycled into new flat glass products**⁶. This is due to the lack of obligations to properly dismantle and sort windows or glazing from buildings before or after renovation/demolition. Instead, **end-of-life glass** is often crushed together with other building materials and used for pavement aggregates or put into landfills.

Additionally, **only the use of recycled flat glass of the highest quality** (clean and non-contaminated flat glass) **is possible for new flat glass production**. This is essential to preserve the integrity of the manufacturing equipment and to ensure the quality, safety and performance requirements of the final products. For example, the use of soda-lime silicate glass coming from bottle banks is extremely complex and would entail huge costs for the flat glass industry. It is therefore important that flat glass cullet is not downcycled and is used in closed loop or else the resource and its benefits in terms of CO₂ emission reduction are lost for the flat glass industry.

The share of recycled glass used as a raw material increased over the last decade thanks to collection schemes. However, a more conducive European framework could really ramp up the efforts. **The European regulatory framework needs to provide further incentives to encourage and properly organise the recycling of construction and demolition glass.**

Glass for Europe policy recommendations

- ▶ **Recognizing the status of ‘by-product’** for pre-consumer cullet in all Member States
- ▶ **Banning the landfilling** of waste building glass from construction and demolition projects and **strengthening the glass provisions from the Landfill Directive**
- ▶ **Setting a framework to incentivise the adequate sorting of construction and demolition waste**
- ▶ **Defining targets for C&D glass waste** and **rules on dismantling windows/glazing and recovering glass**
- ▶ **Providing a high-quality recycling definition** and **implementing a closed-loop model** (flat glass to flat glass)
- ▶ **Having mandatory pre-demolition audits**

⁵ Deloitte, 2016, Economic study on recycling of building glass in Europe

⁶ Ibid. The study however shows important disparities amongst Member States. If collection and recycling of flat glass is well advanced in the Netherlands or Germany, it is sometimes not well implemented, or the glass is downcycled and not returning to flat glass furnaces.

EU instruments and policy measures to be activated

Glass for Europe is calling for EU regulatory instruments and initiatives to be activated in a coordinated manner to achieve concrete results.

An EU-wide recognition of the status of 'by-product' for pre-consumer cullet

If most of the efforts needed to increase recyclable content concerns construction and demolition waste, additional support measures remain needed to increase the recycling of pre-consumer cullet. While most pre-consumer flat glass cullet meets the conditions to be considered as a 'by-product', **many Member States do not recognise the by-product status for pre-consumer cullet.**

This means in practice that trucks of flat glass pre-consumer cullet get controlled, questioned, and stopped, sometimes within a Member State itself or at borders within the EU. This **lack of harmonised approach across Member States represents a major barrier** which could be solved with an EU-wide recognition of the 'by-product' status, eventually linked to specific harmonised technical specifications. It must be noted that such EU-wide by-product status and technical specifications could build upon existing guidelines of some Member States and the technical specifications already in place for end-of-waste criteria for glass.

- **The recognition of the status of 'by-product' should be steered by the European Commission either via a future revision of the Waste Framework Directive (WFD) or the development of by-products harmonized criteria applicable throughout the EU.**

A ban on the landfilling of waste building glass

Currently, most of the construction and demolition waste flat glass at the European level is not returning to flat glass furnaces. In most Member States, waste flat glass still ends up in landfills, despite restrictions taken by some Member States (e.g. the Netherlands, Germany or France). Yet, a significant proportion of this cullet could be easily treated and recycled in closed loop. Unfortunately, landfill costs remain cheaper than the cost of collecting separately and treating building glass in most EU countries and when policies are in place, there is often a lack of legal control by the authorities to ensure effective implementation.

Despite the 2018 recast of the Landfill Directive (1999/31/EC)⁷ which requires Member States to “*establish sorting systems for construction and demolition waste*”, little progress have been made. To advance the recycling of construction and demolition waste flat glass and further encourage the implementation of effective schemes, glass that could fulfil the technical end-of-waste criteria after economically viable treatment should be banned from landfill.

- **Provisions from the revised version of Landfill Directive (1999/31/EC) regarding glass should be strengthened and effectively delivered.**
- **A ban on landfill of recyclable flat glass products should be introduced for flat glass that can fulfil the end of waste criteria, after economically viable treatment.**

A framework to incentivise the adequate sorting of construction and demolition waste that ensures the recovery and recyclability of waste glass

Flat glass cullet from construction and demolition waste has not been considered a priority by EU legislators so far as it represents a relatively low percentage of the total construction and demolition waste. The 70% reuse and recycling target set in Waste Framework Directive (WFD) is therefore too wide and has been unable to trigger any specific push for glass recycling. Yet, the 1.5 million tonnes of waste glass generated annually in the EU could become a major resource for the flat glass sector as it offers the potential to increase by 50% flat glass cullet availability.

⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0098-20180705>



- ▶ **A focus on construction and demolition flat glass waste is required to support the EU's own circularity and climate goals and to lift current barriers to the selective deconstruction and recovery of materials in the building sector.**

Recycling target for waste glass and on-site separation of construction and demolition waste (CDW)

The recent revision of the Waste Framework Directive missed the opportunity to address the building sector and further refine targets for CDW. As glass represents less than 1% of C&D waste, the target set in the WFD does not serve as an incentive to set up flat glass collection scheme.

Theoretically, the 70% target could even be reached without any flat glass being recycled. Furthermore, to answer the quality requirements needed for a closed loop (flat glass to flat glass), a revised framework should introduce the concept of high-quality sorting and recycling specificities.

- ▶ **The European Commission should set individual targets on specific types of waste (such as flat glass) alongside the global 70% target on C&D waste.**
- ▶ **The WFD should be revised to introduce the definition of high-quality recycling and require a closed-loop system, flat glass to flat glass, for building glass waste.**

A generalisation of pre-demolition audits

Audits before demolition or renovation of large tertiary buildings could significantly boost recycling of windows or glazing. The importance of these audits has been underlined in the 2018 Commission's guidelines⁸ for the demolition and renovation works of buildings. However, the guidelines remain too loose, and Member States have not moved fast enough. Audits should lead to recommendations and obligations as to the sorting and recycling of glass material per type of glass (e.g. coated, clear, laminated, enamelled, etc.), when it proves both feasible and cost effective. These types of audits are already required in France and in the UK as part of granting of demolition permits.

- ▶ **A mandatory requirement to carry out audits before tertiary building demolition or renovation should also be introduced in the revised WFD.**

Technical guidance for Member states

In addition to the above proposals, EU guidance should be drafted with technical recommendations for Member States on collection, sorting and recycling of end-of-life building flat glass across Europe. These guidance documents could describe available technical solutions for dismantling glazing and/or windows, separating glass from window frames and treating flat glass cullet, recommendations on creating an efficient and economically acceptable scheme.

- ▶ **Member States should be provided with technical guidance on collecting glass for recycling.**

⁸ <https://ec.europa.eu/docsroom/documents/31521/attachments/1/translations/en/renditions/native>