One destination, multiple pathways: How the European container glass industry is decarbonising glassmaking

FEVE
The European Container Glass Federation

October 2024

feve.org/decarbonisation

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About this report

This report has been produced to inform the work of policymakers, customers and retailers, and organisations represented on the glass value chain. The content is not intended for a consumer audience.

The report has been produced based on data provided by member companies of the European Container Glass Federation (FEVE), representing over 90% of European container glass production by tonnage.

Unless otherwise stated, any references to 'the glass packaging industry' should be understood to refer to the industrial container glass production footprint of the member companies of FEVE within Europe. For a full list of FEVE member companies, refer to p.52. The following national glass associations also contributed to this report: AIVE, ANFEVI, Assovetro, British Glass, BV Glas and Fedeverre.

A selection of imagery used throughout this report was kindly provided by FEVE member companies, including Ardagh Glass Packaging, Heinz-Glas, Park Cam, Verescence, Vetropack, and Vidrala.

For any questions or additional information, please contact **secretariat@feve.org** or visit **www.feve.org.**

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Executive Summary

The container glass industry plays an essential role in supplying a diverse range of brands with healthy, reusable and infinitely recyclable closed loop packaging. To continue to make glass packaging fit for Europe's future, we must address its emissions.

Today, dozens of initiatives are already underway across Europe to reduce glass's carbon footprint and achieve net zero emissions by 2050.

Europe's glass furnaces of the future use a range of energy pathways:

Electricity

Hybrid technology

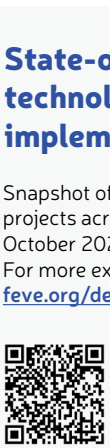
Biofuels & biogas

Hydrogen

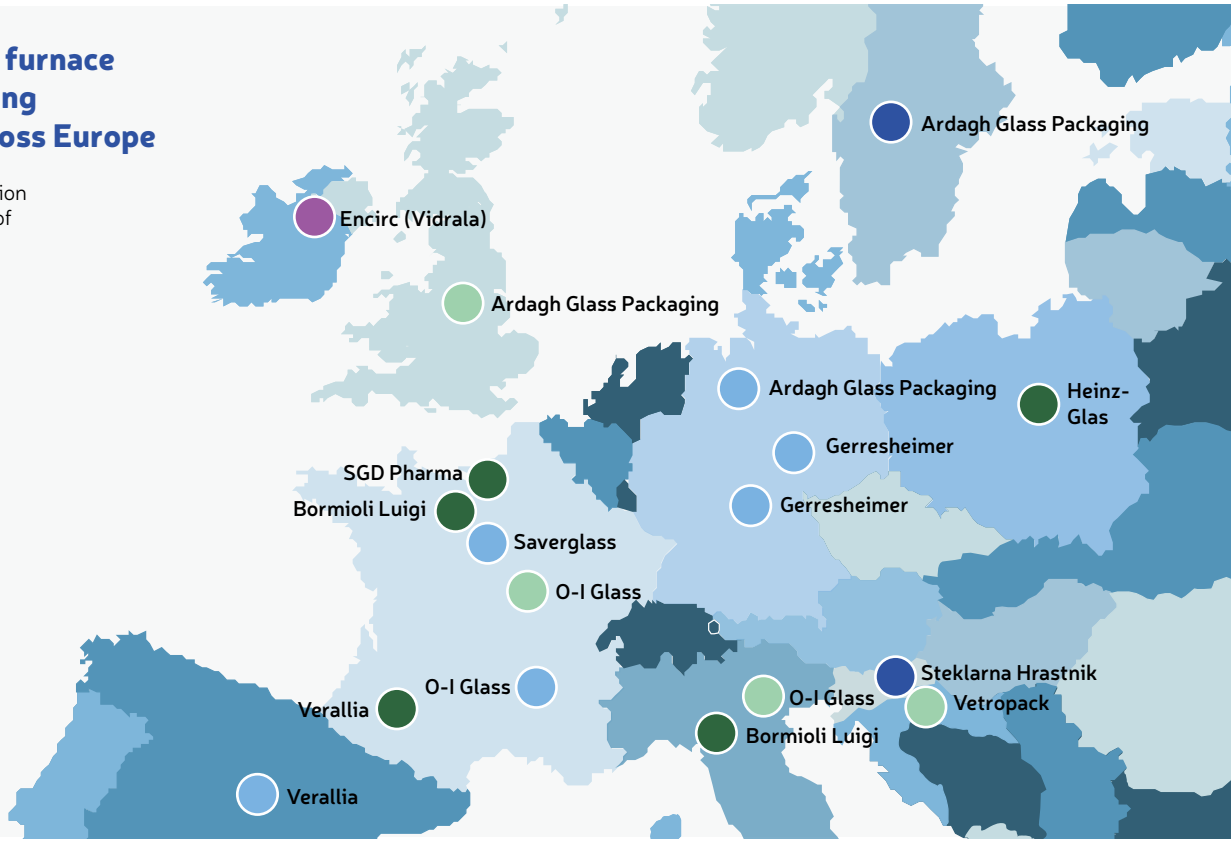
in addition to energy efficiency upgrades to existing furnace technology.

State-of-the-art furnace technology is being implemented across Europe

Snapshot of energy transition projects across Europe as of October 2024.
For more examples, see feve.org/decarbonisation



- Electricity
- Hybrid technology
- Biofuels & biogas
- Hydrogen
- Energy efficiency upgrades



How is the container glass industry progressing on decarbonisation?

1 Furnaces of the Future

To enable low-carbon glassmaking, the industry is investing in breakthrough furnace technologies to enable the energy transition and upgrading existing equipment to be more energy-efficient through its planned life cycle.

Newer furnaces – collectively known as the 'Furnaces of the Future' – will replace fossil fuels with cleaner alternatives, taking advantage of all possible energy pathways (electricity, biofuels and biogas, and hydrogen) located around production sites to enable low-carbon glassmaking. This includes innovative 'hybrid furnace' technologies that replace a proportion of natural gas with renewable energy. As this report showcases in detail, breakthrough technologies have the potential to reduce two-thirds of current CO_2 emissions, with concrete potential for improvement. Use of fossil fuel alternatives such as biofuels could also result in a reduction of CO_2 emissions of by 90%, as the report showcases.

Glass plants are also generating their own renewable electricity, recovering and redirecting heat waste from furnaces, using on-site photovoltaic panels, and entering into power purchase agreements (PPA) to diversify power supply.

2 Closing the Glass Loop

Glass is a 'permanent material' that doesn't lose quality when recycled. Increasing recycled glass content ("cullet") in production lowers the carbon footprint of each bottle or jar, due to a reduction in emissions from melting raw materials at a higher heat.

To increase cullet availability to expand its use in production, glass collection and recycling must be optimised. In a multi-stakeholder partnership involving the full value chain, '**Close the Glass Loop**' has a roadmap to achieve 90% glass packaging collection across Europe by 2030.

Glass manufacturers also invest in optimised collection, sorting and recycling technologies in plants to bring more cullet back into production cycles.

3 Sourcing & Design

Today's glass bottles, jars and flacons are stronger and lighter than ever before, and designed with their carbon footprint in mind.

Manufacturers are decreasing the average weight of container designs to minimise raw materials needed for production and reduce emissions during transit.

Ongoing R&D projects are exploring use of alternative raw materials in the production process, trialling new ingredient mixes (e.g. low carbon limestone, calcium or sodium), and expanding thermal hardening to ensure lighter designs remain durable through transport.

4 Transport & Delivery

Streamlining transport systems and identifying lower-carbon options is an important part of decarbonising the glass industry until the point at which containers reach the final consumer.

Over 70% of raw materials used in glass production in the EU travel less than 300km before reaching the furnace, while suppliers and customers are in relative proximity.

The container glass industry is incorporating alternative modes of transport, including increased use of trains or multi-modal systems, electric or hybrid vehicles, and delivery vehicles powered by alternative fuels, on some legs of the supply chain to reduce emissions.

To date, this progress has seen:

>€600 million
invested into energy efficiency, plant upgrades and decarbonisation projects each year

90%
of container glass production in Europe covered by SBTi targets

80.2%
of glass containers collected for recycling in Europe (2022)

Now, to accelerate progress on decarbonisation, we need public authorities and customers to support us in putting the right enabling conditions in place.

As the trajectory for low-carbon glass progresses, industry investment in new technologies and infrastructure will need to continue to rise. The glass industry contributed 5.7% of the EU's international competitiveness in 2023, so it is essential to support the sector so that European brands can continue producing glass packaging domestically. For this to happen, there are several enabling conditions needed from public authorities and customers to ensure that progress can continue:

Make low-carbon energy accessible by decreasing the cost of grid connection; incentivising authorities to increase financial support for glassmakers switching to renewable energy; and investing in the necessary infrastructure.

Improve glass collection infrastructure through investment into municipal glass collection systems; educating customers on how to prepare their glass for recycling; and campaigns to raise awareness of bottle bank locations and encourage better recycling habits..

Make sustainable design choices to increase the amount of recycled content in glass containers, and follow lightweighting principles to reduce weight and volume without compromising on brand aesthetic.

Identify lower-carbon transport options, like vehicles that run on-low carbon energy and alternative modes of transport (such as trains and ships), and obtain grants, subsidies or tax breaks for companies investing in them.

The rich variety of pathways that Europe's glass manufacturers are pursuing all point to one common industry goal: championing glass's essential role to be the future healthy packaging choice within a resource-efficient, circular and low-carbon economy. Once this energy transition challenge is complete, glass – whether recyclable or reusable/refillable – will be in a league of its own: a packaging material that meets the needs of brands, businesses, and retailers, while being better for people and the planet.

If our industry is empowered to further its decarbonisation vision, we are confident that glass packaging will be an important contributor to Europe's safe, circular, and low-carbon economy. **We are asking you to join us in supporting that vision.**

This report has been produced based on data provided by member companies of the European Container Glass Federation (FEVE), representing over 90% of European container glass production by tonnage. For detailed sources, see the published report.

For a full overview of the latest energy transition projects taking place across European container glass production sites, see: feve.org/decarbonisation

Letter from our Industry:
Our shared commitment to delivering decarbonised glass

We know that a significant step change is required to achieve 'net zero' greenhouse gas emissions by 2050. That's why our companies are putting their weight behind a wide range of initiatives to reduce glass's carbon footprint. In a two-pronged approach, we are already investing in R&D and future technologies, while managing our current impact with the technologies currently available.

In Europe today, glassmakers are starting up electric and hybrid furnaces, switching to low-carbon sources of energy, working to successfully trial hydrogen technologies[1] and delivering lighter weight bottles and jars.[2] Our industry is also assembling around **an industry platform**[3] that aims to achieve a 90% glass collection rate for recycling by 2030.[4] In addition, we are increasing our energy efficiency, investigating carbon capture and storage, and applying waste heat recovery and other energy-efficient technologies to production.

The rich variety of pathways that Europe's glass manufacturers are pursuing all point to one common industry goal: championing glass's essential role to be the future healthy packaging choice within a resource-efficient, circular and low-carbon economy.

The partnerships we have forged with public authorities and our customers have been instrumental to the progress we have made so far, and this will continue in the years to come. Now, we need our partners to go a step further in helping us to create the conditions that enable decarbonised glass packaging to become a reality. From our customers we need continued trust, and from policymakers we need the proper framework and infrastructure to continue to deliver on this progress.

Looking to the future, we are confident that by working together, we can solidify glass's position as a packaging fit for Europe's future[5] – so that customers and consumers can count on a packaging that is not only safe and fully circular, but also low-carbon.

This report describes how our industry is putting that vision into practice.

> **"From our customers we need continued trust, and from policymakers we need the proper framework and infrastructure to continue to deliver on this progress."**

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01

Decarbonisation of the glass sector – it's already underway

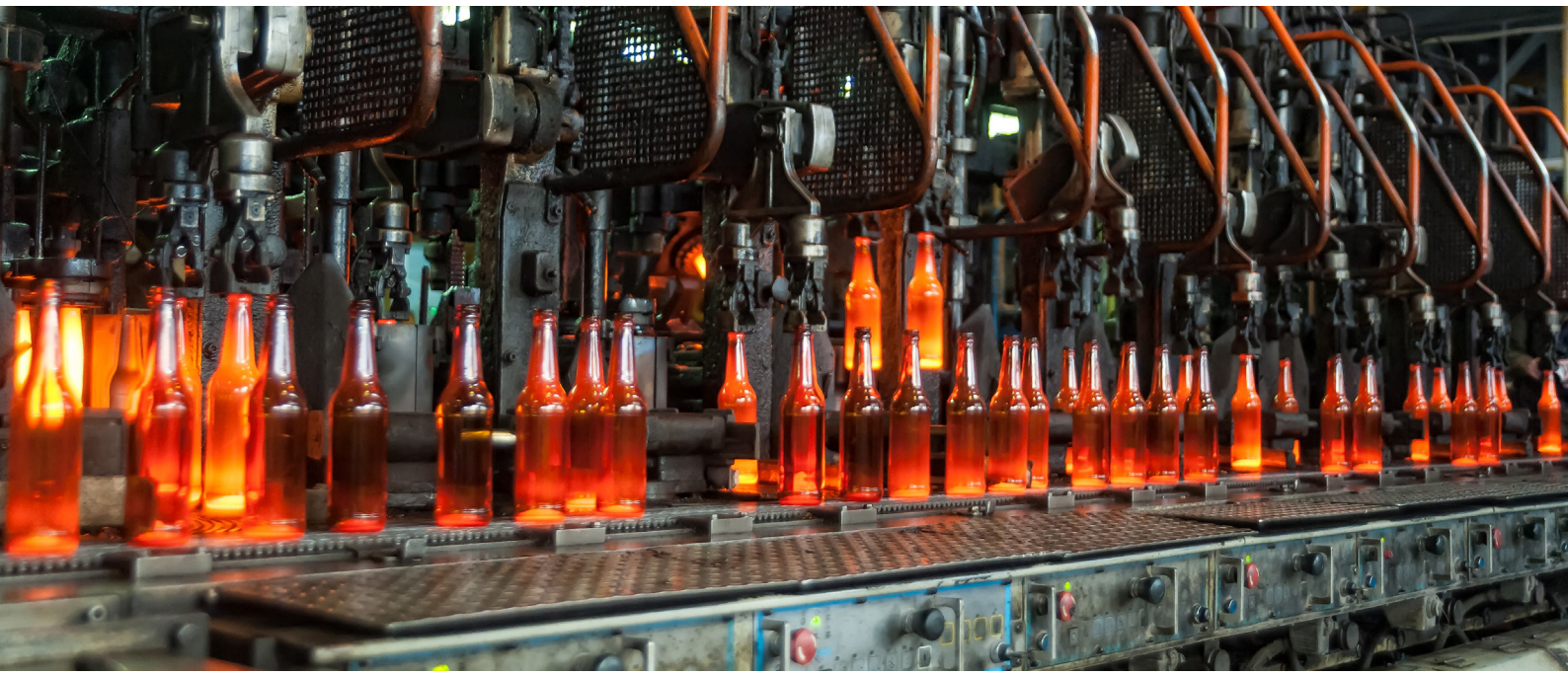
The container glass industry is changing – and fast. For decades, our industry has played an essential role in supplying a diverse range of brands with healthy, reusable and infinitely recyclable[6] closed loop packaging. Glass manufacturers have long been an important partner to a range of sectors – from food and beverages, to perfumery, cosmetics and pharmaceuticals – contributing to around €140 billion in EU exports in 2023.[7] All in all, our footprint, along with the sectors we serve, accounts for an added value to the economy of almost 1% of EU GDP.[8]

With an estimated 45,000 European manufacturing firms selling their products in glass, it has long been an essential packaging material that strategic sectors have relied on. Sustainable glass packaging will remain essential to deliver on economic competitiveness and build brand value,[9] as well as to protect products from the external environment and transport them safely. Though large companies represent a significant customer by volume (e.g. major brands in the beer or pharmaceutical sectors), more than 98% of glass packaging customers[10] are SMEs, especially in sectors such as beverage manufacturing or the production of perfumes and toiletries.

Primary packaging is essential for moving and preserving products, yet to be fit for Europe's future, it can't only meet these criteria. As a new political mandate takes shape and businesses continue to set their sights on ambitious climate transition plans, there is a clear need to ensure glass packaging is produced in a more sustainable, low-carbon way, in line with Europe's ambition to be climate neutral by 2050 and the European Commission's new plan for a 'Clean Industrial Deal.'

Future-proof packaging needs to protect people's health, contribute to the circular economy, and emit net zero carbon emissions. Our industry today is proud to offer a solution to many of these needs, but we know our carbon footprint remains our main stumbling block. Like all industries, addressing it is how we play our part in tackling climate change.

While glass has always been a model for circularity because of its inherent infinite recyclability as a permanent material[11] and high collection (80.2% as of 2022[12]) and recycling rates in Europe, the production of glass has traditionally been a carbon intensive process. To melt sand (SiO_2), soda ash (Na_2CO_3), and limestone ($CaCO_3$) – the raw materials used to produce glass, along with recycled content (cullet) – furnaces need to reach temperatures of around 1200 to 1600 °C. So far, mainly fossil fuels such as oil or natural gas have been used for this purpose, resulting in carbon emissions during the production process.



Decarbonisation: one imperative, multiple paths

Where do our direct emissions come from?[23]

~80%

Combustion of natural gas to run furnaces

Solutions: electrification, green hydrogen, biofuels, energy efficiency improvements, carbon capture utilisation and storage

~20%

Process emissions from decomposition of carbonates in the virgin raw materials

Solutions: greater use of recycled glass (known as cullet) in the batch, use of alternative raw materials, carbon capture utilisation and storage

However, that is changing, with the industry investing in breakthrough furnace technology that can make use of clean energies, and therefore dramatically reduce carbon emissions.[13]

The good news is that we're not starting from scratch. Decarbonisation of glassmaking has come a long way. Today, the average container produced by our companies emits 70% less CO_2 than fifty years ago.[14] And as demand for glass bottles and jars grows, we have already decoupled emissions from production.[15]

Reducing carbon intensity is a top industry priority and presents an opportunity to reinvent the way we produce glass, as we have done throughout previous energy transitions. This is reflected in the broad commitment to ambitious climate targets: currently, 90% of container glass tonnage produced in Europe is made by companies signed up to the Science Based Targets initiative.[16]

Our industry is now working hard to meet these ambitious targets. Glass furnaces have a lifespan of 10-15 years, and the estimated maximum furnace replacement rate is around 10% every year. For the container glass industry, that means that time is running short. In order to achieve net zero by 2050, we must accelerate planning and implementation of low-carbon technologies sooner rather than later.

Decarbonisation investment on the rise

In a business-as-usual scenario, our member companies already make significant investments totalling more than €600 million every year in innovation and decarbonisation efforts, including efficiency and plant upgrades.[17] These investments are translating into breakthrough technologies that enable glassmakers to produce glass using low-carbon energy carriers, such as electricity, hydrogen, and biofuels. Alongside these furnace innovations, glassmakers and our supply chain partners are taking steps to reduce carbon intensity throughout a glass container's lifecycle, from its initial design to the way it is transported, and how it is reused or recycled.

The trajectory for low-carbon glass is progressing. However, increasing this investment requires substantial funding. Technological breakthroughs are expensive, and our industry is no exception. Installing electric or hybrid furnaces, using hydrogen and/or biofuels, or implementing carbon capture utilisation and sequestration will require significantly higher capital and operational expenditure. All across Europe, industry investment in new technologies and infrastructure is on the rise, and further projections at European and national levels are already estimating how this will increase in the years to come.

Take Germany, where BV Glas estimates that transitioning the country's container glass industry to 100% electric melting by 2045 will require an investment of €3.2 billion – a 220% increase only as capital expenditure compared to business as usual, excluding operational expenditure (OPEX) costs.[18]

Translated to a Europe-wide projection, that will mean our industry needs to additionally invest approximately €20 billion in capital expenditure into the upgrade and decarbonisation of production technologies by 2050, compared to business as usual. In reality, this figure only represents a partial estimation of the true cost of industrial decarbonisation and is likely to be underestimated due to the exclusion of the higher OPEX costs linked to the use of electricity, where a realistic estimation is not yet known.

An estimated **~€20 billion capital expenditure will be needed across Europe** for the upgrade and decarbonisation of the container glass industry's production technologies by 2050.

The French glass sector will see a **~40% increase in production** costs related to electrification and technological change by 2050, compared to 2015 baseline.[19]

The German glass decarbonisation roadmap projects **extensive investments will be required** by 2045 to adapt the energy infrastructure of glassworks:

- €3.2 billion for container glass electrification pathway (only CAPEX)
- €4.9 billion for hybrid technology pathway

Based on available sectoral roadmaps published by national glass associations as of October 2024.
Additional roadmaps from other countries are under development and will be published on **feve.org/decarbonisation** when available.

Further advances will depend on whether continued investment frameworks and enabling conditions are put in place by policymakers. As the new furnace technologies already in motion start to produce their first bottles and jars and set their sights on scaling up, our industry's demand for low-carbon electricity, green hydrogen, and biofuels will only increase. Germany's glass association, for example, estimates that their container glass industry's annual electricity demand will increase by about 300% – to 4.8 TWh – by 2045.[20] Energy efficiency projects will be critically important to implement in conjunction with electrification and low-carbon fuels, to minimise future costs and impact on energy infrastructure.

This story will be the same around the whole of Europe. If 300 container glass furnaces are converted to 100% electricity, together they will demand an additional 26 TWh per year.[21] For an industry so important to the EU's international competitiveness – contributing to 5.7% of the EU's total exports in 2023 thanks to products packed in glass[22] – this is a relatively modest energy need, compared to other industries, such as the European chemical industry which is projecting an energy demand of 168 TWh per year.[23]

This transition to low-carbon energy carriers will mean capital expenditure increases are not the only investment on the horizon; increased operational expenditure is also to be expected. In the first half of 2023, while wholesale gas prices at European national gas hubs sat between 30 and 50 EUR/MWh, wholesale electricity prices in Europe ranged between 70 and 120 EUR/MWh.[24] Until these prices come down, the business case for renewable electricity use is uncertain.

That's why we need help from policymakers. As the Antwerp Declaration affirms, a European 'industrial deal' is essential for making Europe green and competitive.[25] The first step is ensuring we have access to a reliable supply of low-carbon energy; the next is making it affordable through lower cost grid connection, closely followed by the need to ensure grid stability. This is essential for keeping Europe's container glass industry competitive against the rest of the world and ensuring that European brands do not need to import their glass packaging from abroad, or to turn to other packaging materials that are less healthy and less circular.

Did you know?

Building a glass furnace is a long-term commitment that is highly capital intensive. Glass furnaces operate continuously 24/7, 365 days a year for 10 to 15 years and cannot be shut down until they are rebuilt.

Given the long investment cycles, it is critical that glassmakers have clarity over the future supply of low-carbon energy. Today's furnaces use around 4 megawatts of electric power, but to go full electric, they would need between 12 to 20 megawatts.[26] This means, when planning to implement new furnace technologies (e.g. electric) or other alternative fuels, glassmakers must make sure they will have adequate connections to the energy grid to power the furnace in the long term.

Our industry in numbers

European container glass production is...

A European industry

With a rich cultural heritage dating back over 5,000 years, glass manufacturing has a proud industrial footprint across Europe's regions and provides highly-skilled jobs while creating many job opportunities along the supply chain.

162
container glass plants in Europe

89.7 billion
glass containers produced in Europe (2023)[27]

23
countries where European container glass plants operate

125,000
direct and indirect jobs provided by the container glass industry[28]

An economic powerhouse

We serve a wide number of sectors crucial for EU international competitiveness, from food and beverages to pharmaceuticals, perfumery and cosmetics. All these sectors represent a notable share of EU exports and feature high quality, world-renowned European products.

~1% of EU GDP
value added by the container glass industry and the industries we serve[29]

~€140 billion
value of EU exports packaged in glass[30]

+€500 million
annual positive trade balance for empty glass containers[31]

98%
of the 45,000 EU manufacturing firms that sell their products in glass are SMEs[32]

A committed partner for sustainable packaging

Glass packaging has always been a model for circularity, and we are already on the path to decarbonisation by investing in breakthrough technologies and forging partnerships to reduce carbon intensity at every stage of the glass lifecycle.

90%
of the container glass production in Europe is covered by SBTi targets[33]

>€600 million
industry investment into efficiency, plant upgrades, and decarbonisation every year[34]

80.2%
collection rate for glass containers in Europe (2022)[35]

92%
of glass that is recycled is done so in a closed loop[36]

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02

Decarbonisation in focus: The Furnaces of the Future

By 2050, container glass production in the EU will need to be 'net zero', and that starts with switching from fossil fuels to low-carbon energy sources. While glass is made from ingredients found in nature and does not require oil or any other fossil fuel as raw material for its production, it does use natural gas for melting glass. With the combustion of natural gas accounting for 80% of the industry's direct (i.e. Scope 1) carbon emissions,[37] transitioning to low-carbon energy is our industry's number-one decarbonisation priority.

Fortunately, the glass packaging industry is very familiar with energy transitions. The industry has already successfully made several energy transitions in the past, from wood, to coal, to heavy fuel oil and to natural gas. The next step – already well underway – is transitioning to using low-carbon energy carriers in glass production.

So how will this energy transition happen?

Glassmakers are pursuing a variety of energy pathways, including electricity, green hydrogen, and biofuels. They are also researching the possibility of using carbon capture utilisation and storage as a future option. Given the specificities of all European markets (including geography, infrastructure, and energy mix), and the lack of clarity over future energy availability, glassmakers are wary of discarding any energy pathway that shows decarbonisation potential. For these reasons, our industry is investing in a wide range of state-of-the-art furnace technologies – collectively known as the 'Furnaces of the Future' – to take advantage of all these energy pathways and enable low-carbon glassmaking.

Europe's glass furnaces of the future use a range of energy pathways:

Electricity

Hybrid technology

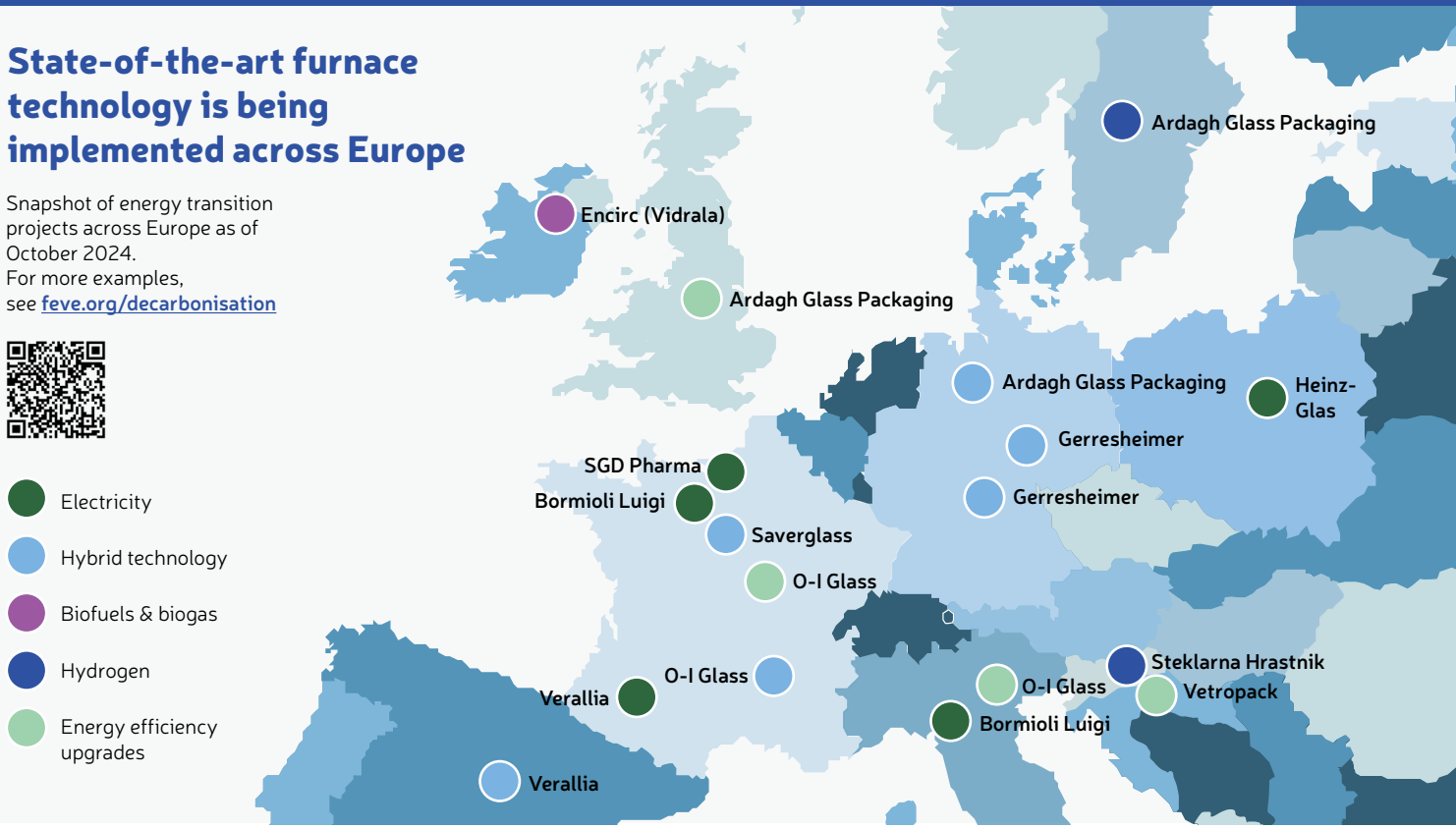
Biofuels & biogas

Hydrogen

in addition to energy efficiency upgrades to existing furnace technology.

State-of-the-art furnace technology is being implemented across Europe

Snapshot of energy transition projects across Europe as of October 2024.
For more examples, see feve.org/decarbonisation



Electricity

Bormioli Luigi	Electric furnaces	Parma, Italy
Groupe Pochet	Electric furnace	Guimerville, France
Heinz-Glas	Electric furnace	Dzialdowo, Poland
SGD Pharma	Increased furnace electrification	Saint-Quentin-Lamotte, France
Verallia	Electric furnace	Cognac, France

Hybrid technology

Ardagh Glass Packaging	NextGen Furnace	Obernkirchen, Germany
Gerresheimer	Planned hybrid furnace	Lohr, Germany
Gerresheimer	Hybrid furnace	Tettau, Germany
O-I Glass	Hybrid flex furnace	Veauche, France
Saverglass	Hybrid furnace trials	Feuquières, France
Verallia	Hybrid furnace	Saragossa, Spain

Biofuels & biogas

Encirc (Vidrala)	Use of biofuels	Derrylin, UK

Hydrogen

Ardagh Glass Packaging	Hydrogen Electrolyser	Limmared, Sweden
Steklarna Hrastnik	H2Glass project	Hrastnik, Slovenia

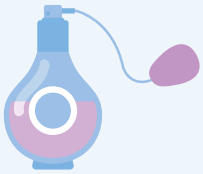
Energy efficiency upgrades

Ardagh Glass Packaging	Efficient furnace	Doncaster, UK
O-I Glass	Gas Oxy + Cullet Preheat + ORC	Villotta, Italy
O-I Glass	Gas Oxy Advances Technology	Gironcourt, France
Vetropack	Furnace rebuild	Hum na Sutli, Croatia

Electricity

Electrification is a promising method to decarbonise production because molten glass conducts electricity. Electrodes are inserted into the glass bath to generate heat through electrical currents, resulting in a higher energy efficiency than the traditional 'above the glass melt firing' achieved with fossil fuels. Assuming the electricity used has a low emissions factor, the reduction in CO_2 emissions can be significant. Switching all production to all-electric melting using decarbonised electricity would eliminate CO_2 emissions from the combustion of fossil fuels.

The challenges for adopting electric melting at scale, however, are multiple. Whereas large-scale commercial furnaces produce 350 tonnes of glass a day, electric furnaces typically produce less than 100 tonnes a day, and mainly for clear glass with low levels of recycled glass content. Nonetheless, electric furnaces are already a reality in Europe to produce smaller-volume containers for sectors such as spirits and perfumery or pharmaceuticals, and special packaging for food and beverages and premium goods.

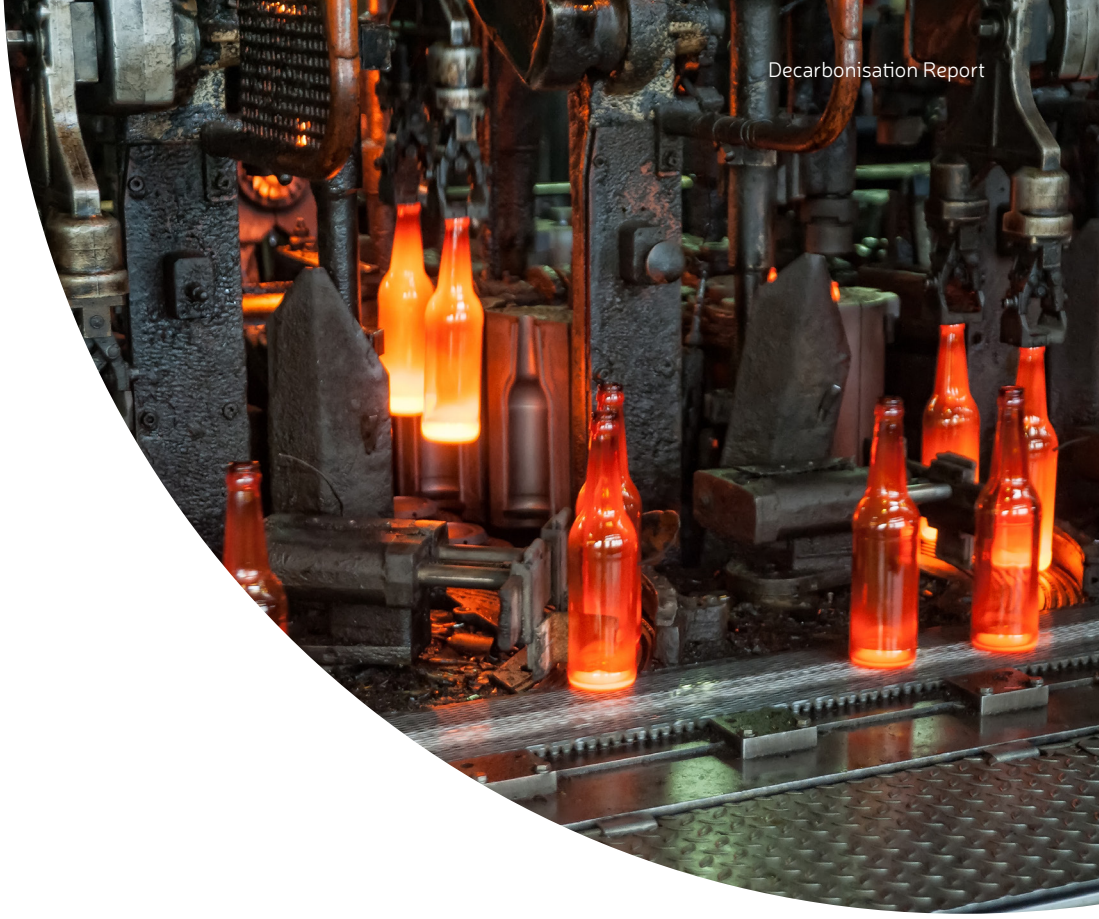


For the beauty market, the **Bormioli Luigi Group** operates two electric melting furnaces at its Parma site, supplied by 30% renewable energy, while its Azuqueca plant operates on 100% supply of renewable electric energy.[38] Its Abbiategrasso furnace will be renovated into a hybrid melting furnace in 2024, to reduce gas consumption. And soon, France will have its first electric furnace for luxury glass packaging. In partnership with industrial engineering group **Fives**, **Groupe Pochet's** installation of a new Prium® E-Melt cold-top vertical melter furnace at Pochet du Courval's Guimerville site[39] is part of the group plan to reduce the CO_2 emissions of its production by 50% by 2033.

Meanwhile, the **Heinz-Glas Group** has been operating exclusively electric furnaces to produce high-quality cosmetics flacons at its site in Kleintettau, Germany, for several years, while an electric furnace with one electric feeder dedicated to making high-quality cosmetics flacons was put into operation at the Dzialdowo site in Poland in 2021. An all-electric glass furnace was inaugurated in September 2024 at the Heinz-Glas site in Piesau, producing 70 tonnes of glass per day and saving up to 5,000 tonnes of CO_2 emissions per year.[40]

The pharmaceutical sector is also embracing the electrification of glass furnaces. **SGD Pharma** has announced a significant rebuild of one of its furnaces at the Saint-Quentin-Lamotte manufacturing site in France.[41] This strategic initiative, partially funded by the French government and the European Union's **REPowerEU**[42] programme, underscores the power of public-private partnership in turning decarbonisation ambitions into reality.

As for the food and beverage sector, in 2024 **Verallia** inaugurated its 100% electric glass furnace at its Cognac plant, set to cut CO_2 emissions by 60% compared to a traditional furnace.[43] With a capacity of 180 tonnes per day, this new electric furnace will produce flint glass bottles, particularly for flagship Cognac brands, and will contribute to the international reputation of French know-how and lifestyle, enhancing the competitiveness of a centuries-old industry rooted in the Charente region. The innovative €57 million furnace, with the possible introduction of up to 60% cullet, will be the first European site to produce flint glass bottles for food packaging with 90% low-carbon electricity and is the result of a partnership with industrial engineering group **Fives**. The first deliveries were made in July 2024.



Hydrogen

Hydrogen is another potential pathway to decarbonise glass production. The combustion of hydrogen generates the necessary heat for glass melting while only emitting water vapour, resulting in carbon-free combustion. However, the use of hydrogen is not without its challenges. Concerns have been raised about its potential impact on the technical quality of the final glass container as well as its availability and price – especially when it comes to renewable (green) hydrogen. Hydrogen does not abundantly exist in its pure form and therefore needs to be produced. While several production methods are available, only water splitting by electrolysis or thermochemical cycles can produce 'green hydrogen'.

Despite these challenges, European container glass manufacturers are continuing to trial green hydrogen in their production. These trials are focused on understanding the impact of hydrogen on glass furnace management, service life, and the overall quality of the final product.

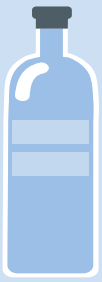
One pioneering project exploring green hydrogen as a viable alternative to non-renewable gas is the H2Glass pilot, a cross-country collaboration between 23 major manufacturers, research and industry institutions – among them glass manufacturers **Steklarna Hrastnik, Zignago Vetro**, Vetrobalsamo, PTML Pilkington and Owens Corning.[44] The goal is to develop the technology stack that will enable 100% green hydrogen (H2) combustion in the glass industry and validate its application in industrial contexts. As the largest green hydrogen viability project of its kind in Europe, set to run from 2023–2027 and supported by €24 million in EU funding through the Horizon Europe project, H2Glass aims to eliminate greenhouse gas emissions from fuel combustion in glassmaking, without significant impacts on production flexibility or furnace lifespans. In 2023, the project marked a considerable milestone with the acquisition of an electrolyser from a reputable European supplier, capable of producing green hydrogen required for testing directly on-site.

Through the H2Glass project, in December 2023, Steklarna Hrastnik's Slovenian subsidiary **Hrastnik1860** marked the first commercial use of green hydrogen in the glass packaging industry with a successful pilot production run that reduced the carbon footprint of the melting process by more than 30% – while having no impact on the technical quality of containers produced for the spirit, perfumery and cosmetic market.[45] They are now planning further steps to incorporate hydrogen into their industrial glass melting furnaces at scale,[46] with the objective of incorporating use of 100% hydrogen in two business units by 2026. Further H2Glass hydrogen trials set to be carried out by **Zignago Vetro** will see on-site testing to replace 10% of natural gas in existing furnaces with green hydrogen in five plants, scheduled to start in the second half of 2025 and extend into 2026.[47] The company aims to diversify its energy mix by increasing their expertise in integrating H2 technology into existing equipment during a furnace's planned operational lifespan.

Saverglass has also made significant strides in this area, having conducted successful hybrid furnace trials at its Feuquières industrial site in 2023.[48] The trials aimed to develop a mixed combustion process using green hydrogen and natural gas, testing hydrogen injection at three different rates: 10%, 20%, and 30%. Trial results, which found that hydrogen can substitute methane gas,[49] confirmed its decision to further pursue hydrogen to decarbonise its glassmaking process.

In parallel, a consortium of glassmakers – including **BA Glass, Şişecam, Stoelzle Glass, Vetropack, Vidrala** and **Wiegand-Glas** – have set their sights on producing the world's first carbon neutral bottle that does not require an offset, working with technology partners, the International Partners in Glass Research, researchers from RWTH University Aachen, and furnace maker HORN Glass Industries.[50] The ZeroCO2Glas project, launched in 2022 and part funded by Germany's Federal Ministry for Economic Affairs and Climate Action, aims to develop a new hydrogen-fired melting tank to melt carbonate-free raw materials – avoiding generation of CO_2 on both the energy input and raw material sides of production.

Green hydrogen is a significant investment, and partnerships are instrumental in making this a commercial reality. European glass packaging manufacturers are teaming up with their customers, particularly in the spirits industry, to explore the potential of hydrogen as a carbon alternative.



Ardagh Glass Packaging has partnered with Absolut to replace 20% of their natural gas with green hydrogen at their Limmared facility in Sweden[51] which will reduce carbon emissions by approximately 17%. To facilitate this transition, Ardagh has built an onsite electrolyser, providing a continuous supply of green hydrogen to the furnace, and significantly reducing the plant's overall carbon emissions, and saving approximately 5,000 tonnes of CO_2 each year.

Likewise, **Hrastnik1860**, together with Bacardi, has completed its first commercial production of glass spirits bottles using hydrogen. During the trial, the two companies produced 150,000 bottles, with green hydrogen contributing more than 60% of the fuel for the glass furnace and reducing the greenhouse gas emissions by more than 30%.[52]

Hybrid technology

In the hopes of overcoming full electric furnaces' technological barriers (i.e. ability to produce amber glass, or reduced glass), glassmakers are now looking to innovative technology that combines energy carriers. Hybrid furnaces have the potential to substantially cut the direct furnace CO_2 emissions, by replacing up to 80% of the natural gas with renewable electricity.[53] The potential CO_2 reduction of this innovation is even higher if it can be subsequently combined with other innovative sources of energy, such as hydrogen or biogas.

In 2023, **Ardagh Glass Packaging** in Obernkirchen, Germany produced the first amber coloured bottles using their breakthrough NextGen Furnace.[54] This hybrid technology aims to use up to 80% renewable electricity for melting glass. Capable of producing up to 350 tonnes per day and using up to 70% cullet, the NextGen Furnace has achieved a consistent 64% reduction in CO_2 emissions in 2024,[55] compared to a typical 330ml glass bottle, and Ardagh is striving for more. This represents a significant step towards maximum decarbonisation in the glassmaking process. The NextGen Furnace is funded through the BMWK[56] 'Decarbonisation of Industry' programme, which is managed by the KEI, and also from the 'NextGenerationEU' European Innovation Fund.

Further German hybrid furnace innovation is taking place at **Gerresheimer's** plant in Tettau.[57] This furnace operates with approximately 50% electricity produced from renewables and will soon be replicated at the manufacturer's plant in Lohr. Work for building the large-scale hybrid furnace in Lohr is set to be complete by Q1 2025.[58]

Beyond Germany, this technology is in the process of spreading around Europe. In 2023, **Steklarna Hrastnik** in Slovenia completed the construction of its Hybrid End-Port Regenerative furnace, which enables up to 40% renewable electricity usage.[59] The furnace is scheduled to enter into full hybrid operation in the fourth quarter of 2024. Similarly, **Verallia** is already equipping its Saragossa plant in Spain with a hybrid technology furnace, marking it as the first Verallia Group plant to adopt this technology. Set to be operational in 2025, the furnace will use up to 80% green electricity and 20% oxy-gas (burning natural gas with pure oxygen instead of air), resulting in a 50% reduction in emissions.[60] This innovative approach to glassmaking is expected to be replicated at Verallia's Saint-Romain-le-Puy site in France by 2026.

And that won't be France's only hybrid furnace: **O-I Glass** has also planned to install a hybrid furnace in Veauche, as part of a $65 million investment into the plant.[61] The furnace will allow the manufacturer to replace up to 70% of the conventional fossil-fuel-based energy with electricity. At an average 50% electricity level, on-site CO_2 emissions are expected to drop by approximately 43% compared to a traditional furnace. The furnace is expected to be up and running by the end of 2025.

Biofuels and biogas

Biofuels – made from organic waste materials – have also shown the potential to melt glass at a greatly reduced carbon footprint, without the need for a full-scale technological shift. Combustion trials undertaken by industrial research group Glass Futures found that low-grade fuels (derived from cooking and waste oils) had a similar heat transfer efficiency as natural gas.[62]

Two manufacturers, **Encirc** and **Verallia**, are at the forefront of implementing biofuels into their glass production. **Encirc** has undertaken a groundbreaking 'net-zero-ready' project in Derrylin, Northern Ireland, in partnership with Glass Futures and supported by UK government funding. The initiative successfully demonstrated that new bottles can be made from 100% recycled glass, using energy derived solely from burning ultra-low-carbon biofuels.[63] These biofuels, made from waste organic materials, are a renewable low-carbon fuel source.[64] The project has the potential to reduce the carbon footprint of each bottle by up to 90%,[65] signalling a significant step towards industry-wide carbon emission reduction.

Similarly, **Verallia** announced in 2021 its aim to power the equivalent of three furnaces with 100% biofuels by 2030.[66] In 2022, the company's Saragossa plant began using biofuel for up to 15% of its consumption,[67] followed by a 2023 memorandum of understanding between Verallia and Charwood Energy to develop a facility for producing syngas, a renewable gas generated by the pyrogasification of biomass.[68] If the project to develop this facility is successful, it has the potential to displace fossil fuels in the glass production process. The development phase is expected to conclude with the signing of a direct purchase contract for syngas supply, with construction of the facility scheduled to start in October 2024.

Making glass production more efficient

Just as Europe's container glass industry is investing in technological breakthroughs to switch to low-carbon energy sources, manufacturers are also making investments to increase the energy efficiency of glass production and therefore reduce its carbon intensity. With energy accounting for well over 20% of all industry costs, efficiency increases are not only a climate imperative but a financial necessity.

Continued modernisation and efficiency optimisation requires substantial investment, as shown by **O-I Glass'** plans for some of their European plants. Since March 2023, O-I Glass has announced investments of more than €280 million to upgrade several of their plants. In France alone, this adds up to €40 million in Reims, €50 million in Vayres,[69] and €55 million in Gironcourt-sur-Vraine,[70] while a further investment of €140 million is planned in its Alloa, UK manufacturing plant between 2024–2026[71] to fit state-of-the-art technology to one new and one existing furnace, featuring increased levels of renewable energy and recycled glass. At the heart of these efforts is the new Gas Oxy Advanced Technology (GOAT) furnace. This furnace uses a mix of gas and oxygen to heat the furnace and is equipped with a heat recovery system to pre-heat raw materials and recycled glass. While the furnace still uses natural gas as its primary energy input, the implementation of this efficient technology can reduce CO_2 emissions by up to 20% and NOx emissions by 60%.[72]

Ardagh Glass Packaging also invested in a technological upgrade to its Doncaster furnace in 2023 to reduce gas consumption and carbon emissions.[73] Its gas filtration process uses filter technology to combat other emissions elements and reduce them to levels substantially below current industrial standards. CO_2 emissions have been reduced by 14% compared to the previous furnace.

This project was part-funded with a grant from the UK Government's Industrial Energy Transformation Fund (IETF), which supports businesses with high energy use to transition to a low carbon future.

Most glassmakers have also put new waste heat recovery initiatives in place to recover even more energy from combustion gases. This also benefits the local communities around production sites. In Corsico, Italy, **Verallia** is using waste heat from production to supply energy to the district heating network, reducing the amount of CO_2 released into the atmosphere by more than 3,000 tonnes a year within the region.[74] The same approach is taken by **O-I Glass** in Reims, France to heat 1,200 homes in a nearby community and save 2,630 tonnes of CO_2 annually.[75] Meanwhile, **Vetreria Cooperativa Piegarese**[76] and **Verallia**[77] have launched respective projects to convert waste heat into electricity that can go back into the production process.

There are other ways in which glassmakers are getting the most out of the heat they generate too, such as batch pre-heating. In Köflach, Austria, **Stoelzle** has installed batch pre-heater technology that uses hot exhaust gas from the furnace to dry and pre-heat the batch.[78] Using this technology results in energy savings of about 4,000 MWh/year, which is equivalent to energy savings of 8% for their amber furnace and approximately 1.3% for the entire Austrian production site. In Villotta, Italy, **O-I Glass** uses multiple existing technologies, including gas-oxy combustion, cullet pre-heating, and an Organic Rankine Cycle, to reduce annual energy consumption by 35% and CO_2 emissions by 10%.[79]

Energy generation and storage

As energy is so precious in glass manufacturing, glassmakers have also taken steps to generate their own renewable electricity to use in their operations.

For example, in 2022, **BA Glass** managed to eliminate their Scope 2 emissions by only purchasing and acquiring electricity from renewable sources.[80] This was supported by the installation of nearly 80,000 m^2 of on-site photovoltaic panels across their plants, enabling a reduction of over 4,100 tonnes of CO_2 emissions in 2022. There are many other examples throughout Europe, from **Ardagh Glass Packaging's** new solar plants in Irvine, Scotland producing 1,500 MWh pa[81], and the two Netherlands facilities: Dongen[82] and Moerdijk,[83] producing up to 8,000MWh pa and 2,500 MWh pa respectively, to **Vidrala's** photovoltaic plant in Crisnova, Spain, with installed capacity of 12 MW,[84] to **Vetreria Etrusca's** photovoltaic system producing 3,000,000 kWh at their facility in Altare, Italy.[85]

Power Purchase Agreements (PPAs) are also a useful way of sourcing wind and solar-powered renewable electricity, in the form of on-site, off-site and even virtual PPAs, providing long-term energy security. **Ardagh Glass Packaging**, for example, has entered a PPA in Sweden for wind-generated electricity to supply approximately 40% of its European operations' power load.[86] An additional solar energy PPA with Sunnic Lighthouse will provide a long-term renewable energy supply to its NextGen Furnace in Germany with approximately 130 GWh pa.[87] Examples from other companies include **Gerresheimer's** agreement to purchase 35 GWh per year from wind turbine operator PNE AG[88] and **Groupe Pochet's** agreement with ABO Wind to support the commissioning of the developer's largest photovoltaic (PV) park in France.[89]

Having generated energy, glassmakers also look into storage solutions that optimise efficiency by storing excess energy during times of low demand and then releasing it during times of high demand.

For instance, in Scotland, **Ardagh Glass Packaging** implemented Europe's largest behind-the-meter storage system, a Tesla Battery Storage System.[90] This innovative solution not only provides a reliable backup during peak energy consumption but also feeds energy back to the grid during low demand. Likewise**, O-I Glass** has partnered with GridBeyond to implement an innovative battery storage solution at its Alloa facility. Powered by AI that strategically charges and discharges the battery based on grid conditions, the system helps to stabilise the local electricity grid during peak periods, increases O-I's resilience against brownouts, and improves the grid's efficiency and sustainability – with a projected annual saving of 240 tonnes of CO_2 emissions at the Alloa facility once operational.[91]

Concurrently, **Hrastnik** 1890 initiated a pilot energy storage project in 2023 under the **i-STENTORE initiative**, co-funded by the European Union.[92] This project aims to optimise the interaction between innovative storage systems (i.e. molten glass storage) and integrated energy sources, focusing on system reliability, energy quality, and cost-effective operation. Located in Zasavje, Slovenia – a coal region in transition – the pilot combines development of a hybrid regenerative furnace with a daily production capacity of 170 tonnes, with a 521 kWp photovoltaic power plant.

> **"Reliable access to low-carbon energy carriers is a key driver of decarbonisation."**

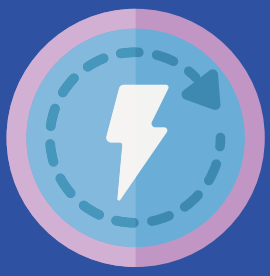
Enabling conditions to drive decarbonisation, together

These initiatives are important for reducing glassmakers' emissions, but crucially, they need to reach scale for powering all glass furnaces. Shifting a conventional container glass furnace melting 350 tonnes of glass per day from natural gas to renewable electricity would require increasing the installed electricity capacity from the existing ~4 MW to ~12 to 20 MW per furnace.[93] This is why our industry needs reliable access to low-carbon energy carriers as a primary driver of decarbonisation.

When you look at the strides made in the decarbonisation of glassmaking in recent years, there is one common thread: **partnership**.

From the German government's support for Ardagh Glass Packaging's NextGen Furnace to the hydrogen collaborations glass manufacturers are striking, it is clear we go further when we go together. That's why, as our industry takes steps to decarbonise the production of glass, we are calling on the help of our partners in the public and private sectors to support us.

How public authorities can help



Ensuring sufficient availability of low-carbon energy carriers for container glass plants.

Continued decarbonisation will rely heavily on the availability of renewable electricity, green hydrogen, and biofuels. However, the supply of these energy carriers is uncertain. Low-carbon electricity is currently hardly sufficient to meet demand. Should all industries, together with the transport sector, shift to electrification, there would not be enough low-carbon electricity for all. Green hydrogen availability is still only marginal, and no infrastructure is in place to bring it to the remote locations of glass factories. For biogas, its security of supply is so low that glassmakers simply cannot rely on it given the need for continuous, 24/7 furnace operation.

Deploying necessary infrastructure for the transport and distribution of low-carbon energy carriers to container glass plants.

The transition from natural gas to low-carbon electricity in furnaces necessitates a significant increase in installed electricity capacity, requiring reinforcement of the existing electric grid and voltage transformation substations. However, the expansion of electric transmission and distribution grids is currently lagging. Similarly, using green hydrogen at scale means either establishing a distribution network or supporting the installation of on-site electrolysers. Governments should support associated capital expenditure increases and streamline permitting procedures to facilitate this infrastructure deployment, bearing in mind that many container glass manufacturers do not tend to be located around industry clusters.

Ensure the affordability of low-carbon energy carriers for the industry.

The availability of low-carbon energy carriers is one thing; the affordability is another. Current power pricing mechanisms in the EU (based on the marginal power stations) make renewable electricity, despite its low operating costs, far more expensive for glass furnace electrification compared to fossil fuel-fired furnaces. Given that EU power prices are generally higher than the rest of the world, ensuring internationally competitive low-carbon energy is vital for accelerating the transition to low-carbon technologies.

Considering glass container industry investment cycles.

Glass manufacturers are laying out their roadmaps for decarbonisation, but it is unclear whether public authorities have their own roadmaps on the future of energy availability. Furnaces can have a lifespan of 10-15 years, so when a glassmaker is making an investment in breakthrough furnace technology, they need to know with certainty they will have access to the low-carbon energy to power it more than a decade later.

Supporting glassmakers facing increased capital and operational expenditure by the design of new financial instruments and the strengthening of existing ones.

Low-carbon investments mean higher capital and operational expenditure than using conventional technologies. This situation will hopefully improve as these new technologies become mainstream and when low-carbon energy carriers' prices reach par with fossil fuel prices. However, in the meantime, authorities should increase the financial support to operators on top of the existing schemes (such as the **Innovation Fund** under the EU Emissions Trading System) which have proven to fall far too short compared to the industry needs. This is crucial to help Europe's glass industry stay competitive with its counterparts around the world.

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03

Decarbonisation in focus: Closing the Glass Loop

Leveraging the circularity of glass

Using more recycled content also plays a key role in reducing emissions. While 80% of direct greenhouse gas emissions in container glass production come from combustion of natural gas to melt glass, the other 20% of direct CO_2 emissions are process emissions arising from the decomposition of carbonates during the melting of the virgin raw materials required to make new glass.[94] These emissions can be significantly reduced if virgin resources are replaced with recycled content, in particular recycled glass (or cullet), or with alternative low carbon raw materials.[95]

> **"Glass bottles and jars can stay in the recycling loop indefinitely without losing their intrinsic properties. As more recycled content is fed into the furnaces, the benefits multiply."**

For glass (a '**permanent material**'), the chemical bonds created during the initial glass container production are so strong that the material is not damaged during the recycling process[96]: bottles and jars can stay in the recycling loop indefinitely without losing their intrinsic properties. As more recycled content is fed into the furnaces, the benefits multiply. Every tonne of recycled glass added to a furnace cuts down on approximately 1.2 tonnes of extracted raw materials, while CO_2 emissions are reduced by 580 kg per tonne of glass produced on a Life Cycle basis.[97] While exact calculations vary depending on furnace size, as a rule, for every 10% increase of cullet in the furnace, there is a 5% reduction in direct CO_2 emissions and a 2.5% reduction in the furnace energy consumption.[98;99] This results from the lower melting point and lack of process emissions from glass cullet compared to raw materials.

Collection and Recycling

Once produced, used and properly collected for recycling, a glass bottle or jar can be remelted and becomes the main resource needed to produce new bottles and jars.[100] Collecting more and better-quality glass upfront therefore enables industry to replace more virgin materials with recycled glass.

Recycled glass is already the most important raw material used to produce new glass packaging: today, the average glass container made in Europe contains 52% recycled content.[101] Technically, bottles and jars can be produced with up to 100% recycled glass, and these, in turn, can be endlessly and easily recycled into new glass packaging applications without any degradation in quality.[102] The only limit is the availability of high-quality and colour-separated recycled glass on the market that can be used for bottle-to-bottle recycling. This underscores the need to recycle more and better glass by ensuring that as much of the glass placed on the market as possible is collected and recycled, and by investing in optimised collection, sorting and recycling technologies to make this happen.

The average glass container made in Europe contains 52% recycled content

With an extensive network of bottle banks and kerbside collection systems across Europe that dates back fifty years, the container glass industry is a long-time leader in circularity. On average, 80.2% (2022)[103] of glass packaging placed on the EU market was collected for recycling and 75.5% (2021)[104] was recycled. The vast majority is reprocessed back into bottles and jars – with one study finding that 92% of the total tonnage collected in Europe was effectively recycled in 2019 and as much as 91% of the recycled tonnage was recycled back into new glass containers.[105]

Close the Glass Loop – our action platform on collection and recycling:

close the glass loop

The glass industry has joined forces with key players along the glass value chain to form 'Close the Glass Loop', a multi-stakeholder initiative to bring back as much post-consumer recycled cullet into production cycles. The platform's goal is to collect more and better glass throughout Europe.

To be effective, tailored solutions that fit the specificities of local contexts are needed. The bottom-up approach connects a network of national platforms in 13 countries to encourage exchange of best practices, with each platform in turn bringing together organisations active locally in improving glass collection for recycling. It counts on all parts of the value chain – from the glass producer to brands and consumers, Extended Producer Responsibility schemes to municipalities. Financial support is also provided to local projects to support glass collection and recycling.

In June 2024, Close the Glass Loop published a roadmap to optimise closed loop recycling of glass packaging outlining key challenges and actions to maximise uptake of recycled content in manufacturing new glass containers.

Platform aims

Achieve 90% average glass packaging collection rate in the EU by 2030

Unlock better quality of recycled glass

Participating countries


Austria


Spain


Poland


Portugal


Romania


Sweden


The Netherlands


France


Belgium

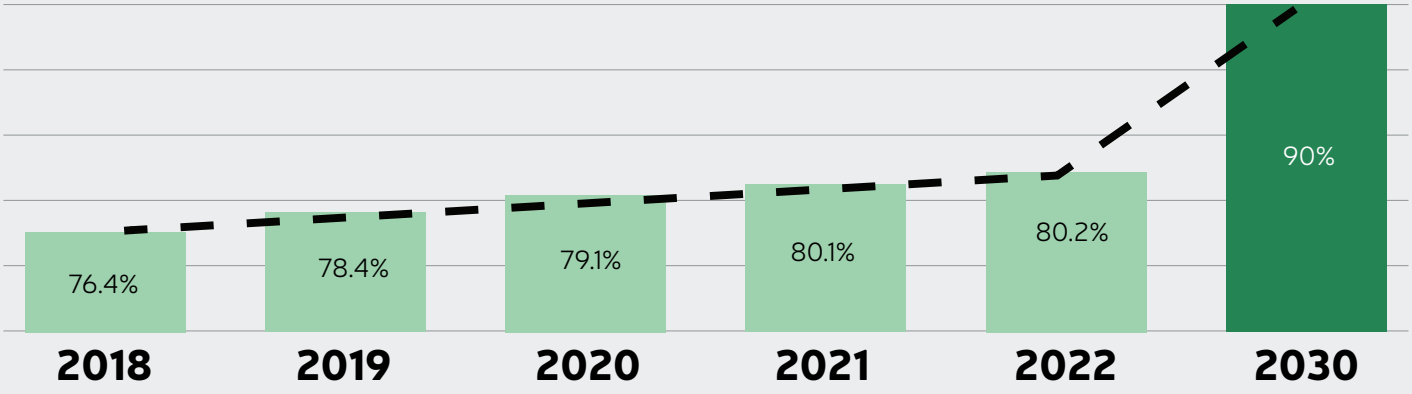

Germany


Ireland


Italy


United Kingdom

Paving the way to 90% collection of glass packaging

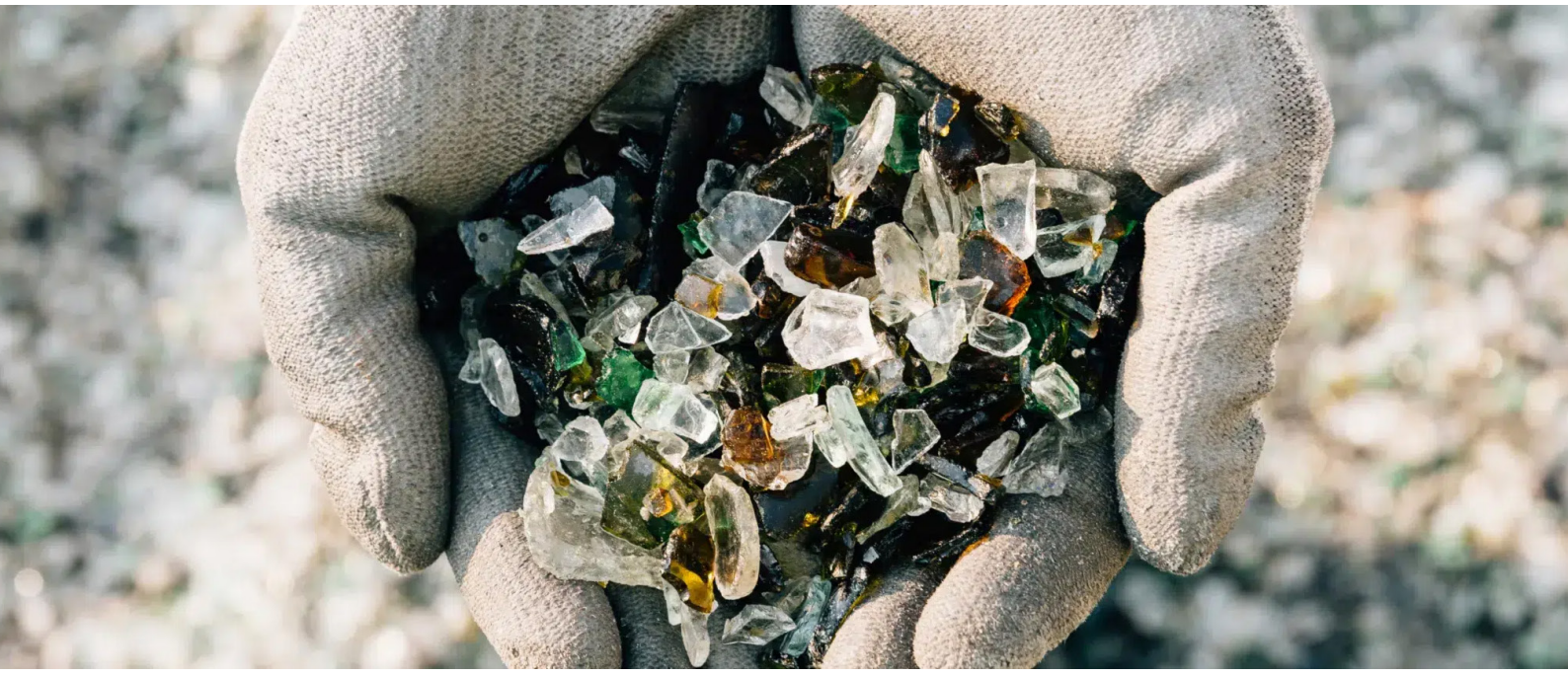


In addition to industry-wide initiatives like Close the Glass Loop, many glass manufacturers have developed their own pathways to increase recycled cullet brought back into production cycles. These range from launching consumer awareness programmes that incentivise better recycling habits, to forging partnerships with local infrastructure partners to install underground bottle banks or 'smart bins' that limit discarded waste around collection sites.

For example, **O-I Glass** has worked alongside local stakeholders in Sicily, from winemakers to glass collectors, to capitalise on both cultural heritage and sustainability ambitions. Sustainability is at the heart of Sicilian winemaking, with many local vendors taking pride in the high quantities of organic grapes that are found in the region. O-I Glass worked with Sicilians at every stage of the production process to create a '100% Sicily' glass bottle, made with 90% recycled glass.[106]

Encirc (a Vidrala company) forms part of the 'Keep Recycling Local' campaign across Northern Ireland, working with councils to adopt better recycling collection infrastructure and advocating for policies that enable local reprocessing of recycled content within the container glass production cycle, rather than being diverted to glass fibre uses.

Collectively, the industry invests in a range of targeted pilot projects to understand and improve people's behaviours around glass recycling. This focuses on areas and sectors with the lowest collection rates (e.g. the highly-fragmented hospitality sector), to support efforts to achieve 90% average glass packaging collection rate in the EU by 2030. In 2024, this includes **Vetropack and FEVE's** partnership with a local Croatian EPR scheme[107] to identify and break down barriers to recycling through targeted digital communications, and Portuguese glass association **AIVE and FEVE's** outreach programme[108] to hospitality professionals to increase the glass collection rates in the HORECA sector. Initial results for both campaigns are expected in late 2024.



In parallel to influencing collection rates, manufacturers are directly increasing their cullet supply by acquiring glass recycling facilities of their own. The Julia Vitrum Cullet Treatment plant – located in the Zona Industriale Ponte Rosso (ZIPR) in Italy's Pordenone province, and operated as a joint partnership between **O-I Glass** and **Zignago Vetro** – is one of Europe's first cullet treatment plants to incorporate innovative technology that produces improved cullet.[109] Traditional glass cullet purification machines can effectively clean impurities above a certain size. The latest generation of purification machines at Julia Vitrum catch and clear even smaller impurities – up to half a particle smaller. This means the plant creates a higher volume of usable cullet than traditional machines to manufacture new glass containers, thereby helping to keep more glass in the manufacturing loop and out of landfills.

In addition, **Verallia's** acquisition of six cullet treatment centres across Spain and Portugal will contribute to achieve its worldwide target of 59% of cullet integrated into production by 2025, joining nine treatment centres already in operation across western Europe.[110] Similarly, **Beatson Clark** in South Yorkshire, UK processes over 42,000 tonnes of recycled glass each year at their on-site recycling plant, adding up to 75% of cullet generated on-site.[111] With waste-to-product business Renewi, **O-I Glass** co-owns Dutch-based glass recycler Maltha, operating in four European countries with seven specialised processing locations.

In Turkey, there is much to do to recover end of life glass containers and discussion is ongoing at national level on how to design efficient collection schemes along the lines of what is done in EU countries with EPR schemes. Glass manufacturers **GCA** and **Park Cam** partner with the BIRCAM Foundation to launch the EKOMAT complementary recycling initiatives,[112] to increase collection of empty glass containers in a country where collection for recycling rates are very low (14% in 2019) and legislative incentives are missing.[113]

Thanks to better collection and cullet processing, glass manufacturers can incorporate more and more recycled content into their containers. Various categories can package their products using higher proportions of recycled content as a result – ranging from wine with **O-I Glass'** Estampe bottle (up to 80% recycled content[114]) to perfumery, with **Ramon Clemente's** luxury EcoLine flacons (up to 50% recycled content[115]). There are countless more examples across Europe.

Glass sand can also be considered as a complementary option to cullet. Glass sand is produced by grinding the rejections from the optical sorting process in the cullet treatment plant, which include glass and non-glass materials. This glass sand is composed of glass and non-glass particles below 1 mm that melt like glass in the furnace, without producing inclusions in the glass container. Glass sand can therefore be considered as a complementary secondary raw material to cullet, with its own technical specification to match glass furnace requirements.

Reuse

Reusable glass has been a reality in Europe for decades, if not centuries. From doorstep milk deliveries delivered fresh from the farmer to Germany's returnable beer bottles, manufacturers are working to offer reusable bottles and jars that deliver on customer needs.

Glass is a leader in reuse. According to 2019 market data,[116] glass accounted for 22% of reusable packaging for beer, bottled water, and carbonates (the three most significant product categories for reusable packaging). The next largest packaging was PET at 3%. While the market share of reusable packaging varies between countries, reusable glass still plays an essential role on a European level. The same data finds that 43% of the European beer market is packed in reusable glass packaging, 18% of the European bottled water market, and 10% of the European soft drinks market.

To meet these needs, Europe's container glass manufacturers are playing a part in enabling reuse when it is economically viable and environmentally sustainable. New innovative product lines launched to expand on bespoke returnable/refillable packaging options include wine and beer bottles that meet national standardisation requirements in countries like Germany and Austria, while maintaining brand customisation options. Manufacturers are also investing in national schemes to support expansion of domestic reuse markets.

Waste management alliance Citeo is partnering with **O-I Glass** and **Verallia** in France to design and develop the first large-scale reusable packaging intended for mass consumption.[117] Under the ReUse project, a range of manufacturers, brands and retailers – including Carrefour, Coca Cola, Danone, Heineken, Intermarché, Leclerc, and Nestle Waters – are working together to scale up a national system for reusable packaging, to complement existing collection and sorting programmes for recycling. The project aims to have 10% of packaging in France reused by 2027, and strengthen the circular economy of household packaging, in line with France's AGEC law.

At just 210 grammes, **Vetropack's** innovative technology produces reusable glass bottles that are 30% lighter than a standard reusable bottle, while thermal hardening means bottles are more durable and can easily be reused, including in standard reverse vending machines.[118] Its lighter weight means easier handling and fewer CO_2 emissions generated: overall CO_2 emissions can be reduced to as little as one quarter in comparison to conventional non-returnable containers, as a result of logistics savings and high shares of recycled glass used in production.

Verallia is investing in the Spanish REBO2VINO viability study as a first step in launching a wine bottle reuse system for on-trade markets.[119] These moves are also making their way into France, where Verallia is putting the finishing touches to its glass pilot project with reuse operator Bout' à Bout', by participating in the construction of their industrial washing plant.[120] The site aims to have a capacity of 60 million bottles a year, making it the largest in France.

Enabling conditions to drive decarbonisation, together

Collecting enough recycled glass, while ensuring the technical quality of glass containers, is a task that requires the involvement of the entire value chain. To ensure a higher amount of post-consumer glass is collected, consumers must be encouraged to recycle their containers after use. This collection infrastructure not only needs to be put in place and maintained, but the cullet needs to be separated from other materials, sorted, and treated before being used in new glass production. That's why circularity is a multi-stakeholder initiative.

How public authorities can help

Improving local collection infrastructure.

Further investments should be made into municipal glass collection systems to ensure that glass is separately collected (i.e. not collected together with other materials such as metals and paper), and that consumers have convenient access to collection points. Tailored initiatives should be supported to target glass collection in areas of high population density or with high transience (such as touristic areas), or from businesses operating in the HORECA sector. The focus should be on improving municipal collection systems (bottle banks and kerbside collection), as Deposit Return Schemes (DRS) are not the right solution to increase collection and recycling of glass packaging.

Providing proper guidance to consumers.

Consumers have an important role to play in supporting the transition to a Circular Economy and should be given adequate guidance on how to properly sort and return their glass packaging waste. This could be done through increased and consistent information at collection points, as well as enabling relevant entities throughout the glass value chain to develop educational campaigns on glass collection and recycling.

Supporting the promotion of transparent eco-modulated Extended Producers Responsibility (EPR) fees for packaging.

These EPR fees should reflect the ease with which a certain type of packaging can be recycled, and the likelihood of the packaging being separately collected, sorted and actually recycled multiple times with no loss of quality.

Recognising the concept of 'Permanent Materials'.

Glass, aluminium, and steel are 'permanent materials' that can be recycled over and over again without losing their key intrinsic properties.[121] Using these materials in packaging ensures that resources remain in the economy, reducing the need for virgin raw materials. The EU Waste Hierarchy should differentiate between materials that can be recycled multiple times without degradation and those that lose significant properties after a few cycles.

Supporting Member States that are at risk of not reaching EU recycling targets.

EU countries having difficulties in meeting the new ambitious EU recycling targets should be helped by targeted EU funding to install an innovative collection and sorting infrastructure and to invest in high quality recycling facilities.

Ensuring timely and proper implementation of the Packaging and Packaging Waste Regulation (PPWR).

As the implementation phase of the PPWR progresses, it is critical to make sure that secondary legislation and standards are adopted in a timely manner to provide visibility and certainty to economic operators. They should support both environmental objectives and the practical needs of the packaging industry.

Encourage the progression of direct air carbon capture and storage (CCS) or bioenergy carbon capture and utilisation (CCU) to industrial proven application.

Despite efforts to increase the availability of high-quality recycled glass, in practice, a certain amount of virgin raw material will always be required for the glass melting process. This results in unavoidable process emissions from the decomposition of carbonates, which need to be captured through direct air carbon capture and storage or on-site utilisation by biological CO_2 transformation. Both methods are currently under research and need to prove their industrial viability. Therefore, it is crucial that research projects in these areas are supported, and the corresponding research efforts are intensified and financially backed by the European Union to accelerate their market readiness.

Support uptake of glass sand as a complementary secondary raw material to cullet.

Review the limit value for Non-metal non-glass inorganics (<1mm) in the End-of-Waste criteria, to ease the uptake of glass sand.

How our customers can help

Support glass manufacturers' efforts to improve industry access to cullet.

Currently, there is more demand for cullet than availability, so the industry needs customers to invest in projects and co-sign solutions that will increase availability of, and access to, recycled glass.

Play their part in communicating the importance of glass collection to consumers.

To ensure more glass is put back into the recycling loop, container glass companies are asking customers to collaborate on joint initiatives that encourage better recycling habits among consumers, to boost collection rates and quality of the collected material, and promote the recyclability of glass to consumers.

Make product design decisions supporting closed-loop recycling, including increased use of recycled glass over virgin raw materials.

Although the biggest challenges to the closed loop glass recycling process come from the interaction with post-consumer waste management systems, there are some steps that can be taken at the product design level to help optimise the process as a whole. This could include cooperation on designing any complementary materials that may be collected together with glass (e.g. closures, labels and other components) to be easily sorted and separated, with their own recycling systems available, as well as increased flexibility on colour choice to enable higher use of recycled glass content over virgin raw materials. The uptake of recycled content in different colours of glass varies across colours (the average was estimated to be 80% for green glass, 50% for amber glass and 40% for flint glass at the time of the last assessment during a FEVE LCA[122]).

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04

Decarbonisation in focus: Sourcing and design

Rethinking what goes into the container and how it is designed

The history of glass packaging stretches back for millennia, but the iconic glass bottle is ever-changing. Today's glass bottles, jars, and flacons are stronger and lighter than ever before, thanks to the collective efforts of glass manufacturers in designing with decarbonisation in mind. These containers are also made up of more and more recycled glass, and increasingly, low-carbon alternative raw materials.

Lightweighting glass bottles means a collective reduction in the amount of glass required to make an individual container without compromising on strength, quality, or design. This reduces the total amount of energy required to produce batches of containers, and also the volume of raw materials needed, which, in turn, reduces the carbon intensity of every bottle.[123] Continuous experimentation with design technologies is bringing down the average weight of a glass bottle across a range of product segments each year,[124] and the industry isn't stopping there. The design standards and capabilities of glass containers will continue to evolve with technological design innovation, so new eco-design principles are constantly in development.

Beyond design, using alternative raw materials in the production process can help to reduce the environmental impact of making new glass. From engaging with material suppliers who have a reduced carbon footprint, to evaluating lower-impact sources of calcium and sodium, efforts are well underway to decarbonise the footprint of each glass container.

Alternative raw materials

While increasing the proportion of cullet in the batch is an important part of decarbonisation efforts, the search for low-carbon raw materials does not end there. From increasing the use of less carbon-intensive virgin raw materials to trialling new ingredient mixes for glass production, many glass manufacturers are making headway in sourcing the most sustainable option available to them.

Stoelzle, for example, has been focusing on a unique, low carbon batch limestone derived entirely from water purification processes. This innovative new limestone is a 100% recycled material. 80% of the carbon emissions from this process are defined as short-term carbon, meaning CO_2 taken up from the atmosphere.[125] Similarly, **Verallia** launched a research and development project to assess available sources of decarbonised calcium and sodium, with the first source approved for use in production processes in early 2023.[126]

Lightweighting principles

Reducing unnecessary packaging and related emissions is a priority for EU policymakers and businesses. Consequently, the production of lightweight container glass has become a significant focus within the industry. Manufacturers are continually transforming the design and weight of glass containers to result in a lower carbon footprint per unit of packaging.

In recent years, several innovative projects have been carried out to deliver on lighter weight glass packaging through reducing weight and volume, while considering distinctive shapes and design rights expected from our customers.

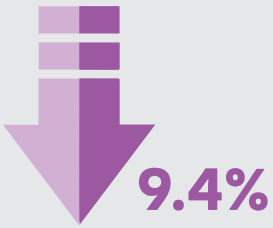
Did you know?

Based on the latest 2023 production data[127] collected from FEVE member companies:

Today, nearly 9 in 10 wine or spirits bottles sold by FEVE members in the EU are light or medium weight.[128]

The average bottle weight for still wines produced in Europe decreased to 450g in 2023 – while for bespoke bottles, it decreased to 530g.

A majority (63%) of sold still wines and spirits bottles were lighter than 500g, with only ~11% weighing more than 600g.



The average dairy product in glass decreased in weight by 9.4% from 2016–2023.

Verallia, for example, has reimagined the traditional Bordelaise wine bottle to create a new Bordelaise Air 300G option that maintains the bottle's iconic design, whilst weighing only 300g (a 25% reduction in weight).[129] Similarly, over a one-year period, **BA Glass** saved 2,500 tonnes of CO_2 by using lightweight designs, leading to a reduction of 6,500 tonnes of glass in 2022.[130] **Encirc's** (a Vidrala company) partnership with Belu resulted in a lighter weight bottle for their mineral water, saving 850,000 kg of glass each year and reducing total carbon emissions by 11%. The company has been partnering with Belu for several years to completely redesign their glass packaging by 20g for their 330ml bottles and 35g for 750ml bottles.[131]

Technology plays a critical role in enabling these new lightweight designs. One example is **O-I Glass'** lightweighting program, ULTRA, which aims to reduce the current weight of O-I's glass packaging by up to 25% by 2030, with no reduction in quality or impact on shape or manufacturing performance.[132] The ULTRA programme uses advanced modelling tools during the concept and design stage, pre-emptively addressing problems relating to downstream production, whilst the glass container is still in the design phase. In 2023, O-I's collective lightweighting efforts saved over 24,400 tonnes of glass, nearly 48,800 MWh of energy, and about 13,120 tonnes of CO_2. Likewise, **SGD Pharma's** IDENCY vials are 25% less carbon intensive than standard vials, thanks to the company's lightweighting process.[133] **Ardagh Glass Packaging** is working on a 'Virtual Twin' R&D project with Diageo to develop a coating that will reduce naturally occurring micro-cracks in the glass surface, enabling glass containers to be lighter without compromising strength and shape.[134]

With Glass Score, **Verescence** offers its customers the ability to evaluate the level of weight reduction of their products, without the influence of the container size. The rating system assigns a score ranging from A+ to F for each bottle, enabling brands to compare their products on a universal scale and develop new glass weight-reduction projects. The average score of perfume and cosmetic bottles on the market is between B and C, and Verescence's goal is to guide its customers towards a more virtuous Glass Score rating by proposing realistic weight reduction objectives that respect the initial design of the project.[135]

The trend towards lighter glass packaging is also taking place for premium products. **Bormioli Luigi's** EcoLine[136] is a lightweight option for luxury glass products that reduces carbon emissions by up to 70% and saves 50% of materials compared to traditional glass bottles and jars, making it a lower-carbon alternative. **Verescence's** Moon and Gem lightweight bottles are another prime example of how luxury cosmetics packaging can also be created with sustainability in mind. Both the Moon and Gem 100ml bottles have been designed to showcase the beauty of glass packaging, and despite their intricate shapes, weigh only 106g and 97g respectively.[137] This is a significant reduction from the average weight of their 100ml bottles in 2022, which then stood at around 235g.

Supply chain monitoring and certification

Container glass suppliers are working alongside their suppliers to reduce emissions at every stage of the industry's value chain, including Scope 3. For this reason, some glass manufacturers are increasingly taking into consideration the activities of their suppliers, and disclosing their progress in their annual sustainability reports.

Enabling conditions to drive decarbonisation, together

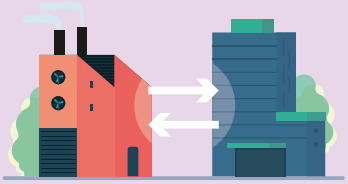
The European container glass industry is working to ensure that all bottles are designed as sustainably as possible and is committed to integrating lower-carbon alternative materials in the production process. However, this isn't a task that can be completed alone.

How public authorities can help

Balancing regulation promoting lightweighting with protections for unique designs in primary packaging.

Advancing eco-design principles is important, and the container glass industry needs support in promoting their importance for decarbonisation. But policymakers must ensure that the unique design aspects of glass packaging are protected, so it can reflect the product and brand's identity.

How our customers can help



Increasing their involvement and collaborating to develop sustainable design options.

Lightweighting requires cooperation between the brand and the glass manufacturer. Customers must understand the importance of their support and input to align on sustainable solutions for the design attributes of a glass container, including its weight.

Understanding that progressive lightweighting will change the design of the bottle.

The container glass industry is collectively working to ensure that the glass bottles of the future will be lighter and less carbon-intensive, but this means that customers will need to also adopt a progressive mindset regarding bottle design.

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05

Decarbonisation in focus: Transport and delivery

Changing how glass is moved

The production process is only the beginning of a glass bottle's life cycle. Once created, it must be delivered to customers to be filled before making its way to consumers.

Container glass manufacturing is considered a local European industry, where roughly 70% of the raw materials used in production travel less than 300km before reaching the furnace[138] and where a significant share of the containers produced are subsequently distributed on the European market. This proximity between suppliers and customers guarantees a shorter supply chain, from sourcing of materials to final delivery, than many other packaging materials.

Yet with transport accounting for almost 25% of the EU's total greenhouse gas (GHG) emissions,[139] all industries have a responsibility to tackle CO_2 emitted during sourcing and delivery – and the glass industry, together with its customers, is no exception. Transport emissions include the transport and delivery of raw materials to manufacturing sites, transit of recycled cullet between cullet treatment plants and manufacturing sites, and distribution of the glass containers themselves once produced.

To reduce the emissions of delivery trucks and road fleets as part of overall Scope 3 emissions, manufacturers are partnering with customers and adopting a range of initiatives to decarbonise, ranging from incorporating increased use of rail routes, to trialling and integrating low carbon delivery vehicles into their transport fleets, including use of alternative fuel sources such as biofuels.

Did you know?

Glass packaging is produced in 162 plants in 23 European countries. In 2023 more than 89.7 billion bottles and jars were produced in Europe, making it one of the largest centres for glass container production in the world.[140]

Over 70% of raw materials used in container glass production travel less than 300 km prior to being used in a glass furnace.[141]

Glass plants deliver more than 50% of their products within 300km.[142]

Low-carbon vehicles

Traditionally, glass containers have been transported by truck due to the need for flexible, reliable, and efficient delivery routes with a door-to-door service that can accommodate production schedules and distribution demands. Replacing vehicles that rely on fossil fuels, such as gasoline or diesel, with lower carbon vehicles that run on low-carbon energy is therefore a key component in the glass industry's pivot to sustainable mobility.

Take **Saverglass**: today, their road fleet of vehicles in Europe is 100% electric or hybrid, and to further streamline transport processes, the company is coordinating transportation circuits so that its trucks never make an empty trip.[143] Similarly, **Vidrala** has combined a move towards biofuels like biomethane by ensuring that any diesel vehicles remaining are certified under the latest Euro 6 or liquified petroleum gas (LPG) standards, alongside investing in a new fleet of natural gas-powered trucks that reduce CO_2 emissions by 50-60% per individual journey.[144] At its Barcelona plant, all combustion engine forklifts have been replaced with electric ones, improving energy efficiency and reducing CO_2 emissions by nearly 300 tonnes.[145]

Other manufacturers are exploring the use of biofuel-powered vehicles running on agricultural byproducts. Grounded in the rapeseed production of the Champagne region, **Verallia** has championed use of rapeseed-based biofuel to deliver champagne bottles from its glass factory in Oiry, France. Substituting conventional fuels with biofuels results in a 60% saving in CO_2 emissions and an 80% reduction in fine particle emissions compared to diesel fuels.[146]

Another company taking inspiration from the by-products of French agriculture is **O-I Glass**: 70% of the champagne bottles produced at their Reims plant are delivered to local customers in trucks powered by grapeseed and fryer oil, with plans in place to deliver all champagne bottles to customers via this system by 2026.[147] Similarly, O-I has switched the transportation of spirits bottles in Ireland, spanning both Northern Ireland and the Republic of Ireland, from diesel fuel to hydrotreated vegetable oil (HVO), reducing transport-related CO_2 emissions for spirits bottles produced in O-I's plant in Alloa, UK, by approximately 75%.[148]

Multi-modal transport

To lower the environmental impact associated with container glass transportation by road, manufacturers are increasingly looking to multi-modal or inter-modal transport, where multiple forms of transportation (including trucks, trains, and ships) are combined to move glass products from manufacturing facilities to end-users. Typically, this means using rail or ships for long-haul segments and trucks for shorter distances.

For **BA Glass**, this increased use of combined road, rail, and short sea shipping has resulted in a 17% reduction in CO_2 emissions for the longest transport routes.[149] Further customer partnerships have seen the implementation of dual trailers for more efficient fuel consumption and lower transport emissions, thanks to a combination of lower speeds and optimised transportation of product volumes – with a projected 25% decrease in CO_2 emissions per truck.[150]

Encirc (a Vidrala company) is staking its bets on the importance of rail within multi-modal transport systems, recognising that every tonne of freight moved by rail means 76% less carbon emissions compared to road transport.[151] As part of its move towards building an 'ultra sustainable' inter-modal glass transport network across the UK, the company has invested in a dedicated rail terminal for its Cheshire-based UK operations – enabling bulk-imported wine products to arrive at the local bottling plant by rail, making the 'last mile' of the delivery route as efficient as possible.[152]

Verallia is another manufacturer which has switched road transport to rail or multi-modal transport wherever possible: in 2022, 70% of Verallia's finished products in northeast Italy were delivered by train, reducing CO_2 emissions by 550 tonnes compared to traditional shipping methods.[153] Its new inter-modal transport system in northern Italy is set to take 4,000 trucks off the roads every year,[154] with more widespread adoption of multi-modal rail/road flows in Spain, Portugal and France ongoing. Likewise, **Wiegand-Glas** has been transporting containers by rail since December 2022, and in June 2023, also began transporting raw materials in the same way. The company's project 'Soda by rail to Steinbach' signifies its intention to switch away from road transport. Regarding soda ash, all upstream and downstream transport trucks have already been eliminated.[155] In conjunction with the aforementioned investment by **O-I Glass** into its facility in Gironcourt-sur-Vraine, France, the majority of the glass bottles produced there are now supplied to customers by rail, reducing the number of trucks per week by about 250.[156]

Transport packaging

Glass packaging requires some additional secondary packaging, like pallets and films to keep the containers in place in transit. While this only represents a small fraction of the container's overall carbon footprint, European glassmakers are still looking at ways of reducing their environmental impact, from optimising the content of the transport packaging to embracing circular principles after delivery.

For instance, **Verallia** works with suppliers to integrate higher quantities of recycled plastic into their film composition.[157] Currently, all their film in Germany and the United Kingdom is recycled, generating an annual reduction of 2000 tonnes of CO_2, and in 2024, this will be applied to all polyethylene on the Iberian Peninsula.[158] **Vetropack** similarly launched a pilot project in 2023, using recycled foil to package and protect pallets of glass containers. Customers are then responsible for returning the used foil to the manufacturer.[159]

With circularity being such a core attribute of glass, manufacturers are also looking to integrate these principles into their transport packaging. A case in point is **BA Glass's** management of wooden pallets delivered to their customers, where they are actively promoting reuse after delivery. In 2022, BA successfully reclaimed over 3.1 million pallets from customers, achieving an impressive reuse rate of 93.1%.[160] Any pallets not recovered by BA are either reused by customers or returned to suppliers for reuse. This is another example that shows that decarbonisation moves quickest when the entire value chain works together.

Streamlining supply chain logistics

There is more to reducing the carbon footprint of transporting glass than changing the vehicle it's moved in or the film it's wrapped in. One key innovation is rethinking the distances products need to travel throughout the supply chain in the first place. By centralising glassmaking, filling, storing, and shipping to one location, certain transport legs can be eliminated.

That's the thinking behind **Encirc's** '360' logistics initiative,[161] which bottles beverages for brands around the world directly in glass manufactured on the same site. Shipping liquid from the brand in bulk, as opposed to in pre-filled bottles, helps to remove previously dead space in containers. One study completed by Accenture on behalf of Encirc showed that by filling wines from places such as Australia, California, Chile and Argentina in the UK, the wine's transport carbon impact can be reduced by over 40%.[162] Once filled, the wine can be stored at their on-site bonded warehouse, again reducing transportation, before going directly to stores.

Enabling conditions to drive decarbonisation, together

Decarbonising the transportation of glass is something that cannot be done without the support of the entire glass value chain, from suppliers to customers.

How public authorities can help

Facilitating the necessary infrastructure.

To decarbonise their activities, the glass industry needs policymakers to support the creation of energy and transportation infrastructure that make it possible to deploy lower-carbon transport at scale.

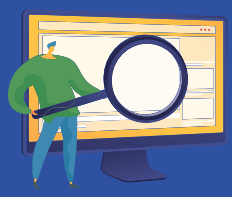
Financial incentives to fund procurement of lower-carbon transport.

Public authorities can provide grants, subsidies, or tax breaks for companies investing in electric or hydrogen-powered vehicles. These incentives can offset the higher upfront costs associated with such vehicles, accelerating their adoption.

How our customers can help

Collaborating with glass manufacturers to streamline transport and deliveries.

The glass industry needs customers to demonstrate flexibility regarding transport routes and methods, and actively support local deliveries.



Implementing the latest logistics technologies available to the industry.

With the development of predictive technologies, including artificial intelligence (AI), customers must collaborate with container glass companies to ensure that deliveries and routes are organised efficiently, so that delivery trucks are loaded to their full capacity and make as few empty journeys as possible.

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06

Decarbonising the loop: Delivering net zero, non-toxic and fully circular glass

As evidenced throughout this report, Europe's container glass industry is taking decarbonisation seriously. Our industry is aiming to make glass packaging a solution not only for a healthy, circular economy, but also for a net zero Europe. That's why we are focusing our efforts on reducing carbon intensity at every stage of glass container's life cycle, from melting glass using low-carbon energy sources to reimagining the design of the bottles themselves. The specific CO_2 emissions from the container glass industry have already been reduced by 16% in the decade between 2007 and 2017,[163] and with a transition to clean technology underway, glass' carbon intensity is set to reduce at a much-accelerated speed.

> **"As the next industrial revolution picks up pace, new technical infrastructure is already being built, multi-billion-euro investments are being made, and new stakeholder partnerships are being forged to take glass manufacturing into the future."**

We are now counting on the support of policymakers and the continued trust of our customers. As the next industrial revolution picks up pace, new technical infrastructure is already being built, multi-billion-euro investments are being made, and new stakeholder partnerships are being forged to take glass manufacturing into the future.

Already in 2024, the Antwerp Declaration for a European Industrial Deal[164] has set out a clear call to policymakers from industry to support the investments being made by thousands of businesses across the continent, by prioritising new projects for abundant and affordable low-carbon renewable energy. In tandem, the European political directions taking shape after June's European elections are showing the strategic importance of doubling down on European business competitiveness while delivering on the promised climate transition.

As you have seen through this report, public authorities and customers will play a crucial role in creating the enabling conditions necessary to serve the businesses and brands relying on glass packaging across Europe and beyond.

This means supporting the industry in facilitating the transition to the latest furnace technologies, through expanding access to affordable low-carbon energy carriers, investing in industrial innovation, and installing the requisite infrastructure. It requires collaborating on projects that enhance local glass collection infrastructure, from educating consumers on better recycling practices to advancing policies that propel more efficient glass collection across the European Union. It means collaborating to develop sustainable design options – ones that promote lightweighting and increased use of recycled content, without compromising on the unique designs that make primary packaging a driver of brand identity – and working together to streamline transport and deliveries, and procure lower-carbon transport options.

There are reasons why key sectors have chosen glass to fulfil their packaging needs. Europe's container glass industry is proud to produce packaging that is fully circular and non-toxic. Now, we are working to add a low carbon footprint to that list.

Once this energy transition challenge is complete, glass – whether recyclable or reusable/refillable – will be in a league of its own: a packaging material that meets the needs of brands, businesses, and retailers, while being better for people and the planet.

Better for business, because it offers a circular packaging material that meets the demands of everyday consumption in a sustainable way. Better for people because it remains inert no matter how many times it is recycled, making it safest for consumer health and best to preserve the quality and taste of products. And better for the planet, because glass can be endlessly recycled, without loss of its intrinsic properties.

If our industry is empowered to further its decarbonisation vision, we are confident that glass packaging will be an important contributor to Europe's safe, circular, and low-carbon economy.

We're asking you to join us in supporting that vision.

Appendix

Member companies of the European Container Glass Federation (FEVE)

The European Container Glass Federation (FEVE) is the Federation of European manufacturers of glass containers for food and beverage and flacons for perfumery, cosmetics and pharmacy markets. As of 2024, FEVE has 75 corporate members belonging to 24 independent corporate groups – producing over 80 billion glass containers per year. Together, FEVE member companies represent 90% of European container glass production by tonnage.

FEVE
The European Container Glass Federation

Ardagh Group

BA Glass Group

Beatson Clark

Bormioli Luigi

Gerresheimer Group

GCA

Heinz-Glas Group

O-I Europe Group

Park Cam

Groupe Pochet

Ramon Clemente

Saverglass Group

SGD Pharma Group

Steklarna Hrastnik

Stoelzle Glass Group

Verallia Group

Verescence Group

Vetreria Cooperativa Piegarese

Vetreria Etrusca

Vetropack Group

Vidrala Group

Wiegand Group

Zignago Vetro Group

European container glass manufacturers taking action on SBTi targets

As of October 2024, 90% of European container glass manufacturers,[165] by tonnage, have opted to join the Science Based Targets initiative[166] (SBTi). This covers both organisations who have had their targets independently validated by the SBTi, as well as organisations who have made a public commitment to set a science-based target aligned with the SBTi's target-setting criteria within 24 months.

This significant percentage indicates a broad industry-wide recognition of the importance of setting measurable pathways to reduce emissions in line with the Paris Agreement goals and the latest climate science.

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

European container glass manufacturers with SBTi-aligned targets include:

- Ardagh Group
- BA Glass Group
- Gerresheimer Group
- Heinz-Glas Group
- O-I Glass
- Saverglass Group
- Stoelzle Glass Group
- Verallia Group
- Verescence
- Vetropack Group
- Vidrala
- Wiegand-Glas

References

163. European Commission, Update of benchmark values for the years 2021 – 2025 of phase 4 of the EU ETS, 2021, p.23. Available at: https://climate.ec.europa.eu/system/files/2021-10/policy_ets_allowances_bm_curve_factsheets_en.pdf.

164. The Antwerp Declaration for a European Industrial Deal, available at: https://antwerp-declaration.eu.

165. Based on glass packaging manufacturing companies who are members of FEVE – the European Container Glass Federation.

166. More information available at https://sciencebasedtargets.org/

This report was produced by members of the European Container Glass Federation.

For further information on how the container glass packaging industry is progressing on delivering decarbonisation of container glass packaging, please visit:
www.feve.org/decarbonisation

linkedin.com/company/feve

x.com/FeveEU

glasshallmark.com

FEVE
The European Container Glass Federation

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October 2024

feve.org/decarbonisation