glass machinery world plants&accessories

BI-MONTHLY INTERNATIONAL MAGAZINE FOR GLASS MANUFACTURING

YEAR 38 • ISSUE NO. 4/2025

SPECIAL
FURNACES

FLOWtech Integration sees BDF INDUSTRIES finetune data-driven processes

From gathering to swabbing NOVAXION leads the transition

Vacuum System expansion to KIOO GLASS by PNEUMOFORE

TGP makes strategic investment in SCHOTT Poonawalla

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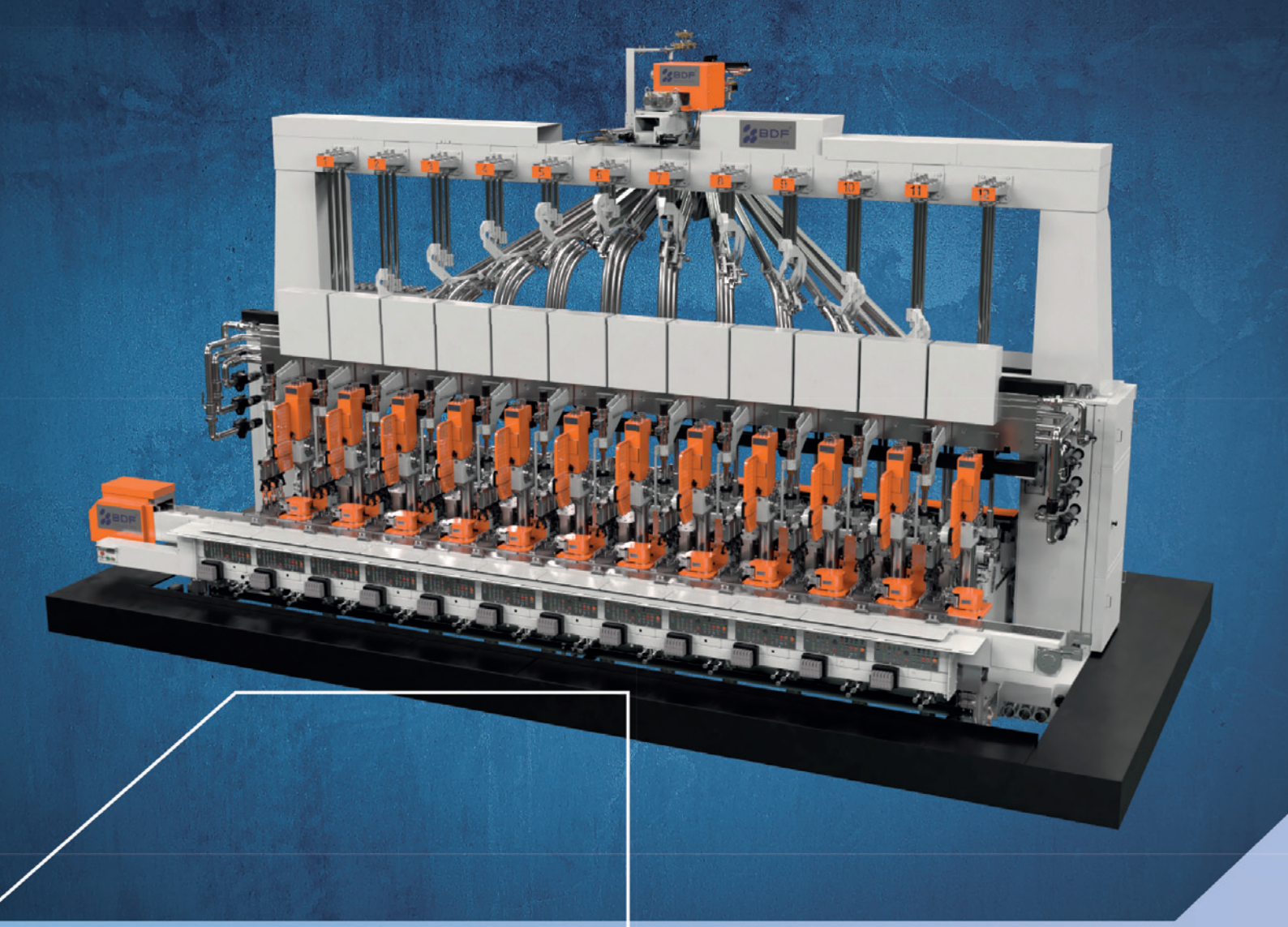

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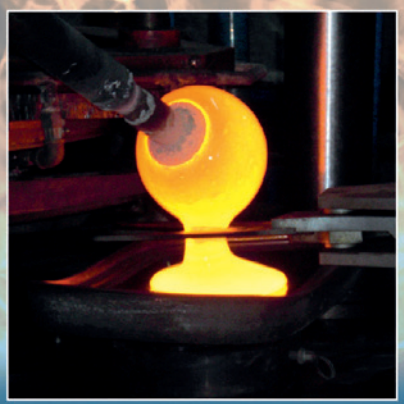

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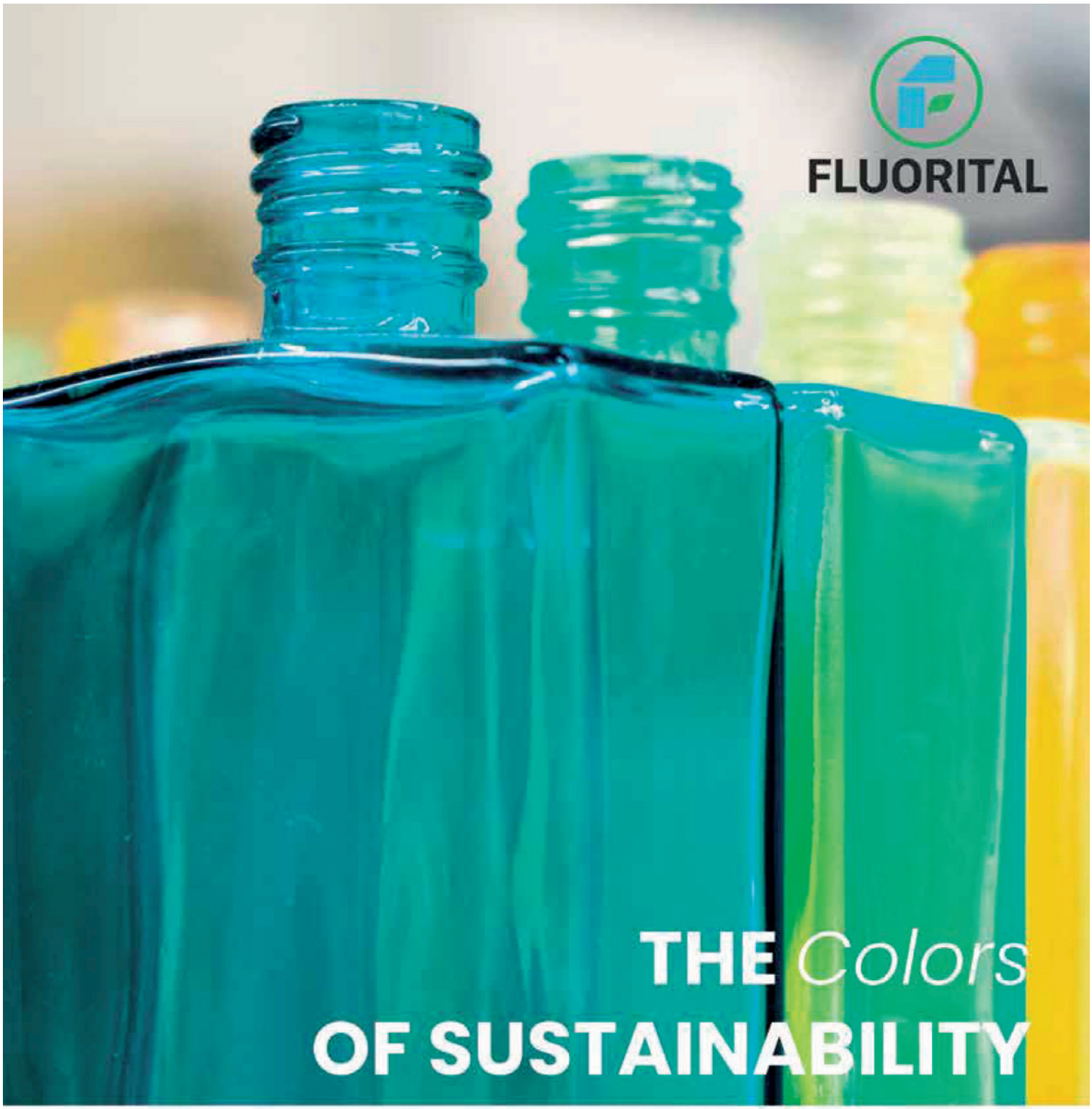

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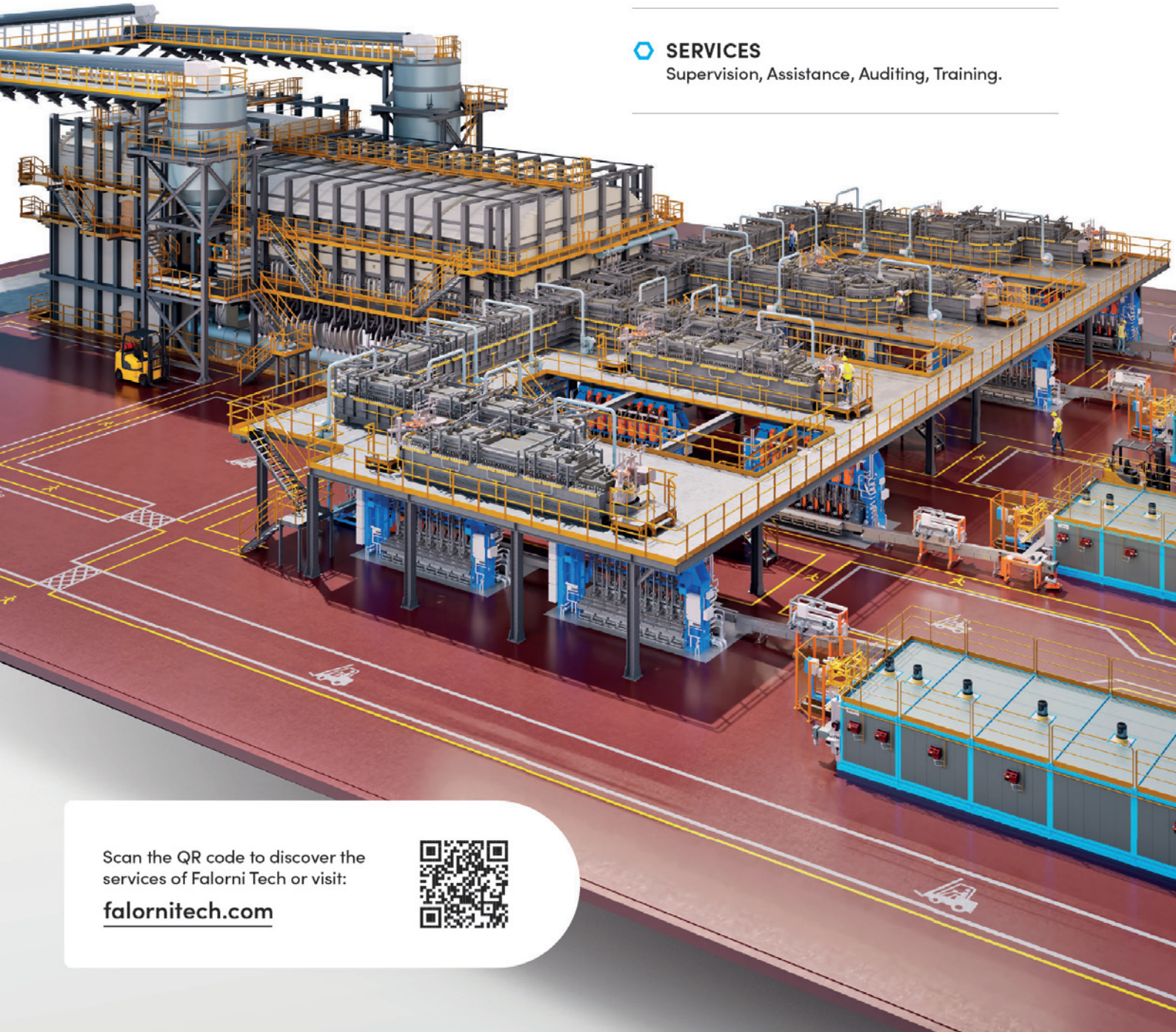

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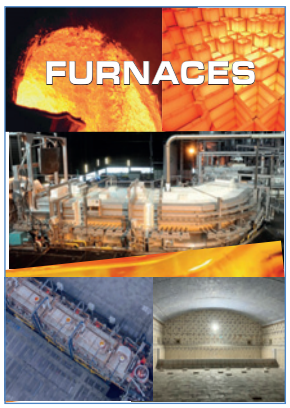

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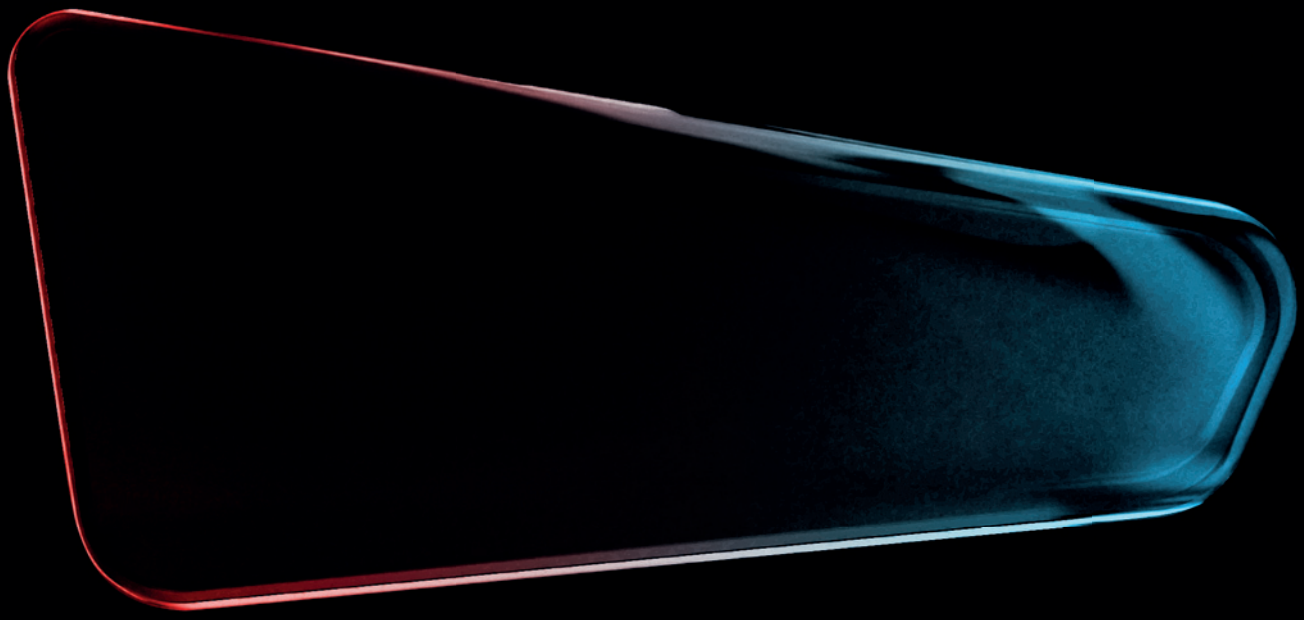

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2025 TRADE FAIRS CALENDAR

The magazine will be distributed at the following Events

issue	exhibition/conference	date	venue	deadlines
2025 1	AMBIENTE	7-11 February	FRANKFURT Germany	Editorial files: 13-01-2025 Deadline Adv files: 17-01-2025
	GLASSMAN ASIA	12-13 February	BANGKOK Thailand	
	COSMOPACK	20-22 March	BOLOGNA Italy	
2025 2	LUXPACK NEW YORK	7-8 May	NEW YORK USA	Editorial files: 7-04-2025 Deadline Adv files: 11-04-2025
	GLASSMAN EUROPE	14-15 May	ISTANBUL Turkey	
2025 3	CHINA GLASS	26-29 May	BEIJING China	Editorial files: 24-04-2025 Deadline Adv files: 30-04-2025
	IPACK-IMA	27-30 May	MILAN Italy	
2025 4	ATIV GLASS CONFERENCE	12-13 June	PARMA Italy	Editorial files: 16-05-2025 Deadline Adv files: 20-05-2025
	17H SEMINAR ON FURNACE DESIGN	18-19 June	VELKE KARLOVICE Czech Republic	
	LUXPACK SPECIAL EDITION	1-2 July	PARIS France	
	FEATURED CONTENT: FURNACES			
2025	Glass Industry Directory 			Editorial files: 09-06-2025 Deadline Adv files: 16-06-2025
2025 5	GLASSPEX INDIA	10-12 September	MUMBAI India	Editorial files: 25-07-2025 Deadline Adv files: 30-07-2025
	VITRUM	16-19 September	MILAN Italy	
	AFGM	22-26 September	CEBU Philippines	
	FEATURED CONTENT: COLD-END			
2025 6	CONFERENCE ON GLASS PROBLEMS	6-9 October	TOLEDO (OH) USA	Editorial files: 15-09-2025 Deadline Adv files: 19-09-2025
	EURASIA PACKAGING	22-25 October	ISTANBUL Turkey	
	CPHI	28-30 October	FRANKFURT Germany	
	FEATURED CONTENT: ARTIFICIAL VISION / AI			

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ANTONINI

A commitment to excellence with ISO22000 and ISO45001 certifications

Prizing quality, safety and responsibility among its core values as cornerstones of sustainable growth and innovation, **Antonini** is a leading Italian manufacturer of glass machinery and recently announced that it has achieved two internationally recognized certifications: ISO 22000 and ISO 45001.

ISO 22000: Ensuring Food Safety Through Precision Engineering

Antonini's commitment to quality extends beyond its operations to the industries it serves. With the ISO 22000 certification, the company reinforces its role as a trusted partner to the food and beverage sector. This standard, which incorporates the principles of HACCP (Hazard Analysis and Critical Control Points), ensures that its machinery complies with the highest standards of food safety management. In the world of food production, where precision, hygiene and traceability are critical, Antonini's ISO 22000 certification confirms that the equipment it designs and manufactures is safe for use in processes that require the strictest hygiene standards. It also highlights the company's dedication to supporting customers in meeting global food safety requirements.

ISO 45001: A Milestone for Workplace Health and Safety

The achievement of ISO 45001 represents a major milestone in Antonini's ongoing commitment to ensuring the health, safety, and well-being of its employees. This certification, the global standard for occupational health and safety management systems, reflects the company's dedication to creating a safe, supportive and compliant working environment. This certification was not merely a regulatory goal - it is part of Antonini's core values. By proactively identifying risks, promoting safety awareness, and continuously improving internal processes, the company demonstrates that the people who work with it are its most valuable asset. Achieving ISO 45001 confirms that Antonini is not only compliant, but a leader in fostering a culture of safety and care.

Looking Ahead

Hardly just awards alone, these certifications are a reflection of Antonini's values and a foundation for future growth. The company will continue to innovate, invest in quality and safety, and serve its partners with the reliability and excellence that define Italian manufacturing. Antonini S.r.l. has consolidated its market position over the years, distinguishing itself through dedication to its customers, product quality and reliability, as well as the preparation and availability of service and spare parts. The needs of its customers and the market in which it operates impose many significant challenges that Antonini embraces and addresses with the same spirit that has made it a market leader. The most recent product innovations, now established in the market, are particularly focused on sustainability and flexibility of use. This is the beginning of an important evolution path that Antonini has undertaken to keep its mission up to date with the times. As one popular in-company dictum runs: Antonini doesn't just build machines. It builds trust.


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Bureau Veritas Certification Holding SAS - Italy Branch certifies that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards detailed below

ISO 22000:2018

Scope of certification

Construction of industrial furnaces for the production of glass used as packaging in the food industry.
CAT J

Original Cycle Start Date:	30-April-2025
Expiry date of previous cycle:	NA
Certification / Recertification Audit date:	09-April-2025
Certification/Recertification Cycle Start date:	30-April-2025
Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on:	29-April-2028

Certificate No. IT342152 Version: 1 Revision date: 30-April-2025

Signed on behalf of BVCH SAS Italy Branch

Certification body address: Viale Monza, 347 - 20126 Milano (MI) Italy
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Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization.
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ISO 45001:2018

Scope of certification

Construction, repair, and maintenance of industrial furnaces, machinery, equipment, and plants for general industry and specifically for the glass industry, encompassing the following stages: manufacturing, assembly, welding, painting, reassembly, testing, and shipping.
IAF: 18

Original Cycle Start Date:	05-December-2024
Expiry date of previous cycle:	NA
Certification / Recertification Audit date:	20-November-2024
Certification/Recertification Cycle Start date:	05-December-2024
Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on:	04-December-2027

Certificate No. IT337984 Version: 1 Revision date: 05-December-2024

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SORG POLSKA

Furnace 2 reconstructed for Qemetica Glass

SORG Polska was recently awarded the contract for a modernisation and complete furnace renewal, including the batch house and batch and cullet transport, for **Qemetica Glass**, Poland's largest manufacturer of glass lanterns for grave lights.

The scope of supply and services ranged from the design and construction to the delivery of the steel, the refractory material, working end, forehearths and regenerators, to the heating up and filling. SORG Polska carried out everything from the modernisation of the batch house with the batch and cullet transport to the installation of the steel and refractory material.

As part of the work, the gas fired furnace was modified to enable a boosting system to be installed at a later date, supporting more flexible operation as a hybrid furnace. SORG Polska also provided systems for the heating, cooling and exhaust gas, as well as transporting the IS machines, their cabling and piping.

Qemetica Glass is part of Qemetica, a leading European group of companies in the chemical industry based in Warsaw, Poland. The company has been continuously active in the production of glass containers since 1946.

SORG Polska would like to thank Qemetica Glass for their trust and cooperation on the project and wishes Qemetica Glass a long and successful furnace campaign.

WWW.SORG.DE - WWW.QEMETICA.COM

LUBEN GLASS

Engineering Heat for Smart Mould Preheating Furnace Systems

One of the important factors to be taken into consideration in the production of glass containers is the temperature of the moulds. In fact, during production start-up, it is often necessary to preheat the moulds and accessories that are to be put into production to prevent the glass from solidifying too quickly, creating defects in the container. Pre-heating of the components is also very important to minimize the risk of thermal shock on the glass.

Luben Glass electric furnaces are specially designed for preheating blank and blow moulds and, more generally, all moulding reaching temperatures of 500-700 °C.

Made with a completely disassemblable external structure, they are equipped with an insulation system consisting of three different layers of insulation material used in different thicknesses depending on requirements and a door with a pantograph opening system.

The pantograph opening of the door has been designed to offer the maximum energy efficiency of the inner chamber and allows minimizing the waste of electrical energy: this type of opening in fact allows the application of a thick layer of insulating material in the inner part of the door itself; the closing movement of the door, which can be equipped with an automatic movement, allows the complete insertion of the insulation layer into the chamber itself; in this way the chamber remains perfectly insulated and does not disperse heat into the surrounding environment. The ovens can be equipped with internal structures for storing shelves and a metallic support for over elevating it; it is also possible to apply loading rollers to automate the work cycle.

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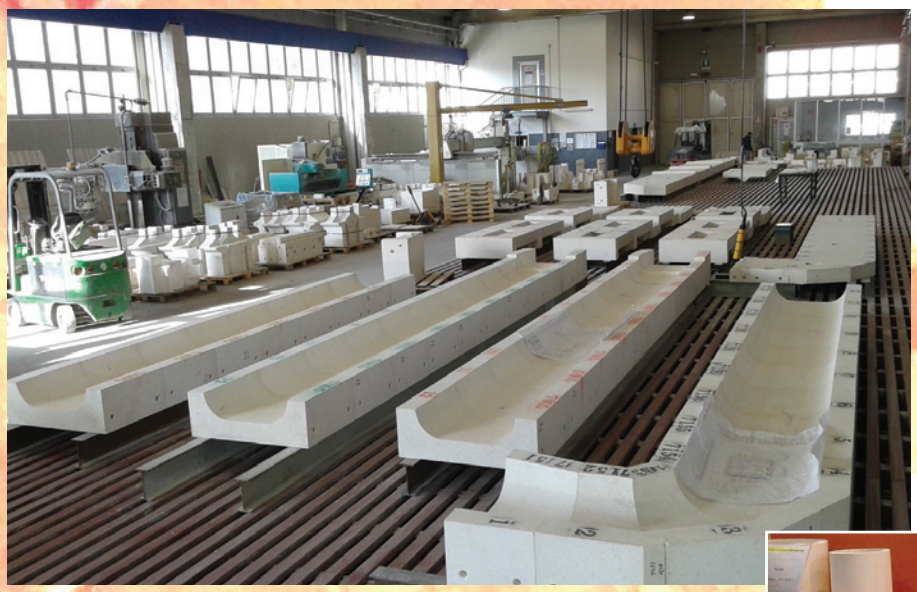

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VIDRARIA ANCHIETA

Installation of new glass melting furnace

Brazilian glassworks **Vidraria Anchieta** is investing in the installation of a new melting furnace, which will come into operation in July 2025.

This investment aims not only to improve the production processes, but also to promote a significant reduction in greenhouse gas (GHG) emissions.

Vidraria Anchieta believes that actions like this are essential to contribute to the preservation of the environment and to the development of a more sustainable and efficient operation.

WWW.VIDRARIAANCHIETA.COM

CINER GLASS

Furnace start up at third Park Cam facility

In a milestone for **Ciner Glass**: the third furnace was recently officially opened and started up at the **Park Cam** facility, in Bozüyük, Türkiye. Thanks to this investment, Park Cam's daily capacity will consequently increase by no less than 50 percent. That means:

- 1,500 tonnes of glass per day
- Enough for 9 million bottles per day

The furnace is now slowly heating up and it will be running

at full capacity by the end of May. This will give Ciner Glass around 25 percent share of the Turkish market.

WWW.PARKCAM.COM.TR

ZIPPE

A new era in control cabinet construction

With the commissioning of its state of the art drilling and milling centre, **Zippe** is now taking control cabinet construction to the next level. The direct connection to Zippe's CAD system EPLAN ensures maximum precision and efficiency.

- Increased precision in control cabinet assembly
- Faster processing and equipping of mounting plates
- Optimised drilling & machining of control cabinet doors

This investment means more efficient processes, higher quality and maximum efficiency.

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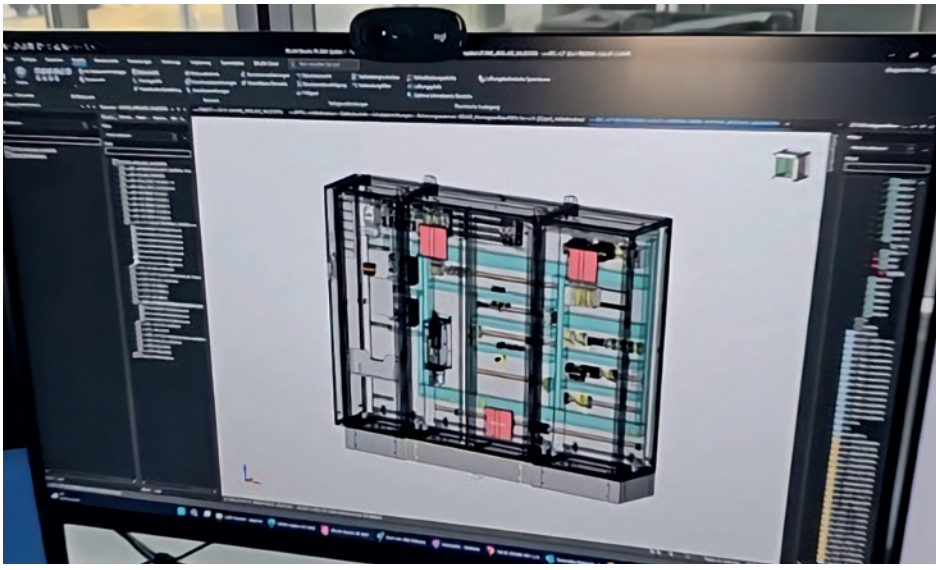

ARDAGH GROUP & BRITISH GLASS

Disproportionate impact of pEPR on UK glass packaging

Technical Director at **British Glass** Nick Kirk met recently with Dan Jarvis MP, Minister for Security and MP for Barnsley North at **Ardagh Group**'s glass packaging production site in Barnsley to discuss the disproportionate impact of the proposed packaging Extended Producer Responsibility (pEPR) fees on glass packaging. Under the current proposals, glass could be liable for a third of the GBP 1.5 billion pEPR costs, despite making up less than 5 percent of total UK packaging. Since pEPR payments to local authorities are not ring-fenced, there is a real risk these funds will not be reinvested into improving glass collection and sorting. Meanwhile, the UK glass sector is facing growing competition from imported empty glass packaging, which benefits from lower gas and raw material costs but comes with higher carbon emissions. Since Brexit, glass packaging imports face no tariffs, while plastic and metal packaging imports carry a 6 percent tariff. British Glass is calling for a level playing field to ensure UK glass manufacturers can compete fairly. Without changes, the current pEPR policy will drive brands away from glass to less recyclable alternatives—something already happening. Dan Jarvis MP listened to the concerns and potential solutions presented by Ardagh Glass and British Glass, and both looks forward to working with the government to realign pEPR policy – supporting UK-manufactured recyclable glass packaging and increasing the quality and quantity of glass collected for recycling.

WWW.BRITGLASS.ORG.UK - WWW.ARDAGHGROUP.COM

GIMAV

Change at the top: Lucia Masutti is the new General Manager

A leadership change was recently announced by **GIMAV** -the Italian Association of Suppliers of Machinery, Accessories and Special Products for Glass Processing- and **Vitrum** - the international trade show for glass technologies. As of June 16, Lucia Masutti is to succeed Fabrizio Cattaneo as General Manager of both entities - also joining the Board of Directors of Vitrum.

Lucia Masutti, currently General Manager of Glass Group -the largest Italian group of flat glass processing industries- and President of the Transformers Section of Assovetro, represents a high-profile figure, selected to lead GIMAV and Vitrum into a new phase of development and consolidation of the glass supply chain.

The strategic decision to entrust the leadership to Lucia Masutti responds to the need to strengthen the interconnection between the different players in the supply chain, thanks to her consolidated knowledge of the flat glass industry players, extensive experience in developing strategic industrial partnerships, and strong expertise in institutional relations, developed through her career at Fondazione Cariplo, one of the leading banking foundations in Europe.

With this appointment, GIMAV and Vitrum are preparing to face a new season of transformation, in which the strategic direction will be the strengthening of the supply chain through dialogue with businesses, institutions and research centres. The Glass Group network and her active role in Assovetro will help give strength and concreteness to the new initiatives under way.

Dino Zandonella Necca, President of GIMAV and Vitrum, commented, "This appointment strengthens the renewal path already undertaken. We believe that the vision and skills of Lucia Masutti can represent a strategic added value for both organizations. The goal is clear: to consolidate GIMAV as a unified point of reference for the entire glass industry -both flat and hollow- strengthening the representation of the supply chain in all its components, and promoting an integrated and innovation-oriented approach. The relationships built over the years by Lucia Masutti, combined with her ability to activate concrete synergies, will be a major driving force in tackling the current and future challenges of the industrial sector."

Lucia Masutti added, "For GIMAV we are already working on a new membership program, aimed at consolidating and expanding the association base, with particular attention to service innovation and the Association's ability to meet the new needs of businesses. For Vitrum, the top priority will be to restore the trade show to full competitiveness, giving it a strong positioning both in terms of appeal for visitors and industry operators, and in terms of geographic market relevance. Vitrum must return to being a strategic destination, a must-attend event for those working in the glass industry, capable of capturing global trends and creating real value for companies.

"We look to 2050 with a clear vision: Vitrum must represent the industry of the future. Innovation, robotics, artificial intelligence and sustainability will be the central themes around which to build a trade show ecosystem capable of attracting operators, stakeholders and decision makers from high-potential emerging markets such as North Africa, Southern Europe, Eastern Europe, the Middle East and Southeast Asia. The goal is to concretely support the internationalization of companies and contribute to the opening of new commercial and industrial opportunities."

To achieve these objectives, it will be essential, starting from this edition, to activate greater involvement of institutions responsible for business economic development and internationalization, starting with ICE -the Italian Trade Agency- which can play a strategic role in facilitating the arrival of qualified buyers and introducing new markets and growth opportunities to Italian companies. Strengthening institutional relations, alongside the involvement of research bodies, universities and competence centres, will be an integral part of a vision that aims to project Vitrum into the near future as a reference platform for advanced manufacturing.

The current economic and industrial context -characterized by complex geopolitical dynamics, rapid technological evolution and growing focus on sustainability- requires a cohesive, strategic and forward-looking approach. In this perspective, the appointment of Lucia Masutti fits into a broader plan of aggregation and collaboration among supply chain actors, institutions, research centres, and international markets. Only through a shared and synergistic vision will it be possible to address the challenges of the coming years, strengthen the competitiveness of companies and enhance Italian excellence in the glass sector.

WWW.GIMAV.IT

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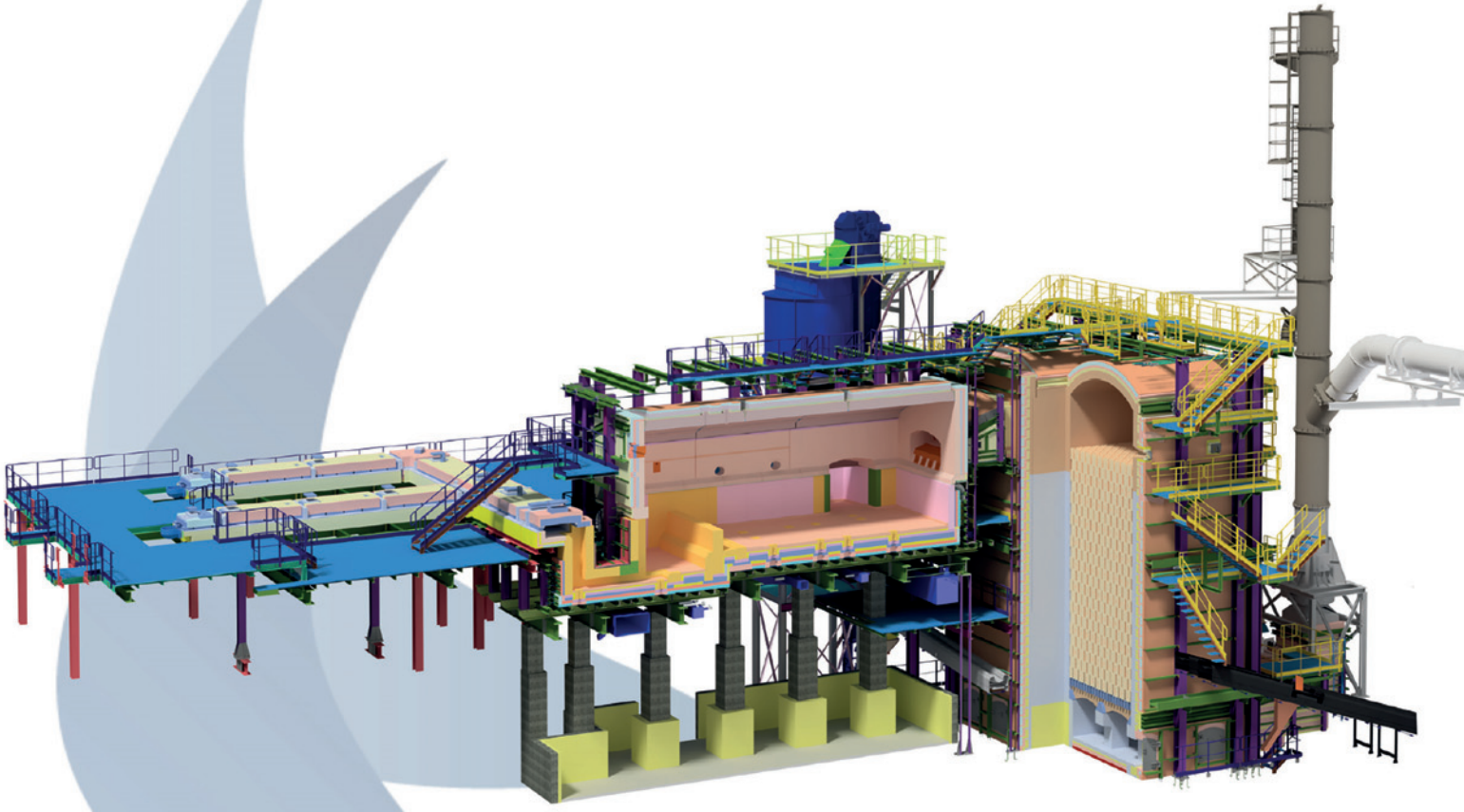

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AGP & CAP GLASS

Glass recycling service partnership

Ardagh Glass Packaging-North America (AGP-North America), an operating business of Ardagh Group, announced a new long-term partnership with **CAP Glass** to invest in establishing glass recycling services throughout the United States. The collaboration with CAP Glass, one of the nation's largest recyclers of glass, will divert tens of thousands of tons of glass from landfills, by collecting, sorting, processing and recycling glass bottles into high-quality cullet (recycled glass) for use in AGP-North America's glass manufacturing process to make new infinitely recyclable glass containers.

Using new, state-of-the-art technology at CAP Glass, AGP-North America will receive high-quality cullet that is critical for producing the premium glass containers that AGP-North America supplies to brands throughout the U.S.

"Ardagh appreciates the valuable contributions from CAP Glass, as well as their forward-thinking approach and dedication to bringing this vision to life," said Derek Wall, Vice President Procurement for Ardagh Glass Packaging-North America. "Their innovative ideas and long-term vision have played a pivotal role in making this collaboration a success."

This partnership demonstrates AGP-North America's commitment to sustainability by creating a closed-loop recycling system, where glass is continually recycled and reused. High-quality cullet allows AGP-North America to maintain superior quality and reduce the environmental impact of its operations while ensuring the supply of premium packaging for customers.

"We are very appreciative of Ardagh Glass Packaging-North America and Baltimore County for their support and collaboration on this project," said Shawn Pilla, Owner at CAP Glass. "We are confident that our venture will yield remarkable results for all parties and will contribute to our shared goal of reducing glass going to landfills and seeing it made into new glass containers."

By diverting glass from landfills and using it to create new glass packaging, this partnership helps reduce waste, lower environmental impact and conserve natural resources, all while contributing to a more sustainable, circular economy

WWW.ARDAGHGROUP.COM

GERRESHEIMER

Launch of silicone-oil and PFAS-free syringe systems

Gerresheimer is now offering complete, silicone-oil and PFAS-free syringe systems made of glass and cyclic olefin polymer (COP). Avoiding silicone-oil significantly reduces particle load and thus minimises potential medical risks and side effects. Silicone-oil-free syringe systems are therefore particularly suitable for sensitive biologics and areas of application with particularly high requirements, such as ophthalmology.

Gerresheimer has now extended its existing cooperation with the Injecto Group and concluded a supply and license agreement with the Danish supplier. Gerresheimer has thus secured the long-term availability of Injecto's patented plunger stoppers. Gerresheimer customers benefit from complete ready-to-fill (RTF) syringe systems from a single source with validated functionality. With the silicone-oil and PFAS-free syringe systems made of glass and COP, Gerresheimer is underlining its positioning as an innovative system and solution provider for the pharma and biotech industry.

"Silicone-oil-free syringe systems are ideal for the administration of sensitive biologics and for ophthalmic applications," said Torben Helmer, CEO of Injecto Group. "As part of the agreement, we are providing our patented plunger stoppers for a function-tested silicone-oil and PFAS-free syringe system from Gerresheimer that meets the highest standards."

"The new Gerresheimer RTF syringe systems made of glass and COP with Injecto plunger stoppers allow precise dosing and offer outstanding functionality - completely without silicone-oil or PFAS," said Oliver Burgel, Global Executive Vice President Syringe Systems at Gerresheimer. "We are pleased that the supply and license agreement with Injecto enables us to guarantee the long-term availability of this innovative syringe configuration for our customers."

WWW.GERRESHEIMER.COM

SUNRISE GLASS

A fired-up future

Sunrise Glass Industries' next-gen furnace is now live at its plant in Kosamba, Gujarat, India, unlocking a new era of efficiency, scale and sustainability. The new furnace has a production capacity of 225 tonnes per day of container glass.

WWW.SUNRISEGIPL.COM

GLINDCO

SNJ India Glasses ignites a 230 TPD glass container furnace

A turnkey consulting and project services company for the glass industry, **GLINDCO** announced recently that the SNJ India Glasses, a division of SNJ Distillers, located near Gummidipoondi, Chennai, India, ignited its 230-tonnes-per-day glass container furnace on April 4, 2025.

GLINDCO has executed the greenfield glass project with a total responsibility from initial planning stage to commissioning of the plant through a turnkey EPCM contract.

The plant, set up with state of the art equipment from batch plant to end of the packing line, will be producing glass containers in flint, green and amber colours.

WWW.GLINDCO.COM

BEATSON CLARK

New Business Development team

Glass packaging manufacturer **Beatson Clark** recently strengthened its sales team with the appointment of two experienced Business Development Managers.

Kimberley Wilkinson is now looking after the north of the UK for Beatson Clark while Andy Terry is responsible for the south of England and Wales. Between them, the two are working closely with the in-house marketing team and UK Sales Manager Aaron Broadley to expand Beatson Clark's customer portfolio.

Kimberley Wilkinson has worked in the packaging industry for eight years across a range of markets including cosmetics, health and beauty, home fragrance and pharmaceuticals. She has primarily worked for packaging sourcing and distribution companies on sales and NPD projects, across a range of materials and decoration finishes.

"It's a wonderful opportunity to join Beatson Clark," Kimberley said. "Working for a UK-based manufacturer is an exciting step for me. The company has a fantastic reputation in the industry and with the recent investment into our new on-site decoration plant it's a great time to have joined the team. I've been given a very warm welcome and great induction training, all good for personal development and in preparation for flying the flag and being out and about meeting customers face to face which I really enjoy."

Andy Terry worked across several different industries before moving into packaging and labelling in 2016. He began his career in the industry working as business development manager for the UK beer, wine, spirit and pharmaceutical sectors.

"Working at Beatson Clark has been brilliant so far and I absolutely love it," Andy said. "I've been made to feel like one of the family. The culture, development opportunities and direction of the company are very exciting.

"I'm very passionate about our new decorating plant; it gives us the chance to work with brands that might not be looking for a new glass supplier just yet but might have a need for glass decoration. It also opens new and exciting markets for us, such as cosmetics and home-ware."

Aaron Broadley is excited to further develop Beatson Clark's experienced sales team, saying, "We've now got a very strong sales and marketing team in place and our Business Development Managers are already bringing in some fantastic sales opportunities."

WWW.BEATSONCLARK.CO.UK

ZIPPE

Successful Factory Acceptance Test completed

Zippe has recently announced the successful completion of the Factory Acceptance Test (FAT) for its latest project.

This comprehensive process included:

- Control cabinet inspection
- Verification of safety zones
- Joint discussions on the HAZOP process and safety topics
- Automation technology and visualization

Throughout this project, Zippe had the opportunity to dive into Australian standards, especially by comparing its CE certification procedures with the Australian workplace safety requirements and related documentation. By complying with IEC/AS NZS 61439 -and specifically implementing the annex describing Form of Segregation 2Bi- Zippe has achieved:

- Improved protection of the Motor Control Centre (MCC) against accidental contact
- Enhanced safety measures to reduce the risk of arc flash incidents

Zippe has also ensured full compliance with local engineering regulations through careful preparation and by obtaining RPEQ (Registered Professional Engineer of Queensland) certification.

WWW.ZIPPE.DE

VIDRALA

New furnace inaugurated at Llodio plant

Vidrala welcomed the Lehendakari of the Basque Government, Imanol Pradales, the Deputy Regional Ministers for Energy Transition, Iranzu Allende, and Industrial Promotion, Andoitz Korta, to its corporate headquarters in Llodio, Spain, where they toured the new production facilities at the Llodio plant.

The Chairman of Vidrala, Carlos Delclaux, and the CEO of the Group, Raúl Gómez, explained to the institutional delegation that the new Aiala Vidrio furnace is synonymous with the future both for the Company and for the province of Álava, where the glassworks was founded 60 years ago.

Led by Víctor Tolosa, Director of the Vidrala Europe business division, the visit to the facilities focused on the technological advances that the Company is implementing in key areas such as energy efficiency, decarbonisation, process digitalisation and equipment safety. The tour culminated with the iconic commissioning of the new Aiala Vidrio furnace, a key infrastructure in Vidrala's industrial strategy and an investment that reinforces the Group's commitment to its Llodio plant and to the economic development of the region. The new furnace, equipped with state-of-the-art technology, will improve the energy efficiency of the process, reduce emissions and increase production capacity, guaranteeing the plant's competitiveness in the long term.

After visiting the new facilities, the Lehendakari Imanol Pradales said, "We must encourage and support the decarbonisation of energy-intensive industrial sectors, which are vulnerable to fluctuations in the price of fossil fuels. The Basque institutions as a whole are doing this: improving the tax incentive package for companies that invest in energy transition, allocating direct and specific aid, and promoting driving projects such as the Basque Hydrogen Corridor, one of whose actions will consist precisely of building a 70-kilometre hydroduct between the Port of Bilbao and Aiaraldea in order to transport green hydrogen for the industrial fabric of this region."

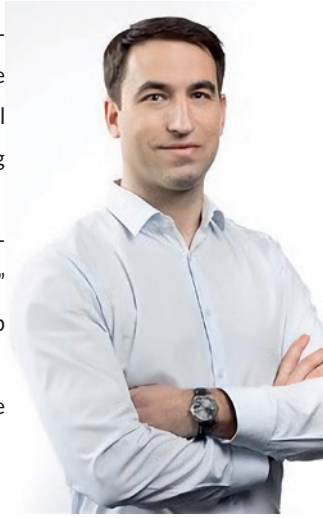
The institutional visit reaffirms Vidrala's role as one of the major industrial benchmarks in the Basque Country, with a constant commitment to innovation, territorial roots and long-term sustainability.

WWW.VIDRALA.COM

SEFPRO

Antoine Peyrude appointed as new Chief Executive Officer

SEFPRO and Glass Service group, both global leaders in refractory and digital solutions for the glass industry, recently announced the appointment of Antoine Peyrude as Chief Executive Officer, effective as of April 14, 2025. With extensive experience in glass manufacturing and a strong track record in driving innovation and sustainable growth, Antoine Peyrude will lead SEFPRO into its next phase of development, building on the company's heritage of excellence and commitment to serving the evolving needs of the glass industry worldwide.



Antoine Peyrude said, "I am honoured to join SEFPRO and look forward to working with our talented teams to continue delivering cutting-edge solutions to our customers around the globe, to help them decarbonize and digitalize the glass industry."

Antoine Peyrude succeeds Laurent Cohen-Scali. The entire SEFPRO team thanks Laurent Cohen-Scali for their leadership and contributions.

This leadership transition marks a new chapter for SEFPRO as it continues to innovate and partner with customers to shape the future of glass manufacturing.

WWW.SEFPRO.COM

VETROPACK

Progress of dismantling at St-Prex

With the dismantling of the production facilities at St-Prex continuing, **Vetropack** will soon be relocating most of the machinery to other sites. One year after the decision was made to close the Vetropack plant in St-Prex, dismantling of the production facilities is now nearing completion. On May 14, 2024, the Vetropack Group announced the closure of the site, and production ceased the following month. In the meantime, the remaining machinery on site has been sold to an Indian company. Back in February, two machines had already been shipped to Italy for refurbishment, where they will continue to be used within the Group.

Since the announcement of the closure -an especially painful decision for the employees in St-Prex and a historic step for Vetropack as the company's last Swiss production site- a lot has changed on site. Now, in spring 2025, Vetropack still has around 45 employees at the site, but a year earlier, there were around 180. The cullet processing operation is still active, but the production facilities have largely been dismantled.

All machines from St-Prex are now entering a new phase of operation. "We have sold our last production machines, together with the cold-end technology, to a company in India," said site manager Christian Schmutz.

Meanwhile, Vetropack has already started repair work on the ten-station AIS 211 machine and the twelve-station AIS 214 machine in Italy. The AIS 211 is expected to be installed at the Nemšová site as early as next year, while the AIS 214 will likely be commissioned in Kremsmünster.

Other equipment is also being repurposed: a MSK shrink film wrapping machine will be delivered to the Vetropack plant in Pöchlarn in June, and a MSK palletizing system will be shipped to a company in Egypt in the same month.

"We were able to reuse all of the IS control systems within the group. Laboratory measuring devices and spare parts have also been distributed to various Vetropack locations. We are very pleased that we have been able to achieve this," Schmutz added.

Even a year later, the end of 113 years of production in St-Prex still resonates with those affected. Vetropack remains fully committed to completing the dismantling process safely and providing the best possible support to its employees during this transition phase.

WWW.VETROPACK.COM

FEVE & ARDAGH GROUP

Visit to Dongen plant in the Netherlands

Behind every glass bottle lies a story of dedication, and deep connection to nature as old as human nature. The European Container Glass Federation **(FEVE)** team, during a visit to **Ardagh Group**'s Dongen plant in the Netherlands, was reminded that what may appear to be a simple object -a glass bottle- is in fact the unique alchemy of sand, recycled glass and other ingredients abundant in nature, high-level engineering, craftsmanship and continuous innovation.

Indeed glass is more than packaging, given that it protects, preserves and elevates the products valued by all. FEVE thanked the entire team at Ardagh Group for the warm welcome and the open, insightful discussion on the daily challenges of glass manufacturing - as well as the passion it takes to meet them.

WWW.ARDAGHGROUP.COM - WWW.FEVE.ORG

VETROPACK & SORG

Furnace awarded CE marking under European Machinery Directive

Following the successful completion of the modernisation of the flint glass furnace in early 2025, **Vetropack Straža**, in Hum na Sutli, Croatia, recently reached another important milestone with its furnace being officially certified in accordance with the European Machinery Directive (2006/42/EC). This is the first time within the Vetropack Group that a furnace has been certified as a technological unit and not just its individual components.

Previously, CE certificates were only issued for specific elements of the glass furnace meaning that there was no formal guarantee that the complete installation met EU safety and technical requirements as an integrated unit.

The final certification inspection in April 2025 confirmed that the furnace meets all relevant safety and technical standards The Machinery Directive covers not only aspects such as structural stability and energy efficiency but also governs the technological processes within the furnace itself. This includes combustion management, raw material melting, and emissions control – all with the aim of ensuring safe operation throughout the entire lifecycle of the equipment. The Directive also sets clear requirements for accessibility, maintenance, and emergency procedures. In the case of the furnace at Vetropack Straža, this meant that every detail – from heat control to evacuation routes – was reviewed to ensure the highest level of safety and compliance.

The certification company TeLo was involved in the project from the outset, working closely with the furnace supplier **SORG** to ensure that every stage of the design and construction process met the stringent requirements of the Directive.

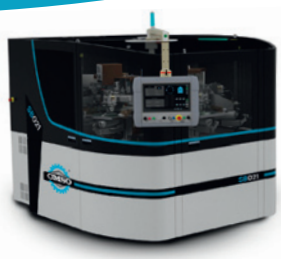
As a result, the final certification audit in April 2025 confirmed that the furnace met all applicable safety and technical standards, culminating in achieving the CE mark. By investing in the certification process, Vetropack Straža has set a new benchmark for future furnace projects throughout the Vetropack Group, reinforcing its commitment to safety, quality and operational excellence.

“We are extremely proud of this achievement,” said Mario Berc, Technical Manager at Vetropack Straža. “Obtaining the CE marking represents the final confirmation of all the efforts invested in this project and symbolises the success of the entire team’s joint work

WWW.VETROPACK.COM - WWW.SORG.DE

DECORATION IN MOTION

SERVOBOTTLE



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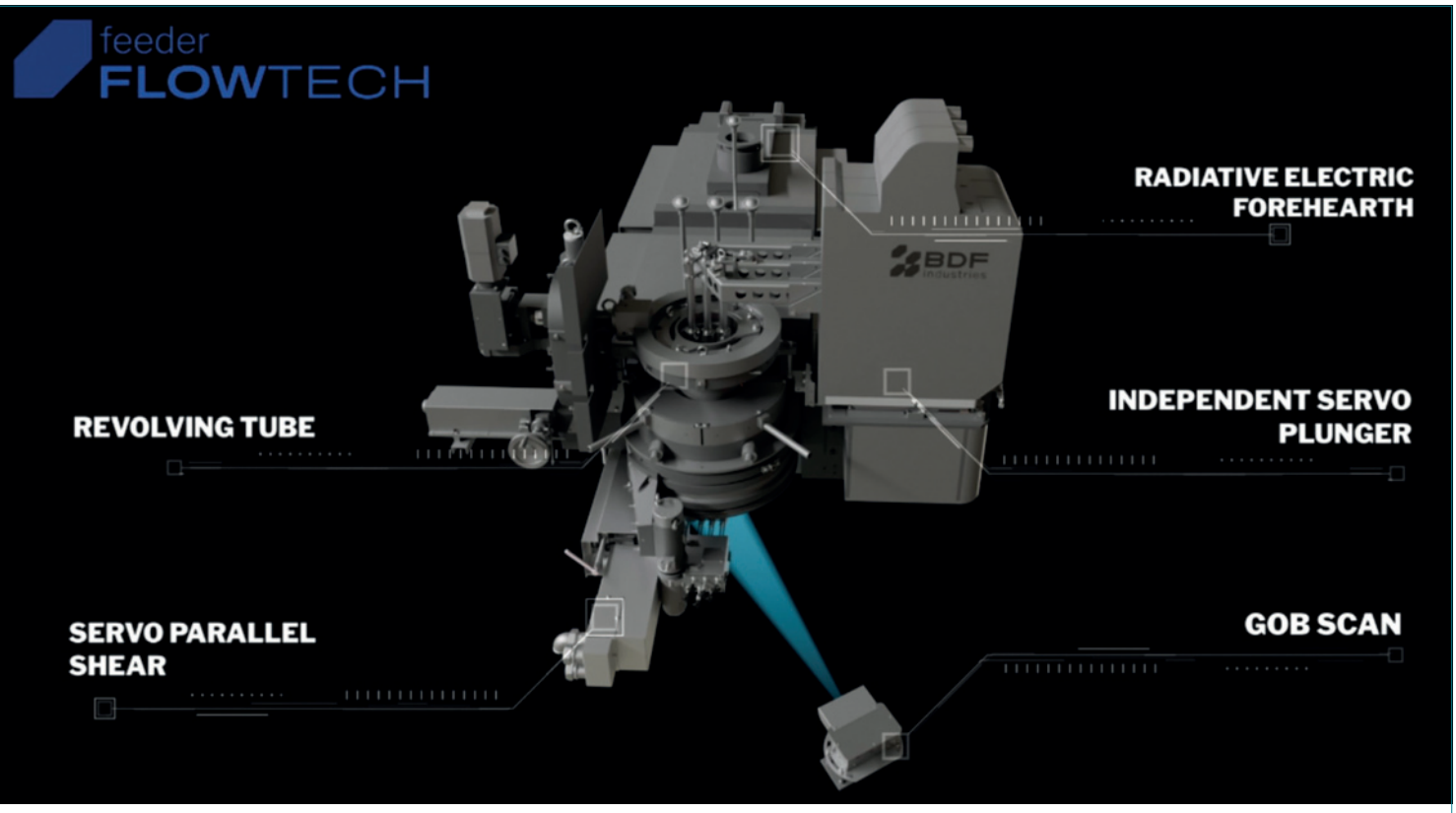
FLOWtech Integration sees BDF INDUSTRIES finetune data-driven processes

Headquartered in Vicenza, Italy, and with over a century of expertise, BDF INDUSTRIES is a global leader in glass machinery solutions. For higher quality products and an ever greater commitment to simplicity, safety and sustainability, the company is shaping the future of glass manufacturing through constant research and development for high-performance solutions that can meet modern industry demands.

Over recent years, BDF has remained focused on creating and making available to its customers products that are consistent with the company's fundamental principles and values. These include the basic safety of operators, the simplicity of interpreting process data and machine operation, attention to the environment and reduction of plant operation costs.

ROBUST CORE VALUES

BDF's philosophy of 3S, namely Simplicity, Safety and Sustainability, guides all company choices in the development of any technological, up-to-date product in the glass industry. Since 2001, the company has been a truly unique hot end process integrator, able to support design while supplying customers with furnaces and forehearths - all thanks to the strong skills of its melting division as well as IS machines for the production of hollow glass. This includes a range of solutions that today spans the whole of production. Within this framework, FLOWtech is a technological platform which aims to drive continuous improvement in the glass manufacturing process through cutting-edge technology. Indeed the glass production process is monitored through all phases, detecting any deviation from the optimal state. Such an innovative



approach and the great strength of the system ensures that no detected anomaly would simply correct the effect. It would also identify the root causes of the deviation and correct it automatically or notify the operator where to act with a clear feedback signal. It is therefore possible to intervene in the process at the earliest possible stage and correct the source of the defect - all with great benefits in terms of timeliness, quality of the result and overall process efficiency.

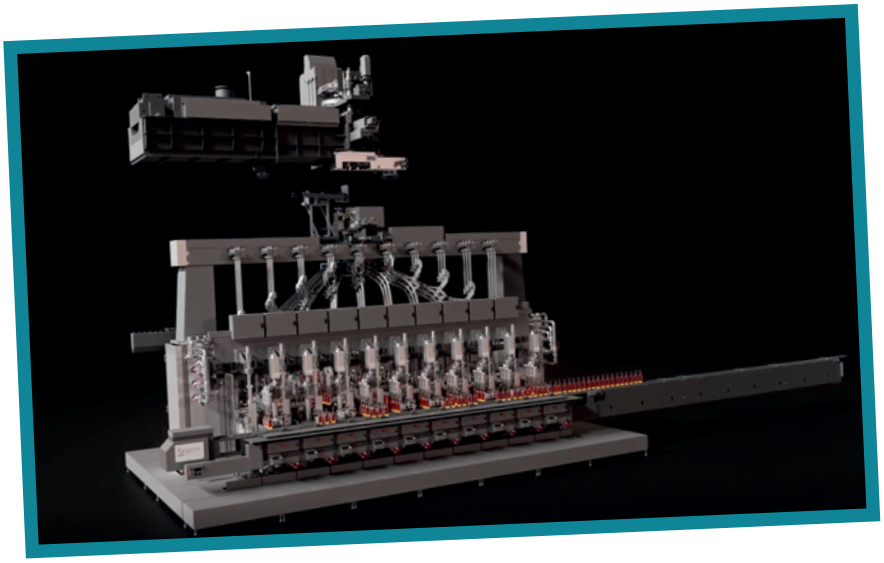
DATA TRACTION

A systematic and statistical approach in data analysis also allows the database of deviations with related causes and countermeasures to augment - ensuring a continuous refinement of the process but also increased precision and a thorough operator feedback.

The Feeder flowtech application is the Flowtech approach to the feeder area. Composed of five devices, these work as a single analysis and feedback system in which reference parameters are continuously acquired and managed by way of three specific control loops - until the perfect process configuration is reached and maintained. These control loops keep the production stable on the optimum state - not only acting upon feeder parameters. They also start from glass conditioning in the forehearth, intercepting those differences in the glass temperatures that are the root cause of many of the defects in the final ware; thereafter they can also fine-adjust shape, weight and falling angles that evaluate and adjust the feeder settings.

FEEDER FLOWTECH EQUIPMENT

- The Gob Scan consists of two vision systems positioned on a horizontal plane below the shear section;
- each includes a visible, thermal camera that reconstructs a 3D image of every gob - thus measuring and detecting a set



of relevant parameters, namely the gob shape and dimensions, weight, falling angle, temperature distribution, inclusions as well as cold and hot spots.

The acquired information is passed to a processing unit in which a proprietary software correlates the data and can act on the operating parameters of the other components of the System.

- The Radiative foreheart guarantees the homogeneity of the glass temperature in the conditioning zone and takes the glass to the plunger mechanism at the correct temperature;
- The revolving tube can regulate gob weight by means of tube height;
- The independent servo plunger creates each gob with real time independent dynamic parameters, determining the ideal shape and weight based on reference data for the process. It has an innovative modular design and is able to manage different electric cams for each section and cavity;
- The Servo Parallel Shear is an high speed shear mechanism that can regulate the length and the falling angle of the gob, by acting on start time, travel and duration of each cut and each gob.

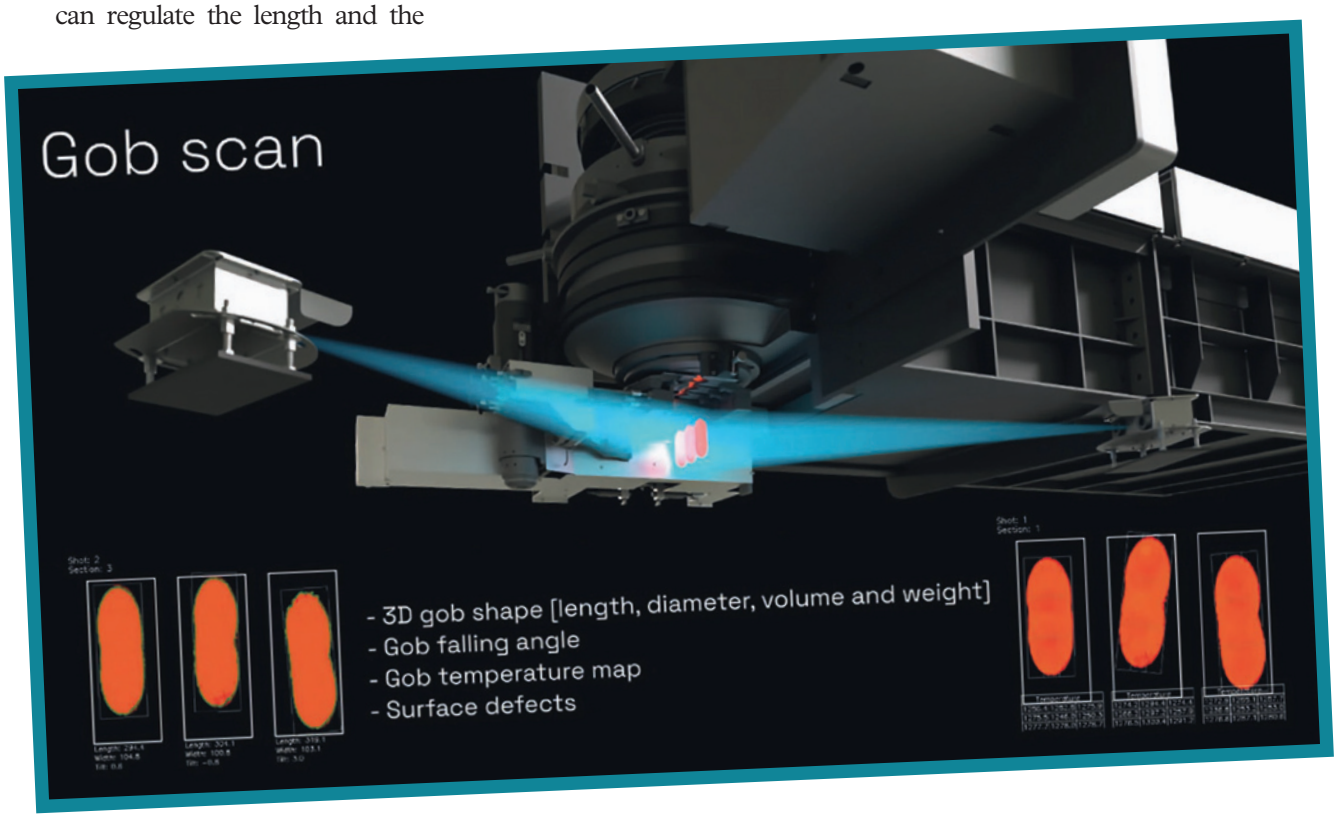
The three main control loops that contribute to process parameter optimization are as follows:

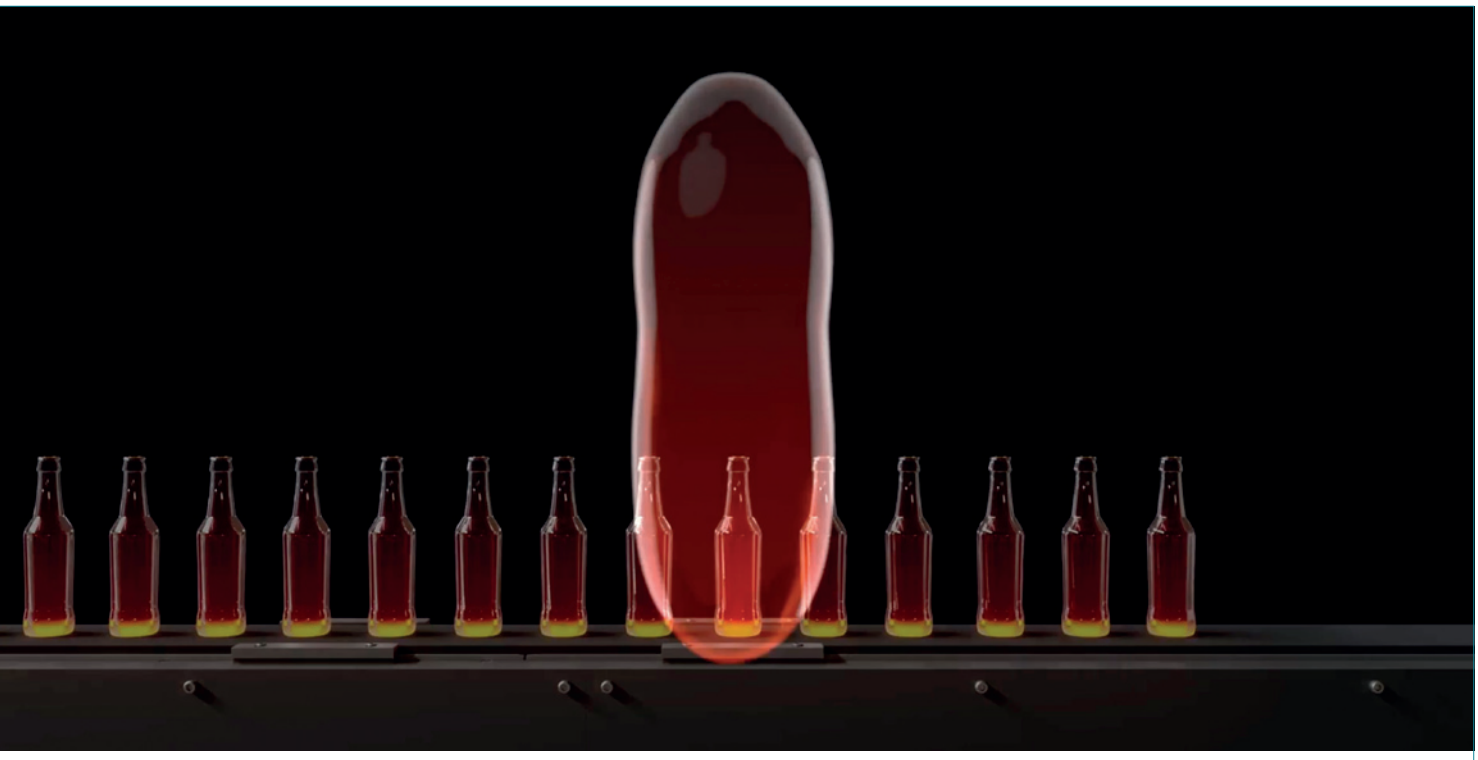
1. TEMPERATURE HOMOGENEITY LOOP WITH FOREHEARTHS

This loop ensures the temperature homogeneity on the gobs remains as close as possible to 100 percent. For each cut, a thermal map of the gob temperature distribution is calculated. The Gob Scan system continuously acquires this thermal map from the forehearths control. These maps are compared and combined to provide the forehearths control system with the actual temperature homogeneity map, which is then used as the input for the conditioning loop. The algorithm used for map combination is patented by BDF. The company's forehearth control system employs the Advanced Control System (ACS) to translate the thermal map into appropriate settings for the glass conditioning loops across each forehearth zone.

2. WEIGHT LOOP WITH SERVO PLUNGER AND TUBE LIFTING

This loop maintains consistent weight for each section and cavity, enabling automatic variable weight setup. The weight of each gob on every cavity and section is calculated. If any deviation from the target weight is detected, adjustments are made to the servo plunger settings. The tube's height is adjusted to control the average gob weight, while the height and stroke of individual cavities are fine-tuned if specific gobs do not meet weight specifications. In variable weight production, the system can automatically configure the feeder setup based solely on target weights. This functionality is made possible by a BDF-patented feeder configuration calculation algorithm, which includes automatic calculation of feeder characteristic parameters and the height and stroke values for each section and cavity. In the event of abnormal behaviour, alarms and notifications are displayed on the HMI.





3. LENGTH AND FALLING ANGLE LOOP WITH SERVO PARALLEL SHEARS

This loop keeps gob length and shape consistent while adjusting the falling angle. Users can define the desired gob shape based on a stable process and gob imagery. The shape and length of each gob on every cavity and section are calculated. If any deviation from the target values is detected, the affected section and cavity are highlighted. When such deviation persists beyond a programmable number of cycles, an alarm is triggered (also on the ADV system). The stroke of the specific cavity is then adjusted to bring the gob shape back to the desired target.

In alignment with 3S philosophy at BDF, the FLOWTECH Feeder already enables significant improvements to the production process.

a) Simplicity:

- Root-cause process optimization
- Optimized gob forming with reduced variation
- Enhanced automatic closed-loop feeder controls
- Simplified maintenance of the plunger mechanism

b) Safety:

- 60 percent reduction in human intervention on the feeder system

c) Sustainability:

- 100 percent decarbonization of forehearth heating
- 70 percent increase in thermodynamic efficiency
- Improved glass quality with reduced waste

LOOKING AHEAD: AI INTEGRATION

The journey doesn't stop here. BDF is already developing the next phase of FlowTech: the integration of Artificial Intelligence into the main steps of the hollow glass melting and forming process, which will further extend automation, optimize decision-making and elevate operational excellence throughout the glass production line. ■

ATIV Conference 2025: HEYE to unpack smart glassmaking in Parma

As the global glass community descends on Parma, Italy, for the 2025 ATIV Conference on June 12–13 -an event renowned for bridging glass science, art and technology- HEYE is set to leave a lasting impression as always, this time with two cutting-edge presentations that underscore its leadership in intelligent glass manufacturing solutions.

With decades of experience in glass container production, Heye International continues to push technological boundaries. At this year's ATIV Conference in Parma, the company will be presenting its pioneering advancements from both ends of the production line, the Hot End and Cold End - emphasizing energy efficiency, quality control and automation.

HARNESSING INDUSTRY 4.0: THE HEYE SMART PLANT

In a presentation titled 'Heye Smart Plant to Increase Efficiency and Energy Saving,' company Sales Manager for Hot End Solutions Anastasiia Bratash will be presenting the Heye Smart Plant as a forward-thinking solution that brings Industry 4.0 to life in the container glass sector. This concept is built to meet the modern demands of efficiency, safety and profitability - with a core focus on minimizing environmental impact. At the heart of the Smart Plant approach is a seamless integration of data, control systems and intelligent process automation.

Here Smart Data enables the real-time collection and analysis of both production and quality parameters, providing plant operators with actionable insights that support proactive decision-making. Smart Machine Controls introduce advanced user interfaces and servo technologies like E-Timing, which together ensure precision in the forming process and enhance system responsiveness. Smart

Process Intelligence then builds on this foundation with closed-loop control mechanisms that automatically adjust forming parameters, supporting the production of high-quality lightweight containers while optimizing resource usage. Indeed Bratash's presentation will demonstrate how the Heye Smart Plant not only elevates performance on the factory floor but also aligns with broader industry goals around sustainability and cost efficiency - a compelling look at how digital transformation can create meaningful, measurable value in glass manufacturing.

PRECISION INSPECTION AT THE COLD END

Delving into Heye International's latest Cold End technologies, company Sales Manager for Cold End Solutions Oriol Gil will then be speaking of the new levels of precision and adaptability to quality control in glass production in a presentation titled 'Check Detection and Wall Thickness Measurement in Container Glass Production'. Central to this innovation is the Ranger 2 inspection system, a high-performance platform featuring Intelligent Cloud Masking (ICM). Unlike traditional systems, which rely on fixed parameters or manual calibration, Ranger 2 automatically adjusts to each unique container. ICM dynamically creates reflection zones tailored to the specific shape and characteristics of every bottle or jar, enhancing detection accuracy and eliminating the inefficiencies of manual "teaching." Complementing the Ranger 2 is Heye's advanced wall thickness control system. This solution employs contactless chromatic confocal sensors to measure container walls with micron-level precision. The ability to inspect lightweight containers without physical contact ensures both high accuracy and minimal risk of damage. Beyond quality assurance, this system supports sustainability by enabling producers to use less raw material while maintaining structural integrity. The result is a significant reduction in energy consumption and CO_2 emissions - a key metric in today's environmentally conscious marketplace. Gil's insights will showcase how Heye's Cold End solutions combine innovation with practical benefits - helping manufacturers meet rising quality expectations and environmental standards without compromising on performance.

A HOLISTIC VISION FOR SUSTAINABLE GLASS PRODUCTION

Heye International's presence at the ATIV Conference exemplifies its commitment to practical, future-ready innovations that serve the evolving needs of the container glass industry. By focusing on intelligent automation, energy savings, and superior quality control, Heye offers glassmakers tangible tools to meet production challenges head-on. The company's dual presentations provide a rare look into how digital transformation is reshaping the entire container glass value chain—from forming to final inspection. As the ATIV Conference continues to foster collaboration and creativity, Heye International stands out as a beacon of technological excellence and sustainable progress in glassmaking. ■

ABOUT HEYE INTERNATIONAL

Based at Obernkirchen, Germany, Heye International GmbH is one of the container glass industry's foremost suppliers of production and inspection technology, high performance equipment and production expertise. Its mechanical engineering has set industry standards for more than six decades, significantly contributing to our customers' success. Heye's vision is to ensure highly cost-effective, sustainable and safe operation of glassworks worldwide and thus further strengthen the position of glass as the packaging material of the future. The company considers glass as the purest and most natural packaging on the planet. Here's why Heye's actions are driven by experience, courage and passion as it strives to make a positive impact on the environment and health while fostering a sustainable future. Today. Tomorrow. Together.

heye international

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From gathering to swabbing NOVAXION leads the transition

In 2006, just two years after its founding, Novaxion launched its groundbreaking high-performance Swabbing Robot. A sophisticated solution, it was engineered to apply a specially formulated swabbing spray to glass moulds - significantly enhancing production quality and consistency. Specializing in robotic technologies tailored for the glass industry, Novaxion went on to reach a pivotal milestone in 2019 when it became a full member of the Rondot Group - a strategic partnership that further bolstered its innovation and global reach. Now a pioneer in the field, today the company offers a distinctive and proven solution for the automatic swabbing of blank moulds and neck rings on IS (Individual Section) Machines. With more than 250 units installed across the globe, it continues to set the standard for performance and reliability in glass manufacturing automation.

SWABBING ROBOT SOLUTIONS

Novaxion offers two core configurations of its Swabbing Robot, each designed to meet the evolving needs of glass manufacturers while maintaining the company's trademark reliability and efficiency.

VALVE BLOCK (EPVB) MOUNTING ON ALL IS MACHINES- BLANK SIDE

The NX-VR-300 model features a next-generation rail mounting system, engineered for installation directly on the valve block of the IS machine's blank side. This design offers:

- Exceptional rigidity to withstand the demands of high-speed, on-the-fly swabbing;
- Compatibility with both single and tandem IS machines.

This robust mounting system ensures stable operation even under continuous, high-cycle production environments.

SUSPENDED SWABBING ROBOT ON ALL IS MACHINES- BLANK SIDE

The NX-SR-300 introduces a suspended (hanging) variant of Novaxion's leading swabbing robot, delivering flexibility and strength in one solution. This configuration is designed to seamlessly integrate with the overhead panel and structural layout of the IS machine. Key features include:

- High rigidity to support high-speed swabbing operations
- Compatibility with both new IS machines and upgrades to existing installations;
- One unit can effectively serve either single or tandem machines.

At Novaxion, customization is paramount - each installation is tailored to meet the specific needs of the customer.

Beginning its journey back in 2004, NOVAXION entered the glass manufacturing sector with a focus upon automation. With its gathering robots specifically designed for handcraft and semi-automatic glassware production, the company soon laid the groundwork for its future in technological advancement and automation excellence.

SUSPENDED SWABBING ROBOT ON ALL IS MACHINES – BLOW SIDE

The NX-BR-300 extends Novaxion's suspended swabbing technology to the blow side of IS machines. It mirrors the mechanical strength and integration flexibility of its blank side counterpart, with enhancements focused on efficiency:

- High rigidity for reliable, high-speed swabbing;
- Compatibility with both new machines and retrofitted systems;
- A smart spray nozzle that performs non-contact swabbing, reducing lubricant usage and preserving mould life.

This advanced nozzle technology ensures consistent swabbing performance while minimizing wear and operational costs.

SWABBING FEATURES

Novaxion's swabbing systems are engineered for precision and minimal disruption. They automatically swab both moulds and neck rings, executing the process on-the-fly within a single section cycle - without generating rejects. The proprietary smart spray nozzle enables closed mould swabbing with no direct contact, significantly reducing lubricant consumption and extending mould longevity. This efficient and clean approach translates to improved production uptime and lower operational costs.

GATHERING ROBOT

Novaxion Gathering Robots are recognized as global leaders in the realm of semi-automatic and high-end glass production. A newly-developed, user-friendly software interface enhances the gathering process by offering intuitive controls and advanced adjustment features. These improvements provide operators with greater flexibility and ensure consistently high product quality.

SERVICES

Novaxion supports its customers with a full suite of after-sales services:

- Robots are equipped for remote diagnosis and technical support;
- Training is available both on-site at customer facilities and at Novaxion's dedicated training centre;
- Maintenance contracts and follow-up training programmes ensure long-term performance;
- 24/7 support guarantees continuous production assistance;
- Lubricant formulations can be tested and approved at Novaxion to ensure compatibility with robotic systems.

From installation to ongoing support, Novaxion remains committed to empowering glass manufacturers with both cutting-edge automation and expert service. ■

NOVAXION
we swab smart™

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Modular, compact, smart: TECNOSENS' quality control solution

Having evolved from a simple final check into a lever for optimizing the entire production process, quality control plays an increasingly strategic role in today's industrial context. The same applies to such traditionally 'conservative' sectors as hollow glass, where TECNOSENS' automation is reshaping both standards and methodologies.

A MEASUREMENT REVOLUTION IN THE GLASS INDUSTRY

The industrial glass sector -particularly glass containers- has always relied on experienced operators to carry out such essential quality checks as dimensional verification and defect detection. However, the growing need for precision, repeatability and traceability is driving the industry towards automated solutions. Modern plants now integrate systems capable of acquiring multiple types of data and processing them in real time, ensuring rapid and reliable responses. This paradigm shift calls for tools that are not only high-performing but also modular, easy to integrate, and equipped with intuitive operator interfaces.

THE CONTRIBUTION BY TECNOSENS

Tecnosens, an Italian company with over thirty years of experience in electronics, automation and sensing technologies, fits perfectly into this context. Active in the import/export market since 1994, the company has built strong expertise in industrial measurement, leading to the development of specific solutions for quality control in glass. Among these, the *Oktilab* system is a synthesis of innovation and practicality: a highly compact and flexible multi-parameter measurement system designed to

meet growing demands for automation, accuracy and ease of use. The system can automatically inspect a wide range of characteristics in glass containers, including:

- Dimensional measurements
- Wall thickness
- Residual stress
- Weight
- Labelability
- Volume
- Colour

These inspections are performed without stopping the conveyor belt, ensuring continuous productivity. The software interface allows operators to set up customized 'recipes' for each product type, simplifying interaction and minimizing error margins.

MODULARITY AND TRACEABILITY: SYSTEM CORNERSTONES

One of the most distinctive features of Tecnosens' solution is its modular architecture. The system is designed to grow with the production plant: additional measurement modules or auxiliary functions can be integrated as needed, allowing for flexible configuration. Another key strength is complete traceability of each sample, achieved through automatic mold number reading and integration with LIMS (Laboratory Information Management Systems), increasingly common in industrial environments. The result is a system that not only performs measurements but also collects, organizes, and presents data in a functional way - transforming quality control into a strategic production management tool.

OPERATOR CENTRALITY AND THE IMPORTANCE OF TRAINING

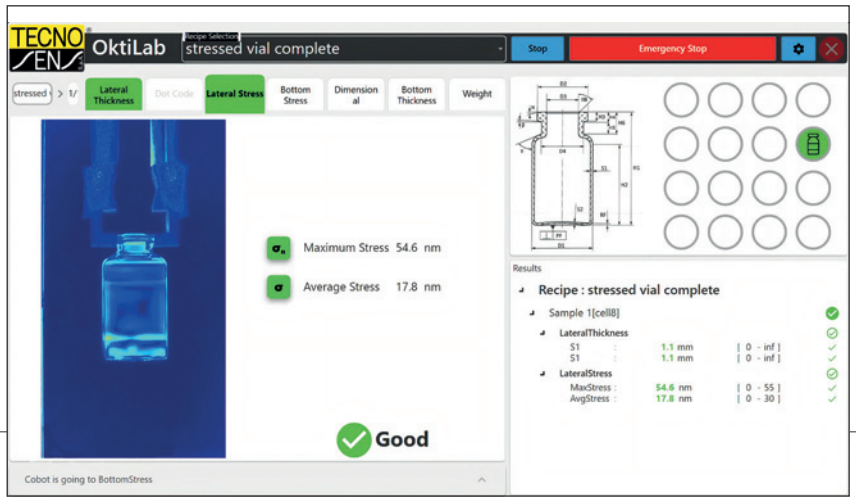
Despite the high level of automation achieved, Tecnosens emphasizes the ongoing importance of the human operator. Robotics does not replace human intelligence - it enhances it. The goal is to empower the operator by relieving them of repetitive, low-value tasks and equipping them with intuitive tools for process monitoring and intervention. The interface has been designed with this in mind: to provide full control without requiring advanced programming skills. In this context, training becomes essential: to supervise automated processes, operators must evolve into informed supervisors capable of understanding and optimizing human-machine interaction.

SMART AUTOMATION AND THE IMPACT OF NEW TECHNOLOGIES

The increasing use of collaborative robots and artificial intelligence in industrial measurement is opening new opportunities in the glass sector as well. Robots can autonomously handle sample collection, rejection and positioning - improving process continuity and reducing human error. AI, for its part, can assist with data analysis and automatic defect recognition, making the system capable of learning and adapting to production changes. Tecnosens welcomes this evolution while maintaining a pragmatic approach: the goal is not to replace humans but to foster the synergy between human expertise and machine efficiency.

IN SUM

Tecnosens' approach to quality control in hollow glass is a virtuous example of a new generation of measurement systems: modular, compact, intelligent and user-friendly. Automation is not an end in itself, but a means to make production more efficient, traceable and customizable. In a sector where quality is critical, solutions like *Oktilab* prove that measurement is no longer just a checkpoint. It is also an active component of the production process that's capable of generating both value and innovation. ■



Vacuum System expansion to KIOO GLASS by PNEUMOFORE

A global leader in Rotary Vane vacuum pumps and compressed air technology, Pneumofore has expanded its vacuum system installation at Kioo, one of the largest container glass manufacturers in East Africa. The milestone follows nearly a decade of successful operation and strong customer satisfaction with Pneumofore's energy-efficient vacuum solutions for the glass industry.

TEAMING UP FOR GROWTH

The partnership began in 2016 with the installation of Pneumofore UV16 Rotary Vane vacuum pumps to support the moulding process of IS machines. Since then, the customer has relied on the proven reliability and efficiency of Pneumofore technology. Kioo Glass progressively expanded its system with additional UV16 vacuum units in 2017, 2018 and 2020 - bringing the total to five vacuum pumps operating continuously with high performance and minimal downtime. At Glasstec 2024, Kioo Glass engineers visited the Pneumofore booth to share their positive feedback and confirm their new plans for plant expansion. Based on their experience of the proven reliability and efficiency of Pneumofore's technology, Kioo Glass finalized an order for six additional UV16 pumps - thereby boosting the total vacuum capacity to over 10,000 m³/h at their Dar es Salaam facility.

MAXIMIZED ENERGY EFFICIENCY

Located on the East African coast, Tanzania is a country with high ambient temperatures frequently exceeding 30°C. This climate poses specific operational challenges. Kioo Glass required equipment capable of withstanding hot climate conditions. To

Expanding its proven vacuum system at KIOO GLASS, Tanzania's leading container glass manufacturer, PNEUMOFORE is now building upon nearly a decade of successful operations with a new installation that boosts capacity and efficiency with advanced UV16 Rotary Vane pumps tailored for tropical climates - ensuring energy-conscious performance.

meet these demands, Pneumofore will deliver the new units in the HC (Hot Climate) air-cooled configuration, ideal for tropical environments. All vacuum pumps will also feature Variable Speed (VS) drives for optimized energy efficiency and adaptability to the dynamic demands of container glass production. Kioo Glass operates its vacuum system independently, thanks to hands-on training provided by Pneumofore during initial commissioning of the first installed vacuum pumps. The total OEM-independence, low maintenance needs and robust design of the UV16 Rotary Vane vacuum pumps were key factors in choosing Pneumofore technology again to expand the installation.

GROWTH CHARACTERISED BY ENVIRONMENTAL STEWARDSHIP

Known for their low rotation speed, active sealing system and low operating temperature, the UV series vacuum pumps offer unmatched energy efficiency and reliability over decades. When serviced regularly with genuine Pneumofore spare parts, these vacuum systems are covered by a ten-year energy efficiency warranty, demonstrating long-term performance. This latest expansion reinforces Pneumofore's dedication to sustainable, long-term performance vacuum solutions in demanding industrial environments. By supporting customers like Kioo Glass with reliable and energy-efficient equipment, Pneumofore contributes to lowering CO_2 emissions, reducing operating costs and offering the lowest Life Cycle Cost for industrial vacuum systems. ■

kioo GLASS

ABOUT PNEUMOFORE

Founded in 1923, Pneumofore manufactures vacuum pumps and compressors for industrial applications worldwide. The company's compressors and vacuum pumps are found worldwide - whenever customers require extraordinary reliability and constant performance over time. A leader in the Rotary Vane technology, Pneumofore solutions focus on efficiency, durability, minimal Life Cycle Cost and high environmental respect.

Pneumofore

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Actionable data: XPAR VISION CEO on future-proofing container glass forming

A trio of major challenges confronts today's glass industry. Firstly, more container glass users and manufacturers are committed to a drastic reduction of CO_2 emissions. Secondly, container glass manufacturers need to increase their competitiveness with other packaging materials. And thirdly, glass manufacturers are seeing experienced people retiring and are having difficulties hiring and retaining new staff in their factories. In answer to the first challenge a few advances can be observed. Obviously, there is a movement towards the use of alternative energy sources for heating up furnaces. Besides that, there is more recycling of glass containers and more returnable containers instead of non-returnable containers. Finally, there is a movement towards redesigning containers with the aim of reducing weight. Lighter and returnable containers are a widely accepted answer to the first and second challenge. The third challenge though is not yet properly addressed. In my opinion, a stronger focus on the forming process is the answer to all challenges but remains underexposed. Briefly, these ideas come down to the following: the current container glass industry forming process performance has huge room for improvement. With a focus on forming process control and specifically by the use of actionable data, improvements can be realised, resulting in a potential gain of around 25 percent. This means producing better bottles, with less defects and less dependency on people, using

Unpacking how forming processes can be improved through actionable data, XPAR VISION CEO Paul Schreuders explains glass bottle production that has less defects while advancing decarbonisation goals and increasing competitiveness in the industry.

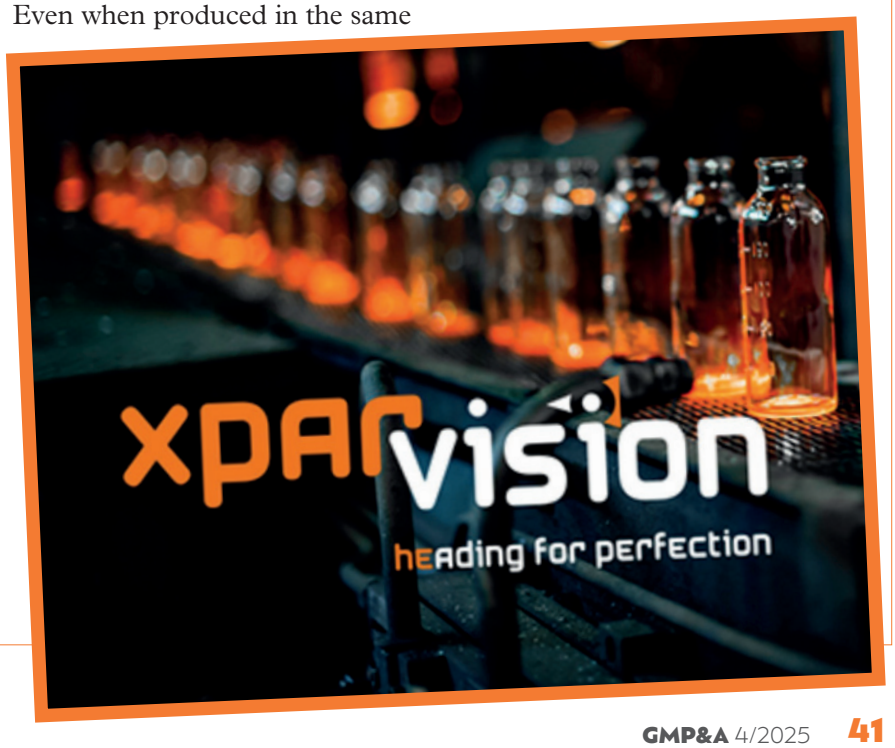
less raw materials and energy, and thus reducing CO_2 emissions, increasing competitiveness and results at the same time.

THE FORMING PROCESS

As we all know, container glass forming is a complex process. The complexity comes from the fact that there are many variables, which are constantly changing: raw materials, cullet, environmental temperature and humidity, glass condition and homogeneity and wear of metal machine parts as moulds and deflectors. As a result, its output is constantly changing. In this environment operators must ensure that the IS machine keeps producing. As such they swab the moulds and deflectors, change materials, align deflectors with troughs, change timings, etc. The better operators are trained for these tasks and the more experienced they are, the more the forming process stays within the natural working range and the more good bottles they produce. Of course, it also requires a disciplined shop floor, which is well organised around the tasks of the operators.

PERFORMANCE

Asking container glass manufacturers about their performance, the majority of them refers to pack-to-melt (or pack-to-pull, or pack-to-cut). The global container glass industry has a pack-to-melt of roughly 85 percent on average. This basically means that out of 100 percent melted, 15 percent are qualified as bad bottles. Most bad bottles have their root cause in the forming process, so it is obvious to conclude that the forming process performance is roughly 85 percent. There is no industry in the world that accepts these kinds of efficiency figures! Moreover, pack-to-melt is only a partial coverage of the forming process performance. The other part is called glass wall thickness variations or glass distribution variations. Those active in forming will admit that glass wall thickness variations are a representation of forming process variations, and the main root cause behind the bad containers produced. But even the good containers produced possess huge glass wall thickness variations, both horizontally as well as vertically, within a single bottle and between bottles produced. Even when produced in the same cavity. These glass wall thickness variations directly relate to the constantly changing forming process, in combination with the manual interventions made to ensure the IS machine keeps producing. These glass wall thickness variations are a so-called 'Hidden Factory', which has a potential for weight decrease, and eventually speed increase. The term Hidden Factory, outlined by organisation Six Sigma, is the hidden world of waste and flaws that slows down production and lowers the quality of goods. With infrared (IR) sensing technology containers are inspected and glass wall thickness variations are measured. Based on years of IR data collection, understanding of the forming process and the application of data science, it can be concluded that a possible reduction of glass wall thickness variations is estimated



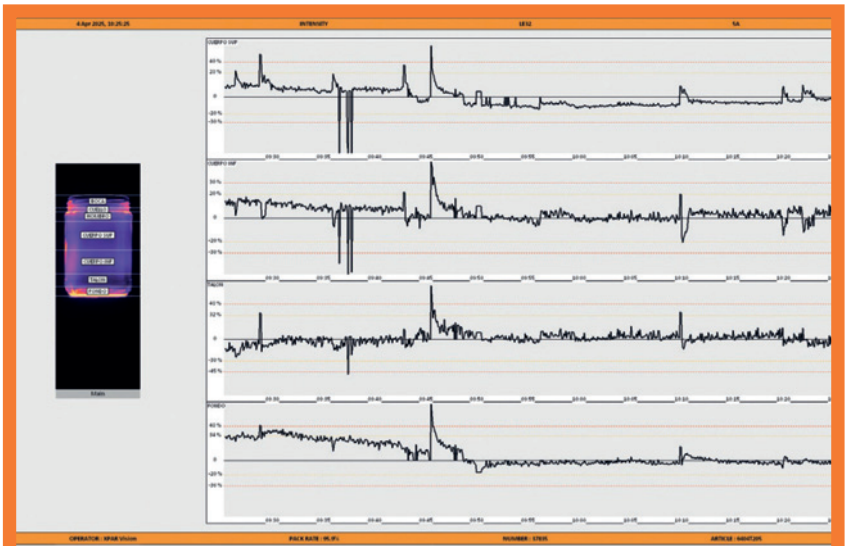
to be up to 30 percent. Knowing this, in combination with current pack-to-melts, it is safe to state that the current forming process performance has a potential for improvement of results and competitiveness and reduction of CO_2 emissions of around 25 percent.

CONTROL

Knowing the potential for doing better and knowing people's dependency when facing the challenges, as mentioned, a focus on forming process control is required. The aim should be to do more with less, forming more good bottles, with less energy/materials and less people dependency. Above all, it is a way to reduce costs and improve financial results, and it is a basic requirement for glass to become more competitive and sustainable. Only then, glass can be the preferred packaging material for foods and beverages. With IR sensing technology, the level of forming process control can be measured. The higher the level of forming process control, the lower the level of glass wall thickness variations and the higher the pack-to-melt. With IR sensing technology, the forming process performance, as well as any problem, change and/or improvement to this forming process, can be measured. So, in order to work towards the next level of forming process control, IR sensing technology is a must for any container glass manufacturing.

XPAR VISION

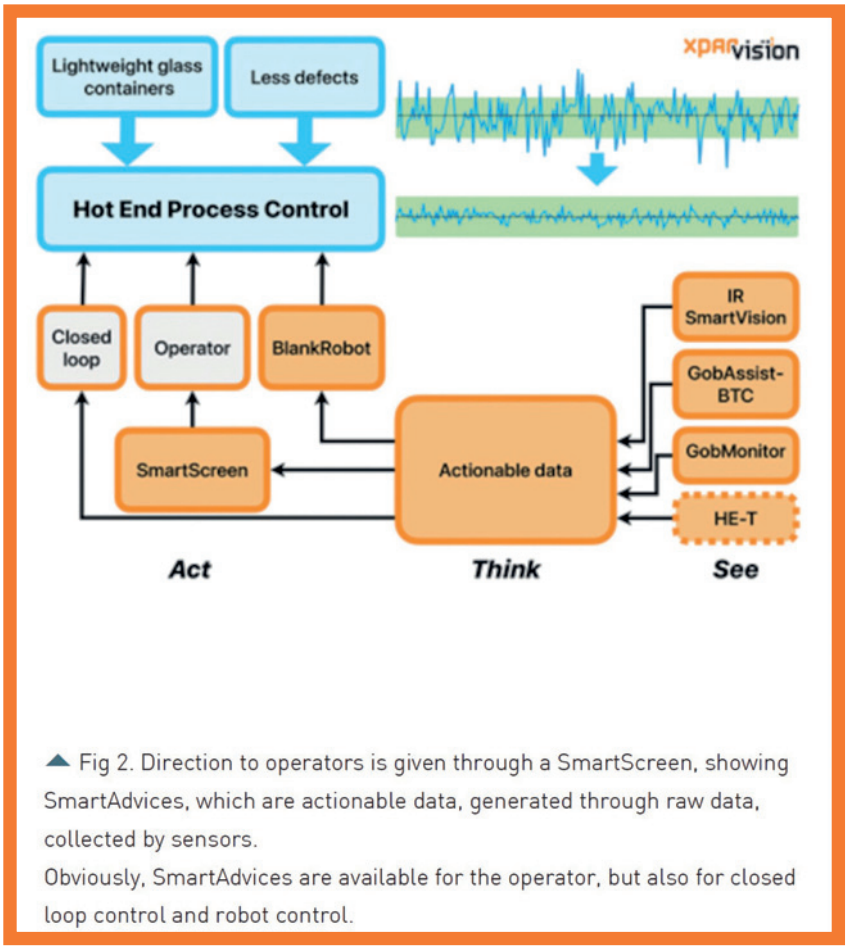
More than 25 years ago, Xpar Vision was the first supplier of IR sensor equipment for the container glass industry, meant for hot end process monitoring, and capable of inspecting and rejecting critical defects in the hot end. It started with a group of technologists with mostly beta backgrounds (physics, mathematics, computer science, and Artificial Intelligence), and later experienced glassmakers and data scientists also joined. After IR sensor equipment, other sensors and lately robot technology has also been developed. All for container glass and all for the hot end. With an install base of more than 650 globally, today the majority use the IR sensor equipment for inspection, and not for process monitoring, let alone for forming process control. This originates from the fact that the reading of forming process data collected by the IR sensor does require knowledge and experience of the tool, as well as of the forming process. For an average operator, forming process data collected by InfraRed sensors is difficult to read. Fig. 1 is the representation of infra-red intensity variation of four out of eight zones of a container, produced at one cavity during one hour of production. Besides intensity values, typical process data are asymmetry, verticality and diameter. These process data (up to 32 per individual container) are collected per container produced. Even if an operator can read the data, making combinations, applying statistics, overseeing various cavities at the same time, etc. is difficult and time consuming, even for a specialist.



▲ Fig 1. For an average operator, forming process data collected by Infra-Red sensor are difficult to read. E.g. picture is the representation of infra-red intensity variation of 4 out of 8 zones of a container, produced at one cavity during one hour of production. Besides infra-red intensity values, typical process data are asymmetry, verticality and diameter. These process data (up to 32 per individual container) are collected per container produced. Even if an operator can read the data, making combinations, applying statistics, overseeing various cavities at the same time, etc. is difficult and time consuming, even for a specialist.

ACTIONABLE DATA

Over the years, Xpar Vision has intensified its research and development activities drastically. More than 25 years of experience in hot end data collection, combined with understanding of data, understanding of the forming process, and lately also the application of data science, has led to a breakthrough: abstract data are now converted into action-



▲ Fig 2. Direction to operators is given through a SmartScreen, showing SmartAdvices, which are actionable data, generated through raw data, collected by sensors.
Obviously, SmartAdvices are available for the operator, but also for closed loop control and robot control.

able data. An important subset for actionable data is SmartAdvices: a system that gives advice for action to operators, based on a statistical trend recognition of combinations of process data, with the aim to stabilise the forming process once it starts to destabilise. Because the SmartAdvices are based upon process data, early intervention is possible, preventing defects from being produced. Consider it as a virtual consultant for even the least experienced operators to execute specific actions at the right time, even without training to use the tool and even without specific glass forming experience. Following SmartAdvices will lead to the production of more good containers with less energy/materials and less people dependency. The logic of SmartAdvices is visualised in Fig 2. The next level of forming process control can be achieved by using SmartAdvices. The result is less defects produced and less glass wall thickness variations, with the possibility to produce lighter glass containers, eventually at higher speed. Besides SmartAdvices, another subset of actionable data are metrics to measure and quantify the forming process variations in a certain period. As such, within a job priorities for action and/or improvement can be qualified. Also, the effect of actions can be monitored. And finally, with the same logic, production lines or specific jobs can be benchmarked.

IR SMARTVISION

SmartAdvices and SmartScreen are available in the new generation IR sensing technology, named IR SmartVision. Besides SmartAdvices and SmartScreen, the IR SmartVision includes:

- SmartDetection: a renewed algorithm to inspect containers, round, and non-round, with or without engravings and embossing, which is self-learning, and does not require example containers.
- SmartSettings: easy to set up (only two set points).
- SmartView: a possibility to use multiple cameras, through which 360° inspection and thus even more effectiveness is realised. A hardware redesign has resulted in a smaller footprint of the camera stands.
- SmartSensing: an extra sensitive filter ensures over and/or underexposed parts of the container to be corrected for, as such adding to the effectiveness of inspection.
- SmartCooling: a thermo-electric camera cooling system, lowering both installation (no piping for water) and operational costs (no compressed air), and bringing the robustness to a next level.

With IR SmartVision container glass manufacturers have the tool to create the next level of forming process control, producing containers with less defects and less glass wall thickness variations, allowing for weight reduction and eventually speed increase, being less dependent on people. As such, IR SmartVision is opening the door to realise the potential gains of around 25 percent, and a major step to reduce CO_2 emissions, bottom line results and competitiveness with other packaging materials, and a major step towards 'heading for perfection.'

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FURNACES

Sustainability breakthrough signalled by SORG hybrid furnace

Marking a major sustainability breakthrough for the glass industry, SORG's CLEAN Melter® hybrid furnace combines electric and combustion heating - also reducing carbon emissions while delivering high-performance flexibility. Backed by global installations, it indicates a transformative shift toward low-carbon glass production worldwide.

Sorg, a global leader in glass melting and conditioning, is working with leading international glass manufacturers on the next generation of sustainable melting technologies. Although glass is generally 100 percent recyclable, the energy required and emissions produced during melting remain a major sustainability challenge for the industry.

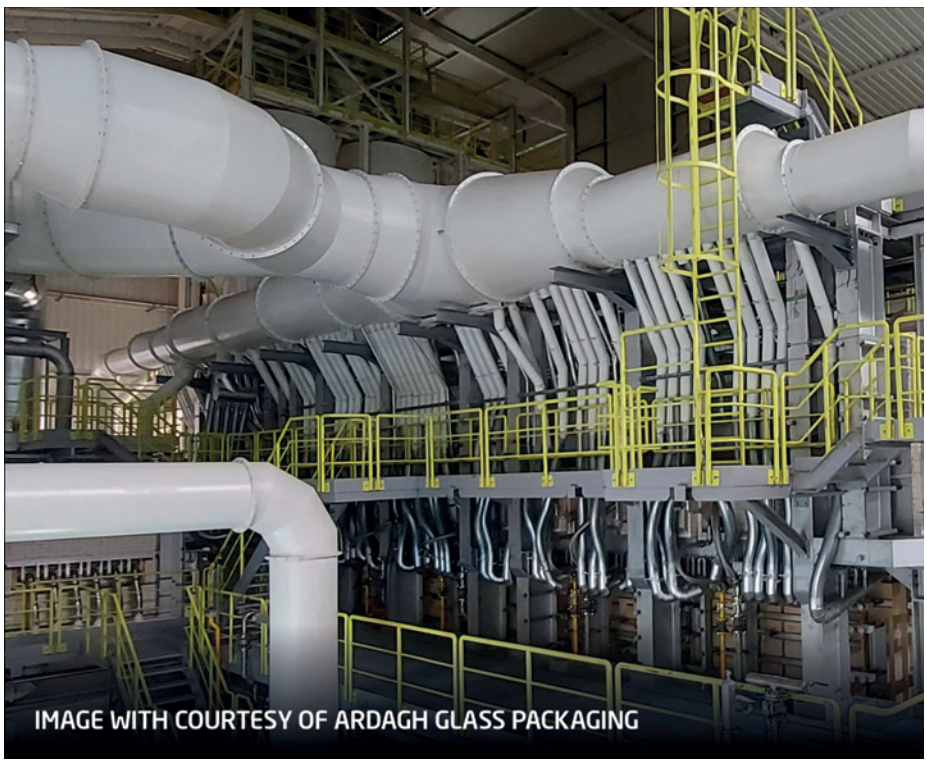

IMAGE WITH COURTESY OF ARDAGH GLASS PACKAGING

THE INITIAL NEED FOR EVOLUTION

All electric melters have been a proven technology for glass melting for many years. However, they have a certain number of limitations that restrict their use in a wide range of applications. These limitations include maximum pull, restricted glass chemistry and sensitivity to changes in raw materials and pro-

cesses. The logical conclusion was that a new technology was needed to expand the use of electric melting to a broader range of applications and to overcome its limitations. Sorg addressed this challenge by combining electric heating with fuel combustion in a hybrid furnace - marking a significant advancement in sustainable glass melting. Sorg Group's new CLEAN Melter® hybrid furnace allocates 20-80 percent of power to (renewable) electric energy, reducing carbon emissions compared to a non-hybrid/ nonelectric furnace.

A HYBRID SOLUTION

Meeting market demand for technology that offers future-proofed flexibility in the choice of energy source, this breakthrough furnace supports large applications and high pull rates. Like most pioneering technologies, this hybrid furnace has actually been built on decades of proven experience as well as established processes and components. Key characteristics of the CLEAN Melter® include a refining shelf to stabilise the melting process and secure the glass quality. A radiation wall keeps the energy of the superstructure heating in the melting area. The CLEAN Melter® also delivers high flexibility in raw materials and raw material changes with no negative impact on the quality of the glass produced.

ARDAGH GLOBAL LAUNCH

Launch customer Ardagh Glass Packaging, a Luxembourg-based global sustainable supplier, officially unveiled their hybrid furnace, branded 'NextGen Furnace' by the company, at Obernkirchen in Germany in November 2023. The Sorg Group supplied all the technology and managed the process from design and engineering to installation, with the construction completed over six months. After a successful operational launch, the furnace is now producing low-carbon amber glass bottles.

POWERING UP IN PARAGUAY

At the end of 2024, the Sorg Group celebrated commissioning the world's second CLEAN Melter® furnace, at Fabrica Paraguaya de Vidrios (FPV) in Paraguay. FPV is a highly respected manufacturer of glass packaging in the Mercosur region. Helping FPV meet the company's emissions and sustainability goals, the CLEAN Melter® is set up to achieve an electric share of up to 80 percent of the melting energy. Planned and supplied by Nikolaus Sorg, the furnace is designed for a melting capacity of 140tpd, melting flint, amber and green glass. The Sorg Group delivered technology including all furnace-specific equipment and Sorg 340S+® forehearths, with the furnace steel supplied and installed by Siam Furnace Construction (Thailand), an SKS company. Sorg Feuerungsbau und Service GmbH was responsible for the heating up and filling of the furnace.

FUTURE CLEAN MELTER® LAUNCHES PLANNED

Sorg Group is now continuing to design CLEAN Melter® hybrid furnaces for installation across the world, with new project and contract announcements expected soon. The company says many manufacturers are discussing the introduction of hybrid furnace technology as part of their sustainability strategies to reduce CO2 emissions. Internationally, numerous projects are at different stages of project implementation.

SUPPORTING A SUSTAINABLE FUTURE

The glass industry's journey to a low-carbon tomorrow continues. The CLEAN Melter® has moved smoothly from concept to proven technology. Minimising carbon emissions through the increased use of electricity has always made sense in the glass-melting industry. The Sorg Group is working with leading international glass manufacturers on the next generation of sustainable melting technologies, driving down emissions and helping glassmakers to produce net zero glass at volume within the near future. ■

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High capacity, low carbon: BDF goes fully electric

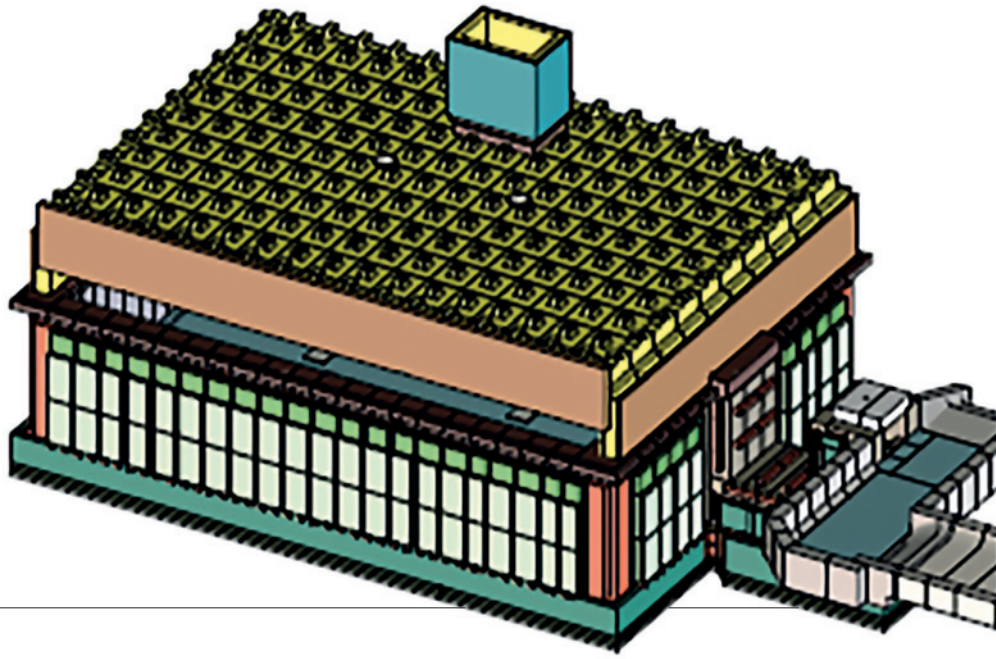
As the glass sector races towards decarbonization, BDF Industries unveils its modular, fully-electric furnace - capable of melting over 250 TPD. Merging efficiency, scalability and sustainability, this next-generation solution empowers manufacturers to meet rising demand whilst dramatically reducing both emissions and energy costs.

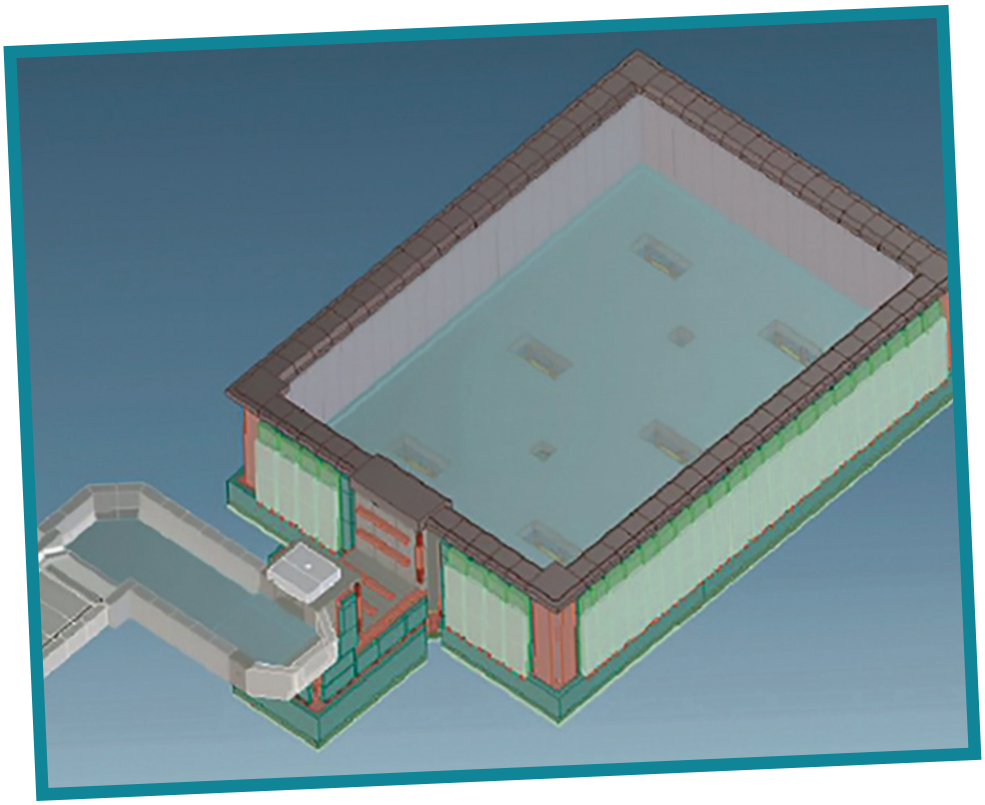
STORY OF FURNACES

Since the early 20th century, end-port (end-fire) furnaces have been the standard in container glass melting for small to medium pull rates. From the 1970s onwards, regenerative and oxy-fuel furnaces became widespread - offering higher efficiency and lower emissions. In recent years, the push for decarbonization has led to the development of hybrid and fully-electric furnaces - combining conventional combustion with electric boosting to meet high-pull demands sustainably.

SO WHY ELECTRIFY NOW?

Global container-glass demand continues to rise -up 2.6 percent CAGR through 2030- yet carbon budgets are shrinking. European Union Emissions Trading Scheme allowances already add a fee per ton of hot-end CO_2, and the next review is expected to tighten free allocations further. Gas prices remain volatile; electricity sourced from wind and solar has fallen below in price per MWh in several markets. These dynamics make an electric melter not only greener but, in many regions, cheaper over a ten-year horizon. Conventional oxy-fuel designs capture some of that benefit but still emit combustion CO_2 and require expensive oxygen generation. Full electrification eliminates both while simplifying flue-gas treatment and stack-monitoring compliance.





ELECTRIFYING GLASS MELTING: BDF'S MODULAR ALL-ELECTRIC FURNACE FOR >250 TPD

As the glass industry accelerates its path toward decarbonization, full electrification of melting furnaces is emerging as a game-changing solution. Yet, scaling electric technology to support high production capacities -beyond 250 tons per day (TPD)- remains a technical and strategic challenge. BDF Industries, drawing from over a century of experience and over seventy years in glass plant engineering, introduces its new fully-electric, modular melting furnace concept. This solution is designed to meet the dual demand of industrial-scale output and radical emissions reduction, making it a key asset for glass manufacturers aiming to align productivity with sustainability.

A LEGACY OF INNOVATION IN GLASS TECHNOLOGY

Since 1906, BDF Industries has been a technology leader in the hollow glass sector. As the first European company to manufacture IS machines, and with hundreds of melting plants commissioned globally, BDF has developed deep, vertically integrated expertise across Melting and Forming technologies. This new electric furnace reflects that heritage. Each project is tailored with precision engineering, combining robust process knowledge with field-proven components to ensure efficiency, reliability and high glass quality.

A MODULAR APPROACH TO HIGH-CAPACITY ELECTRIC MELTING

The BDF electric furnace is built around a modular architecture: the melting tank is divided into pre-engineered sections, on-site assembly, and long-term maintenance. This modularity enables flexible plant design, scalable production capacity and easier upgrades - making the system adaptable to future energy and production scenarios.

Key benefits:

- Scalable design: production capacity can be increased by adding modules, minimizing downtime and maximizing return on investment;
- Improved energy efficiency: each module features independent electrical circuits and high-performance thermal insulation, limiting heat loss;
- Faster deployment: standardized fabrication reduces engineering complexity and speeds up on-site installation.

SEAMLESS INTEGRATION WITH ELECTRIC FOREHEARTHS AND SMART CONTROL SYSTEMS

The electric melting furnace is designed to work in synergy with BDF's well-established electric forehearths, which use silicon carbide heaters to deliver precise, homogeneous glass temperatures. These systems are fully enclosed, minimizing air infiltration and energy loss during the glass' journey to the forming lines. To enhance performance and process transparency, BDF also offers its digital control platform Panorama 4.0™ - a real-time supervision system that integrates data from the furnace, forehearths, and forming lines into a unified dashboard. From energy monitoring to electrode power tracking, operators can make informed decisions faster, improving uptime and efficiency.

FULL-ELECTRIC MELTING: A KEY ENABLER FOR DECARBONIZATION

Replacing fossil fuels with electricity in the melting process eliminates direct emissions of CO_2, NO_x, and SO_x. Additionally, electric heating enables direct energy transfer to the glass bath via electrodes, achieving thermal efficiencies above 85 percent—significantly higher than conventional gas furnaces, which typically operate around 45-60 percent. Recent analyses show that fully elec-

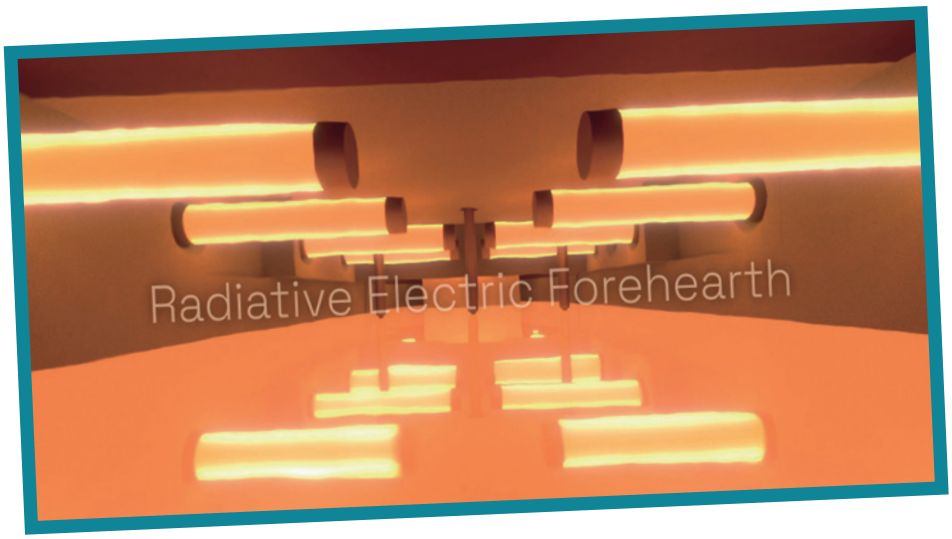
tric furnaces can reduce total energy consumption by up to 35 percent compared to gas-fired systems. These performance gains align with broader industry trends: today's glass packaging is about 30 percent lighter than it was 50 years ago, manufactured using 70 percent less energy and emitting half the CO_2 per unit produced. While the full environmental benefit of electric melting depends on the source of electricity, the energy grid is rapidly shifting toward renewables. In many regions, electric solutions are already becoming cleaner and more cost-effective than localized combustion - and that trend is expected to accelerate.

COMPARING TECHNOLOGIES: ELECTRIC VS. HYBRID AND FOSSIL-FUELED FURNACES

In high-capacity applications, traditional regenerative or recuperative gas furnaces still dominate. Hybrid furnaces -mixing electric and fossil energy- have been deployed as a transitional step, cutting CO_2 emissions by 20-45 percent by shifting up to 50 percent of energy input to electrodes.

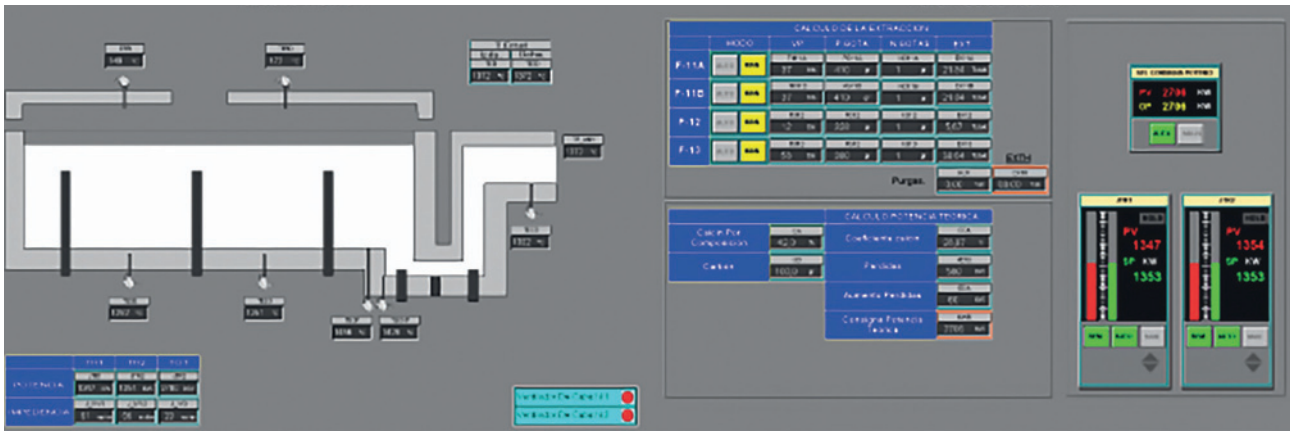
Full-Electric furnaces, like the new BDF solution, take decarbonization further:

- Zero combustion emissions: eliminating burners and combustion chambers reduces direct environmental impact;
- Superior thermal control: modular heating zones and real-time monitoring deliver process stability and energy savings;
- Future-ready infrastructure: designed to operate with renewable energy sources, full-electric furnaces align with long-term sustainability goals.



THE BDF ADVANTAGE: INDUSTRIAL SCALABILITY MEETS CLEAN ENERGY

By combining modular engineering, advanced process controls and a legacy of glass melting expertise, BDF's electric furnace is more than a new product. It's a strategic tool for transformation. With capacities above 250 TPD, it proves that high-volume, all-electric melting is not only possible, but also practical and profitable. When integrated with BDF's electric forehearths, forming lines and smart control platforms, this solution delivers unmatched operational performance and environmental impact reduction. For glassmakers navigating the energy transition, BDF Industries offers a clear path forward - combining innovation with proven industrial strength. ■



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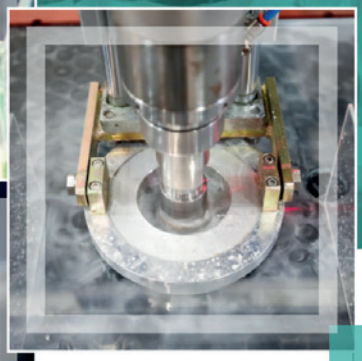
GLASS PRODUCTION TECHNOLOGIES & PROCESSES

INDIA

INDIA'S PREMIER EXHIBITION FOR THE GLASS PRODUCTION



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Green Deal

Effective GLASS SERVICE ITALY technology leverages oxygen in sustainable Working End

Delivering its own impactful response to EU challenges, Glass Company aims to cut fuel consumption and CO_2 emissions by at least 40 percent by supplying the oxygen-gas skid.

TECHNOLOGY ANTICIPATING THE EU GREEN DEAL

As the European Union tightens decarbonization targets for heavy industry (-55 percent CO_2 by 2030) and gas prices remain volatile with significant increases in energy process costs, Glass Service Srl, the Italian leader in combustion systems for glass manufacturers, has signed an agreement for the supply of a new gas-oxygen combustion system for the working end.

ACCELERATING DECARBONIZATION FOR THE INDUSTRY

Following the success at last installations, Glass Service replicates the oxygen-gas technology with his customer for the 11-zone working end combustion system. Targets: -40 percent gas and CO_2, and +5 percent energy efficiency.

THE TECHNOLOGY AND ITS BENEFITS

The custom-designed combustion system consists of:

- 1 main reduction skid for gas and oxygen
- 4 regulation skids for the working end zones (11 total), each equipped with a nitrogen (N_2) purge line for both gas and oxygen lines.

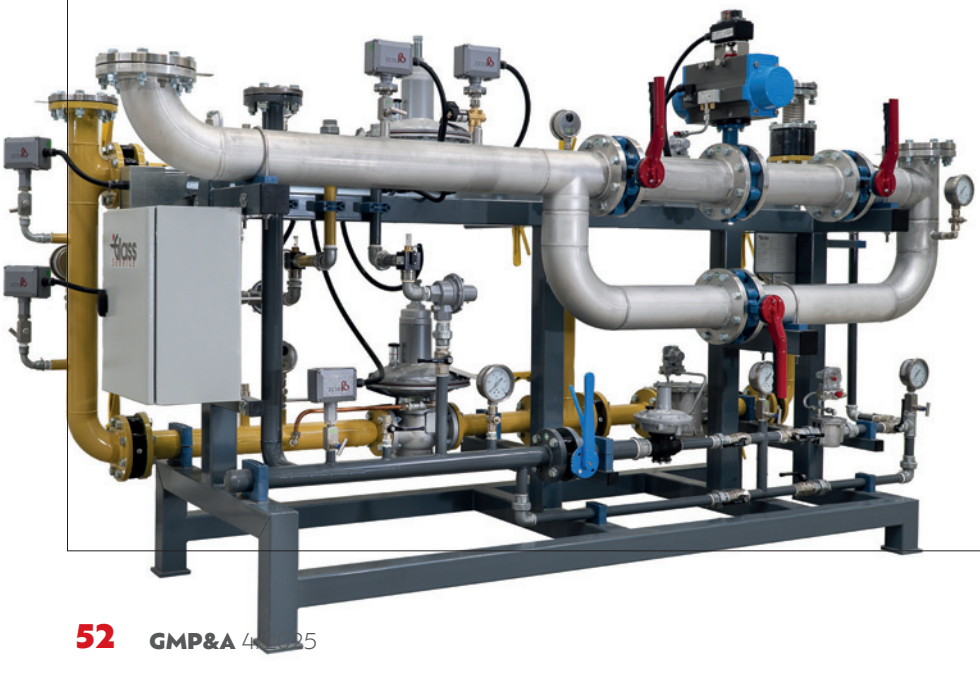
THE SYSTEM INTEGRATES

- Oxygen as a comburent (O_2) for cleaner, high-efficiency combustion.
- Dynamic control system for the 11 zones, regulating flows and mixtures in real time to reduce waste and emission peaks.

INNOVATION ALIGNED WITH FIT FOR 55

The shift from air combustion to oxygen combustion represents a technological leap because:

1. Eliminates nitrogen from the process (75 percent reduction in flue gas volume).
2. Reduces heat that gets lost in flue gases due to lower volumes from nitrogen elimination.
3. Shorter, more intense flames (+30 percent heat transfer).
4. Exceeds current BAT (Best



Pioneering a transformative leap in sustainable glass manufacturing with its advanced oxygen-gas combustion system, GLASS SERVICE ITALY is slashing fuel use and CO2 emissions by 40 percent. Fully in synchrony with EU Green Deal goals, this innovation sets a new benchmark for decarbonisation in the hard-to-abate glass industry.

Available Techniques) limits with:

- Combustion efficiency >92 percent
- NOx emissions <150 mg/Nm³
- Hydrogen compatibility (up to 30 percent blend without retrofitting).

> "Using oxygen instead of air drastically reduces fossil fuel consumption, flue gas volumes, and heat dispersion, cutting NOx and CO_2 emissions while improving the thermal stability of the working end."
> Oliver Bellina, Glass Service

IMPLICATIONS FOR EU DECARBONIZATION

Each Std m^3 of gas saved = 2Kg CO_2 avoided.

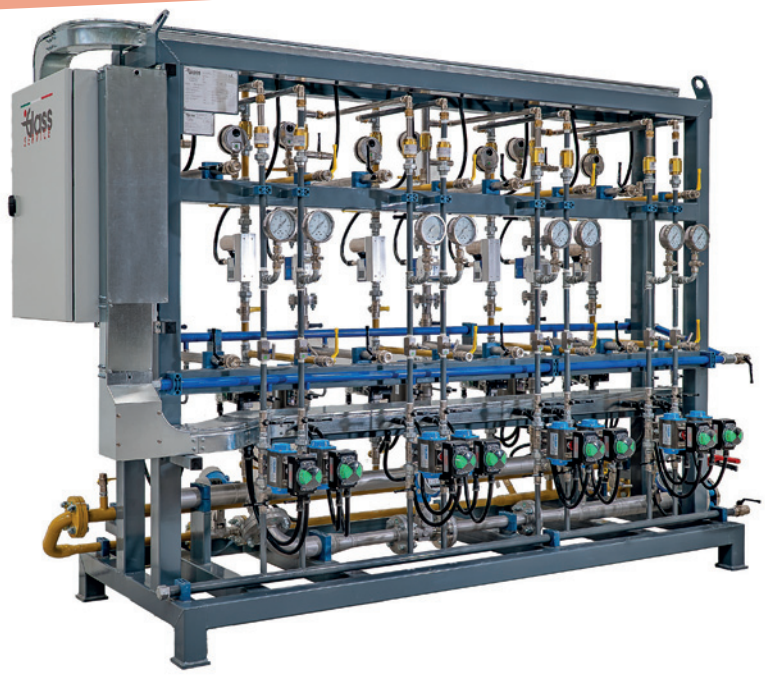
Full alignment with:

- EED (Energy Efficiency Directive)
- Tax credits for alternative fuels

CASE STUDY

The projects already concluded with success demonstrated:

- 22-month full ROI.
- 7 - 10 percent improved thermal stability.
- 40 percent NOx reduction.
- 55 percent natural gas savings.
- sensible reduction in CO_2 emissions.



- Lower combined costs for fuel purchases and CO_2 quotas (ETS Directive).

WHY THIS TECHNOLOGY MATTERS (CLASSIFIED AS HARD-TO-ABATE)

The Glass Service experience proves that oxy-fuel combustion is the most effective technical solution for the glass industry to achieve decarbonization, thanks to:

1. Dual benefit: Gas savings + carbon credits (Emission Trading System).
2. Simple retrofit for transitioning to H_2 blends (up to 30 percent).
3. Immunity from future carbon taxes.

> "After successfully optimizing consumption obtained in the early projects, we can now replicate and implement this solution as a Glass Service standard best practice."
> Fulvio Puccioni, Glass Service

GLASS SERVICE ITALY

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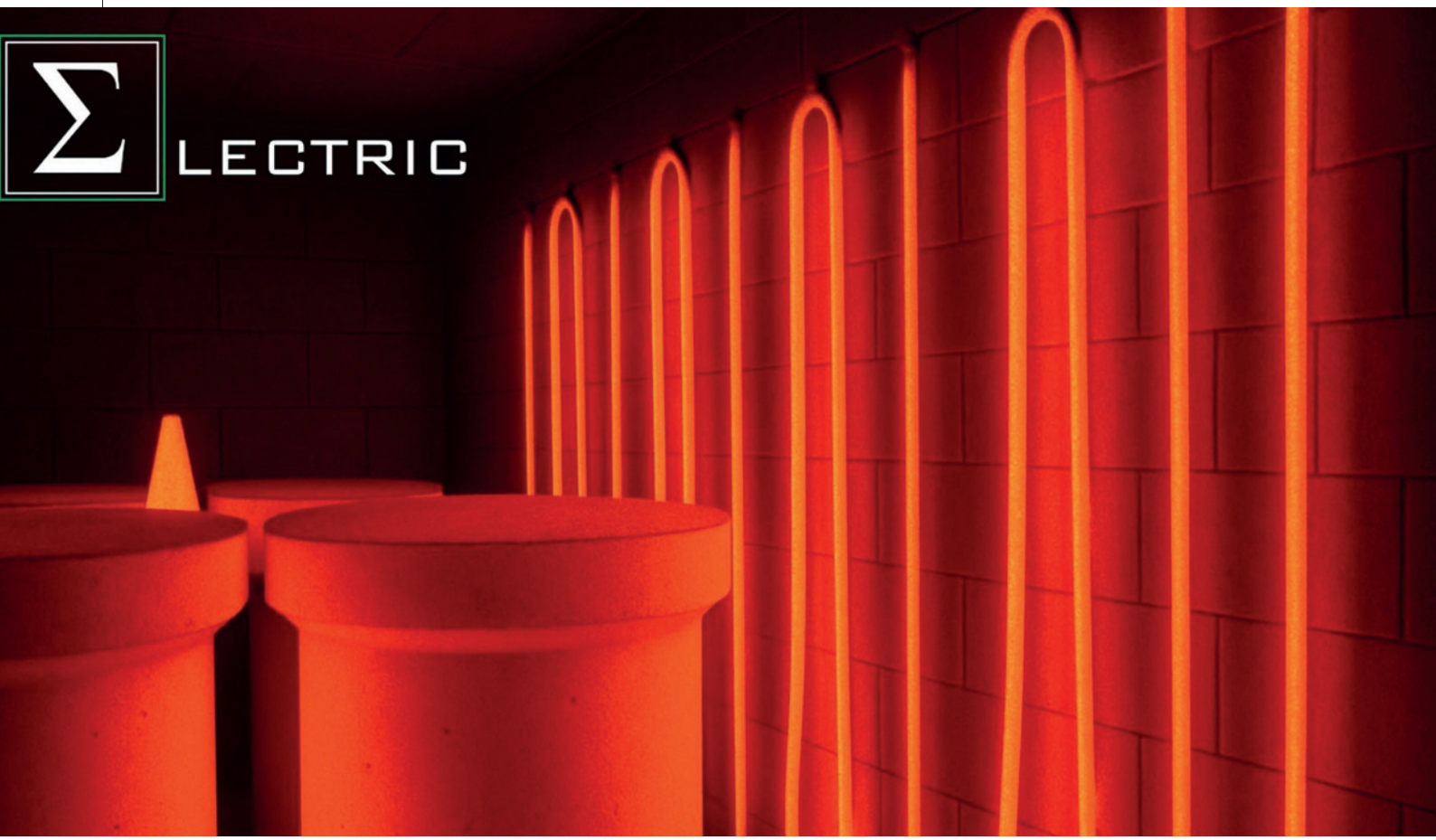
www.glassservice.it

Success story

New era begins for SIGMA as electric furnace goes live

Having recently flipped the switch on a groundbreaking 1750°C electric furnace at its Plovdiv plant, SIGMA now sets a new standard in sustainable refractory manufacturing. This milestone marks a bold leap toward carbon neutrality – combining advanced engineering with a firm commitment to environmental responsibility.



In the heart of Plovdiv, a transformative chapter unfolds for the glass and refractories industry. Sigma Group has brought to life a next-generation electric furnace capable of reaching an intense 1750°C - an engineering feat that redefines refractory production and places sustainability at its core. The newly commissioned furnace is more than a technological advancement. It is a bold statement of intent. By eliminating gas combustion, the furnace achieves near-zero on-site carbon emissions - an essential move in a sector where heavy industry still accounts for approximately 25 percent of global greenhouse gas output. Power for the furnace will be partly supplied by Sigma's own solar array, which already generates 340,000 kWh annually and saves 180 tonnes of CO_2 each year.

The photovoltaic system at the group's Locate Varesino facility produces 560,000 kWh annually, saving 300 tons of CO_2 emissions per year. 85 percent of the energy generated is self-consumed, covering 35 percent of the facility's electricity needs.

POWERING SUSTAINABILITY: PRECISION, PERFORMANCE AND NEAR-ZERO EMISSIONS

Beyond environmental gains, the electric furnace introduces unprecedented precision to the firing process. With digitally controlled profiles, the system enables remarkable consistency and superior material performance, seamlessly uniting traditional materials science with modern electrical engineering. Such a leap forward did not come easily. Designing an electric furnace capable of sustaining extreme temperatures while ensuring throughput and stability demanded daring innovation and technical mastery. Sigma's engineers met the challenge - proving that sustainability need not mean compromise.

ENGINEERING BREAKTHROUGHS: BUILDING THE FURNACE OF THE FUTURE

The project required bold thinking, robust expertise and an unwavering commitment to progress. As such it represents a turning point in industrial furnace design - one that pairs energy efficiency with world-class refractory output. Indeed by reducing Scope 3 emissions and embedding lower carbon footprints into its products, Sigma is thus delivering solutions that align with global climate goals - without sacrificing reliability, performance or quality.

BEYOND THE FURNACE: A BROADER GREEN VISION TAKES SHAPE

The electric furnace is only one part of the group's multifaceted green transition. Recent installations of photovoltaic systems generating 900,000 kWh per year and smart energy solutions are cutting carbon emissions by a further 480 tonnes annually - the equivalent of taking 104 cars off the road. Sigma's efforts demonstrate that responsible manufacturing can be both practical and impactful. As the industry seeks lower-emission partners, SIGMA has shown its leadership with action - offering tangible progress toward a more sustainable world. ■

Sigma Group's new photovoltaic system at the Plovdiv site is now generating 340,000 kWh annually, reducing CO_2 emissions by 180 tons per year. This helps ensure a more sustainable and cost-effective energy supply.

Smart furnace design through TECSIGLASS physics-based simulation

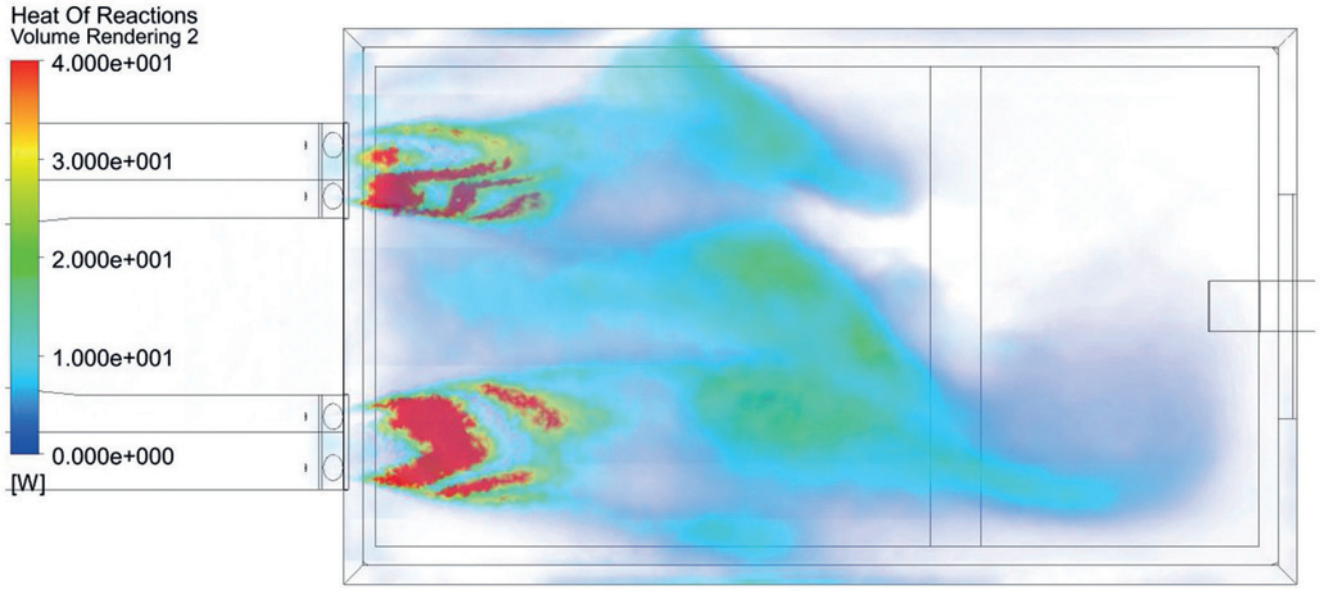
A rising leader in glass furnace innovation, TECSIGLASS blends deep technical expertise with cutting-edge research. Through advanced CFD modeling and strategic partnerships, the company is redefining furnace design, simulation and diagnostics – offering efficient, sustainable solutions for today's challenges and tomorrow's glassmaking demands.

SIMULATION FROM THE FURNACE DESIGNER AND THE END-USER PERSPECTIVE

A cutting-edge company in the design and supply of glass furnaces, Tecsiglass S.r.l. is headquartered in Genoa, Italy. Despite its recent establishment, the company has quickly emerged as a market leader, thanks to the extensive experience of its technicians and the enthusiasm and innovative vision of new generations. This blend of expertise and energy has enabled Tecsiglass to achieve significant milestones in a short period. One of the distinctive features of Tecsiglass is its strong commitment to research and development (R&D). Recently, the company created a Ph.D. position to further strengthen its team, which already includes the collaboration of about ten researchers from the University of Genoa and SIRELAB S.r.l.. These researchers work in synergy to develop advanced models and applications to support the design, monitoring and management of glass furnaces.

PIONEERING SIMULATION FOR ADVANCED FURNACE DESIGN

Several R&D projects have been completed over the last decade receiving fundings from regional, national or European institutions resulting in a strong competence acquired on numerical simulation of the main aspects related to the glass furnace system design and operation. The main achievement recently is that of an innovative, fully-coupled CFD (Computational Fluid Dynamics) numerical model for the simultaneous simulation of combustion and melted glass flows with superior characteristics of stability, accuracy and applicability with respect to existing commercial codes for glass furnace simulation. The model is based on basic reacting fluid flow physics with advanced and general chemical kinetic schemes or multiphysics setup (i.e. electric field). As such it is an effective tool to conceive and develop truly innovative solutions. On the contrary, existing simulation approaches with simplified modelling, highly tuned on current state of the art furnaces, cannot certainly be trusted as valuable tools to drive innovation for new and peculiar configurations.



INNOVATIVE APPLICATIONS OF CFD IN OPERATIONAL SUPPORT

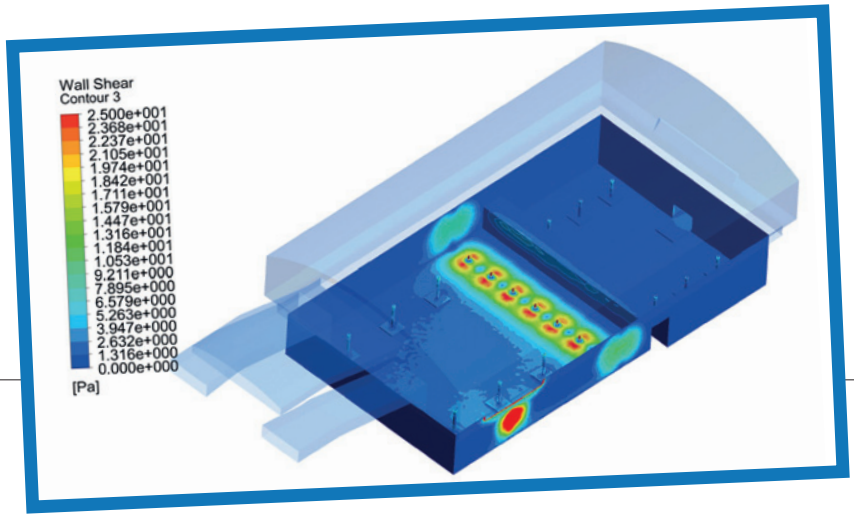
Tecsiglass is determined in introducing the use of the above simulation approach for a wide range of purposes:

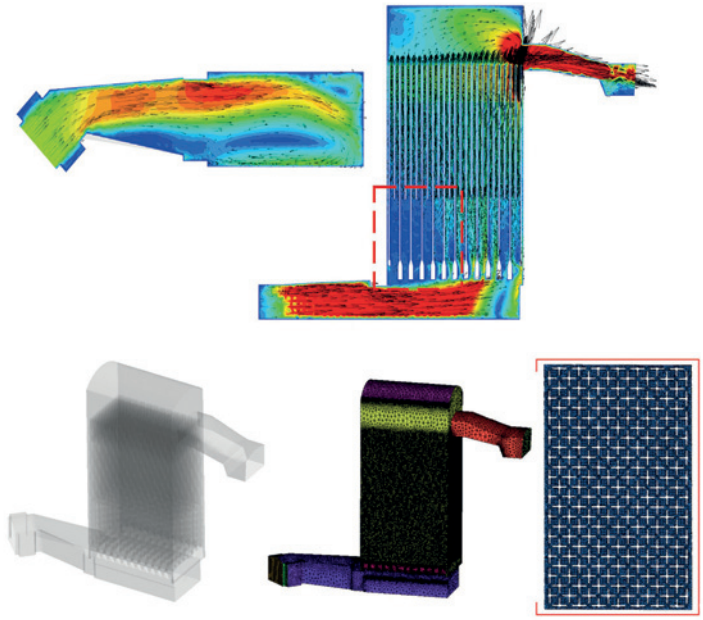
- Supporting the design of efficient and innovative solutions;
- Allowing for the critical analysis of existing solutions with detailed investigation and physical interpretation for troubleshooting of fault and malfunction in operation;
- Developing advanced monitoring and diagnostic platforms with the joint use of numerical simulation, data acquisition and artificial intelligence;
- Innovative training systems using virtual or augmented reality platforms with embedded results from simulation to support the teaching of difficult topics (i.e. the complex melted glass flow paths and the effects of electric boosting or mixing enhancers like boilers).

In the context of decarbonizing the sector, the CFD model represents a fundamental tool for evaluating the impact of introducing hydrogen as a fuel and increasing the share of melting energy obtained using boosters. The model allows for a detailed analysis of the effect on the glass bath due to the positioning of the electrodes and/or the increase in the power delivered. The following figures show a simulation of the combustion flames with reaction heat of 30 percent from H2 and the presence of boilers and electrodes activated. The model enables analysis of the stress on refractories caused by glass movements and temperature variations, providing insights into their potential erosion. In this way, it offers an additional tool for optimizing design and process management. An example of CFD use for troubleshooting is described in the following pictures. In a standard end-port furnace both regenerative chambers, during furnace reconstruction phase, showed a peculiar damage of the refractories into the core flow in a region close to the external walls with perfect symmetry into the right and left chambers. The flow inside the regenerative chamber has been simulated using the actual 3D layout and details of the internal checkers. It emerged that the design of the feeding channel of the camber, due to its excessive section variation, in air phase, induces a large flow recirculation that causes a bad feeding of the refractories in the corresponding lower part. As a consequence, the upper part of the refractories are not adequately fed with combustion air; they do not follow the correct air-fumes cycle with enhanced thermal stress and pollution with erosion from the fumes. If the original configuration and layout of the regenerative chamber system had been designed using CFD the above problem would have never occurred.

DIGITAL TWIN TECHNOLOGY AND FOREHEARTH OPTIMIZATION

The forehearth is a complex system that must deliver melted glass to the forming machines with a prescribed temperature profile

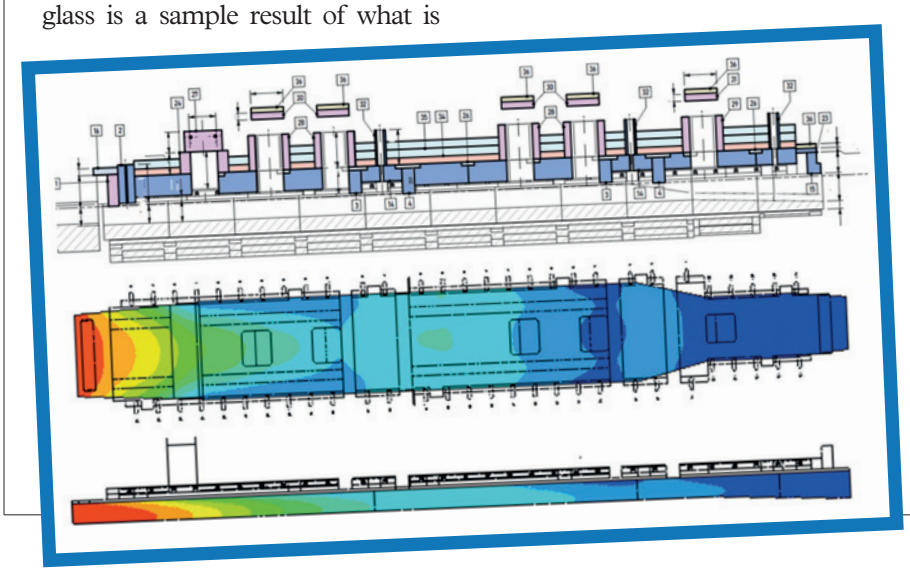


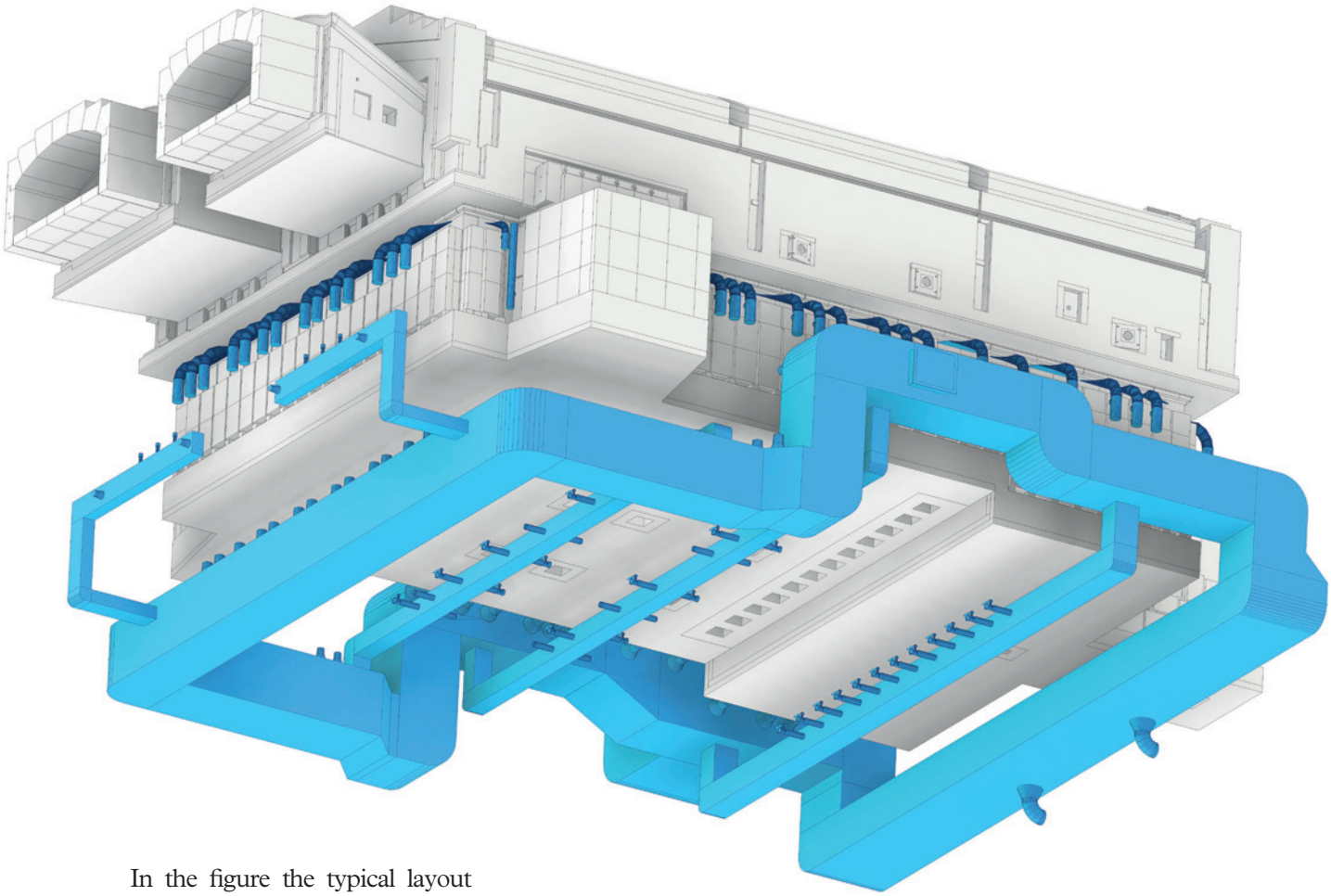


to guarantee final product quality; its thermal setup during production change is a crucial phase that tends to give production waste with related financial and environmental costs. Tecsiglass with its technological partners, is developing a digital twin of the system able to support the decisions of the personnel for the forehearth setup and useful for maintenance, diagnostic and also training purposes. CFD models, data acquisition and artificial intelligence are the combined ingredients that form the digital twin platform. The CFD simulation is the central core of the strategy to support artificial intelligence and data mining tools with the underlying physics. In the following figures the temperature distribution in the melted glass is a sample result of what is obtained from the abovementioned combined combustion and melted glass coupled 3D CFD approach, specifically set for forehearths simulations. The flames from all the burners in the three sections of the channel are numerically solved and the thermal effects of heat fluxes through the walls and the ventilation from chimneys are also considered. The model is validated against several data available from actual operation campaigns.

COOLING SYSTEMS AND INTEGRATED DESIGN PLATFORMS

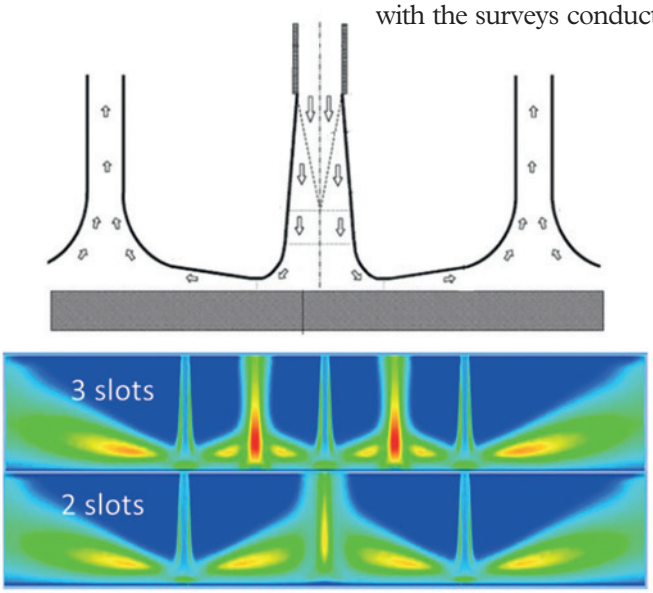
The furnace tank and throat cooling is a crucial aspect to extend refractory life and it is also a source of high energy consumption due to the continuous forced ventilation process from specific blowing systems. The thermal control is obtained with a slot impingement flow mechanism that needs to be well-tuned and optimized to reduce energy costs and to maximize heat transfer effects. Tecsiglass has a long-term design practice of the above ventilation system and it is effectively using CFD to optimize the above slot impingement process. The accurate quantitative simulation of the heat transfer process from slot impingement, especially with several slots interacting, is not an easy task. Tecsiglass can rely upon the appropriate models and CFD procedures developed by its partners University of Genoa and SIRELAB to design the most efficient thermal control system and layout for a given furnace.





In the figure the typical layout for the tank and throat ventilation is shown The forced ventilation heat transfer effectiveness depends on the complex thermal fluid-dynamic interaction of several slots (as shown in the figure). In the figure the turbulent kinetic energy for two or three slot interaction is shown from the validated CFD model in use that gives an idea of the flow complexity.

Tecsiglass, in partnership with SIRELAB, is also developing an advanced software platform that integrates all the information derived from various numerical simulations with the surveys conducted on furnaces at the end of their campaign using high-accuracy laser scanning and photogrammetry technologies. This platform, based on a Client-Server logic, can also use the data collected within a dedicated database, facilitating the reprocessing of field data. The above platform can be effectively used with virtual or augmented reality hardware for training purposes or for advanced revision of furnace design and maintenance. ■



Defect-free glass delivery at AGR from batch and furnace operations

When it comes to glass-making, chemistry is king. Indeed glass composition determines the material properties of the product and has a major influence on quality. Consequently, monitoring and understanding batch and furnace operations is an essential, routine function of a well-run glass plant.

COMPOSITIONAL ANALYSIS

Regular monitoring of batch material quality is the first step, as raw materials can shift in composition over time as different areas of a quarry or mine are accessed. American Glass Research's (AGR) laboratory in Maumee, Ohio is specially equipped to perform compositional analysis on sand and other raw materials so that the data can be used

Atomic Absorption (AA) Spectrometer, used for measurement of alkali elements and heavy metals

As American Glass Research advances glass quality through expert monitoring of batch and furnace operations from raw material analysis to final melt composition, Dr Brandon Aldinger, a Senior AGR Scientist, looks here at how the company is ensuring defect-free, consistent glass by leveraging cutting-edge techniques powered by decades of expertise in chemistry, colour and regulatory compliance.

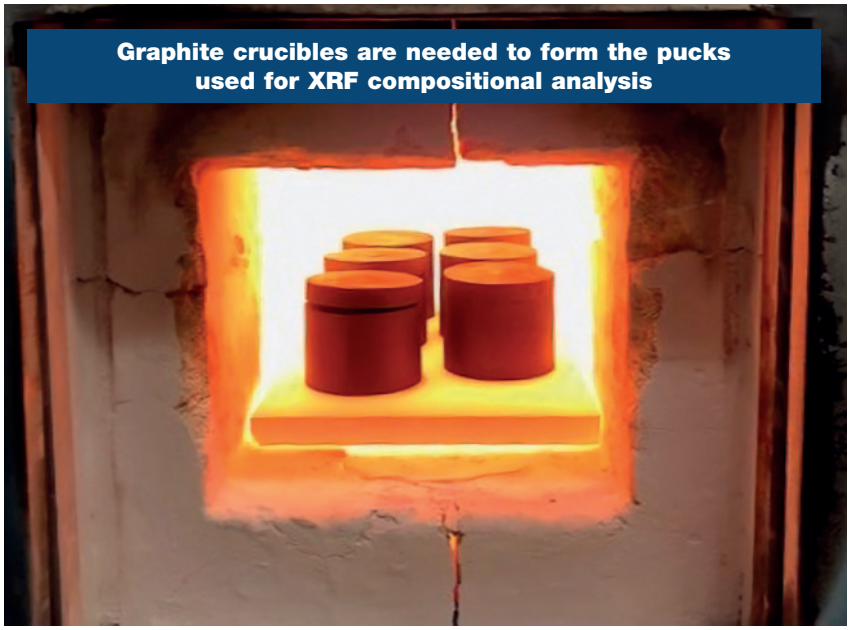
for batch formulation. In addition, measuring iron impurities in sand can be vital for production of ultra-clear products such as high-end liquor bottles, tableware, or low-iron float glass.

BATCH MEASUREMENT

After the glass has been formed, the final properties of the melt can be compared to specifications. Perhaps most importantly, the bulk glass composition should be periodically compared with batch calculations. This measurement is performed by slumping approximately 40g of glass in a graphite crucible. The puck is polished to obtain a flat surface and analyzed with a Wavelength Dispersive X-ray Fluorescence (WDXRF) spectrometer to obtain the percentages of the component oxides. For analyses of elements to the parts-per-million (ppm) level, different techniques are used such as Inductively Coupled Plasma (ICP) spectrometry, UV/VIS spectrometry, or Atomic Absorption (AA) spectrometry is used. Adequate sensitivity is needed to measure elements such as cadmium, hexavalent chromium, lead, and mercury to ensure regulatory requirements are met.

COLOUR FACTORS

The ability to tailor colour is one of the most desirable properties of glass. AGR can provide transmittance measurements that include LAB colour, dominant wavelength, and redness ratio. Redness ratio, in particular, is used to specify colour in amber glass, which is designed to protect liquid products from ultraviolet (UV) light. Blocking UV light is important to lengthen the shelf life of beer and to shield some active pharmaceutical ingredients. Glass colour, in turn, is heavily influenced by the 'redox' state of the furnace. All furnaces are oxidizing, in the sense that most batch compounds end up as oxides in the glass; however, altering certain batch components can make the combustion environment more 'reducing.' Because the oxidation state of metal ions determines their colour, furnace redox (an abbreviation of reduction/oxidation) must be controlled. The analytical lab at AGR measures the relative proportion of FeO to Fe_2O_3, which can then be used to adjust the batch.



Graphite crucibles are needed to form the pucks used for XRF compositional analysis

THERMAL EXPANSION

Certain applications rely on the mechanical or thermal properties of the glass, which are determined by glass composition. The softening point is defined as the temperature at which glass begins to deform under its own weight. The coefficient of thermal expansion (α) describes the expansion or contraction of a

material as a function of temperature. Although glass density is not vital for most applications, this physical property can be measured to four decimal places using a sink-float comparator. Consequently, density is regularly monitored as a leading indicator of glass composition issues. Sudden changes in density can provide a warning of an undetected change in the raw materials or an upset in the furnace. In addition to manufacturing sink-float instruments, AGR can perform density measurements, create oils with a known density, or provide a glass density standard.

IDENTIFYING STONES

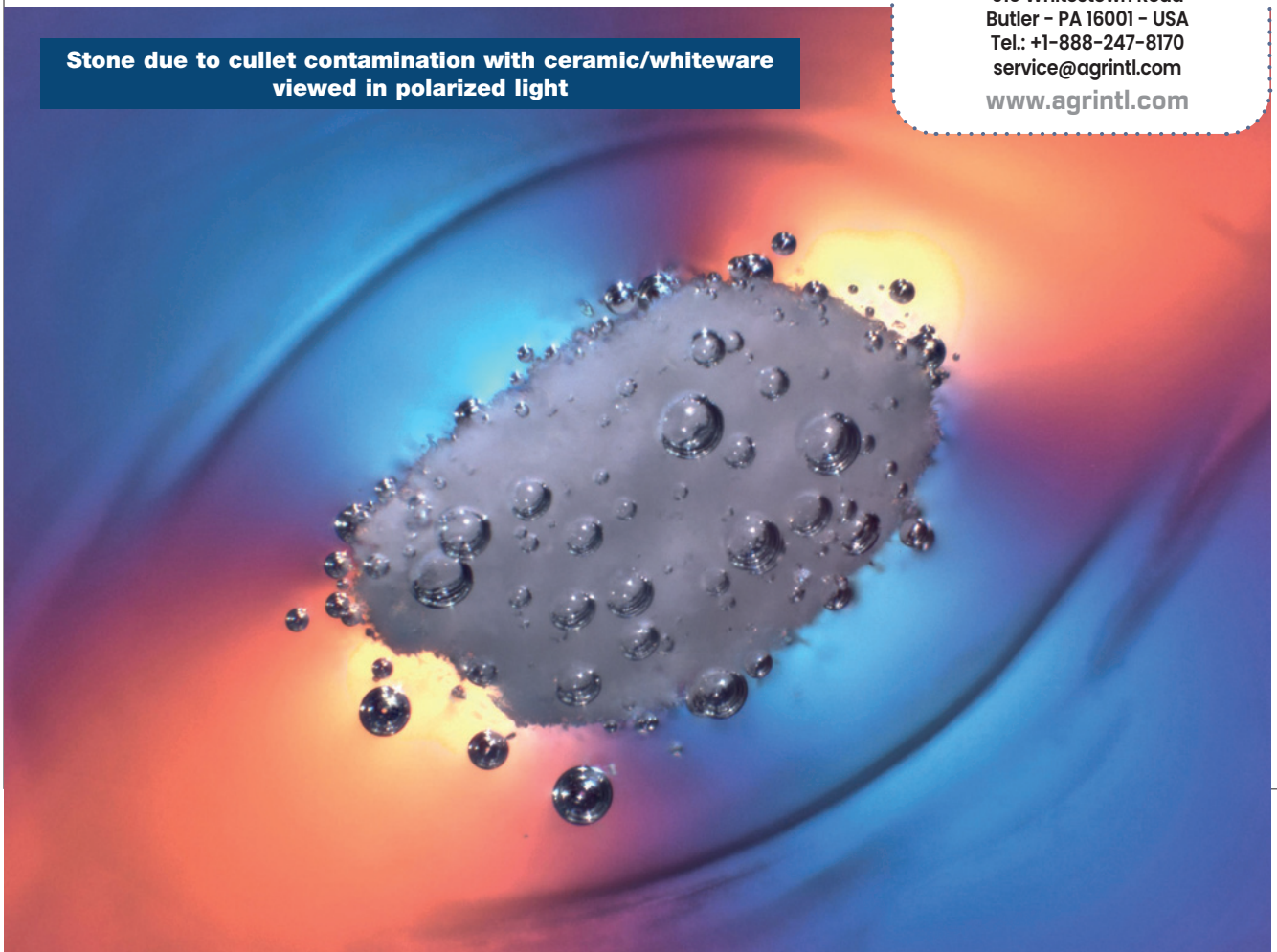
Unfortunately, glass problems can occur even with proper monitoring. Solid inclusions in glass, referred to as stones, are a common cause of glass breakage. Stones can arise from inadequate melting of batch materials, furnace upsets, refractory erosion, contaminants, or devitrification. Identification of stones is needed to determine appropriate corrective actions. AGR's lab in Butler, PA, provides stone analysis services and training on using stereomicroscopes, polarized light microscopy, and SEM-EDX to analyze stones.

PUTTING THE ENVIRONMENT FIRST

Sustainability in the glass plant goes hand-in-hand with cost savings. Post-consumer glass cullet (broken, recycled glass) decreases the energy required to melt the batch, which directly saves on energy costs and indirectly increases furnace lifetimes. Cullet, however, can vary in composition. Thus, periodic analysis of cullet composition must be performed so that batch calculations can be re-adjusted. Another focus on sustainability occurs in furnace exhaust processing at a glass plant. Electrostatic precipitators (EP) help to remove fine particulates from the combustion gases that normally go up the stack. This dust is not a waste product, however, and consists of batch material and scrubber reaction compounds that can be reintroduced into the furnace. AGR can analyze the composition of "EP dust," which can then be factored into batch calculations.

DEFECT-FREE GLASS

In conclusion, the goal of batch and furnace operations is to deliver homogenous, defect-free glass to subsequent forming equipment. Careful monitoring of the glass chemistry, both before and after melting, is essential to successful glass manufacturing. At AGR, scientists with decades of experience focused on glass technology are available to partner with companies. ■



Stone due to cullet contamination with ceramic/whiteware viewed in polarized light

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Energy-efficient glass melting technology emanates HORN® expertise

A global leader in glass melting technology, HORN® Glass Industries offers advanced furnace solutions and turn-key plants. With over 140 years of expertise, the company delivers innovative, energy-efficient systems tailored to diverse glass production needs - ensuring both high performance and sustainability for manufacturers worldwide.

As a glass melting technology specialist, HORN® Glass Industries AG supplies the float and container glass industry with a wide range of high-quality individual products and turn-key plants. Its high performance glass melting furnaces and turn-key plants are planned, built and delivered to glass manufacturers all over the world to produce beverage bottles, food containers, drinking glasses, window panes, automotive glass, glass tubes, glass fibres or specialty glass. With more than 140 years of experience in the construction of glass melting furnaces HORN® is well known as a specialist and expert

in the glass industry. Over the years, the company has extended its capabilities and expertise and has grown from being a glass melting furnace manufacturer into an industry leader in technological plants. The group has also grown considerably with subsidiary companies in China, Malaysia, India, Croatia, Ukraine, Brazil and the Czech Republic and Romania, adding value – such as proximity and short response time for global customers. Almost 90 percent of the products are exported from the HORN® headquarters in Plössberg (located in the Bavarian Upper Palatinate, Germany) to more than 75 countries worldwide. At all times, HORN® offers its customers full support and a helping hand. Due to a very high level of vertical integration of all products, HORN® offers tailor-made solutions and, at the same time, has ventured into new areas, e.g. in the construction of proprietary tin baths and related equipment. HORN® manufactures a wide range of products in its own workshops in Plössberg and is the service provider for the realisation of customer visions and projects in the field of glass production. HORN® supports its customers from the first draught through to the process of implementation to permanent on-site production support. HORN® builds a wide variety of glass furnace types for its customers, ranging from the usual end fired furnace to the all electric melting furnace. Furnace selection depends on individual customer requirements and demands. Depending on glass quality, furnace capacity, raw material specifications and glass type, each furnace is customised and optimally designed in compliance with the requirements of the customer. HORN®'s know-how and experience of many years concerning the optimisation of energy consumption and emissions are also reflected in the sophisticated design of all melting furnace components.

SCOPE OF SERVICE AND SUPPLY

- Melting technology and know-how
- Design of steel, refractory, piping, cabling, control systems and equipment
- Refractory supply
- Heat-up and Start-up
- Optimisation of melting process
- Troubleshooting

Although its technology is state-of-the-art, HORN® nevertheless continues to strive for the development of innovative technologies such as large scale all electric and hybrid furnaces, new measuring devices, new equipment and related control strategies.

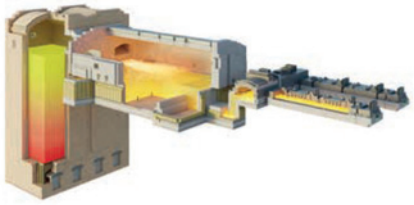
TYPICAL CONCEPTUAL FACTORS FOR SELECTING A MELTING FURNACE

- Melting capacity, glass colour, product type, requirements concerning the glass quality, etc.
- Medium for firing of the furnace, such as natural gas, oil, LPG and the possibility of using oxygen
- Environmental requirements or other legal requirements
- New construction or replacement of a melting furnace already in place
- Space conditions in the melting furnace building

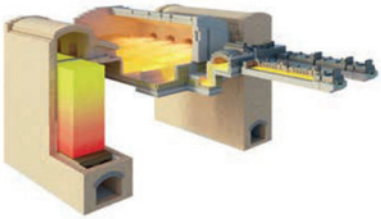
FURNACE TYPES

HORN®, with its extensive experience, expert knowledge and expertise, designs different types of furnaces best suited to the various glass melting processes. Furthermore HORN® consid-

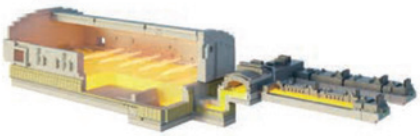
Regenerative End Fired Furnaces



Regenerative Cross Fired Furnaces

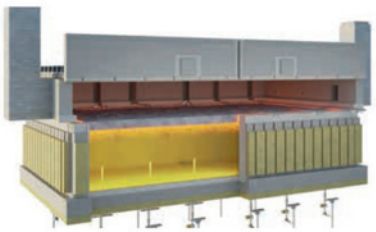


Oxyfuel Furnaces

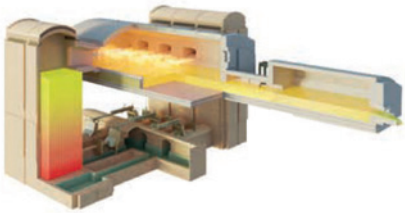


Recuperative Furnaces

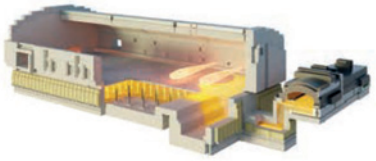
All Electric Furnaces



Float Glass Furnaces



Hybrid Furnaces



ers local circumstances like energy prices and environmental regulations. HORN® Glass Industries AG supplies the following furnace types:

ALL-ELECTRIC FURNACES (COLD-TOP)

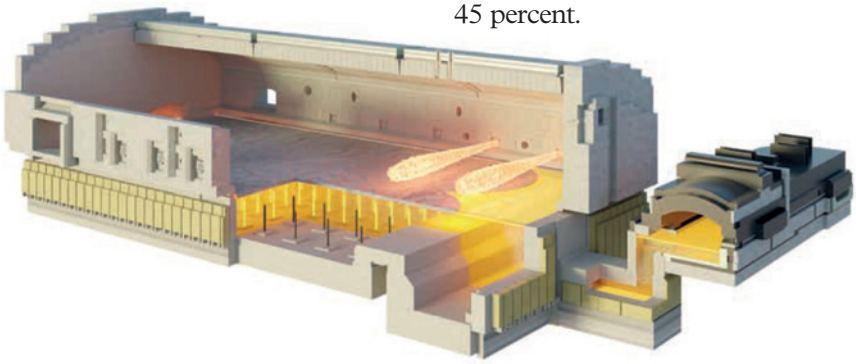
In general, all electric furnaces following the cold top technology are typically used for a production range of 5-80 t/d. It is possible to increase the melting capacity up to 200 t/d and more. For this furnace type energy is not supplied by means of fossil fuels, but exclusively by electric energy that's supplied by molybdenum electrodes.

DESCRIPTION

It is possible to use rod electrodes with specially developed, water-cooled electrode holders or block electrodes. The electrodes can be installed in the furnace bottom, in the lateral walls of the tank or inserted from the top, so-called top electrodes. Appropriate positioning and wiring of the electrodes lead to reduced corrosion of the refractories and thus increase the furnace life. The most efficient concept is usually the usage of top electrodes. In case of a cold top furnace the batch is supplied by an area batch charger at an open side wall of the superstructure. This layer insulates the glass bath from the environment, making additional insulation unnecessary. The melting, refining and homogenising processes in all electric furnaces are directionally vertical. All electric furnaces are not controlled by temperature but rather by electric power and batch thickness. There is a very delicate balance between these two measures making the furnace less flexible in respect to pull changes. The flexibility can be improved by means of furnace design. The specific pull is higher and not comparable with fossil fuel fired furnaces due to the vertical melting process. The glass quality can be drastically higher than in a fossil fuel fired furnace. For this reason, high quality specialty glass, e.g. for optical application, is molten with all electric furnaces. The energy consumption of all electric furnaces is lower than the one of fossil fuel fired furnaces. This is especially true for small furnaces, making small furnaces even more cost efficient. Increasing costs for CO2 allowances can be a deciding factor for all electric furnaces despite higher costs for electric energy in the near future.

REDUCED ENERGY CONSUMPTION

Hybrid furnaces combine the combustion of a fuel (mostly natural gas) with a highly increased proportion of electric power. For the combustion, an end-fired as well as a cross-fired setup can be used. This includes furnaces with regenerators, recuperator and oxyfuel combustion. If the overall electric share is aimed to be over 40 to 50 percent, the latter is the preferred solution. Compared to their classic pendant with little to no boosting, the overall energy consumption is reduced by approximately 5 to 10 percent, while CO2 emissions from combustion decreases from 20 to 45 percent.



HYBRID FURNACES

HORN® hybrid furnaces are specially designed to combine the classic heating method of combusting a fossil fuel with the usage of more electric power by using electrodes in the melting tank. The high electric share leads to a reduction of the fuel consumption and therefore to lower temperatures in the superstructure. In combination with a lower flue gas volume (even more for an oxyfuel furnace), this requires a modification of the superstructure design and possibly of the refractory materials to avoid cold spots and the subsequent damage. In the melting tank, a high number of electrodes are necessary. They can be installed as side or bottom electrodes depending on steelwork, position of burners, glass composition, etc. and preferably form "convection zones" in the tank. In these areas, the typical convection is preserved, despite the influence of all the electrodes, to support the melting process. To some degree, a hybrid setup offers flexibility regarding the energy contribution between fossil and electric and also for the pull rate. Currently hybrid concepts are used for furnaces with smaller pullout of 50 to 400 t/d and/or specialty glass, but in general the maximum furnace size is approximately the same as for the classic fossil furnaces (750 t/d and even larger). ■

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State-of-the-Art facility in Lohr successfully completes GERRESHEIMER investment

In a project that strengthens its position as a global innovation partner and reliable regional employer in the pharmaceutical and glass industries, GERRESHEIMER has successfully completed a EUR 100M modernization of its Lohr facility – featuring a cutting-edge oxy-hybrid furnace that boosts capacity, efficiency and sustainability.

As a leading systems and solutions provider and global partner for the pharma, biotech and cosmetics industries, Gerresheimer recently completed a successful expansion and modernization project at its Lohr site with a total investment volume of around EUR 100M after more than two years of planning and construction. The core of the project was the replacement of one of the two glass melting furnaces with a state-of-the-art oxy-hybrid furnace. The new furnace offers increased capacity, can operate with up to 50 percent electricity, and reduces CO2e emissions by up to 40 percent compared to conventional furnace technology. The project also included infrastructure measures for the power supply, the expansion of production buildings, new production machines and a new environmentally friendly cooling system. The modernization and expansion project at the Lohr site is one of Gerresheimer's largest investments in Moulded Glass in recent years. With this project, Gerresheimer is strengthening its competitive position as an innovative systems and solutions provider and as a reliable, future-proof employer in the region. "Our investments in cutting-edge production technology, such as the new facility in Lohr, secure the future," explains Dietmar Siemssen, CEO of Gerresheimer AG. "With state-of-the-art facilities for high-value products, we are strengthening our competitiveness, securing long-term jobs in the region and making significant progress toward our ambitious sustainability goals."

The first production run after replacing the melting furnace with a state-of-the-art oxy-hybrid melting furnace.

NEW OXY-HYBRID FURNACE FOR ENHANCED EFFICIENCY AND SUSTAINABILITY

Industrial glass production furnaces are usually replaced every eight to twelve years. Gerresheimer

Gerresheimer invested around €100 million in an expansion and modernization project at its Lohr site in Germany, including a new state-of-the-art furnace.

has used the planned replacement of the white glass furnace in Lohr to upgrade to the latest technology and expand production capacity to support its planned growth. The new furnace can operate with up to 50 percent electricity. This diversifies the energy supply and reduces CO2e emissions by up to 40 percent compared to conventional furnace technology. Currently, the Lohr site sources approximately 70 percent of its electricity from renewable energy, with plans to increase this share to 100 percent by 2030. Modernization also includes an upgrade to the cooling system: the new adiabatic cooling technology is more energy-efficient and consumes less water than conventional cooling systems, further supporting the company's sustainability goals.

ADDITIONAL INFRASTRUCTURE UPGRADES AND NEW PRODUCTION FACILITIES

The project was meticulously planned and executed by Gerresheimer experts over more than two years and implemented during ongoing operations. Amber glass production continued without interruption at the site. To meet increased electricity demand, new power lines were installed and new supply buildings constructed. The expansion also involved a new cooling system and the expansion of production halls. The actual furnace replacement, including the dismantling of the old furnace and construction of the new oxy-hybrid furnace, took place from January 2025 and was completed within four months. Several production lines were also upgraded to the latest generation and equipped with Gerresheimer's AI-based inspection system for quality assurance. This technology will enable the Lohr plant to further increase its share of high-value products in the future.

The new oxy-hybrid melting furnace (inside view) has a significantly higher capacity and can be operated with up to 50 percent electricity.

INVESTMENT SUPPORTING FURTHER GROWTH

At the Moulded Glass plant in Lohr, Gerresheimer produces a wide range of glass products made of white and amber glass with around 500 employees, from syrup, dropper, tablet and infusion bottles for the pharmaceutical industry to glass containers and bottles for the food and beverage industry. The plant in Lohr is one of three Moulded Glass plants in Germany and one of eight Moulded Glass plants worldwide within the Gerresheimer Group. The modernization and expansion project at the Lohr site is one of the company's key investment projects in recent years for the further profitable growth of the Group. ■

gerresheimer

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ABOUT GERRESHEIMER

Gerresheimer is an innovative systems and solutions provider and a global partner for the pharma, biotech and cosmetic industries. The Group offers a comprehensive portfolio of drug containment solutions including closures and accessories, as well as drug delivery systems, medical devices and solutions for the health industry. The product range includes digital solutions for therapy support, medication pumps, syringes, pens, auto-injectors and inhalers as well as vials, cartridges, ampoules, tablet containers, infusion, dropper and syrup bottles and more. Gerresheimer ensures the safe delivery and reliable administration of drugs to the patient. It also supports its customers with comprehensive services along the value chain and in addressing the growing demand for enhanced sustainability. With over 40 production sites in 16 countries in Europe, America and Asia, Gerresheimer has a global presence and produces locally for regional markets. Together with Bormioli Pharma, the Group generated revenues of around EUR 2.4bn in 2024 and currently employs around 13,400 people. Gerresheimer AG is listed in the MDAX on the Frankfurt Stock Exchange (ISIN: DE000A0LD6E6).

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BOOK YOUR SPACE

Success story

Glass furnace design and data detection, courtesy of STARA GLASS

Example
End-port

Main data	
Pull [t/day]	**300**
Melting area [m2]	**75**
Boosting [kW]	**1700**
Cullet %	**70**
Specific pull [t/m2day]	4,00
Preheated air temperature [°C]	1310
Glass temperature at the throat [°C]	1370
Furnace waste gas outlet temperature [°C]	1540
O2 excess at the port [%]	1,2
Room air temperature [°C]	20
Mix humidity %	2,5
Fuel: CH4 = 1 ; Dense oil = 2 ; CH4-Oxy = 3	1
NCV [kcal/Sm3]	8200

Heat balance

	Input heat	kcal/kg	GJ/ton	Gcal/h	%
In1→	Fuel	694	2,904	8,671	85,0
In2→	Electrical power	117	0,490	1,462	14,3
In3→	Air	5	0,022	0,066	0,6
	Total input heat	**816**	**3,416**	**10,199**	**100,0**
	Output heat				
Out1→	Glass	435	1,823	5,443	53,1
Out2→	Chemical reactions	41	0,173	0,516	5,0
Out3→	H2O evaporation	16	0,066	0,198	1,9
Out4→	Waste gas and leakage	204	0,855	2,554	24,9
Out5→	Holes and air leakage	7	0,028	0,083	0,8
Out6→	Thermal loss	116	0,485	1,449	14,1
	Total output heat	**819**	**3,431**	**10,243**	**100,0**

Fuel [Sm3/h]	**1057,4**	± 5%
[Nm3/h]	**1002,3**	± 5%
Specific consumption [kcal/kg]	**811**	± 5%
Specific consumption [GJ/ton]	**3,394**	± 5%
Specific useful heat [Mcal/m2h]	72,4	± 5%

Average glass residence time [h]	18,9
Minimum residence time (estimation) [h]	4,2

Cost	**6978**	**k€/Y**	**63,7**	**€/ton**
	€/unit	*M€/year*	*€/ton*	
Fuel [Sm3]	0,38	3,52	32,1	
Electrical energy [kWh]	0,14	2,09	19,0	
O2 [Sm3]	0,11	0,00	0,0	
CO2 [ton/y]	75	1,37	12,5	

Figure 1 – The heat balance of a glass furnace

What's the difference between the design of a glass furnace and its practical operation? And what stands between the computed and measured performance of a plant? In the following article we will explore precisely these differences - providing formulas and methods to design and detect the analyses values. Here Figure 1 represents the heat balance of a well performing glass furnace producing 300 tons per day of coloured glass. Indeed Figure 1 is the most typical chart that Stara Glass customers receive together with the drawings when they buy a glass furnace design, except that power Input and Output voices have been indicated in blue for the purposes of this article. On the left is the input data, on the right the computing output, and on the bottom the production cost, depending on the indicated unitary values. The table is the main output of the design and simulation software FurnaceMaster©, that Stara Glass has been constantly maintaining and implementing in the last 15 years.

In our view, the highest value of Stara Glass design activity stands on the fact that the people that code and utilize FurnaceMaster are the same people that oversee our furnace heat balance detection operation. This implies that every time I input, for example, the value of a waste gas temperature in the software, my mind will inevitably go to the one-hundred times I have

Exploring the critical gap between glass furnace design and real-world performance, STARA GLASS Head of Innovation Ernesto Cattaneo blends simulation and on-site data detection here to reveal how true furnace optimization stems not from theory alone but, significantly, from systemic experience as well.

been sampling that same number on an operating furnace with our suction thermocouple on my shoulder. It is not about mistake avoidance; it is about having a deep awareness of the process. A glass furnace is a complex thermal-dynamic system. All the physical formulas that describe its operation are freely available on Wikipedia, but the real expertise in glass furnace design lies in a wide systemic awareness of the operational parameters, that can exclusively come for a longstanding experience in both furnace simulation and data detection. In this article, we will examine all the heat balance input and output voices from both points of view: the designer's and the data detectors.

INPUT

In1 – Fuel Computing

Fuel represents the main energy input of non-fully electric glass furnace, which is:

Q = Mc Hi where:

Q = heat flux [kW - kcal/h]

Mc = fuel flow rate [Sm3/h]

Hi = (lower) calorific value of the fuel [kJ/Sm3 - kcal/Sm3]

Detecting

When collecting heat balance data, the flow rate is measured from the present gasometer, and the calorific value of the fuel can be analyzed by consulting and verifying the data from the fuel supplier.

In2 – Electric booster Computing

The electric booster supplies heat to the glass by the Joule effect, normally its power is expressed in kW. The design of a boosting system is a complex activity that we will explore in a successive article. It is crucial to design a system able to provide the requested power to the glass, considering losses and phases.

Detecting

During the heat balance data collection phase, this quantity can be consumptively seen from the bill of electrical power utilized for the glass melting.

In3 – Air Computing

In this model, the calculations relating to the heat balance of the furnace refer to normal (0°C) temperature conditions. Therefore, considering, for example, referring an analysis to normal conditions, an air flow will add a thermal flow:

%	Specie	Air Sm3/Sm3	Air Sm3/kg	Fumes Sm3/Sm3	Fumes Sm3/kg	CO2 %	H2O %	N2 %	Ar %	LHV kcal/Sm3	HHV kcal/Sm3	MW	ρ kg/Sm3
99	CH4	9,62	14,18	10,62	15,65	9,42	19,29	70,38	0,91	8112	9002	16	0,71
0,4	C2H6	16,83	13,24	18,33	14,42	10,91	16,83	71,34	0,92	14436	15771	30	1,34
0,1	C3H8	24,04	12,90	26,04	13,97	11,52	15,82	71,73	0,92	20665	22446	44	1,96
0,05	C4H10	31,25	12,72	33,75	13,74	11,85	15,28	71,94	0,93	26878	29103	58	2,59
0,02	C5H12	38,46	12,61	41,46	13,60	12,06	14,94	72,08	0,93	33082	35752	72	3,21
0	C6H14	45,67	12,54	49,17	13,50	12,20	14,70	72,17	0,93	39296	42410	86	3,84
0	C7H16	52,88	12,49	56,88	13,43	12,31	14,53	72,24	0,93	45510	49071	100	4,46
0	C8H18	60,10	12,45	64,60	13,38	12,38	14,40	72,29	0,93	51725	55730	114	5,09
0	C9H20	67,31	12,42	72,31	13,34	12,45	14,30	72,33	0,93	57941	62391	128	5,71
0	C10H22	74,52	12,39	80,02	13,31	12,50	14,21	72,36	0,93	64156	69051	142	6,34
0,43	N2	0,00	0,00	1,00	1,00	0,00	0,00	100,00	0,00			28,00	1,25
100													

Air Sm3/Sm3	Air Sm3/kg	Fumes Sm3/Sm3	Fumes Sm3/kg	CO2 %	H2O %	N2 %	Ar %	LHV kcal/Sm3	HHV kcal/Sm3	ρ kg/Sm3
9,519231	14,03737	10,50923	15,49726	9,306222	19,05966	69,52822	0,894829	8030,596	8911,681	0,706701
0,067308	0,052957	0,073308	0,057677	0,075202	0,115966	0,491614	0,006327	57,74339	63,08344	0,005354
0,024038	0,012897	0,026038	0,01397	0,028201	0,038731	0,175576	0,00226	20,66549	22,4455	0,001963
0,015625	0,00636	0,016875	0,006869	0,0188	0,024235	0,114125	0,001469	13,43895	14,55146	0,001294
0,007692	0,002522	0,008292	0,002719	0,0094	0,011642	0,056184	0,000723	6,616342	7,150363	0,000642
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0,0043	0,0043	0	0	0,040421	0	0	0	0,005372
										0
9,63	14,11	10,64	15,58	9,44	19,25	70,41	0,91	8129	9019	0,721328
								34035	37760	
				Calc		Kcal/Nm3		8575	9514	0,683778
				Test		Kcal/Sm3		8134		

Table 2 – Example of fuel heating value verification

Q = M c ΔT where:
Q = heat flux [kW - kcal/h]
M = air flow [kg/h]
c = specific heat of the air [kcal/kg °C]
ΔT = temperature difference with respect to the conditions considered

Naturally, in conditions of temperature outside the system below 0°C, the thermal contribution of the air will assume a negative value and will be zero at the reference temperatures.

This apparent heat contribution, positive or negative, will be algebraically included in output waste gas heat, it is in fact possible to notice in Table 1 that specific consumption [kcal/kg] is only the sum of gas and electrical boosting [kcal/kg] with no contribution of the ambient air heat value.

Detecting

There is no need to describe thermometers. Let's use this space to imagine producing glass on a 1500°C hot planet, of course the energy expense would decrease almost completely, but it would be challenging to keep the product formed. In the exoplanet HD 189733b, sometimes it rains glass. On HD 189733b we all would be unemployed, and dead, of course.

OUTPUT

Out1 – Heat transferred to the glass

Computing

The transfer of heat to the melting glass is the primary function of our furnaces, this considerable energy contribution can be evaluated as:

Q = Cs (Tg – Trif) where:
Q = heat transferred to the glass [kW/kg - kcal/kg glass h]
Tg = glass temperature at the throat [°C]
Trif = reference temperature for calculations (typically, 0 or 15°C)
Cs = specific heat of the glass [J/kg °C - kcal/kg °C] can be evaluated according to the composition and temperature of the glass. There are several empirical formulas consolidated in technical literature.

Detecting

To detect this value on the field, we utilize an indirect analysis: we measure the glass temperature at the raiser with an optical pyrometer, we compute the heat loss by raiser and throat, and we compute the glass temperature at the throat inlet by adding to the glass the successively lost heat.

Image 3 – HD 189733b (Wikipedia)

Out2 – Chemical reactions

Computing

The heat required by chemical reactions varies according to the composition of the glass.

The chemical reactions that take place in a glass furnace produce, among other compounds, a certain amount of H2O and CO2, which implies that:

Not all the vitrifiable mass will become glass, because these gases are released into the fumes, of which they become part

The flow rates of these substances (loss on ignition) will absorb part of the heat produced.

This thermal contribution is computable by considering the formation enthalpies of the different chemical species. In a first but solid approximation, any percentage of cullet introduced in the mix reduces the value of the same percentage. If all glass mix were made of cullet, this contribution would be null. This is why the utilization of cullet reduces consumption and CO2 emission.

Detecting

We commonly rely on the recipes shown by the glassmakers and their mix weighing systems.

Out3 – Water evaporation

Computing

In the vitrifiable mixture there is a percentage of water which will absorb a non-negligible part of the energy supplied to the plant to transform into steam, to which is added the water coming from the chemical reactions in the basin.

The evaporation heat of water is λ = 540 kcal/kg. In the common practice of calculating the heat balance, it is a reasonable approximation to assume

Cullet %	70
Humidity %	3,5
Glass mix	
Na2CO3 [%]	19,45
CaCO3 [%]	12,20
CaMg(CO3)2 [%]	4,50
Na2SO4 [%]	0,48
K2CO3 [%]	0,00
BaCO3 [%]	0,00
Tot. anhydrous bo	0,00
CaF2 [%]	0,00
Na2SiF6 [%]	0,00
NaNO3 [%]	0,00
Al(OH)3 [%]	0,00
SiO2 [%]	63,37

Main

USE THISMIX

Increasing Loss on ignition
1,1884 18,84
Total exothermic heat + LOI [kcal/kg]
137,71

MIX	kg	kg H2O	%
soda	147		19,30
Sand	432		56,73
marble	81		10,64
feldspar	51		6,70
dolomite	47		6,17
sulphate	3,5		0,46
slag [vitritis]	0		0,00
Sodium fluosilicate	0		0,00
CaF2	0		0,00
barium carbonate	0		0,00
Na2NO3	0		0,00
K2CO3	0		0,00
Borax anhydrous	0		0,00
Borax pentahydrate	0	0,0	0,00
powder	0		0,00
Al(OH)3	0	0,0	0,00
Tot	761,5	0,0	100,00

Primary reactions	Components	Molecular weight	Mix %	Mix % after dolomite dissolution	Carbonate dissolution reaction [kcal/mole]	Carbonate dissolution reaction [kcal/kg]	Exothermic heat [kcal/kg]	Glass mix	Loss on ignition
	Na2CO3	106	19,45	19,45	76,9	725,00	141,01	11,38	8,07
	CaCO3	100	12,20	14,64	42,5	425,00	62,23	8,20	6,44
	MgCa(CO3)2	184,3	4,50	0,00	8,8	47,75	0,00		
	MgCO3	84,3	0,00	2,06	28,1	333,45	6,86	0,98	1,07
	K2CO3	138	0,00	0,00	93,5	677,39	0,00	0,00	0,00
	BaCO3	197,3	0,00	0,00	63,9	323,62	0,00	0,00	0,00
	Na2SO4	142	0,48	0,48	160,5	1130,56	5,43	0,21	0,26
	Na2B4O7	201,2	0,00	0,00	74,3	369,28	0,00	0,00	0,00
	CaF2	78	0,00	0,00	-32,2	-412,82	0,00	0,00	0,00
	NaNO3	85	0,00	0,00	73,4	864,00	0,00	0,00	0,00
	Al2O3	102	0,00	0,00	0,0	0,00	0,00	0,00	0,00
	Na2SiF6	188	0,00	0,00	160,4	853,19	0,00	0,00	0,00
	SiO2	60	63,37	63,37				Total 84,14	Total 15,85

Secondary reactions		Tot. silicate [%]	Silicate [%]	kcal/mole	kcal/kg	kcal/kg
	MgSiO3	100,3	1,47	2,45	-8,7	-86,74	-2,12
	Na2SiO3	122	11,21	22,80	-58,2	-477,05	-108,76
	CaSiO3	116	8,79	16,98	-20,1	-173,28	-29,43
	K2SiO3	154	0,00	0,00	-75,0	-487,01	0,00
	BaSiO3	213,3	0,00	0,00	-20,7	-97,05	0,00
	Al2O3.SiO2	162	0,00	0,00	-37,71	-232,78	0,00
	SiO2	60	21,46	41,91	2,9	48,33	40,67
	B2O3	69,6		0,00	4,4	63,22	0,00
			Tot	84,14		dehydration	0,00
			LOI Verification	15,86		Total exothermic heat	115,9

Table 4 – Example of chemical reaction computing

that, by bringing this value to 600 kcal/kg, in addition to the heat necessary for the evaporation of the liquid, the heat necessary to bring the water vapor to the temperature of the fumes is considered too. Therefore, this outgoing energy flow will be worth:

Qev [kcal/h] = [T 0.01U (100-PR)/100 + PF] λ' where:

T = pull [kg/s]

U = humidity of the mixture [%]

PR = cullet percentage [%]

PF = losses on ignition [kg/s]

λ' = 600 kcal/kg

Detecting

The simple procedure to evaluate mix humidity consists in sampling a cup of mix from the batch charger, weighing it, heating it up in a furnace until the complete evaporation of water, and weighing it again.

Out4 – Residual heat in the fumes

Computing

The heat contained in the fumes leaving the chimney is a portion of the thermal energy obtained by burning fuel which is thrown away. The maximum theoretical efficiency of a furnace would be obtained if the exhaust gases were evacuated exactly at the temperature of the external environment: this is impossible for practical reasons. The amount of energy which is released into the external environment is:

Qf = Mf cf ΔT where:

Q = heat flux [kW - kcal/h]

M = flue gas [kg/h]

cf = specific heat of the fumes [J/kg °C - kcal/ kg °C]

ΔT = difference between the flue gas outlet temperature and the reference temperature

It is possible to evaluate the specific heat of the fumes by knowing their composition and having, for each species of gas they contain, a curve of the specific heat as a function of the temperature, similar to

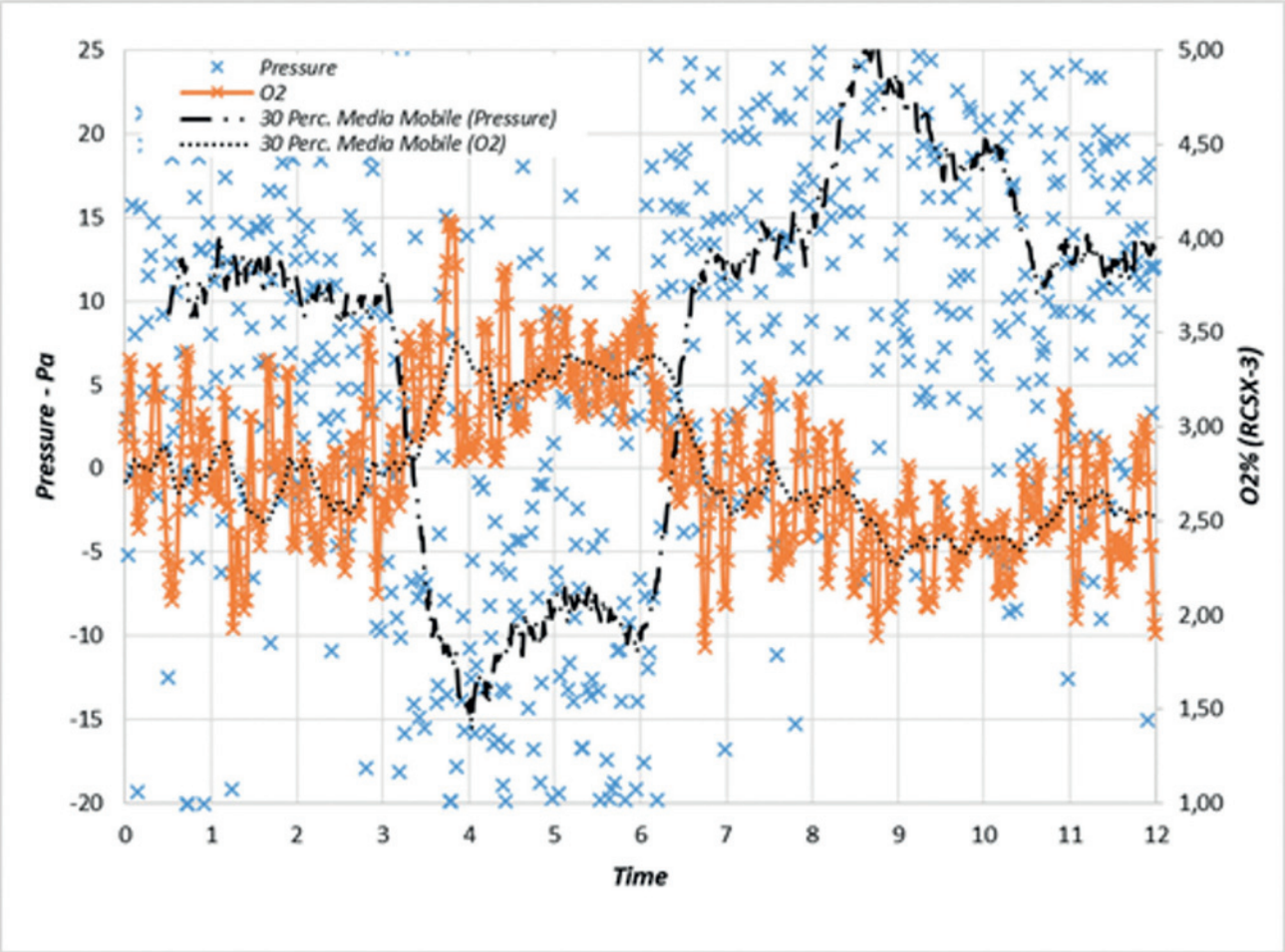

Figure 5 – Example of pressure test report

that proposed for the air. The stoichiometric composition of waste gas can be computed by the composition of the fuel.

Detecting

The measured oxygen content will define how much air needs to be added to the stoichiometric composition, and the detected temperature will confirm it. It is recommended to evaluate the waste gas specific heat with an integral methodology. It is necessary to measure the temperature with a suction thermocouple, which shields the detection elements from the wall radiation.

Out5 – Holes and leakage Computing

A glass furnace, however much the design and construction efforts must be aimed at in this direction, is never a perfectly sealed system. Therefore, in areas where the pressure inside the system is lower than the outside, there will be an entry of air into the furnace which will lower the temperature, harmfully.

In areas where the pressure is higher than the external one, there will be air and fumes leaks through imperfect sealing or real holes, with the consequent loss of the energy contained in the heated gases. In the points where it is possible to see the inside of the furnace from the outside, for example, through an open sight glass, in addition to the losses described above, there will be a loss of heat due to thermal radiation. Obviously, in the design phase it is impossible to establish the presence of holes in the system, and the estimation of their importance is entrusted to the experience and common sense of the technician. In our case, an empiric statistical hypothesis of the infiltration level is integrated in FurnaceMaster, such as for the total heat loss.

Detection

To evaluate the infiltrations, it is necessary to sample the oxygen content in waste gas in successive zones of the fumes path. In order to estimate the leakages, it is possible to measure the oxygen content in waste gas at the port under different positive and negative pressure set points. This allows to create an infiltration/leakage curve depending on the internal pressure.

Out6 – Thermal loss

Depending on the insulation level and furnace size, between 15 percent and 40 percent of the total thermal output is represented by heat loss. It is possible to evaluate

Customer	-
Furnace	EP

Zone	Mcal/h	kW
Tank	473	550
Tank thermal bridges	525	610
Total tank	*998*	*1160*
Air port	43	50
A.P. thermal bridges	16	19
A.P. total	*59*	*69*
Waste gas port	58	67
W.G.P. thermal bridges	20	23
W.G.P. total	*78*	*91*
Air chamber	71	82
A.C. thermal bridges	26	30
A.C. total	*96*	*112*
Waste gas chamber	103	120
Air chamber - bottom	32	37
W.G.C. total	*134*	*156*
	Total	*Total*
	1366	1588

Zone	Structure	Th. [mm]	Area [m2]	q [kcal/m2h]	q [W/m2]	Q [kcal/h]	Q [W]	Ti [°C]	Te [°C]	Layers	Hc
Tank	Bottom	760	84,30	780	907	65769	76475	1400	20	7	4
Tank	Deep bottom	715	16,95	786	914	13324	15493	1400	20	7	4
Tank	Free soldier blocks	250	8,35	18186	21146	151858	176577	1500	20	1	100
Tank	Lower soldier blocks	531	23,58	1415	1645	33358	38788	1450	20	7	20
Tank	Higher soldier blocks	521	7,79	1608	1870	12521	14560	1450	20	7	20
Tank	Lower soldier blocks - deep	531	15,29	1415	1645	21628	25149	1450	20	7	20
Tank	Higher soldier blocks - deep	521	3,91	1608	1870	6282	7304	1450	20	7	20
Tank	DH soldier blocks	521	2,99	1608	1870	4811	5594	1450	20	7	20
Tank	Side superstructure	565	39,75	888	1033	35302	41048	1550	20	7	20
Tank	Throat wall superstructure	565	28,45	888	1033	25263	29376	1550	20	7	20
Tank	Port wall superstructure	565	21,88	888	1033	19433	22597	1550	20	7	20
Tank	Burner zone	565	1,29	2163	2515	2788	3241	1500	20	4	20
Tank	Tank crown	787	90,36	893	1038	80653	93781	1560	20	6	20
Air port	Air port - chamber side bottom	390	8,34	1545	1796	12876	14972	1250	20	7	20
Air port	Air port - furnace side bottom	231	2,41	4737	5508	11406	13263	1250	20	4	20
Air port	Air port - Sidewalls	565	11,90	782	909	9299	10812	1250	20	7	20
Air port	Air port - crown	605	11,82	767	892	9063	10539	1250	20	7	20
Waste gas port	WG port - chamber side bottom	390	8,34	2088	2428	17408	20242	1550	20	7	20
Waste gas port	WG port - furnace side bottom	231	2,41	6357	7392	15308	17800	1550	20	4	20
Waste gas port	WG port - Sidewalls	565	11,90	1081	1257	12857	14950	1550	20	7	20
Waste gas port	WG port - crown	605	11,82	1047	1217	12373	14387	1550	20	7	20
Air chamber	Air chamber - crown	650	22,55	666	775	15024	17469	1250	20	5	20
Air chamber	Air chamber - port wall	720	18,03	673	782	12126	14100	1250	20	6	20
Air chamber	Air chamber - high walls	720	34,65	673	782	23307	27101	1250	20	6	20
Air chamber	Air chamber - medium walls	720	43,68	307	357	13399	15580	800	20	5	20
Air chamber	Air chamber - low walls	720	43,68	147	171	6424	7470	700	20	4	20
Air chamber	Air chamber - below	950	11,80	21	25	249	289	100	20	3	20
Waste gas chamber	WG chamber - crown	650	22,55	932	1084	21019	24440	1550	20	5	20
Waste gas chamber	WG chamber - port wall	720	18,03	908	1055	16365	19029	1550	20	6	20
Waste gas chamber	WG chamber - high walls	720	34,65	1055	1227	36574	42528	1550	20	6	20
Waste gas chamber	WG chamber - medium walls	720	43,68	462	537	20189	23475	1100	20	5	20
Waste gas chamber	WG chamber - low walls	720	43,68	174	202	7598	8835	800	20	4	20
Waste gas chamber	WG chamber - below	950	11,80	102	118	1200	1395	500	20	3	20

FurnaceMaster

Table 6 – Total heat loss report for a regenerative furnace

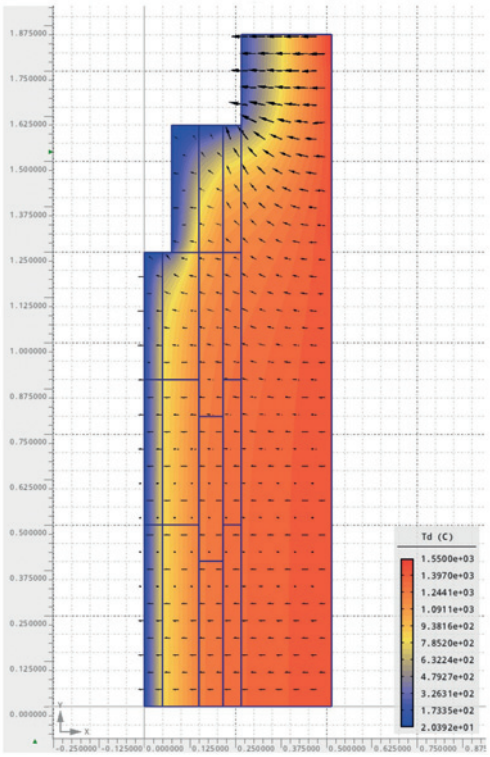

Figure 7 – Example of thermal bridges of a palisade

the heat loss mathematically, by considering dimension and conductivity of all material constituting the furnace and its recovery system. It is important to create an interactive computing environment where conductivities and temperatures are codependent. Stara Glass has a database including more than 600 construction materials.

Heat losses through homogeneous surfaces like sidewalls and bottom are evaluated zone by zone with a simple one-dimensional analysis, yet typically more than half of the furnace heat loss is given by the different relevant thermal bridges of the oven, like soldier block cooling, soldier block joints, tuckstones, skewback, electrodes, etc. For the accuracy of the computing, it makes sense to evaluate all these thermal bridges one by one with proper finite element models.

Conclusion

The carbon footprint of a glass plant largely depends on the furnace consumption. Besides radical changes such as electrification or hydrogen combustion, the first two actions that need to be taken to limit a furnace carbon emission are an optimized design and a regular maintenance of the melter and its performance. By law, we all need to have professionals regularly check the performance of our 2 kW domestic boilers and our 100 kW cars: it probably makes sense to regularly check our 10 MW furnaces too. ■

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TGP makes strategic investment in SCHOTT POONAWALLA

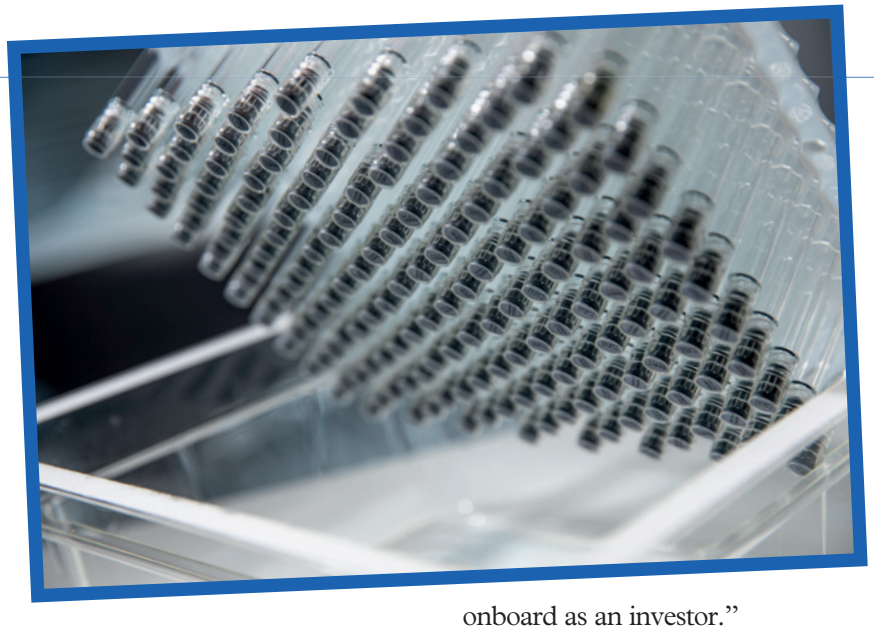
A pioneer in drug containment and delivery solutions, SCHOTT PHARMA recently announced that leading global alternative asset management company TPG has entered into a binding agreement to acquire a 35 percent stake in joint venture SCHOTT Poonawalla from Serum Institute of India (SII).

A global leader in vaccine manufacturing that's dedicated to providing affordable vaccines worldwide, SCHOTT Pharma and SII joint venture SCHOTT Poonawalla is part of the Cyrus Poonawalla Group. TPG Growth, TPG's middle market and growth equity platform, is funding the investment, along with Novo Holdings as a co-investor. Following the transaction, SII will retain a minority stake in the company.

A MILESTONE IN GROWTH AND GLOBAL AMBITIONS

With deep healthcare investing experience and local expertise in India, having TPG join the partnership alongside SCHOTT Pharma and Serum Institute of India represents a significant milestone in SCHOTT Poonawalla's growth, equipping the company with additional resources and strategic insight to support its long-term global ambitions.

SCHOTT Poonawalla designs advanced drug containment and delivery solutions for pharmaceutical and biotechnology customers. The company's portfolio features a large range of products including cartridges for auto-injector pens, prefillable syringes for a wide variety of biologics, vials, ampoules, as well as regulatory services for biotech and pharmaceutical companies, and Contract Development and Manufacturing Organizations (CDMOs).



BUILDING ON MANUFACTURING EXCELLENCE AND MARKET LEADERSHIP

"We are excited to partner with SCHOTT Pharma and Serum Institute of India and build upon SCHOTT Poonawalla's market leadership position as India's largest injectables-focused drug containment solutions company," said Bhushan Bopardikar, Business Unit Partner at TPG Growth.

"On the back of a world-class manufacturing infrastructure in India, SCHOTT Poonawalla has developed an industry leading reputation by offering a comprehensive product portfolio of the highest quality for over two decades. We look forward to partnering with the senior leadership team as they continue to innovate and improve the quality and standards of pharmaceutical drug containment solutions."

POSITIONING FOR INNOVATION AND GLOBAL EXPANSION

"Partnering with TPG marks an important step for us," said Adar Poonawalla, CEO of Serum Institute of India. "Their experience in healthcare investing and global network make them a strong partner as we scale and explore new opportunities. Our collaboration with SCHOTT Pharma will continue, ensuring supply chain resilience and advancing innovation in vaccine packaging and delivery." Said Andreas Reisse, CEO at SCHOTT Pharma: "India continues to be one of the most dynamic and strategically important manufacturing hubs for SCHOTT Pharma. Welcoming TPG to the partnership marks an exciting step forward in our collaboration."

"Now more than ever, our pharmaceutical customers are relying on us to supply next-generation cutting-edge drug delivery solutions," added Ashok Saxena, Managing Director, SCHOTT Poonawalla. "We are excited to welcome TPG onboard as an investor."

The transaction is subject to customary closing conditions and is expected to close within the first half of 2025. Jefferies acted as the financial advisor to TPG. AZB & Partners acted as the legal advisors to TPG and SCHOTT Pharma. J. Sagar Associates (JSA) acted as the legal advisors to Serum Institute. ■

Bold new sustainability goals set by O-I GLASS

Identifying 2025 as a milestone year for O-I sustainability, Chief Administrative and Sustainability Officer Randy Burns told attendees at the company's Investor Day: "This year, we're going to hit many of the sustainability goals that were initially set for 2030. Today, a new set of even more ambitious sustainability goals will be unveiled." Using 2019 as its baseline year, O-I marks a pivotal change here as the company focuses on radically reducing enterprise costs while raising the bar with the following updated sustainability targets for 2030:

- 47 percent reduction in GHG emissions
- 80 percent use of renewable electricity
- 60 percent use of cullet (recycled glass) on average

These elevated goals not only place O-I on par with competitors' stated objectives but also align with a 1.5-degree Celsius pathway.

ACHIEVING THE GOALS

The updated goals represent a significant increase from previous targets. Specifically, the company is increasing its GHG emissions reduction goal from 25 percent to 47 percent, its renewable electricity goal from 40 percent to 80 percent and its average cullet usage goal from 50 percent to 60 percent. To meet these ambitious targets, O-I will implement several key strategies:

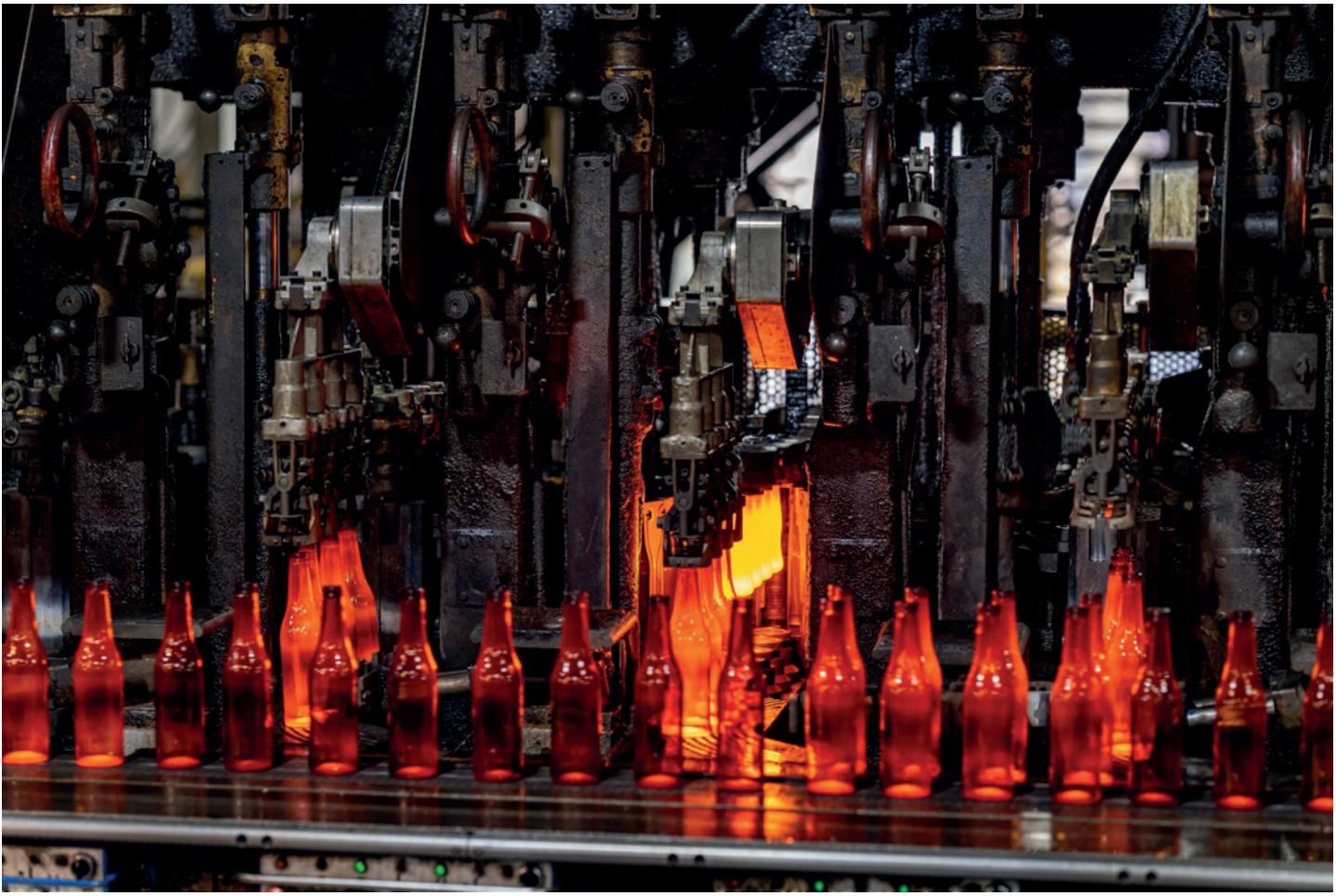
- Renewable Electricity: A substantial portion of GHG reduction will come from increasing the use of renewable electricity. O-I primarily purchases Renewable Electricity Certificates (RECs) to green its electricity supply and is also developing several potential solar projects.
- Recycled Content: Increasing cullet use will play a crucial role in reducing GHG emissions. The company will continue to foster recycling ecosystems, particularly where infrastructure is weak or nonexistent, such as in parts of its American footprint.

With glass being ranked among the most sustainable packaging materials out there, O-I GLASS recently announced its ambitious sustainability goals and bold new steps it plans to take to further enhance its circularity and decarbonization through an elevation of its 2030 targets.

- Energy Management: An energy strike team has been established to identify and eliminate energy waste across the network. This highly skilled, cross-functional group is already working directly with facilities to reduce energy consumption and improve energy efficiency, contributing to GHG reduction efforts.
- Technology Improvements: O-I is continuing to implement advanced technologies such as GOAT furnaces, hybrid electric furnaces, and a DOE project in Ohio, USA. These innovations are expected to significantly advance the company's sustainability achievements.
- Alignment with the Paris Agreement

These elevated goals reflect O-I's decisive action to further solidify its position as a leader in sustainable glass manufacturing.

Said O-I Sustainability Director Sonya Pump: "The 47 percent GHG reduction aligns O-I with a 1.5-degree pathway. This aligns O-I with the target



of the 2015 Paris Agreement to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels. The idea is that keeping the temperature increase below 1.5 degrees should minimize extreme global warming effects."

Increasing cullet usage to 60 percent supports the circular economy by advancing the reuse of materials. The benefits of increased recycled content include:

- Energy Savings: Recycled glass melts at a lower temperature than raw materials, reducing the energy required in the manufacturing process and consequently lowering GHG emissions.
- Reduced Raw Material Usage: Using more recycled glass decreases the need for raw materials like sand, soda ash, and limestone, reducing GHG emissions related to batch materials while conserving natural resources and minimizing the environmental impact of mining and transportation.
- Lower Carbon Footprint: Incorporating recycled glass lowers the overall carbon footprint of glass production, as energy savings and reduced use of raw materials translate directly into fewer carbon emissions.
- Waste Reduction: Adding recycled glass into the manufacturing process helps divert glass waste from landfills, promoting a circular economy.
- Operational Efficiency: Utilizing recycled glass can enhance operational efficiency by reducing wear and tear on furnaces and related equipment.

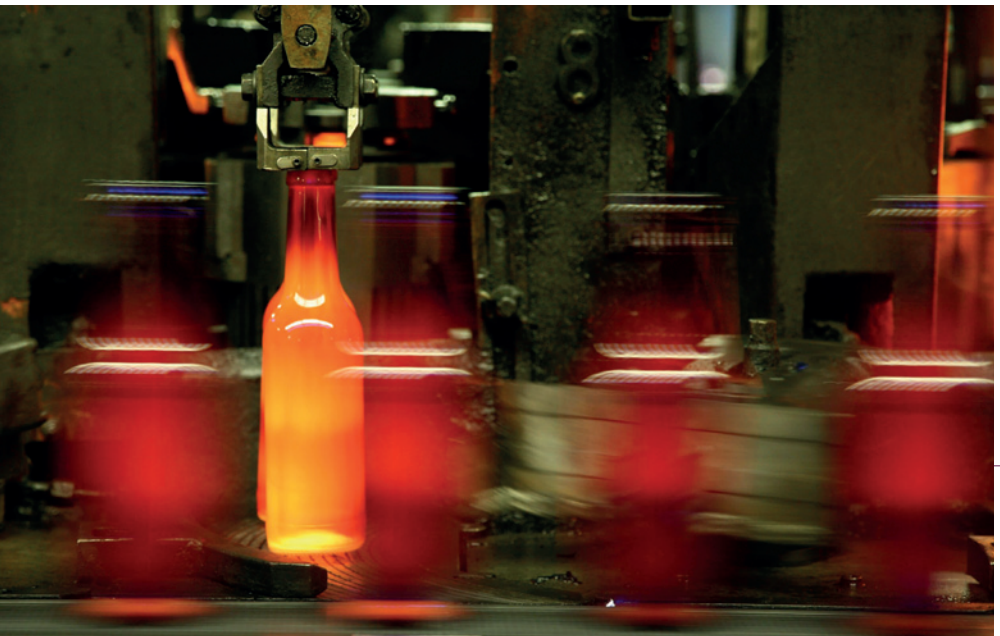
This alignment ensures that O-I remains competitive while continuing to lead the industry in sustainability.

POSITIVE IMPACT ON CUSTOMERS

The updated goals will also positively impact customers. Here, by aligning ambitions with those of its partners, O-I demonstrates its commitment to supporting broader sustainability objectives.

"O-I is already leading the glass industry in delivering reductions of GHG emissions. Now, our more ambitious GHG, cullet and renewable electricity goals send a strong signal that there is no intention of slowing down," says Pump.

Glass is 100 percent recyclable and endlessly recyclable. It does not cause end-of-life waste issues. Time and time again, glass proves it is the ideal packaging material to support a circular economy and the health of Earth's people. As a long-time leader in glass packaging, O-I sees it as a responsibility to innovate the manufacturing process to support the circularity of this material. The ability to outpace and accomplish previous goals -and establish these updated ones- is a testament to the company's mindset and sustainability vision. ■



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GLASS vs PLASTIC for wine: Why lightweight glass bottles win

Despite plastic's lower weight and durability, when it comes to GLASS vs PLASTIC packaging, glass wins hands-down on recyclability, life cycle impact and regulatory trends - making it the preferred eco-friendly option for environmentally-conscious producers and consumers alike. In the following article, sustainability advocate Jessica Allison explores why lightweight glass bottles are emerging as the most sustainable choice for wine packaging.

Sustainability, like in every industry, is becoming a high-priority subject in the wine industry as well. This is because consumers and producers alike are becoming more climate conscious, so they strive to reduce their environmental footprint. Needless to say, wine packaging plays a major role in this equation. Traditionally, wine has always been kept in glass bottles. Later on, plastic bottles emerged as a lightweight and cost-effective alternative to glass. However, the lighter option isn't necessarily the most sustainable one. Here we will explore the comparative sustainability of plastic and lightweight glass in wine packaging - delving into why modern lightweight wine glass bottles are becoming the more eco-friendly choice.

THE ENVIRONMENTAL IMPACT OF PACKAGING MATERIALS

First, we need to understand which packaging material has what kind of impact on the environment. While environmental impact depends on a lot of factors, some of the key ones that play a role here are analyzed below.

MATERIAL COMPOSITION AND LIFECYCLE

Glass is composed of natural raw materials such as sand, limestone, and soda ash. These ingredients are abundant in nature. Moreover, once combined, they form a chemically stable material that doesn't degrade over time. Glass is non-toxic, non-reactive, and does not release chemicals into liquids or melt in moderately high temperatures, which is

exactly what's ideal for food and beverage casings.

Plastic, however, is made from petroleum-based polymers. The chemicals can seep into the wine, making it harmful for health. But that's not all. While plastic is light and cheap to produce, it can persist in the environment for hundreds of years, posing a significant waste management challenge.

CARBON FOOTPRINT CONSIDERATIONS

The production of traditional thick glass bottles requires a high amount of energy due to the high temperatures needed to melt raw materials. In comparison, producing plastic bottles requires less energy, so manufacturing causes smaller amounts of emissions. However, if we consider the full life cycle, that calculation changes. The invention of lightweight glass has significantly reduced the carbon footprint of glass bottles. By cutting glass weight by up to 30 percent, less raw material is needed and thus, less energy is consumed during production. Moreover, transportation becomes more efficient too. In contrast, plastic's advantage shows a decline over time. This is due to its lower recyclability and the environmental burden of plastic bottles' end-of-life disposal.

RECYCLABILITY

An important factor of eco-friendliness is recycling. Those who are conscious about the environment and climate put

high priority on using components that can be recycled for future use. Let us compare the recyclability of glass and plastic:

GLASS RECYCLING

Glass is 100 percent recyclable and can be recycled indefinitely without having to worry about losing quality or purity. A recycled glass bottle can become another glass bottle, reducing the need for virgin raw materials. Countries that have strong glass recycling systems routinely collect, process, and reintroduce used glass bottles into new ones.

PLASTIC RECYCLING

While plastics are technically recyclable, the process is unfortunately a lot more complex. PET (polyethylene terephthalate), the most commonly used plastic for beverage bottles, shows gradual degradation with each recycling cycle. Contamination, lack of infrastructure for the recycling procedure, and sorting difficulties are some of the other causes. It is also hard to recycle it into new plastic bottles. Most of the time, they would be recycled into other simpler objects, that too, of a compromised quality.

TRANSPORTATION AND LOGISTICS

How easily a material can be transported is a small but crucial determining factor of how environment-friendly the material is. Heavier packaging increases consumption of fuel, leading to higher carbon emissions during shipping. Here, too, lightweight glass and plastic have considerable differences:

REDUCING EMISSIONS THROUGH LIGHTWEIGHT GLASS

Traditional glass bottles used to be one of the heaviest beverage containers used, so naturally their emissions were more. But lightweight glasses changed the game. A standard 750 ml lightweight glass wine bottle can weigh as little as 400-450 grams, compared to the 600-900 grams weight of traditional bottles. This weight reduction has caused a significant decrease in transportation emissions.

FRAGILITY VS DURABILITY FOR PLASTIC

For plastic, transportation is even more advantageous. Lightweight aside, due to its break resistance, it is more resilient during transport and handling, which can reduce product loss due to breakage. However, you could argue that advancements in glass design and packaging materials have reduced breakage incidents significantly, which includes that for lightweight glass as well. Given the environmental considerations, many wineries prioritize the recyclability and lower long-term impact of glass over the slight durability benefit offered by plastic.

REGULATORY AND MARKET TRENDS

Eco-friendliness is not just a choice of the consumer, but also of the businesses selling the products. On a wider scale, the market perspective of the lightweight glass vs. plastic debate looks like this:

INDUSTRY INITIATIVES IN SUPPORT OF LIGHTWEIGHT GLASS

In regions like Europe and Australia, there is a regulatory pressure driving a shift towards more sustainable packaging. This

includes mandates for recyclable materials and emissions reductions.

Hence why many wine producers are now including lightweight glass bottles as part of their sustainability strategies. Wineries are not only being transparent but also advertising about their eco-friendly packaging choices, with some including carbon footprint information on their labels or websites.

CONSUMER PREFERENCES AND THE NEED FOR EDUCATION

Consumer awareness around plastic pollution has increased a lot over the past few years. More buyers than ever before are switching to sustainable alternatives to plastic. Glass, especially when labeled as recycled or low-carbon, is being more widely accepted as a responsible choice in its stead. However, many consumers are still not aware of the benefits of lightweight glass specifically. This is where educational campaigns and clear labeling can help bridge the gap, encouraging buyers to support wines packaged in eco-friendly glass bottles. In the debate between glass and plastic for wine packaging, lightweight glass bottles win by a mile due to the compelling balance of environmental friendliness, superior aesthetics and consumer appeal. While plastic bottles still provide advantages by being lighter and less fragile, their limited recyclability, shorter shelf life and association with disposable culture all make them a less sustainable choice in the current times - especially for the wine industry. ■

Jessica Allison
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GLASS SERVICE ITALY	www.glassservice.it
LINCO BAXO	www.lincobaxo.com
NOVAXION	www.novaxion.fr
OMSO SPA	www.omso.it
PENNEKAMP	www.pennekamp.de
SKS - SORG KERAMIK SERVICE	www.sks.net
SORG NIKOLAUS	www.sorg.de
STARA GLASS	www.staraglass.it
TECSIGLASS	www.tecsiglass.com

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THERMOCOUPLES & ASSEMBLIES

Bock Energietechnik
Falorni Tech
Fives
GCG - Glass Consulting
Stara Glass

THERMO SHOCK TEST MACHINES

BDF Industries

TIN OXIDE ELECTRODES & CONNECTORS

Horn
Stara Glass
TECO Group

TRAINING SERVICES

AGR International Inc

TOOLS & EQUIPMENT

Bottero
Fives
Luben Glass
Stara Glass

TUBING LINES

Falorni Tech
Olivotto Glass Technologies
Stara Glass

TURNKEY PLANTS ENGINEERING & CONSTRUCTION

Amig - Ocmi - MT Forni
BDF Industries
Falorni Tech
EME
Glass Service
Horn
Olivotto Glass Technologies
Stevanato Group
Stara Glass
TECO Group
Waltec Maschinen

UV LAMPS

Graphoidal Developments

VACUUM PLANTS & ACCESSORIES

Pneumofore

VACUUM PUMPS

Pneumofore

VIAL AFTER FORMING MACHINES/LINES

Euromatic
Moderne Mecanique
OCMI OTG
Pennekamp
Stevanato Group

VIAL FORMING MACHINES/LINES

Euromatic
Moderne Mecanique
OCMI OTG
Pennekamp
Stevanato Group

VIAL PACKAGING MACHINES

Euromatic
KYP Accesories
Moderne Mecanique
OCMI OTG
R.Cestaro
Stevanato Group

VIBRATING EQUIPMENT

EME
Lahti Glass Technology
Vetromeccanica
ZIPPE

WASTE GAS CLEANING SYSTEMS

BDF Industries

WASTE GASES DUCT WORKS AND VALVES CLEANING SYSTEMS

BDF Industries

WATER CLEANING SYSTEMS

BDF Industries
Graphoidal Developments
Luben Glass
Tecsiglass
ZIPPE

WATER COOLING SYSTEMS

Bock Energietechnik

APPLITECH

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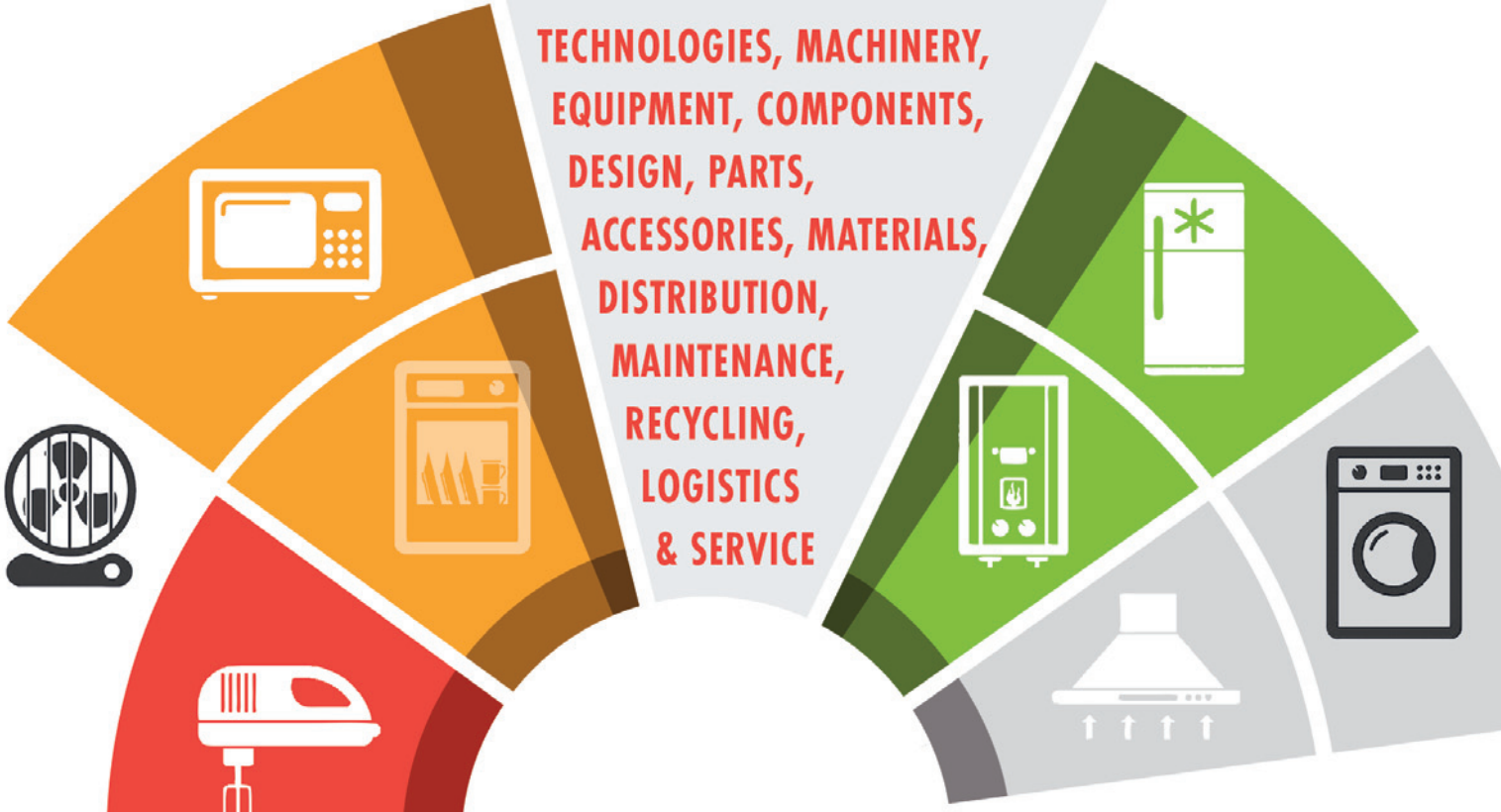
FOR THE SUPPLY CHAIN AND MANUFACTURING OF DOMESTIC, PROFESSIONAL, INDUSTRIAL APPLIANCES & CONSUMER ELECTRONICS

TECHNOLOGIES, MACHINERY, EQUIPMENT, COMPONENTS, DESIGN, PARTS, ACCESSORIES, MATERIALS, DISTRIBUTION, MAINTENANCE, RECYCLING, LOGISTICS & SERVICE



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For enquiries or to express an interest in attending please contact us at **segreteria@ativ.eu**

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